Ventura River Watershed Monitoring Program
Quality Assurance Project Plan (QAPP)
Santa Barbara Channelkeeper

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2. Table of Contents

3. Distribution List

All group leaders, and technical advisors will receive copies of this Quality Assurance (QA) Project Plan, and any approved revisions of this plan. Once approved, this QA plan will be available to any interested party by requesting a copy from Santa Barbara Channelkeeper and/or Erick Burres (see address on title page).

4. Project Organization

The Ventura River Watershed Monitoring Program (VRWMP) is managed by Santa Barbara Channelkeeper (SBCK) , in a partnership with the Ventura Chapter of the Surfrider Foundation. The Project will monitor discrete locations within the Ventura watershed. Organizations involved with the project include:

1. **Santa Barbara Channelkeeper: Leigh Ann Grabowsky, Director of Watershed Programs**. Responsibilities include project management, recruitment and training of volunteers, equipment and supply upkeep and calibration, data management, quality assurance and quality control, and field data collection.

2. **Ventura Chapter of the Surfrider Foundation: Paul Jenkin, Environmental Director**. Responsible for recruitment of volunteers, field data collection, and quality assurance/quality control.

Several resource agencies have assisted in the development of this project from its conception. Additional partnerships will be developed to ensure adequate technical support to all participating groups. The QA plan reflects the diversity of monitoring and organizational support involved in this project. For the elements of this QA plan, we have addressed aspects that are shared with all groups as well as those aspects that are unique to individual groups. While the goals of monitoring may vary, the data quality objectives are consistent, allowing us to compare data collected by different organizations.

4.1. Technical Advisory Committee:

1. Brian Brennan, Mayor, City of Ventura
2. Erick Burres, Clean Water Team, State Water Resources Control Board
3. Bill Carey, Ventura County Watershed Protection District
4. Paul Jenkin, Environmental Chair, Ventura Chapter of the Surfrider Foundation
5. Allen Leydecker, researcher, University of California Santa Barbara
6. Ron Sheets, Ojai Valley Sanitary District
7. Karen Waln, City of Ventura
8. Damon Wing, Program Director, Ventura Coastkeeper
9. Darla Wise, Ventura County Watershed Protection District

5. Problem Definition/Background

5.1. Problem Statement

Currently, there is insufficient information to adequately assess the status of water quality in the Ventura River watershed. Adequate data quality assurance will ensure that the Ventura River Watershed Monitoring Program will collect valuable information for watershed management and pollution prevention.

5.1.1. Regional Citizen Monitoring Mission and Goals

5.1.1.1. Mission

The VRWMP is a volunteer-based water quality monitoring program targeting the Ventura River watershed. The VRWMP informs and engages the community in effective watershed stewardship.

5.1.1.2. Program Goals

The goals of this program include:

- recruiting and training a network of citizen volunteer monitors,
- establishing a baseline dataset of water quality parameters for sites throughout the watershed,
- use monitoring information to track and identify sources of pollution.

This project will supplement the existing agency information by monitoring streams in the Ventura Watershed. The focus of the project is on chemical, physical and biological parameters as measures of water quality. Data will be collected in the field with test kits and field instruments. Other data will be obtained through laboratory procedures. This information will be provided to the regulatory agencies. Data will also be provided to the public. It is the responsibility of the agencies to ensure that adequate and valid data are collected to meet their regulatory requirements. Additionally, citizen monitors build awareness of water quality issues, aquatic resources and pollution prevention.

5.2. Intended Usage of Data

The data will be used by SBCK for general watershed assessment. Data will be made available to the public for informational purposes. Data will be made available to regulatory and resource management agencies such as City of Buenaventura, the County of Ventura, State Water Resources Control Board or the Los Angeles Regional Water Quality Control Board to supplement their existing data collection effort. The main database will be maintained by SBCK and a back-up copy will be stored off-site.

6. Project/Task Description

The Ventura River Watershed Monitoring Program's "Stream Team" monitors water quality in the Ventura watershed. Physical, chemical and biological parameters are measured. Table 6.1 identifies the program's monitoring. Samples will be taken by volunteers and staff. Certain parameters will be measured in the field, or the in-house laboratory at SBCK's office.

