1. Title and Approval Sheet

Quality Assurance Project Plan for SWAMP Monitoring Project 2007/2008

May 15, 2007
Revised May 22, 2007

Approvals

Project Manager _____ Date 5/22/07
Lilian Busse

Regional Board QA Officer _____ Date 5/22/07
Lisa Honma

Contract Manager _____ Date 5-22-07
Lesley Dobalian

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2. Table of Contents

Figures and Tables:

3. Distribution List

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Laboratory Contact	1	Marco A. Sigala, MPSL	(831) 771-4173
Sampler	1	Moss Landing Marine Laboratories	(858) 627-3933

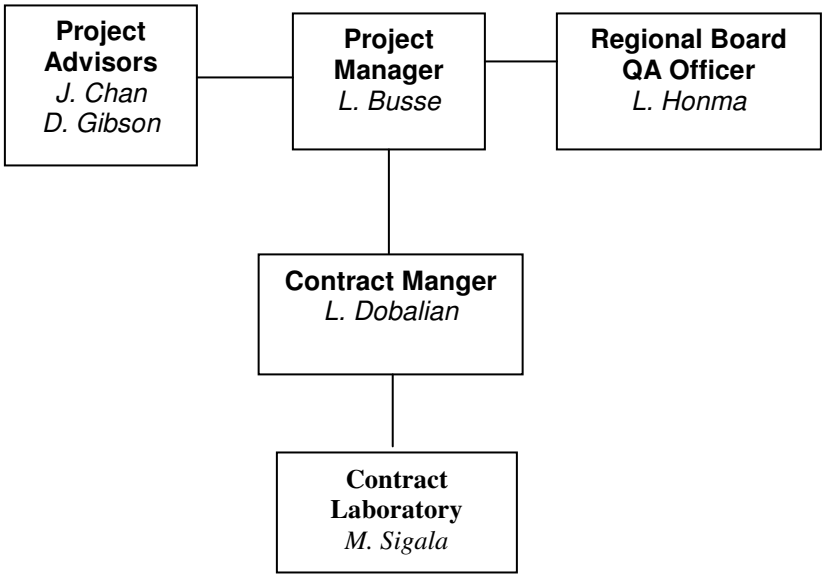
4. Project/Task Organization

The Project Team will consist of Lilian Busse, Julie Chan, Lesley Dobalian, and David Gibson. The Project Manager, Lilian Busse, will be responsible for general oversight of the project, and will serve as the main point of contact, and will hold the original versions of the Quality Assurance Project Plan (QAPP) and the Monitoring Plan (MP). Julie Chan and David Gibson will serve as Project Advisors and offer expert advice and assistance (as needed) on all aspects of the project. Lesley Dobalian, the SWAMP coordinator for Region 9, will oversee the project.

The Quality Assurance Officer for the California Regional Water Quality Control Board, San Diego Region (Regional Board) will ensure that all aspects of this Quality Assurance Project Plan (QAPP) are adhered to by those individuals taking and handling samples for the Regional Board. Lisa Honma will serve in this capacity and is not part of the Project Team.

Lesley Dobalian will serve as the Contract Manager and ensure that the sample handling and analysis of the project samples by Moss Landing Marine Laboratory is performed in accordance with the contractual obligations. Marco Sigala will be the laboratory contact for the Moss Landing Marine Laboratory.

Figure 1: Organization Chart



5. Problem Definition/Background

Problem Statement

Under the Surface Water Ambient Monitoring Program (SWAMP), the 11 hydrologic units that comprise the San Diego Region were sampled on a rotating watershed basis to ensure that each hydrologic unit was sampled once over a five year period from 2000 to 2005. The sampling revealed elevated concentrations of nutrients (nitrogen and phosphorous) and toxicity. Bioassessment samples collected by the Regional Board in 1998-2001 and by the San Diego Municipal Storm Water Permit Copermittees (Copermittees) showed degradation of the benthic macroinvertebrate community. It is necessary to perform follow up monitoring to further evaluate the watershed in preparation for the next round of SWAMP sampling.

SWAMP funds are available for the fiscal year 2006-2007 that will allow the Regional Board to take bioassessment samples and conventional water chemistry samples. Due to budget, staff, and time constraints, the monitoring will be limited to only a few sites in each watershed. Sites will only be sampled once.

Decisions or Outcomes

This project will serve as a continuation of the first five years of monitoring conducted under SWAMP. Sampling will focus on Reference sites which were not extensively sampled in the past. Also, some sites sampled under SWAMP in the past that demonstrated exceedances in water quality objectives or degraded benthic macroinvertebrate communities will be re-sampled. The data collected will provide information for future water quality assessments required the Clean Water Act sections 303(d) and 305(b).

Water Quality or Regulatory Criteria

Data collected for this project will be compared to the water quality objectives contained in the Water Quality Control Plan for the San Diego Basin (Region 9).

6. Project Task/Description

Work Statement and Produced Products

We will collect three types of field data in streams in the San Diego Region: in-situ field measurements, conventional water chemistry, and bioassessment samples including physical habitat assessments. Sample sites will be located throughout 11 hydrologic units in the San Diego Region. Approximately 40 sites will be sampled over the course of a 2 year period. We will calculate the index of biotic integrity (IBI) based on the benthic macroinvertebrate sampling. Based on the results, we will identify potential relationships between the IBI and chemical, physical, and habitat parameters.

