SWAMP
Surface Water Ambient Monitoring Program

SWAMP Assessment Report for the Central Coast Region	2001-02

Central Coast Ambient Monitoring Program Hydrologic Unit Report for the 2001-02 South Coast Watershed Rotation Area

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1 Introduction

1.1 Overview of the Surface Water Ambient Monitoring Program in California

California Assembly Bill 982 (Water Code Section 13192; Statutes of 1999) required that the State Water Resources Control Board (SWRCB) assess and report on State water monitoring programs and prepare a proposal for a comprehensive surface water quality monitoring program. In the SWRCB Report to the Legislature from November 2000, entitled "Proposal for a comprehensive ambient surface water quality monitoring program", the SWRCB proposed to restructure existing water quality monitoring programs into a new program, the Surface Water Ambient Monitoring Program (SWAMP). The SWAMP program is intended to provide comprehensive statewide environmental monitoring focused on information necessary to effectively manage the State's water resources. The program is designed to be consistent, cooperative, adaptable, scientifically sound, and to meet clear monitoring objectives. The program focuses on spatial and temporal trends in water quality statewide. It will facilitate reporting and categorizing of the State's water quality under Sections 305 (b) and 303 (d) of the Federal Clean Water Act. A Comprehensive Monitoring and Assessment Strategy (October, 2005), also know as the Ten-Point Strategy, elaborates on SWAMP goals, objectives, design, indicators, data management, quality control, and other program information. Specific program details can be found in the SWAMP Quality Assurance Management Plan (QAMP) (Puckett 2002).

Specifically, the statewide SWAMP is designed to meet four goals:

1. Create an ambient monitoring program that addresses all hydrologic units of the State.

2. Document ambient water quality conditions in potentially clean and polluted areas.

3. Identify specific water quality problems preventing the realization of beneficial uses of water in targeted watersheds.

4. Provide the data to evaluate the overall effectiveness of water quality regulatory programs in protecting beneficial uses of waters of the State.

1.2 Central Coast Ambient Monitoring Program

The Central Coast Regional Water Quality Control Board is responsible for water quality issues along the central coast of California. The region extends from southern San Mateo County in the north to northern Ventura County in the south, and includes Monterey, Santa Cruz, San Benito, San Luis Obispo, Santa Barbara and portions of Santa Clara counties. The Central Coast Ambient Monitoring Program (CCAMP) is the Central Coast Regional Water Quality Control Board's ambient monitoring program, and a major portion of its funding comes from SWAMP**.** The goal of monitoring in the Central Coast region is to provide a screening level assessment of water quality in all Hydrologic Units, based on a variety of chemical, physical and biological indicators. Monitoring data is used to evaluate beneficial use support in the surface waters of the Region. Monitoring approaches include conventional water quality, water toxicity, sediment chemistry and toxicity, tissue chemistry, rapid bioassessment for benthic invertebrates, and habitat assessment. CCAMP uses a rotating basin approach where conventional water quality monitoring is conducted monthly at all sites, and at a subset of the sites other monitoring approaches are conducted annually or biannually. Coastal confluence sites, just above salt water influence, are monitored monthly on an ongoing basis, and serve for long-term trend monitoring and as “integrators” of upstream impacts.

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 (10% exceedance with 90% certainty), 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.

1.3 Program Questions, Objectives and Decision-Making Criteria

General programmatic objectives of CCAMP are to:

1. Determine the status and trends of surface, estuarine and coastal water quality and associated beneficial uses in the Central Coast Region
2. Coordinate with other data collection efforts
3. Provide information in easily accessible forms to support decision-making

The following sections address questions posed in the SWAMP Monitoring Guidance related to beneficial use support. The monitoring approach and the water quality criteria that address these beneficial uses are discussed.

Is there evidence that it is unsafe to swim?
Beneficial Use: Water Contact Recreation (REC-1)
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 for fecal and total coliform only; assessments are based on these parameters
Criteria:

- 10% of samples over 400 MPN/100 ml fecal coliform
- Geometric mean of fecal coliform samples greater than 200 MPN/100mL
- 10% of samples over 235 MPN/100 ml *E. coli*

Interpretation: Minimum of five exceedances is required to determine impairment. If fewer than five exceedances, site is considered partially impaired. At least 10% of samples or the geomean must exceed the respective criterion to determine impairment.

Is there evidence that it is unsafe to drink the water?
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. Screen for presence of chemical effects which may cause detrimental physiological response in humans using multi-species toxicity testing.
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:

- 10% of nitrate samples over 10 mg/L (as N)
- 10% of pH samples under 6.5 or over 8.3

Interpretation: For nitrate and pH<6.5, a minimum of five exceedances is required to determine impairment. At least 10% of samples must exceed criterion for a site to be considered impaired. If fewer than five exceedances, 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.

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 is not routinely collecting bioaccumulation samples due to loss of funding.
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.

Interpretation: If there are two or more exceedances of a chemical criterion, from two or more separate samples site is considered impaired. If there is one exceedance, site is considered partially impaired.

Is there evidence that aquatic life uses are not supported?
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 comprehensive.
Critera:

- Sediment or water toxicity effects significantly greater than reference tests and survival, growth, or reproduction less than 80% of control
- Sediment concentrations over Probable Effects Levels (MacDonald, et al, 1996) for chemicals with available criteria. Sediment concentrations of other organic chemicals above detection limits.
- Tissue concentrations of organic chemicals over established U.S. Fish and Wildlife and National Academy of Sciences guidelines for protection of aquatic life. Tissue concentrations for chemicals without guidelines above detection limits.
- 10% of dissolved oxygen samples below 7.0 mg/L (cold water streams) or 5.0 mg/L (warm water streams)
- 10% of pH samples under 7.0 or above 8.5
- 10% of un-ionized ammonia samples over 0.025 mg/L NH_3 as N
- Bio-stimulatory risk rank falls within scoring range of lower quality sites (above 0.4)
- Index of Biotic Integrity falls within scoring range of lower quality sites (below 3.0)

Interpretation: For toxicity, sediment chemistry or tissue chemistry**,** if there are two or more exceedances of any analyte criterion, site is considered impaired. If there is one exceedance, site is considered partially impaired. For ammonia, pH (<7.0) and dissolved oxygen, if there are five or more exceedances of any analyte criterion, site is considered impaired. If there are fewer than five exceedances, 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.

Is there evidence that water is unsafe for agricultural use?
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:

- 10% of pH samples below 6.5 or above 8.3
- 10% of chloride samples over 106 mg/L
- 10% of electrical conductivity results over 3000 uS/cm
- 10% of boron samples over 0.75 mg/L
- 10% of sodium samples over 69 mg/L
- 10% of nitrate samples over 30 mg/L as NO_3 as N

Interpretation: Minimum of five exceedances of any analyte criterion are required to determine impairment. If there are fewer than five exceedances, 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 an assessment for trash. *E. coli* was not sampled in the Santa Maria watershed.
Criteria:

- 10% of pH samples under 7.0 or over 8.3
- 10% of samples over 400 MPN/100 ml fecal coliform
- 10% of samples over 409 MPN/100 ml *E. coli*
- 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 any analyte criterion are required to determine impairment. If there are fewer than five exceedances, 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 scum, odor, trash, or oil films are present at levels sufficient to represent a nuisance or hazard.

1.4 Overview of the CCAMP Approach

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

The CCAMP strategy of establishing and maintaining permanent long term monitoring sites provides a framework for trend analysis and detection of emergent water quality problems and maintenance of high quality waters. CCAMP uses a variety of monitoring approaches to characterize status and trends of coastal watersheds, including conventional water quality analysis, benthic invertebrate bioassessment, analysis of tissue and sediment for organic chemicals and metals, and toxicity evaluation.

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

Watershed characterization involves three major components: acquisition and evaluation of existing data, monitoring of surface water and habitat quality, and developing a watershed assessment based on findings. Existing sources of data are evaluated for pollutants of concern, historic trends, data gaps, etc. These include Department of Health Services, USGS, Department of Fish and Game, Department of Pesticide Regulation, Toxic Substances Monitoring Program, STORET, NPDES discharge data, and other sources. Data from County, City, and other selected programs are also acquired. Selected data is compiled into the CCAMP data base format and used along with data collected by CCAMP to evaluate standard exceedances, pollutant levels which warrant attention, beneficial use impairment, and other pertinent information. Basic GIS data layers, where available, describing land use, geology, soils, discharge locations, etc. are used in analysis and display of data, to further understanding of probable sources and causes of identified problems.

1.5 Scope of the Report

This report provides a data summary for watershed monitoring completed during the first two fiscal years of the SWAMP Program (2000-01 and 2001-02). This includes CCAMP watershed rotation monitoring of 31 sites in the South Coast Hydrologic Unit (315) between January 2001 and March 2002, as well as coastal confluences monitoring at eight sites in this Hydrologic Unit between January of 2001 and March 2003. The report provides an analysis of beneficial use support and determination of impairment for monitored waterbodies.

2 Sampling Design

Watershed rotation area monitoring sites are placed at safe access locations along the main stem of each major creek and river, typically upstream of each major tributary input, and also at the lower end of each major tributary. Sampling locations frequently are located at public bridge crossings because of all-weather public access. Care is taken to ensure that samples are not influenced by the bridge structure itself. Approximately thirty sites are allocated within the sampling area; in addition, long-term coastal confluence sites are monitored continuously on a monthly basis at thirty-three creek mouths throughout the Region.

The CCAMP program design includes monthly monitoring for conventional water quality (CWQ) at all selected sites. At a subset of sites, generally selected based on hydrogeomorphological considerations or local issues of concern, other monitoring approaches are applied. These include sediment chemistry and toxicity, fish and freshwater clam tissue chemistry, benthic macroinvertebrate assessment and habitat assessment.

3 Methods

3.1 Conventional Water Quality

CCAMP staff collects monthly grab samples and field measurements for conventional parameters at all watershed rotation area and coastal confluence sites. Sampling is conducted following the protocols outlined in CCAMP Standard Operating Procedures (Puckett, 2002).

Field measurements are taken using a multi-analyte Hydrolab DS4a. Measured values are stored in a Surveyor 4a and subsequently downloaded into the CCAMP data management system. Data are also recorded on field data sheets, and are used to verify electronically recorded values. Probes are lowered into flowing water, at least two inches but no more than eight inches below the water's surface. Probes are held at this depth and allowed to equilibrate for at least one minute prior to recording measurements. Field measurements include dissolved oxygen, pH, conductivity, salinity, water temperature, and turbidity. In addition, air temperature, percent algal cover, percent shading from canopy, presence of scum, trash, and foam, and several other field observations are noted.

Samples are collected for laboratory analysis at the Central Coast Region's contract laboratory, BC Laboratories in Bakersfield, California (Table 3.1a). Samples are collected in pre-cleaned bottles provided by the contract laboratory. Pre-cleaned 1-L plastic bottles are used to collect samples for nutrients, salts, dissolved and suspended solids analyses. Sterile and sealed 120ml plastic bottles containing sodium thiosulfate preservative are used to collect total and fecal coliform samples. Sample bottles are rinsed three times with stream water and then filled facing upstream. Once collected, samples are stored in ice chests at 4º C until they are transferred to the contract laboratory. Proper chain of custody documentation is maintained for all samples as described in the SWAMP QAMP (Puckett, 2002).

Table 3.1a. Laboratory analytes and typical methods

Analyte	**Method**
Nitrate as N	EPA 300.0
Nitrite as N	EPA 353.2
Total Ammonia as N	EPA 350.1
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

Three times during the summer months (July-September) CCAMP staff collect pre-dawn dissolved oxygen measurements to characterize oxygen sags, should they exist. CCAMP staff visit each site with safe 24 hour access between 3 a.m. and 30 minutes before sunrise to collect in-situ dissolved oxygen measurements using the Hydrolab DS4a.

Quality Assurance

Hydrolab probes (DS4a) are calibrated prior to and following each sampling event. Probes are calibrated using laboratory certified standards for pH, conductivity and turbidity, and are air calibrated for dissolved oxygen. Calibration data is recorded in an Excel spreadsheet and is used to evaluate instrument performance. The SWAMP QAMP has defined +/- 20% difference as the maximum allowable variation between the calibration standard and post calibration measurement of the standard (Puckett, 2002, Appendix C).

A blind field duplicate sample is collected once per sampling trip, resulting in 10% total field duplicates. For duplicates samples, two bottles are filled side by side and labeled with a unique site tag to remain anonymous to the contract laboratory. Data from duplicates is compared to original samples and evaluated using the SWAMP maximum for relative percent difference of 25% (Puckett 2002, Appendix C).

The quality control measures employed by the contract laboratory are also evaluated using SWAMP criteria. These measures include but are not limited to matrix spike recovery, laboratory control samples, calibration control samples, method blanks and lab duplicates.

3.2 CCAMP Bio-stimulatory Risk Index

CCAMP has developed a "Bio-stimulatory Risk Index" to serve as a screening tool to evaluate sites for risk of problems associated with eutrophication. A more complete description of the index and its use is found in Appendix A; however, it is briefly summarized in this section.

The Bio-stimulatory Risk Index simultaneously considers factors which serve as stimuli (nutrient concentrations), in parallel with those which act as responders (pH, dissolved oxygen, algal and plant cover, water column chlorophyll concentrations). The index is intended to characterize both in-situ monitoring site response to Bio-stimulatory substances and the capacity of monitoring site water quality parameters to induce adverse Bio-stimulatory responses in downstream areas. The index currently has no provision for addressing nutrient-poor waters, nor waters impacted by toxic effects associated with several of its components.

The Bio-stimulatory Risk Index is a combination of several different measures, or "metrics" of stimuli or response, which have been percentile ranked and combined to form a single value. CCAMP collects data on a number of parameters that serve as measures of biostimulation or response. Some of these measures, such as nutrient or chlorophyll concentrations, serve as metrics based on magnitude alone (where higher concentrations are considered "worse" than lower concentrations and are ranked accordingly). Others are more complex, particularly "double-ended" parameters such as dissolved oxygen and pH. For example, both supersaturated and depressed concentrations of dissolved oxygen can be indicative of eutrophication. For such parameters the departure of the measurement from the Regional median value is used to calculate the metric (where a larger departure ranks worse than a smaller departure). Various forms of plant cover are stimulated by nutrients and can create nuisance conditions. The Index utilizes the maximum value from three qualitative estimates of percent cover for rooted plants, filamentous algae and periphyton, to calculate a plant cover metric.

CCAMP staff has evaluated performance of the Index using data from the entire Region. Above an average Index score of 0.40, sites begin to commonly show signs of impairment, including algal blooms, widely ranging dissolved oxygen concentrations, and elevated nutrient concentrations. We are using this value as a threshold to screen monitoring data for Bio-stimulatory risk. In Appendix A, we discuss the regional evaluation and determination of the risk threshold.

3.3 Rapid Bioassessment

CCAMP staff collected benthic macroinvertebrates (BMIs) following California Stream Bioassessment Protocols (Harrington 1999 as cited in Puckett 2000, Appendix G) in two consecutive spring seasons at each site. All BMI samples are processed and identified to the lowest possible taxon at the California Department of Fish and Game Aquatic Bioassessment Laboratory (DFG-ABL).

Samples are collected during base-flow conditions. Sampling reaches are always selected in association with conventional water quality monitoring sites. When riffle habitat is present, a reach of stream containing riffles is selected for sampling. Riffles are typically the most taxonomically diverse microhabitats within streams, and are targeted for BMI sample collection. Three riffles within each stream reach are randomly selected for sampling. At each riffle, a transect location is randomly chosen from all possible meter marks along the upper third of the riffle. Three samples are collected along the transect, which is perpendicular to the direction of flow, using a D-shaped kick net. A 1x1 foot area of substrate upstream of the kick-net is disturbed for 1 minute at each site. The three samples from each transect are composited into a single sample. Each sample is preserved in 95% ethanol until analyzed.

When riffle habitat is not present, a representative 100m reach is measured out and three transect locations are chosen randomly from the 100 possible meter marks in the reach. At each transect location the two margins and thalweg are sampled by disturbing a 1 x 2-foot portion of substrate upstream of the kick-net to approximately 4-6 inches in depth. The three site collections per transect are composited to create one sample that is sieved to 0.5 mm and preserved in 95% ethanol. All samples are stored at the Central Coast Regional Board until they are transferred with the appropriate chain of custody forms to the DFG laboratory at Rancho Cordova for identification.

At the laboratory, BMI samples are randomly sub-sampled and sorted to obtain 300 individuals per sample. These individuals are stored in an ethanol-glycerin solution, identified to genus or the lowest possible taxonomic unit, and enumerated. Metrics calculated from individual count data include abundance, taxa richness and composition, taxa tolerant or intolerant of impaired conditions, and relative dominance of functional feeding groups. All organisms identified and included in the individual taxa list for each site are labeled with scientific name, date and location collected, and are returned to CCAMP for archiving.

Physical and habitat characteristics are estimated at each site based on visual observations, which score the following habitat parameters on a 1-20 scale: epifaunal substrate, embeddedness, velocity/depth regimes, sediment deposition, channel flow, channel alteration, riffle frequency, bank vegetation, bank stability, and riparian zone width. Field samplers are trained by CDFG staff to conduct this assessment, and scores are inter-calibrated for consistency prior to start of sampling.

CCAMP Index of Biotic Integrity

The CCAMP Index of Biotic Integrity (CCAMP-IBI) is a sum of several ranked metric scores, including taxonomic richness, number of *Ephemeroptera* taxa, number of *Trichoptera* taxa, number of *Plecoptera* taxa, percentage of intolerant individuals (with tolerance scores of 0, 1, or 2), percentage of tolerant individuals (with tolerance scores of 8, 9 or 10), percent dominant taxon, and percent predators. This index includes all metrics utilized by Karr and Chu (1999) in their Index of Biotic Integrity, with the exception of "clinger taxa count" and "long-lived taxa count." CCAMP-IBI scores range from 0 to 10. Sites in the lowest quartile of all CCAMP bioassessment data score below approximately 3.0, as a site average. Sites in the highest quartile score above 6.0. This index is described in more detail in Appendix B.

3.4 Water Toxicity

Sampling for toxicity to fathead minnow larvae (*Pimephales promelas*) and water fleas (*Ceriodaphnia dubia*) is conducted at a subset of watershed rotation area sites. Samples are collected in four 1-gallon amber glass bottles and are maintained at 4° C until delivery to the laboratory within 48 hours. Toxicity testing is performed at the University of California Davis Marine Pollution Studies Laboratory at Granite Canyon (UCD-GC). All tests are conducted for seven days, at 25ºC according to US EPA (1994) protocols. Water quality parameters including conductivity, hardness, alkalinity, pH, dissolved oxygen, and ammonia are measured at the beginning of each test. Test solutions are renewed daily; dissolved oxygen and pH are measured on the old solution and replacement solution. Temperature is monitored continuously by a temperature probe in an additional test solution placed in the controlled temperature room. Details of toxicity testing methods can be found in the SWAMP QAMP (Puckett 2002, Appendix F).

Larvae of the fathead minnow are purchased from an organism supplier and received on test initiation day (less than 24 hours old). Ten fish are randomly distributed to each of five test containers containing 250 mL of sample. Test containers are checked daily, and the number of living fish recorded; immobile fish that do not respond to a stimulus are considered dead. Survival and growth endpoints (as dry weight) are recorded for each test container at the end of seven days.

Water flea neonate individuals (<24 h old) are introduced singly into small cups containing 15 mL sample. Each sample includes ten replicates. Survival and reproduction are monitored daily in each replicate. Survival and reproduction endpoints (number of neonates and broods) were recorded for each test container at the end of seven days.

Samples are tested for chlorpyrifos and diazinon using Enzyme-Linked Immunosorbent Assay (ELISA). All ELISA analyses are performed at UCD-GC with kits from Strategic Diagnostics Inc. (Newark, DE). The lowest detectable doses are 30 ng/L for diazinon and 50 ng/L for chlorpyrifos (Sullivan and Goh 2000).

Quality Assurance

Field duplicate samples are tested to estimate the variability in results associated with sampling and laboratory procedures. All toxicity tests include both positive and negative controls. Positive control tests are conducted monthly at the laboratory and concurrently with test samples. (see the UCD-GC SOP document included in Puckett 2002 for more detailed QAQC information).

To verify accuracy of the ELISA method, an external standard is quantified with each batch. Accuracy of these measurements is considered acceptable if the measured value is within 20% of the known concentration. In addition, 5% of the samples measured using the ELISA method are also measured using an EPA analytical method for comparison. The measurement is considered acceptable if the relative percent difference between the results using the two methods is less than 50%. The SWAMP QAPP allows the program manager to determine control limits for external QA assessments (Puckett 2002).