6.1. General Overview of Project

The following paragraphs identify the specific overviews of the citizen monitoring projects included in this plan.
This QA plan only addresses data quality objectives for the following parameters:

Temperature
Dissolved Oxygen
pH
Conductivity
Turbidity
Total Coliform Bacteria
E. coli Bacteria
Enterococcus Bacteria

Flow will be determined for streams and storm drains by using the protocol described in the Ventura Watershed Monitoring Manual (*VRWMP Manual*) and/or in the U.S. EPA Volunteer Stream Monitoring Manual.

In addition to collecting quantitative data, the VRWMP has provisions for recording observational data. Chemical, physical, and biological parameters will be monitored using protocols outlined in the *VRWMP Manual*. This program has a systematic method recording visual and other qualitative observations. A Visual Observation sheet, with instructions, is included in the Ventura Watershed Monitoring Manual. Observational data include water color, clarity and odor, algal cover and color, presence of oil or tar, trash, and foam.

Stream habitat quality will be assessed for each site, at least once per year, using the California Dept. of Fish and Game Physical Habitat Assessment Form. This form allows for observational data including epifaunal substrate/available cover, embeddedness, velocity/depth regimes, sediment deposition, channel flow status, channel alteration, frequency of riffles, bank stability, vegetative protection, and riparian vegetative zone width.

Analysis for the following parameters are not addressed in this QA plan:

Nutrients
Metals
Oil and Grease and PAH's
Pesticides and other synthetic organic compounds

Samples for these and other parameters will be taken by volunteers and staff, and sent to a certified or approved agency, commercial, or academic laboratory for analysis. The agency or laboratory should adhere to SWAMP QA/QC standards at a minimum. Samples will be collected in dedicated bottles provided by the professional, agency or academic laboratory, and will be labeled and handled as specified (see Table 11.1 for requirements on bottles and holding times).

Table 6.1 Summary of Monitoring Design

Parameter	Type	Frequency
Flow	Field	Monthly
Temperature	Field	Monthly
Dissolved Oxygen	Field	Monthly
pH	Field	Monthly
Conductivity / TDS	Field	Monthly
Turbidity	Field	Monthly
Odor and Visual Observations	Field	Monthly
Bacteria (Total Coliform, E. Coli and Enterococcus)	In-house Laboratory	Monthly
Ammonia-Nitrogen	Professional Laboratory	Monthly
Nitrate-Nitrogen	Professional Laboratory	Monthly
Nitrite-Nitrogen	Professional Laboratory	Monthly
Ortho-Phosphate	Professional Laboratory	Monthly
Metals	Professional Laboratory	Seasonal, irregular
Oil and Grease	Professional Laboratory	Seasonal, irregular
Inorganics	Professional Laboratory	Seasonal, irregular
Organics	Professional Laboratory	Seasonal, irregular

6.1.1. Monitoring

Volunteer citizens will measure physical, biological, and chemical parameters at sites throughout the Ventura Watershed using techniques covered by this QAPP. Field data will be measured and reported on field data sheets. All instruments used in the assessment of the river will be calibrated and tested using known standard concentrations to prevent errors.

6.1.2. Analysis

Chemical, physical, and biological parameters will be monitored using protocols outlined in the *VRWMP Manual*. Flow, pH, temperature, Dissolved Oxygen, turbidity and conductivity will be measured directly in the field. Water samples collected by the volunteers will be analyzed in-house at SBCK for nutrients (nitrate, nitrite and orthophosphate) and bacteria (Total, E. Coli, and Enterococcus).
Data reduction and analysis will be done by Santa Barbara Channelkeeper.

