Southern California Bight 2008 Regional Marine Monitoring Survey (Bight'08)

Offshore Water Quality Field Operations Manual

Prepared by:
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Prepared for:
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I. Introduction

A. Background and Study Objectives

The background and study objectives for the Bight'08 Offshore Water Quality Monitoring Program can be found in SCCWRP Workplan (2008). The overall goal of this project is to quantify the major nutrient sources to the Southern California Bight (SCB) that trigger or maintain coastal algal blooms and to characterize the extent and magnitude of these blooms. The study objectives are as follows:

1) Establish the relative nutrient contributions of four major sources to the SCB (upwelling, POTW discharge, atmospheric deposition, terrestrial coastal runoff)
2) Characterize the spatial and temporal patterns of algal blooms, as well as the effects of these blooms, with an emphasis on *Pseudo-nitzschia* and domoic acid (DA).
3) Identify the specific water quality conditions associated with bloom events.

The first objective will establish the relative nutrient (nitrogen, phosphorus, silica) contributions from the four major nutrient sources to the SCB (upwelling, POTW discharge, atmospheric deposition, and terrestrial runoff). The timing and magnitude of nutrient delivery to the coastal ocean relative to remotely-sensed and field observations of algal blooms in the SCB will be investigated.

The second objective will characterize the spatial and temporal patterns of algal blooms, as well as the effects of these blooms, with an emphasis on the occurrence of *Pseudo-nitzschia* and the toxin domoic acid. Historic patterns in algal bloom frequency and biomass will be assessed using remote sensing, CTD data and modeled estimates of historic nutrient loads from the four sources to understand trends over time. The timing and bight-wide distribution of blooms of *Pseudo-nitzschia* and associated concentrations of domoic acid, nutrient and other physiochemical parameters will be characterized by analysis of data obtained from a combination of remote sensing, gliders, pier-based and ship-based sampling during January – June 2009. Additional questions to be addressed include where algal blooms originate, how frequently they occur and if this frequency has increased over the last 10 years, are blooms originating nearshore where terrestrial runoff and POTW discharges are present, are they originating offshore where the main nutrient source is upwelling?

The third objective will identify the specific water quality conditions and nutrient sources associated with bloom events. Data collected synoptically on ambient nutrient concentrations and loads from the various sources, upwelling patterns, and other remote sensing data will be used to investigate factors associated with bloom events. A special study using natural isotopes will be used to determine which form of nutrients to which the algae are responding. This information will help to determine which nutrient sources are potentially being utilized by the phytoplankton community.

II. Conceptual Overview of Field Survey

The water quality sampling design for Bight'08 will be divided into three components. These include: 1) the nutrient sources (terrestrial runoff, atmospheric deposition, POTW discharge and upwelling); 2) the spatial and temporal patterns of algal blooms and 3) nutrient source tracking. A combination of field measurements, remote sensing and modeling targeted over a one-year period from November 2008 to October 2009 will provide estimates of the contribution of each of the nutrient sources. Table 1 categorizes the sources and lists the constituents that will be measured in each. The precise methods that will be used to estimate nutrient loads from each of the sources are summarized in the Field Measurements sections below.

The spatial and temporal patterns of algal blooms will be characterized using data derived from remote sensing, pier based weekly sampling, USC Webb Research gliders and ship based surveys. An intensive study will be conducted on the San Pedro Shelf with the use of USC Webb Research gliders which measure temperature, salinity, chlorophyll fluorescence, CDOM fluorescence, phycoerythrin fluorescence and optical backscatter at three minimally absorbing wavelengths (550, 650 and 880 nm). By using two gliders, exchanged about every three weeks, it will be possible to maintain a nearly continuous presence for this period. This data will be transmitted to shore every 6 hours and will be used for initiating additional pier and ship sampling should a bloom event occur. Ship sampling will be comprised of three event surveys following the onset of a 'bloom' or upwelling event from February to June 2009 (see Appendix 14-22 for station locations). There will also be two surveys conducted by the Central Bight Water Quality (CBWQ) group and one survey by the City of San Diego (SD) as part of their permit monitoring programs (see Appendices 7-13 for station locations). A pilot study utilizing the isotopic composition of nitrate in the SCB could potentially be used to identify point and non-point sources of nitrate to the bight and/or the biological transformation of nitrate. The study involves two parts: 1) determination of nitrate nitrogen and oxygen isotope ratios in specific sources (POTW effluent, river discharge, and upwelled water); and 2) field measurements to determine if source signatures are maintained in the SCB or if they are over-written by biological transformations.

A. Nutrient Sources

Table 1 List of constituents to be sampled for each nutrient source

Constituent	Watershed Loading	Atmospheric Deposition		POTW Effluent	Upwelling (modeled by ROMS)
		Wet	Dry		
Nitrate+Nitrite	X			X	
Nitrate		X	X		X
Ammonia	X	X	X	X	
Phosphate	X	X	X	X	X
Silicate	X			X	X
Urea	X			X	
Particulate Nitrogen	X	X	X	X	
Total Nitrogen	X	X	X	X	
Particulate Phosphorus	X	X	X	X	
Total Phosphorus	X	X	X	X	

B. Field Measurements

i. Pier-based sampling

Sampling will occur at five piers located in San Luis Obispo, Santa Barbara, Santa Monica Bay, Newport Beach and La Jolla (Table 2). The piers will have mounted sensors for continuous time-series data of temperature, salinity and chlorophyll fluorescence. Discrete water samples will be collected weekly and analyzed for the constituents listed in Table 3. These samples will be used as a trigger to evaluate if an algal bloom is developing in the SCB.

Table 2 SCCOOS pier sampling locations and research groups

Pier	City	Laboratory	Researcher/PI	Institution
California State Polytechnic Pier	San Luis Obispo	Moline Laboratory	Mark Moline	California State Polytechnic University
Stearn's Wharf	Santa Barbara	Brzezinski laboratory	Mark Brzezinski	University of California Santa Barbara
Santa Monica Pier	Santa Monica	Shipe Laboratory	Rebecca Shipe	University of California, Los Angeles
Newport Pier	Newport Beach	Jones and Caron Laboratories	Burt Jones and David Caron	University of Southern California
Scripps Pier	La Jolla	McGowan laboratory	John A. McGowan/Melissa Carter	University of California, San Diego - Scripps Institution of Oceanography

Table 3 Pier-based indicators to be sampled

Component	Indicator/Analyte
Continuous sensor	temperature salinity fluorescence
Discrete water samples	chlorophyll *a* nitrate ammonium phosphate silicate domoic acid temperature HAB species counts *Pseudo-nitzschia* *Alexandrium* *Lingulodinium polyedrum* *Prorocentrum* *Dinophysis* *Akashiwo sanguineum* *Cochlodinium* *Phaeocystis*

III. Program Organization

A. Program Chain of Command

Table 4 List of personnel and contact information

Name	Organization	Contact Information	Area
George Robertson	Orange County Sanitation District	(714) 593-7468 grobertson@ocsd.com	Chair, Water Quality Committee CTD Field Surveys
Steve Weisberg	SCCWRP	(714) 755-3203 Stevew@sccwrp.org	Vice-Chair Water Quality Committee
Meredith Howard	SCCWRP	(714)-755-3263 mhoward@sccwrp.org	Program Coordination Ship Field Survey Coordination POTW Effluent
Martha Sutula	SCCWRP	(714) 755-3222 marthas@sccwrp.org	Terrestrial Nutrients
Burton Jones	University of Southern California/SCCOOS	(213)740-5765 bjones@usc.edu	Glider Surveys SCCOOS Pier Program
Mike Mengel	Orange County Sanitation District	(714) 593-7465 mjmengel@ocsd.com	CTD Field Surveys
David Caron	University of Southern California	(213)740-0203 dcaron@usc.edu	HAB analysis SCCOOS Pier Program
Keith Stozenbach	University of California, Los Angeles	(310) 206-7624 stolzenb@seas.ucla.edu	ROMS Modeling Upwelling
Nick Nezlin	SCCWRP	(714) 755-3227 nikolayn@sccwrp.org	Satellite Imagery
Lisa Sabin	SCCWRP	(714) 755-3221 lisas@sccwrp.org	Atmospheric Deposition

B. Permits

There are no additional permits needed for this field study.

IV. Quality Assurance/Quality Control Procedures

The QA/QC procedures are described in detail in each section.

V. Terrestrial Nutrient Sources

A. Study design

This section details the methods for the estimation of terrestrially-derived nutrient sources that enter the Bight via surface water drainage from coastal watersheds. Watershed-based sources of nutrients will be estimated from a combination of measured and modeled wet weather and dry weather loads from all coastal watersheds that drain to the SCB. Watershed loading models will use a Rational Method approach to quantify wet weather loads. Wet and dry weather loads will use measured flows where possible and where not, relationships will be developed between watershed size, land use, and measured flows for the non-gaged watersheds.

Watershed wet and dry weather models will be calibrated using data on nutrient concentrations and loads measured at 33 mass emission stations collected by Stormwater Monitoring Coalition (SMC) agencies under their National Pollution Discharge Elimination System (NPDES) permits during the period of November 2008- October 2009. These mass loadings are generally monitored as an event mean concentration (EMC). These agencies routinely analyze a suite of contaminants including nutrients. Protocols for dissolved inorganic nutrients and total nitrogen and phosphorus are standardized and an interagency calibration has been conducted for these analytes. Other analytes of interest are not routinely monitored by the SMC agencies, including urea, silicate, and total dissolved nitrogen and phosphorus. Under Bight ’08, these agencies will supply SCCWRP with a water sample from each of their wet and dry weather events monitored to analyze these additional analytes of interest in the Offshore Water Quality Study.

Currently there is no consistency in the protocols used by the SMC agencies to monitor wet and dry weather loads. SCCWRP is working with the SMC to develop a regional monitoring program for wet and dry weather monitoring of watershed based sources. One of the elements of this program would be a standardization of wet and dry weather monitoring protocols, which would then be incorporated into permits under the next cycle. In view of this larger effort to develop a regional stormwater monitoring program, wet and dry weather monitoring protocols will not be standardized under the Bight ’08 Offshore Water Quality study; however, SCCWRP staff will conduct in depth interviews from each participating SMC agency to document their methodology. This effort will serve two purposes: 1) aid the interpretation of data for the modeling effort and 2) provide a basis for discussion among SMC agencies on standardization of monitoring protocols.

Existing data on wet weather runoff from various land uses and wet and dry weather loads from mass emission stations will be compiled from SMC agencies to provide supporting data for model development.

B. Field data collection

i. Personnel and Chain of Command

Field sampling will be conducted by SMC agency personnel responsible in stormwater sampling. The following chain-of-command is recommended to avoid confusion, identify responsible parties, and ensure that proper protocols and information flow are followed by each organization:

1. The Terrestrial Sources Study Coordinator (Martha Sutula) and Field Coordinator (Liesl Tiefenthaler) are responsible for coordinating sample delivery from all SMC field teams. All technical matters, such as equipment problems, sampling schedules, etc. should be communicated to the Field Coordinator by the Field Lead designated by each SMC agency as soon as possible.

2. The SMC Agency Field Lead will be each agency’s primary contact regarding all survey and field-related matters. Field Leads will be responsible for organizing and implementing monitoring efforts at their designated mass emission sites. They have the

authority to delay sampling or alter sampling sites as their NPDES permit specifies. Any changes in sampling should be documented and reported to the Field Coordinator.

3. Field leads will be responsible for supervising the field teams and sampling operations. They must insure that all sampling protocols are followed and that QA/QC standards are met. At the end of each sampling day, he/she will make sure that all field data and samples are delivered to the appropriate processing personnel within all designated holding times.

4. Protocols for stormwater sampling vary from agency to agency. The Field Coordinator and designated staff will conduct interviews with each agency to document the protocol used. These interviews will be conducted during the 2008-2009 wet season.

Table 5 gives the names and organizations of the designated agency field leads from each participating SMC agency.

Table 5 Designated field leads from SMC agencies for the Bight '08 Water Quality study.

Agency	Agency Lead	Field Lead (If Different from Agency Lead)
Orange County RDMD	Theodore Von Bitner	Same
Ventura County WDP	Arne Anselm	Tommy Liddell
San Diego County	JoAnn Weber	Dave Renfrew
Los Angeles County DPW	Fred Gonzalez	Same

ii. Timing for Field Data Collection

Field data collected through NPDES wet and dry weather monitoring during November 2008-October 2009 will be utilized for the Bight '08 Offshore Water Quality Study.

iii. Station Locations

SMC agencies currently monitor 38 mass loading stations, identified in Appendix 2. All these stations will be included in the Bight '08 Offshore Water Quality Study.

iv. Communications, Sample Delivery, and Holding Times

SMC agency field leads will advise the field coordinator of their intent to monitor a storm event and will follow up with a phone call to provide an estimated time when samples will be delivered to SCCWRP. Agency field leads will advise the field coordinator two weeks ahead of time of their intent to monitor dry weather events and will follow up with a phone call to provide an estimated time when samples will be delivered.

Agency field leads will assure that wet and dry weather samples are delivered to SCCWRP within 6 hours of finishing sample collection in the field. Please note that the samples must also be processed within the allotted 6 hr. One liter of sample water and one liter of deionized water (field blank) will be delivered on wet ice with a chain of custody form.

v. Field data sheets

Field data collection consists of recording the station ID, date, start and end times of composite wet weather or dry weather event, and agency sample ID no. A hard copy of the field data sheet should be delivered with the sample and filled out electronically and sent to SCCWRP within 2 weeks of sample delivery.

vi. Protocols for processing of nutrient samples

Agency field leads and designated staff will follow protocols established by their agencies to process samples for nutrient and contaminant analysis.

Appendix 3 gives the protocols that will be used by SCCWRP staff to process nutrient samples to prepare them for laboratory analysis. These protocols are consistent with those used to process offshore nutrient samples.

The SMC has conducted an interlaboratory calibration on analysis of dissolved inorganic nutrients. All laboratories were found to be within an acceptable

vii. Laboratory Analytical Methods and Designated Contract Laboratories

Table 6 gives the targeted analytes, the analytical methods, and designated contract laboratories for each suite of samples from participating SMC agency. Each agency analyzes at minimum, the dissolved inorganic nitrogen species. To complete the suite of nutrient forms of interest, SCCWRP will analyze, through contract laboratories, the following species: 1) phosphate, 2) silicate, 3) urea, 4) total nitrogen, 5) total phosphorus, 6) particulate nitrogen and 7) particulate phosphorus.

An intercalibration has been performed between SMC laboratories on dissolved inorganic nutrient analysis and acceptable agreement was had among those participating. Therefore there is confidence in using the dissolved inorganic nitrogen data without further intercalibration.

Table 7 gives a list of the contract or in-house laboratories utilized by each participating agency responsible for data analysis.

Table 6. List of targeted analytes and analytical methods by participating agency.

Constituent	Ventura County	Los Angeles County	Orange County	San Diego County	SCCWRP
Nitrate	EPA 300.0	SM 4110 B	*EPA 353.2.0	SM4500-NO3 E	N/A
Nitrite	EPA 300.0	SM 4110 B	*EPA 353.2.0	SM4500-NO2 B	N/A
Ammonia	SM 4500-NH3 F	SM 4500	4500 NH3 B	SM4500-NH3 D	N/A
Phosphate	N/A	N/A	SM 4500 P B2	N/A	SM4500P C
Silicate	N/A	N/A	EPA 200.8	N/A	SM 4500 Si04
Urea	N/A	N/A	N/A	N/A	
Total Phosphorus	SM 4500-P E	SM 4500-P E	SM 4500-P E	N/A	USGS I-2650-03
Particulate Nitrogen	N/A	N/A	N/A	N/A	EPA 9060
Particulate Phosphorus	N/A	N/A	N/A	N/A	Aspila et al. 1976

* Orange County does not analyze nitrate and nitrite separately.

Table 7. List of contract or in-house laboratories utilized by each participating agency.

Agency	Dissolved Inorganic Nutrients and Particulate Nitrogen (Including silicate)	Total Nutrients	Particulate Phosphorus	Urea
Ventura County	CRG	CRG	N/A	N/A
Los Angeles County	Agricultural Commissioner/Weights & Measures Department Toxicology Lab	Agricultural Commissioner/Weights & Measures Department Toxicology Lab	N/A	N/A
Orange County	Associated Labs	Associated Labs	N/A	N/A
San Diego County	Westin	Westin	N/A	N/A
SCCWRP	University of California Santa Barbara Marine Science Institute Analytical Laboratory	University of Georgia Institute of Ecology	University of South Carolina	SCCWRP

Table 8 Samples will be analyzed by the following organizations:

Constituent	Ventura County	Los Angeles County	Orange County	San Diego County
Nitrate	Ventura County	Los Angeles County	Orange County	San Diego County
Nitrite	Ventura County	Los Angeles County	Orange County	San Diego County
Ammonia	Ventura County	Los Angeles County	Orange County	San Diego County
Phosphate	MSI Analytical Laboratory	MSI Analytical Laboratory	MSI Analytical Laboratory	MSI Analytical Laboratory
Silicate	MSI Analytical Laboratory	MSI Analytical Laboratory	MSI Analytical Laboratory	MSI Analytical Laboratory
Urea	SCCWRP	SCCWRP	SCCWRP	SCCWRP
Total Phosphorus	University of Georgia	University of Georgia	University of Georgia	University of Georgia
Total Nitrogen	University of Georgia	University of Georgia	University of Georgia	University of Georgia
Particulate Nitrogen	MSI Analytical Laboratory	MSI Analytical Laboratory	MSI Analytical Laboratory	MSI Analytical Laboratory
Particulate Phosphorus	University of South Carolina	University of South Carolina	University of South Carolina	University of South Carolina

viii. Submission of laboratory analytical results and field data

SMC agency contract or in-house laboratories will submit an electronic copy of the wet and dry weather laboratory analytical results to SCCWRP within 3 months of sample acquisition. Data format will be pre-determined Bight ’08 data formats as agreed upon with field leads or in a SWAMP compatible format (if no Bight’08 data format exists).

ix. Documentation of SMC agency wet and dry weather monitoring protocols

The Bight ’08 Offshore Water Quality study design takes advantage of stormwater monitoring conducted under NPDES permits to estimate nutrient concentrations and loads in wet and dry weather runoff. Each of the SMC agencies participating has a protocol for stormwater and dry weather sampling that have been followed for years under their individual monitoring programs (Figure 1). These protocols are not standardized among agencies. Currently there is an effort by the SMC to develop recommendations for a regional stormwater monitoring program. This will entail collecting information on what protocols are currently employed and getting the agencies to agree on a standardized approach. Because this process is underway and because of the difficulty in changing protocols established through permit conditions, a decision was made not to attempt standardization of stormwater monitoring protocols. Instead, an effort would be made to carefully document what is currently being done and use this information to aid the interpretation of the data for modeling terrestrial nutrient loads (see section 10 below).

Figure 1. Summary of protocols that have been used to collect stormwater samples by the SMC agencies.

	Ventura County	Los Angeles County	Orange County	San Diego County
Storm Mobilization Criteria				
Antecedent rainfall	72 hr	72 hr	96 hr	72 hr
Predicted rainfall quantity	0.10 in	0.25 in	0.10 in	0.10 in
Min. No. Storms/Station/Year	3	5	3	3
No. Samples/storm				
Grab samples	1	1	1	1
Composite samples	1	1	2 - 3	1
No. samples per composite	12-40+	4+	4-24+	12-40+
Composite weighting	Flow	Flow	Time	Flow
Min. Flow Capture Criteria	Yes	No	Yes	Yes
Storm capture	80%	-	75%	80%
Storm end trigger	120% of base flow	-	96 hr from start of flow	120% of base flow

Detailed documentation of SMC agency wet and dry weather monitoring protocols will occur from December 2008 through September 2009. Documentation will occur through staff interviews and observations of protocols.

x. Modeling terrestrial nutrient loads

Terrestrial nutrient loads will be estimated using a regional watershed model. The modeling approach will follow the methodology detailed in Ackerman and Schiff (2003). Briefly, that method used a geographic information system (GIS)-based storm water runoff model to estimate pollutant mass emissions based on land use, rainfall, runoff volume, and local water-quality information. Local monitoring data were used to derive runoff coefficients; over 1,700 storm water sampling events were used to calibrate and validate annual loadings. The data collected in this study will be used to validate the load estimation of the regional model.

A bounded iterative optimization will be used to empirically derive runoff coefficients from local runoff data. The optimization goal will be to produce a set of runoff coefficients for each land-use type. The technique entails comparing the measured versus modeled storm volumes and evaluating the residual differences. The sum of the residual differences will be set to zero to minimize storm water load estimation bias. The runoff coefficients will be bounded to ensure non-negativity and less than unity. Large watersheds will typically have a proportionally large effect on the residual estimation. To minimize the influence of the larger watersheds over the smaller watersheds, the residuals will be normalized with respect to drainage area. Bightwide optimized runoff coefficients will be applied in conjunction with the watershed land-use patterns and typical year rainfall to estimate storm water runoff.

Stream flow and rainfall data will be used to calibrate and validate the storm water runoff model. Stream data will be obtained from local monitoring programs and USGS-gauged sites. Rain data, at times, will be collected at the same site as the stream data; but for the majority of the sites, rain gauges from within the watershed will be used to assign a rainfall amount to a gage for a specific storm.

Data collected by the San Diego, Orange, and Los Angeles county NPDES storm water monitoring programs will be used for calibration and validation of model hydrology. In the past, storm water volume and rainfall data by storm event were collected from 1993 to 1999, with 214 calibration and 172 verification events from the three counties from 19 and 20 sites, respectively. The data set consisted of those storms that had overall runoff coefficients (rainfall volume to runoff volume ratio) between 0.01 and 1.0. Outliers were removed to ensure that runoff was the dominant forcing function. Events with extreme rainfall, beyond the 10th and 90th percentile, were removed. The resulting data set spanned a range of precipitation events from 2.54 to 56.9 mm. Data available since 1999 will be compiled and processed in a similar manner to increase the robustness of the model.

In the past, a total of 667 site-events from 45 sites were used to estimate storm water quality parameters for model input. The data were collated from San Diego, Los Angeles, and Ventura County municipal storm water monitoring programs generated as part of their NPDES permit programs. Sampling consisted of flow-weighted composite samples over the course of an entire storm event. Samples were collected from small, homogeneous land-use areas representative of five categories: agriculture (n=518); commercial (n=5160); industrial (n=5181); open (n=578); and residential (n=5230) land uses. The sixth land-use category used in the model, other urban, was defined as areas that were a mixture of the major land-use categories and included data from all the urban sources (commercial, industrial, and residential). Water quality and flow collected through the Bight '08 study year in conjunction with normal NDPES stormwater monitoring will be used in conjuction with existing data to further refine and validate model hydrology and loads.

Additional water quality monitoring and stream flow data that is routinely collected throughout southern California will be used to estimate the dry weather loads. Estimates of regional dry weather loads have been previously developed for NASA project investigating the effects of terrestrial nutrient inputs on the coastal plankton community. The approach is based on a stochastic method which estimates dry weather loading based on land uses. This approach will be employed here, using existing and new data collected on dry weather loads from participating SMC agencies for NPDES monitoring.

C. Quality Assurance/Quality Control Procedures

Standard quality assurance/ quality control procedures apply for the collection, analysis and data management of the wet and dry weather samples. QAQC procedures are detailed below for each applicable component of data collection and management.

i. Field Data Collection

Field data collection for this component of the study consists of wet weather and dry weather monitoring of nutrient concentrations and loads, conducted under the auspices of each participating agency's NPDES permit. All data collection must comply with the quality assurance and quality control procedures and data quality objectives compatible with the Surface Water Ambient Monitoring program (SWAMP), which maintains a high standard because of the need to meet regulatory requirements for use of these data. Thus the use of SWAMP-compatible procedures for sample collection and standard methods for laboratory analysis ensure a high standard of quality assurance. QA objectives are the detailed QC specifications for representativeness, comparability, and completeness (Table 9). The data quality objectives for field sampling and laboratory analysis are presented in Table 10. These quality assurance objectives will be used as comparison criteria during data quality review by SCCWRP to determine if the minimum requirements have been met and the data may be used as intended.

Table 9. Quality assurance objectives for representativeness, comparability, and completeness.

Representativeness	Comparability	Completeness
The selected stations and sampling frequency were chosen for their representativeness of conditions during dry and wet weather. Wet weather sampling is important because this is when water quality in the streams is most frequently compromised. The extent to which the measurements represent actual environmental conditions will be somewhat restricted by the time of year the samples are taken and the overall weather conditions of that year (i.e. wet versus dry year).	To maximize the quality of the data collected, and to collect data that is comparable with other studies, accepted sampling procedures will be used during this study. All samples collected will be sent to laboratories that use Standard Methods.	If the data collected is sufficient to complete the Bight '08 Water Quality Monitoring report, than the data is considered to be complete. Measurement performance criteria help determine the completeness of a data set. Evaluation of collected data will be conducted to insure that data quality objectives, as outlined in the QAPP, were achieved.

Table 10. Data quality objectives

Constituent	Method	Units	MDL	RL	Precision / RPD	Accuracy (value/%)	Recovery1 (%)	Complete-ness (%)
Flow	Field	ft3/s	na	na	na	±10%	na	90
pH	Field	na	na	na	± 5	± 0.5 units	na	90
Temperature	Field	deg F	na	na	± 5	± 0.5° C	na	90
Dissolved Oxygen	Field	mg/L	na	na	± 20	± 0.5 mg/L	na	90
Turbidity	Field	NTU	na	na	± 10	±10%	na	90
Electrical Conductivity	Field	µS/m	na	na	± 5	± 5	na	90
Solids, Total Suspended	SM 2540B	mg/L	0.5	0.5	25	80-120%	80-120%	90
Ammonia-N	SM 4500NH3H	mg/L	0.01	0.05	25	80-120%	80-120%	90
Nitrate	EPA 300.0	mg/L	0.01	0.05	25	80-120%	80-120%	90
Nitrite	EPA 300.0	mg/L	0.01	0.05	25	80-120%	80-120%	90
Phosphate	SM4500PB2	mg/L	0.01	0.05	25	80-120%	80-120%	90
Silicate	SM 4500Si04	mg/L	0.01	0.05	25	80-120%	80-120%	90
Urea	Goeynes et al, 1998	mg/L	0.01	0.05	25	80-120%	80-120%	90
Total Dissolved Nitrogen	USGS I-4650-03	mg/L	0.25	0.5	25	80-120%	80-120%	90
Total Nitrogen	USGS I-4650-03	mg/L	0.25	0.5	25	80-120%	80-120%	90
Total Dissolved Phosphorus	USGS I-2650-03	mg/L	0.25	0.5	25	80-120%	80-120%	90
Total Phosphorus	USGS I-2650-03	mg/L	0.25	0.5	25	80-120%	80-120%	90

[1]RPD Relative Percent Difference
na = not applicable

ii. Sample processing and laboratory analysis

Samples arriving at SCCWRP for processing and analysis will be transferred through chain of custody forms. All samples will bear identification labels that match information entered onto field data sheets by field crews. Labeling information for all samples will include the following:

- Project name
- Date
- Time
- Sampling location name and number
- Collector's initials
- Sample ID number
- Analyte(s) to be analyzed
- Preservation, if applicable

Water samples will be accompanied by hard copy of field data sheets that identify the appropriate site information. Hard copies of the field and laboratory data sheets will be maintained in a project notebook by the field coordinator (Liesl), and by laboratory personnel, respectively. Field data sheets and chain of custody forms (CoCs) will be filled out by field teams. CoCs will accompany the water and sediment samples delivered to the laboratories.