3.5 Sediment Chemistry and Toxicity

Bed sediment samples are collected by CCAMP staff at a subset of watershed rotation area sites targeting fine-grained sediments within the wetted creek channel. A pre-cleaned Teflon™ scoop is used to collect the top 2 cm of sediment from five or more sub-sites into a pre-cleaned glass composite jar. After an adequate amount of sediment is collected, it is homogenized thoroughly and aliquoted into pre-cleaned, pre-labeled sample jars (glass or polyethylene, as appropriate) for organic chemical, metal or toxicological analysis. Once collected, samples are stored at 4°C and shipped with appropriate chain-of-custody and handling procedures to the analytical laboratories (MPSL-DFG, Rancho Cordova-DFG and UCD-GC). Field data sheets are completed for each sampling event to document conditions and sampling notes. Details on sediment sampling are described in the bed sediment procedures outlined in the SWAMP QAMP (Puckett 2002, Appendix D).

In sediment samples, analyses for metals, organic chemicals, polynuclear aromatic hydrocarbons, total organic carbon, and grain size were conducted at BC Laboratories in Bakersfield. Analysis and QC procedures used by BC Laboratories are outlined in their QAPP (BC Labs 1999).

Toxicity and ELISA analyses are conducted at UCD-GC. Ten-day sediment toxicity testing using *Hyalella azteca* (EPA 2000) is conducted using eight 100-mL replicates, each with 10 *Hyalella* individuals. Water quality parameters, including conductivity, hardness, alkalinity, pH, dissolved oxygen, and ammonia are measured in overlying water from one replicate of each sample at the beginning and end of each test. Dissolved oxygen is measured daily in one replicate of each sample. Temperature is monitored continuously by placing a probe in an additional test solution in the controlled temperature room. Endpoints recorded after ten days are survival and growth (as dry weight).

<u>Quality Assurance</u>

Sediment toxicity QA procedures such as field duplicates, and positive and negative controls are similar to those discussed in the section on water toxicity. See Puckett (2002) for a complete discussion on QAQC procedures. In sediment toxicity tests the positive control test consists of a dilution series of cadmium (from cadmium chloride). The negative control for *Hyalella* consists of reference sediment subjected to the same well-water renewals as the samples.

3.6 Tissue Bioaccumulation

Resident fish and transplanted freshwater clams (*Corbicula fluminea*) are used to assess bioaccumulation of organic chemicals and metals in streams and lakes throughout the watershed rotation areas.

MPSL-DFG staff performs deployment, collection and preparation of fresh water clams at a subset of watershed rotation sites. Clams are collected from Big Break Lake near the Sacramento River Delta, and tested for contamination prior to deployment. Clams are deployed for one month in anchored polypropylene mesh bags, approximately 15 cm above the streambed. Approximately 25 to 50 clams, 20 to 30 mm in diameter, are deployed at each site for each analysis (organics and metals). After a month-long deployment, clams are collected and sent to the laboratory for analysis. Clams intended for metals analysis are transported in plastic bags;

clams intended for organic analysis are bagged in aluminum, then plastic. All sample handling is performed with methods designed to minimize contamination. Details of clam collection, handling, deployment and retrieval can be found in the SWAMP QAMP (Puckett 2002, Appendix D).

Fish sampling in reservoirs and at watershed rotation area sites is conducted by the DFG-ABL through the Toxic Substances Monitoring Program (TSMP). Two to four composite samples containing four fish each are collected for each species. Within each composite the smallest fish is at least 75% the length of the largest fish. Larger, older fish are targeted. When the target species is a food fish, the minimum size is set at the legal angling size or practical eating size for that species.

Fish collection techniques include boat and backpack electro-fishing, gill netting and seine netting. Fish species and length are recorded. Fish are sacrificed and wrapped in aluminum foil or Teflon®. The heads and tails of fish larger than the wrapping material are removed prior to wrapping (gut contents are kept intact). Fish are kept on dry ice in the field, and then frozen at -20º C prior to analysis. Details of fish sampling methods used in the TSMP can be found in the CDFG-MPSL Standard Operating Procedure document, Method 102 (CDFG-MPSL 2001).

4 South Coast Hydrologic Unit Description

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.

Most of these creeks originate in steep chaparral, 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. In the Carpinteria and Santa Barbara area, channelized watersheds include Arroyo Burro, Mission, Sycamore, San Ysidro, Romero, Toro, Arroyo Paredon, Santa Monica and Franklin Creeks. 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 Paredon 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 on the Clean Water Act Section 303(d) List of Impaired Waters (Table 4b).

Table 4a. Waterbodies identified on the 2002 Clean Water Act Section 303(d) list of impaired waters in the South Coast Hydrologic Unit.

Water Body / Beach	**Listing**	**Listing**	**Listing**	**Listing**
Arroyo Burro Creek	Pathogens			
Mission Creek	Pathogens	Toxicity		
Carpinteria Creek	Pathogens			
Carpinteria Marsh	Pathogens	Priority organics	Dissolved oxygen	
Goleta Slough	Pathogens	Priority organics	Metals	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			

<u>Summary of Existing Data for Hydrologic Unit 315</u>

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.

Table 4b. Heal the Bay Report Card grades for Santa Barbara beaches. Dry weather grades include 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 weather grade 4/2002-10/02**	**Wet weather grade 10/2002-3/03**
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.

5 South Coast Hydrologic Unit Assessment

In this section, the South Coast Hydrologic Unit is evaluated according to questions posed in the SWAMP report to the Legislature (2000). It is only possible to address these questions in terms of analytes actually evaluated, for the given sampling period and sampling frequency. For example, from the standpoint of assessing whether water is of adequate quality to drink, only a few of the many chemicals with drinking water standards have been evaluated. However, when violations of standards and criteria are found, they support conclusions of water quality impairment. We determine evidence of impairment by comparing data to criteria described in Section 1.2. Monitoring sites and types of monitoring activities are listed and identified in Table 5.1a .

5.1 Summary of monitoring

Table 5.1a. Specific monitoring activities conducted at sites in the South Coast Hydrologic Unit (HU 315). **CWQ** - Conventional Water Quality; **BMI** - Benthic Macroinvertebrate Assessment; **Sed Chem & Tox** - Sediment Chemistry and Toxicity; **Tissue Chem** - Tissue Chemistry analysis.

Site Tag	**Monitoring Site**	**CWQ**	**BMI**	**Water Tox**	**Sed Chem & Tox**	**TissueChem**
315JAL	Jalama Creek at RR bridge	X	X	X	X	
315GAV	Gaviota Creek at State Park entrance	X	X	X	X	
315GAI	Gaviota Creek at Highway 1	X	X	X		
315RSB	Canada del Refugio at Highway 101	X	X	X		
315CAP	Canada del Capitan below Highway 101	X	X	X		
315DOS	Dos Pueblos Creek at Highway 101	X		X		
315TCI	Tecolote Creek at Baccara Resort entrance	X		X		
315BEL	Bell Creek at Baccara Resort entrance	X	X	X	X	
315DEV	Devereaux Slough tributary at Golf Course	X		X	X	
315ANN	Glen Annie Creek at Hollister Road	X		X	X	
315LCR	Los Carneros Creek at Hollister Road	X		X		
315SJC	San Jose Creek at Hollister Road	X		X		
315SPC	San Pedro Creek below Hollister Road	X		X		
315ATA	Atascadero Creek at Ward Drive	X	X	X		
315ATU	Atascadero Creek at Patterson Drive	X		X		00f
315MYC	Maria Ygnacio Creek at Patterson Drive	X		X		
315ABU	Arroyo Burro Creek at Cliff Drive	X	X	X	X	
315ABH	Arroyo Burro Creek at Hope Drive	X	X	X		
315MIS	Mission Creek at Montecito Drive	X	X	X	X	00c,f
315MIU	Mission Creek at Foothill Road	X	X	X		
315SCC	Sycamore Creek at Punta Gorda	X		X	X	
315MTC	Montecito Creek at Via Real	X		X		
315YSI	San Ysidro Creek at Jamison Lane	X		X		
315ROM	Romero Creek at Jamison Lane	X		X		
315TOR	Toro Creek at Via Real	X	X	X		
315APC	Arroyo Paredon at Via Real	X		X	X	
315SMC	Santa Monica Creek at Carpinteria Avenue	X		X		
315FRC	Franklin Creek at Carpinteria Avenue	X		X	X	
315CRP	Carpinteria Creek below Carpinteria Ave.	X	X	X	X	
315CAU	Carpinteria Creek at Highway 192	X	X	X		
315RIN	Rincon Creek at Bates Road, above Hwy 101	X	X	X	X	
315CAR	Carpinteria Marsh					99f & 00c,f

CCAMP collected water quality data at 31 sites throughout the South Coast Hydrologic Unit, eight of which are coastal confluence sites. Figures 5.1a and 5.1b show the locations of these sites. The specific monitoring activities conducted at each location are listed in Table 5.1a.

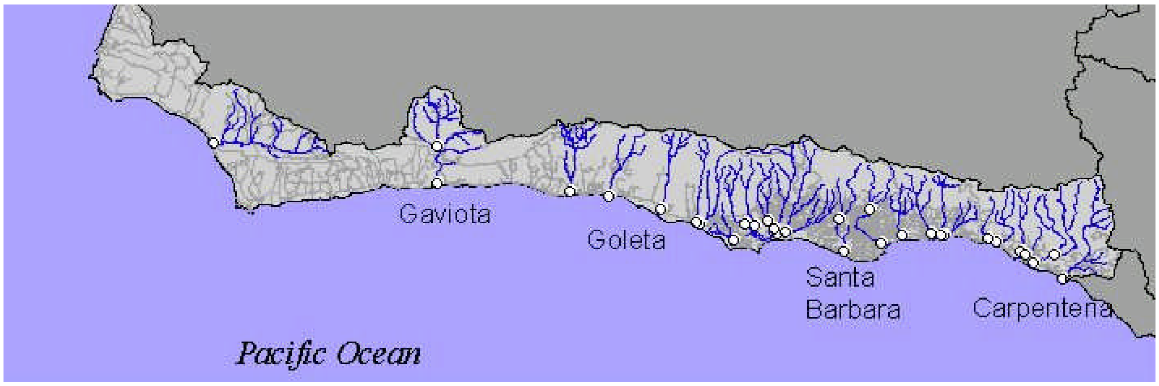

Figure 5.1a. Monitoring sites in the South Coast Hydrologic Unit.

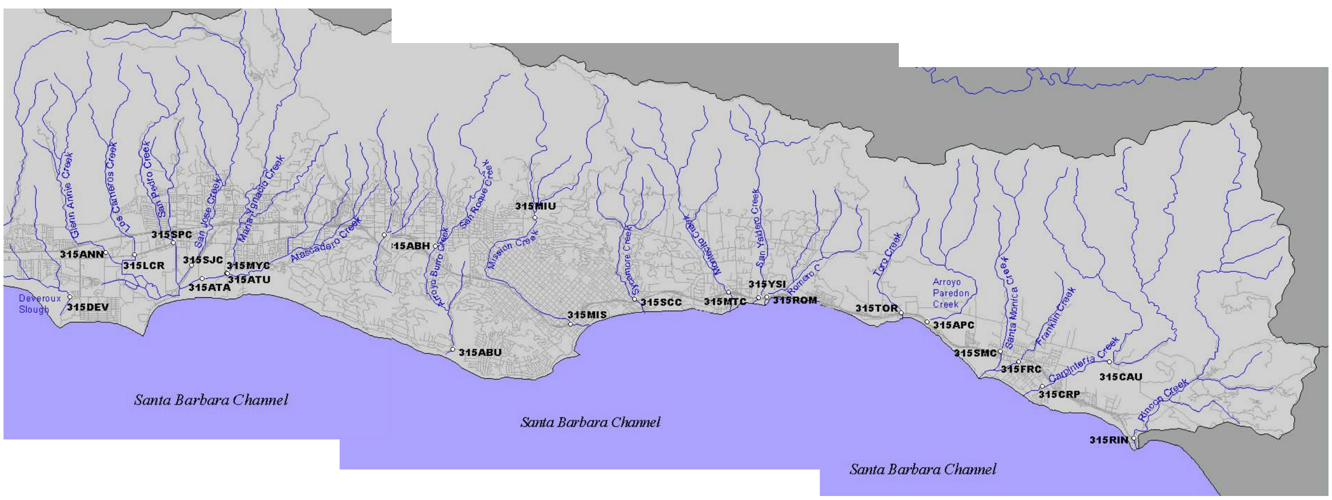

Figure 5.1b. Monitoring sites in the Goleta, Santa Barbara and Carpinteria Hydrologic Sub-areas.

Table 5.1b. Summary of findings related to monitoring questions for sites in the South Coast Hydrologic Unit (HU315). **Yes** - evidence that a problem exists, **No** - no evidence that a problem exists, **S** – some evidence that a problem may exist, dash symbol (**-**) - not assessed.

Site Tag	Monitoring site	Unsafe to Swim?	Unsafe to drink?	Are aquatic life uses impaired?	Unsafe to eat fish?	Are agriculture uses impaired?	Are non-contact recreation activities impaired?
315JAL	Jalama Creek at RR bridge	**S**	**S**	**Yes**	-	**Yes**	**S**
315GAV	Gaviota Creek at State Park entrance	**S**	No	**S**	-	**Yes**	**S**
315GAI	Gaviota Creek at Highway 1	**Yes**	No	**S**	-	**Yes**	**S**
315RSB	Canada del Refugio at Highway 101	**Yes**	No	**Yes**	-	**Yes**	**S**
315CAP	Canada del Capitan below Highway 101	**S**	No	**S**	-	No	**S**
315DOS	Dos Pueblos Creek at Highway 101	No	No	**S**	-	**Yes**	**S**
315TCI	Tecolote Creek at Baccara Resort entrance	**S**	No	**S**	-	**Yes**	**S**
315BEL	Bell Creek at Baccara Resort entrance	**Yes**	**Yes**	**S**	-	**Yes**	**S**
315DEV	Devereaux Slough tributary at Golf Course	**Yes**	No	**Yes**	-	**Yes**	**S**
315ANN	Glen Annie Creek at Hollister Road	**Yes**	**Yes**	**Yes**	-	**Yes**	**S**
315LCR	Los Carneros Creek at Hollister Road	**S**	**S**	**S**	-	**Yes**	**S**
315SJC	San Jose Creek at Hollister Road	**Yes**	**S**	**S**	-	**Yes**	**S**
315SPC	San Pedro Creek below Hollister Road	**Yes**	**S**	**S**	-	**Yes**	**S**
315ATA	Atascadero Creek at Ward Drive	**Yes**	No	**S**	-	**Yes**	**S**
315ATU	Atascadero Creek at Patterson Drive	**Yes**	No	**Yes**	**S**	**Yes**	**S**
315MYC	Maria Ygnacio Creek at Patterson Drive	**Yes**	**S**	**S**	-	**Yes**	**S**
315ABU	Arroyo Burro Creek at Cliff Drive	**Yes**	No	**Yes**	-	**Yes**	**S**
315ABH	Arroyo Burro Creek at Hope Drive	**S**	No	**Yes**	-	**Yes**	**S**
315MIS	Mission Creek at Montecito Drive	**Yes**	No	**Yes**	**S**	**Yes**	**Yes**
315MIU	Mission Creek at Foothill Road	**S**	No	**S**	-	No	**S**
315SCC	Sycamore Creek at Punta Gorda	**Yes**	**S**	**S**	-	**Yes**	**S**
315MTC	Montecito Creek at Via Real	**Yes**	**S**	**S**	-	**S**	**S**
315YSI	San Ysidro Creek at Jamison Lane	**Yes**	**S**	**S**	-	**S**	**S**
315ROM	Romero Creek at Jamison Lane	**S**	**S**	**S**	-	**Yes**	**S**
315TOR	Toro Creek at Via Real	**Yes**	No	**Yes**	-	**Yes**	**S**
315APC	Arroyo Paredon at Via Real	**Yes**	**Yes**	**Yes**	-	**Yes**	**S**
315SMC	Santa Monica Creek at Carpinteria Avenue	**Yes**	**S**	**S**	-	**S**	**S**
315FRC	Franklin Creek at Carpinteria Avenue	**Yes**	**Yes**	**S**	-	**Yes**	**Yes**
315CRP	Carpinteria Creek below Carpinteria Avenue	**Yes**	No	**Yes**	-	**Yes**	**S**
315CAU	Carpinteria Creek at Highway 192	**S**	**S**	**S**	-	**S**	**S**
315RIN	Rincon Creek at Bates Road, above Hwy 101	**Yes**	No	**Yes**	-	**Yes**	**S**
315CAR	Carpinteria Marsh	-	-	**S**	**S**	-	-

5.1.1. Is there evidence that it is unsafe to swim?

Fecal coliform data show consistently elevated levels throughout the Hydrologic Unit, with Most Probable Number (MPN) ranging from “not detected” to greater than 160,000. Most sites in the Unit exceeded one or both of the Basin Plan Objectives for fecal coliform. As summarized in Table 5.1.1a, all sites but Dos Pueblos Creek (315DOS) had some evidence of impairment (one or more samples exceeding 400 MPN/100mL). Nineteen sites in the Unit had five or more samples that exceeded this criterion.

The Basin Plan also states for any 30-day period the geometric mean shall not exceed 200MPN/100mL. Figure 5.1.1a shows the annual geometric mean and range of fecal coliform values for samples collected at sites in the Hydrologic Unit. This data is not compliant with the 30 day requirement of the Basin Plan but does provide a measure of central tendency for the year. More than half of the South Coast Hydrologic Unit sites have annual geomean values that exceed the Basin Plan Objective.

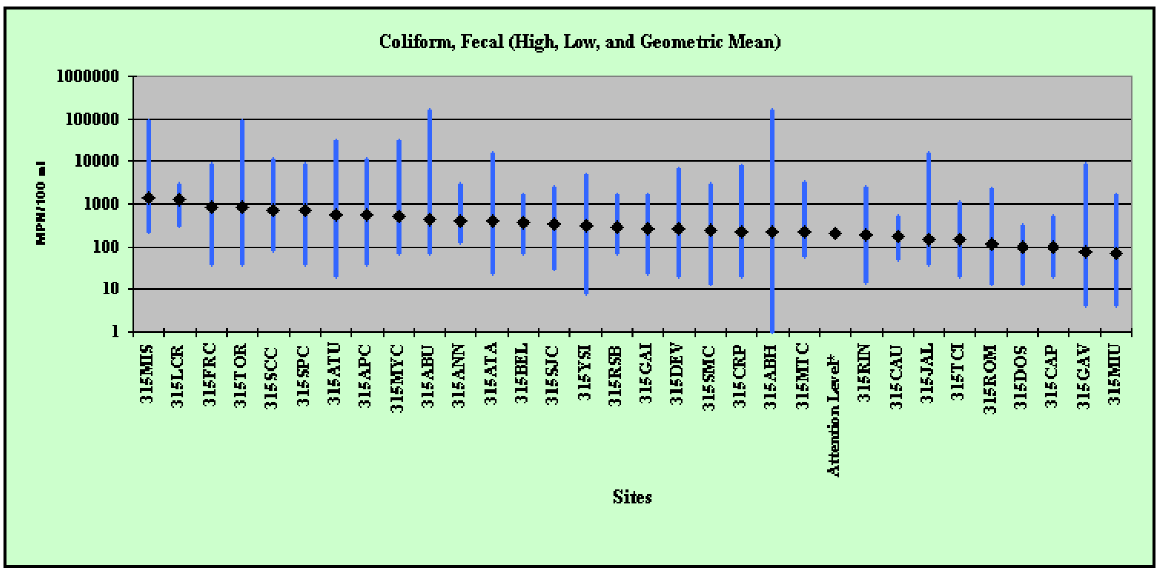

Figure 5.1.1a. Annual geometric mean and range of fecal coliform values (MPN/100 ml) for sites monitored by CCAMP between January 2001 and April 2003.

Table 5.1.1a. Site specific assessment of data used to assess impairment of water contact recreational uses in the South Coast Hydrologic Unit (HU315). **Yes** - evidence that a problem exists, **No** - no evidence that a problem exists, **S** – some evidence that a problem may exist, dash symbol (-) - not assessed. Note: Annual geometric means are not used alone to determine impairment.