Twice a year, in a 'wet' and 'dry' season, water samples will be sent to a professional laboratory for the "full suite" analysis of metals, organics, inorganics, volatiles and oil and grease. Section 10 of this plan contains references and instructions for the collection of samples for the following substances: Total Organic Carbon, Metals, Oil and Grease, PAH's, Pesticides and other synthetic organic compounds, and Toxicity. It has been determined that there will be no project-specific quality assurance and data quality objectives developed for the data generated. Samples may be sent to any laboratory capable of performing analysis that will adhere to SWAMP QA/QC standards at a minimum. The project accepts the data generated that is within the analyzing laboratory's internal quality assurance program and the project will not comment on its quality relative to data from the same test generated by other laboratories.

6.1.3. Reporting

Data resulting from each sampling event will be stored in a database kept at the Santa Barbara Channelkeeper office. A final "Status of the River" report will be produced and distributed after one year of sampling has occurred.

6.2. Project Timetable

Table 6.2 identifies the schedule of major activities associated with this project.

Table 6.2 Project Timetable

Activity	Date
Identify monitoring leaders	October 2004, as needed thereafter
Obtain training for monitoring leaders	October 2004, as needed thereafter
Recruit monitors	October 2004, continuous thereafter
Obtain and check operation of instruments	October 2004, continuous thereafter
Train monitors	October 2004, continuous thereafter
Initiate monitoring	November 2004, monthly thereafter
Initiate data entry	November 2004, monthly thereafter
Calibration and quality control sessions	November 2004, monthly thereafter
Review data with technical advisors	December 2004, quarterly thereafter

7. Data Quality Objectives

This section identifies how accurate, precise, complete, comparable, sensitive and representative our measurements will be. These terms are defined in the following section. Data quality objectives were derived by reviewing the QA plans and performance of other citizen monitoring organizations (e.g. Southern California Citizen Monitoring Steering Committee, Heal the Bay Malibu StreamTeam), by considering the specifications of the instruments and methods we will employ, and by considering the utility of the data.

Data quality objectives are summarized in Tables 7.1. and 7.2. Whenever possible the methods with the greatest sensitivity and lowest detection limit will be employed as the primary methods. Methods with lesser sensitivity and higher detection limits will be used for field confirmations or as back-up methods in the case that the primary methods are not available or functioning properly for a particular sampling event.

Table 7.1. Data Quality Objectives for Conventional Water Quality Parameters

Parameter	Method/range	Units	Detection Limit	Sensitivity	Precision	Accuracy	Completeness
Air Temperature	Thermometer (-30° to 120°)	°F	-30°F	1 °F	± .5°C	± .5°C	90%
Water Temperature	Electronic meter/probe	°C	-5°C to 45°C	0.1°C	± .5°C	± .5°C	90%
Dissolved oxygen	Electronic meter/probe	mg/l	0.1 mg/l	0.01 mg/l	± 10%	± 10%	90%
pH	pH meter	pH units	1	0.1 pH	± .2 pH	± .2 pH	90%
Conductivity TDS	conductivity meter	mhos/cm	10	10 µ mhos/cm	± 10%	± 10%	90%
Turbidity TSS	Nephelometer/ Turbidity Meter	NTU's	<0.1	0.1	± 10%	± 10%	90%

Table 7.2. Data Quality Objectives for Biological Parameters

Parameter	Method/range	Units	Detection Limit	Resolution	Precision	Accuracy	Completeness
Total Coliform Bacteria	Colilert 18 hour	MPN/ 100 ml	10	See IDEXX quantitray tables	Duplicates within 95% confidence limits	Positive standard within ½ of an order of magnitude	90%
Fecal Coliform Bacteria	Colilert 18 hour	MPN/ 100 ml	10	See IDEXX quantitray tables	Duplicates within 95% confidence limits	Positive standard within ½ of an order of magnitude	90%
Entero-coccus Bacteria	Enterolert 24 hour	MPN/ 100 ml	10	See IDEXX quantitray tables	Duplicates within 95% confidence limits	Positive standard within ½ of an order of magnitude	90%

7.1. Accuracy

Accuracy describes how close the measurement is to its true value. Accuracy will be tested through the measurement of a sample of known concentration and comparing the known value against the measured value.