Water samples will be processed in the laboratory (where appropriate). Once sample containers are filled, they will be placed on ice, in a cooler, in the dark and transported to the laboratory for processing within specified holding times (6 hours). For each set of samples that arrive from an agency, a field blank and duplicate will be prepared for each analyte of interest. The sample sets will be batched as is necessary to meet holding times and one field and duplicate sample will be analyzed per batch. Additional QA samples will be requested of the laboratory, including matrix spikes, laboratory duplicates, and equipment blanks.

Unless otherwise stated, containers for nutrient analysis will be in pre-combusted glass fiber filters (for particulate samples) and high density polyethylene (HDPE) bottles for nutrient samples. Table 11 gives the volumes, containers and holding times associated with each analyte.

Table 11 Sample handling and custody.

Parameter	Matrix	Container	Volume	Initial Preservation	Holding Time
Total Nitrogen/ Total Phosphorus	Whole Water	HDPE	20 mL	Cool to 4°C, dark, freeze	28 days at 20°C, dark
Dissolved Inorganic Nutrients (Ammonium, Nitrate + nitrite, Nitrite, phosphate silicate)	Filtered Water	HDPE	20 mL	Cool to 4°C, dark, freeze	28 days at 20°C, dark
Particulate Phosphorus (PP)	Pre-weighed Combusted Glass Fiber Filter	Petri Dish	20-60 mls	Keep at 4°C, dark, but must filter within 24 hrs, freeze	12 months after drying at 80C for 24 hours
Particulate Nitrogen and Organic Carbon	Pre-weighed Combusted Glass Fiber Filter	Petri Dish	20-60 mls	Keep at 4°C, dark, but must filter within 24 hrs, freeze	12 months after drying at 80C for 24 hours
Urea	Filtered Water	Corning 50 mls Centrifuge Tube	30 mL	Freeze immediately to 4°C, dark, freeze	90 days at 20°C, dark

Transport of the samples to the analytical laboratory will be coordinated by the Project Manager to ensure that all samples are handled and analyzed within the proper holding time. CoCs will be reviewed by personnel at the receiving laboratories to ensure that no samples have been lost in transport, and the laboratories will also verify that each sample has been received within necessary holding times (Table 11.) All other samples will be properly and safely disposed of by the analytical laboratory once analyses are completed and all analytical quality assurance/quality control procedures have been reviewed and accepted.

Any failures (*e.g.*, instrument failures) that occur during data collection and laboratory analyses will be the responsibility of the field crew or laboratory conducting the work, respectively. In the case of field instruments, problems will be addressed through instrument cleaning, repair, or replacement of parts or the entire instrument, as warranted. Crews will carry basic spare parts and consumables with them to the field, and will have access to spare parts to be stored at SCCWRP. Contract laboratories have procedures for dealing with failures

All samples will be submitted to laboratories within the holding times required for specific analytes. Laboratories will be responsible for conducting analyses, or implementing appropriate preservation measures, within holding times as arranged ahead of time by the Project Manager. Laboratory turnaround times will be sufficiently timely to allow for QA checks of the data, entry into the database, analysis, and reporting by the project team in order to meet project planning and deliverable deadlines.

iii. Data management

Quality assurance procedures for data management are specified in SCCWRP's Bight Information Management Plan. These procedures will be followed to ensure that data collected under the study are of highest quality possible.

iv. Important Telephone Numbers

The names, phone numbers, and email addresses of appropriate personnel and emergency services are listed in Table 12. If a particular individual cannot be reached at the listed number the caller should contact SCCWRP, where an attempt will be made to provide an alternate means by which the individual can be reached.

Table 12. Contact Numbers

Name	Organization	Role	Phone #	Email
Martha Sutula	SCCWRP	Study coordinator	949-374-1037	marthas@sccwrp.org
Liesl Tiefenthaler	SCCWRP	Field coordinator	714-755-3231	lieslt@scccwrp.org
Shelly Moore	SCCWRP	Bight '08 IM coordinator	714-755-3207	shellym@sccwrp.org
Ted Von Bitner	Orange County	Agency and field lead	714-955-0680	Theodore.VonBitner@rdmd.ocgov.com
Arne Anslem	Ventura County	Agency lead	805-654-3942	Arne.Anslem@ventura.org
Tommy Liddell	Ventura County	Field lead	805-662-6758	Tommy.Liddell@ventura.org
Fred Gonzalez	Los Angeles County DPW	Agency and field lead	626-458-5948	FGonzal@dpw.lacounty.gov
Tommy Wells	Westin Solutions	Field lead	760-795-6958	Tommy.wells@WestonSolutions.com

VI. Atmospheric Deposition

A. Study Design

The atmospheric nutrient load to the SCB will be estimated from wet and dry atmospheric deposition flux measurements at four coastal locations adjacent to the SCB. The sites will be selected to account for the expected gradients between onshore/offshore, and along the coast.

B. Description of Field Teams and Activities

i. Personnel and chain of command

Field sampling will be conducted by SCCWRP personnel under the direction of Lisa Sabin, with additional personnel from outside of SCCWRP for sampling at the Catalina Island site, as resources allow. Lisa will coordinate and supervise all field sampling operations, develop field sampling protocols, provide training, as necessary, to additional personnel, and act as the primary contact person for all atmospheric deposition field sampling activities.

ii. Communications and important contact information

All questions regarding atmospheric nutrient deposition field sampling and data analysis should be directed to Lisa Sabin at SCCWRP. Contact information for Lisa Sabin is as follows: email: lisas@sccwrp.org; Tel: (714) 755-3221; Cell: (310) 713-6159.

C. Field Data Collection

i. Station locations

Exact station locations are still to be determined, but will include three coastal sites (e.g. Santa Barbara area, Los Angeles/Long Beach Harbor, and San Diego area) to account for the north-south coastal gradient, and a fourth site on Catalina Island, as resources allow, to capture the onshore/offshore gradient.

ii. Sample schedule

All field sampling will take place between January 2009 and December 2009. For dry deposition, this will include quarterly sampling at each site for one year, with a minimum of three additional samples collected at designated locations (to be determined) to capture Santa Ana wind conditions. Wet deposition samples will be collected during winter/spring 2009. Samples will be collected at a minimum of one site, with sample collection at additional sites as resources allow. The number of samples collected will depend on the number and type of rainfall events, with the goal of collecting enough samples to characterize wet deposition for the majority of the rainfall volume during the 2008-2009 wet season.

iii. Equipment

For dry deposition, a specially designed water surface sampler (WSS) will be used to measure dry atmospheric flux of nutrients. This sampler passively collects both gaseous and particulate constituents that absorb/deposit from the atmosphere to a static water surface. For wet deposition, an automated rainwater collector, developed by the National Atmospheric Deposition Program, will be used. Meteorological data will also be recorded during sampling events using a portable meteorological station.

iv. Sample preparation/collection protocols

Standard Operating Procedures for all atmospheric deposition sampling, including pre-sampling preparation, all field collection procedures, and post collection processing to prepare nutrient samples for laboratory analysis are detailed in Appendix 4.

v. Field data sheets

Field data collection consists of recording the station ID, start and stop dates and times of composite wet weather or dry weather event, volumes collected (as applicable), general observations (e.g. contamination in the samples), and sample ID number. The original field data sheets will be maintained at SCCWRP. The field data sheet is included in Appendix 5.

vi. Sample delivery and holding times

All samples will be transported on ice from the field site to SCCWRP within 6 hours, and will remain frozen until analysis. Lisa Sabin will be responsible for coordinating subsequent delivery of all samples to the laboratories for analysis, accompanied by a chain of custody form, within the appropriate holding times.

vii. Laboratory Analysis

Laboratory analysis of atmospheric samples will be done at one of the contract laboratories utilized by Bight 08 participating agencies, using established analytical methods as described in Tables 6 and 7 of the Terrestrial Sources Section. The suite of nutrients to be analyzed will include total nitrate, total ammonia, total nitrogen and total phosphorus. Other constituents may be analyzed as logistical considerations (e.g. adequate sample volume) and resources allow.

viii. Submission of laboratory analytical results and field data

Agency contract laboratories will submit an electronic copy of the wet and dry weather laboratory analytical results to SCCWRP within 3 months of sample acquisition. Data format will be pre-determined Bight ’08 data formats.

D. Quality Assurance/Quality Control Procedures

Standard quality assurance/ quality control procedures apply for the collection, analysis and data management of the wet and dry weather samples. QAQC procedures are detailed below for each applicable component of data collection and management.

i. Field Data Collection

Field blanks will be collected during each sampling event, to account for contamination in the handling and transport of samples. Duplicate samples will be collected during a minimum of 10% of sample events to estimate the precision of the measurement equipment. Detailed descriptions of field blank and duplicate sample collection protocols are given in Appendix 4.

ii. Sample Processing and Laboratory Analysis

Samples arriving at SCCWRP for processing and analysis will be transferred through chain of custody forms. All samples will bear identification labels that match information entered onto field data sheets by field crews. Labeling information for all samples will include the following:

- Project name
- Date
- Time
- Sampling location name and number
- Collector's initials
- Sample ID number
- Analyte(s) to be analyzed
- Preservation, if applicable

Water samples will be accompanied by hard copy of field data sheets that identify the appropriate site information. Hard copies of the field and laboratory data sheets will be maintained in a project notebook by the field coordinator (Lisa), and by laboratory personnel, respectively. Field data sheets and chain of custody forms (CoCs) will be filled out by field teams. CoCs will accompany the samples delivered to the laboratories. An example of CoC form is shown in Appendix 5.

Water samples will be processed in the laboratory (where appropriate). Once sample containers are filled, they will be placed on ice, in a cooler, in the dark and transported to the laboratory for processing within specified holding times (6 hours). For each set of samples that arrive from an agency, a field blank and duplicate will be prepared for each analyte of interest. The sample sets will be batched as is necessary to meet holding times and one field and duplicate sample will be analyzed per batch. Additional QA samples will be requested of the laboratory, including matrix spikes, laboratory duplicates, and equipment blanks.

Unless otherwise stated, containers for nutrient analysis will be in high density polyethylene (HDPE) bottles. Table 13 gives the volumes, containers and holding times associated with each analyte.

Table 13. Sample Handling and Custody

Parameter	Matrix	Container	Volume	Initial Preservation	Holding Time
TN/TP	Whole Water	HDPE	50 mL	Acidify with H_2S0_4, Cool to 4°C, dark, freeze	30 days at 4°C, dark
Inorganic Nutrients (Ammonia, Nitrate, phosphate)	Whole Water	HDPE	50 mL	Acidify with H_2S0_4, Cool to 4°C, dark, freeze	30 days at 4°C, dark

Transport of the samples to the analytical laboratory will be coordinated by the Lisa Sabin to ensure that all samples are handled and analyzed within the proper holding time. CoCs will be reviewed by personnel at the receiving laboratories to ensure that no samples have been lost in transport, and the laboratories will also verify that each sample has been received within necessary holding times (Table 13) All other samples will be properly and safely disposed of by the analytical laboratory once analyses are completed and all analytical quality assurance/quality control procedures have been reviewed and accepted.

Any failures (e.g., instrument failures) that occur during data collection and laboratory analyses will be the responsibility of the field crew or laboratory conducting the work, respectively. In the case of field instruments, problems will be addressed through instrument cleaning, repair, or replacement of parts or the entire instrument, as warranted. Crews will carry basic spare parts and consumables with them to the field, and will have access to spare parts to be stored at SCCWRP. Contract laboratories have procedures for dealing with failures.

All samples will be submitted to laboratories within the holding times required for specific analytes. Laboratories will be responsible for conducting analyses, or implementing appropriate preservation measures, within holding times as arranged ahead of time by the Project Manager. Laboratory turnaround times will be sufficiently timely to allow for QA checks of the data, entry into the database, analysis, and reporting by the project team in order to meet project planning and deliverable deadlines.

All samples collected during this study will be sent to laboratories that use Standard Methods to ensure a high standard of quality assurance. Laboratory analysis data quality objectives for precision, accuracy, and percent recovery have been defined in the Table 14. These quality assurance objectives will be used as comparison criteria during data quality review by SCCWRP to determine if the minimum requirements have been met and the data may be used as intended.

Table 14. Data quality objectives

Constituent	Method	Units	MDL	RL	Precision / RPD	Accuracy (value/%)	Recovery[1] (%)	Complete-ness (%)
Ammonia-N	SM 4500NH3H	mg/L	0.01	0.05	25	80-120%	80-120%	90
Nitrate	EPA 300.0	mg/L	0.01	0.05	25	80-120%	80-120%	90
Phosphate	SM4500PB2	mg/L	0.01	0.05	25	80-120%	80-120%	90
Total Nitrogen	USGS I-4650-03	mg/L	0.25	0.5	25	80-120%	80-120%	90
Total Phosphorus	USGS I-2650-03	mg/L	0.25	0.5	25	80-120%	80-120%	90

[1]RPD Relative Percent Difference

iii. Data management

Quality assurance procedures for data management are specified in SCCWRP's Bight Information Management Plan. These procedures will be followed to ensure that data collected under the study are of highest quality possible.

VII. POTW Effluent

Nutrient concentrations in the effluent will be measured monthly at each of the following large POTWs:

- Hyperion Treatment Plant (HTP) operated by City of Los Angeles
- Joint Water Pollution Control Plant (JWPCP) operated by Los Angeles County Sanitation District
- Treatment Plant No. 2 operated by Orange County Sanitation District
- Point Loma Wastewater Treatment Plant (PLWTP) operated by City of San Diego

Table 15 provides a complete list of constituents being measured quarterly for this nutrient source from December 2008 through December 2009. These concentrations will be multiplied by measured effluent discharge rates to produce quarterly loads to the SCB.

Table 15 List of the constituents that will be analyzed by the large POTWs (indicated by an "X") as part of the Bight 2008 Water Quality Study and the comparison study. The empty boxes indicate additional B'08 WQ samples that will be collected and analyzed by a contract laboratory.

Constituents to be analyzed	Hyperion	JWPCP	OCSD	PLWTP
Nitrate	X	X		X
Nitrite	X	X		
Ammonia	X	X	X	X
Phosphate				X
Silicate				
Urea				
Particulate Nitrogen				
Total Nitrogen				
Particulate Phosphorus				
Total Phosphorus	X	X		

A. Description of field teams and activities

i. Personnel

Field sampling will be conducted by personnel who normally collect effluent samples at each facility. One person will be designated as the point of contact for each participating organization. The samples will be collected anytime during the quarter when the normal monthly samples are collected. Samples should be collected as described in Appendix 3 for the discrete samples and stored frozen.

Table 16 List of Contact Personnel for each POTW

Responsible Person	Organization	Shipping Address	Phone Number	Email Address
Sheri Fama	CRG Laboratories	2020 Del Amo Blvd., Suite 200, Torrance, CA 90501	310-533-5190 X116	sfama@crglabs.com
Ruey Huang	City of LA	EMD, 12000 Vista del Mar, Playa del Rey, CA 90293	(310) 648-5247	Ruey.Huang@lacity.org
Greg Hoerner	LACSD	24501 Figueroa Street Carson, Ca 90745	(310) 830-2400, ext 5512	ghoerner@lacsd.org
Dan Trembly	OCSD	10844 Ellis Avenue, Fountain Valley, CA 92708	(714) 593-7480	dtremblay@ocsd.com
Brent Bowman	City of SD	5530 Kiowa Drive, La Mesa, CA 91942	(619) 668-3214	bbowman@sandiego.gov

ii. Chain of Command

The main contact personnel listed above in Table 16 will be responsible for organizing and implementing sampling from each of their organizations. After the sample(s) are collected, the contact personnel will make sure that all samples and documentation are delivered to the appropriate processing personnel within a reasonable time. Any changes in sampling should be documented and sent to the POTW Effluent Project Leader (Meredith Howard).

The samples will be delivered to the designated organization or personnel analyzing each constituent.

Table 17 List of analysis information for all samples collected by the Hyperion Treatment Plant (HTP)

Constituent	Analysis By:	Contact	Phone	Email
Nitrate	HTP	Farhana Mohamed or James Kim	(310) 648-5923 OR (310) 648-5846	farhana.mohamed@lacity.org OR james.kim@lacity.org
Nitrite	HTP	Farhana Mohamed or James Kim	(310) 648-5923 OR (310) 648-5846	farhana.mohamed@lacity.org OR james.kim@lacity.org
Ammonia	HTP	Farhana Mohamed or James Kim	(310) 648-5923 OR (310) 648-5846	farhana.mohamed@lacity.org OR james.kim@lacity.org
Phosphate	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Silicate	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Urea	SCCWRP	Meredith Howard	714-755-3263	mhoward@sccwrp.org
Particulate Nitrogen	University of Georgia	Tom Maddox	(706) 542-6023	trmaddox@uga.edu
Particulate Phosphorus	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Total Phosphorus	HTP	Farhana Mohamed or James Kim	(310) 648-5923 OR (310) 648-5846	farhana.mohamed@lacity.org OR james.kim@lacity.org
Total Nitrogen	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com

Table 18 List of analysis information for all samples collected by the Joint Water Pollution Control Plant (JWPCP). Samples are collected on the first Tuesday of every month.

Constituent	Analysis By:	Contact	Phone	Email
Nitrate	JWPCP	Greg Hoerner	310-830-2400 X5512	ghoerner@lacsd.org
Nitrite	JWPCP	Greg Hoerner	310-830-2400 X5512	ghoerner@lacsd.org
Ammonia	JWPCP	Greg Hoerner	310-830-2400 X5512	ghoerner@lacsd.org
Phosphate	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Silicate	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Urea	SCCWRP	Meredith Howard	714-755-3263	mhoward@sccwrp.org
Particulate Nitrogen	University of Georgia	Tom Maddox	(706) 542-6023	trmaddox@uga.edu
Particulate Phosphorus	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Total Phosphorus	JWPCP	Greg Hoerner	310-830-2400 X5512	ghoerner@lacsd.org
Total Nitrogen	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com

Table 19 List of analysis information for all samples collected by OCSD Treatment Plant No. 2.

Constituent	Analysis By:	Contact	Phone	Email
Nitrate	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Nitrite	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Ammonia	OCSD	Charles McGee	714 -593-7504	CMCGEE@OCSD.COM
Phosphate	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Silicate	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Urea	SCCWRP	Meredith Howard	714-755-3263	mhoward@sccwrp.org
Particulate Nitrogen	University of Georgia	Tom Maddox	(706) 542-6023	trmaddox@uga.edu
Particulate Phosphorus	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Total Phosphorus	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Total Nitrogen	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com

Table 20 List of analysis information for all samples collected by Point Loma Wastewater Treatment Plant.

Constituent	Analysis By:	Contact	Phone	Email
Nitrate	PLWTP	Brent Bowman	619-668-3214	bbowman@sandiego.gov
Nitrite	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Ammonia	PLWTP	Brent Bowman	619-668-3214	bbowman@sandiego.gov
Phosphate	PLWTP	Brent Bowman	619-668-3214	bbowman@sandiego.gov
Silicate	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Urea	SCCWRP	Meredith Howard	714-755-3263	mhoward@sccwrp.org
Particulate Nitrogen	University of Georgia	Tom Maddox	(706) 542-6023	trmaddox@uga.edu
Particulate Phosphorus	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Total Phosphorus	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com
Total Nitrogen	CRG Laboratories	Sheri Fama	310-533-5190 X116	sfama@crglabs.com

iii. Permits

There are no additional permits required to obtain these samples.

Quality Assurance/Quality Control Procedures

i. Data Quality Assurance

The individual agencies will follow their normal protocols for sample analysis and normal holding time of 48 hours. A comparison study will be conducted to determine the amount of variability between laboratories analyzing the same constituents of POTW effluent. Two effluent samples (from City of San Diego and Orange County Sanitation District) and one reference standard will be distributed to all of the labs for analysis.

ii. Chain of Custody Forms

The chain of custody form is in Appendix 25.

iii. Sample Delivery

All samples that are not being processed at the individual POTWs will be delivered (either via physically dropping off or shipping Fedex overnight) to CRG laboratories. CRG laboratories will analyze all samples ***within 48 hours of collection***. CRG laboratories will process the urea samples and freeze them.

VIII. Spatial and Temporal Patterns of Algal Blooms

A. Remote Sensing

Satellite remote-sensing for Bight'08 offshore water quality studies

Within the scope of Bight'08 offshore water quality studies, we plan to use satellite data on ocean color (indicating chlorophyll concentration in the surface layer, CHL, as a measure of phytoplankton biomass) and sea surface temperature (SST, indicating the zones of coastal upwelling). Satellite imagery will be used for three different tasks:

1) Historical statistical analysis of the mechanisms regulating phytoplankton blooms in SCB;
2) Analysis of data collected during Bight'08 offshore water quality surveys;
3) Real-time satellite observations to detect emerging upwelling/bloom events.

All three tasks include different methodological approaches and are based on different satellite data, characterized by different spatial and temporal resolution, obtained from different sources, stored in different formats and processed and analyzed using different software.

Task 1. Historical analysis of phytoplankton blooms dynamics in SCB is based on Level 3 data, i.e., regular grids of daily/weekly/monthly satellite observations of CHL and SST produced at NASA using standard algorithms and distributed via NASA Distributed Active Archive Center (DAAC). Additional source of Level 3 CHL data is SCCWRP partnership with NOAA NCCOS. The available archives of Level 3 satellite data include CHL: SeaWiFS (since September 1997) and MODIS-Aqua (since July 2002) and SST: Pathfinder AVHRR (since 1985), MODIS-Terra (since January 2000) and MODIS-Aqua (since July 2002).

Task 2. Analysis of satellite data will be done in parallel with the analysis of ship-based observations collected during the Bight'08 offshore water quality surveys. Using satellite data, we can

- perform a synoptic view on the study regions, evaluate the spatio-temporal limits of the processes we study (e.g., phytoplankton blooms, upwelling, etc.);
- assess the correlations between remotely-sensed optical properties of ocean surface (e.g., absorption and backscattering at different wavelengths) and the measured in situ parameters (e.g., chlorophyll concentration, CDOM, etc.). These correlations can be used for assessment of total quantities of phytoplankton biomass in SCB, which is important in terms of its nutrient budget.

Task 3. To detect in a timely manner upwelling and bloom events in SCB, we can use the coastal observing systems including SCCOOS and CoastWatch. These systems provide real-time access to satellite imagery, including ocean color, CHL and SST.

SCCOOS (Southern California Coastal Ocean Observing System) provides access to the following types of satellite data:

- JPL Remote Sensing;
- MODIS SST / Color;
- OCM Ocean Color;
- Optimally Interpolated SST;
- GOES Hourly Satellite Images.

The NOAA CoastWatch Program's Central Operations (http://coastwatch.noaa.gov/) provides access to various kinds of near-real time satellite data/products, including ocean color (CHL, nLw's/RRS), SST, and ocean surface winds.

- MODIS moderate resolution (~ 1km) ocean color data from both the Aqua and Terra Platforms are available from CoastWatch within 12 hours of acquisition (satellite overpasses are ca. 10:30 a.m. for MODIS-Terra and ca. 1:30 p.m. for MODIS-Aqua). Note that Terra data are available, but these should only be used qualitatively given problems with this sensor.
- MODIS-Aqua high-resolution (250 m/500 m) ocean color data/products (CHL, nLw's/RRS) and images are currently available at: http://www.star.nesdis.noaa.gov/sod/mecb/coastwatch/modis/L3/indicatrix.html
- SeaWiFS high resolution (~ 1km) ocean color data (including L1A) are typically available within 2-10 hours of acquisition. Note that use of the digital data in real time is restricted to civilian government management activities, which for these purposes can include state/local agencies; imagery is available to other participants. SeaWiFS data will only be available through early March, however.
- MERIS CHL reduced resolution (~ 1km) data is available in near-real time to approved investigators of the European Space Agency; see the CoastWatch website for further details on gaining access.
- AVHRR and GOES SST data are typically available within 3 hours of acquisition.

A user-friendly web interface enables browsing and selection of near-real time imagery and downloading the images in graphical and digital formats on the CoastWatch website. Graphical images can be visually analyzed and used as illustrations, indicating the zones of low SST (upwelling) and high CHL (phytoplankton blooms). Digital data (in CW-HDF format) can be analyzed using the CoastWatch Software Library and Utilities and the CoastWatch Data Analysis Tool (CDAT). Users can manipulate the color scale, zoom into the regions of interest, navigate and annotate, generate statistics and perform data match-ups, functions and analyses (e.g., extract digital information in the points and regions of different shape, along transects, etc.), and export data images in various formats.

The CoastWatch West Coast Regional Node (WCRN; http://coastwatch.pfel.noaa.gov/) will also be offering tailored 250 m and 500 m MODIS Aqua ocean color data/products, as well as 300 m MCI (Maximum Chlorophyll Index) and FLH (fluorescence line height) products from MERIS, though these are unlikely to be served through the usual WCRN browser. Instead, a special site to provide HDF, netCDF, and jpg will be established in support of Bight '08.

IX. Offshore Vessel Surveys

A. Sampling Effort

The ship-based sampling effort for the Bight'08 water quality program will consist of five separate surveys. Three of these surveys will be timed to follow the onset of a "bloom" event from February to May 2010. The onset (trigger) of an event will be determined by sampling at five piers located along the coast (see Field Measurement section above) and data from the Southern California Coastal Ocean Observation System (SCCOOS) gliders (see section below). Two additional surveys will be conducted by the Central Bight Water Quality (CBWQ) group and by the City of San Diego (SD) as part of their permit monitoring programs. These offshore field surveys will consist of CTD (conductivity, temperature, depth) and bio-optical (percent light transmittance; chlorophyll, and Colored Dissolved Organic Matter; CDOM fluorometry) vertical profiles. Discrete water samples will be collected at the surface and at the subsurface chlorophyll-*a* fluorescence maximum for measurements of domoic acid, chlorophyll-*a*, nutrients, and phytoplankton.

A total of 975+ water-column stations (Appendices 13 & 22) will be sampled during the survey for the parameters listed in Table 21.