Constituents to be Monitored and Sample Costs

The following table summarizes the sampling and analysis plan and provides the estimated costs for analysis of each sample:

Table 1: Sampling and Analysis Plan and Budget Estimation

SWAMP FY06-07 RWQCB 9 WDPF Funds-- Work Order No. SJS-06-9-001	Work Order Title: "SJS Field and Lab Services for RWQCB 9 for FY06-07 WDPF funds"	SWAMP Station Name and Number (please use required SWAMP conventions) ------>	2007 Sampling	2008 Sampling	Total units	Total Cost (Total Units x cost/unit)
Analysis or Service to be Performed	Description	Unit Cost (per sample)				
Sediment and/or Water Sample Collection (actual costs may vary after discussion w/RB, depending on site logistics, etc). Note: when chemistry/toxicity field work is done in combination with bioassessment field work, price combinations will be determined with RB swamp staff; prices shown here reflect ONLY chemistry/toxicity field work being conducted.	Collect bioassessment and water chemistry samples; conduct centroid velocity measurement as possible; conduct multiparameter probe reading as possible; includes all sample shipping. For close access, drive-up/walk-in sites only. Sample collection costs not only include field time/costs, but also field data entry & QA, pre-trip preparation, post-trip duties, etc. Non-random, directed sites. Sampling by MPSL-DFG	$885	10	10	20	$17,700
	Collect bioassessment and water chemistry samples; conduct centroid velocity measurement as possible; conduct multiparameter probe reading as possible; includes all sample shipping. For close access, drive-up/walk-in sites only. Sample collection costs not only include field time/costs, but also field data entry & QA, pre-trip preparation, post-trip duties, etc. Non-random, directed sites. Sampling by DFG-ABL	$885	10	10	20	$17,700
	Sampling/Cruise Reports - Cost shown is per discrete sampling/seasonal event	$645	1	1	2	$1290
Conventional Water Chemistry	OrthoPhosphate as P (OPO4) - aka Soluble Reactive Phosphorous (SRP)	$34	20	20	40	$1,360
	Phosphorous as P (total; TPHOS) - typical	$43	20	20	40	$1,720
	Phosphorous as P (dissolved; TPHOS)	$65	20	20	40	$2,600
	Nitrate as N (NO3)	$34	20	20	40	$1,360
	Nitrite as N (NO2)	$34	20	20	40	$1,360
	Nitrogen, Total Kjeldahl (TKN)	$50	20	20	40	$4,000
	Ammonia as N (NH3)	$28	20	20	40	$1,120
	Chloride (CL) not on the other table	$30	0	0	0	$0
	Fluoride (F) not on the other table	$30	0	0	0	$0
	Sulfate (SO4)	$30	0	0	0	$0
	Alkalinity as CaCO3 (ALK)	$28	20	20	40	$1,120
	Hardness as CaCO3 (HARD; should do if doing metals in freshwater)	$28	20	20	40	$1,120
	Total Dissolved Solids (TDS)	$34	20	20	40	$1,360
	Chlorophyll-a (CHL; syringe-filtered)	$67	20	20	40	$2,680
	Total Suspended Solids (TSS; recommend SSC instead…see below)	$39	20	20	40	$1,560
	Suspended Sediment Concentration (SSC)	$62	0	0	0	$0

SWAMP FY06-07 RWQCB 9 WDPF Funds-- Work Order No. SJS-06-9-001	Work Order Title: "SJS Field and Lab Services for RWQCB 9 for FY06-07 WDPF funds"	SWAMP Station Name and Number (please use required SWAMP conventions) ------>	2007 Sampling	2008 Sampling	Total units	Total Cost (Total Units x cost/unit)
Analysis or Service to be Performed	Description	Unit Cost (per sample)				
Biological & Habitat Assessment Note: when bioassessment field work is done in combination with chemistry/toxicity field work, price combinations will be determined with Regional Board swamp staff; prices shown here reflect ONLY bioassessment work being conducted.	Bioassessment site collection/field work only (non-random)—includes collection of TWO samples per site (+ new PHAB), using collection protocol for 500-count EPA-required taxonomy (no taxonomy or other services provided; field work only). Separate reconnaissance costs will be charged if RWQCB does not conduct & provide reconnaissance forms for each site well prior to field work.	sample charge included above	00	0	0	$0
	Reconnaissance: negotiated costs will be charged if RWQCB does not conduct & provide required reconnaissance forms/info for each site well prior to field work.	To be negotiated with specific Regions	0	0	0	$0
	Bioassessment site collection/field work only (random)	To be negotiated with specific Regions	0	0	0	$0
	Bioassessment lab services only –cost is for taxonomy for one sample, but two samples must be analyzed per site, using 500-count EPA-required taxonomy (sample sorting, taxonomy, QA, data report--no sample collection; sample must be provided by RWQCB or sample collection charges apply as appropriate).	$618	40	40	80	$49,440
SJSUF Miscellaneous	Regional proportional share of statewide cost of SJSUF pass-thru subcontract ovrhd, coordination/logistics/management cost (*will calculate after know total $ each region in each subcontract)	*different for each region	0	0	0	$0
	Regional Annual Interpretive Report / Publication	Negotiate	0	0	0	$0
TOTAL COST FOR ALL SERVICES/ANALYSES DESCRIBED ABOVE:						$107,490