7.1.1. Chemical and Physical Parameters

The accuracy of chemical measurements will be checked by performing tests on standards at quality control sessions held twice a year. A standard is a known concentration of a certain solution. Standards can be purchased from chemical or scientific supply companies. Standards might also be prepared by a professional partner, e.g. a commercial or research laboratory. The concentration of the standards should be within the mid-range of the equipment. SBCK's VRWMP Database calibration form will be completed to record equipment accuracy and adjustments.

For all chemical water quality parameters volunteers should obtain results within 10% of the true value, when the true value is within the mid-range of the expected values.

7.1.2. Biological Parameters

Accuracy for bacterial parameters will be determined by completing the following analysis:

- 1 field blank per trip
- 1 lab blank per batch
- 1 lab duplicate per 10 samples, or 1 per batch
- 1 lab positive control sample per reagent lot number
- 1 lab negative control sample per reagent lot number

7.2. Comparability

Comparability is the degree to which data can be compared directly to similar studies. SBCK will use methods to ensure that our data can be compared to others, including:

- U.S. EPA's Volunteer Monitoring Manuals (Streams, Lakes and Estuaries)

- Heal The Bay's Malibu Creek Stream Team Monitoring Protocols
- SWRCB Clean Water Team Compendium For Water Quality Monitoring and Assessment

Before modifying these methods, or developing alternative or additional methods, technical advisors will evaluate and review the effects of the potential modification. It will be important to address their concerns about data quality before proceeding with the monitoring program.

7. 3. Completeness

Completeness is the fraction of planned data that must be collected in order to fulfill the statistical criteria of the project. There are no statistical criteria that require a certain percentage of data. However, it is expected that 90% of all measurements could be taken when anticipated. This accounts for adverse weather conditions, safety concerns, and equipment problems.

We will determine completeness by comparing the number of measurements we planned to collect compared to the number of measurements we actually collected that were also deemed valid. An invalid measurement would be one that does not meet the sampling methods requirements and the data quality objectives. Completeness results will be checked quarterly. This will allow us to identify and correct problems. The Data Quality Form: Completeness found in Appendix A, will be used to record completeness.

7. 4. Precision

Precision describes how well repeated measurements agree. The precision objectives described here refer to repeated measurements taken by either different volunteers on the same sample (at quality control sessions) or the same volunteer analyzing replicate samples in the field. Additional variability would be expected if comparisons were made between different samples taken at the same location.

7.4.1. Chemical and Physical Parameters

These precision objectives apply to duplicate and split samples taken as part of the quality control session or as part of periodic in-field QC checks. For most parameters, measurements on the same sample read by different volunteers using the same equipment should be within 10% of each other.

7.4.2. Biological Parameters

Precision for bacterial parameters will be determined by having the same analyst complete the IDEXX procedure for two or more duplicates of the same sample. At a minimum this should be done once for every 20 samples, or 5%. The results of the duplicates should be within the confidence limits supplied by the manufacturer.

7.5 Representativeness

Representativeness describes how relevant the data are to the actual environmental condition. Problems can occur if:

- Samples are taken in a stream reach that does not describe the area of interest (e.g. a headwaters sample should not be taken downstream of a point source),
- Samples are taken in an unusual habitat type (e.g. a stagnant backwater instead of in the flowing portion of the creek),
- Samples are not analyzed or processed appropriately, causing conditions in the sample to change (e.g. water chemistry measurements are not taken immediately).

Representativeness will be ensured by processing the samples in accordance with Section 10, 11 and 12, by following the established methods, and by obtaining approval of this document.

7. 6. Method Detection Limit and Sensitivity

The method detection limit is the lowest possible concentration the instrument or equipment can detect. This is important to record because we can never determine that a pollutant was not present, only that we could not detect it. Sensitivity is the ability of the instrument to detect one concentration from the next. Sensitivities are noted in Tables 7.1. - 7.2.