B. Triggers

The dates of the field sampling will be determined by several 'triggers'. These triggers are the following:
<u>ROMS Modeling</u>

The JPL ROMS 3–D model (0-2000 m) provides both existing ("nowcast") and predictive (up to 48 hours in 6–hour increments) representations of temperature, salinity, sea surface height, and currents. The model outputs will be used to identify changes in ocean temperature that would indicate in-progress or predicted coastal upwelling events. Currents will also be evaluated to identify potential transport of plankton from outside the study area (e.g., north of Point Conception). Model temperature predictions will be compared to real–time temperature measured at the five Bight '08 sentinel piers as well as daily satellite imagery.

Remote Sensing

Satellites

In concert with ROMS model output, daily satellite remote sensing will be used to identify surface algal blooms (using chlorophyll-a) as well as spatial patterns in sea surface temperature. Satellite data products that will be used include:

- Chlorophyll-a measured by SeaWiFS (available through early March 2009), MODIS and MERIS;
- SST measured by satellites (AVHRR, MODIS and GOES);

Gliders

One autonomous glider will be deployed in San Pedro Bay (~Dana Point to Palos Verdes). Data will be transmitted to shore every ~6 hours. These data will provide trigger information offshore and subsurface that will be used to evaluate potential onset of algal blooms. Glider data will also be assimilated into the JPL ROMS model runs.

Continuous Automated Sampling

National Data Buoy Center (NDBC) buoys

Sea surface temperatures will be monitored at selected NDBC buoys.

Pier-based Sampling

SCCOOS HAB pier-based sampling program will be used as primary triggers for offshore field sampling. These sentinel piers are located in San Luis Obispo, Santa Barbara, Santa Monica Bay, Newport Beach and La Jolla. The piers have mounted sensors for continuous time-series data of temperature, salinity and chlorophyll fluorescence. Discrete water samples will also be collected weekly and analyzed for the constituents listed in Table 3. If a trigger event is seen (e.g. sharp increase in chlorophyll-a or drop in temperature below 13.5 °C (sigma-theta > 25 kg/m^3)) additional discrete samples will be collected to confirm the onset of a phytoplankton bloom.

Trigger Integration and Evaluations

A representative from each group responsible for a data product will be available for consultation with the Bight'08 Committee Chair and Co-Chair (or their designees) and recommendation on the initiation of a coordinated offshore water quality sampling will be made and transmitted to the responsible sampling agencies. It is the goal to begin sampling within one week of the onset of a significant algal bloom.

Table 21 Parameters to be collected for the ship based offshore water quality surveys. Collection protocols are listed in Appendix 6.

Component	Indicator/Analyte	
	Required	**Optional**
CTD profile	Conductivity Temperature Depth Dissolved Oxygen Percent Light Transmittance Fluorescence (Chlorophyll-*a*) pH	Irradiance Fluorescence (Color Dissolved Organic Matter)
Discrete water samples	Chlorophyll-*a* Nitrate Nitrite Phosphate Silicate Urea Ammonium Particulate Nitrogen (PN) Particulate Phosphorus (PN) Total Nitrogen (TN) Total Phosphorus (TP) *Pseudo-nitzschia* cell counts (whole water, WW) Domoic Acid (DA)	

Each organization will sample the following number of stations:

1) **<u>POTW NPDES Surveys</u>**

City of Oxnard/ABC Labs – 45 CTD stations from the Ventura River to Point Dume, 12 discrete sample stations.
City of Los Angeles – 54 CTD stations, 9 discrete sample stations from Point Dume/Malibu Creek to King Harbor, Redondo Beach.
LACSD – 48 CTD stations, 12 discrete sample stations from the western side of the Palos Verdes peninsula to the San Gabriel River.
OCSD – 66 CTD stations, 12 discrete sample stations from the San Gabriel River to Crystal Cove State Beach.
City of San Diego – 76 CTD stations and 15 discrete sample stations.

There may be an additional 1-2 carboys of water to collect for the isotope study (for filtering and processing at SCCWRP). LACSD and OCSD will be the two organizations that will need to provide these extra samples (SCCWRP will provide the carboys and transportation and will process samples back at the laboratory at SCCWRP).

Table 22 Station Commitment for NPDES surveys

Responsible Agency	Number of CTD stations for each survey	Total number of CTD stations for both NPDES Surveys	Number of Discrete sample stations for each survey	Total Discrete samples per analyte for each survey (2 depths)	Total number of discrete samples per analyte for both NPDES Surveys
City of Oxnard/ABC Labs	45	90	12	24	48
City of Los Angeles	54	108	9	18	36
LACSD	48	96	12	24	48
OCSD	66	132	12	24	48
City of San Diego					
-PLOO	36	72	6	12	24
-IWTP	40	80	9	18	36
TOTAL	**289**	**578**	**60**	**120**	**240**

2) Event Surveys

Contractor (ABC Labs) – 10 stations from the Goleta Outfall to the Ventura River (*only if funding becomes available)*
ABC Labs/City of Oxnard – 24 stations from the Ventura River to Magu Lagoon.
City of Los Angeles – 18 CTD stations and 18 Discrete stations/depths from Malibu Creek to the Hyperion outfall
LACSD – 24 stations from the LACSD outfall to the San Gabriel River
OCSD – 24 stations from the Bolsa Chica Inlet to Crystal Cove State Beach
Contractor (Weston Solutions) – 20 stations from the Santa Margarita River to the Encina outfall
City of San Diego – 28 stations from Mission Bay to the Tijuana outfall

Table 23 Station Commitment for the three event surveys

Responsible Agency	Number of CTD stations for each survey	Total number of CTD stations for all event surveys	Number of Discrete sample stations for each survey	Total Discrete samples per analyte for each survey (2 depths)	Total number of discrete samples per analyte for all event Surveys
Contractor Santa Barbara (ABC Labs)	10	30	6	12	36
ABC Labs	24	72	12	24	72
City of Los Angeles	18	54	9	18	54
LACSD	24	72	12	24	72
OCSD	24	72	12	24	72
Contractor North San Diego (Weston Solutions)	20	20 (1 survey)	12	24	24 (1 survey)
City of San Diego	28	84	15	30	90
TOTAL	**148**	**404**	**78**	**156**	**420**

i. SAMPLING SCHEDULE

The glider surveys will begin in mid-February 2010 and continue through mid-June 2010. The three CTD Event Surveys will start in February 2010 and go through June 2010. Event Surveys will begin within one week of a bloom trigger. In absence of a trigger (e.g., upwelling) or the lack of a bloom response to such triggers, it may be decided to sample on a set temporal frequency (e.g., every two weeks). The two quarterly (Winter: January – March; Spring: April – June) NPDES Permit Surveys will be targeted to events during the respective quarters, but under no circumstance will sampling be delayed past the second week of the month ending each quarter (i.e., March and June). Field sampling blackout dates, when no sampling will occur are listed in Table 24.

Table 24 List of Black Out dates for B'08 Offshore Water Quality Sampling

January 1, 2010	New Year's Day
January 18, 2010	Martin Luther King Day
February 15, 2010	Presidents' Day
March 31, 2010	Caesar Chavez Day
May 31, 2010	Memorial Day

ii. SAFETY

Collection of samples in field surveys is inherently hazardous and this danger is greatly compounded in bad weather. Thus, the safety of the crews and equipment is of paramount importance. Each person working on board a vessel should take personal responsibility for his or her own safety. Since a large portion of each sampling crew's time is spent on a research vessel, all field personnel must be able to swim. Many accidents at sea are preventable. "Safety awareness" by the captain and all crew members is the greatest single factor that will reduce accidents at sea. Each survey crew should follow established rules and provisions within their respective agency's safety program. Field personnel should be aware of Material Safety Data Sheets for any hazardous materials that they are likely to encounter.

Sampling should be canceled or postponed during hazardous weather conditions. The final decision is made by the vessel captain, who is responsible for the safety of everyone on board. As with any field program, the first priority is the safety of the people on board, followed by the safety of the equipment, and the recovery of the data.

iii. Important Contact Information

Contact information for each agency involved in the offshore water quality surveys (CTD & Glider) are listed in Table 25.

Table 25 Contact information for B'08 offshore water quality surveys

Name	Agency Representing	Contact Information	Area
David Caron	University of Southern California	(213)-740-0203 dcaron@usc.edu	HAB analysis
Curtis Cash	City of Los Angeles, Environmental Monitoring Division	(310) 648-5269 curtis.cash@lacity.org Cell (310)309-7143	CTD Field Surveys
Meredith Howard	Southern California Coastal Water Research Project/ University of Southern California	(714) 755-3263 mhoward@sccwrp.org	Program Coordination
Scott Johnson	City of Oxnard/ Aquatic Bioassay Laboratories, Inc.	(805) 643-5621 scott@aquabio.org	CTD Field Surveys Contract Ship – North (Santa Barbara)
Burton Jones	University of Southern California/Southern California Coastal Ocean Observation System	(213) 740-5765 bjones@usc.edu	Glider Surveys
Mike Kelly	City of San Diego Metropolitan Wastewater Department, Environmental Monitoring and Technical Services Division	(619) 758-2342 mkelly@sandiego.gov	CTD Field Surveys
George Robertson	Orange County Sanitation District	(714) 593-7468 grobertson@ocsd.com	SAMPLE CZAR CTD Field Surveys
Alt. Mike Mengel	Orange County Sanitation District	(714) 593-7465 mjmengel@ocsd.com	SAMPLE CZAR CTD Field Surveys
Astrid Schnetzer	University of Southern California	(213) 740-3675 astrids@usc.edu	Sample Collection Training Ship based discrete samples
Alex Steel	Los Angeles County Sanitation Districts Ocean Monitoring & Research Group	(562) 699-7411 x2812asteele@lacsd.org	CTD Field Surveys
Liesl Tiefenthaler	SCCWRP	(714) 755-3231 lieslt@sccwrp.org	Receive all discrete samples at SCCWRP
Matthew Wartian	Weston Solutions	(760) 809-1959 Matt.wartian@westonsolutions.com	CTD Field Surveys Contract Ship – North San Diego

iv. Navigation

Accurate location of sampling sites is important to the success of all monitoring surveys. For standard operations, differential global positioning system (DGPS) is required; standard GPS is acceptable as a back-up in the event that the differential GPS is down.

v. Site Acceptability Criteria

The location of each station will be designated in advance as a set of coordinates (latitude and longitude). Most of these sites are either visited routinely by the various agencies are have been part of previous regional projects (e.g., Bight'98). In the advent a station has not been sampled previously, than upon arrival at the site, the depth at the station depth will be determined by fathometer. This will be regarded as the nominal station depth for all subsequent sampling at the station during the Bight'08 survey and will be used for calculating station acceptability if the station must be moved.

vi. Cruise and Site Data

A specific set of cruise and site data should be recorded for every CTD survey. The following data should be recorded for each cruise: (1) date; (2) vessel; and (3) vessel crew and scientific party.

Each agency is responsible for maintaining a station log during each cruise (Appendix 23). Coordinates of each station must be based on North American Datum 1983 (NAD 83) and should be expressed in degrees, minutes, and thousandths of a minute. Each vessel must also have a fathometer. Depth should be recorded for each station in meters and included with the navigation data. All samples must be collected within 100 m radius of the nominal station co-ordinates; a 50 m radius is the optimal distance. Coordinates, distance from nominal, and fathometer readings should be recorded electronically, if possible.

The following data should be recorded at each sampling site:

1) Date;
2) Coordinates (latitude and longitude in degrees, minutes, and thousandths of a minute) of sampling site;
3) Time;
4) Depth (in meters);
5) Weather observations (sky, wind speed, and wind direction should be measured on an 8 point compass in degrees from magnetic north);
6) Sea conditions (swell height and direction, period).

Additional specific data to be collected are discussed under the Water Column Profiling section below.

C. Discrete Samples

All discrete samples will be collected aboard the ships according to the protocols in Appendix 6 and frozen immediately except the cell counts which can be stored at room temperature. The samples should be put into a cooler with plenty of regular ice or dry ice while at sea. ***If questions arise during sampling, please call the persons listed in order on the list in Appendix 24.***

After the survey has ended, the frozen samples should be stored frozen before analysis and during shipping/transporting to the appropriate organization. Samples shipped via overnight services need to be shipped with **DRY ICE** otherwise the samples will be compromised.

i. Discrete Sample Labels/Tracking

Each sample will be identified and tracked by the station, depth, date sampled, and parameter. Individual log numbers may be used at the discretion of the sampling organization.

ii. Labels

Labels will be printed by the agency responsible for field sampling prior to each survey and will include, at a minimum, the station number, depth, and date, and parameter. Dates will be reported as month/day/year (mm/dd/yy). External labels should be covered with clear postal tape to prevent them from falling off the container only if they will not stick on some surfaces. Most of the discrete samples will not require tape. Labels will be supplied by SCCWRP and the ***dates will need to be filled in on each label once determined***. ***These labels should be put on bottles or sample vials before the cruise (they will not stick after sample collection).*** We will use the following abbreviations for the labels:

Table 26 Label Information

Samples	**Short name for label**
Chlorophyll	Chl 1 Chl 2 (duplicates)
Domoic Acid	DA1 DA2 (duplicates)
Particulate Nitrogen	PN1 PN2 (duplicates)
Particulate Phosphorus	PP1 PP2 (duplicates)
Cell counts (whole water)	WW
Urea	Urea
Dissolved Inorganic Nutrients (nitrate, nitrite, ammonium, phosphate, silicate)	DIN
Total Nitrogen and Total Phosphorus	TN/TP

Sample labels will have the station number/label, depth of sample, date of collection and short name of sample type. Here is an example of how to label samples:

Bight 08 NPDES **OR** EVENT Survey Ocean
Station #
Depth
Date
Sample type

For example, Quarter 1 NPDES survey:

Bight 08 NPDES Survey Ocean
Station 1
Surface
Quarter 1 2010
TN/ TP

For example, First EVENT survey:

Bight 08 EVENT1 Survey Ocean
Station 1
Chl max 25m
Date 031509
TN/ TP

If the volumes filtered need to be adjusted because of the large amount of biomass, the actual filtered volumes need to be recorded on the sample label with sharpie AND on the field cruise sheet.

Table 27 Sample Collection Details

Sample	**Number of samples per station depth**	**Filter and water needed**	**Volume required**	**Bottle Type**	**Storage**
		FILTERS			
Chlorophyll	2 samples	GF/F filter and seawater	100 mls	Glass test tube with cap	Immediately frozen and covered in foil
Domoic Acid	2 samples	GF/F filter and seawater	200 mls	Cryovial	Immediately frozen
Particulate Nitrogen	2 samples	Pre-weighted Combusted GF/F filter and seawater	200 mls	Petri dish	Immediately frozen
Particulate Nitrogen FIELD BLANKS	3 samples **per cruise**	Pre-weighted Combusted GF/F filter and **DI Water**	200 mls	Petri dish	Immediately frozen
Particulate Phosphorus	2 samples	Pre-weighted Combusted GF/F filter and seawater	200 mls	Petri dish	Immediately frozen
Particulate Phosphorus FIELD BLANKS	3 samples **per cruise**	Pre-weighted Combusted GF/F filter and **DI water**	200 mls	Petri dish	Immediately frozen
		UNFILTERED WHOLE WATER			
Cell Counts	1 sample	Whole seawater	95 mls	Square glass bottles	Stored at room temp
Total Nitrogen and Total Phosphate	1 sample	Whole seawater	Fill bottle 2/3 full	HDPE bottles	Immediately frozen
Total Nitrogen and total phosphate FIELD BLANKS	3 samples **per cruise**	**DI water**	Fill bottle 2/3 full	HDPE bottles	Immediately frozen
		FILTRATE (DISSOLVED PORTION OF FILTERED WATER)			
Urea	1 sample	Filtered seawater	40 mls	50 mls centrifuge tube	Immediately frozen
Urea FIELD BLANKS	3 samples **Per cruise**	Filtered **DI water**	40 mls	50 mls centrifuge tube	Immediately frozen
Dissolved Inorganic Nutrients (nitrate, nitrite, phosphate, silicate) DIN	1 sample	Filtered seawater	Fill bottle 2/3 full (not less than 20mls)	HDPE bottles	Immediately frozen
DIN FIELD BLANKS	3 samples **Per cruise**	Filtered **DI water**	Fill bottle 2/3 full (not less than 20mls)	HDPE bottles	Immediately frozen

All samples except the cell counts will be frozen and shipped to SCCWRP (see Appendix 25). All frozen samples that are not hand delivered to SCCWRP will need to be sent in ***dry ice via overnight carrier service*** in order to ensure samples are not compromised.
Organizations that are analyzing their domoic acid samples should take the samples to their lab after the cruise for analysis (do not ship those filters to SCCWRP).

For the Domoic Acid samples, there will be 2 samples (duplicates) collected at each station and depth. A subset of the cruise samples will be analyzed initially using only 1 of the 2 filters collected. The results of the initial subset of samples will determine if the remaining cruise samples will be analyzed (if there is no DA detected, it may be more cost effective not to analyze them as it is highly likely they will be negative as well). The second filter will be analyzed for 20% of the total samples collected per cruise. Of these filters, if the second filter is not within 30% of the first filter, then all of the duplicates for that cruise will need to be analyzed.

iii. Shipping of Samples

All discrete samples not retained by the sampling agency will be shipped to directly to SCCWRP. Most samples do not have to be delivered on the same calendar day collected, but must be stored as indicated and delivered within 48 hours of sample collection (<12 hours preferred). All shipping of samples will be the responsibility of the field sampling organizations. If you are shipping (not delivering or dropping off in person) the samples, ***you must use dry ice and an overnight shipping service to ship samples.*** If both of these conditions are not met, the samples will be compromised.
For all samples to be shipped to SCCWRP please use the following address:

Liesl Tiefenthaler
Southern California Coastal Water Research Project
3535 Harbor Blvd, Suite 110
Costa Mesa, CA 92626
Phone: 714-755-3231
Fax: 714-755-3299

Information regarding which organization is analyzing the samples and where to ship every sample is provided in Appendix 25.

iv. Chain of Custody Forms

Chain of custody forms are to be filled out at the end of each sampling day for transfer of samples from the vessel sampling crew to the laboratory or to delivery personnel. A form is to be filled out for each set of samples that will be transferred to a specific location. Sample identification numbers (or station, depth, and date) and sample and container types are to be included on the form to identify the samples being transferred.

This form is to be signed by the chief scientist transferring the samples and the laboratory staff member receiving them. A copy of the form is to be kept and the original form with signatures will accompany the samples. If samples are shipped by carrier, a copy of the chain of custody form is to be faxed to SCCWRP for tracking purposes. Appendix 26 has the chain of custody form.

v. Field Data Sheets

Field data sheets and cruise logs are to be completed by each sampling organization (Appendix 23). Upon completion of each survey original field data sheets are to be sent to SCCWRP (see address in Appendix 25) with copies retained by the sampling organization. Field data sheets should be forwarded to SCCWRP within 7 days of survey completion.

D. Field Database Management

A field computer system has been developed for the Bight'08 that includes the forms with all of the fields for all of the field data sheets. This system employs laptop computers and has an instruction manual for training and reference. Use of the field computer system is optional during the Bight'08 survey.

The data entry screens are identical to the field data sheets. Data can either be entered into the computer while at sea, or it can be taken from the data forms at a later time. Although hard copies of all field data sheets are mandatory, these can either be hand-written or hard copy printouts from the computer.

The data entered into each field of the electronic forms is checked automatically by the software and it provides a warning when the data do not fall within an expected range. After entering the data into the field computer system, it will be printed out to hard copy and checked by the Chief Scientist against the original handwritten data sheets. Once the data have been checked, corrected (if necessary), and accepted by the Chief Scientist, the crew will not be granted access to the data any further.

E. Water Column Profiling

i. Purpose

Water-column profiles are collected to characterize depth-related gradients in temperature, salinity, hydrogen ion content (pH), percent light transmittance, ambient light levels (PAR), dissolved oxygen (DO), and fluorescence (for Chlorophyll-*a* and Colored Dissolved Organic Matter; CDOM). For instance, high chlorophyll fluorescence values may indicate the presence of phytoplankton. Water-column profiles can describe whether stratification (layering) is present and, if so, the depth of the thermocline or pycnocline. Variation in these parameters at the same depth among stations may indicate anthropogenic or natural perturbations of the environment.

ii. Equipment

A conductivity-temperature-depth profiler (CTD) with additional sensors will be used to provide a continuous (8-24 scans/second) water-column profile of temperature, salinity, dissolved oxygen, pH, percent light transmittance, irradiance, and fluorescence (for Chlorophyll-*a* & CDOM) with depth. This instrument must meet the program performance specifications for temperature, salinity, DO, pH, transmissivity, and pressure (27).

Table 28 The program performance specifications for temperature, salinity, DO, pH, transmissivity, and pressure

Parameter	Initial Accuracy/Sensitivity	Resolution
Conductivity	0.0003 S/m	0.00004 at 24 Hz
Temperature	±0.001 °C	0.0003 °C at 24 samples/sec
Pressure	0.01%	0.0001%
Dissolved Oxygen	2% of saturation	Not available
pH	0.1 pH	Not available
Light Transmittance	1.25 mV	Not available
Irradiance	$1x10^{17}$quanta/(cm^2·sec)	Not available
Chlorophyll-*a* fluorescence	≥0.03 µg/L	Varies per sensor
CDOM fluorescence	0.100 ppb QSD	Varies per sensor
*Values obtained from manufacturer's specifications (SeaBird Electronics, WETLabs, and Biospherical Instruments.		

iii. Training

Any individual who will be maintaining, calibrating, or operating the CTD and/or glider should be trained in each of these operations. Prior to performing these operations unsupervised, an individual should demonstrate proficiency in that operation to a senior, experienced agency staff member. Proficiency should be evaluated based on successfully completing the operation following written procedures and demonstrating an understanding of the equipment. Additionally, the individual should be evaluated on his/her ability to troubleshoot common problems. All training and demonstration of proficiency should be documented. An agency using and deploying a CTD should be an active participant in the Southern California CTD Users Group. Gliders will be operated by labs from USC and UCSD/SIO, whose technicians are trained in glider deployments.

F. CTD Pre-Cruise Checkout and Calibration

i. Pre-cruise Equipment Checkout

A pre-cruise equipment checkout and calibration will be conducted prior to starting the cruise. This inspection should include the following:

1) A visual inspection of the CTD for any obvious defects;

2) A check of all metal components for corrosion, cleaning or replacing as necessary;
3) An inspection and cleaning of all connections with contact cleaner, as necessary;
4) Verification that the plugs are secure and waterproof and lubricated with silicone;
5) An inspection of all cables for nicks, cuts, abrasions, or other signs of physical damage;
6) A test of the CTD to see if connections and software work properly;
7) Cleansing and/or replacement of all accessory tubing as necessary; and
8) Checking battery status for all units using RAM data storage.

ii. Pre-cruise Calibrations

A pre-cruise calibration will be conducted less than or equal to 72 hours prior to starting the cruise for pH, percent light transmittance, and pressure. There is no required lab calibration for DO, conductivity, temperature, irradiance, and fluorescence (chlorophyll-*a* and CDOM). Verification that the proper sensor coefficients are in the configuration file should be made before proceeding. A CTD calibration data sheet will be prepared at that time, with all required information entered on that sheet.

Hydrogen Ion Content (pH):
The pH sensor may be calibrated by using commercially available buffer solutions. When sampling in the ocean it is best to use three buffers of pH 7, 8, and 9. The manufacturer's specifications should always be followed during calibration of the probe. For example, when calibrating the sensor, it may be necessary to make an electrical connection between the body of the pH sensor module and the buffer solution. This connection may be made using any convenient piece of wire. One end of the wire is attached to one of the screws attaching the zinc anode. The other end of the wire is immersed in the solution. It is important that the buffer is thermally equilibrated with the water bath; this is best accomplished by keeping the CTD in the water bath and using a holding bracket for the cup of buffer. The water temperature, pH, and voltage output for each of the three buffers is then recorded. These values are entered into the manufacturer's software and checked against three buffers, recording the pH values.

Transmissometer:
This calibration is performed in air. The transmissometer should be calibrated according to manufacturer procedures. The CTD software should be modified to reflect any changes that are made during the calibrations

Pressure Offset:
This determination should also be performed in air. The pressure sensor is checked before use, recording air sea-level values. The pressure reading in air at sea level should be a negative number between 0.00 and -0.60 db. If out of this range, adjustments should be made **to the offset value** and the manufacturer software should be rerun to achieve a value between 0.00 and -0.60 db. If this does not correct the

displayed pressure value, the unit should be serviced. The pressure output and any changes made are recorded on the calibration sheet.

Following calibration, the sensors and equipment should be disturbed as little as possible.

iii. Factory Calibration and Maintenance

Maintenance and calibration of the CTD and/or specific sensors should be documented, including dates of most recent servicing. All sensors shall be calibrated by the manufacturer annually. Preventative maintenance should be conducted on the CTD unit periodically. Upon return from the factory, enter any new factory calibration coefficients and input where appropriate.

The temperature and conductivity sensor calibration should be conducted by the National Oceanic and Atmospheric Administration/National Regional Calibration Center (NOAA/NRCC) lab and certified and inspected by the manufacturer. Certification should be provided when the sensor is returned.

iv. Post-cruise calibration

The Chief Scientist is responsible for deciding whether post-cruise calibrations are within acceptable limits. The time between last cast and the completion of the postcalibration should be not more than 72 hr.

Hydrogen Ion Content (pH):
Agreement between sensor output and known values should be within 0.1 pH unit. The only similarity between the post-cruise and pre-cruise calibration of the pH sensor is that the sensor is checked against the three buffers with no adjustments being made. The water temperature should be recorded, as well as the pH and voltage output for each buffer. Agreement should occur between each sensor value and the known buffer value, and should be within 0.15 pH units. If agreement is out of this range, the unit should be recalibrated and the new calibration coefficients used for processing the data.

*Transmissivity and Pressure***:**
Post-calibration of the transmissometer and pressure sensors are the same as those performed in the pre-calibration. If the pressure reading in air at sea level is not a negative number between 0 and -0.60 db, record the pressure output and any changes on the calibration sheet.

v. CTD Deployment

The CTD should be deployed with a means of data storage, such as a deck or RAM (random access memory -- an internal recording instrument) unit. The instrument should be set for a scan rate of no fewer than eight scans/sec. If there is a risk of obtaining less than three scans/m, the deployment descent rate should be decreased.

The recommended optimum speed is 0.75-1 m/sec. The CTD descent rate should not be less than 0.25 meter/second or greater than 1.5 m/sec. If deploying real-time, some manufacturer software allows this rate to be monitored by displaying and viewing the lowering rate variable. If RAM is used during deployment, the rate should be monitored with a meter wheel and timer. Descent rates should always be slower than 1.5 m/sec to minimize spiking of sensor output.