Sampling Sites

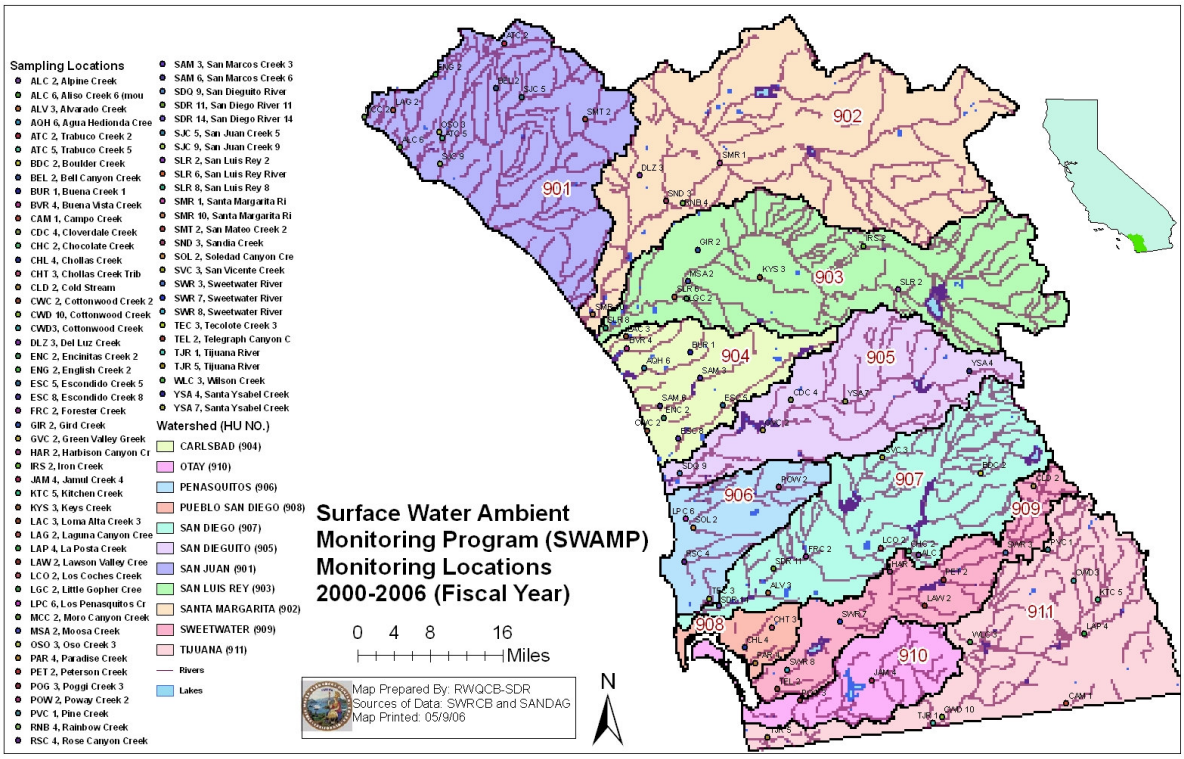
The work to be performed will take place in streams in the San Diego Region. Suitable sampling sites will be established during site selection and reconnaissance in 2007 and 2008. Sampling sites will be selected based on previously established sampling sites by the Regional Board, as well as safety and accessibility concerns. We will focus the 2007 and 2008 sampling on Reference sites, and on sites known to exceed water quality objectives and/or exhibit degraded benthic macroinvertebrate communities. Over the course of the project, issues such as drought, or changes in ownership of land or permission to access sites, or changes in land use, might require a shifting of sampling from planned sites to new sites.

Table 2 summarizes a pool of potential sampling locations which include reference sites as well as targeted sites.

Table 2: Potential Sampling Locations

Watershed	HU	Sampling locations
San Juan	901	ALC 6, ATC 2, ATC 5, BEL 2, ENG 2, LAG 2, MCC 2, OSO 3, SJC 5, SJC 9, SMT 2
Santa Margarita	902	DLZ 3, RNB 4, SMR 1, SND 3, SMR 10
San Luis Rey	903	GIR 2, IRS 2, KYS 3, MSA 2, SLR 2, SLR 8
Carlsbad	904	AQH 6, BUR 1, BVR 4, CWC 2, ENC 2, ESC 5, ESC 8, LAC 3, SAM 3, SAM 6
San Dieguito	905	CDC 4, GVC 2, SDQ 9, YSA 4, YSA 7,
Los Penasquitos	906	LPC 6, POW 2, RSC 4, SOL 2, TEC 3
San Diego River	907	ALC 2, ALV 3, BDC 2,FRC 2, LCO 2, SDR 11, CHC 2, SDR 14, SVC 3
Pueblo	908	CHL 4, CHT 3, PAR 4
Sweetwater River	909	CLD 2, HAR 2, LAW 2, SWR 3, SWR 7, SWR 8,
Otay	910	JAM 4, POG 3
Tijuana River	911	CAM 1, CWD 10, LAP 4, PVC 1, TJR 1, TJR 5

Figure 2 Map of potential sampling locations



Project Schedule

The following table outlines the anticipated project schedule and completion dates.