8. **Training Requirements**

Each citizen monitoring sampling team is led by a Team Captain. All Team Captains must participate in at least two hands-on training sessions on monitoring conducted by the Santa Barbara Channelkeeper. Additional training may be aquired through other organizations (e.g., Heal The Bay). The following topics are covered under this training:

- General hydrology
- Ecology
- Safety
- Quality Assurance and Quality Control Measures
- Sampling Procedures
- Field Analytical Techniques
- Data recording.

Team Captains will be trained to train rank-and-file volunteers. Individual trainees are evaluated by their performance of analytical and sampling techniques. By comparing their results to known values, and to results obtained by trainers and other trainees.

In addition to completion of the above-described training course citizen monitoring leaders must participate in semi-annual quality control sessions. These quality control sessions will be supervised by QC trainers, and will provide an opportunity for citizen monitoring groups to check the accuracy and precision of their equipment and testing techniques. Trainers are defined as water quality professionals from the U.S. Environmental Protection Agency, the State Water Resources Control Board, and the Regional Water Quality Control Boards. Additional qualified trainers will be recruited and designated by these agencies from experienced citizen monitoring organizations, universities and colleges, commercial analytical laboratories, and other federal, state, and local agencies.

The monitor will bring VRWMP equipment to the session. The monitor will conduct duplicate tests on all analyses and meet the data quality objectives described in Section 7. If a monitor does not meet the objectives, the trainer will re-train and re-test the monitor. If there is insufficient time at the QC session to re-train and re-test monitors, the monitor will be scheduled for an additional training session. The monitor will be encouraged to discontinue monitoring for the analysis of concern until training is completed.

The quality control trainer will examine kits for completeness of components: date, condition, and supply of reagents, and whether the equipment is in good repair. The trainer will check data quality

by testing equipment against blind standards. The trainer will also ensure that monitors are reading instruments and recording results correctly. Sampling and safety techniques will also be evaluated. The trainer will discuss corrective action with the volunteers, and the date by which the action will be taken. The citizen monitoring leader is responsible for reporting back that the corrective action has been taken. Certificates of completion will be provided once all corrective action has been completed.

9. Documentation and Records

All field results will be recorded at the time of completion, using the data sheets (see Appendix 2). Team Captains will review data sheets for outliers and omissions before leaving the sample site, and will be signed after review by the Monitoring Leader. Data sheets will be stored in hard copy form at the SBCK office. Field sheets are archived for three years from the time they were collected.

If data entry is performed at another location, duplicate data sheets will be used, with the originals remaining at the headquarters site. Hard copies of all data as well as computer back-up disks are maintained at the SBCK office. An additional back-up disk of all electronic data will be stored at an offsite facility.

A maintenance log will also be kept by SBCK. This log details the dates of equipment inspection, battery replacement and calibrations, as well as the dates reagents are replaced. The log, along with other forms detailing the dates of equipment purchase, warranty information, etc., are included in the Santa Barbara Channelkeeper Monitoring Database. This database will be maintained as described above.

10. Sampling Process Design

10.1. Rationale for Selection of Sampling Sites

Sampling sites are indicated on the map in Appendix 3. The following criteria were evaluated when choosing sampling locations:

- access is safe,
- permission to cross private property where applicable,
- sample can be taken in main river current or where homogeneous mixing of water occurs,
- sample is representative of the part of the river of interest,
- location complements or supplements historical data,
- location represents an area that possesses unique value for fish and wildlife or recreational use.

Reference sites are chosen upstream of any potential impact. A site chosen to reflect the impact of a particular discharge, tributary or land use should be located downstream of the impact where the impact is completely integrated with the water, but upstream of any secondary discharge or disturbance.

Prior to final site selection, permission to access the stream is obtained from all property owners. If access to the site is a problem, the citizen monitoring leader will select a new site. Safety issues are included in the Monitoring Handbook.

Volunteers are instructed to work in teams of at least two people. If a scheduled team cannot conduct the sampling together, the available team member will call an additional member.

Sample sites will be periodically reviewed by the leader. A narrative description, photographs, maps and driving directions will be included for each site in the VRWMP monitoring Handbook Sample Design Logistics

10.2. Sample Design Logistics

Volunteers are instructed to work in teams of at least two people. If a scheduled team cannot conduct the sampling together, the team captain is instructed to contact the citizen monitoring leader so that arrangements can be made for a substitute trained volunteer.