The objective of water-column profiling is to collect water-column data for every meter. Therefore, to avoid omissions in data from a given meter of depth, it is recommended that the scan rate should not be less than 8 scans/sec and a descent rate less than 1 m/sec is to be used. Optimal scan value and descent rate are dependent upon sea surface conditions during deployment and should be evaluated and adjusted accordingly.

Before beginning a cast, the CTD sensors are brought to thermal equilibration with the ambient seawater. If applicable, the pump should be activated and bubbles should be purged from any tubing. This is best accomplished by lowering the CTD a few meters and (if capable) monitoring salinity and DO values to ensure their stabilization. In either case, a 3-min equilibration upon initial power-up at the first station and 90 sec at each station thereafter is the minimum soak time for thermal equilibration and sensor stabilization. After sensor stabilization and at least the 3 min or 90 sec, the CTD is raised so the top of the unit is at the water surface and profiling is begun.

Downcast data will be used for data processing; however, data should be logged throughout the entire cast to allow for recovering missed or poor quality cast data (e.g., 1 m surface values). The CTD should be deployed to within 2 meters of the bottom or to 75 meters if the station is deeper than this depth.

iv. CTD Cast Acceptability

The goal of monitoring surveys is to collect water-column profiles at all stations. During field sampling, cast acceptability should be determined immediately following the first cast of the day (it is recommended that this be done following each cast for real time data) in one of two ways:

1) All parameters can be displayed graphically to determine if any grossly anomalous readings occurred. Graphs can be scaled to illustrate obviously anomalous values that lie outside the control limit range for each parameter (Table 29); or

2) A range-checking computer program can be used to evaluate the presence of anomalous values based on predetermined criteria (i.e. range acceptability checks).

Casts should also be evaluated by comparison of values obtained at previous or nearby stations.

Table 29 CTD parameter ranges. Source: 1998-2008 Central Bight Water Quality combined Winter and Spring surveys.

Parameter	Range	Mean
Conductivity (S/m)	1.1 – 4.5	3.9
Temperature (°C)	6.2 – 19.3	12.3
Dissolved Oxygen (mg/L)	0.5 – 15.2	6.4
Salinity (psu)	18.1 – 37.3	33.6
Transmissivity (%)	0.1 – 99.5	83.2
Density (σ-theta)	13.8 – 32.2	25.4
pH	6.5 – 8.6	8.0
CDOM	0.0 – 60.9	2.0
Chlorophyll-a	0.0 – 122.0	3.8

If anomalous values are present, the cause should be investigated and remedied before proceeding. If damage to the CTD (due to striking the bottom or some other event) is suspected, review that cast as described above to ensure acceptability. Further review of the subsequent cast in a like manner will ensure that all sensors are functioning properly. If a sensor is replaced during the day, a replicate cast should be made with the new sensor, at the last station at which the malfunctioning sensor was known to have been working properly. If a sensor is replaced, all coefficients for that sensor should be entered and saved in the configuration file. All activities relating to the occurrence of these types of events (e.g., repeated casts, damaged equipment and remedies, replaced sensors, etc.) should be noted in the field logbook. If feasible, a station should be resurveyed when an unacceptable profile is obtained.

v. CTD Quality Assurance/Quality Control

No field quality control (QC) of any of the parameters is required beyond the cast acceptability check described above or the range checks. Dissolved oxygen, pH, pressure offset, and transmissivity performance are carefully monitored and calibrated prior to and immediately following a survey. This evaluation is deemed sufficient to assure the quality of the performance. Conductivity and temperature are evaluated and calibrated on a strict factory maintenance schedule and traceable to NOAA/NRCC standards. Their performance and integrity from calibration to calibration are reliable to such a level that field QC is deemed unnecessary. The typical ranges are guidelines only and any value outside of them should be evaluated relative to the entire cast and the entire day's survey; legitimate values may exist outside of these ranges but the vast majority of values will fall within these ranges.

All data will be checked to be certain all data and configuration files are present and properly named. All data files should contain proper and complete header information.

This check should be verified and documented by field personnel. All data will be reviewed graphically and statistically for single point outliers (spikes) as well as trends.

vi. CTD Data

If CTD data are to be submitted to another agency, data will be output using a mutually agreed upon format. The format will be defined in the Bight'08 Information Management Plan. The three primary data types will be cast event data, bin-averaged cast data, and discrete sample depth data.

The following header information, parameters, units, and format is an example of the cast event data output:

1) Station ID
2) Latitude
3) Longitude
4) Sampling organization
5) Sample date
6) Cast time
7) Station depth
8) CTD method
9) Equipment
10) Cast number

The following header information, parameters, units, and format is an example of the water quality depth samples data output:

1) Station ID
2) Sample date
3) Sample number
4) Sample depth
5) Sampling organization
6) Comments

The following header information, parameters, units, and format is an example of the cast event data output:

1) Station ID
2) Sample Date
3) Start Of Cast Time
4) Temperature, ITS 90, °C
5) Conductivity, S/m
6) pH. Standard pH units
7) Beam Transmission, %
8) Beam Attenuation, 1/m
9) Elapsed Time, seconds
10) Chlorophyll, ug/L

11) Chlorophyll Voltage, volts
12) CDOM, ug/L
13) CDOM Voltage, volts
14) Depth, meters
15) Dissolved Oxygen, mg/L
16) Oxygen Saturation, mg/L
17) Percent Oxygen Saturation, %
18) Salinity, practical salinity units (PSU)
19) Density, sigma-theta, kg/m^3
20) Cast Portion, E (equilibration) ,D (downcast) , U (up-cast)
21) Comments

Hard copies of all sensor and equipment factory maintenance, pre- and postcruise calibration sheets, and CTD field data sheets should be maintained and made available upon request. Additionally, raw CTD files should be archived. These should include all data files, configuration files, header files, and any mark files created.

G. Glider Information

i. CTD-Glider Intercomparison

Glider CTD intercomparison will be done using manufacturer calibrations and CTD profiles obtained spatially and temporally near glider profiles. Optical sensors will be calibrated and compared using bench top techniques and comparisons with field CTD and batch sample analyses taken near the glider tracks.

ii. Glider Pre-cruise Equipment Checkout

A pre-cruise equipment checkout and optical sensor calibration will be conducted prior to glider deployment. This inspection should include the following:

1) A visual inspection of the glider for any obvious defects;
2) A check of all metal components for corrosion, cleaning or replacing as necessary;
3) An inspection and cleaning of all connections with contact cleaner, as necessary;
4) Verification that the plugs are secure and waterproof and lubricated with silicone;
5) An inspection of all cables for nicks, cuts, abrasions, or other signs of physical damage;
6) A test of CTD and optical sensors to verify that instruments and software work properly;
7) Replacement of battery packs, and reballasting of glider.
8) Verifying that all communications links (FreeWave, Iridium, Argos) are working reliably.

iii. Pre-cruise Calibrations

A pre-cruise calibration will be conducted prior to glider deployment. This will include validation of CTD sensors by comparison with a comparable CTD that has a current factory calibration. Optical sensors will be calibrated in a custom calibration chamber that will allow calibration with of the chlorophyll fluorometer with a mixed phytoplankton population, CDOM calibration using a newly developed method that uses Diet Coke© (Wetlabs, unpublished), and optical backscatter will be calibrated with beads of known size and backscatter characteristics.

A glider calibration data sheet will be prepared at that time, with all required information entered on that sheet.

iv. Factory Calibration and Maintenance

Maintenance and calibration of the glider and/or specific sensors should be documented, including dates of most recent servicing. Preventative maintenance should be conducted on the glider unit periodically but not to exceed manufacturer's recommendations. Upon return from the factory, enter any new factory calibration coefficients and input where appropriate.

v. Post-cruise Calibration

The Chief Scientist is responsible for deciding whether post-cruise calibrations are within acceptable limits.
Gliders will have batteries replaced, reballasted, and sensor calibrations checked between deployments. Deployments are expected to last approximately 3 weeks.

H. Glider Deployment

i. Glider Cast Acceptability

During the glider deployment, the gliders will continuously obtain profiles along their flight path. During deployment, the glider data will be evaluated from the telemetered data stream to ensure that the sensors are operating within their specifications. Data will be checked by plotting T/S plots from the CTD to ensure that the CTD data set is within the expected range for the southern California Bight. The acceptable range is based on historical data from CalCOFI, routine water quality monitoring, and data sets obtained by our laboratory using traditional CTDs over the last 20 years.

When the water quality monitoring agencies are performing field sampling, the glider data can be directly compared with the agency CTD data sets.

ii. Glider Quality Assurance/Quality Control

No field quality control (QC) of any of the parameters is required beyond the cast acceptability check described above or the range checks (Table 28). Dissolved oxygen, pH, pressure offset, and transmissivity performance are carefully monitored and calibrated prior to and immediately following a survey. This evaluation is deemed sufficient to assure the quality of the performance. Conductivity and temperature are evaluated and calibrated on a strict factory maintenance schedule and traceable to NOAA/NRCC standards. Their performance and integrity from calibration to calibration are reliable to such a level that field QC is deemed unnecessary. The typical ranges (Table 29) are guidelines only and any value outside of them should be evaluated relative to the entire cast and the entire day's survey; legitimate values may exist outside of these ranges but the vast majority of values will fall within these ranges.

All data will be checked to be certain all data and configuration files are present and properly named. All data files should contain proper and complete header information. This check should be verified and documented by field personnel. All data will be reviewed graphically and statistically for single point outliers (spikes) as well as trends.

GLIDER DATA

iii. Glider Data

If data are to be submitted to another agency, data (where applicable) will be output using a mutually agreed upon format. The following header information, parameters, units, and format is an example of output:

- **X.** Agency
- **XI.** Latitude
- **XII.** Longitude
- **XIII.** Date
- **XIV.** Time
- **XV.** Depth (m)
- **XVI.** Temperature (°C)
- **XVII.** Conductivity (Siemens/m)
- **XVIII.** Chlorophyll fluorescence (µg/L)
- **XIX.** CDOM fluorescence (?) (µg/l)
- **XX.** Salinity, PSS-78 (PSU)
- **XXI.** Density (st), (kg/m3)
- **XXII.** Backscattering 880nm (m^{-1})
- **XXIII.** Backscattering 620nm (m^{-1})
- **XXIV.** Backscattering 532nm (m^{-1})

X. Appendices

Appendix 1 Pier-based sample processing protocols

Seawater samples are filtered as follows:

Domoic Acid

200mL of seawater filtered onto a GF/F filter (duplicate samples are collected). The samples are immediately frozen at -20C.

Chlorophyll

100mL of seawater filtered onto a GF/F filter (duplicate samples are collected). The samples are immediately extracted in 100% acetone, covered in foil and frozen at -20C.

Nutrients

Nutrients are collected at the pier by rinsing a 50mL syringe w/a small amount of the sample. Syringe filter 30mL of the sample into a 50mL Corning Orange Cap Tube and freeze immediately at -20C.

Live Observations

Observe an aliquot of the net tow sample under the dissecting microscope. Observations are recorded on the abundant, common and rare harmful algal bloom species observed.

Preserved Samples

Whole water sample

90mL whole water + 10mL 37% Formaldehyde

Net Tow sample

19mL net tow sample + 1mL 37% Formaldehyde

Appendix 2 List of mass emission stations where nutrient concentrations and loads will be measured under Bight'08 water quality study.

County	Location	Number of Wet & Dry Weather Events	Type of Discharge Data Available	Frequency of Data Storage	Data Format	Channel Type	Data Online
Los Angeles	Ballona Creek at Sawtelle	3 storms + 2 dry	Sigma 800 Bubbler, AV sensor	AFM[1] 15min	Excel	Concrete	Yes
Los Angeles	Coyote Creek at Spring Street	3 storms + 2 dry	Sigma 800 Bubbler, AV sensor	AFM[1] 15min	Excel	Concrete	Yes
Los Angeles	Dominguez Channel at Artesia Blvd	3 storms + 2 dry	Sigma 800 Bubbler, AV sensor	AFM[1] 15min	Excel	Concrete	Yes
Los Angeles	Los Angeles River at Wardlow	3 storms + 2 dry	Sigma 800 Bubbler, AV sensor	AFM[1] 15min	Excel	Concrete	Yes
Los Angeles	Malibu Creek at Piuma Road	3 storms + 2 dry	Sigma 800 Bubbler, AV sensor	AFM[1] 15min	Excel	Concrete	Yes
Los Angeles	San Gabriel River at SGR Parkway	3 storms + 2 dry	Sigma 800 Bubbler, AV sensor	AFM[1] 15min	Excel	Concrete	Yes
Los Angeles	Santa Clara River at The Old Road	3 storms + 2 dry	Sigma 800 Bubbler, AV sensor	AFM[1] 15min	Excel	Natural	Yes
Orange	San Diego Creek at Campus	3 storms + ≥ 3 dry	OC Gaging Station	5 min	Excel	Natural	No
Orange	Bolsa Chica at Westminster	3 storms + 2 dry	OC Gaging Station	5 min	Excel	Natural	No
Orange	Bonita Cyn Wash u/s University	3 storms + ≥ 3 dry	USGS Gaging Station	5 min	Excel	Natural	No
Orange	Costa Mesa Channel at Highland	3 storms + ≥ 3 dry	OC Gaging Station	5 min	Excel	Concrete	No
Orange	Garden Grove Wintersburg at Gothard	3 storms + 2 dry	OC Gaging Station	5 min	Excel	Concrete / u/s rip-rap	No
Orange	Santa Ana Delhi at Irvine Ave	3 storms + ≥ 3 dry	OC Gaging Station	5 min	Excel	Concrete	No
Orange	Aliso Creek at Aliso/Woods Cyn Park	3 storms + 2 dry	OC Gaging Station	5 min	Excel	Natural	No
Orange	Laguna Canyon at Woodland	3 storms + 2 dry	OC Gaging Station	5 min	Excel	Concrete and Natural	No
Orange	Prima Deschecha at Calla Grande Vista	3 storms + 2 dry	OC Gaging Station	AFM[1]	Excel	Concrete	No
Orange	Segunda Deschecha at El Camino Real	3 storms + 2 dry	OC Gaging Station	AFM[1]	Excel	Concrete and Natural	No
Orange	San Juan Creek at La Novia	3 storms + 2 dry	USGS Gaging Station	5 min	Excel	Natural	No
Orange	Trabuco Creek at Del Obispo Road	3 storms + 2 dry	USGS Gaging Station	5 min	Excel	Natural	No
San Diego	Santa Margarita River	1 storm	Sigma 950 Bubbler, AV sensor	AFM[1] 5min	Excel	Natural	No
San Diego	San Luis Rey River	1 storm	Sigma 950 Bubbler, AV sensor	AFM[1] 5 min	Excel	Natural	No
San Diego	Agua Hedionda Creek	1 storm	Sigma 950 Bubbler, AV sensor	AFM[1] 5 min	Excel	Natural / rip-rap	No
San Diego	Escondido Creek	1 storm	Sigma 950 Bubbler, AV sensor	AFM[1] 5 min	Excel	Natural	No
San Diego	San Dieguito River	1 storm	Sigma 950 Bubbler, AV sensor	AFM[1] 5 min	Excel	Natural	No
San Diego	Penasquitos	1 storm	Sigma 950 Bubbler, AV sensor	AFM[1] 5 min	Excel	Natural	No
San Diego	Tecolote Creek	1 storm	Sigma 950 Bubbler, AV sensor	AFM[1] 5 min	Excel	Concrete	No
San Diego	San Diego River	1 storm	Sigma 950 Bubbler, AV sensor	AFM[1] 5 min	Excel	Natural	No

County	Location	Number of Wet & Dry Weather Events	Type of Discharge Data Available	Frequency of Data Storage	Data Format	Channel Type	Data Online
San Diego	Chollas Creek	1 storm	Sigma 950 Bubbler, AV sensor	AFM[1]5 min	Excel	Concrete	No
San Diego	Sweetwater River	1 storm	Sigma 950 Bubbler, AV sensor	AFM[1]5 min	Excel	Natural / rip-rap	No
San Diego	Tijuana River	1 storm	Sigma 950 Bubbler, AV sensor	AFM[1]5 min	Excel	Natural	No
Ventura	Calleguas Creek at CSUCI Bridge	4 storms + 2 dry	Sigma 950 Bubbler, AV sensor	15 min	Excel	Rip-rap / concrete	Yes
Ventura	Freeman Diversion, Saticoy	4 storms + 2 dry	Problematic	Problematic	Excel	Diversion Dam	Yes
Ventura	Ojai Valley Sanitation District	4 storms + 2 dry	Bubbler	15 min	Excel	Natural / rip-rap	Yes
Ventura	La Vista Drain	1st storm	Not sampling	NA	NA	NA	NA
Ventura	Revolon Slough	1st storm	Not sampling	NA	NA	NA	NA

[1]AFM = Automated Flow Meter

Appendix 3 Nutrient Collection Protocols for Terrestrial Sources

This protocol will generate the following samples:

2 filters for PN/POC (Particulate Nitrogen/Particulate Organic Carbon)
2 filters for PP (Particulate Phosphorus)
1 30 mL HDPE bottle for TN/TP (Total Nitrogen/Total Phosphorus, whole water)
1 30 mL HDPE bottle for urea (filtered water)
1 30 mL HDPE bottle for dissolved inorganic nutrients (DIN) (phosphate and silicate)

Get Ready:

- Anything that needs cleaning before hand (i.e. filter holders, etc.) should be soaked in 5-10% HCL, triple rinsed with DI, and dried in an oven at (80°C for 4 hours)
- Combust ~ one hundred 25 mm (0.7 micron) Glass Fiber Filters (GFF) in the kiln, spread out between two sheets of aluminum foil.
- Put on a pair of latex gloves and arrange a clean workspace with a clean sheet of lab paper.
- Supplies:
  - 30 ml HDPE bottles
  - 60 mL plastic syringes
  - 25 mm GFF filters - combusted
  - Forceps
  - Clean filter holders (i.e. petri dishes)
  - Lab paper
  - Tape
  - Scissors
  - Weatherproof labels for bottles
  - Clean 50 and/or 100 mL graduated cylinder
  - Data sheets
  - Sharpies and pencils
  - MilliQ or DI water in a squirt bottle
  - 5-10% HCL (for cleaning glassware and filter holders, etc.)
  - Filter manifold or hand pump

Total Nitrogen/Total Phosphorus

- Gently turn water sample bottle end to end 10 times to mix sample
- Open a 30 mL HDPE bottle pre-labeled for TN/TP.
- Triple rinse 30 mL HDPE bottle with sample water and discard.
- Fill 30 mL HDPE bottle to the 20 mL mark, close tightly, and freeze. This is necessary because water will expand when frozen.

Particulate Nitrogen/Carbon and Particulate Phosphorus Filters

- Prepare a filter holder with a preweighed and pre-combusted 25 mm GFF filter. Place a few drops of DI water onto filter to hold in place.
- Gently screw together the top piece of the filter holder to the bottom piece. Hand tighten. Connect hand-pump and filtering apparatus to filter holder OR place filter on filter manifold and clamp down the filter funnel.

- Rigorously shake amber water column sample bottle. Measure out 20-60 ml of volume into a clean graduated cylinder, depending on turbidity of sample and volume of filtering cup. Record the volume.
- Turn on the filter manifold or start the hand pump and filter water through the filter.
- Remove filter holder after the water has been sucked through and store in the petri dish.
- Collect 2 filters for PN/POC and 2 other filters for PP; each filter should have 20-60mls of sample filtered onto it and the volume for each should be recorded on the data sheet.
- Dry the filters in desiccating oven set at 80 °C for 24 hours.

Dissolved inorganic nutrients and urea

-
- Affix prepackaged 0.45 µm Fisherbrand MCE (mixed cellulose ester) filter (Cat No. 09-719B) on the end of the syringe.
- Put a few milliliters of sample water into the syringe. Rinse the syringe and the rubber stopper end of the plunger by tipping the syringe back and forth, then discard rinse water. Repeat for a total of 3 rinses.
- After the third rinse, fill syringe to the 60 mL mark with sample water from the sample bottle.
- Carefully put the plunger back in the syringe.
- Invert the syringe so the filter holder is facing up. Remove the filter holder and burp the syringe to make sure that all air is out. (Do Not Touch the end of the filter where the water comes out).
- Put the filter holder back on the syringe.
- Push approximately 5 mL of sample through the filter discarding this water to rinse the filter.
- Open a 30 mL HDPE bottle pre-labeled for **dissolved inorganic nutrients** (ammonia, phosphate, silicate, nitrate, nitrite)
- Expel 5 mL of sample water into the bottle, rinse bottle and cap, discard rinse water; repeat for 3 rinses total.
- Slowly push ~20 mL of water into the dissolved nutrients bottle. Bottle should only be no more than two-thirds full. Freeze sample immediately.
- Open a Fisherbrand 50ml polypropylene sterile centrifuge tube prelabeled for **Urea**.
- Expel 5 mL of sample water into the bottle, rinse bottle and cap, discard rinse water; repeat for 3 rinses total.
- Slowly push ~30 mL of water into the urea bottle. Freeze sample immediately.

  .

Appendix 4 Standard Operating Procedures for the Water Surface Sampler and Automated Rainwater Collector

Water Surface Sampler (dry atmospheric deposition)

Pre-Sampling Preparation

Supplies:

- 60 ml HDPE bottles
- 50 ml glass volumetric pipets
- 250 ml glass corning Petri dish covers
- pipet bulb
- Labels for sample bottles
- Data sheets
- Sharpies and pencils
- MilliQ or DI water in a squirt bottle
- MilliPore water in a clean 1 liter container, acidified with H_2S0_4
- 5-10% HCL (for cleaning glassware)
- Methanol
- Lint-free cloth wipes
- Plastic storage boxes

All glassware and sample bottles will be cleaning prior to sample collection by soaking in 5-10% HCl for a minimum of 24 hours, triple rinsed with DI water, and allowed to air dry. Once dried, all glassware will be stored in cleaned, covered containers.

Surfaces of the water surface sampler will be wiped clean with methanol soaked wipes before each sampling event.

Field Collection Procedures

The water surface sampler will be set up according to the manufacturer's instructions, including leveling of the surface prior to the start of sampling.

A clean Petri dish cover will be inserted into the sampling well in the WSS to collect the sample. The dish will be filled with acidified sample water (approximately 250 ml) using a clean 50 ml volumetric pipet. To collect the field blank, 50 ml of sample water will then be removed from the Petri dish and placed into a clean, labeled 60 ml HDPE container. An additional 50 ml of sample water will be added back to the Petri dish and sampling will start. The start date and time will be recorded in the field data sheet.

At the end of the sampling period, two water samples will be collected from the Petri dish. For the first sample, a 50 ml sample of the water remaining in the Petri dish will be collected using a 50 ml volumetric pipet and transferred to a clean, labeled, 60 ml HDPE container. Using a second clean volumetric pipet, 50 ml of blank acidified sample water (from the same bottle used to fill the Petri dish at the start of sampling) will be added back to the Petri dish, and a second 50 ml sample of the water in the Petri dish will be collected using a 50 ml volumetric pipet and transferred to a clean, labeled, 60 ml HDPE container.

Samples from co-located water surface samplers will be collected at a rate of 5-10% of samples to estimate the precision of the measurement equipment used in this study.

Preservation of WSS Samples

Prior to the start of sampling, sample water for the WSS will be preserved by adding 0.8 ml of concentrated sulfuric acid to 1 L of Milli-pore water. This acidified water will be used for the sample water and for the blank. After samples have been collected, if required by the laboratory, samples will be neutralized by adding an equivalent amount of sodium hydroxide to the samples. To neutralize the samples, pipet 100 ul of 2.5 N sodium hydroxide into the 20 ml scintillation vial. This will result in neutralizing ~17 mls of sample, which leaves some headroom for expansion upon freezing.

All samples will then be stored in a cooler with ice for transport back to the lab, where they will be immediately frozen and stored in the dark.

Automated Rainwater Collector (wet atmospheric deposition)

Pre-Sampling Preparation

All equipment including buckets, glassware, and sampling containers will be soaked in 5-10% HCl for a minimum of 24 hours, then triple rinsed with DI water and allowed to air dry.

Field Collection Procedures

The automated rainwater collector will be wet up according to the manufacturer's instructions. Prior to the start of sampling, the clean sample bucket will be filled with Millipore water and a 50 ml sample will be collected and transferred to a clean, labeled, HDPE container for the field blank. The bucket will be emptied of the water, and placed on the "wet" side of the rainwater collector, and covered with the automated cover. The cover on the rainwater collector is programmed to open at the start of any measurable precipitation, and to close again when rainfall stops.

At the end of the sampling period, the cover will be removed from the bucket. The volume of water in the bucket will be recorded, and a 50 ml sample of rainwater in the bucket will be collected using a clean, glass volulmetric pipet and placed in a clean, labeled HDPE bottle. The total rainfall volume (as determined from the meteorological station) during the sampling period will be recorded on the field data sheet. All samples will be stored in a cooler with ice for transport to the lab, and then frozen in the dark prior to analysis.

Appendix 5 Sample Field data sheets and Chain of Custody for wet and dry weather atmospheric deposition samples.

ATMOSPHERIC NUTRIENT DEPOSTION FOR BIGHT 08

Water Surface Sampler Field Data Sheet

Personnel: ____________________

Site: _________________________ Site Location (Lat/Long):_____________________

Sampler ID____________________ Sampler Height: ___________________________

Start Date: ____________________ Stop Date: ________________________________

Start Time: ____________________ Stop Time: ________________________________

First Sample ID__________________ First Sample Volume (ml)____________________

Second Sample ID________________ Second Sample Volume (ml)_________________

(e.g. after addition of 50 ml blank water)

Blank Sample ID: ______________ Sample Water Preservation?___________________

Samples neutralized with NaOH?______________

Comments:____

____

____

Automated Rainwater Collector Field Data Sheet

Personnel: ____________________________________

Site ID: ___________________Site Location (Lat/Long):______________________________

Sample Pick Up Date/Time: ____

Storm Date/Time: ____

Sampler ID:_____________________

Sample ID: ____________________ Blank ID: __________________________________

Sample Volume: ________________ Rain Gauge Rainfall Volume__________________

Comments:____

____

Appendix 6 Sample Collection Protocols for the ship based discrete samples

Filter Samples: Chlorophyll, domoic acid, particulate nitrogen and phosphorus

If the volumes filtered need to be adjusted because of the large amount of biomass in the water, the actual filtered volumes need to be recorded on the sample label with sharpie AND on the field cruise sheet.