Table 3: Project Schedule

Activity	Date (MM/DD/YY)		Deliverable	Deliverable Due Date
	Anticipated Date of Initiation	Anticipated Date of Completion		
Start Project First year Second year	 3/1/07 3/1/08	 6/1/07 6/1/08	Sampling Plan and Quality Assurance Project Plan	 6/1/07 6/1/08
Sample Collection First year Second year	 6/1/07 6/1/08	 9/1/07 9/1/08	Samples Collection	 9/1/07 9/1/08
Summarize Data	9/1/07	3/1/09	Complete Data Set and Summary Report	3/1/09

7. Quality Objectives and Criteria for Measurement Data

Data Quality Objectives

Data quality objectives (DQOs) are generally used to determine the level of error considered to be acceptable in the data produced by the sampling program. The DQOs are used to specify acceptable ranges of field sampling and laboratory performances. Data quality objectives for all parameters measured in this project will consist of the following:

Table 4: Data Quality Objectives for Sampling Program

Measurement or Analysis Type	Applicable Data Quality Objectives
Field sampling for bioassessment	Completeness, Representativeness, Comparability
Field sampling for water samples	Completeness, Representativeness, Comparability
Field assessment of physical habitat	Completeness, Comparability
Field testing for dissolved oxygen, pH, conductivity, temperature, turbidity, alkalinity	Accuracy, Precision, Completeness, Representativeness, Comparability
Laboratory Testing, conventional water chemistry	Accuracy, Precision, Completeness, Comparability
Laboratory Testing, identification of benthic macroinvertebrates	Accuracy (Identification), Precision (Enumeration), Completeness, Representativeness, Comparability

Representativeness

The representativeness of the data is mainly dependent on the sampling locations and the sampling procedures adequately representing the true condition of the sample site. Sample sites, sampling of relevant media (water, sediment and biota), and use of only approved/documented analytical methods will determine that the measurement data represents the conditions at the investigation site, to the extent possible.

It is well known that water flowing past a given location on land is constantly changing in response to inflow, tidal cycle, weather, etc. Sampling schedules will be designed with respect to frequency, locations and methodology in order to maximize representativeness, where possible.

To remove bias and achieve representativeness for the proposed study, water and bioassessment samples will be collected at randomly assigned points along each stream reach. Only one water sample will be taken at a random point at each stream location. Multiple bioassessment samples will be taken according to the SOP for bioassessment. Samples will be composited into one sample. Because multiple samples for bioassessment will have been collected at random, the resulting samples should be representative of the sampling reach from which they were drawn.

Comparability

The comparability of data produced by and for SWAMP is predetermined by a commitment to use standardized methods, where possible, including USEPA-approved analytical methods, or documented modifications thereof, which provide data of equal or higher quality than those specified under SWAMP. These methods specify the units in which the results are to be reported.

Measurements are made according to standard procedures, or documented modifications thereof, which provide data of equal or higher quality, using common units such as Celsius, feet, feet/sec, mg/L, mg/kg, etc. Analytical procedures are set by the USEPA approval list published in 40 CFR 136.

Completeness

The completeness of data is a relationship between how much of the data are available for use compared to the total potential data identified in the monitoring plan. Ideally, 100% of the data should be available. However, the possibility of data becoming unavailable due to laboratory error, or samples broken in shipping must be expected. Also, unexpected situations may arise where field conditions do not allow for 100% data completeness. Therefore, 90% data completeness is required. Completeness results will be checked; this will allow identifying and correcting problems.

Precision and Accuracy

The precision and accuracy of data are determined by particular actions of the analytical laboratory and field staff. The precision of data is a measure of the reproducibility of the measurement when an analysis is repeated. It is reported in Relative Percent Difference (RPD) or Relative Standard Deviation (RSD). The accuracy of an analysis is a measure of how much of the constituent actually present is determined. It is measured, where applicable, by adding a known amount of the constituent to a portion of the sample and determining how much of this spike is then measured. It is reported as Percent Recovery. The acceptable percent deviations and the acceptable percent recoveries are dependent on many factors including: analytical method used, laboratory used, media of sample, and constituent being measured.

Laboratory precision measurements will be determined on laboratory replicates. The number of laboratory replicates will be in accordance with the Laboratory's Quality Assurance document. Field duplicates will be collected for the precision of field samples. At least ten (10) percent of all samples collected shall be quality control samples. The number of replicates will be one per sampling event. Dissolved oxygen, pH, conductivity, temperature, and turbidity will be taken in triplicate at each location.

The evaluation of accuracy for water quality parameters tracked by the SWAMP laboratory will be conducted by the use of spikes, matrix spikes, and check standards as outlined in the Laboratory Quality Assurance document and the Standard Operating Procedures for the prescribed Method. The data quality objectives for field and laboratory measurements for the projects are provided in Table 5. The target reporting limits are in accordance with the SWAMP target reporting limits or lower.

Accuracy of identifications and precisions of enumeration of benthic macroinvertebrates collections are assessed by re-analysis of samples at the rate of one for every ten samples analyzed. This consists of complete re-examination of the organisms in the archived original sample, including remnants from the sorting process. If any additional organisms are identified in the "remnant" fraction of the archived sample, the numbers of taxa and organisms are recorded. The total number of organisms and enumeration of individual taxa for the re-examined sample should be within 5% of the original total. Discrepancies in taxonomic identification or enumeration should be resolved as soon as possible.

Table 5: Data Quality Objectives for field and laboratory measurements

Analyte	Target Reporting Limit	Acceptance Criteria
Temperature	0.5℃	5%*
pH	0.5 units	5%*
Conductivity	2.5 mS/cm	5%*
Turbidity	0.5 NTU	10%*
Dissolved Oxygen	0.5 mg/L	10%*
Nitrate and Nitrite (NO_3 + NO_2)	0.05 mg/L	
Total Kjehldahl Nitrogen (TKN)	0.05 mg/L	- Reference Material: measured value <95%
Ammonia as N (NH_3)	0.05 mg/L	confidence intervals, or 80-120% recovery
Total Phosphorus (TPO_4)	0.01 mg/L	- Matrix spike: 80-120% recovery
Orthophosphate as P (OPO_4)	0.01 mg/L	- Matrix spike duplicate, laboratory duplicate
Sulfate (SO_4)	0.05 mg/L	and field duplicates: 25% relative percent
Alkalinity as $CaCO_3$ (ALK)	10 mg/L (for kit)	difference
Total Suspended Solids (TSS)	0.5 mg/L	
Benthic Macroinvertebrates	n/a	5%

* = no SWAMP requirement available

8. Special Training Needs/Certification

Under this project, the sampling crews and the laboratories are under the master contract between State Water Resources Control Board (State Board) and Moss Landing Marine Laboratories (MLMS) and therefore follow SWAMP procedures.