Water Contact Recreation Assessment Threshold	More than 10% of samples >400	Geometric mean > 200	Evidence of Impairment
Sites			
315JAL	**S**	No	**S**
315GAV	**S**	No	**S**
315GAI	**Yes**	**Yes**	**Yes**
315RSB	**Yes**	**Yes**	**Yes**
315CAP	**S**	No	**S**
315DOS	No	No	No
315TCI	**S**	No	**S**
315BEL	**Yes**	**Yes**	**Yes**
315DEV	**Yes**	**Yes**	**Yes**
315ANN	**Yes**	**Yes**	**Yes**
315LCR	**S**	**Yes**	**S**
315SJC	**Yes**	**Yes**	**Yes**
315SPC	**Yes**	**Yes**	**Yes**
315ATA	**Yes**	**Yes**	**Yes**
315ATU	**Yes**	**Yes**	**Yes**
315MYC	**Yes**	**Yes**	**Yes**
315ABU	**Yes**	**Yes**	**Yes**
315ABH	**S**	**Yes**	**S**
315MIS	**Yes**	**Yes**	**Yes**
315MIU	**S**	No	**S**
315SCC	**Yes**	**Yes**	**Yes**
315MTC	**S**	**Yes**	**Yes**
315YSI	**S**	**Yes**	**Yes**
315ROM	**S**	No	**S**
315TOR	**Yes**	**Yes**	**Yes**
315APC	**Yes**	**Yes**	**Yes**
315SMC	**Yes**	**Yes**	**Yes**
315FRC	**Yes**	**Yes**	**Yes**
315CRP	**Yes**	**Yes**	**Yes**
315CAU	**S**	No	**S**
315RIN	**Yes**	**No**	**Yes**
315CAR	-	-	-

5.1.2. Is there evidence that it is unsafe to drink the water?

In general, nitrate was low throughout the Hydrologic Unit, relative to the Basin Plan Objective for Municipal and Domestic Supply, However, elevated nitrate levels were consistently observed at four sites (Figure 5.1.2a): Arroyo Paredon Creek (315APC), Franklin Creek (315FRC), Bell Canyon Creek (315BEL) and Glenn Annie Creek (315ANN). Four other sites in the Hydrologic Unit had single exceedances of the objective. These included Los Carneros Creek (315LCR), Carpinteria Creek (315CRP), Maria Ygnacio Creek (315MYC) and Santa Monica Creek (315SMC).

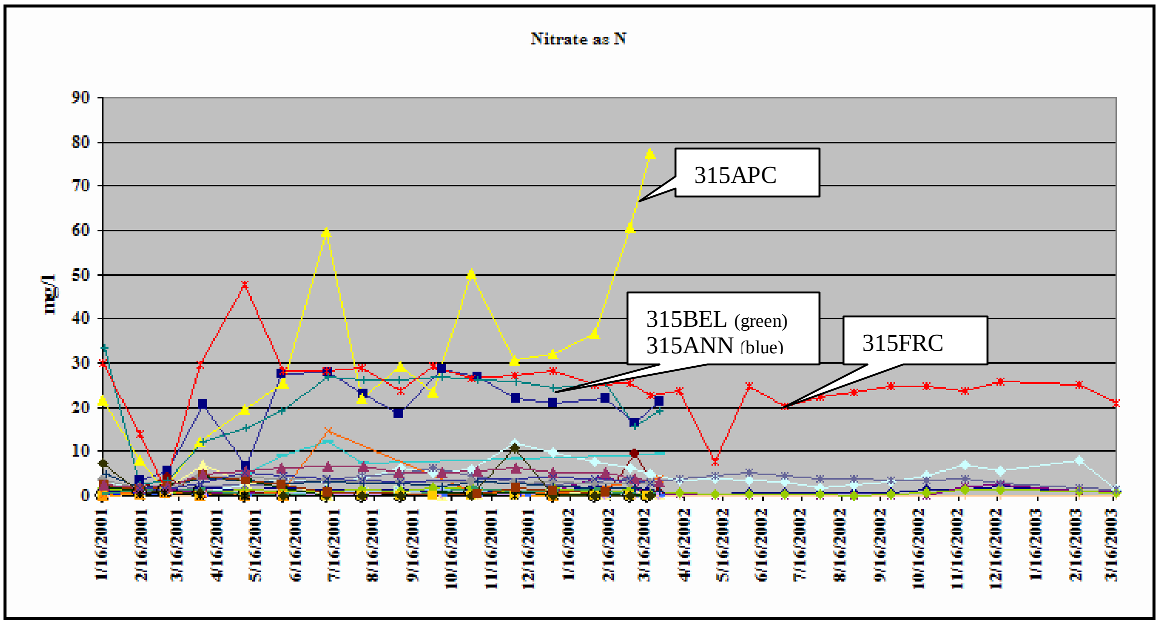

Figure 5.1.2a. Time series of nitrate values (NO_3 mg/L as N) from sites in the South Coast Hydrologic Unit, between January 2001 and April 2003.

Elevated pH values were recorded at most sites in the Hydrologic Unit, with 21 of the sites having at least one exceedance of the upper Basin Plan objective (Figure 5.1.2b). The highest pH value was recorded at Maria Ygnacio Creek (315MYC), at 9.69 pH units. The pH at this site exceeded the objective in 33% of samples collected but less than five samples exceeded the criteria. Other sites with high maximum pH values and average pH exceeding the objective include Los Carneros Creek (315LCR) and Santa Monica Creek (315SMC). There were no pH measurements below 6.5 pH units in this Hydrologic Unit.

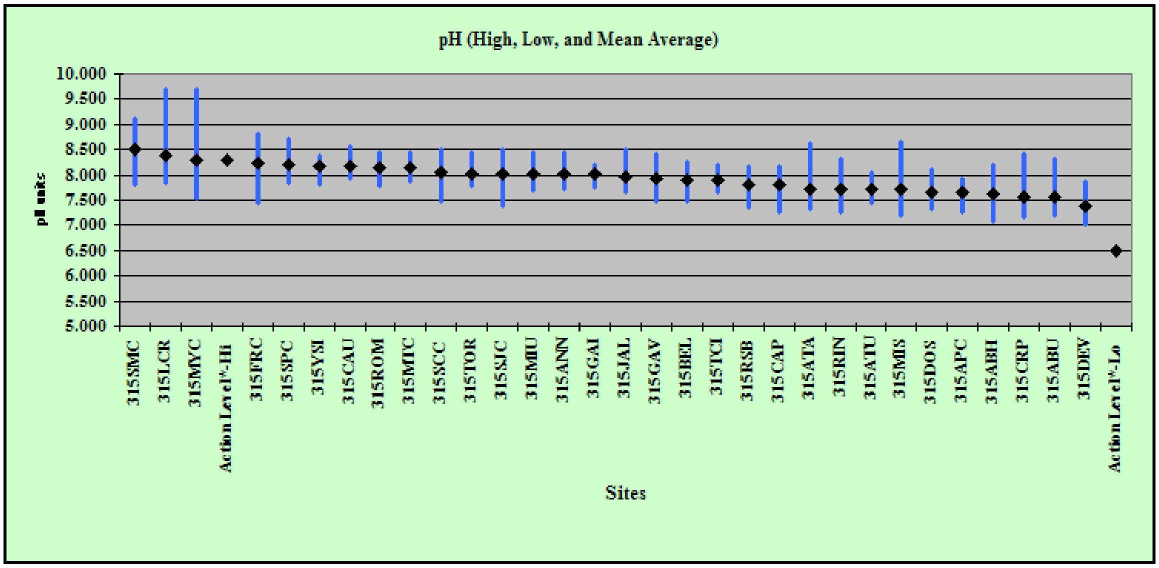

Figure 5.1.2.b Range and mean pH values measured at sites in the South Coast Hydrologic Unit between January 2001 and March 2003

Table 5.1.2a. Site specific assessment of data used to assess impairment of municipal and domestic supply uses in the South Coast Hydrologic Unit (HU315). **Yes** - evidence that a problem exists, **No** - no evidence that a problem exists, **S** – some evidence that a problem may exist, dash symbol (-) - not assessed. Note: pH is not used alone to determine impairment.

Constituent	Nitrate as N	pH	**Evidence of Impairment**
Units	ppm	pH	
Matrix	H20	H20	
Municipal and Domestic Supply Assessment Threshold	10	<6.5 or >8.3	
Sites			
315JAL	No	**S**	**S**
315GAV	No	No	No
315GAI	No	No	No
315RSB	No	No	No
315CAP	No	No	No
315DOS	No	No	No
315TCI	No	No	No
315BEL	**Yes**	No	**Yes**
315DEV	No	No	No
315ANN	**Yes**	No	**Yes**
315LCR	**S**	**S**	**S**
315SJC	No	**Yes**	**S**
315SPC	S	**Yes**	**S**
315ATA	No	No	No
315ATU	No	No	No
315MYC	**S**	**S**	**S**
315ABU	No	No	No
315ABH	No	No	No
315MIS	No	No	No
315MIU	No	No	No
315SCC	No	**S**	**S**
315MTC	No	**S**	**S**
315YSI	No	**S**	**S**
315ROM	No	**Yes**	**S**
315TOR	No	No	No
315APC	**Yes**	No	**Yes**
315SMC	**S**	**Yes**	**S**
315FRC	**Yes**	**Yes**	**Yes**
315CRP	**S**	No	**S**
315CAU	No	**S**	**S**
315RIN	No	No	No
315CAR	-	-	-

5.1.3 Is there evidence that it is unsafe to eat the fish?

Resident fish were collected at three sites in the Hydrologic Unit by Department of Fish and Game staff working with the Toxic Substances Monitoring Program (TSM) and CCAMP in 2000. These included Mission Creek (315MIS), Atascadero Creek at Patterson Drive (315ATU), and Carpinteria Marsh (315CAR). Historic monitoring conducted by CDFG staff at Devereaux Slough and Carpinteria Marsh (prior to 1998) is not included in this discussion. Because there is only a single sample from each of these latter sites, there is not enough data to determine impairment. However, fish from both sites have accumulated elevated levels of some chemicals and metals.

Metal concentrations in fish tissue generally were below Median International Standards (MIS). However, the chromium concentration in *Pimephales promelas* (fathead minnows) collected from Atascadero Creek was more than twice the MIS value. Also of note - the concentration of zinc in the tissue of three-spined stickleback (*Fundulus parvipinnis*) collected at Mission Creek (315MIS) measured 43.8 ppm, near but not in excess of the 45 ppm MIS criteria.

Several organic chemicals were detected in resident fish tissues from these three sites. PCBs exceeded the OEHHA standard. All three sites had low levels of DDT and it metabolites, as well as of chlordane. Dieldrin concentrations in tissue from the Mission Creek site (315MIS) were more than twice the Toxic Substances Monitoring Program “Elevated Data Level (EDL) 95”, or the concentration of the 95th percentile for all samples collected by the program (N=48). But, there were no exceedances of any criteria for pesticides in these samples. It should be noted that very few criteria are available to evaluate these data.

Table 5.1.3a. Site specific assessment of data used to assess impairment of fish consumption use in the South Coast Hydrologic Unit (HU315). **Yes** - evidence that a problem exists, **No** - no evidence that a problem exists, **S** – some evidence that a problem may exist, dash symbol (-) - not assessed. Note: Minimum of two sample is necessary to determine impairment.

Constituent	Arsenic [1]	Cadmium [1]	Chromium [3]	Copper [3]	Lead [3]	Mercury [1]	Selenium [1]	Zinc [3]	Aldrin [2]	DDT, Total [1]	Dieldrin [1]	Endrin [1]	Heptachlor Epoxide [1]	PCB, Total [1]	Elevated levles of chemicals without published criteria (relative to EDLs)	**Evidence of Impairment**
Fish Consumption Use Assessment Threshold	1.0	3.0	1.0	20.0	2.0	0.3	2.0	45	300	100	2.0	1000	4.0	20		
Units	ppm	ppm	ppm	ppm	ppm	ppb	ppb	ppm	ppb	ppb	ppb	ppb	ppb	ppb	ppb	
Matrix	Tis	Tis	Tis	Tis	Tis	Tis	Tis	Tis	Tis	Tis	Tis	Tis	Tis	Tis	Tis	
Sites																
315JAL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315GAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315GAI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315RSB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315CAP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315DOS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315TCI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315BEL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

315DEV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315ANN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315LCR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315SJC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315SPC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315ATA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315ATU	No	No	**S**	No	No	No	No	No	No	No	No	No	No	**S**	No	**S**
315MYC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315ABU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315ABH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315MIS	No	No	No	No	No	No	No	No	No	No	No	No	No	**S**	No	**S**
315MIU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315SCC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315MTC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315YSI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315ROM	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315TOR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315APC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315SMC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315FRC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315CRP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315CAU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315RIN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
315CAR	No	No	No	No	No	No	No	No	No	**S**	No	No	No	No	No	**S**

[1] Criteria based on OEEHA standards, [2] Criteria based on FDA standards, [3] Criteria based on MIS standards

5.1.4 Is there evidence that aquatic life uses are not supported?

Several lines of evidence are evaluated to determine if water quality supports aquatic life beneficial uses. Numeric Basin Plan objectives for un-ionized ammonia or dissolved oxygen can show evidence of impairment. Interpretation of narrative Basin Plan objectives for toxicity, and presence of organic chemicals are also used to determine threshold exceedances. Other measures such as the CCAMP Bio-stimulatory Risk Index and the CCAMP Index of Biotic integrity are used to evaluate water quality but are not used alone to determine evidence of impairment. If additional lines of evidence of impairment are available these criteria can support assessment of threshold exceedances.

Several sites in this Hydrologic Unit have evidence of impairment for use by aquatic life based on monthly conventional water quality monitoring, as well as annual toxicity, sediment chemistry and benthic macroinvertebrate monitoring (Table 5.1.4a). Many of these sites have both chemical and biological results showing degraded conditions.

Table 5.1.4a. Site specific assessment of data used to assess impairment of aquatic life uses in the South Coast Hydrologic Unit (HU315). **Yes** - evidence that a problem exists, **No** - no evidence that a problem exists, **S** – some evidence that a problem may exist (i.e. less than five conventional pollutant exceedances or less than 2 toxin or toxicity exceedances observed), dash symbol (-) - not assessed . Note: pH, Bio-stimulatory Risk and CCAMP IBI are not used alone to determine impairment.

Constituent	Ammonia as N, Unionized	Oxygen, Dissolved	Oxygen, Saturation	pH	Toxicity	Bio-stimulatory Risk	CCAMP IBI	Arsenic 1	Chromium 1	Copper 1	Lead 1	Mercury 1	Selenium 1	Zinc 1	DDT, Total 2	Dieldrin 2	Endrin 2	PCB,Total 2	DDT, Total 3	Dieldrin 3	Organic Chemicals without criteria	**Evidence of impairment**
Aquatic Life Use Assessment Threshold	0.03	<7 or <5	Median <85	<7 > 8.5	<80% and significantly different than control	0.4	<3.0	1.5	1	20	2	0.5	2	45	1000	100	100	500	46	8	> RL	
Units	ppm	ppm	%	pH	% survival			ppm	ppm	ppm	ppm	ppb	ppb	ppm	ppb	ppb	ppb	ppb	ppb	ppb	ppm	
Matrix	H20	H20	H20	H20	H20 or Sed	NA	NA	Tis	Tis	Tis	Tis	Tis	Tis	Tis	Tis	Tis	Tis	Tis	Sed	Sed	Sed	
Sites																						
315JAL	No	No	**S**	**S**	**Yes**	No	-	-	-	-	-	-	-	-	-	-	-	-	No	No	**S**	**Yes**
315GAV	No	No	**S**	No	**S**	No	No	-	-	-	-	-	-	-	-	-	-	-	No	No	**S**	**S**
315GAI	No	No	**S**	No	**S**	No	No	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315RSB	No	No	**S**	No	**Yes**	**Yes**	**S**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Yes**
315CAP	No	No	**S**	No	No	No	No	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315DOS	No	No	**S**	No	No	No	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315TCI	No	No	**S**	No	No	No	No	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315BEL	No	**S**	**S**	No	**S**	**Yes**	-	-	-	-	-	-	-	-	-	-	-	-	**S**	No	**S**	**S**
315DEV	No	**S**	**Yes**	No	No	**Yes**	-	-	-	-	-	-	-	-	-	-	-	-	No	**S**	**S**	**Yes**
315ANN	No	No	**S**	No	**Yes**	**Yes**	-	-	-	-	-	-	-	-	-	-	-	-	No	No	**S**	**Yes**
315LCR	No	No	**S**	**S**	**S**	**Yes**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315SJC	No	**S**	**S**	**Yes**	No	**Yes**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315SPC	No	No	**S**	**Yes**	No	**Yes**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**

315ATA	No	**S**	**S**	No	No	**Yes**	**Yes**	-	-	-	-	-	-	-	-	-	-	-	No	No	**S**	**S**
315ATU	No	**Yes**	**S**	No	No	**Yes**	-	No	**S**	No	No	No	No	No	**S**	No	No	No	-	-	-	**Yes**
315MYC	**S**	No	**S**	**S**	No	**Yes**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315ABU	No	No	**S**	No	**Yes**	**Yes**	**Yes**	-	-	-	-	-	-	-	-	-	-	-	No	No	**S**	**Yes**
315ABH	No	**Yes**	**Yes**	No	No	**Yes**	**S**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Yes**
315MIS	No	**Yes**	**S**	No	**S**	**Yes**	**S**	No	No	No	No	No	No	No	**S**	No	No	No	No	No	**S**	**Yes**
315MIU	No	No	**S**	No	No	No	No	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315SCC	No	**S**	**S**	**S**	**S**	**Yes**	-	-	-	-	-	-	-	-	-	-	-	-	No	No	**S**	**S**
315MTC	No	No	No	**S**	No	No	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315YSI	No	No	No	**S**	No	No	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315ROM	No	No	No	**Yes**	No	**Yes**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315TOR	No	No	**S**	No	No	**Yes**	No	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315APC	No	No	**S**	No	**Yes**	**Yes**	-	-	-	-	-	-	-	-	-	-	-	-	No	No	**S**	**Yes**
315SMC	No	**S**	**S**	**Yes**	**S**	**Yes**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315FRC	No	**S**	**S**	**Yes**	**S**	**Yes**	-	-	-	-	-	-	-	-	-	-	-	-	No	No	**S**	**S**
315CRP	No	**Yes**	**S**	No	**Yes**	**Yes**	**Yes**	-	-	-	-	-	-	-	-	-	-	-	No	No	**S**	**Yes**
315CAU	No	No	No	**S**	**S**	No	No	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**S**
315RIN	No	No	**S**	No	**Yes**	**Yes**	No	-	-	-	-	-	-	-	-	-	-	-	No	No	**S**	**Yes**
315CAR	-	-	-	-	-	-	-	No	No	No	No	No	No	No	**S**	No	No	No	No	No	No	**S**

[1] Criteria based on OEEHA standards, [2] Criteria based on FDA standards, [3] Criteria based on MIS standards

Water toxicity samples were collected at all sites in the Hydrologic Unit and tested for toxic effects to water fleas (*Ceriodaphnia dubia*) and larval fathead minnows (*Pimephales promelas*). At a subset of these sites, sediment samples were also collected and tested for toxicity using the amphipod *Hyallela azteca* and analyzed for organic chemicals, petroleum products and metals (see Table 6.1b for a site list). Toxic effects were observed at several sites in the Hydrologic Unit, many of which had multiple toxic results (Table 5.1.4b).

For each site a total of four toxicity tests were conducted; two C. dubia tests and two P. promelas tests. Arroyo Paredon Creek (315APC) samples showed significantly lower survival of *C. dubia*, relative to the control in both spring and winter samples. However, no toxic effects were documented in the two fathead minnow test conducted on these same samples. At this site, the diazinon concentrations were 0.398ppm and 0.033ppm respectively in the two water samples. These concentrations likely contributed to the toxic response as the diazinon criterion concentration maximum is 0.16ppm (Finlayson 2004). Similarly, the diazinon concentration at Carpinteria Creek (315CRP) was 0.921ppm and survival of *C. dubia* was 0% in the spring sample. Toxic effects to *C. dubia* were also reported for the spring sample from El Capitan Creek (315CAP). This result is flagged and is considered estimated, due to elevated conductivity in the sample. If valid, this result is contrary to the seemingly good water quality at the site, which has relatively high scores for both the CCAMP IBI (upper 90th percentile) and the Bio-stimulatory Risk Index (2nd lowest score in the Hydrologic Unit). Water samples from Rincon Creek (315RIN), Arroyo Burro at Cliff Drive (315ABU), Glen Annie Creek (315ANN) and Jalama Creek (315JAL) were toxic to *P. promelas* in both spring and winter samples. Several other sites had one sample with toxic effects in fathead minnow tests (Table 5.1.4b).