Preparation of Chlorophyll a sample collection:

- Using clean filter forceps, center a glass-fiber filter (Whatman GF/F) onto the mesh platform of a clean filtering tower apparatus. Avoid touching the filters with hands or anything other than clean forceps.
- Mix sample gently but thoroughly to ensure the sample is fully mixed (to get any particulates off the bottom of the bottle). Do not vigorously shake the bottle (that will break cells apart).
- Rinse the graduated cylinder with a small amount of sample water (enough to cover the surface of the cylinder). Then discard the rinse water.
- Carefully measure 100 mLs of the sample into the graduated cylinder.
- Pour the measured sample into the filter reservoir.
- Collect 2 chlorophyll filter samples.
- Gently vacuum filter the sample.
- Remove vacuum as soon as water has passed through filter to avoid damaging or breaking up the cells and particulate material.
- Fold filters onto themselves using forceps and place each in a separate glass test tube labeled with the number.
- Record chlorophyll numbers on the field data sheets and the total amount of water filtered onto each filter sample.
- Place samples in the cooler with lots of ice and cover the rack of samples with foil.
- If it is not possible to filter all of the 100 mLs of the sample, remove the water, discard the filter and try again with a smaller volume (50-75 mLs). Record the actual volume that was filtered

Preparation of Domoic Acid sample collection:

- Using clean filter forceps, center a glass-fiber filter (Whatman GF/F) onto the mesh platform of a clean filtering tower apparatus. Avoid touching the filters with hands or anything other than clean forceps. You will need to separate filters to collect 2 separate chlorophyll samples.
- Mix sample gently but thoroughly to ensure the sample is fully mixed (to get any particulates off the bottom of the bottle). Do not vigorously shake the bottle (that will break cells apart).
- Use the same graduated cylinder as for the chlorophyll sample (and therefore, it is not necessary to rinse it again).
- Carefully measure 200 mLs of the sample into the graduated cylinder.
- Pour the measured sample into the filter reservoir.
- Collect 2 domoic acid filter samples (each with 200 mLs filtered).
- Gently vacuum filter the sample.
- Remove vacuum as soon as water has passed through filter to avoid damaging or breaking up the cells and particulate material.
- Fold filters onto themselves using forceps and place each in a separate cryovial tube labeled with the station number, depth, date and DA.
- Record all of the information on the field data sheets
- Place samples in the cooler with lots of ice and cover the rack of samples with foil.
- If it is not possible to filter all of the 200 mLs of the sample, remove the water, discard the filter and try again with a smaller volume (150 mLs). Record the actual volume that was filtered.

Particulate nitrogen sample collection (2 samples per station depth):

- Using clean filter forceps, center a pre-weighted **COMBUSTED** glass-fiber filter (Whatman GF/F) onto the mesh platform of a clean filtering tower apparatus. Avoid touching the filters with hands or anything other than clean forceps. Make sure to keep track of the petri dishes as the filter will need to be placed back into the exact same petri dish for storage and analysis. Two separate filter samples will be collected.
- Mix sample gently but thoroughly to ensure the sample is fully mixed (to get any particulates off the bottom of the bottle). Do not vigorously shake the bottle (that will break cells apart).
- Rinse the graduated cylinder with a small amount of sample water (enough to cover the surface of the cylinder). Then discard the rinse water.
- Carefully measure 200 mLs of the sample into the graduated cylinder.
- Pour the measured sample into the filter reservoir.
- Collect 2 particulate filter samples (each with 200 mLs filtered).
- Gently vacuum filter the sample.
- Remove vacuum as soon as water has passed through filter to avoid damaging or breaking up the cells and particulate material.
- Fold filters onto themselves using forceps and place each filter back into *the same* labeled petri dish it came out of. Label with the station number, date, depth and PN.
- Record all information on field data sheets
- Place samples in the cooler with lots of ice. Samples should be stored frozen (-20^{o}C)
- If it is not possible to filter all of the 200 mLs of the sample, remove the water, discard the filter and try again with a smaller volume (150 mLs).

Particulate Nitrogen Field Blanks

Collect 3 field blanks PER CRUISE. Follow the same procedures as above but Instead of sample water, use DI or MQ water and filter.

Particulate phosphorus sample collection (2 samples per station depth):

- Using clean filter forceps, center a pre-weighted **COMBUSTED** glass-fiber filter (Whatman GF/F) onto the mesh platform of a clean filtering tower apparatus. Avoid touching the filters with hands or anything other than clean forceps. Make sure to keep track of the petri dishes as the filter will need to be placed back into the exact same petri dish for storage and analysis. Two separate filter samples will be collected.
- Mix sample gently but thoroughly to ensure the sample is fully mixed (to get any particulates off the bottom of the bottle). Do not vigorously shake the bottle (that will break cells apart).
- Rinse the graduated cylinder with a small amount of sample water (enough to cover the surface of the cylinder). Then discard the rinse water.
- Carefully measure 200 mLs of the sample into the graduated cylinder.
- Pour the measured sample into the filter reservoir.
- Collect 2 particulate filter samples (each with 200 mLs filtered).
- Gently vacuum filter the sample.
- Remove vacuum as soon as water has passed through filter to avoid damaging or breaking up the cells and particulate material.
- Fold filters onto themselves using forceps and place each filter back into *the same* labeled petri dish it came out of. Label with the station number, date, depth and PP.
- Record all information on field data sheets
- Place samples in the cooler with lots of ice. Samples should be stored frozen (-20^{o}C)
- If it is not possible to filter all of the 200 mLs of the sample, remove the water, discard the filter and try again with a smaller volume (150 mLs).

Particulate Phosphorus Field Blanks

Collect 3 field blanks PER CRUISE. Follow the same procedures as above but Instead of sample water, use DI or MQ water and filter.

Whole water samples:

Preserved whole water sample for cell counts (*Pseudo-nitzschia* counts; 1 sample collected per sample depth):

- Use the same graduated cylinder as for the chlorophyll sample (and therefore, it is not necessary to rinse it again).
- Carefully measure 95 mLs of the sample into the graduated cylinder.
- Pour the measured sample into the glass French square jar that is pre-filled with formalin (5 mLs of 37% formaldehyde).
- Label glass jar with station name, date, depth and WW.
- Record all information on the field data sheet.

Filtering Samples for Nutrient Analysis:

Start by collecting field blanks (3 **per cruise** at any station)

- Wear gloves
- Open Fisher Brand MCE 0.45 µm filter
- Pull plunger out of a clean 60 mL syringe
- Affix MCE filter on the end of the syringe
- Fill the syringe with a few milliliters of distilled deionized water (DDI) and rinse the syringe and the rubber stopper of the plunger. Rinse a total of three times.
- Fill the syringe with DDI water
- Put the plunger back in the syringe, take off the filter to push out the air trapped in the syringe.
- Push ~10 mL through the filter and discard the rinse water
- Open the Dissolved Inorganic Nutrients (DIN) field blank bottle
- Rinse three times with blank water, discarding rinse water each time
- Fill dissolved nutrients FB bottle no more than 2/3 full with blank water.
- Refill the syringe with DDI water as necessary
- Open the Urea sample bottle (orange cap 50mls centrifuge tube)
- Rinse the urea bottle 3 times with unfiltered DDI blank water, discarding the rinse each time
- Fill urea bottle with 40 mls of DI or MQ water pushed through the syringe filter.
- Store all the field blanks on ice in the dark.
- Note on the Data Sheet that the blanks were collected.
- Take the syringe filter off the syringe and discard.
- Open the TN/TP (Total Nitrogen/Total Phosphorus) sample bottle
- Rinse the TN/TP bottle 3 times with **unfiltered** DDI blank water, discarding the rinse each time
- Fill TN/TP bottle no more than 2/3 full with blank **unfiltered** water.

Collect Nutrient Samples (DIN, Urea, Ammonium, TN/TP) (1 sample per station depth):

- Wear gloves
- Open Fisher Brand MCE 0.45 µm filter
- Pull plunger out of a clean 60 mL syringe
- Affix MCE filter on the end of the syringe
- Fill the syringe with a few milliliters sample water and rinse the syringe and the rubber stopper of the plunger. Rinse a total of three times.
- Fill the syringe with sample water
- Put the plunger back in the syringe, take off the filter to push out the air trapped in the syringe.
- Push ~10 mL through the filter and discard the rinse water
- Open the Dissolved Inorganic Nutrients (DIN) bottle
- Rinse three times with sample water, discarding rinse water each time
- Fill dissolved nutrients FB bottle no more than 2/3 full with filtered sample water.
- Open the Urea sample bottle (orange cap 50mls centrifuge tube)
- Rinse the urea bottle 3 times with sample water, discarding the rinse each time
- Fill urea bottle with 40 mls of filtered sample water
- Store all the samples on ice in the dark.
- Note on the Data Sheet that the samples were collected.
- Take the syringe filter off the syringe and discard.
- Open the TN/TP (Total Nitrogen/Total Phosphorus) sample bottle
- Rinse the TN/TP bottle 3 times with **unfiltered whole** sample water, discarding the rinse each time
- Fill TN/TP bottle no more than 2/3 full with blank **unfiltered whole** sample water.
- Store samples on ice.

Sample Delivery

Samples from each cruise will be delivered or shipped to the following organizations:

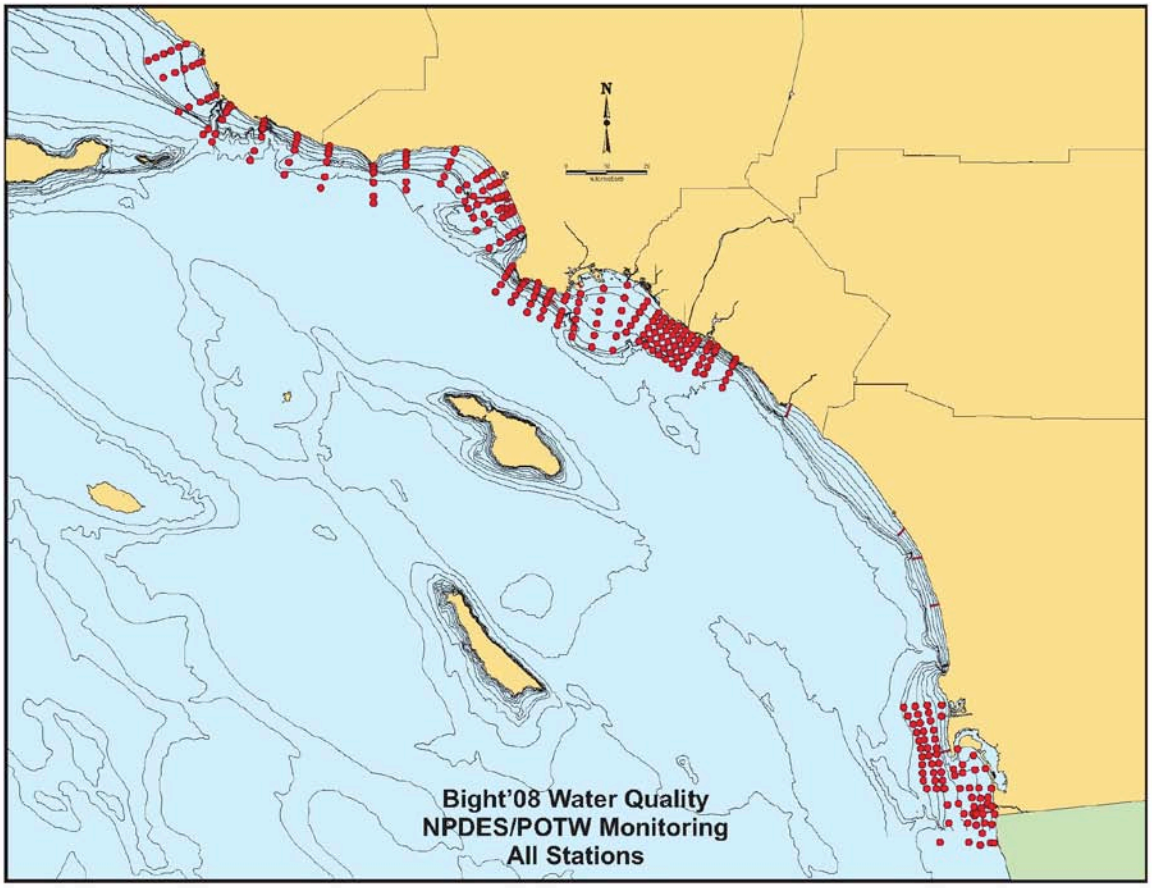
Ship	Chlorophyll	Domoic acid filter	Particulate Nitrogen filter	Particulate Phosphorus filter	Cell counts (whole water)	CTD analysis	DIN	TN/TP Bottle	Urea Bottles
Contract	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP
Oxnard	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP
Hyperion	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP
LACSD	SCCWRP	LACSD	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP
OCSD	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP
Contract (Weston Solutions)	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP
San Diego	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP	SCCWRP

Sample Analysis

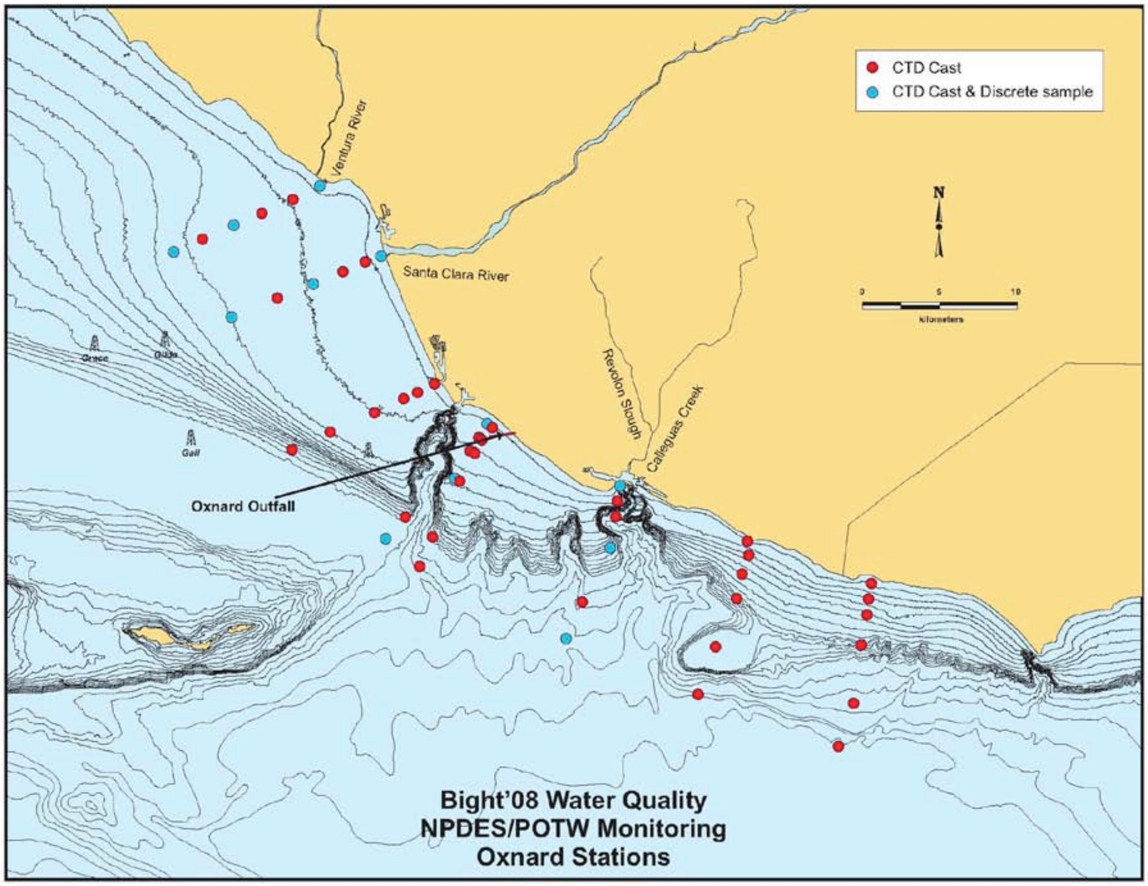
Samples from each cruise will be analyzed by the following organizations:

Ship	Chlorophyll	Domoic acid filter	Particulate Nitrogen filter	Particulate Phosphorus filter	Cell counts	DIN	Urea	TN/TP
Contract Santa Barbara (ABC Labs)	SCCWRP	Caron Lab	MSI Analytical Labs	Univ. South Carolina	SCCWRP	MSI Analytical Labs	SCCWRP	Univ. of Georgia
Oxnard (ABC Labs)	SCCWRP	Caron Lab	MSI Analytical Labs	Univ. South Carolina	SCCWRP	MSI Analytical Labs	SCCWRP	Univ. of Georgia
Hyperion	SCCWRP	Caron Lab	MSI Analytical Labs	Univ. South Carolina	SCCWRP	MSI Analytical Labs	SCCWRP	Univ. of Georgia
LACSD	SCCWRP	LACSD	MSI Analytical Labs	Univ. South Carolina	SCCWRP	MSI Analytical Labs	SCCWRP	Univ. of Georgia
OCSD	SCCWRP	Caron Lab	MSI Analytical Labs	Univ. South Carolina	SCCWRP	MSI Analytical Labs	SCCWRP	Univ. of Georgia
Contract (Weston Solutions)	SCCWRP	Caron Lab	MSI Analytical Labs	Univ. South Carolina	SCCWRP	MSI Analytical Labs	SCCWRP	Univ. of Georgia
San Diego	SCCWRP	Caron Lab	MSI Analytical Labs	Univ. South Carolina	SCCWRP	MSI Analytical Labs	SCCWRP	Univ. of Georgia

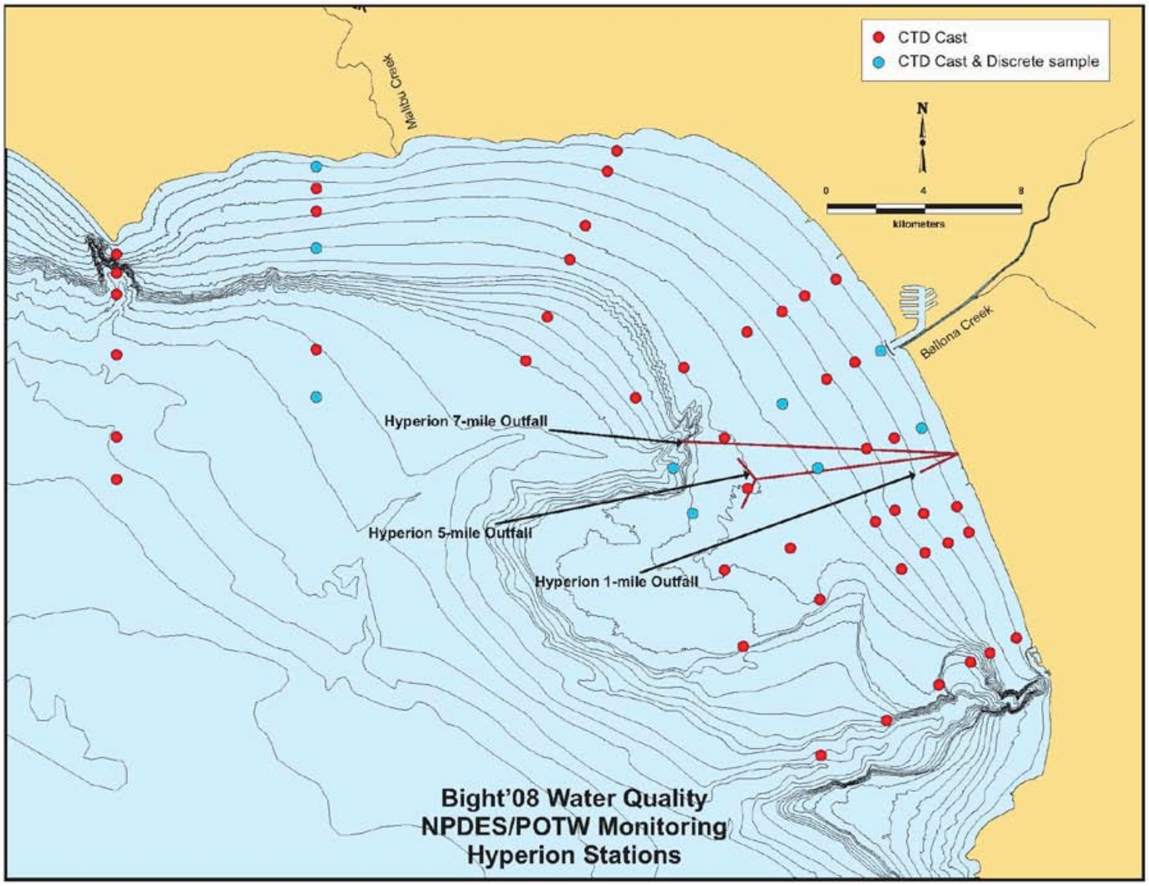
Appendix 7 Bight'08 offshore sampling locations conducted by the Central Bight Water Quality (CBWQ) and San Diego as part of their NPDES permit monitoring program.



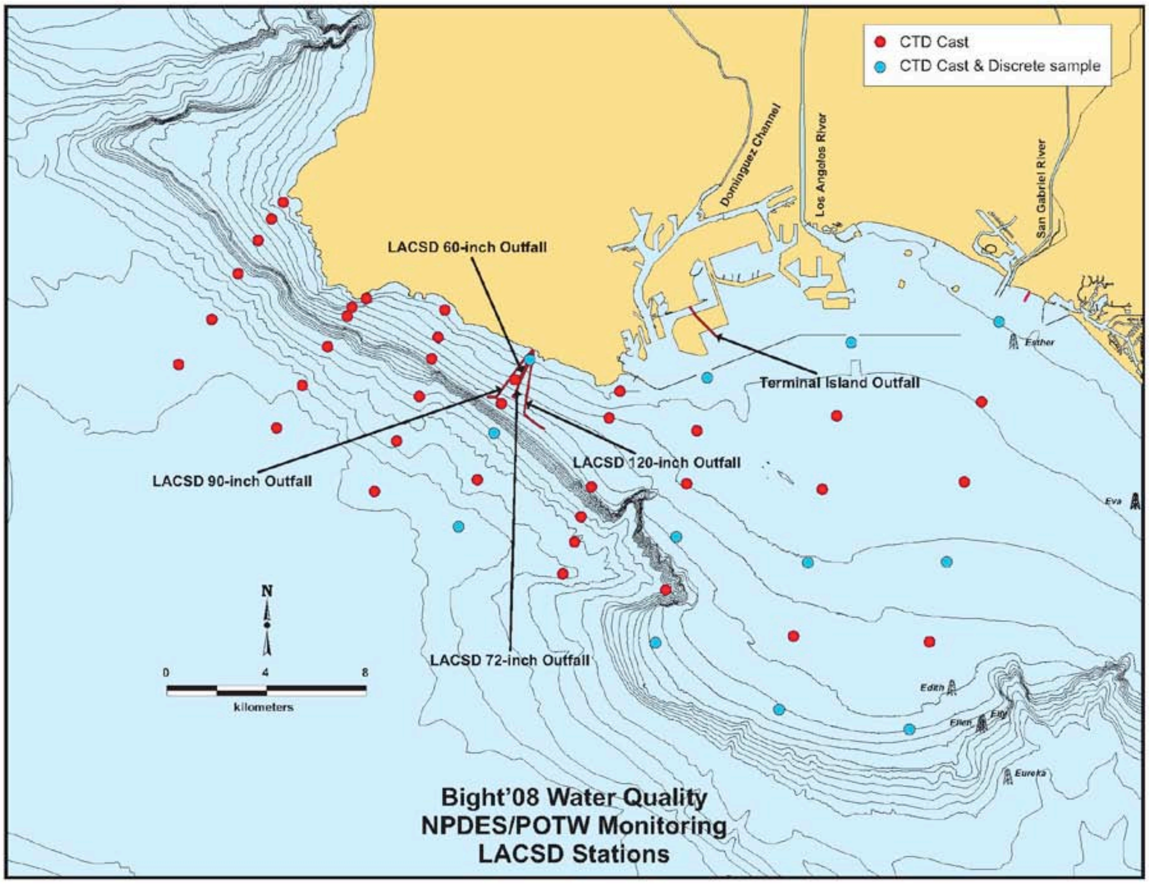
Appendix 8 Bight'08 offshore sampling locations conducted by City of Oxnard as part of their NPDES permit monitoring program.



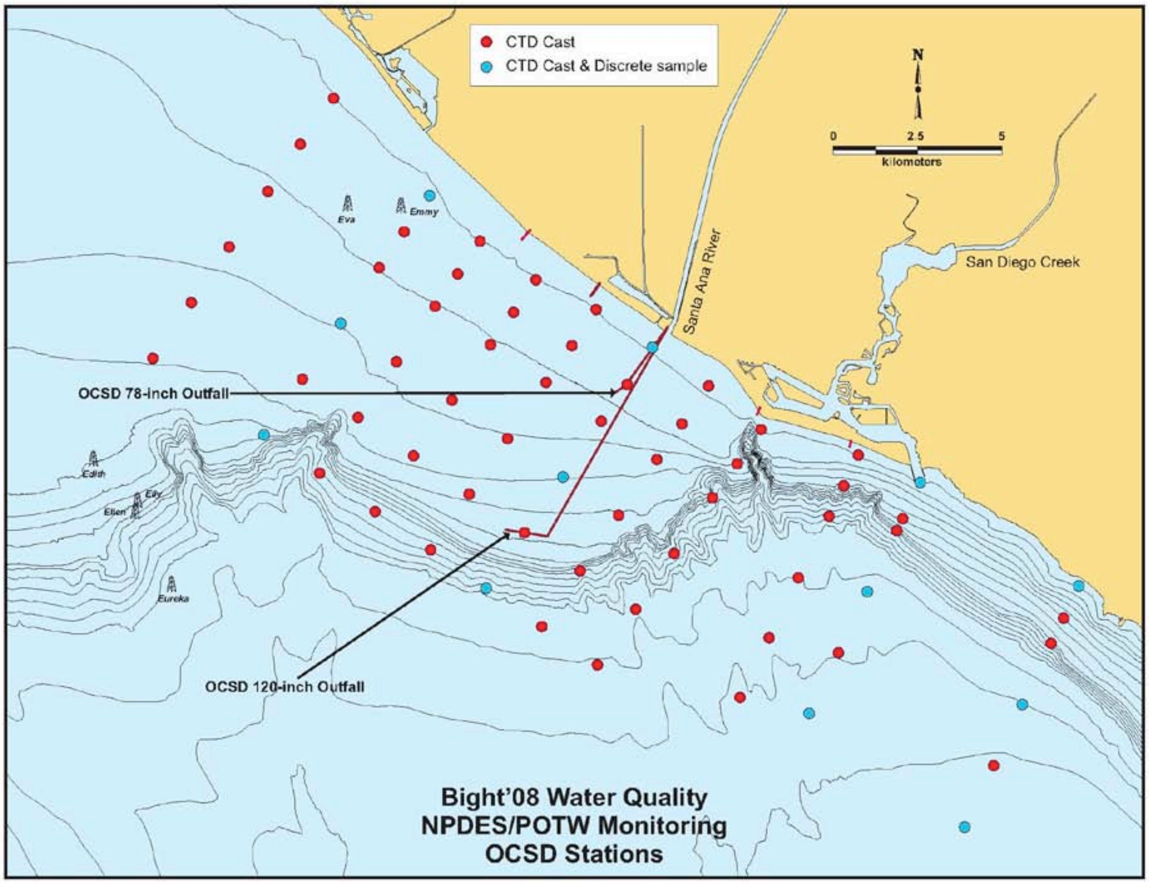
Appendix 9 Bight'08 offshore sampling locations conducted by City of Los Angeles as part of their NPDES permit monitoring program.