9. Documents and Records

The Regional Board will collect records of sample collection and field observations. Samples sent to Moss Landing Laboratory will include a Chain of Custody form. The MLMS will generate records for sample receipt and storage, analyses, and reporting.

Copies of this QAPP will be distributed to all parties involved with the project, including field sampling crews. Any future amendments to the Sampling Plan will be held and distributed in the same fashion. All originals of this first and subsequent document will be held at the Regional Board office. Copies of versions, other than the most current, will be discarded so as not to create confusion.

10. Sampling Process Design

Work performed under this QAPP will focus on sampling watersheds in San Diego Region for bioassessment. Historic data collected in the San Diego Region by the Regional Board and other agencies indicate adverse impacts to the aquatic life beneficial uses. Currently under SWAMP, no sampling is conducted in the San Diego Region for bioassessment. Bioassessment samples taken under the NPDES program focuses mostly on highly urbanized sites in the San Diego Region. During the proposed SWAMP sampling in 2007 and 2008 we will sample targeted impaired sites that are not sampled under the NPDES program and reference sites.

The purpose of this study is to collect data to answer the following questions:

What is status of the aquatic life beneficial use in Region 9?

a. What are the extent and the locations of impaired water bodies?
b. What are the extent and the locations of Reference sites?

To answer these questions, the Regional Board will focus SWAMP monitoring for FY 2006-07 on bioassessment. Bioassessment is an important tool to assess the quality of streams for the following reasons:

a. Bioassessment provides insight into the status of the aquatic life beneficial use;
b. Bioassessment monitoring integrates variation over time and constituents;
c. Bioassessment provides data on the ecological health of the streams; and
d. Historical bioassessment data are available in the San Diego Region.

In addition, conventional water chemistry and physical habitat assessment will be measured at the sites. Measurements of physical habitat (instream and riparian habitat) and ambient water chemistry are essential to interpretation of bioassessment data and therefore should be sampled.

Given funding constraints, the Regional Board will focus SWAMP monitoring in Fiscal Year 2006-07 on bioassessment at selected sites in the 11 hydrologic units.

11. Sampling Methods

Collection of Water Samples for Water Chemistry

Dissolved oxygen, pH, conductivity, temperature, turbidity will be measured in situ at each location about 0.1-meter depth. All sampling instruments will be rinsed with distilled water following use at each site.

Samples will be collected as grab samples from approximately midstream and at least 0.3 meters from bank and about 0.1-meter depth. All water samples collected for conventional constituents in the water column will be collected using clean techniques that minimize sample contamination. Sampling methods will generally conform to USEPA “clean” sampling methodology described in Method 1669: Sampling Ambient Water for Trace Metals (USEPA 1995a). Samplers will always wear gloves to prevent contamination of the sample and to protect human health. Grab samples will be collected into appropriate pre-cleaned containers into polyethylene or Teflon™ sample containers appropriate for the analyses to be performed or will be collected directly into the sample containers, if appropriate. After collection, field-collected samples will be stored at 4˚C until arrival at the contract laboratory.

This sample collection method requires that the sample bottle and lid come into contact only with surfaces known to be clean, or with the water sample. If the performance requirements for specific samples are not met, the sample will be re-collected. If contamination of the sample container is suspected, a fresh sample container will be used.

Note to samplers: Make sure there is enough blue-ice for all samples. Each sample container should be in immediate contact (touching) the blue ice. Samplers should bring a small ice chest to the sample site containing sufficient blue ice for each sample container to be in immediate contact with blue ice. Sampling containers should be placed on blue ice without delay. This means not transporting sampling containers without cooler, and not placing sampling containers on hot asphalt while opening vehicle. Coolers should be placed in vehicle in a closely packed fit to avoid movement of ice chests and samples during transportation. Sample containers should be placed in ice chest upright when possible, and in a closely packed fashion to avoid spillage and movement.

Collection of Bioassessment Samples

Bioassessment samples will be collected following the SWAMP SOP for field sample collection in appendix D. In the field, all samples will be packed in wet ice or frozen ice packs during shipment, so that they will maintain 4℃ temperatures. Sample containers will be clearly labeled with an indelible marker. The receiving laboratory sample custodian will examine the samples for correct documentation, proper preservation and holding times.

Table 6: Collection of Water and Bioassessment Samples

Sampling location	Analytical parameter	Matrix	Depth	Samples	Sampling SOP	Sampling volume
All locations	Dissolved oxygen, pH, conductivity, temperature, turbidity	Water	0.1 m below water surface	1 per site	SWAMP QMP	N/A
All locations	Conventional Water Chemistry	Water	0.1 m below water surface	1 per site	SWAMP QMP	4 L
All locations	Benthic macroinvertebrate	Substrate	Channel bottom	2 per site	SWAMP QMP	N/A

12. Sample Handling and Custody

Sample Handling

In the field, all samples will be packed in wet ice or frozen ice packs during transport so that they will be kept at approximately 4˚C. All caps and lids will be checked for tightness prior to storing. All samples will be handled, prepared, transported and stored in a manner so as to minimize bulk loss, analyte loss, and contamination or biological degradation. Sample containers will be clearly labeled with an indelible marker. Water samples will be kept in Teflon™, glass, or polyethylene bottles and kept cool at a temperature of 4˚C until analyzed. Maximum holding times for specific analyses are listed in Table 4 below.