At a subset of sites in the Hydrologic Unit, sediment samples were tested for toxicity to the amphipod *H. azteca* and were analyzed for pesticides, petroleum products and metals. Toxic effects were reported for several of these sites (Table 5.1.4b). At both Rincon Creek (315RIN) and Carpinteria Creek (315CRP) the un-ionized ammonia concentration in the pore water of these samples exceeded Basin Plan criteria and is directly toxic to aquatic life. Sediment chemistry data does not show elevated levels of pesticides at sites where toxicity effects were reported. It should be noted that chemistry testing does not include several of the currently applied pesticides used in urban areas.

Resident fish were collected from Carpinteria Marsh, Atascadero Creek and Mission Creek. All fish tissue samples were analyzed for organic chemicals and metals. These data are previously discussed in section 5.1.3.

Table 5.1.4b. Number of toxic tests (based on survival) at sites in the South Coast Hydrologic Unit. Water samples were collected at all sites on two separate occasions (March and November 2002). Sediment samples were collected at a subset of these sites in March 2002. Number of significant toxicity test responses are shown. Dash symbol indicates no sample collected. * Flagged estimated

Stream	Site Tag	Ceriodaphnia (survival < 80% of control)	Pimephales (survival < 80% of control)	Hyallea (survival <80% of control)
Rincon Creek	315RIN	0	**2**	**1**
Carpinteria Creek	315CRP	**1**	0	**1**
Carpinteria Creek	315CAU	0	**1**	-
Franklin Creek	315FRC	0	0	**1**
Santa Monica Creek	315SMC	0	**1**	-
Arroyo Paredon	315APC	**2**	0	0
Romero Creek	315ROM	0	0	-
Toro Creek	315TOR	0	0	-
San Ysidro Creek	315YSI	0	0	-
Montecito Creek	315MTC	0	0	-
Sycamore Creek	315SCC	0	0	**1**
Mission Creek	315MIS	0	0	**1**
Mission Creek	315MIU	0	0	-
Arroyo Burro	315ABU	0	**2**	**1**
Arroyo Burro	315ABH	0	0	-
Maria Ygnacio Creek	315MYC	0	0	-
Atascadero Creek	315ATU	0	0	-
Atascadero Creek	315ATA	0	0	0
Glenn Annie	315ANN	0	**2**	0
Los Carneros Creek	315LCR	0	**1**	-
San Jose Creek	315SJC	0	0	-
San Pedro Creek	315SPC	0	0	-
Devereaux Slough	315DEV	0	0	0
Bell Canyon Creek	315BEL	0	**1**	0
Tececleote Creek	315TCI	0	0	-
Dos Pueblos Creek	315DOS	0	0	-
Canada del Refugio	315RSB	0	**1**	-
Canada del Capitan	315CAP	1*	0	-
Gaviota Creek	315GAV	0	0	**1**
Gaviota Creek	315GAI	0	**1**	-
Jalama Creek	315JAL	0	**2**	**1**

Sediment chemistry was analyzed at a subset of the sites in the Hydrologic Unit; these sites were also tested for toxicity using the amphipod *Hyallela azteca*. Organic chemicals were detected in all sediment samples collected in March 2002. Table 5.1.4c summarizes only those specific chemicals that were detected at each site. In addition to detecting at least one organic chemical at all sites for which sediment samples were analyzed, it should be noted that concentrations of some chemicals were measured above published criteria values (NOAA ERMs in marine sediment, NOAA UET values and Florida PELs for freshwater sediment). For example, both the total DDT and p'p'DDE concentrations at the Bell Creek site (315BEL) were above the NOAA UET value. Total DDT at this site was 249 ng/g. The dieldrin concentration at the Devereaux Slough site (315DEV) exceeded the Florida PEL value. This site also had elevated levels of total chlordane and one of its components, trans-nonachlor. The concentration of total chlordane nearly reached the Florida PEL value. Dieldrin was used for mosquito control, soil treatment and as a termiticide up until the mid-1970s. Chlordane was commonly applied to control ants and other lawn pests at golf courses, and was used up until 1988 as a termiticide. A golf course is immediately upstream of this site, and the creek flows directly into the Slough via a culvert below the sample location. Metals were not found in concentrations that exceed published criteria at any site in the Hydrologic Unit.

Table 5.1.4c. Organic chemicals detected at sites in the South Coast Hydrologic Unit (measurements that exceed ERMs or PELs are in **bold** font). NOAA UET values are based on either infaunal effects ([I]) or microtox assay ([M]).

Site Tag	Chlordane, Total	Chlorpyrifos	DCBP(p,p')	DDT, Total	Dieldrin	Endosulfan sulfate	Heptachlor epoxide	Nonachlor, trans	Oxadiazon	Total PCB	Toxaphene
315ABU	2.4			1.32	1.38			0.825		5.393	
315ANN	2.8	1.42		1.55				1.15	2.2	6.849	
315APC	**6.1**			15.4				2.15		8.522	
315ATA	3.3	28.4		6.38	0.998	3.3		1.44	12.5	11.672	
315BEL	5.4	5.96	5.06	**249**	1.4			3.07		11.956	
315CRP	3.5	2.89		1.59	0.896			2.33	7.08	6.656	4.6
315DEV	**8.6**			16.6	**6.72**			5.78		23.273	
315FRC		12.6		18.9					185	5.35	
315GAV										6.215	
315JAL										8.016	
315MIS	**8**			4.62	2.82		1.36	2.88	43.4	6.568	
315RIN				2.44							16.9
315SCC	0.6										
ERM marine	**6**			**46.1**	**8**					**180**	
PEL freshwater	**8.9**				**6.67**		**2.74**			**277**	
UET freshwater	**30[I]**			**50[I]**	**300[I]**		**30[I]**			**26[M]**	

Fish and bivalve tissue chemistry data were collected at several sites in the Hydrologic Unit by CDFG staff working with the State Mussel Watch and Toxic Substances Monitoring Programs. These data are discussed in the previous section regarding fish consumption.

Wide diurnal swings in dissolved oxygen were reported at several of the sites in the Hydrologic Unit had, ranging from super-saturated conditions to levels below criteria identified for aquatic life protection. Both Sycamore (315SCC) and Franklin (315FRC) creeks had ranges of more than 15 mg/L dissolved oxygen in a single 24-hour period; both of these sites have low summer flows and are contained within cement box channels as they flow through urban areas. Sites with the lowest range of dissolved oxygen concentrations (varying less than 2 mg/L) were upper Carpinteria Creek (315CAU), Montecito Creek (315MTC) and San Ysidro Creek (315YSI). However, each of these sites dried up in late spring and therefore no data is available from summer months when dissolved oxygen typically fluctuates the most. The range of dissolved oxygen values at sites in the 315 Hydrologic Unit is shown in Figure 5.1.4a.

Most of the creeks in the Hydrologic Unit are designated as both cold and warm water habitat in the Central Coast Basin Plan. The dissolved oxygen objective that applies to these designations is 7.0 mg/l (as a lower limit) for cold water and 5.0 mg/L for warm water habitats. Jalama, Los Carneros, Arroyo Burro, Romero and Arroyo Paredon are designated as warm water habitat only. Depressed dissolved oxygen levels (relative to the appropriate objective) throughout the summer months were observed at Atascadero Creek at Hope Drive (315ABH), Devereaux Slough (315DEV), Mission Creek (315MIS), Carpinteria Creek (315CRP) and two sites on Atascadero Creek, at Ward Drive (315ATU) and at Preston Drive (315ATA). For comparison, the upstream site on Mission Creek (315MIU) did not have any dissolved oxygen measurements below the objective. Also of note, the Hope Street site on Arroyo Burro Creek (315ABH) had very low flow during summer months, with only a trickle flowing out of a large pooled area above the sample site. The lower site on Arroyo Burro (315ABU) has more flow year round and never exceeded the warm water habitat objective. Increased flow and/or riparian corridor cover would likely improve dissolved oxygen and water temperature conditions in this Hydrologic Unit.

The median value for percent oxygen saturation was below the Basin Plan objective of 85% at several sites in the Hydrologic Unit. When median values are below 85% saturation, the site is considered impaired. However, when median values are above 85% saturation but there are one or more measurements below 85%, we consider this an indication of “some” evidence of impairment. Two sites in the Unit had median percent saturation levels below 85%: Devereaux Creek (315DEV) and Arroyo Burro Creek at Hope Street(315ABH). Most other sites in the Hydrologic Unit had at least one dissolved oxygen saturation measurement below 85% (Table 5.1.4a).

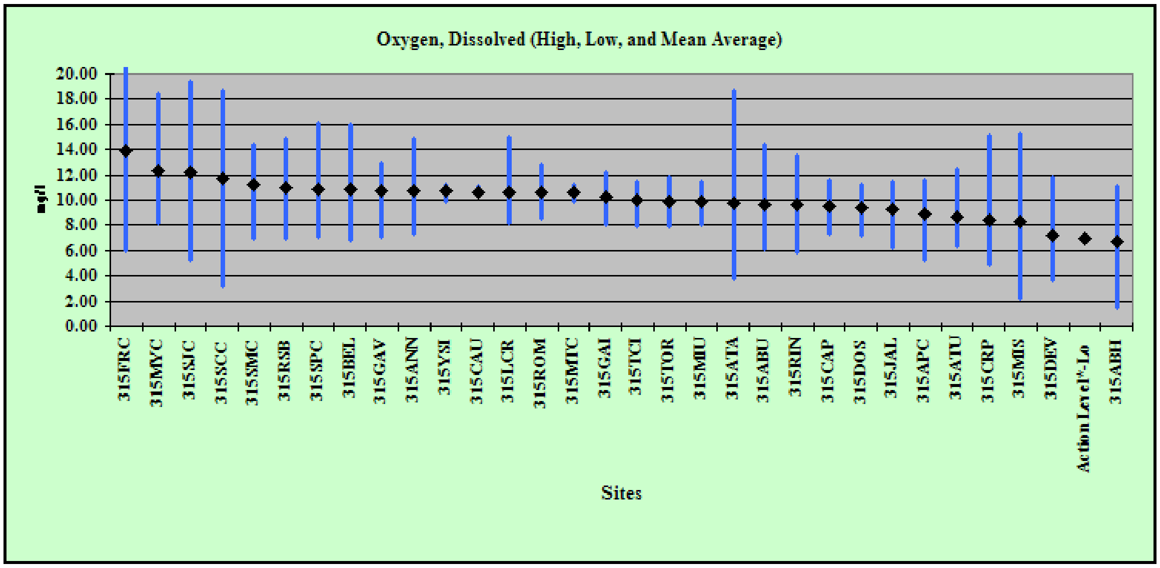

Figure 5.1.4a. Range and mean of dissolved oxygen concentrations (mg/L) measured at sites in the Hydrologic Unit between January 2001 and April 2003.

Elevated pH levels were recorded consistently at several sites in the Hydrologic Unit as shown in Figure 5.1.4b. Many of these creeks are located in urban areas and are flowing through cement box channels at the monitoring site location. Three sites had average pH levels that exceeded the maximum Basin Plan objective of 8.3; at the Santa Monica Creek site (315SMC), 72% of the measurements exceeded this objective. Twenty-one sites in the Hydrologic Unit had at least one exceedance of the maximum pH objective. No measurements in the Unit were below the lower pH objective of 6.5.

Figure 5.1.4b. Percent exceedances of the maximum pH Basin Plan objective at sites in the South Coast Hydrologic Unit between January 2001-April 2003.

Unionized ammonia concentration is calculated from field measurements of water temperature and pH and lab measured concentrations of total ammonia. Unionized ammonia exceeded the Basin Plan Objective once, at Maria Ygnacio Creek (315MYC). Because pH affects the amount of total ammonia that is in this toxic form, it is noteworthy that this site also had pH levels which exceeded the Basin Plan objective in 27% of the measurements. No other site in the Hydrologic Unit exceeded the unionized ammonia objective in monthly water quality monitoring.

The Bio-stimulatory Risk Index has ranked sites at Franklin Creek (315FRC) and Devereaux Slough (315DEV) in the 25 worst sites in the Region. As shown in Figure 5.1.4c, these two sites have risk scores that range from 0.35 to 1.0 (the highest risk score). The Risk Index combines pH and dissolved oxygen ranges with nutrient concentrations and measures of aesthetic impairment to provide an estimate of eutrophication risk for a given a site. Other sites, including Arroyo Paredon (315APC), Carpinteria Creek (315CRP), lower Arroyo Burro Creek (315ABU), lower Mission Creek (315MIS) and Santa Monica Creek (315SMC) also have high Risk Index scores relative to all sites in the Region. Each of these sites has been discussed in the previous paragraphs because of elevated pH or depressed dissolved oxygen levels. Elevated nutrient concentrations at Franklin Creek (315FRC) Devereaux Slough (315DEV), Arroyo Paredon (315APC) and Carpinteria Creek (315CRP) are primary factors contributing to the high Risk Index scores at these sites.

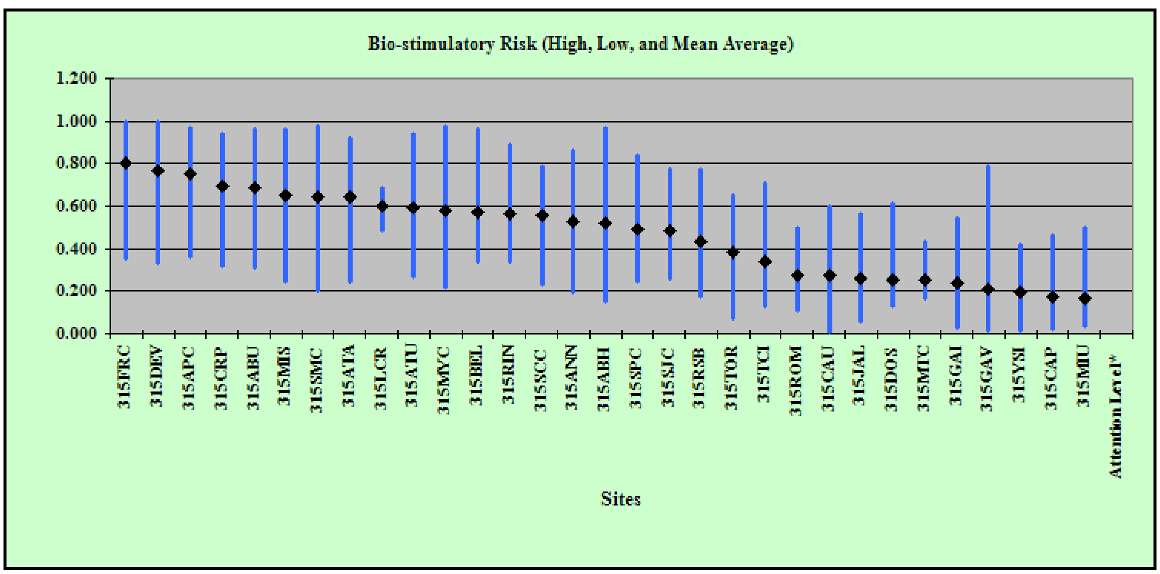

Figure 5.1.4c. Range and mean Bio-stimulatory Risk Scores for sites in the South Coast Hydrologic Unit. Risk of eutrophic conditions is greatest at sites with scores near 1.0.

Orthophosphate is the biologically available form of phosphorus in water and is commonly the limiting nutrient in most systems. Elevated orthophosphate levels were indirectly discussed in the preceding text as they are included in the calculation of Bio-stimulatory risk. However, there are currently no Basin Plan criteria for orthophosphate. For reference, the USEPA has recommended 0.1 mg/L as the 303(d) listing criteria for this parameter. Relative to this criteria, elevated orthophosphate levels were observed consistently at two sites in the South Coast Hydrologic Unit (Figure 6a). All samples collected at Arroyo Paredon (315APC) exceeded the USEPA recommended criteria level and the maximum value reported was 11.0 mg/l. At Franklin Creek (315FRC) and Santa Monica Creek (315SMC), multiple samples exceeded the USEPA recommended criteria. Common to each of these three sites is the direct discharge of greenhouse and nursery facilities to the streams. Region 3 staff has since worked with most of the growers in these watersheds to find alternative disposal methods to protect these waters. Except during the rainy season (February 2001), other sites in the Hydrologic Unit generally had low concentrations of orthophosphate.

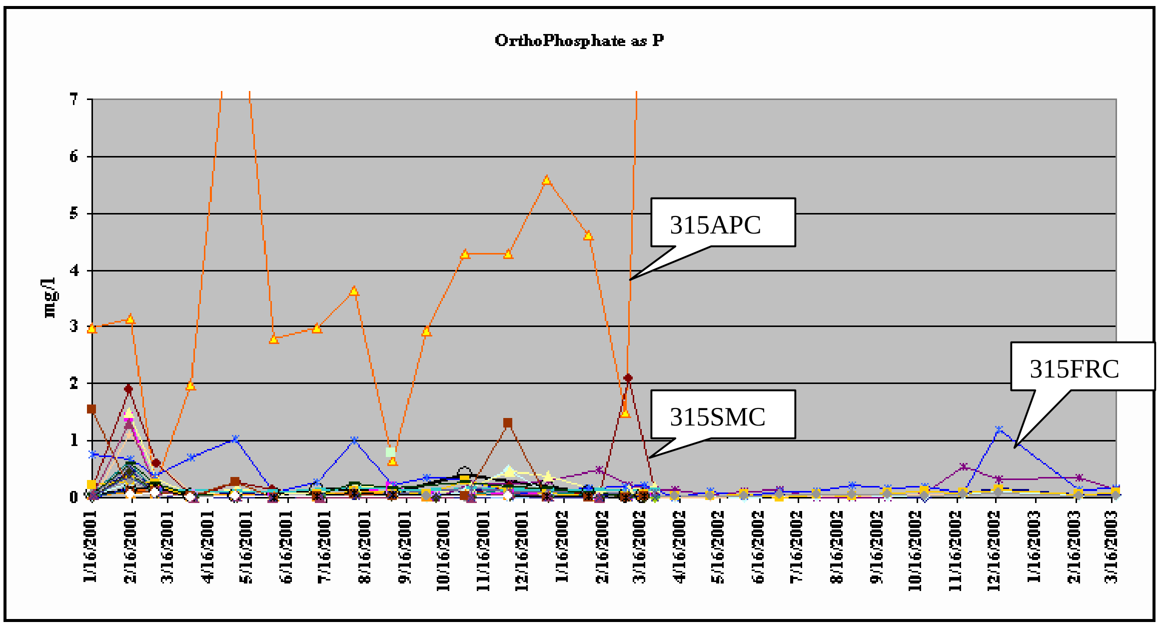

Figure 5.1.4d. Time series of orthophosphate concentrations at sites in the South Coast Hydrologic Unit, January 2001 through April 2003.

Benthic macroinvertebrates were collected at several sites throughout the Hydrologic Unit in March of 2002 and 2003. The CCAMP IBI scores for each site are shown in Figure 5.1.4d. Relative to all sites in the Region, the sites at El Capitan Creek (315CAP), upper Mission Creek (315MIU) and upper Carpinteria Creek (315CAU) had good Biological Integrity (mean CCAMP IBI score > 6). Common to each of these sites is cool flowing water, high quality riffle habitat and relatively low impact from urbanization. Sites scoring low using the CCAMP IBI (mean score < 3) include Atascadero Creek at Ward Drive (315ATA), Mission Creek at Montecito Street (315MIS), Arroyo Burro Creek at Cliff Drive (315ABU) and lower Carpinteria Creek (315CRP). In contrast to the upper watershed sites on Mission and Carpinteria Creeks, the downstream sites are heavily influenced by urbanization, and although some riffle habitat is available, low flows at these sites have warmer water temperature in combination with degraded water quality. Similar flow and water temperature condition occur at the sites on Atascadero and Arroyo Burro Creeks. However, at these sites there is no riffle habitat and the substrate is primarily fine sediment.