Safety measures will be discussed with all volunteers. No instream sampling will be conducted if there are small creek flood warnings or advisories. Gloves and waterless hand cleaner is provided in all field backpacks. It is the responsibility of SBCK to ensure the safety of their volunteer monitors. Safety issues are included in the Ventura Watershed Monitoring Manual.

11. Sampling Method Requirements

The VRWMP Monitoring Handbook describes the appropriate sampling procedure for collecting samples for water chemistry. Whenever possible, the instrument probe will be held directly in the stream. If the procedure requires that a sample be drawn first then samples will be taken by dipping a container into midstream.

Sample containers (that are not pre-sterilized and do not include preservatives/fixing agents) will be rinsed three times with sample water prior to taking each sample. If safety becomes a concern, the collector will sample from a bridge. All samples are taken in mid-stream, at least one inch below the surface. Whenever possible, samples will be collected such that the creek is not disturbed from wading. If it is necessary to wade into the water, the sample collector stands downstream of the sample, taking a sample upstream. If the collector disturbs sediment when wading, the collector will wait until the effect of disturbance is no longer present before taking the sample. All samples will be taken from flowing water unless indicated otherwise.

The following table describes the sampling equipment, sample holding container, sample preservation method and maximum holding time for each parameter.

Table 11.1 Sampling Method Requirements

Parameter	Sampling Equipment	Preservation and Holding Times
Conventional Parameters		
Temperature	plastic or glass container or sample directly	immediately
Dissolved oxygen	measure directly from stream	
pH	plastic or glass container, or sample directly	immediately
Conductivity/TDS	plastic or glass container or sample directly	immediately / refrigerate up to 28 days
turbidity	plastic or glass container	immediately / store in dark for up to 24 hr.

Biological Samples		
Bacteria	125 ml sterile plastic container	refrigerate in the dark; start analysis within 6 hours
Nutrients		
Ammonia	Van Dorn, LaMotte or plastic sampling bottle	immediately
Nitrates	Van Dorn, LaMotte or plastic sampling bottle	immediately / refrigerate in dark for up to 48 hr.
Phosphate	Van Dorn, LaMotte or plastic sampling bottle	Immediately, filter
Laboratory Analysis of Chemical Parameters		
Total Organic Carbon	polyethylene or glass container	Cool to 4°C HC1 or H2SO4 or H3PO4, to pH<2. send to lab immediately. max holding time 28 days.
Metals (Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, Thallium, Zinc)	plastic or glass container	HNO3 to pH<2. send to lab immediately. max holding time 28 days.
Oil and Grease	glass container	Cool to 4°C, HCl or H2SO4 to pH<2. send to lab immediately. max holding time 28 days.
PAH's	glass container, teflon-lined cap	Cool to 4°C, 0.008% Na2S2O3. send to lab immediately. max holding time 7 days until extraction, 40 days after extraction.
Pesticides and other synthetic organic compounds	glass container	Cool to 4°C, pH 5-9. send to lab immediately. max holding time 1 year.

12. Sample Handling and Custody Procedures

12.1. Sample Handling

Identification information for each sample will be recorded on the field data sheets (see Appendix 2) when the sample is collected. Identification information will also be written on the bottle, including Date, Time, Station ID, Sample Number, Name of Person Collecting Sample, and Test Type. The station IDs are recorded in the Monitoring database with all necessary metadata. The Monitoring Leader will keep records of stations covered by each volunteer for each sampling event.

12.2. Custody Procedures

Water quality monitoring tests do not require specific custody procedures since they will, in most cases, be conducted immediately by the same person who performs the sampling. In certain circumstances (such as driving rain or extreme cold), samples may be taken to a nearby residence or residence for analysis. Samples requiring chemical preservations will be fixed prior to transport.