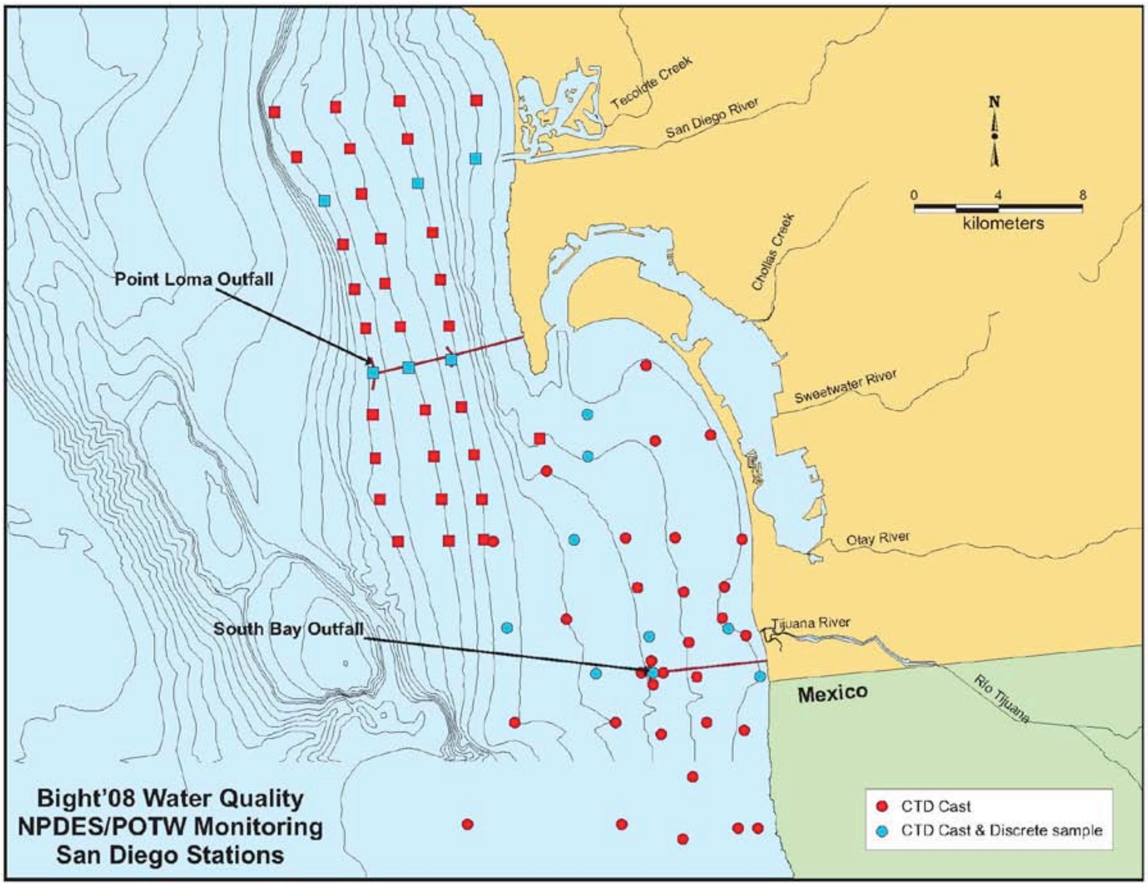
Appendix 10 Bight'08 offshore sampling locations conducted by Los Angeles County Sanitation District as part of their NPDES permit monitoring program.



Appendix 11 Bight'08 offshore sampling locations conducted by Orange County Sanitation District as part of their NPDES permit monitoring program.



Appendix 12 Bight'08 offshore sampling locations conducted by City of San Diego as part of their NPDES permit monitoring program.



Appendix 13 List of station locations for the NPDES permit surveys.

Bight'08 Water Quality POTW/NPDES (Winter/Spring) Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Samples ***	**Location**	**Responsible Agency**
Central	4701	34.27123	-119.31041	10	*	Ventura River	City of Oxnard (ABC Labs)
Central	4702	34.26350	-119.32909	20		Ventura River	City of Oxnard (ABC Labs)
Central	4703	34.25557	-119.35091	20		Ventura River	City of Oxnard (ABC Labs)
Central	4704	34.24853	-119.37058	20	*	Ventura River	City of Oxnard (ABC Labs)
Central	4705	34.24054	-119.39239	30		Ventura River	City of Oxnard (ABC Labs)
Central	4706	34.23303	-119.41258	30	*	Ventura River	City of Oxnard (ABC Labs)
Central	4601	34.23065	-119.26730	10	*	Santa Clara River	City of Oxnard (ABC Labs)
Central	4602	34.22732	-119.27850	20		Santa Clara River	City of Oxnard (ABC Labs)
Central	4603	34.22166	-119.29413	30		Santa Clara River	City of Oxnard (ABC Labs)
Central	4604	34.21452	-119.31484	30	*	Santa Clara River	City of Oxnard (ABC Labs)
Central	4605	34.20637	-119.33997	30		Santa Clara River	City of Oxnard (ABC Labs)
Central	4606	34.19531	-119.37207	35	*	Santa Clara River	City of Oxnard (ABC Labs)
Central	4501	34.15659	-119.22992	10			City of Oxnard (ABC Labs)
Central	4502	34.15167	-119.24178	20			City of Oxnard (ABC Labs)
Central	4503	34.14807	-119.25161	20			City of Oxnard (ABC Labs)
Central	4504	34.13992	-119.27199	20			City of Oxnard (ABC Labs)
Central	4505	34.12876	-119.30299	30			City of Oxnard (ABC Labs)
Central	4506	34.11839	-119.32968	60			City of Oxnard (ABC Labs)
Central	4401	34.13350	-119.19300	15	*	Port Hueneme/Oxnard Outfall	City of Oxnard (ABC Labs)
Central	4402	34.12550	-119.19900	20		Port Hueneme/Oxnard Outfall	City of Oxnard (ABC Labs)
Central	4403	34.11770	-119.20500	25		Port Hueneme/Oxnard Outfall	City of Oxnard (ABC Labs)

Bight'08 Water Quality POTW/NPDES (Winter/Spring) Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Samples ***	**Location**	**Responsible Agency**
Central	4404	34.10180	-119.21600	40	*	Port Hueneme/Oxnard Outfall	City of Oxnard (ABC Labs)
Central	4405	34.07941	-119.25044	100		Port Hueneme/Oxnard Outfall	City of Oxnard (ABC Labs)
Central	4406	34.06687	-119.26411	100	*	Port Hueneme/Oxnard Outfall	City of Oxnard (ABC Labs)
Central	4391	34.13118	-119.18943	10			City of Oxnard (ABC Labs)
Central	4392	34.12417	-119.19680	15			City of Oxnard (ABC Labs)
Central	4393	34.11637	-119.20182	25			City of Oxnard (ABC Labs)
Central	4394	34.10033	-119.21225	35			City of Oxnard (ABC Labs)
Central	4395	34.06795	-119.23137	100			City of Oxnard (ABC Labs)
Central	4396	34.05077	-119.24043	100			City of Oxnard (ABC Labs)
Central	4301	34.09760	-119.10000	15	*	Mugu Lagoon/Calleguas Creek	City of Oxnard (ABC Labs)
Central	4302	34.08870	-119.10200	20		Mugu Lagoon/Calleguas Creek	City of Oxnard (ABC Labs)
Central	4303	34.07960	-119.10300	65		Mugu Lagoon/Calleguas Creek	City of Oxnard (ABC Labs)
Central	4304	34.06160	-119.10700	100	*	Mugu Lagoon/Calleguas Creek	City of Oxnard (ABC Labs)
Central	4305	34.03021	-119.12659	100		Mugu Lagoon/Calleguas Creek	City of Oxnard (ABC Labs)
Central	4306	34.00905	-119.13779	100	*	Mugu Lagoon/Calleguas Creek	City of Oxnard (ABC Labs)
Central	4201	34.06532	-119.01072	10			City of Oxnard (ABC Labs)
Central	4202	34.05740	-119.00988	30			City of Oxnard (ABC Labs)
Central	4203	34.04640	-119.01457	60			City of Oxnard (ABC Labs)
Central	4204	34.03222	-119.01830	100			City of Oxnard (ABC Labs)
Central	4205	34.00423	-119.03314	100			City of Oxnard (ABC Labs)

Bight'08 Water Quality POTW/NPDES (Winter/Spring) Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Samples ***	**Location**	**Responsible Agency**
Central	4206	33.97667	-119.04532	100			City of Oxnard (ABC Labs)
Central	4101	34.04100	-118.92400	30			City of Oxnard (ABC Labs)
Central	4102	34.03200	-118.92600	60			City of Oxnard (ABC Labs)
Central	4103	34.02280	-118.92700	100			City of Oxnard (ABC Labs)
Central	4001	33.99528	-118.80526	20			City of Los Angeles (Hyperion)
Central	4002	33.98833	-118.80526	100			City of Los Angeles (Hyperion)
Central	4003	33.98055	-118.80526	100			City of Los Angeles (Hyperion)
Central	4004	33.95833	-118.80526	100			City of Los Angeles (Hyperion)
Central	4005	33.92805	-118.80526	100			City of Los Angeles (Hyperion)
Central	4006	33.91250	-118.80526	100			City of Los Angeles (Hyperion)
Central	3901	34.02750	-118.71667	10	*	Malibu Creek	City of Los Angeles (Hyperion)
Central	3902	34.01943	-118.71667	20		Malibu Creek	City of Los Angeles (Hyperion)
Central	3903	34.01110	-118.71667	30		Malibu Creek	City of Los Angeles (Hyperion)
Central	3904	33.99750	-118.71667	60	*	Malibu Creek	City of Los Angeles (Hyperion)
Central	3905	33.96027	-118.71667	100		Malibu Creek	City of Los Angeles (Hyperion)
Central	3906	33.94277	-118.71667	100	*	Malibu Creek	City of Los Angeles (Hyperion)
Central	3801	34.03333	-118.58333	10			City of Los Angeles (Hyperion)
Central	3802	34.02583	-118.58750	20			City of Los Angeles (Hyperion)
Central	3803	34.00583	-118.59722	45			City of Los Angeles (Hyperion)
Central	3804	33.99333	-118.60417	60			City of Los Angeles (Hyperion)
Central	3805	33.97222	-118.61417	100			City of Los Angeles (Hyperion)
Central	3806	33.95610	-118.62360	100			City of Los Angeles (Hyperion)
Central	3701	33.98610	-118.48610	10			City of Los Angeles (Hyperion)
Central	3702	33.98000	-118.50000	20			City of Los Angeles (Hyperion)
Central	3703	33.97417	-118.51000	30			City of Los Angeles

Bight'08 Water Quality POTW/NPDES (Winter/Spring) Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Samples ***	**Location**	**Responsible Agency**
							(Hyperion)
Central	3704	33.96667	-118.52555	45			City of Los Angeles (Hyperion)
Central	3705	33.95360	-118.55360	60			City of Los Angeles (Hyperion)
Central	3706	33.94250	-118.57500	100			City of Los Angeles (Hyperion)
Central	3601	33.95973	-118.46625	10	*	Ballona Creek	City of Los Angeles (Hyperion)
Central	3602	33.95555	-118.47777	20		Ballona Creek	City of Los Angeles (Hyperion)
Central	3603	33.94943	-118.49027	30		Ballona Creek	City of Los Angeles (Hyperion)
Central	3604	33.94027	-118.50977	45	*	Ballona Creek	City of Los Angeles (Hyperion)
Central	3605	33.92777	-118.53555	60		Ballona Creek	City of Los Angeles (Hyperion)
Central	3606	33.91667	-118.55833	100	*	Ballona Creek	City of Los Angeles (Hyperion)
Central	3501	33.93138	-118.44805	10	*	Hyperion Outfall	City of Los Angeles (Hyperion)
Central	3502	33.92777	-118.46027	20		Hyperion Outfall	City of Los Angeles (Hyperion)
Central	3503	33.92388	-118.47250	30		Hyperion Outfall	City of Los Angeles (Hyperion)
Central	3504	33.91667	-118.49417	45	*	Hyperion Outfall	City of Los Angeles (Hyperion)
Central	3505	33.90917	-118.52527	60		Hyperion Outfall	City of Los Angeles (Hyperion)
Central	3506	33.90000	-118.54972	80	*	Hyperion Outfall	City of Los Angeles (Hyperion)
Central	3401	33.90250	-118.43250	10			City of Los Angeles (Hyperion)
Central	3402	33.90000	-118.44722	20			City of Los Angeles (Hyperion)
Central	3403	33.90110	-118.46000	30			City of Los Angeles (Hyperion)
Central	3404	33.89693	-118.46860	45			City of Los Angeles (Hyperion)
Central	3405	33.88722	-118.50638	55			City of Los Angeles (Hyperion)
Central	3406	33.87917	-118.53555	60			City of Los Angeles (Hyperion)
Central	3301	33.89305	-118.42722	10			City of Los Angeles (Hyperion)
Central	3302	33.88917	-118.43638	20			City of Los Angeles (Hyperion)
Central	3303	33.88555	-118.44666	30			City of Los Angeles (Hyperion)

Bight'08 Water Quality POTW/NPDES (Winter/Spring) Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Samples ***	**Location**	**Responsible Agency**
Central	3304	33.87945	-118.45695	45			City of Los Angeles (Hyperion)
Central	3305	33.86833	-118.49333	60			City of Los Angeles (Hyperion)
Central	3306	33.85112	-118.52722	80			City of Los Angeles (Hyperion)
Central	3201	33.85416	-118.40612	10			City of Los Angeles (Hyperion)
Central	3202	33.84861	-118.41778	30			City of Los Angeles (Hyperion)
Central	3203	33.84528	-118.42638	100			City of Los Angeles (Hyperion)
Central	3204	33.83695	-118.44055	100			City of Los Angeles (Hyperion)
Central	3205	33.82388	-118.46362	100			City of Los Angeles (Hyperion)
Central	3206	33.81110	-118.49278	100			City of Los Angeles (Hyperion)
Central	3101	33.77100	-118.43017	10			LACSD
Central	3102	33.76498	-118.43538	30			LACSD
Central	3103	33.75730	-118.44105	60			LACSD
Central	3104	33.74527	-118.44977	300			LACSD
Central	3105	33.72877	-118.46123	770			LACSD
Central	3106	33.71254	-118.47551	790			LACSD
Central	3051	33.73632	-118.39430	13			LACSD
Central	3052	33.73315	-118.40043	30			LACSD
Central	3053	33.72995	-118.40247	60			LACSD
Central	3054	33.71893	-118.41098	300			LACSD
Central	3055	33.70497	-118.42198	800			LACSD
Central	3056	33.68966	-118.43313	830			LACSD
Central	3001	33.73217	-118.36030	10			LACSD
Central	3002	33.72238	-118.36315	30			LACSD
Central	3003	33.71462	-118.36592	60			LACSD
Central	3004	33.70098	-118.37132	300			LACSD
Central	3005	33.68492	-118.38107	590			LACSD
Central	3006	33.66679	-118.39075	800			LACSD
Central	2901	33.71430	-118.32345	10	*	LACSD Outfall	LACSD
Central	2902	33.70693	-118.32983	30		LACSD Outfall	LACSD
Central	2903	33.69847	-118.33568	60		LACSD Outfall	LACSD
Central	2904	33.68783	-118.33900	300	*	LACSD Outfall	LACSD
Central	2905	33.67094	-118.34618	555		LACSD Outfall	LACSD
Central	2906	33.65409	-118.35430	775	*	LACSD Outfall	LACSD
Central	2801	33.70288	-118.28438	10			LACSD

Bight'08 Water Quality POTW/NPDES (Winter/Spring) Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Samples ***	**Location**	**Responsible Agency**
Central	2802	33.69327	-118.28908	30			LACSD
Central	2803	33.66845	-118.29680	60			LACSD
Central	2804	33.65767	-118.30128	300			LACSD
Central	2805	33.64854	-118.30404	540			LACSD
Central	2806	33.63708	-118.30919	630			LACSD
Central	2701	33.70775	-118.24666	26	*	Los Angeles Harbor/Dominguez Channel	LACSD
Central	2702	33.68864	-118.25112	26		Los Angeles Harbor/Dominguez Channel	LACSD
Central	2703	33.66953	-118.25559	28		Los Angeles Harbor/Dominguez Channel	LACSD
Central	2704	33.65042	-118.26005	50	*	Los Angeles Harbor/Dominguez Channel	LACSD
Central	2705	33.63131	-118.26452	220		Los Angeles Harbor/Dominguez Channel	LACSD
Central	2706	33.61220	-118.26898	80	*	Los Angeles Harbor/Dominguez Channel	LACSD
Central	2601	33.72043	-118.18426	19	*	Long Beach Harbor/Los Angeles River	LACSD
Central	2602	33.69398	-118.19050	23		Long Beach Harbor/Los Angeles River	LACSD
Central	2603	33.66752	-118.19674	23		Long Beach Harbor/Los Angeles River	LACSD
Central	2604	33.64107	-118.20299	32	*	Long Beach Harbor/Los Angeles River	LACSD
Central	2605	33.61461	-118.20923	47		Long Beach Harbor/Los Angeles River	LACSD
Central	2606	33.58816	-118.21547	62	*	Long Beach Harbor/Los Angeles River	LACSD
Central	2501	33.72787	-118.12025	10	*	San Gabriel River/Alamitos Bay	LACSD
Central	2502	33.69904	-118.12779	20		San Gabriel River/Alamitos Bay	LACSD
Central	2503	33.67021	-118.13533	26		San Gabriel	LACSD

Bight'08 Water Quality POTW/NPDES (Winter/Spring) Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Samples ***	**Location**	**Responsible Agency**
						River/Alamitos Bay	
Central	2504	33.64139	-118.14287	33	*	San Gabriel River/Alamitos Bay	LACSD
Central	2505	33.61256	-118.15041	44		San Gabriel River/Alamitos Bay	LACSD
Central	2506	33.58102	-118.15908	60	*	San Gabriel River/Alamitos Bay	LACSD
Central	2451	33.69125	-118.06573	10			OCSD
Central	2452	33.67898	-118.07640	17			OCSD
Central	2453	33.66645	-118.08673	22			OCSD
Central	2454	33.65163	-118.09910	30			OCSD
Central	2455	33.63683	-118.11125	36			OCSD
Central	2456	33.62197	-118.12352	42			OCSD
Central	2401	33.66533	-118.03505	10	*	Bolsa Chica Inlet	OCSD
Central	2402	33.65570	-118.04322	16		Bolsa Chica Inlet	OCSD
Central	2403	33.64608	-118.05120	21		Bolsa Chica Inlet	OCSD
Central	2404	33.63125	-118.06347	29	*	Bolsa Chica Inlet	OCSD
Central	2405	33.61643	-118.07573	37		Bolsa Chica Inlet	OCSD
Central	2406	33.60160	-118.08800	60	*	Bolsa Chica Inlet	OCSD
Central	2349	33.65317	-118.01892	10			OCSD
Central	2350	33.64445	-118.02610	14			OCSD
Central	2351	33.63585	-118.03335	21			OCSD
Central	2352	33.62103	-118.04565	29			OCSD
Central	2353	33.60622	-118.05795	37			OCSD
Central	2354	33.5914	-118.07023	123			OCSD
Central	2301	33.64287	-118.00107	10			OCSD
Central	2302	33.63422	-118.00825	15			OCSD
Central	2303	33.62562	-118.01560	21			OCSD
Central	2304	33.61082	-118.02790	29			OCSD
Central	2305	33.59600	-118.04020	38			OCSD
Central	2306	33.58118	-118.05248	114			OCSD
Central	2221	33.63498	-117.98180	10			OCSD
Central	2222	33.62537	-117.98957	15			OCSD
Central	2223	33.61557	-117.99785	22			OCSD
Central	2224	33.60058	-118.01013	31			OCSD
Central	2225	33.58577	-118.02243	47			OCSD
Central	2226	33.57095	-118.03472	135			OCSD

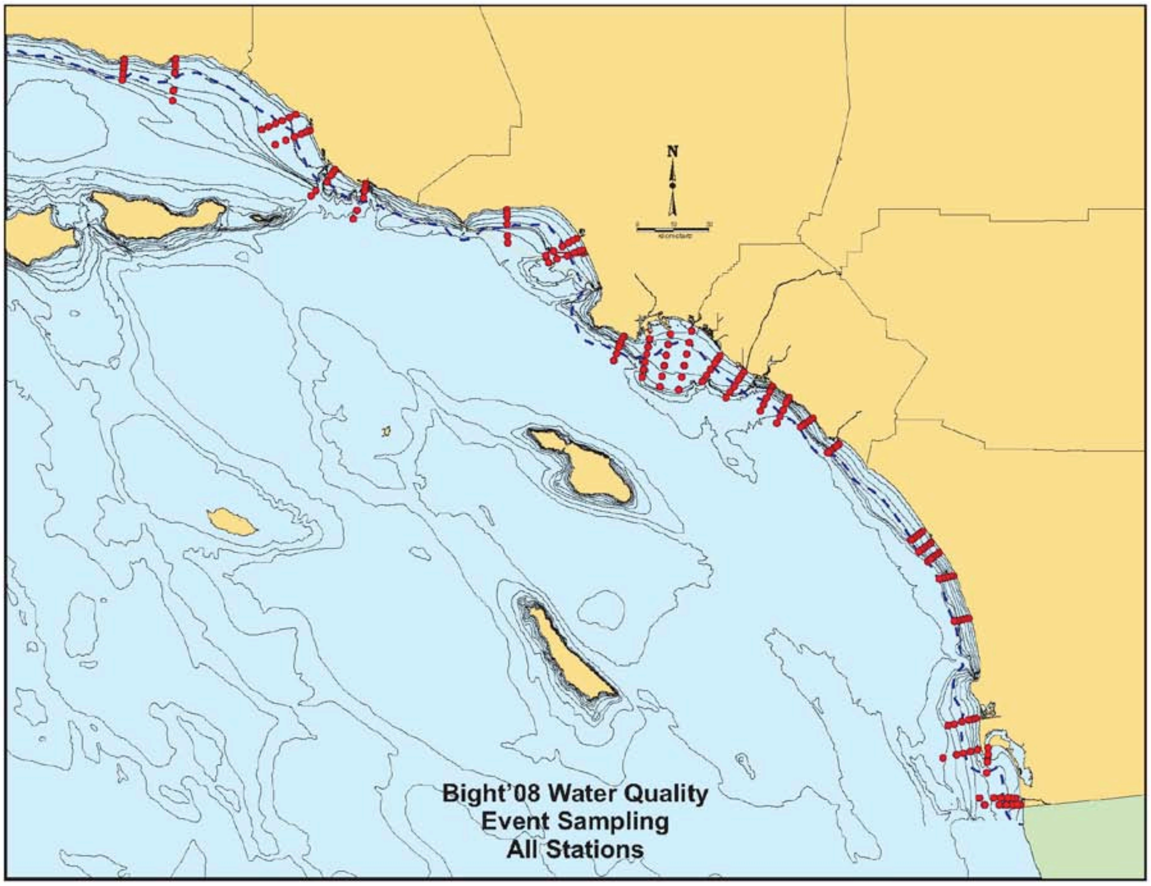
Bight'08 Water Quality POTW/NPDES (Winter/Spring) Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Samples ***	**Location**	**Responsible Agency**
Central	2201	33.62488	-117.96385	10	*	Santa Ana River	OCSD
Central	2202	33.61502	-117.97190	16		Santa Ana River	OCSD
Central	2203	33.60522	-117.98017	25		Santa Ana River	OCSD
Central	2204	33.59038	-117.99243	39	*	Santa Ana River	OCSD
Central	2205	33.57557	-118.00470	57		Santa Ana River	OCSD
Central	2206	33.56073	-118.01697	185	*	Santa Ana River	OCSD
Central	2181	33.61462	-117.94587	10			OCSD
Central	2182	33.60453	-117.95440	15			OCSD
Central	2183	33.59502	-117.96240	36			OCSD
Central	2184	33.58018	-117.97467	51			OCSD
Central	2185	33.56537	-117.98692	114			OCSD
Central	2186	33.55053	-117.99918	247			OCSD
Central	2101	33.60305	-117.92915	10			OCSD
Central	2102	33.59385	-117.93677	26			OCSD
Central	2103	33.58482	-117.94463	110			OCSD
Central	2104	33.56998	-117.95690	143			OCSD
Central	2105	33.55515	-117.96917	280			OCSD
Central	2106	33.54033	-117.98142	309			OCSD
Central	2021	33.59618	-117.89803	10			OCSD
Central	2022	33.58805	-117.90270	53			OCSD
Central	2023	33.57993	-117.90737	165			OCSD
Central	2024	33.56352	-117.91718	300			OCSD
Central	2025	33.54752	-117.92655	390			OCSD
Central	2026	33.53167	-117.93582	432			OCSD
Central	2001	33.58892	-117.87820	10	*	Newport Harbor/San Diego Creek	OCSD
Central	2002	33.57925	-117.88380	60		Newport Harbor/San Diego Creek	OCSD
Central	2003	33.57608	-117.88573	100		Newport Harbor/San Diego Creek	OCSD
Central	2004	33.55982	-117.89513	345	*	Newport Harbor/San Diego Creek	OCSD
Central	2005	33.54355	-117.90438	410		Newport Harbor/San Diego Creek	OCSD
Central	2006	33.52745	-117.91373	470	*	Newport Harbor/San Diego Creek	OCSD
Central	1901	33.56137	-117.82757	10	*	Crystal Cove State	OCSD