Contract laboratories will follow sample custody procedures outlined in their QA plans. Contract laboratory QA plans are on file with the respective laboratory.

All samples remaining after successful completion of analyses will be disposed of properly. It is the responsibility of the personnel of each analytical laboratory to ensure that all applicable regulations are followed in the disposal of samples or related chemicals.

Chain-of-custody procedures require that possession of samples be traceable from the time the samples are collected until completion and submittal of analytical results. A complete chain-of-custody form is to accompany the transfer of samples to the analyzing laboratory.

Plastic containers supplied by the contract laboratory will be used for sample collection. New sample bottles will be picked up from the laboratory prior to each sampling event.

Laboratory Custody Log

Laboratories shall maintain custody logs sufficient to track each sample submitted and to analyze or preserve each sample within specified holding times. A sample is considered under custody when is in actual possession, in view after a physical possession and it is placed in a secure area (accessible by or under the scrutiny of authorized personnel only after in possession).

Field Log

Field crews shall be required to keep a field log for each sampling event. The following items should be recorded in the field log for each sampling event:

- Time of sample collection
- Sample ID numbers, including etched bottle ID numbers for Teflon™ mercury sample containers and unique IDs for any replicate or blank samples
- The results of any field measurements (temperature, D.O., pH, conductivity, turbidity) and the time that measurements were made
- Qualitative descriptions of relevant water conditions (e.g. color, flow level, clarity) or weather (e.g. wind, rain) at the time of sample collection
- Description of any unusual occurrences associated with the sampling event, particularly those that may affect sample or data quality

The field crews shall have custody of samples during field sampling. Chain of custody forms will accompany all samples during shipment to contract laboratories. All water quality samples will be transported to the analytical laboratory directly by the field crew or by overnight courier.

Table 7: Summary of Sample Container, Volume, Initial Preservation, and Holding Time Recommendations for Water Samples

Parameters for Analysis	**Recommended Containers (all containers pre-cleaned)**	**Minimum Sample Volume (ml)**	**Initial Field Preservation**	**Maximum Holding Time**
Ammonia, Nitrate, and Nitrite ($NO_3 + NO_2$)	Polyethylene bottles	100 ml	Cool to 4°C, dark	48 hours
Total Keldjahl Nitrogen (TKN)	Polyethylene bottles	200 ml	Cool to 4°C, dark	Recommend: 7 days Maximum: 28 days
Total Phosphorus (TPO_4) and Orthophosphate	Polyethylene bottles	100 ml	Cool to 4°C, dark	28 days
TSS	Polypropylene bottles	100 ml	Cool to 4°C, dark	48 hours
OrthoPhosphate as P (OPO_4) - aka Soluble Reactive Phosphorous (SRP)	Polythelene bottles	150ml	Cool to 4°C, dark	48 hours to 4°C, dark
Phosphorous as P (total; TPHOS) – typical TPO_4	Polythelene bottles	300ml	Cool to 4°C, dark	28 days to 4°C, dark
Nitrate as N (NO_3)	Polyethylene bottles	150ml	Cool to 4°C, dark	48 hours to 4°C, dark
Nitrite as N (NO_2)	Polyethylene bottles	150ml	Cool to 4°C, dark	48 hours to 4°C, dark
Nitrogen, Total Kjeldahl (TKN)	Polyethylene bottles	600ml	Cool to 4°C, dark	Recommended: 7days Maximum: 28 days Either one at 4°C, dark
Ammonia as N (NH3)	Polyethylene bottles	500ml	Cool to 4°C, dark	28 days to 4°C, dark
Sulfate (SO4)	Polyethylene bottles	300ml	Cool to 4°C, dark	28 days to 4°C, dark
Alkalinity as CaCO3 (ALK)	Polyethylene bottles	100ml	Cool to 4°C, dark	14 days to 4°C, dark
Hardness as CaCO3 (HARD; should do if	200ml polyethylene or	200ml (one bottle)	Cool to 4°C, dark No acid	Keep at 4°C, dark for up to 24 hours: must notify lab in advance.

Parameters for Analysis	Recommended Containers (all containers pre-cleaned)	Minimum Sample Volume (ml)	Initial Field Preservation	Maximum Holding Time
doing metals in freshwater)	glass bottle			
Total Dissolved Solids (TDS)	Polyethylene bottles	1000ml	Cool to 4°C, dark	7 days at 4°C, dark
Chlorophyll-a (CHL; syringe-filtered)	1-L amber polyethylene bottle	1000ml(one bottle)	Cool to 4°C, dark	Keep at 4°C, dark, but must filter within48 hours. Filters may be stored frozen up to 30 days
Total Suspended Solids (TSS; recommend SSC)	500ml amber glass jar	100ml (two jars)	Cool to 4°C, dark	7 days at 4°C, dark
Suspended Sediment Concentration (SSC)	500ml amber glass jar	100ml (one jar)	Cool to 4°C, dark	7 days at 4°C, dark

13. Analytical Methods

Laboratories

The State Board contracts for SWAMP Program laboratory services for itself, as well as for all of the Regional Boards, through utilization of the central contracting office at the State Board. The State Board currently utilizes two "master contracts" for providing analytical, field, technical/scientific consulting, and other assistance to State Board and any/all Regional Boards desiring to utilize these master contracts. Currently, the two master contracts are with:

1) California Department of Fish and Game (DFG);
2) U.S. Geological Survey (USGS).