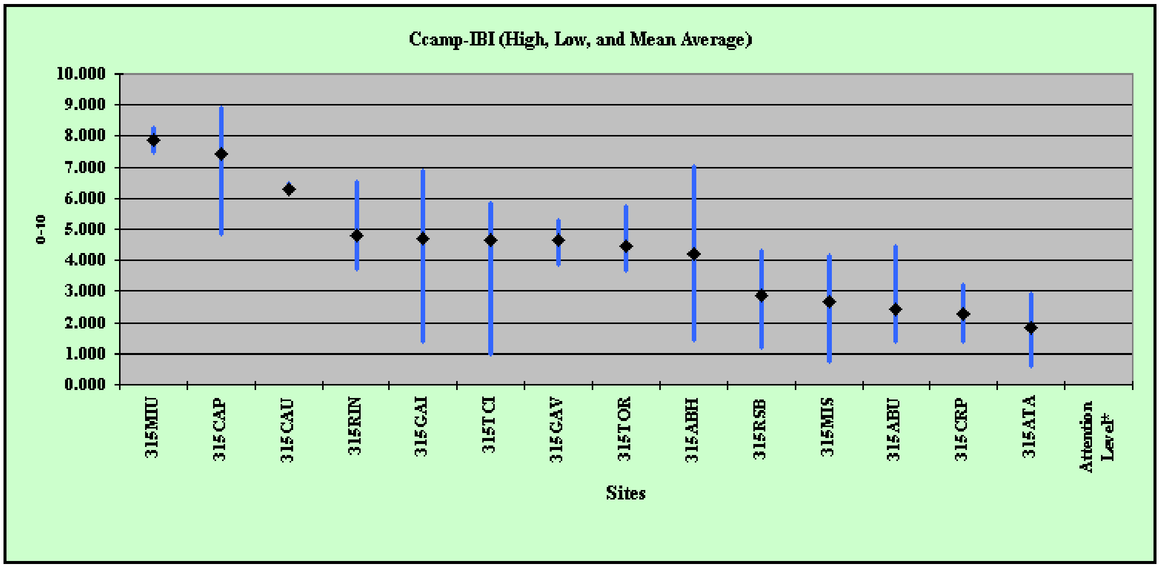

Figure 5.1.4e. Range and mean of CCAMP IBI scores for sites in the South Coast HU. Scores above 6 indicate good macroinvertebrate community composition and scores below 3 indicate poor condition.

5.1.5 Is there evidence that agricultural uses are not supported?

The following text discusses site specific exceedances of various criteria which apply to assessment of agricultural beneficial uses. Table 5.1.5a summarizes threshold exceedances of these criteria.

The pH was consistently elevated above levels that are of concern for agricultural uses at two sites; Santa Monica Creek 315(SMC) and Franklin Creek (315FRC). For more information on pH at sites in the Hydrologic Unit see the section 5.1.2 discussing drinking water.

The Central Coast Basin Plan states that conductivity greater than 3000 uS/cm in irrigation water can cause severe problems for crops. Three sites in the Hydrologic Unit had conductivity levels exceeding this value in 50% or more of the samples. These sites include San Jose Creek (315SJC), Devereaux Slough (315DEV) and Bell Canyon Creek (315BEL). Of these creeks, only San Jose Creek has the agriculture beneficial use designation. The elevated conductivity at this site is due to a permitted discharge from a water softening company in the city of Goleta. Effects of the elevated conductivity to the receiving water should be evaluated in future monitoring in coordination with the permit staff at Region 3. San Jose Creek also has extremely high levels of chloride and sodium. At this site chloride ranges up to 5,410 mg/l relative to the Basin Plan objective for agriculture use of 106 mg/L.

Several other sites had elevated levels of chloride and sodium and mean levels are shown in Figures 5.1.5a and 5.1.5b.

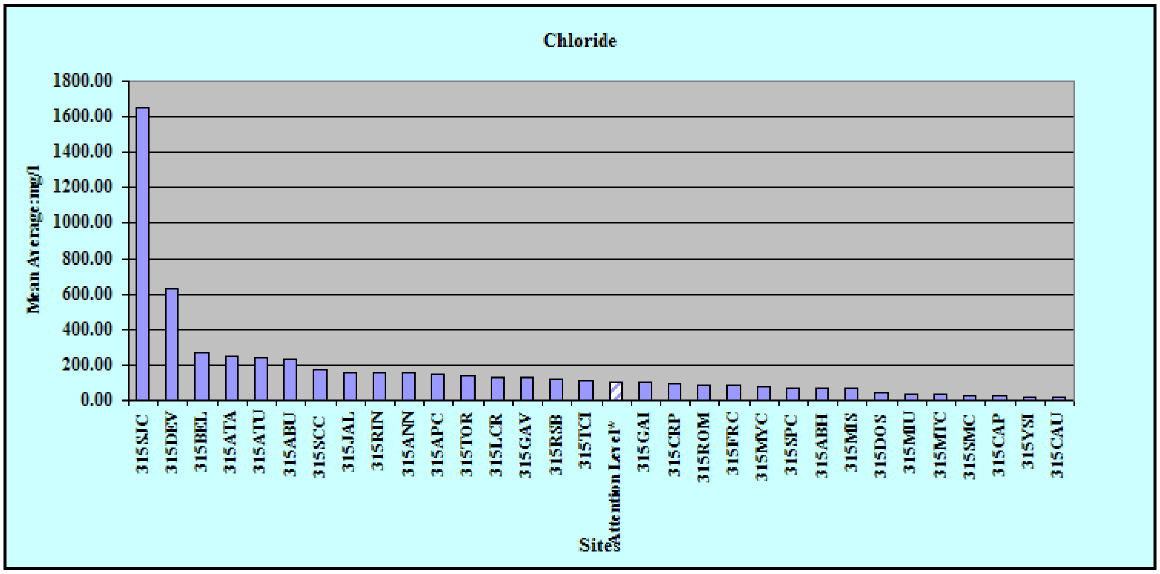

Figure 5.1.5a. Mean of chloride levels measured at sites in the South Coast Hydrologic Unit between January 2001-April 2002.

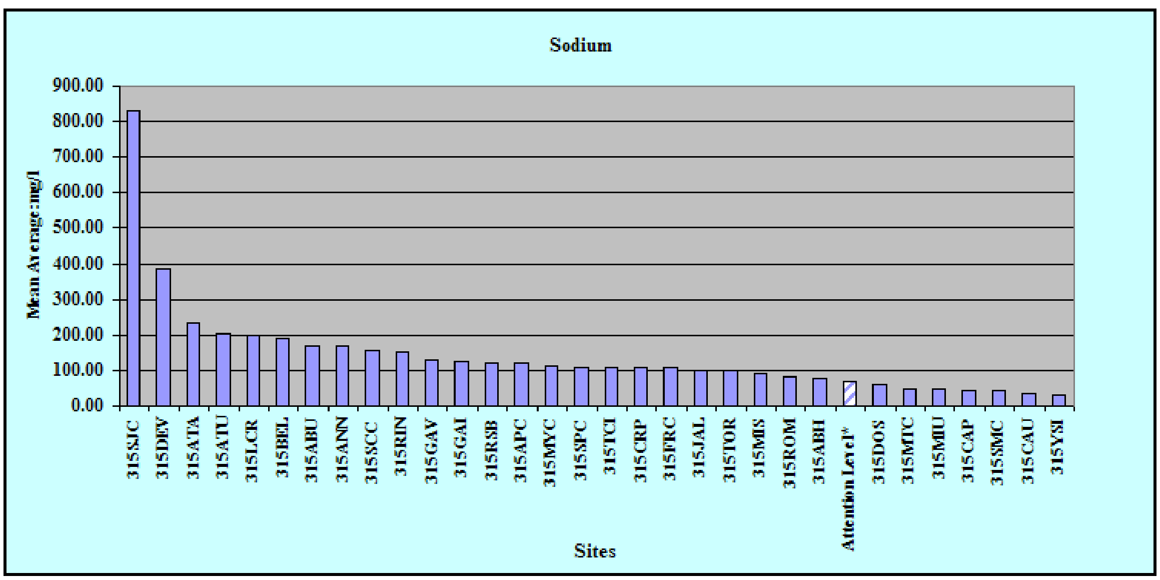

Figure 5.1.5b. Mean of sodium levels measured at sites in the South Coast Hydrologic Unit between January 2001-April 2002.

Boron levels in this Hydrologic Unit were generally low (less than 0.75 mg/L). Only four sites in the Unit had more than five sample results in exceedance of the Basin Plan Objective for irrigation waters (Table 5.1.5a). Of these only Gaviota and Arroyo Paredon are designated for agricultural uses. At these two sites more than 50% of the total samples exceed this criterion.

The Basin Plan also identifies nitrate levels in excess of 30 mg/L as N as potentially harmful to agricultural uses. Arroyo Paredon (315APC) is the only site that had more than five nitrate measurements above this value. This site is located adjacent to greenhouse and nursery operations and is also receiving water for nitrate contaminated groundwater discharges. Franklin Creek, which is also the receiving water for several direct discharges from greenhouse and nursery operations, exceeded this objective twice. Region 3 staff is currently working with greenhouse and nursery operators to upgrade their operations and cease discharges to the creeks in the Carpinteria area.

Table 5.1.5a. Site specific assessment of data used to assess impairment of agricultural beneficial uses in the South Coast Hydrologic Unit (HU315). **Yes** - evidence that a problem exists, **No** - no evidence that a problem exists, **S** – some evidence that a problem may exist (i.e. a non threshold value is exceeded or less than five exceedances observed, dash symbol (-) - not assessed. Note: pH is not used alone to determine impairment

Constituent	Boron	Chloride	Sodium	Conductivity	Nitrate as N	pH	**Evidence of Impairment**
Matrix	H20	H20	H20	H20	H20	H20	
Units	mg/L	mg/L	mg/L	uS/cm	mg/L	pH	
Agricultural Use AssessmentThreshold	0.75	106	69	3000	30	<6.5 or >8.4	
Sites							
315JAL	No	**Yes**	**Yes**	No	No	**S**	**Yes**
315GAV	**Yes**	**Yes**	**Yes**	No	No	No	**Yes**
315GAI	**S**	**Yes**	**Yes**	No	No	No	**Yes**
315RSB	No	**Yes**	**Yes**	No	No	No	**Yes**
315CAP	No	No	No	No	No	No	No
315DOS	No	No	**Yes**	No	No	No	Yes
315TCI	No	**Yes**	**Yes**	No	No	No	**Yes**
315BEL	**Yes**	**Yes**	**Yes**	**Yes**	**S**	No	**Yes**
315DEV	**Yes**	**Yes**	**Yes**	**Yes**	No	No	**Yes**
315ANN	**S**	**Yes**	**Yes**	No	No	No	**Yes**
315LCR	No	**S**	**Yes**	No	No	**S**	**Yes**
315SJC	**S**	**Yes**	**Yes**	**Yes**	No	**S**	**Yes**
315SPC	No	**S**	**Yes**	No	No	**S**	**Yes**
315ATA	No	**Yes**	**Yes**	No	No	**S**	**Yes**
315ATU	No	**Yes**	**Yes**	**S**	No	No	**Yes**
315MYC	**S**	**S**	**Yes**	No	No	**S**	**Yes**
315ABU	**Yes**	**Yes**	**Yes**	**S**	No	No	**Yes**
315ABH	No	**S**	**Yes**	No	No	No	**Yes**
315MIS	No	**S**	**Yes**	No	No	No	**Yes**
315MIU	No	No	No	No	No	No	No
315SCC	**S**	**Yes**	**Yes**	No	No	**S**	**Yes**
315MTC	No	No	No	No	No	No	No
315YSI	No	No	No	No	No	No	No
315ROM	No	No	**Yes**	No	No	No	**Yes**
315TOR	No	**Yes**	**Yes**	No	No	No	**Yes**
315APC	**Yes**	**Yes**	**Yes**	No	**Yes**	No	**Yes**
315SMC	No	No	No	No	No	**Yes**	**S**
315FRC	No	**Yes**	**Yes**	No	**S**	**Yes**	**Yes**
315CRP	No	**S**	**Yes**	No	No	No	**Yes**
315CAU	No	No	No	No	No	**S**	**S**
315RIN	**S**	**Yes**	**Yes**	No	No	No	**Yes**
315CAR	-	-	-	-	-	-	-

5.1.6 Is there evidence that non-contact recreation uses are not supported?

The following text discusses site specific exceedances of various criteria which apply to assessment of non-contact recreation beneficial uses. Table 5.1.6a summarizes threshold exceedances of these criteria.

The pH was consistently elevated at several sites in the Hydrologic Unit. For more information on pH at sites in the Hydrologic Unit see the drinking water section (section 5.1.2).

The Basin Plan objective fecal coliform in waters used for non-contact recreational activities is 4000 MPN/100 ml. Several sites in the Hydrologic Unit had one or more exceedances of this objective (Figure 5.1.6a). The Mission Creek site (315MIS) is a coastal confluence program site monitored monthly since April 2001; of the 27 samples collected, 7 exceeded the objective. At this site, homeless encampments are evident and human feces have been observed on the creek banks on numerous occasions. This site is located in downtown Santa Barbara. Each of the other sites with multiple exceedences of this objective are also located within urban areas. No other site in the Unit had five or more exceedances of this objective.

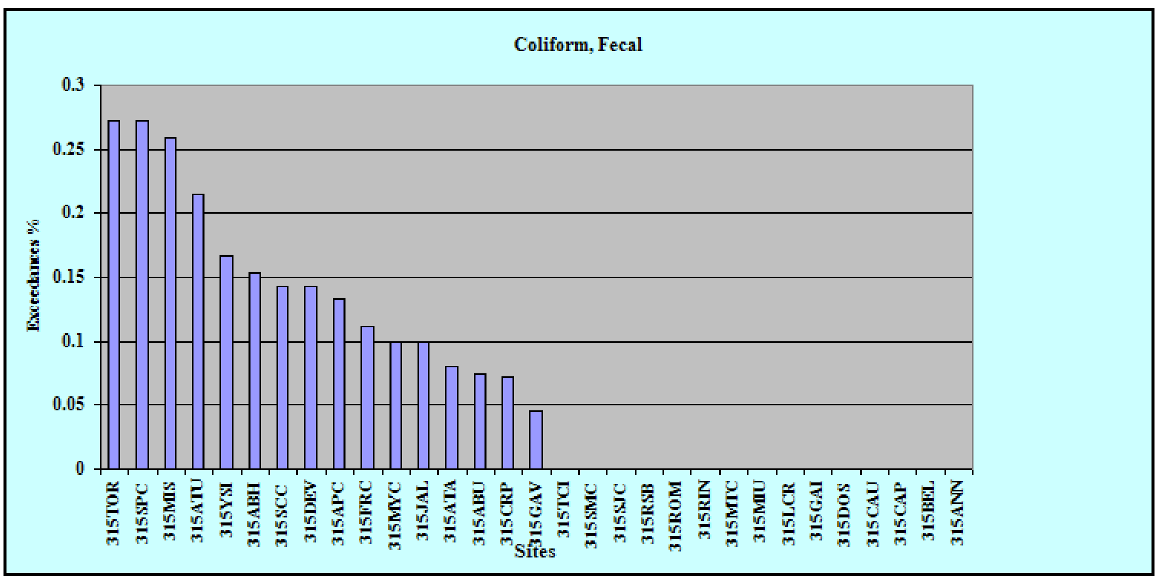

Figure 5.1.6a. Percent exceedances of the Basin Plan objective for non-contact recreation at sites in the South Coast Hydrologic Unit, January 2001 – March 2003.

Persistent turbidity in the dry season is an aesthetic impairment. CCAMP uses a screening value of 10 NTU to evaluate dry weather turbidity. Several sites in the Hydrologic Unit had a single exceedance of this value; however, persistent conditions were not observed at any site. Turbidity above 100 NTU was measured twice at both the Atascadero Creek site at Ward Drive (315ATA) and the Devereaux Slough site (315DEV) during summer monitoring. Causes of these conditions are not known.

Evaluation of algal cover in the active stream channel shows that several sites have nuisance conditions throughout the summer and fall. Thick algal mats may result in oxygen depletion as well as aesthetic impairment. All sites that had flowing water through the summer months had over 75% of the stream substrate covered in periphyton. Thick filamentous algae covering the water surface was observed at Arroyo Burro Creek at both the Hope Street site (315ABH) and the Cliff Drive (315ABU), as well as at both Atascadero Creek sites (315ATA and 315ATU) and the Maria Ygnacio Creek site (315MYC). Each of these sites had deep (1-3 feet) slow moving water throughout the summer and fall.

Nuisance trash and litter was observed at several of the channelized sites in the urban areas of Carpinteria and Santa Barbara. Creeks with persistent trash in the channel include Franklin Creek (315FRC), Santa Monica Creek (315SMC), Mission Creek at Montecito Drive (315MIS) and Sycamore Creek (315SCC). Trash found at Franklin, Santa Monica and Mission Creek consisted primarily of beverage containers, food wrappers and other disposable items. At Sycamore Creek field staff frequently observed large appliances and other household items. At both Sycamore and Mission creeks, human feces were observed on more than one sampling event.

Table 5.1.6a. Site specific assessment of data used to assess impairment of water contact recreational uses in the South Coast Hydrologic Unit (HU315). **Yes** - evidence that a problem exists, **No** - no evidence that a problem exists, **S** – some evidence that a problem may exist (i.e. a non threshold value is exceeded or less than five exceedances observed, dash symbol (-) - not assessed. Note: pH, turbidity and algal cover are not used alone to determine impairment.

Constituent	% Algal Cover	% algal Cover, filamentous	Coliform, Fecal	Coliform, Fecal	pH	Turbidity(NTU)	**Evidence of Impairment**
Units	%	%	MPN/100 ml	MPN/100 ml	pH	NTU	
Matrix	NA	NA	H20	H20	H20	H20	
Non-Contact Recreation Assessment Threshold	25%	25%	More than 10% of samples >4000	Geometric mean > 2000	<6.5 or >8.3	10	
Sites							
315JAL	**Yes**	No	**S**	**S**	**S**	No	**S**
315GAV	**Yes**	No	**S**	No	No	**S**	**S**
315GAI	**Yes**	No	No	No	No	**S**	**S**
315RSB	**Yes**	**Yes**	No	No	No	No	**S**

315CAP	**Yes**	No	No	No	No	No	**S**
315DOS	**Yes**	No	No	No	No	**S**	**S**
315TCI	**Yes**	No	No	No	No	No	**S**
315BEL	**Yes**	**Yes**	No	No	No	No	**S**
315DEV	**Yes**	**Yes**	**S**	**S**	No	**Yes**	**S**
315ANN	**Yes**	No	No	**S**	**S**	**S**	**S**
315LCR	No	**Yes**	No	**S**	**S**	**S**	**S**
315SJC	**Yes**	No	No	**S**	**Yes**	**S**	**S**
315SPC	No	No	**S**	**S**	**Yes**	**S**	**S**
315ATA	**Yes**	**Yes**	**S**	**S**	**S**	**S**	**S**
315ATU	**Yes**	No	**S**	**S**	No	**S**	**S**
315MYC	**Yes**	**Yes**	**S**	**S**	**S**	**S**	**S**
315ABU	No	**Yes**	**S**	**S**	No	**S**	**S**
315ABH	**Yes**	**Yes**	**S**	**S**	No	No	**S**
315MIS	**Yes**	**Yes**	**Yes**	**Yes**	No	No	**Yes**
315MIU	**Yes**	No	No	No	**S**	No	**S**
315SCC	**Yes**	**Yes**	**S**	**S**	**S**	No	**S**
315MTC	**Yes**	**Yes**	No	**S**	**S**	No	**S**
315YSI	No	No	**S**	**S**	**S**	No	**S**
315ROM	**Yes**	No	No	No	**Yes**	No	**S**
315TOR	**Yes**	No	**S**	**S**	**S**	No	**S**
315APC	**Yes**	No	**S**	**S**	No	**S**	**S**
315SMC	**Yes**	**Yes**	No	No	**Yes**	**S**	**S**
315FRC	**Yes**	No	**S**	**Yes**	**Yes**	**S**	**Yes**
315CRP	**Yes**	**Yes**	**S**	No	No	No	**S**
315CAU	**Yes**	No	No	No	**S**	**S**	**S**
315RIN	**Yes**	**Yes**	No	No	No	No	**S**
315CAR	-	-	-	-	-	-	-

6 Discussion

CCAMP monitoring data collected in this Hydrologic Unit indicates that at several sites more than one beneficial use is impaired (Table 5.1b).

In the Carpinteria Hydrologic Sub-area, most beneficial uses are impacted to some degree at all sites. In this area, CCAMP monitoring sites on Rincon, Carpinteria, Franklin and Santa Monica Creeks are located at the lower ends of the watershed with one additional upper watershed site on Carpinteria Creek.