When samples are transferred from a volunteer or from the VRWMP to an outside professional laboratory, then the Chain of Custody form supplied by the lab should be used. This form identifies the waterbody name, sample location, sample number, data and time of collection, sampler's name, and method used to preserve sample (if any). It also indicates the date and time of transfer, and the

name and signature of the sampler and the sample recipient. In cases where the sample remains in the custody of SBCK, then the sample collection field data sheet may be allowed to double as the chain of custody form.

When a sample leaves the custody of SBCK, then the Chain of Custody form used will be the one provided by the outside professional laboratory. Similarly, when a professional lab performs quality control checks, their samples will be processed under their chain of custody procedures with their labels and documentation procedures.

12.3. Disposal

All analyzed samples including used reagents, buffers or standards will be collected in a plastic bottle clearly marked "Waste" or "Poison". This waste material will be disposed of according to appropriate state and local regulations.

Liquid waste from the cadmium reduction nitrate test will be kept separate and disposed of at a facility that is permitted to handle, transport, or dispose Cadmium waste. Waste from the salicylate ammonia test can be held in the regular waste container and disposed of as described in the previous paragraph.

13. Analytical Methods Requirements

Water chemistry is monitored using protocols outlined in the VRWMP Monitoring Handbook. The methods were chosen based on the following criteria:

- capability of trained staff and volunteers to use methods,
- methods that will produce data of known quality,
- ease of use,
- methods can be compared to professional methods in *Standard Methods*.

If modifications of methods are needed, comparability will be determined by side-by-side comparisons with a US EPA or APHA Standard Method on no less than 50 samples. If the results meet the same precision and accuracy requirements as the approved method, the new method will be accepted.

Table 13.1 outlines the methods to be used, any modifications to those methods, and the appropriate reference to a standard method.

Table 13.1. **Analytical Methods for Water Quality Parameters**

Parameter	Method	Modification	Reference (a)
Temperature	Thermometric	Mercury-filled thermometer marked in 1.0 ^{o}C increments	2550 B.
Dissolved Oxygen	Membrane Electrode	None	4500-O G.
pH	Electrometric	None	4500-H B.
Conductivity/TDS	Electrometric	None	2520 B.
Turbidity	Nephelometric	None	None
Total Coliform Bacteria	Colilert 18 hour	None	9223
E. coli Bacteria	Colilert 18 hour	None	9223
Enterococcus Bacteria	Enterolert 24 hour	None	IDEXX Corp.

All of the above cited methods, with the exception of enterococcus bacteria, are described in Standard Methods for the Examination of Water and Wastewater, prepared and published jointly By American Public Health Association, American Water Works Association, Water Environment Federation, 20th edition, Washington, DC : American Public Health Association, 1998. *Enterolert* is an official ASTM method (#D6503-99).

14. Quality Control Requirements

Quality control samples will be taken to ensure valid data are collected. Depending on the parameter, quality control samples will consist of field blanks, replicate samples, or split samples. In addition, quality control sessions (a.k.a. intercalibration exercises) will be held twice a year to verify the proper working order of equipment, refresh volunteers in monitoring techniques and determine whether the data quality objectives are being met.

Observational data sheets have few numerical values, therefore are difficult to standardize. We will conduct a Quality Control Session for Observational Data collection at least once a year. At least 3 volunteers and one Team Leader will separately fill out a data sheet, and will compare results. Any deviations will be discussed.

Flow measurements will be compared to data collected by Ventura County Flood Control staff gauges where possible. At least once a year, we will measure flow using our 'orange peel' technique in a side-by side comparison with an actual flow meter. Past tests indicate that our technique produces data within 15% of manual and electronic flow meters.

14.1. Blanks, Replicates, Duplicates, Split Samples and Standardization

Table 14.1 describes the quality control regimen.

Our methodology includes blanks, duplicate /replicate samples, split samples, trip blanks, and temperature blanks.

Field/Laboratory Blanks: For turbidity and specific chemical analysis (see Table 14.1) performed in the field Field blanks (a.k.a. reagent blanks) will be taken once every 20 samples, or quarterly whichever comes first except for nutrient sampling.