In addition, Regional Boards may negotiate and establish contracts for SWAMP services with any number of other qualified agencies, organizations, or commercial laboratories through the State Board central contracting office. All contract laboratories must document the methods they use, the SOPs, and the data acceptability criteria of their analytical capabilities in their QAPP and Quality Assurance (QA) Manual respectively, also. The laboratory analytical procedures used by particular SWAMP laboratories are on file with the respective laboratory, and the acceptability criteria within which analytical procedures must be performed within are outlined in Appendix C.

The laboratory supervisor of each contracted lab has primary responsibility for responding to a failure of analytical systems. Solutions which are consistent with

the measurement objectives will be reached in consultation with the project manager. The method numbers used by each contract laboratory for each analytical procedure they perform for SWAMP is available in each laboratory's respective QA Plan on file with that laboratory.

Corrective Action for Laboratory Activities:

Failures in field and laboratory measurement systems involve, but are not limited to such things as, instrument malfunctions, failures in calibration, sample jar breakage, blank contamination, and quality control samples outside of the defined limits (Data Acceptability Criteria) listed in Appendix C. In many cases, the field technician or lab analyst will be able to correct the problem. If the problem is resolvable by the field technician or lab analyst, then they will document the problem in their field notes or laboratory record and complete the analysis. If the problem is not resolvable, then it is conveyed to the respective supervisor, who will make the determination if the analytical system failure compromised the sample results and should not be reported. The nature and disposition of the problem is documented in the data report that is sent to the SWAMP Project Manager. Detection limits may be affected by instrument sensitivity or by bias due to contamination or matrix interferences. Common laboratory practice is to adjust detection limits upward in cases where high instrument precision (i.e., low variability) results in calculated detection limits that are lower than the absolute sensitivity of the analytical instrument. In these cases, best professional judgment is used to adjust detection limits upward to reduce false positives and values below the detection limit are not reported. In all cases, results cannot be reported for values less than the Method Detection Limit (MDL-see definitions below).

For SWAMP, the recommended applications of detection and quantification limits should follow:

- Values below the Method Detection Limit (MDL, per 40 CFR Part 136) are to be reported as a negative ("-") sign followed by the actual MDL value, and flagged with an ND = not detected.
- Values between the MDL and the Reporting Limit (RL, aka quantification limit, which is the MDL multiplied by a factor of 1-10, as determined by the lab to provide acceptable precision values among replicated measurements) should be reported as the actual measured value (not negative), with a flag that is carried all the way through data storage, handling, and reporting. The flag is DNQ = detected, not quantifiable.
- Values above the RL (or quantification limit) are deemed as acceptable values without reservation, and are shown as the actual measured value, and assigned a QA code of A (Acceptable without reservation).
- Other QA qualification codes may occur if QC criteria are not met or qualification is deemed appropriate during subsequent QA review.

Analytical Methods

Methods used for field testing, water chemistry, and bioassessment (including physical habitat assessment) follow SWAMP approved SOPs.

Table 8: Field testing, laboratory analytical and bioassessment methods

Analyte	SOP	Modified yes/no
Temperature	SM 2550-B	no
pH	SM 2510-B	no
Conductivity	SM 2510-B	no
Turbidity	SM 2130-B	no
Dissolved Oxygen	SM 4500O-G	no
Nitrate and Nitrite (NO_3 + NO_2)	EPA 354.1	no
Total Kjehldahl Nitrogen (TKN)	EPA 35101-351.4	no
Ammonia as N (NH_3)	EPA 350.1/ 350.2/ 350.3/	
Total Phosphorus (TPO_4)	EPA 365.3	no
Orthophosphate as P (OPO_4)	EPA 365.1/ 365.2/ 365.3/ SM4500 P E	no
Sulfate (SO_4)	EPA 375.1	no
Alkalinity as $CaCO_3$ (ALK)	EPA 305.1	Modified if kit is used
Total Suspended Solids (TSS)	EPA 160.2	no
Benthic Macroinvertebrates	SWAMP SOP	no

14. Quality Control

Adherence to Standard Operating Procedures by all data collectors for SWAMP monitoring project will ensure that all samples are collected, handled, and processed with the maximum level of quality control as summarized in table 8. Quality assurance and quality control activities for sampling include the collection of field replicates for chemical testing, and the preparation of field blanks.

Field replicates are used to assess the variability attributable to collection, handling, shipment, storage, and/or laboratory handling and analysis. Procedures for collecting field replicates should be the same as that used for the collecting field samples. Replicates of samples will be collecting by filling two sample containers at the same time or in rapid sequence at a minimum of 5% of the sites. Sample containers will be labeled separately, but will not be identified as “replicate” to the laboratory.

Field Blanks are used to determine if field sampling activities are a potential source for contamination. Field blanks will be periodically submitted to verify that sample contamination is not occurring. To collect field blanks, the same equipment used for collection of field samples should be used to pour blank water into blank sampling containers.

Analytical quality assurance includes the following: (1) Adherence to documented procedures, U.S. EPA methods, SOPs or other approved methods; (2) adequate Calibration of analytical instruments, and (3) complete documentation of sample tracking and analysis.