Land use in the Rincon Creek watershed is primarily rural residential and orchards. Several beneficial uses are impaired in this watershed. Fecal coliform levels are persistently above Basin Plan objectives for recreational uses. Aquatic life beneficial uses are impaired, as indicated by toxicity, high Bio-stimulatory risk index scores and presence of pesticides in sediment samples. Agriculture uses are also impaired by elevated levels of chloride and sodium. Finally, nuisance algae and emergent vegetation are problematic for non-contact recreational uses. Rincon Creek is currently on the 303(d) list of impaired waters for toxicity and boron. Rincon will also be proposed for addition to the list for impairment to agricultural uses due to sodium and chloride and impairment to recreational uses due to fecal colifom.

CCAMP conducted monitoring at two sites in the Carpinteria watershed, in the lower watershed below Carpinteria Ave (315CRP) and in the upper watershed at Highway 192 (315CAU). Land uses in the upper watershed are primarily rural residential and orchards. Below Highway 192, the creek flows through the urban areas of Carpinteria, and then to the ocean at Carpinteria State Beach.

In 2001, the upper Carpinteria watershed was dry at Highway 192 for most of the year. Flowing water was present during four sampling events between January 2001 and April 2002. Elevated pH and fecal coliform were measured only once at this site. As the creek dried out, algal growth was a concern for aquatic life and aesthetic uses. Monitoring in the lower watershed shows that fecal coliform was elevated on multiple occasions, nitrate concentrations exceeded criteria on occasion, and salts (sodium and chloride) were elevated above levels which are harmful to irrigated plants. In addition, non-contact recreation uses in the lower watershed were impaired by algal growth, and on occasion fecal coliform levels exceeded 4000 MPN/100mL. Carpinteria Creek is currently on the 303(d) list of impaired waters for pathogens

The Carpinteria Marsh is one of the few remaining estuaries and coastal wetland habitats in the southern part of the State. Two major watersheds drain to the marsh; Franklin and Santa Monica Creeks. These watersheds both drain the steep slopes of the Santa Ynez Mountains before they are channelized to flow through the urban areas of Carpinteria. Both watershed are heavily influenced by agricultural (primarily greenhouses and nurseries) as well as groundwater discharges. Franklin Creek is the only site at which all beneficial uses are impaired (with the exception of fish consumption). This creek flows to the marsh year-round and has an average nitrate concentration above 20mg/L (NO_3 as N). Bio-stimulatory Risk Index scores for this site are in the highest quartile for the entire region, based primarily on nitrate and phosphate concentrations. Downstream effects have not been evaluated by this program, but nutrient loading studies conducted by University of California Santa Barbara staff show high levels in the marsh and ocean. Franklin Creek also is plagued by high fecal coliform levels, sometimes exceeding 4000 MPN/100mL. Elevated pH, chloride and sodium levels are also of concern for agricultural uses in the lower Franklin Creek watershed. Franklin Creek is currently on the 303(d) list for impairment due to nitrate and will be proposed for addition to the list for fecal colifom in 2008. Santa Monica Creek is a larger watershed and is less impacted by groundwater and nursery discharges. This creek did not have year-round flows in the lower watershed in 2001. However, elevated coliform and pH levels are problematic for multiple beneficial uses. Santa Monica Creek is not currently on the 303(d) list of impaired waters but will be pro[posed for addition to the list due to elevated fecal colifom levels.

Arroyo Paredon Creek flows from the steep southern face of the Santa Ynez Mountains to the Ocean just northwest of Carpinteria. The upper watershed is mostly in National Forest land, and also has some rural residential areas in the foothills. After crossing Highway 192, the creek flows through greenhouse facilities and urban areas. The lower watershed is also influenced by groundwater discharges from blow-off valves and leaking conveyance systems of these waters. CCAMP data shows evidence of impairment to all beneficial uses. Fecal coliform levels in this creek sometimes exceed 4000 MPN/100mL. Nitrate frequently exceeds both the drinking water and agriculture supply objectives. Toxicity data and high scores on the Bio-stimulatory Risk Index indicate that the habitat is impaired for aquatic life. Although groundwater is know to contain high levels of nitrate and is frequently discharged to the surface water in the lower watershed, future investigation to identify sources of chemicals, nutrients and coliform should continue. Arroyo Paredon is currently listed on the 303(d) list of impaired waters for boron, nitrate and toxicity and will be proposed for addition to the 2008 list for fecal coliform.

In the Montecito Hydrologic Sub-area, there is evidence indicating all beneficial uses evaluated in this report are impaired in various watersheds. CCAMP monitoring sites on Toro, Romero, San Ysidro and Montecito Creeks are located in the lower watersheds near Highway 101.

Toro Creek, and its tributary Garrapata Creek, flows from the Santa Ynez Mountains to the ocean at Loon Point. The upper watershed is mostly within forested areas of the Los Padres National Forest. The lower reaches of this watershed are channelized, and the creek flows through rural residential and some urban areas on the outskirts of Montecito. Water quality in lower Toro Creek is impacted by fecal coliform, algal growth and salts. In summer months, dissolved oxygen is slightly depressed as the creek begins to dry up. Benthic macroinvertebrate communities at this site are in fair condition (using the CCAMP IBI) and scored slightly higher in 2002 than in 2001. Toro Creek is not currently on the 303(d) list of impaired waters.

Headwaters for Romero Creek are also in the National Forest areas of the Los Padres and flow to the ocean west of Summerland at Frenald Point. Like other creeks in this area, Romero Creek is channelized in the lower reaches as it flows through the urbanized areas of Montecito and the Birnam Wood Golf Club. However, natural substrate is still present.

Elevated pH,and sodium levels are persistent in the lower watershed. Fecal coliform and some high scores for the Bio-stimulatory Risk index (driven by instream algal conditions) indicate that additional problems may exist at this site. Romero Creek is not currently on the 303(d) list of impaired waters.

San Ysidro Creek also originates in the National Forest areas of the Los Padres and flows through the urban areas of Montecito to the ocean west of Frenald Point. The lower reaches of this creek flow through the urbanized areas of Montecito and some orchard properties. Although the data did not show that any beneficial use was clearly impaired, there was evidence that all beneficial uses may be somewhat impaired. For example, fecal coliform in one sample from this site measured 4,900 MPN/100mL. However, limited data was available for this site, as the stream bed dried up in May of 2001 and remained dry until the winter rains in November. San Ysidro Creek is not currently on the 303(d) list of impaired waters.

Montecito originates in the National Forest areas of the Los Padres and flows through the urban areas of Montecito to the ocean. Montecito is channelized in the lower reaches but maintains its boulder and cobble substrate. In the summer of 2001 this creek was dry at the CCAMP monitoring site so data for this assessment was limited to seven samples collected in winter and spring. Available data shows that water quality was generally good. One sample had elevated coliform levels during a rain event, and high pH levels are of concern for several beneficial uses. As this creek was going dry, algae created large mats, which may be a concern for aquatic life and aesthetic uses. Montecito Creek is not currently on the 303(d) list of impaired waters.

CCAMP conducted monitoring in three watersheds in the Santa Barbara Hydrologic Sub-area. Sycamore, Mission and Arroyo Burro Creek. All originate in the steep southern slopes of the Santa Ynez Mountains, within the Los Padres National Forest boundaries. Each of these watersheds is channelized as it flows through the City of Santa Barbara to the ocean.

Sycamore Creek is the smallest of the three Santa Barbara Area watersheds assessed in this report. CCAMP conducted monitoring at one site, located at Punta Gorda St. near Highway 101 in Santa Barbara. At this location water quality is impaired by fecal coliform levels, having more than 50 % of samples exceed 400 MPN/100mL and two samples exceed 4000 MPN/100mL. CCAMP staff observed human feces on the banks of this urban channel on multiple occasions. CCAMP staff also recorded that furniture, appliances and litter was frequently dumped into the channel at this location. High pH levels contribute to partial impairment of several beneficial uses in this creek. In addition low dissolved oxygen, algal growth in summer months and high levels of sodium and chloride are problematic for aquatic life and agricultural uses. Syccamore Creek is not currently on the 303(d) list of impaired waters. However, It will be proposed for addition to the 2008 list for impairment due to fecal coliform.

Mission Creek and it main tributary Rattlesnake Creek flow from National Forest areas where the primary use is recreation. Below the confluence of these two creeks, CCAMP monitored at the Highway 192 Bridge. Water quality was generally good at this location with the exception of pre-dawn dissolved oxygen saturation levels dipping below 85% and two elevated fecal coliform samples. These fecal coliform data were reported for late summer, when flows are low and guano from bats nesting upstream in the bridge was visible on exposed substrates. CCAMP data from 2001 did not show that any beneficial uses were impaired. However, the upper reaches of this stream are habitat for steelhead trout, and dissolved oxygen may be of concern at this location. CCAMP staff observed trout trapped in the pool below the Highway 192 Bridge in summer months when flow was too low for the fish to pass. CCAMP staff also conducted monitoring downstream at Montecito Street, below Highway 101. Between the upstream location and the ocean, Mission Creek is channelized, often within a cement box channel. Water quality data from the downstream location show fecal coliform levels were extremely high, exceeding 4000 MPN/100mL on multiple occasions. At this location, human feces are frequently observed on the banks. Water quality issues related to aquatic life beneficial uses at this location include low dissolved oxygen and algae in summer months, high Bio-stimulatory Risk Index scores, and organic pesticides (including DDT) in sediments and tissues of resident fish. Also at this location sodium and chloride levels are elevated relative to the upstream site. Because this stream is in the southern-most range of steelhead trout, it is imperative that habitat be available for migration of those fish to the upper watershed. Ongoing monitoring at the lower site, as part of the CCAMP coastal confluences program, has not shown significant improvement in water quality since 2001. The lower 8.5 miles of Mission Creek is currently listed on the 303(d) list of impaired waters for pathogens and for toxicity.

Arroyo Burro watershed includes both Arroyo Burro and San Roque Creeks, which flow from the Los Padres National Forest to the City of Santa Barbara. The confluence of these two creeks is at Hope street, also the location of the upper CCAMP monitoring site in this watershed. Water quality data from Hope Street includes summer samples and field measurements taken when flows were extremely low and almost stagnant at times. This data is not necessarily representative of the upper watershed as a whole and should be interpreted with these conditions in mind. At the Hope Street location, both creeks are contained in cement box channels. Three samples collected from this site had elevated fecal coliform levels. Aquatic life uses at this location are impaired, as shown by dissolved oxygen levels as low as 2 mg/L in summer months, and poor scores on the CCAMP IBI and Bio-stimulatory Risk Index. Increased flow levels and corridor shading would improve these conditions. Downstream at Cliff Drive, Arroyo Burro Creek is contained within a narrow mud bottom channel that flows down a 20 foot tall cement barrier to the lagoon. Except in winter, the creek is generally deep and slow moving at this location. Water quality data shows that several salts are elevated above Basin Plan Objective for agricultural uses, and above levels seen just upstream at Hope Street. Data from the lower watershed site also shows that aquatic life beneficial uses are impaired. Toxicity to fathead minnows and invertebrates as well as poor scores on the CCAMP IBI and Bio-stimulatory Risk Index are of concern. The large barrier at Cliff Drive is likely to inhibit migration of fish for most of the year; however, at high flows this barrier may be passable for steelhead. Arroyo Burro Creek is currently listed on the 303(d) list of impaired water for fecal colifom. It will be proposed for addition to the 2008 list form impairment ot agricultural use due to sodium and chloride.

The Goleta Hydrologic Sub-area includes all watersheds that flow from Los Padres National forest to the ocean at Goleta Slough. All of these watersheds are channelized as they flow through the urban areas of Goleta, and beneficial uses are impaired to some degree in the lower reaches of each of these creeks.

The Atascadero Creek watershed is the largest in the Goleta Sub-area. Atascadero Creek has two main tributaries; Maria Ygnacio and Cieneguitas creeks. Above the confluence with Maria Ygnacio, Atascadero Creek flows east and north through urban areas of Santa Barbara and Hope Ranch golf course. This creek is unique because it does not extend beyond the urban areas into the Los Padres National Forest. Urban and industrial influences are prevalent, but there are also some orchard and greenhouse properties in this watershed. Maria Ygnacio Creek flows north from Atascadero Creek, creating the boundary between Goleta and Santa Barbara urban areas. Approximately half of this watershed is within natural habitats upstream of the city limits.

CCAMP monitoring was conducted on both of these creeks just upstream from their confluence, at Patterson Avenue. Flows in the late summer months were very low and conditions were near stagnant at times in both creeks. Interpretation of these data should be done with these conditions in mind. Water quality data from the Maria Ygnacio arm at this location show some evidence of beneficial use impairment. A single sample in July 2001 had elevated nitrate (> 10 mg/L) and unionized ammonia (0.025 mg/L) levels. Aquatic Life beneficial uses at this site may be impaired by ammonia and dissolved oxygen as indicated in the high Bio-stimulatory Risk Index scores. However additional data is necessary before this can be determined. The data does show that recreation and agricultural beneficial uses are impaired by elevated levels of fecal coliform and salts, which exceed objectives for these uses. Maria Ygnacio is not currently listed on the 303(d) list of impaired waters.

Water quality in Atascadero Creek at Patterson Drive was similar with the exception of ammonia and nitrate. No sample from this site exceeded Basin Plan Objectives for these parameters. However, orthophosphate levels were frequently measured above the EPA recommended listing criteria (0.10 mg/L) and nutrient data, low dissolved oxygen and algal cover data resulted in high scores for this site on the Bio-stimulatory Risk Index. In addition, fish tissue samples did show low levels of some pesticides. Downstream in Atascadero Creek (at Ward Drive) CCAMP conducts ongoing monitoring as part of the Coastal Confluences program. At this location fecal coliform levels are elevated particularly in winter runoff. Flow at this site is extremely low most of the year and trickles from a deep and wide channel over a cement dam into the tidally influenced lagoon. Dissolved oxygen variability at this site is extreme, ranging from 5 mg/L to 17 mg/L in the summer months when algal mats can completely cover the water's surface. The lagoon-like nature of this reach of the creek, with deep slow moving water and very little canopy cover, contributes to the summer conditions. Salts such as chloride and sodium regularly exceed Basin Plan objectives for agricultural uses at this site. This is the same condition observed at the Patterson site. Atascadero Creek is not currently listed on the 303(d) list of impaired waters. However, it will be proposed for addition to the 2008 list for impairment to recreational beneficial uses due to fecal colifom and for agricultural uses due to sodium and chloride.

San Jose Creek watershed originates in the steep slopes of the Santa Ynez Mountains. In the foothills, orchards, grazing and rural residential are the primary land uses. As the Creek flows through the residential, commercial and industrial areas of Goleta it is channelized and ultimately contained within a cement channel that parallels Highway 217. Water quality data shows that recreational and agricultural uses are impaired due to elevated levels of fecal coliform, conductivity, pH and salts. Conductivity and salts are a direct result of a permitted discharge to the channel below Hollister Ave (from a water softening facility). Low dissolved oxygen measurements may indicate a problem for aquatic life; however, additional data are needed. San Jose Creek is not currently listed on the 303(d) list of impaired waters. However, it will be proposed for listing in 2008 due to impairment of recreational uses because of fecal coliform.

San Pedro Creek watershed also originates in the steep slopes of the Santa Ynez Mountains and flows through orchards and some row crop agriculture in the foothills. San Pedro Creek is channelized as it flows through urban and commercial areas of Goleta. Like San Jose Creek, recreational and agricultural uses are impaired due to elevated levels of fecal coliform, conductivity, pH and salts. San Pedro Creek is not currently listed on the 303(d) list of impaired waters. However, it will be proposed for listing in 2008 due to impairment of recreational uses because of fecal coliform.

Los Carneros Creek originates in the steep south-facing slopes of the Santa Ynez Mountains. In the foothills above Goleta orchards, grazing and rural residential are the primary land uses. As the Creek crosses Cathedral Oaks Road it is bordered by agricultural fields until it reaches Highway 101. At this point the Creek is channelized and contained with a cement canal until it reaches Glenn Annie Creek and Goleta Slough. Water quality data from the lower watershed shows that fecal coliform and salts exceed Basin Plan Objectives. In addition, there is some evidence of impairment to aquatic life beneficial uses including high scores on the Bio-stimulatory Risk Index (as a result of nutrient and wide ranges of dissolved oxygen) and one sample causing toxicity to fathead minnows. Additional data is needed to determine if these problems are persistent. Los Carneros Creek is not currently listed on the 303(d) list of impaired waters.

Glenn Annie Creek originates in the steep south facing slopes of the Santa Ynez Mountains. Orchards are the primary land use in the foothills and upper flood plain of this watershed. Below Cathedral Oaks Road the urbanized areas of East Goleta have a mix of residential, industrial and agriculture uses. Although the Creek is channelized below Highway 101, the substrate of the Creek is relatively natural for most of the watercourse. CCAMP monitoring data from the lower watershed show that multiple beneficial uses are impaired. Nitrate levels far exceeded 10 mg/L in most samples. Fecal coliform levels exceeded Recreational Beneficial Use Objectives on multiple occasions. Levels of boron, chloride and sodium are elevated above objectives for agriculture. Finally, sample water was toxic to fathead minnows in both wet and dry season monitoring. Aquatic life beneficial uses may also be impaired as evident by some low dissolved oxygen levels and high scores on the Bio-stimulatory Risk Index.

Devereux Creek is a small coastal watershed that flows to Devereux Slough, an important coastal estuary. The creek flows from the lower slopes of the Santa Ynez Mountains, through residential areas of Goleta and directly through the Ocean Meadows Golf Course. In 2001, CCAMP staff observed year-round flows at Devereux Creek with winter flows dependent on storm water events and summer flows maintained by agricultural and landscape runoff. CCAMP staff monitored at the discharge point of the creek to the slough. Water quality concerns in this creek include elevated conductivity, total dissolved solids and boron, which can have negative effects for agriculture when the water is used for irrigation. Fecal coliform levels were elevated on numerous occasions at this site, exceeding the recreation Basin Plan Objective in five of fourteen samples. Finally, dissolved oxygen was depressed in multiple samples collected from Devereux Creek. Dissolved oxygen was below the warm water habitat objective of 5.0 mg/L, as well as the general objective for oxygen saturation of 85% on multiple occasions. Devereux Creek is not currently listed for impairment of beneficial uses on the 303(d) list.

The Arguello Hydrologic Sub-area includes several creeks with headwaters in the western slopes of the Santa Ynez Mountains and the Los Padres National Forest. This Sub-area includes Bell Canyon Creek, Tecolote Creek, Dos Pueblos Canyon Creek, Canada de Capitan, Canada de Refugio, Canada de Gaviota, and Jalama Creek.

Bell Canyon Creek flows through agricultural and range land areas to the Sandpiper Golf Course on the Baccara Resort property before it flows to the ocean. CCAMP staff collected monitoring data from Bell Creek in 2001 downstream of Highway 101 and above the golf course. CCAMP water quality data showed that agricultural beneficial uses (specifically for irrigation) were impaired by elevated levels of conductivity, total dissolved solids and boron. However, this creek is not identified in the Central Coast Basin Plan as having specific beneficial uses and therefore only aquatic life, municipal and domestic supply and recreation beneficial uses apply for assessment of impairment (in spite of the fact that agriculture is present in the watershed). Toxicity samples were collected twice from this location and one sample was toxic to larval fish. Fecal coliform levels exceeded the Basin Plan objective for recreation in eight of sixteen samples collected by CCAMP staff. In addition, nitrate levels exceeded the Municipal Supply beneficial use in fifteen of seventeen samples collected between January 2001 and April 2002. This creek is currently listed for impairment of the Municipal Supply beneficial use on the 303(d) list.

Tecolote Creek watershed is adjacent to and west of Bell Creek. This watershed flows through orchard and estate ranchettes before crossing Highway 101. The lowest reaches of this creek flow through the Baccara Resort and to the ocean. Water quality in this watershed is generally good. Three fecal coliform samples (out of sixteen) exceeded the Recreation beneficial use. This watershed is not currently listed for impairment of beneficial uses on the 303(d) list.

Dos Pueblos Canyon Creek watershed primarily flows through National Forest areas of Los Padres before reaching the ranch and orchard areas above Highway 101. Below the highway, the creek flows through large ranch estates and to the ocean. Water quality in Dos Pueblos Creek was generally good in 2001 and 2002. There were only a few exceedances of Basin Plan objectives, including one exceedance of the total coliform objective and three low oxygen saturation levels (below 85%).

Canada del Capitan or El Capitan Creek flows through National Forest areas of Los Padres before reaching the ranch and recreational areas of El Capitan Ranch and State Park. The creek flows to the ocean through the State Park. CCAMP staff monitored this creek within the State Park property, below Highway 101. Water quality at this site was generally good. Two of fifteen fecal coliform samples exceeded the recreation beneficial use objective and three of eighteen dissolved oxygen saturation (% saturation) measurements were below the general objective. One of the two toxicity samples collected at this site did have reduced survival relative to the control sample. However, this result is flagged as estimated because of elevated conductivity in the sample. This watershed is not currently listed for impairment of beneficial uses on the 303(d) list.