Bight'08 Water Quality POTW/NPDES (Winter/Spring) Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Samples ***	**Location**	**Responsible Agency**
						Beach	
Central	1902	33.55275	-117.83240	60		Crystal Cove State Beach	OCSD
Central	1903	33.54603	-117.83637	100		Crystal Cove State Beach	OCSD
Central	1904	33.52978	-117.84557	405	*	Crystal Cove State Beach	OCSD
Central	1905	33.51350	-117.85475	510		Crystal Cove State Beach	OCSD
Central	1906	33.49715	-117.86403	550	*	Crystal Cove State Beach	OCSD
South	F01	32.63768	-117.24032	19			City of San Diego
South	F02	32.75697	-117.27273	19	*	Mission Bay	City of San Diego
South	F03	32.78183	-117.27242	18			City of San Diego
South	F04	32.59453	-117.26875	60			City of San Diego
South	F05	32.61168	-117.26965	60			City of San Diego
South	F06	32.63083	-117.27360	60			City of San Diego
South	F07	32.65113	-117.27999	62			City of San Diego
South	F08	32.67133	-117.28515	63	*	Point Loma Outfall	City of San Diego
South	F09	32.68555	-117.28632	60			City of San Diego
South	F10	32.70542	-117.29066	60			City of San Diego
South	F11	32.72554	-117.29463	60			City of San Diego
South	F12	32.74658	-117.30207	61	*	Mission Bay	City of San Diego
South	F13	32.76538	-117.30720	60			City of San Diego
South	F14	32.78156	-117.31142	59			City of San Diego
South	F15	32.59410	-117.28645	80			City of San Diego
South	F16	32.61183	-117.29007	80			City of San Diego
South	F17	32.63002	-117.29417	80			City of San Diego
South	F18	32.64977	-117.29833	80			City of San Diego
South	F19	32.66785	-117.30683	81	*	Point Loma Outfall	City of San Diego
South	F20	32.68542	-117.31097	80			City of San Diego
South	F21	32.70380	-117.31869	81			City of San Diego
South	F22	32.72273	-117.32090	80			City of San Diego
South	F23	32.74188	-117.33042	81			City of San Diego
South	F24	32.76122	-117.33645	81			City of San Diego
South	F25	32.77895	-117.34358	79			City of San Diego
South	F26	32.59377	-117.31220	98			City of San Diego
South	F27	32.61178	-117.32138	98			City of San Diego
South	F28	32.62929	-117.32372	99			City of San Diego
South	F29	32.64782	-117.32493	98			City of San Diego
South	F30	32.66567	-117.32483	96	*	Point Loma Outfall	City of San Diego

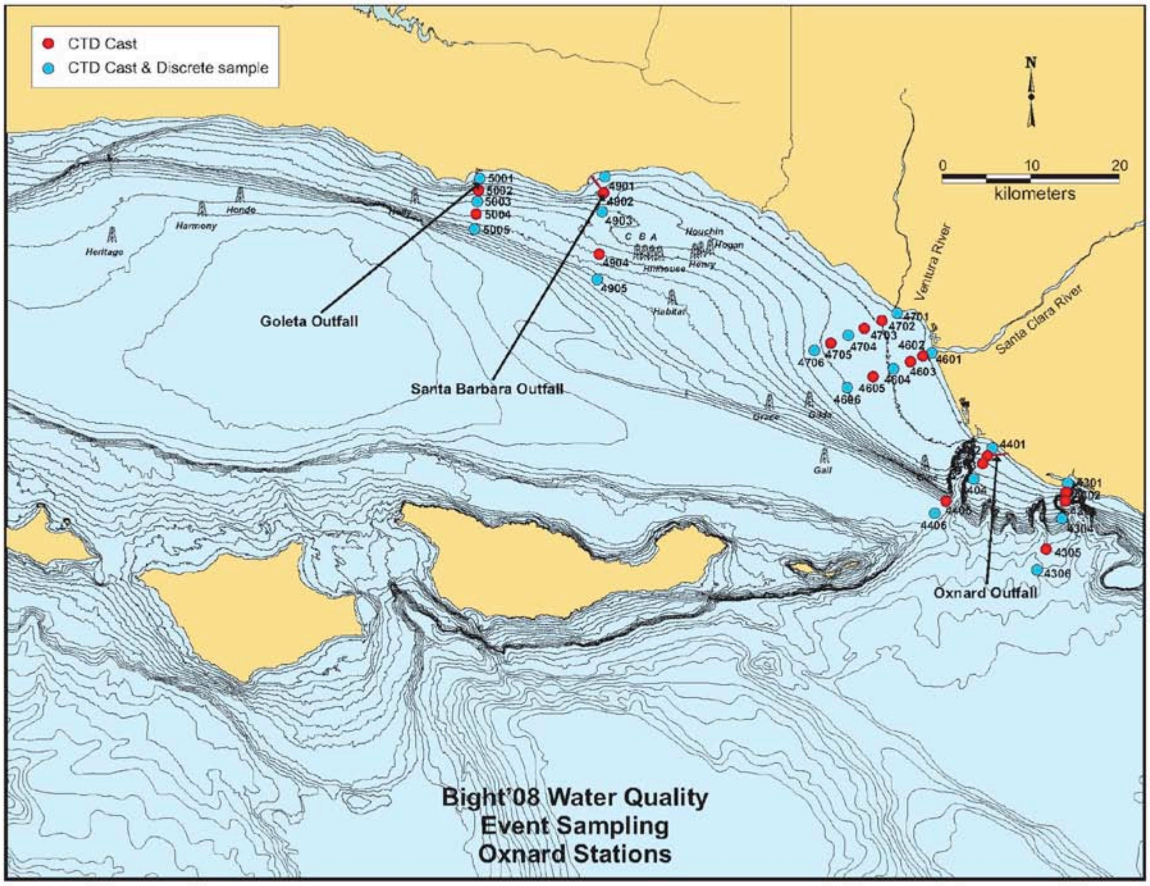
Bight'08 Water Quality POTW/NPDES (Winter/Spring) Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Samples ***	**Location**	**Responsible Agency**
South	F31	32.68467	-117.32835	97			City of San Diego
South	F32	32.70142	-117.33417	99			City of San Diego
South	F33	32.72047	-117.33992	99			City of San Diego
South	F34	32.73890	-117.34937	99	*	Mission Bay	City of San Diego
South	F35	32.75770	-117.36338	99			City of San Diego
South	F36	32.77678	-117.37457	98			City of San Diego
South	I1	32.47333	-117.27700	60			City of San Diego
South	I2	32.47333	-117.19900	32			City of San Diego
South	I3	32.46700	-117.16800	27			City of San Diego
South	I4	32.47167	-117.14000	18			City of San Diego
South	I5	32.47167	-117.13000	14			City of San Diego
South	I6	32.49350	-117.16300	26			City of San Diego
South	I7	32.51667	-117.25300	52			City of San Diego
South	I8	32.51667	-117.20200	36			City of San Diego
South	I9	32.51167	-117.17900	29			City of San Diego
South	I10	32.51667	-117.15600	19			City of San Diego
South	I11	32.51333	-117.13700	13			City of San Diego
South	I12	32.53283	-117.18300	28			City of San Diego
South	I13	32.53750	-117.21200	38	*	Tijuana Outfall	City of San Diego
South	I14	32.54300	-117.18400	28			City of San Diego
South	I15	32.53783	-117.18900	31			City of San Diego
South	I16	32.53783	-117.18300	28	*	Tijuana Outfall	City of San Diego
South	I17	32.53783	-117.17800	25			City of San Diego
South	I18	32.53617	-117.16100	19			City of San Diego
South	I19	32.53633	-117.12900	10	*	Tijuana Outfall	City of San Diego
South	I20	32.55700	-117.25700	55	*	Tijuana River	City of San Diego
South	I21	32.56067	-117.22700	41			City of San Diego
South	I22	32.55333	-117.18500	28	*	Tijuana River	City of San Diego
South	I23	32.55083	-117.16500	21			City of San Diego
South	I24	32.55667	-117.14500	11	*	Tijuana River	City of San Diego
South	I25	32.56117	-117.14800	9			City of San Diego
South	I26	32.57450	-117.14700	9			City of San Diego
South	I27	32.57417	-117.19100	28			City of San Diego
South	I28	32.59383	-117.26400	55			City of San Diego
South	I29	32.59450	-117.22300	38	*	San Diego Bay	City of San Diego
South	I30	32.59533	-117.19700	28			City of San Diego
South	I31	32.59550	-117.17200	19			City of San Diego
South	I32	32.59467	-117.13800	10			City of San Diego
South	I33	32.62383	-117.23700	30			City of San Diego

Bight'08 Water Quality POTW/NPDES (Winter/Spring) Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Samples ∗**	**Location**	**Responsible Agency**
South	I34	32.63000	-117.21600	19	∗	San Diego Bay	City of San Diego
South	I35	32.63667	-117.18200	19			City of San Diego
South	I36	32.63917	-117.15400	11			City of San Diego
South	I37	32.64800	-117.21633	12	∗	San Diego Bay	City of San Diego
South	I38	32.66883	-117.18667	11			City of San Diego
South	I39	32.57233	-117.16750	18			City of San Diego
South	I40	32.55383	-117.13617	10			City of San Diego

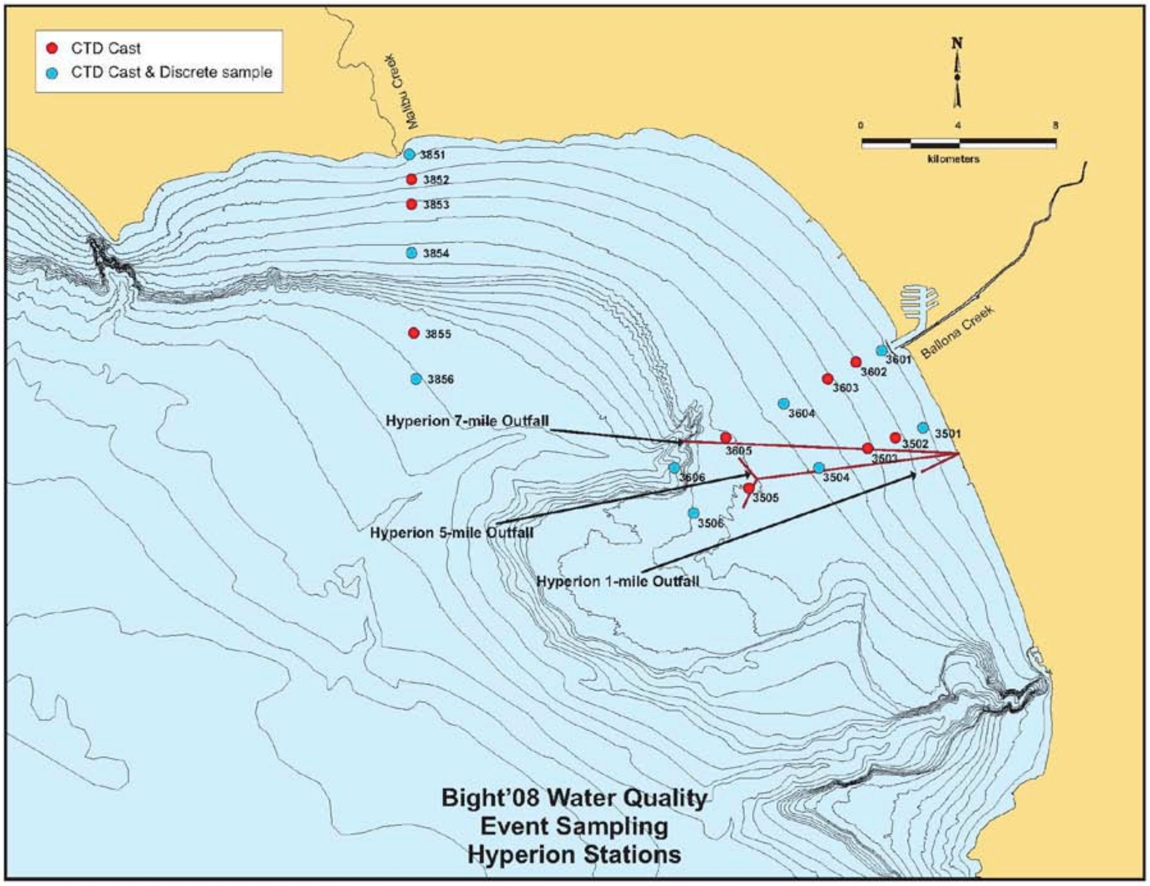
Appendix 14 Map of the Bight'08 offshore water quality sampling locations for the event surveys.



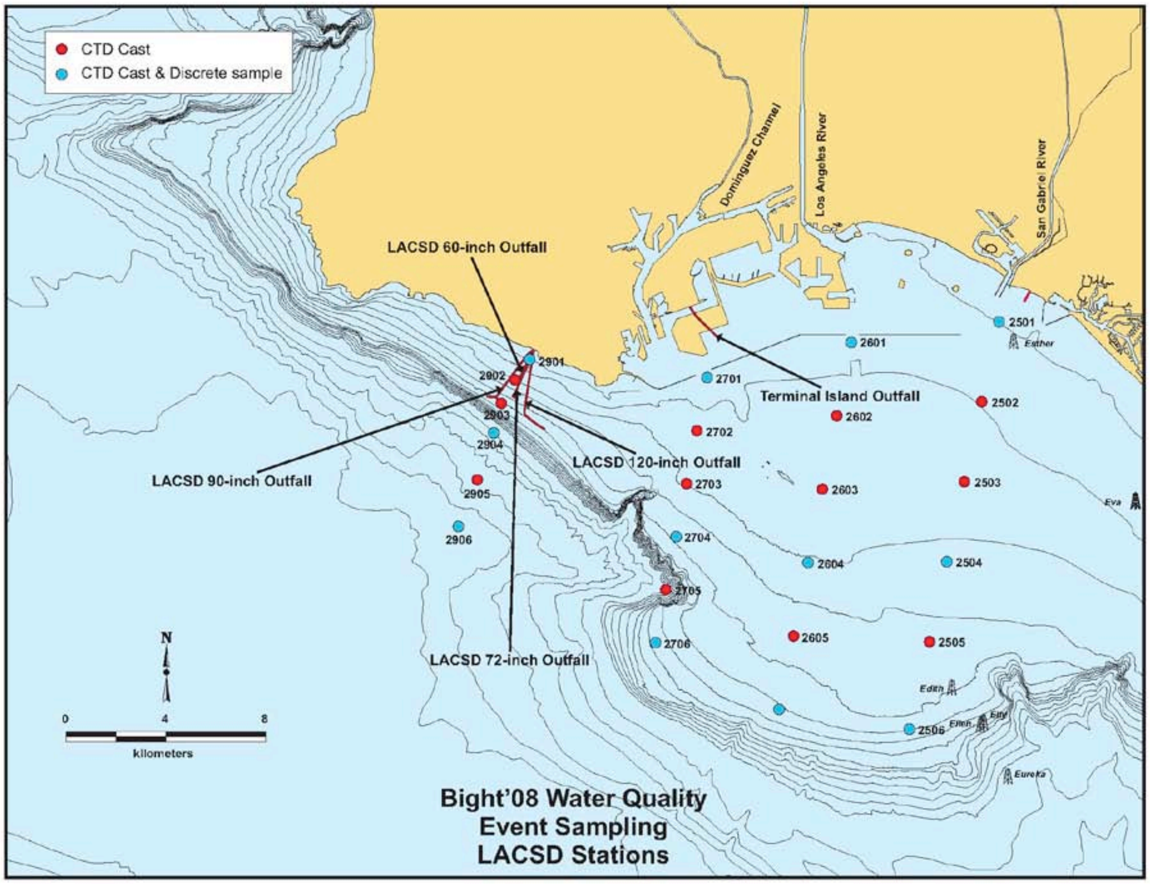
Appendix 15 Bight'08 offshore sampling locations conducted by City of Oxnard for the event surveys. ***Stations 5001-5005 and 4901-4905 will only be included if additional funding becomes available.***



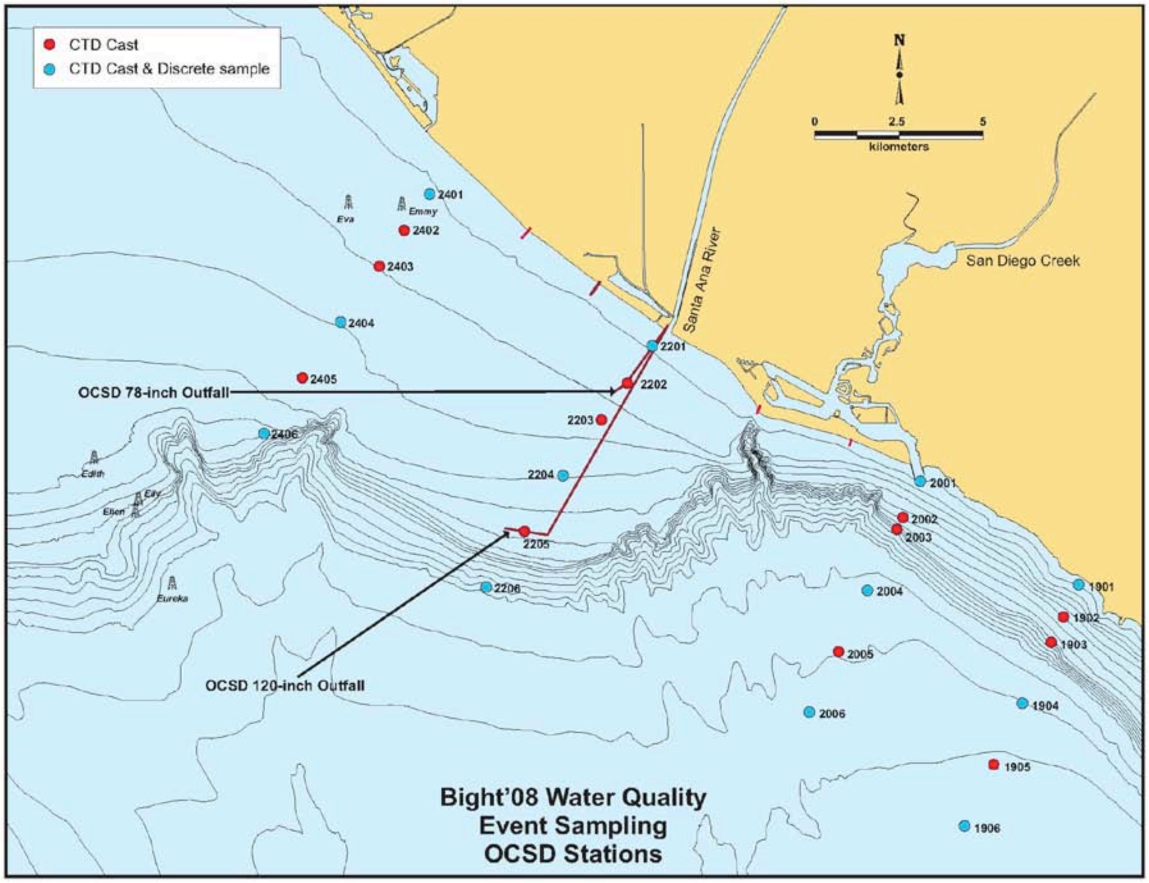
Appendix 16 Bight'08 offshore sampling locations conducted by City of Los Angeles for the event surveys.



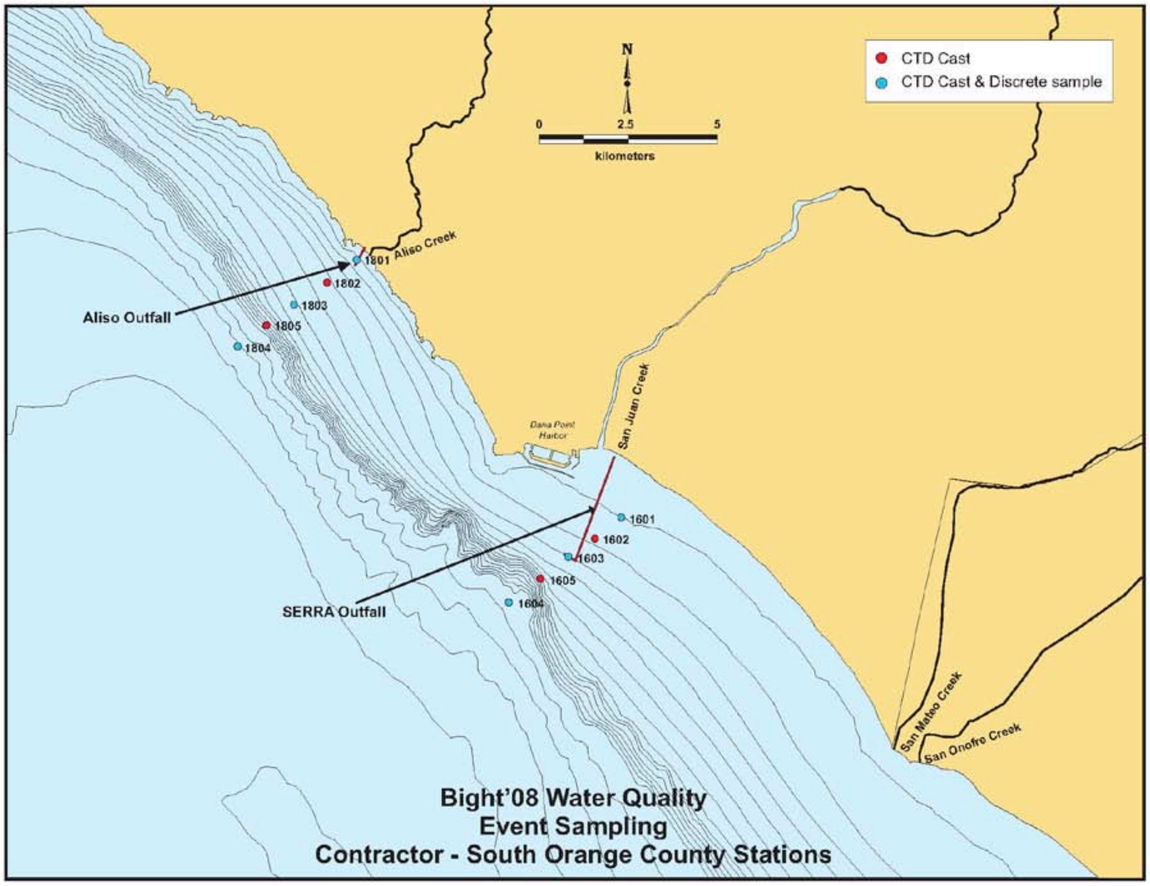
Appendix 17 Bight'08 offshore sampling locations conducted by the Los Angeles County Sanitation District for the event surveys.



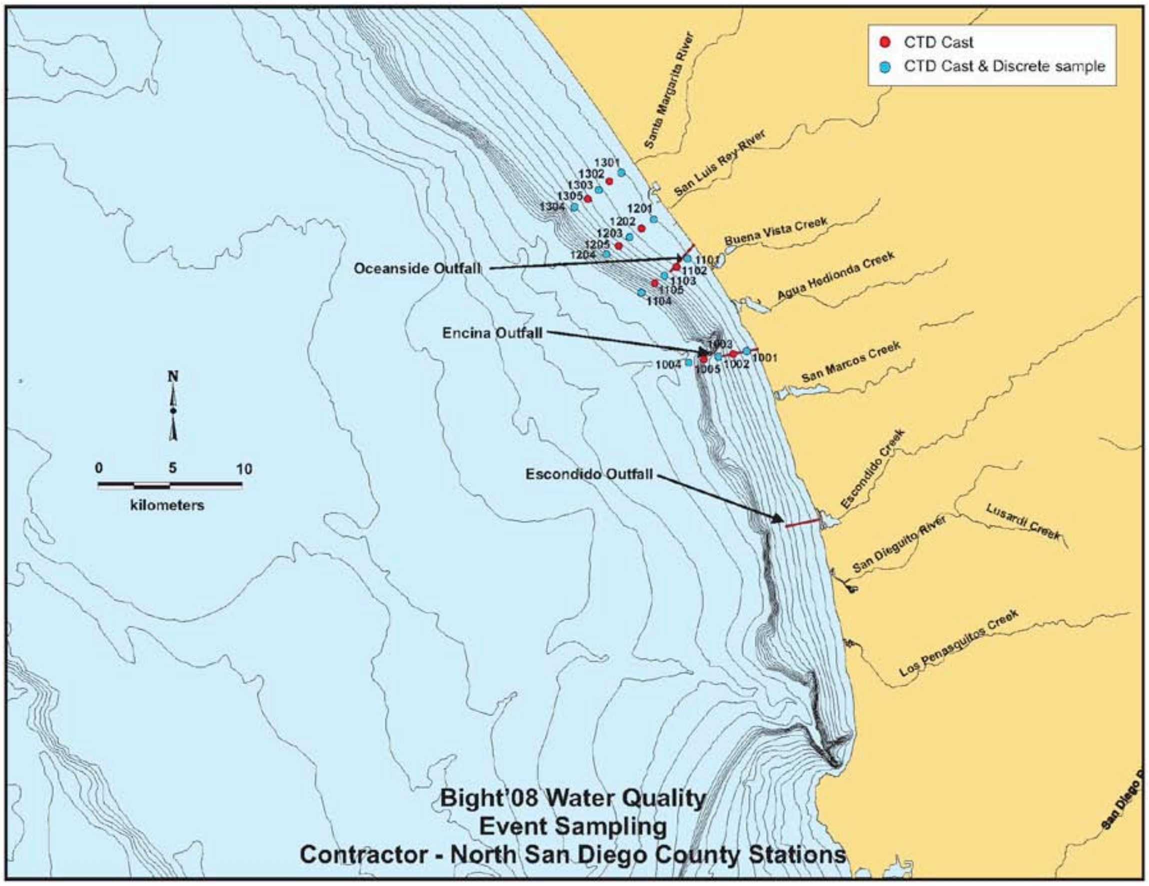
Appendix 18 Bight'08 offshore sampling locations conducted by Orange County Sanitation District for the event surveys.