Laboratory quality control checks will include the use of method blanks, matrix spikes, duplicates, and laboratory control samples.

Corrective actions will be taken when analysis is deemed suspect for some reason. The corrective action typically involves the following:

- A check of procedures
- A review of documents and calculations to identify possible errors.
- Correction of errors
- A re-analysis of sample if available

Table 9: Standard Operating Procedures

QC Check	Information Provided
Field replicates	
Field samples	Sampling + measurement precision
Field replicates	Precision of all steps after acquisition
Field blanks	
Bottle blank	Cleanliness
Field Blank	Transport, storage, and field handling bias
Laboratory QA	
Blanks	Minimum detection limit per each analyte
Field splits	Shipping + inter-laboratory precision
Laboratory splits	Inter-laboratory precision
Laboratory replicates	Analytical precision
Analysis replicates	Instrument precision
Matrix spike replicate	Analytical bias and precision
Analysis matrix spike, Instrument bias	80-120% Acceptance limit
Surrogate spike	Analytical bias
Calibration check samples	Following USEPA guidelines and recommendations of instrument manufacturer for Accuracy / Precision
Zero check	Calibration drift and memory effect
Span check	Calibration drift and memory effect
Mid-range check	Calibration drift and memory effect
Replicates, Splits etc.	75-125% Acceptance limit pg 48
Reagent Blank	Contaminated reagent
Rinsate or equipment blank	Contaminated equipment
Method blank	Response of an entire laboratory analytical system
Spikes	Percent recovery will be assessed for 1in 20 samples
Matrix Spike	Analytical (preparation + analysis) bias

15. Instrument/Equipment Testing, Inspection, and Maintenance

The MLML and DFG will test, maintain, and maintain their field equipment in accordance with its SOPs, which include those specified by the manufacturer and those specified by the method.

The project's contract laboratories maintain their equipment in accordance with their SOPs, which include those specified by the manufacturer and those specified by the method. Because the contract labs are under the SWAMP master contract, they will be in compliance with SWAMP criteria.

16. Instrument/Equipment Calibration and Frequency

All equipment used by the field crews of the Moss Landing Marine Laboratory and the Department of Fish and Game will calibrate their field equipment based in accordance with its SOPs, which include those specified by the manufacturer and those specified by the method.

Contract laboratories will perform their calibration for their instruments according to their SOPs. Because the contract labs are under the SWAMP master contract, they will be in compliance with SWAMP criteria.

17. Inspection/Acceptance for Supplies and Consumables

All supplies and consumables will be purchased through the field crew from the Moss Landing Marine Laboratory and the Department of Fish and Game. They will inspect the necessary supplies and consumables according to their SOPs. Laboratory supplies will be inspected by the contract laboratories according to their SOPs. All supplies and consumables will be inspected prior use, and examined for any damage.

18. Non-direct Measurements (Data Acquisition)

Existing data will be used to help make decisions about study sites that will be sampled under this sampling program. Previous sampling was conducted under SWAMP, the National Pollutant Discharge Elimination System (NPDES), and the San Diego Stream Team in San Diego Region. Data on water quality, bioassessment and physical habitat assessment will serve as basic information to screen study sites for site selection for this project. Landscape data will include characteristics such as catchment size, slope, landuse data will be identified using existing databases such as USGS, and the County of San Diego.

19. Data Management

The MLML data will maintain a file of data records (field and laboratory data sheets). Moss Landing Marine Laboratory will follow their SOPs for data management, including record keeping and tracking, document control, and data handling. All data will be included into the SWAMP database by the Moss Landing Marine Laboratory.

20. Assessment and Response Actions

The field crews from Moss Landing Marine Laboratory and Department of Fish and Game, and the contract laboratories under this project will be routinely monitored by the SWAMP QA team. Any inadequacy will be noted in a response letter, and the field crews and the contract laboratories is responsible for making any corrections needed and to report those corrections to the SWAMP QA team.

21. Reports to Management

After the sampling in 2007 and the sampling 2008, draft reports will be prepared by the Project Manager. A final report will be prepared by 03/01/2009 by the Project Manager depending on the availability of data. The Project Advisors and the Project Manager will provide an analysis of watershed sampling results under this sampling program and recommendations to management.

22. Data Review, Verification, and Validation

Data generated by project activities will be reviewed against the DQOs and the quality assurance/quality control practices cited in this document. Data will be separated into three categories: data meeting all data quality objectives, data meeting failing precision or recovery criteria, and data failing to meet accuracy criteria. Data meeting all data quality objectives, but with failures of quality assurance/quality control practices, will be set aside until the impact of the failure on data quality is determined. Once determined, the data will be moved into either the first category or the last category.

Data falling into the first category is considered usable by the project. Data falling into the last category is considered not usable. Data falling in the second category will have all aspects assessed. If sufficient evidence is found supporting data quality for use in this project, the data will be moved to the first category, but will be flagged with a “J” as per USEPA specifications.

23. Verification and Validation Methods

The field crews from MLML and DFG, and the contract laboratory will perform checks on data, and any issues will be noted. Any corrections require an agreement with the Regional Board that the correction is appropriate. After data forms are signed, the SOP will be followed for data entry.

24. Reconciliation with User

The goal of the present study is to establish a dataset of benthic macroinvertebrates, physical habitat assessment, and conventional water chemistry for streams in San Diego Region. Regulatory agencies like the Regional Board can use this information to identify waterbodies where pollution controls may be needed as well as to determine the effectiveness of controls that are already in place.

25. Appendix: Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessment in California