Canada del Refugio originates in the Los Padres National Forest and flows to the ocean at Refugio State Park. The creek flows through orchards and ranchettes before crossing Highway 101. At this location, where the CCAMP site is located, the creek is channelized and the substrate is cemented boulders. CCAMP water quality data shows that fecal coliform levels are elevated, with five of fifteen samples exceeding the Basin Plan recreation objective. Parameters with fewer than five exceedances of relevant Basin Plan objectives included total dissolved solids and oxygen saturation. This watershed is not currently listed for impairment of beneficial uses on the 303(d) list, but will be proposed for listing of fecal coliform in 2008.

Canada de la Gaviota drains the southern slopes of the Santa Ynez Mountains to the west of Highway 101 and flows to the ocean at Gaviota State Park. The upper watershed is primarily within ranchland areas and the lower watershed is within State Park property. Much of the creek in this vicinity has been channelized to align with Highway 101. CCAMP staff monitored two locations in this watershed, at the Highway 1/101 intersection and downstream at the State Park campground entrance. Boron levels collected in 2001-2002 exceeded the agricultural objective for irrigation water in multiple samples from both sites. Fecal coliform levels were elevated in five of twelve samples at the upstream location but only in one sample from the State Park entrance. Toxicity data was also collected at these sites. Two water samples were tested from each site, using both fish and invertebrate test species. In one sample, the water from the Highway 1/101 site (315GAI) was toxic to larval fish. Staff also collected one sediment sample from each site and tested for toxicity to *Hyalella* (an amphipod). This test showed toxicity in the sample from the State Park entrance (315GAV). Canada de la Gaviota is currently listed for boron and impairment to the Agriculture beneficial use on the 303(d) list. The upper watershed (above Highway 1/101) will be proposed to be listed as impaired by fecal coliform on the 2008 303(d) list.

Jalama Creek flows to the Pacific Ocean north of Point Conception and south of the Santa Ynez Mountains. The creek drains rangeland with some dry land agriculture. Jalama Creek flows to the ocean at Jalama County Park campground. CCAMP staff monitors the creek just upstream of the lagoon formed adjacent to the campground. Water quality data from 2001 and 2002 show that boron levels were elevated on five sampling occasions, fecal coliform levels exceeded recreation objectives only once and oxygen saturation levels were below the Basin Plan general objective on five occasions. However, CCAMP staff did not measure dissolved oxygen levels below the Basin Plan objective for warm water habitat (5 mg/L). Toxicity data was collected at this site on three occasions; two water samples were tested using invertebrates and larval fish, and one sediment sample was tested using amphipods. Both water samples were toxic to larval fish, but not to invertebrates. The sediment sample was toxic to amphipod test species. Jalama Creek is not currently listed on the 303(d) list for impairment but will be proposed for impairment to aquatic life beneficial uses due to toxicity.

7 Conclusions

CCAMP has documented a number of violations of Central Coast Basin Plan objectives and exceedances of other published criteria and guidelines at sites throughout the South Coast Hydrologic Unit. We have recommended several additions to the 2004 Clean Water Act 303(d) list of impaired waters (April 2005) based on these data. Table 7a show these proposed listings. In addition to these listings, we recommend that lower Mission and Franklin Creeks be considered for listing due to impairment of aesthetic beneficial uses, due to trash and litter. At this time, staff has not recommended dissolved oxygen listings in spite of several violations of Basin Plan objectives. All sites which show depressed dissolved oxygen levels in summer months are at the low ends of the watershed and have acceptable oxygen levels during fish migration and spawning season. Low flows and lack of riparian canopy cover during summer months should be addressed throughout the Hydrologic Unit in order to improve summer oxygen levels.

Elevated pH levels at the lower end of the watersheds in this Hydrologic Unit may be influenced by lack of riparian cover and low water flows, and the resulting increases in water temperature, algal growth and diurnal swings in dissolved oxygen. Additional monitoring in the upper watersheds should be conducted to determine if elevated pH levels are the result of watershed geology or if they are the result of anthropogenic influences that can be managed.

Table 7a. Proposed (2004) and existing CWA 303(d) listings for creeks in the South Coast Hydrologic Unit.

Waterbody	Pollutant	Existing or Proposed
Arroyo Burro Creek	Pathogens	Existing
Arroyo Paredon Creek	Boron	Proposed
Arroyo Paredon Creek	Nitrate	Proposed
Bell Creek	Nitrate	Proposed
Carpinteria Creek	Pathogens	Existing
Franklin Creek	Nitrate	Proposed
Gaviota Creek	Boron	Proposed
Glenn Annie Creek	Nitrate	Proposed
Mission Creek	Pathogens	Existing
Rincon	Boron	Proposed

Fecal coliform is elevated through the Hydrologic Unit with more that half of the 31 sites in the Hydrologic unit exceeding Basin Plan objectives identified to protect recreational beneficial uses. Staff recommends listing several of these sites for fecal coliform.

We recommend the following in addition to CWA 303(d) listing for impairment:

- Follow up Monitoring (TMDL and Implementation Programs)
    - Evaluate sources of chromium in the Atascadero watershed
    - Evaluate nutrient sources throughout the Bell Creek and Glenn Annie watersheds
    - Evaluate sources of toxicity and conduct TIE analysis at sites with toxic effects identified in 5.1.5b. Particularly, follow up on toxicity at Jalama Creek with TIE evaluations.
    - Evaluate sources of fecal coliform throughout the Hydrologic Unit.

- Basin Planning
    - Consider adding or adjusting site-specific objectives for salts in the Hydrologic Unit
    - Consider whether upper pH objectives are appropriate for Central Coast watersheds

- Nonpoint Source Management
    - Continue to work with greenhouse and nursery facilities in the Carpinteria area to improve both surface and groundwater quality.
    - Manage for Bio-stimulatory risk in the lower ends of Franklin, Carpinteria, Arroyo Paredon, Santa Monica, Mission, Arroyo Burro and Devereaux creeks.
    - Manage for increasing impairment by fecal coliform throughout the Hydrologic Unit.
    - Manage for trash impairment in the lower reaches of Mission Creek, Franklin Creek and Santa Monica Creek.

8 Quality Assurance

<u>Evaluating field data</u>
Field equipment is calibrated prior to and following each sampling event. Field data is qualified with a flag and disabled from use in data calculations and determination of beneficial use impairment if the following is true:

- Post calibration measurements differ from the calibration standard values by more than 20% as identified in the SWAMP QAMP (Puckett 2002, Appendix C).

<u>Evaluating laboratory data</u>
Data is qualified with a flag if it meets one of the following criteria:

- Analyte of interest is not detected (non-detect), the minimum detection limit (MDL) and/or practical quantifiable limit (PQL) is higher than the SWAMP target reporting limit (TRL), and the MDL does not exceed levels of concern or Basin Plan objectives.
- The result is between the MDL and the PQL and these values are below the appropriate water quality criterion.
- The difference between the results from a blind field duplicate and an original sample exceeds the allowable relative percent difference (RPD) defined in the SWAMP

QAMP (Puckett 2002, Appendix C). The maximum RPD for conventional parameters, synthetic organics and metals is 25%.

- Blind field duplicates for coliforms exceed the 95% confidence interval values.
- Holding time requirements are not met.

Data is qualified with a flag and disabled from use in calculations and determination of beneficial use impairment if it meets one of the following criteria.

- Analyte of interest is not detected (non-detect), the minimum detection limit (MDL) and/or practical quantifiable limit (PQL) is higher than the SWAMP target reporting limit (TRL), and the non-detect value is near or exceeding a criterion.
- The surrogate spike recovery levels exceed the allowable range of acceptance as identified by the contract laboratory's quality assurance program (BC Labs, 2002). The acceptable levels vary between analytes.
- Matrix spike recovery values exceed the allowable RPD as defined in the SWAMP QAMP (Puckett 2002, Appendix C). The maximum variation in percent recovery for conventional parameters and metal in sediment is 25%. For synthetic organics in sediment the RPD is 50%.
- The batch precision violates the precision requirements defined in the SWAMP QAMP (Puckett 2002, Appendix C). These requirements are 80-120% recovery for conventional parameters and 50-150% recovery for organic chemicals in sediment and tissue.
- The method blank results exceed the method detection limits (MDL).
- The RPD between the blind field duplicate result and the original sample exceeds the allowable relative percent difference defined in the SWAMP QAMP (Puckett 2002, Appendix C) and the difference between the two results is greater than twice the analyte's SWAMP TRL.

All data was evaluated relative to the SWAMP QA criteria. Flags that have been accepted are included in the database as qualifiers. These data are used by CCAMP in analyses but can be excluded by other users such as TMDL staff. Data, which are rejected because they are outside of the QA criteria defined in the SWAMP QAMP, are disabled from all analyses.

CCAMP field and laboratory data was evaluated using the SWAMP QAMP and CCAMP acceptability criteria outlined above. This resulted in qualified data as summarized in Table 7a. Because the SWAMP acceptability criteria were generally less strict than that of the contract laboratory, several of the data were flagged by the contract laboratory and remained flagged in the CCAMP database but are acceptable for use in some data analyses using SWAMP criteria. Data that did not meet SWAMP acceptability criteria were flagged with the appropriate code and the term "reject". Rejected data was not included in any of the analyses discussed in this document.

There were a total of 468 flags attached to Santa Barbara Hydrologic Unit data collected between January 2001 and March 2003 (Table 5.1.9a). Of these there are 241 results that were flagged but not disqualified from use because they meet data quality objectives identified in the SWAMP QAMP (Puckett 2002). However, 277 data results are outside of these criteria and therefore were rejected from use in analyses of these data. Rejected data are in the database but, are identified with a flag and "reject" in the disposition.

Field Duplicates

Blind field duplicate results were compared to original sample data. Data pairs were compared in terms of relative percent difference and determined to be unacceptable if the difference between duplicate pairs exceeded the analyte's specific data quality objective (DQO) and was greater than twice the target reporting limit (TRL), as defined in the SWAMP QAMP (Puckett 2002). For each blind field duplicate pair, there are several different analytes. Blind field duplicate samples were collected on 26 occasions between January 2000 and March 2006. Samples sent to the laboratory are analyzed for 20 different analytes by the contract laboratory. When results from the blind field duplicates are compared to the original sample results and RPD is calculated, two criteria must be met. The RPD must be within the SWAMP DQO as defined in the SWAMP QAPP (Puckett 2002), and the RPD must be less that two times the TRL. This second criteria is added to assess variation when results are low or near the detection limit. For these 26 samples, each with 20 analytes, 17 sample analytes did not meet the SWAMP allowable RPD; however, the difference was less than the TRL. For these results the flag is attached but data is still used for analysis. There were 174 sample analytes that failed to meet both criteria. The majority of these were fixed dissolved solids and fixed suspended solids (145 of the 174 results). These resulted in the rejection of the duplicate result and a qualifying flag attached to the original sample analyte.

The contract lab also analyzed blind field duplicate samples for total and fecal coliform on 26 occasions. Because analysis of these data is not discussed in the SWAMP QAMP, we compared the duplicate result to the original sample using the 95% confidence interval table from Standard Methods (1999) for multiple tube dilutions. For these data, 6 fecal and 4 total coliform blind field duplicate samples failed to be within the 95% confidence interval. CCAMP staff determined that because of the natural variability known to be associated with these analyses that these data should be qualified but not disabled from analyses. A flag was attached to these sample batches.

In the case of chlorophyll *a*, field measurements were taken using a Scufa Probe. These field measurements were compared to samples sent to the laboratory and analyzed using Standard Method 10200H. This QAQC scenario is not covered specifically in the SWAMP QAMP and Region 3 has not yet made a decision on appropriate evaluation of these data. Of the 26 samples sent to the lab only one exceeded the field duplicate criteria noted above. A flag noting exceedance of SWAMP DQOs is attached to the chlorophyll data; however, no data has been disabled from analyses as a result of the comparison between field and laboratory data. The appropriate QA procedure to analyze the accuracy of the Chlorophyll probe is to compare pre- and post-calibration values. Unfortunately, post-calibration measurements were not regularly taken prior to 2003. Region 3 is now consistently recording both pre- and post-sampling calibration data.

Reporting Limits

Comparison of reported MDLs and PQLs relative to the target values defined in the SWAMP QAMP (Puckett 2002) can result in several flags including the following: result between

MDL and PQL, MDL above TRL and PQL above TRL. Additional qualifying flags related to MDL and PQL results include the following: elevated MDL/PQL due to matrix interference and elevated MDL/PQL due to sample dilution. For data discussed in this report a total of 354 samples, each with 20 analytes, were screened. We identified 16 sample analytes that had MDLs or PQLs elevated above the SWAMP TRL. Of these 11 were rejected as a result of the elevated level; each of these was for chlorophyll *a* samples. This evaluation is based on comparison of the reported MDL/PQL and the appropriate analyte's water quality criteria. Additionally 96 sample analytes had results between the MDL and PQL values. Of these, none were rejected and all were simply qualified with a flag.

The contract laboratory did not submit QAQC data for results discussed in this report. However, the contract laboratory did evaluate data relative to the quality control criteria outlined in the BC Labs QAPP (1999). For conventional analysis the QC criteria used by the lab are stricter than those listed in the SWAMP QAPP. For example, the matrix spike QC criteria for nitrate percent recovery at the lab is 80-120%, where as the SWAMP criteria is 75-125%. BC Labs did submit flags that were assigned to data as a result of their analysis of the QC data. These flags were accompanied with the relevant QC data and were re-evaluated by CCAMP staff using the SWAMP criteria. BC Labs submitted 7080 results, of which 267 had attached flags. These flags were reevaluated using the SWAMP data quality objectives where appropriate. A count of all flags attached to data discussed in this report are listed in Table 7a.

Matrix Spikes

The contract laboratory identified a total of 85 sample analytes for which there was a matrix spike recovery problem (being outside of the laboratory's QC criteria). Reevaluation of these data using the SWAMP DQOs resulted in the rejection of 19 sample analytes and the acceptance, with a qualifying flag, of 66 sample analytes. Interestingly, 18 of the rejected sample analytes were analyses done for TKN.

Method blank flags reported by the contract laboratory were also reevaluated using the SWAMP DQOs. The Laboratory reported only 1 method blank sample analyte for which the detection of the analyte of interest exceeded the lab's reporting limit. Samples in this batch were flagged and disqualified from use.

Table 8a. Summary of flags and flag codes in the CCAMP database. Dispositions (i.e. accept and reject) qualify the data as to its usability in analyses for this report.

CCAMP Flag	SWAMP Flag	Analyte	Disposition	Count	Flag Text
4	PG	Chloride	Accept	9	CCV problem
4	PG	Ortho Phosphate as P	Accept	1	CCV problem
7	DF	Dissolved Boron	Accept	1	Elevated MDL, PQL due to matrix interference
7	DF	Nitrate as N	Accept	1	Elevated MDL, PQL due to matrix interference
7	DF	Nitrate as NO3	Accept	15	Elevated MDL, PQL due to matrix interference
8	D	Nitrate as N	Accept	5	Elevated MDL, PQL due to sample requiring dilution
10	FDP	Fecal Coliform	Accept	6	Field Dup. Coliform count fails DQO check
10	FDP	Total Coliform	Accept	4	Field Dup. Coliform count fails DQO check
12	FDP	Fixed dissolved solids	Accept	4	Field duplicate exceeds SWAMP percentage limit (RPD)

12	FDP	Turbidity	Accept	3	Field duplicate exceeds SWAMP percentage limit (RPD)
12	FDP	Fixed dissolved solids	Reject	4	Field duplicate exceeds SWAMP percentage limit (RPD)
12	FDP	Ortho Phosphate as P	Reject	2	Field duplicate exceeds SWAMP percentage limit (RPD)
12	FDP	Total Dissolved Solids	Reject	2	Field duplicate exceeds SWAMP percentage limit (RPD)
12	FDP	Turbidity	Reject	2	Field duplicate exceeds SWAMP percentage limit (RPD)
26	GB,IL	Ammonia as NH3	Accept	11	Matrix spike recovery problem
26	GB,IL	Ortho Phosphate as P	Accept	1	Matrix spike recovery problem
26	GB,IL	Ortho Phosphate as PO4	Accept	5	Matrix spike recovery problem
26	GB,IL	Phosphate as P	Accept	9	Matrix spike recovery problem
26	GB,IL	Total Kjehdahl Nitrogen as N	Accept	40	Matrix spike recovery problem
26	GB,IL	Ammonia as N	Reject	1	Matrix spike recovery problem
26	GB,IL	Total Kjehdahl Nitrogen as N	Reject	18	Matrix spike recovery problem
27	IP	Phosphate as P	Accept	1	Method Blank problem
32	H	Nitrate as NO3	Accept	5	Sample or extract held beyond acceptable holding time.
32	H	Ortho Phosphate as P	Accept	1	Sample or extract held beyond acceptable holding time.
33		Fixed dissolved solids	Accept	6	Sample precision is not within established limits.
33		Total Dissolved Solids	Accept	10	Sample precision is not within established limits.
33		Volatile Suspended Solids	Accept	1	Sample precision is not within established limits.
33		Volatile Dissolved Solids	Reject	13	Sample precision is not within established limits.
50	DNQ	Dissolved Boron	Accept	9	Result between MDL and PQL
50	DNQ	Fixed dissolved solids	Accept	8	Result between MDL and PQL
CCAMP Flag	SWAMP Flag	Analyte	Disposition	Count	Flag Text
50	DNQ	Ammonia as NH3	Accept	7	Result between MDL and PQL
50	DNQ	Nitrite as N	Accept	7	Result between MDL and PQL
50	DNQ	Nitrite and NO2	Accept	13	Result between MDL and PQL
50	DNQ	Nitrate as N	Accept	17	Result between MDL and PQL
50	DNQ	Nitrate as NO3	Accept	8	Result between MDL and PQL
50	DNQ	Ortho Phosphate as P	Accept	8	Result between MDL and PQL
50	DNQ	Ortho Phosphate as PO4	Accept	8	Result between MDL and PQL
50	DNQ	Phosphate as P	Accept	8	Result between MDL and PQL
50	DNQ	Total Kjehdahl Nitrogen as N	Accept	2	Result between MDL and PQL
50	DNQ	Volatile Suspended Solids	Accept	1	Result between MDL and PQL
52		Phosphate as P	Accept	5	MDL above SWAMP Reporting Limit
52		Chlorophyll a	Reject	11	MDL above SWAMP Reporting Limit
55		Fixed dissolved solids	Accept	1	MDL/PQL elevation (of no consequence)
56		Chlorophyll a	Reject	1	Difference between sample and field duplicate is > TRL
56		Fixed dissolved solids	Reject	45	Difference between sample and field duplicate is > TRL
56		Fixed dissolved solids	Reject	100	Difference between sample and field duplicate is > TRL
56		Ortho Phosphate as P	Reject	2	Difference between sample and field duplicate is > TRL
56		Turbidity	Reject	26	Difference between sample and field duplicate is > TRL

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Appendix I. CCAMP Bio-stimulatory Risk Index

Introduction

Nutrients, such as nitrate, ammonia and phosphate, are often found at elevated concentrations in waterbodies of the Central Coast Region, and elsewhere in the State of California. Some nutrients have numeric objectives associated with particular beneficial uses. Specifically, to protect for municipal and domestic water supply, nitrate as N cannot exceed 10 mg/L. To protect against general toxicity, ammonia concentrations cannot exceed 0.025 mg/L. However, there are no numeric objectives that protect surface waters from the Bio-stimulatory effects of excessive nutrients. Eutrophication results from a complex interaction of multiple nutrients, sunlight, substrate, water velocity, and other factors. It is difficult to identify specific nitrate or phosphate concentrations that represent thresholds over which problems will certainly occur. Consequently, the Central Coast Basin Plan narrative objective for Bio-stimulatory substances is as follows:

> "Waters shall not contain bio-stimulatory substances in concentrations that promote aquatic growths to the extent that such growths cause nuisance or adversely affect beneficial uses."

Understanding how to manage surface waters for biostimulation is complex, as interactions and effects of excessive nutrients are not always readily apparent. For example, a site that has excessive concentrations of phytoplankton or other algae may not display elevated concentrations of dissolved nutrients, as the nutrients may have already been taken up by plant material. This interplay of chemical, physical, and biological factors complicates assessment of overall water quality.