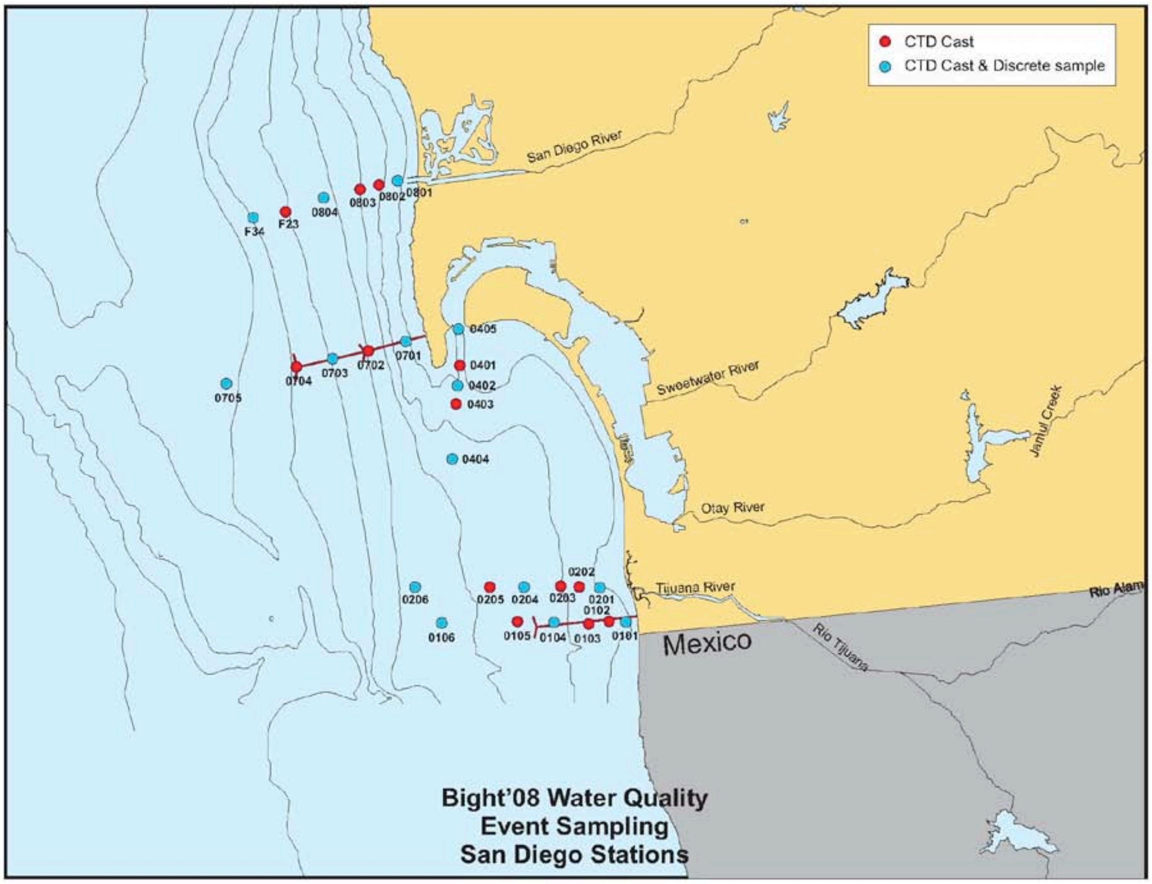
Appendix 19 Bight'08 offshore sampling locations conducted in the south Orange County for the event surveys *if additional funding becomes available*.



Appendix 20 Bight'08 offshore sampling locations conducted in the North San Diego County for the event surveys.



Appendix 21 Bight'08 offshore sampling locations conducted by City of San Diego for the event surveys.



Appendix 22 Bight ’08 Water Quality Event Sampling Station List

Bight’08 Water Quality Event Sampling Station List.

Area	Station Name	Latitude	Longitude	Depth	Discrete Sampling *	Location	Responsible Agency
North	5001	34.40860	-119.82540	10	*	Goleta Outfall	Contractor
North	5002	34.39640	-119.82690	45		Goleta Outfall	Contractor
North	5003	34.38500	-119.82820	60	*	Goleta Outfall	Contractor
North	5004	34.37230	-119.82980	70		Goleta Outfall	Contractor
North	5005	34.35700	-119.83200	100	*	Goleta Outfall	Contractor
North	4901	34.41050	-119.67090	10	*	Santa Barbara Outfall	Contractor
North	4902	34.39390	-119.67250	20		Santa Barbara Outfall	Contractor
North	4903	34.37460	-119.67430	50	*	Santa Barbara Outfall	Contractor
North	4904	34.33140	-119.67800	70		Santa Barbara Outfall	Contractor
North	4905	34.30560	-119.68040	100	*	Santa Barbara Outfall	Contractor
Central	4701	34.27123	-119.31041	10	*	Ventura River	Oxnard (ABC Labs)
Central	4702	34.26350	-119.32909	20		Ventura River	Oxnard (ABC Labs)
Central	4703	34.25557	-119.35091	20		Ventura River	Oxnard (ABC Labs)
Central	4704	34.24853	-119.37058	20	*	Ventura River	Oxnard (ABC Labs)
Central	4705	34.24054	-119.39239	30		Ventura River	Oxnard (ABC Labs)
Central	4706	34.23303	-119.41258	30	*	Ventura River	Oxnard (ABC Labs)
Central	4601	34.23065	-119.26730	10	*	Santa Clara River	Oxnard (ABC Labs)
Central	4602	34.22732	-119.27850	20		Santa Clara River	Oxnard (ABC Labs)
Central	4603	34.22166	-119.29413	30		Santa Clara River	Oxnard (ABC Labs)
Central	4604	34.21452	-119.31484	30	*	Santa Clara River	Oxnard (ABC Labs)
Central	4605	34.20637	-119.33997	30		Santa Clara River	Oxnard (ABC Labs)
Central	4606	34.19531	-119.37207	35	*	Santa Clara River	Oxnard (ABC Labs)
Central	4401	34.13350	-119.19300	15	*	Port Hueneme/Oxnard Outfall	Oxnard (ABC Labs)
Central	4402	34.12550	-119.19900	20		Port Hueneme/Oxnard Outfall	Oxnard (ABC Labs)
Central	4403	34.11770	-119.20500	25		Port Hueneme/Oxnard Outfall	Oxnard (ABC Labs)
Central	4404	34.10180	-119.21600	40	*	Port Hueneme/Oxnard Outfall	Oxnard (ABC Labs)

Bight'08 Water Quality Event Sampling Station List.

Area	Station Name	Latitude	Longitude	Depth	Discrete Sampling *	Location	Responsible Agency
Central	4405	34.07941	-119.25044	100		Port Hueneme/Oxnard Outfall	Oxnard (ABC Labs)
Central	4406	34.06687	-119.26411	100	*	Port Hueneme/Oxnard Outfall	Oxnard (ABC Labs)
Central	4301	34.09760	-119.10000	15	*	Mugu Lagoon/Calleguas Creek	Oxnard (ABC Labs)
Central	4302	34.08870	-119.10200	20		Mugu Lagoon/Calleguas Creek	Oxnard (ABC Labs)
Central	4303	34.07960	-119.10300	65		Mugu Lagoon/Calleguas Creek	Oxnard (ABC Labs)
Central	4304	34.06160	-119.10700	100	*	Mugu Lagoon/Calleguas Creek	Oxnard (ABC Labs)
Central	4305	34.03021	-119.12659	100		Mugu Lagoon/Calleguas Creek	Oxnard (ABC Labs)
Central	4306	34.00905	-119.13779	100	*	Mugu Lagoon/Calleguas Creek	Oxnard (ABC Labs)
Central	3851	34.03190	-118.67600	10	*	Malibu Creek	Hyperion
Central	3852	34.02280	-118.67500	20		Malibu Creek	Hyperion
Central	3853	34.01360	-118.67500	30		Malibu Creek	Hyperion
Central	3854	33.99570	-118.67500	60	*	Malibu Creek	Hyperion
Central	3855	33.96624	-118.67400	100		Malibu Creek	Hyperion
Central	3856	33.94944	-118.67300	100	*	Malibu Creek	Hyperion
Central	3601	33.95973	-118.46625	10	*	Ballona Creek	Hyperion
Central	3602	33.95555	-118.47777	20		Ballona Creek	Hyperion
Central	3603	33.94943	-118.49027	30		Ballona Creek	Hyperion
Central	3604	33.94027	-118.50977	45	*	Ballona Creek	Hyperion
Central	3605	33.92777	-118.53555	60		Ballona Creek	Hyperion
Central	3606	33.91667	-118.55833	100	*	Ballona Creek	Hyperion
Central	3501	33.93138	-118.44805	10	*	Hyperion Outfall	Hyperion
Central	3502	33.92777	-118.46027	20		Hyperion Outfall	Hyperion
Central	3503	33.92388	-118.47250	30		Hyperion Outfall	Hyperion
Central	3504	33.91667	-118.49417	45	*	Hyperion Outfall	Hyperion
Central	3505	33.90917	-118.52527	60		Hyperion Outfall	Hyperion
Central	3506	33.90000	-118.54972	80	*	Hyperion Outfall	Hyperion
Central	2901	33.71430	-118.32345	10	*	LACSD Outfall	LACSD
Central	2902	33.70693	-118.32983	30		LACSD Outfall	LACSD

Bight'08 Water Quality Event Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Sampling ***	**Location**	**Responsible Agency**
Central	2903	33.69847	-118.33568	60		LACSD Outfall	LACSD
Central	2904	33.68783	-118.33900	300	*	LACSD Outfall	LACSD
Central	2905	33.67094	-118.34618	555		LACSD Outfall	LACSD
Central	2906	33.65409	-118.35430	775	*	LACSD Outfall	LACSD
Central	2701	33.70775	-118.24666	26	*	Los Angeles Harbor/Dominguez Channel	LACSD
Central	2702	33.68864	-118.25112	26		Los Angeles Harbor/Dominguez Channel	LACSD
Central	2703	33.66953	-118.25559	28		Los Angeles Harbor/Dominguez Channel	LACSD
Central	2704	33.65042	-118.26005	50	*	Los Angeles Harbor/Dominguez Channel	LACSD
Central	2705	33.63131	-118.26452	220		Los Angeles Harbor/Dominguez Channel	LACSD
Central	2706	33.61220	-118.26898	80	*	Los Angeles Harbor/Dominguez Channel	LACSD
Central	2601	33.72043	-118.18426	19	*	Long Beach Harbor/Los Angeles River	LACSD
Central	2602	33.69398	-118.19050	23		Long Beach Harbor/Los Angeles River	LACSD
Central	2603	33.66752	-118.19674	23		Long Beach Harbor/Los Angeles River	LACSD
Central	2604	33.64107	-118.20299	32	*	Long Beach Harbor/Los Angeles River	LACSD
Central	2605	33.61461	-118.20923	47		Long Beach Harbor/Los Angeles River	LACSD
Central	2606	33.58816	-118.21547	62	*	Long Beach Harbor/Los Angeles River	LACSD
Central	2501	33.72787	-118.12025	10	*	San Gabriel River/Alamitos Bay	LACSD
Central	2502	33.69904	-118.12779	20		San Gabriel River/Alamitos Bay	LACSD
Central	2503	33.67021	-118.13533	26		San Gabriel River/Alamitos Bay	LACSD
Central	2504	33.64139	-118.14287	33	*	San Gabriel River/Alamitos Bay	LACSD
Central	2505	33.61256	-118.15041	44		San Gabriel	LACSD

Bight'08 Water Quality Event Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Sampling ***	**Location**	**Responsible Agency**
						River/Alamitos Bay	
Central	2506	33.58102	-118.15908	60	*	San Gabriel River/Alamitos Bay	LACSD
Central	2401	33.66533	-118.03505	10	*	Bolsa Chica Inlet	OCSD
Central	2402	33.65570	-118.04322	16		Bolsa Chica Inlet	OCSD
Central	2403	33.64608	-118.05120	21		Bolsa Chica Inlet	OCSD
Central	2404	33.63125	-118.06347	29	*	Bolsa Chica Inlet	OCSD
Central	2405	33.61643	-118.07573	37		Bolsa Chica Inlet	OCSD
Central	2406	33.60160	-118.08800	60	*	Bolsa Chica Inlet	OCSD
Central	2201	33.62488	-117.96385	10	*	Santa Ana River	OCSD
Central	2202	33.61502	-117.97190	16		Santa Ana River	OCSD
Central	2203	33.60522	-117.98017	25		Santa Ana River	OCSD
Central	2204	33.59038	-117.99243	39	*	Santa Ana River	OCSD
Central	2205	33.57557	-118.00470	57		Santa Ana River	OCSD
Central	2206	33.56073	-118.01697	185	*	Santa Ana River	OCSD
Central	2001	33.58892	-117.87820	10	*	Newport Harbor/San Diego Creek	OCSD
Central	2002	33.57925	-117.88380	60		Newport Harbor/San Diego Creek	OCSD
Central	2003	33.57608	-117.88573	100		Newport Harbor/San Diego Creek	OCSD
Central	2004	33.55982	-117.89513	345	*	Newport Harbor/San Diego Creek	OCSD
Central	2005	33.54355	-117.90438	410		Newport Harbor/San Diego Creek	OCSD
Central	2006	33.52745	-117.91373	470	*	Newport Harbor/San Diego Creek	OCSD
Central	1901	33.56137	-117.82757	10	*	Crystal Cove State Beach	OCSD
Central	1902	33.55275	-117.83240	60		Crystal Cove State Beach	OCSD
Central	1903	33.54603	-117.83637	100		Crystal Cove State Beach	OCSD
Central	1904	33.52978	-117.84557	405	*	Crystal Cove State Beach	OCSD
Central	1905	33.51350	-117.85475	510		Crystal Cove State Beach	OCSD
Central	1906	33.49715	-117.86403	550	*	Crystal Cove State Beach	OCSD
South	1301	33.22530	-117.42600	15	*	Santa Margarita River	Contractor
South	1302	33.21990	-117.43500	20		Santa Margarita River	Contractor
South	1303	33.21450	-117.44300	25	*	Santa Margarita River	Contractor
South	1305	33.20900	-117.45100	30		Santa Margarita	Contractor

Bight'08 Water Quality Event Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Sampling ***	**Location**	**Responsible Agency**
						River	
South	1304	33.20380	-117.46100	55	*	Santa Margarita River	Contractor
South	1201	33.19620	-117.40200	15	*	San Luis Rey River/Oceanside Harbor	Contractor
South	1202	33.19060	-117.41100	20		San Luis Rey River/Oceanside Harbor	Contractor
South	1203	33.18520	-117.42000	25	*	San Luis Rey River/Oceanside Harbor	Contractor
South	1205	33.17960	-117.42810	45		San Luis Rey River/Oceanside Harbor	Contractor
South	1204	33.17460	-117.43700	65	*	San Luis Rey River/Oceanside Harbor	Contractor
South	1101	33.17190	-117.37700	15	*	Oceanside Outfall	Contractor
South	1102	33.16650	-117.38500	20		Oceanside Outfall	Contractor
South	1103	33.16100	-117.39400	45	*	Oceanside Outfall	Contractor
South	1105	33.15660	-117.40120	75		Oceanside Outfall	Contractor
South	1104	33.15060	-117.41100	155	*	Oceanside Outfall	Contractor
South	1001	33.11410	-117.33300	15	*	Encina Outfall	Contractor
South	1002	33.11230	-117.34300	30		Encina Outfall	Contractor
South	1003	33.11060	-117.35400	65	*	Encina Outfall	Contractor
South	1005	33.10890	-117.36470	100		Encina Outfall	Contractor
South	1004	33.10690	-117.37600	155	*	Encina Outfall	Contractor
South	0801	32.75710	-117.26505	12	*	Mission Bay	San Diego
South	0802	32.75502	-117.27597	22		Mission Bay	San Diego
South	0803	32.75280	-117.28703	40		Mission Bay	San Diego
South	0804	32.74875	-117.30815	65	*	Mission Bay	San Diego
South	F23	32.74188	-117.33042	81		Mission Bay	San Diego
South	F34	32.73890	-117.34937	99	*	Mission Bay	San Diego
South	0701	32.67817	-117.26035	14	*	Point Loma Outfall	San Diego
South	0702	32.67353	-117.28207	59		Point Loma Outfall	San Diego
South	0703	32.66960	-117.30302	79	*	Point Loma Outfall	San Diego
South	0704	32.66558	-117.32412	93		Point Loma Outfall	San Diego
South	0705	32.65735	-117.36497	100	*	Point Loma Outfall	San Diego
South	0405	32.68420	117.22960	10	*	San Diego Harbor	San Diego
South	0401	32.66637	-117.22888	15		San Diego Harbor	San Diego
South	0402	32.65633	-117.23008	14	*	San Diego Harbor	San Diego
South	0403	32.64740	-117.23100	17		San Diego Harbor	San Diego

Bight'08 Water Quality Event Sampling Station List.							
Area	**Station Name**	**Latitude**	**Longitude**	**Depth**	**Discrete Sampling ***	**Location**	**Responsible Agency**
South	0404	32.62038	-117.23322	32	*	San Diego Harbor	San Diego
South	0201	32.55713	-117.14718	10	*	Tijuana River	San Diego
South	0202	32.55748	-117.15927	16		Tijuana River	San Diego
South	0203	32.55782	-117.16995	20		Tijuana River	San Diego
South	0204	32.55742	-117.19142	30	*	Tijuana River	San Diego
South	0205	32.55743	-117.21142	38		Tijuana River	San Diego
South	0206	32.55740	-117.25495	53	*	Tijuana River	San Diego
South	0101	32.54035	-117.13193	11	*	Tijuana Outfall	San Diego
South	0102	32.54057	-117.14177	15		Tijuana Outfall	San Diego
South	0103	32.53930	-117.15368	18		Tijuana Outfall	San Diego
South	0104	32.54000	-117.17398	24	*	Tijuana Outfall	San Diego
South	0105	32.54047	-117.19515	33		Tijuana Outfall	San Diego
South	0106	32.53975	-117.23932	45	*	Tijuana Outfall	San Diego

Appendix 23 Field Log Sheet

Date	______	**Station number**	______
Time	______	**Nominal depth**	______
Vessel	______	**Actual depth**	______
Navigation Type (GPS or DGPS)	______		
Latitude	______	**Longitude**	______
Weather[1]	______	**Sea State**[3]	______
Wind speed	______	**Swell Height**	______
Wind Direction[2]	______	**Swell Direction**[4]	______
		Swell Period	______
Abandoned (yes/no)	______	**Comments**	______

Depth	**Insert the *VOLUME* of water filtered in mls and the *DEPTH* of the Chlorophyll Maximum sample**								**Mark a check if sample collected**			
	Chl a (1)	Chl a (2)	DA (1)	DA (2)	PN (1)	PN (2)	PP (1)	PP (2)	Cell Counts	TN/TP	Urea	DIN
Surface (1 meter)												
Chlorophyll Maximum												

1 Clear, Drizzle, Fog, Fog and Drizzle, Haze, Overcast, Partly Cloudy, Rain, Thunderstorm
2 N,NE,E,SE,S,SW,W,NW, (XX for calm) (NR for not recorded).
3 Calm, rough, choppy, or confused.
4 N,NE,E,SE,S,SW,W,NW, (XX for calm) (NR for not recorded).

Appendix 24 Survey Sample Collection Questions Phone List

If you have any sampling questions while on the cruise, please call the following people. Start at the top of the list, and if you are unable to reach the person, please leave a message with a ship phone number, then call the next person on the list.

Astrid Schnetzer, University of Southern California

Cell (310) 683-9124

Liesl Tiefenthaler, SCCWRP

Office (714) 755-3231

Erica Seubert, University of Southern California

Cell (626) 318-4088

Meredith Howard, SCCWRP

Cell (949) 202-9804

Martha Sutula, SCCWRP

Cell (949) 374-1037

Appendix 25 List of sample analysis information and contacts.

SCCWRP Shipping Address:
Liesl Tiefenthaler
Southern California Coastal Water Research Project
3535 Harbor Blvd, Suite 110
Costa Mesa, CA 92626
Phone: 714-755-3231

University of Southern California (Caron Lab) Shipping Address:
Astrid Schnetzer
University of Southern California
3616 Trousdale Pkwy, AHF 301
Los Angeles, CA 90089-0371
Phone: 213-740-3675

City of Oxnard and Northern area contractor (ABC Labs) Cruise Discrete Samples

Sample	Analysis By:	Ship To:	Contact	Phone	Email
Chlorophyll	SCCWRP	SCCWRP	Scott Johnson	805-643-5621	scott@aquabio.org
Domoic Acid	USC (Caron Lab)	Caron Lab	Scott Johnson	805-643-5621	scott@aquabio.org
Particulate Nitrogen	MSI Labs	SCCWRP	Scott Johnson	805-643-5621	scott@aquabio.org
Particulate Phosphorus	Univ. of South Carolina	SCCWRP	Scott Johnson	805-643-5621	scott@aquabio.org
Cell Counts	SCCWRP	SCCWRP	Scott Johnson	805-643-5621	scott@aquabio.org
Urea	SCCWRP	SCCWRP	Scott Johnson	805-643-5621	scott@aquabio.org
Dissolved Inorganic Nutrients	MSI Labs	SCCWRP	Scott Johnson	805-643-5621	scott@aquabio.org
Total Nitrogen and Total Phosphate	University of Georgia	SCCWRP	Scott Johnson	805-643-5621	scott@aquabio.org

Hyperion Cruise Discrete Samples

Sample	Analysis By:	Ship To:	POTW Contact	Phone	Email
Chlorophyll	SCCWRP	SCCWRP	Curtis Cash	310-648-5263 Cell 310-309-7143	Curtis.cash@lacity.org
Domoic Acid	USC (Caron Lab)	SCCWRP	Curtis Cash	310-648-5263 Cell 310-309-7143	Curtis.cash@lacity.org
Particulate Nitrogen	MSI Labs	SCCWRP	Curtis Cash	310-648-5263 Cell 310-309-7143	Curtis.cash@lacity.org
Particulate Phosphorus	Univ. of South Carolina	SCCWRP	Curtis Cash	310-648-5263 Cell 310-309-7143	Curtis.cash@lacity.org
Cell Counts	SCCWRP	SCCWRP	Curtis Cash	310-648-5263 Cell 310-309-7143	Curtis.cash@lacity.org
Urea	SCCWRP	SCCWRP	Curtis Cash	310-648-5263 Cell 310-309-7143	Curtis.cash@lacity.org
Dissolved Inorganic Nutrients	MSI Labs	SCCWRP	Curtis Cash	310-648-5263 Cell 310-309-7143	Curtis.cash@lacity.org
Total Nitrogen and Total Phosphate	University of Georgia	SCCWRP	Curtis Cash	310-648-5263 Cell 310-309-7143	Curtis.cash@lacity.org

LACSD Cruise Discrete Samples

Sample	Analysis By:	Ship To:	POTW Contact	Phone	Email
Chlorophyll	SCCWRP	SCCWRP	Alex Steele	310-830-2400 x2812	asteele@lacsd.org
Domoic Acid	LACSD	LACSD	Alex Steele	310-830-2400 x2812	asteele@lacsd.org
Particulate Nitrogen	MSI Labs	SCCWRP	Alex Steele	310-830-2400 x2812	asteele@lacsd.org
Particulate Phosphorus	Univ. of South Carolina	SCCWRP	Alex Steele	310-830-2400 x2812	asteele@lacsd.org
Cell Counts	SCCWRP	SCCWRP	Alex Steele	310-830-2400 x2812	asteele@lacsd.org
Urea	SCCWRP	SCCWRP	Alex Steele	310-830-2400 x2812	asteele@lacsd.org
Dissolved Inorganic Nutrients	MSI Labs	SCCWRP	Alex Steele	310-830-2400 x2812	asteele@lacsd.org
Total Nitrogen and Total Phosphate	University of Georgia	SCCWRP	Alex Steele	310-830-2400 x2812	asteele@lacsd.org

OCSD Cruise Discrete Samples

Sample	Analysis By:	Ship To:	POTW Contact	Phone	Email
Chlorophyll	SCCWRP	SCCWRP	Ken Sakamoto	714-593-7468	ksakamoto@ocsd.com
Domoic Acid	USC (Caron Lab)	SCCWRP	Ken Sakamoto	714-593-7468	ksakamoto@ocsd.com
Particulate Nitrogen	MSI Labs	SCCWRP	Ken Sakamoto	714-593-7468	ksakamoto@ocsd.com
Particulate Phosphorus	Univ. of South Carolina	SCCWRP	Ken Sakamoto	714-593-7468	ksakamoto@ocsd.com
Cell Counts	SCCWRP	SCCWRP	Ken Sakamoto	714-593-7468	ksakamoto@ocsd.com
Urea	SCCWRP	SCCWRP	Ken Sakamoto	714-593-7468	ksakamoto@ocsd.com
Dissolved Inorganic Nutrients	MSI Labs	SCCWRP	Ken Sakamoto	714-593-7468	ksakamoto@ocsd.com
Total Nitrogen and Total Phosphate	University of Georgia	SCCWRP	Ken Sakamoto	714-593-7468	ksakamoto@ocsd.com

Contractor North San Diego (Weston Solutions) Cruise Discrete Samples:

Sample	Analysis By:	Ship To:	Contact	Phone	Email
Chlorophyll	SCCWRP	SCCWRP	Matt Wartian	760-809-1959	Matt.wartian@westonsolutions.com
Domoic Acid	USC (Caron Lab)	SCCWRP	Matt Wartian	760-809-1959	Matt.wartian@westonsolutions.com
Particulate Nitrogen	MSI Labs	SCCWRP	Matt Wartian	760-809-1959	Matt.wartian@westonsolutions.com
Particulate Phosphorus	Univ. of South Carolina	SCCWRP	Matt Wartian	760-809-1959	Matt.wartian@westonsolutions.com
Cell Counts	SCCWRP	SCCWRP	Matt Wartian	760-809-1959	Matt.wartian@westonsolutions.com
Urea	SCCWRP	SCCWRP	Matt Wartian	760-809-1959	Matt.wartian@westonsolutions.com
Dissolved Inorganic Nutrients	MSI Labs	SCCWRP	Matt Wartian	760-809-1959	Matt.wartian@westonsolutions.com
Total Nitrogen and Total Phosphate	University of Georgia	SCCWRP	Matt Wartian	760-809-1959	Matt.wartian@westonsolutions.com

City of San Diego Discrete Samples:

Sample	Analysis By:	Ship To:	POTW Contact	Phone	Email
Chlorophyll	SCCWRP	SCCWRP	Mike Kelly	619-758-2342	mkelly@sandiego.gov
Domoic Acid	USC (Caron Lab)	SCCWRP	Mike Kelly	619-758-2342	mkelly@sandiego.gov
Particulate Nitrogen	MSI Labs	SCCWRP	Mike Kelly	619-758-2342	mkelly@sandiego.gov
Particulate Phosphorus	Univ. of South Carolina	SCCWRP	Mike Kelly	619-758-2342	mkelly@sandiego.gov
Cell Counts	SCCWRP	SCCWRP	Mike Kelly	619-758-2342	mkelly@sandiego.gov
Urea	SCCWRP	SCCWRP	Mike Kelly	619-758-2342	mkelly@sandiego.gov
Dissolved Inorganic Nutrients	MSI Labs	SCCWRP	Mike Kelly	619-758-2342	mkelly@sandiego.gov
Total Nitrogen and Total Phosphate	University of Georgia	SCCWRP	Mike Kelly	619-758-2342	mkelly@sandiego.gov

Appendix 26 Chain of custody form for ship samples

BIGHT'08 WATER QUALITY
CHAIN-OF-CUSTODY FORM

Agency: ______________________ **Contact Name: _________________________**

Contact Number: _________________________

Sample By: ___________________________ **Date: ________________________**

Station	Sample Type	Container Type	# of Containers

Relinquished By: ____________________________ **Accepted By: ______________________________**

Agency: _____________________________________ **Agency: ____________________________________**

Signature: __________________________________ **Signature: _________________________________**

Date: ______________________________ **Time: ______________________________**

Relinquished By: ____________________________ **Accepted By: ______________________________**

Agency: _____________________________________ **Agency: ____________________________________**

Signature: __________________________________ **Signature: _________________________________**

Date: ______________________________ **Time: ______________________________**

Comments: ____

____