The Central Coast Ambient Monitoring Program has developed a "Bio-stimulatory Risk Index" to serve as a screening tool to simultaneously consider factors which serve as stimuli (nutrients), in parallel with those which act as responders (algal and plant cover, pH, dissolved oxygen and water column chlorophyll concentrations). The index is intended to characterize both in-situ monitoring site response to Bio-stimulatory substances and the capacity of monitoring site water quality parameters to induce adverse Bio-stimulatory responses in downstream areas. The index currently has no provision for addressing nutrient-poor waters, nor waters impacted by toxic effects associated with several of its components.

Bio-stimulatory Risk Index Development

The Bio-stimulatory Risk Index is a combination of several different measures, or "metrics" of stimuli or response, which have then been ranked and combined to form a single value. The Central Coast Ambient Monitoring Program collects data on a number of parameters that serve as measures of biostimulation or response. In developing the preliminary Index, several of these parameters have been evaluated for use as metrics.

Some of these measures, such as nitrate concentration, may serve as metrics based on magnitude alone (where higher concentrations are considered "worse" than lower concentrations and are ranked accordingly). Others are more complex, particularly "double-ended" parameters such as dissolved oxygen and pH. For example, both supersaturated and depressed concentrations of dissolved oxygen can be indicative of eutrophication. Thus, one possible indicator of dissolved oxygen impairment is the departure of the measurement from the median value (where a larger departure ranks worse than a smaller departure).

Index development included testing of a number of metrics that reflect various measures of nutrient stimulus and response. Candidate components included ranked concentrations of individual nutrient forms (such as un-ionized ammonia, orthophosphate, etc.), measures of dissolved solids, turbidity, various characterizations of percent vegetative cover and other measures. A subset of these candidates was selected for use.

Selected Components

- Chemical composite
  - Nitrate as N
  - Ammonia as N
  - Nitrite as N
  - Ortho-Phosphate as P
- Oxygen Saturation
- pH
- Chlorophyll *a*
- Plant Cover composite
  - Algal cover
  - Algal cover periphyton
  - Algal cover filamentous
  - Instream plant cover

Five metrics were developed using the selected components. They were calculated as follows:

1) c = Chemical composite metric = Sample percentile rank of summed concentrations (mg/L) of NO2-N + NO3-N + NH3-N + (PO4-P * 10)

This metric assumes that dissolved nutrients of various forms can all contribute to biostimulation, either at the site or downstream from it, and that they can be summed to represent overall nutrient availability, once adjustments have been made for the typical uptake ratio of phosphorus to nitrogen in plant tissue (1:10).

2) p = pH metric = Sample percentile rank departure from median of entire CCAMP dataset (8.2)

This metric reflects fluctuations in pH levels in response to photosynthetic and respiration activity by plants. Photosynthetic activity uses up carbon dioxide, causing bicarbonate ions to dissociate to create more CO2 and OH^-; this process increases alkalinity. The opposite is true during respiration and decay. This process assumes that pH that diverges widely from the median can be a measure of excessive plant activity, either as photosynthesis or respiration, and thus an indicator of biostimulation.

3) o = Oxygen metric = Sample percentile rank departure from median of entire CCAMP dataset for percent saturation (92.6)

The assumption driving this metric is that both depressed and supersaturated oxygen levels are indications of biostimulation. Samples taken in association with significant amounts of aquatic plant and algae growth may be supersaturated in late afternoon, and depressed in pre-dawn samples. Oxygen levels may remain depressed throughout the day when plant decay is prevalent. Percent saturation is used instead of dissolved oxygen concentration because it takes into account the confounding effects of water temperature and salinity.

4) a = Chlorophyll *a* component = Sample percentile rank of water column concentration of chlorophyll *a* (ug/L)

This metric assumes that higher concentrations of water column chlorophyll *a* are indications of phytoplankton abundance and hence of Bio-stimulatory activity.

5) f = Flora component = Sample percentile rank of the maximum of one of the following: (Filamentous, Periphyton, or total Algal cover, instream plant cover)

This metric assumes that various forms of plant and algal cover represent uptake of nutrients from the stream system and hence indicate Bio-stimulatory activity. Light availability, substrate and other factors affect which form of plant predominates; therefore this metric calculates rank based on the maximum value of the various forms quantified. This metric is not weighted highly because the quantified values are extremely subjective in nature and are highly variable.

Metrics are weighted and summed for each sampling event at each site, as follows:

$$a = 2^{(f1*c\ +\ f2*p\ +\ f3*o + f4*a\ +\ f5*f)}$$

Where:

f1=chemical composite weight = 6
f2= pH weight = 7
f3=oxygen weight = 5
f4=chlorophyll *a* weight = 9
f5=flora weight = 1

The mean percentile rank of ‘a’ for each site is utilized as the Bio-stimulatory Index for that site.

Weighting factors f1, f2, f3, f4, and f5 were initially determined by confining the database under consideration to several hydrologic units well known to staff, and setting weighting factors to values that ranked sites in a sequence that was consistent with staff knowledge of the sites. Performance of the index was then examined in other hydrologic units not used to develop the weighting factors, using different staff, knowledgeable of site and waterbody characteristics in the new set of hydrologic units. Through iterative adjustment of weighting factors, index performance was tested until all staff agreed that site rankings best reflected overall staff knowledge of the sites.

Index development assumptions

The Bioassessment Risk Index is not based on bio-chemical process modeling. The only component of the index that deals with plant uptake of nutrients is the chemical composite component that assumes that phosphate concentration impacts occur at levels 10 times lower than nitrogenous compounds. The factor of ten was selected based on the typical ratio of these two nutrients in plant tissue. Freshwater systems tend to be limited by phosphorus. If the N:P ration is above 10:1 N:P a system will likely experience an algal bloom, the severity of which will be dictated by the amount of available phosphorus. (Schindler 1978 and Jaworski 1981). Examination of the data indicates that nitrogen is rarely the limiting nutrient in streams and rivers that exhibit problems with bio-stimulatory substances on the Central Coast of California. For this reason we selected a multiplier on the high end of literature values.

Since the Index is intended for use in moving water, it does not rely upon the assumption that effects will be located at the same place or time as causes.

Ranking of nutrient concentrations assumes that oligotropic conditions do not exist in the Central Coast Region and that a straight ranking of nutrient concentration from low to high reflects conditions moving from “good” (i.e. low concentrations) to “bad” (i.e. high concentrations). We have not documented conditions which appeared to be nutrient-poor in this Region.

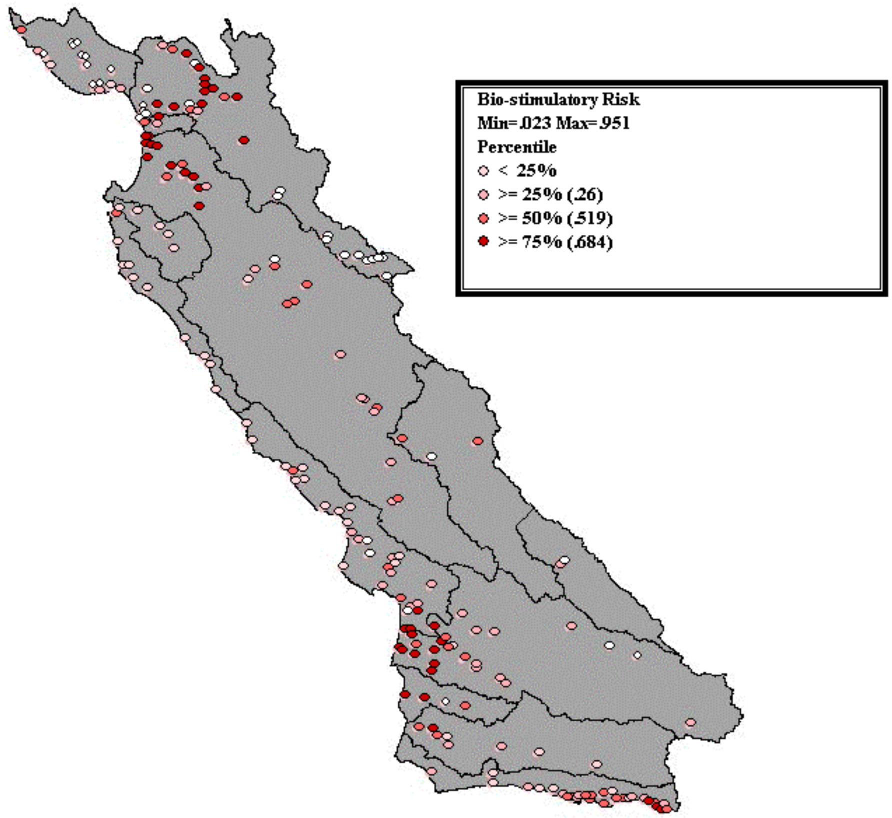
The Index does not rely upon mass loading calculations (e.g. total pounds of a stressor delivered to a monitoring site). Bio-stimulatory impacts in stream and river systems are more related to concentrations found within a given reach than to nutrient loads moving through the reach. For example, during storm events very large quantities of nutrients move rapidly through river and stream systems with little or no impact on the streams and rivers. The true impacts of these nutrients are not manifest until they reach a ‘terminal water body’ such as a lake or the near shore ocean.

Bio-stimulatory Risk in the Central Coast Region

In general, Bio-stimulatory Risk Index scores are highest in areas of the Central Coast Region already known to suffer from very high levels of nutrients. Most of these areas are associated with intensive irrigated agricultural activity (Figure 1). Sites in the upper quartile of ranked scores are primarily in watersheds that have already been 303(d) listed as impaired by nutrients. Many are smaller tributaries that enter impaired rivers, such as Quail Creek (tributary to Salinas River), Little Oso Flaco Creek (tributary to Oso Flaco Creek), Main Street Canal, Orcutt-Solomon Creek and Blosser Channel (tributary to Santa Maria River), and Salsipuedes and Llagas Creeks (tributary to Pajaro River).

Many of these tributaries have exceptionally high concentrations of nutrients and serve as major nutrients sources to the main stem systems. For example, Quail Creek concentrations have ranged as high as 94.7 mg/L for nitrate (as N) and 2.8 mg/L for orthophosphate (as P). Other waterbodies scoring in the top quartile are slow moving terminal waterbodies, such as Tembladero Slough, Moro Cojo Slough, and the Old Salinas River. These types of systems tend to have relatively high scores for pH, oxygen, and chlorophyll *a*, in addition to chemistry. Though much less common, some chemical scores are driven more by elevated phosphate concentrations than by nitrate. These include San Antonio and Carneros Creek sites. Santa Ynez River, Chorro Creek and San Luis Obispo Creek also have relatively high phosphate levels downstream of their respective wastewater treatment plant discharges. A few waterbodies not currently 303(d) listed for nutrients also scored in the top quartile. These include Franklin Creek, Arroyo Paredon Creek, Los Berros Creek and San Antonio Creek. They will be considered for 303(d) listing in the next listing cycle.

Waterbodies which fall in the lowest risk quartile include all of the Carmel River watershed, all creeks in the Santa Lucia Hydrologic Unit (along the Big Sur coast), most creeks in northern San Luis Obispo County (excluding San Simeon Creek), and small creeks in relatively undisturbed watersheds, such as Scott Creek (Santa Cruz County), Toro Creek, Old Creek above the reservoir, and Coon Creek (San Luis Obispo County), and El Capitan Creek and Gaviota Creek (Santa Barbara County). Several waterbodies which do not score in the lowest quartile overall have upper watershed sites with scores in the lowest quartile. These include San Luis Obispo Creek, Santa Ynez River, and San Simeon Creeks above their respective wastewater treatment plants.



Several of the creeks that score in the lowest quartile are dry in the summer, so scoring is calculated only from wet weather samples, which do not typically represent the worst case conditions relative to biostimulation. These include Montecito and San Ysidro Creeks in Santa Barbara County, both of which are channelized drainages passing through urban and agricultural land uses, and Villa Creek in San Luis Obispo County, which supports upstream irrigated agriculture.

Bio-stimulatory Risk Index and Waterbody Impairment

RWQCB staff have evaluated sites rankings alongside water quality and habitat data and subjectively made a determination of the Index score for creeks beginning to show "impairment". The value 0.40 was selected, as a site average. Sites in this range begin to show somewhat elevated nutrient concentrations, occasional algal blooms, and depressed dissolved oxygen concentrations.

Appendix II. CCAMP Index of Biotic Integrity

The CCAMP Index of Biotic Integrity (CCAMP-IBI) is a sum of several ranked metric scores, including taxonomic richness, number of Ephemeroptera taxa, number of Trichoptera taxa, number of Plecoptera taxa, percentage of intolerant individuals (with tolerance scores of 0, 1, or 2), percentage of tolerant individuals (with tolerance scores of 8, 9 or 10), percent dominant taxon, and percent predators. This index includes all metrics utilized by Karr and Chu (1999) in their Index of Biotic Integrity, with the exception of "clinger taxa count" and "long-lived taxa count". The CCAMP program has been utilizing this index for a number of years for evaluating benthic invertebrate data in the Central Coast.

CCAMP-IBI scores range from 0 to 10. Sites in the lowest quartile of all CCAMP bioassessment data score below approximately 3.0, as a site average. Sites in the highest quartile score above 6.0. We have examined these quartile break points relative to other indices of water quality as shown in the following figures.

Figure 1 shows the mean CCAMP IBI score Southern California IBI score for each site. The Southern California IBI was developed for coastal watersheds in Monterey County south to San Diego County (Ode et al. 2005). The high correlation between scores is likely due to the similarity in the metrics that make up each IBI. The SoCal IBI includes coleoptra richness and percent non-insect taxa; these metrics are not included in the CCAMP IBI.

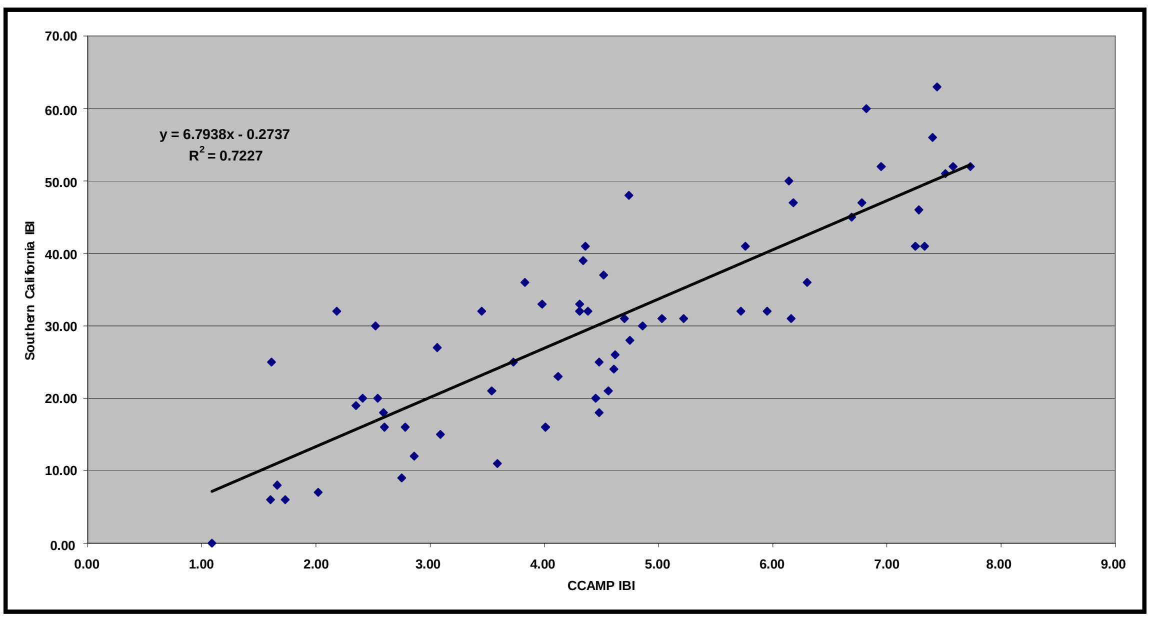


Figure 1. Regression of Southern California Index of Biotic Integrity scores against Central Coast Ambient Monitoring Program Index of Biotic Integrity scores for the Central Coast Region.

When the CCAMP IBI scores are compared to the toxicity data (Figure 2) we see that 60% of all sites in the lowest quartile (CCAMP IBI score less than 3), multiple measures of toxicity were present; only 20% of these sites had no evidence of toxicity. At sites in the highest quartile (CCAMP IBI score 6 or higher), 60% were free of toxicity and the remaining sites showed only a single indication of toxicity (such as reduced growth or reproduction).

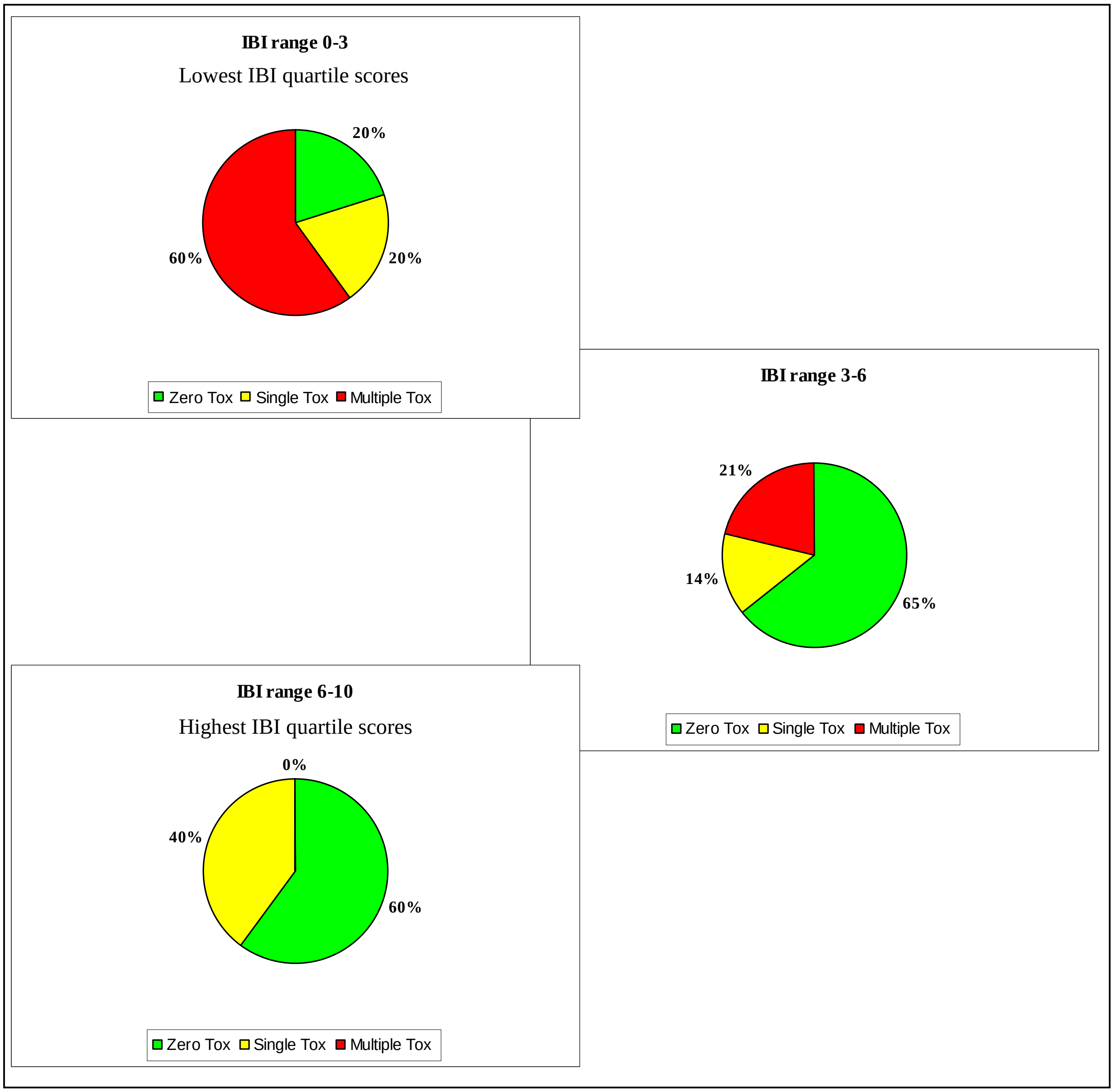


Figure 2. Percent of sites showing zero toxicity, a single toxic result or multiple toxic results, arranged according to CCAMP-IBI quartile scores. Toxicity tests include results from *C. dubia*, *P. promelas* and *H. azteca* tests.