For bacterial analysis performed at SBCK, a laboratory blank will be performed for each sampling/analysis event. If more than 50 samples are expected in one day, an additional blank will be analyzed.

Instructions for Field and Lab Blanks: Distilled water is taken into the field or used in the laboratory and handled just like a sample. It will be poured into the sample container and then analyzed. Field blanks are recorded on the normal sampling datasheet. For bacterial analysis, the reagents are added to distilled water (in the same manner as for a field sample) and that "blank" is then sealed in a quantitray and incubated along with the field samples. The blank should be below detection limits at the end of the incubation period.

Replicate/Duplicate Field Samples: Replicate samples are 2 or more samples collected at the same time and place. When there are only two replicates, they are referred to as duplicates. These samples are collected for checking the preciseness of the sampling process. For chemical, physical, and bacterial analysis duplicate field samples will be taken at one randomly chosen site at every sampling event (monthly). Replicate samples are collected at the same time and from the same source as the study samples.

Split Samples: These samples are taken to check analytical performance. The sample is taken in one container, mixed thoroughly, and split into another container. Both halves are now samples that represent the same sampling point. One half will be analyzed as usual by SBCK, the other will either be sent to a certified lab or to another monitoring organization (e.g. Heal The Bay).

Spiked Split Samples: Twice a year, split spiked samples (standards) will be analyzed as part of the Quality Control (Intercalibration) Session. These split samples will contain a known concentration of a standard analyte. Split standards will be analyzed by the volunteers, and sent to a professional laboratory (except for dissolved oxygen, temperature, and pH), before the maximum sample handling time is exceeded. Volunteers will analyze the split standard normally and will perform at least three analyses on that same sample. From these results accuracy and precision will be determined. The professional laboratory will analyze the sample using the method referenced in Table 13.1

For turbidity, split field samples will be analyzed as part of the QC session. The two results will be compared to ensure proper use, calibration and function of the turbidimeter.

For bacteria, split field samples or split positive controls will be analyzed by the citizen monitoring group and an outside professional laboratory twice annually. In addition, at the intercalibration session different analysts from the citizen monitoring group(s) will each read a minimum of the three quantitrays and compare their results. These results should be within $\pm$ one well for concentrations of less than 1000 MPN/100 ml, and within $\pm$ two wells for concentrations of greater than 1000 MPN/100ml.

Trip Blanks: Twice a year, trip blanks will be analyzed in-house along with the collected bacteria and nutrient samples. These blanks consist of sample bottles filled with distilled water that are taken into the field with the sealed sample bottles, and then are brought back and analyzed along side the collected samples.

Temperature Blanks: Twice a year, temperature blanks will be tested to ensure proper storage of sample bottles. Temperature blanks consist of sample bottles filled with distilled water that are taken into the field and kept inside the cooler along with the samples obtained in the field. Before sample analysis, the temperature of the blank is measured to ensure that samples are at or below 4°C.

Table 14.1. **Summary of Quality Control Requirements**

Parameter	Blank	Duplicate Sample	Split Sample to lab	QC session (intercal.)
Misc.				
Site Observations	none	Compare volunteer obs. with Team leader obs.		Once a year
Flow	none	Perform technique and compare with flowmeter		Once a year
Water quality				
Temperature	none	5% or a minimum of once a year	none	twice a year
Dissolved oxygen	none	5% or a minimum of once a year	none	twice a year
pH	none	5% or a minimum of once a year	none	twice a year
conductivity	5%	5% or a minimum of once a year	twice a year	twice a year
turbidity	5%	5% or a minimum of once a year	twice a year	twice a year
Nutrients (colorimeters or spectrophotometers)				
Ammonia	daily	5% or a minimum of once a year	twice a year	twice a year
Nitrate	daily	5% or a minimum of once a year	twice a year	twice a year
Phosphate	daily	5% or a minimum of once a year	twice a year	twice a year
Biological Parameters				

Total & E. Coli	daily	5% or a minimum of once a year	twice a year	twice a year
Enterococcus	daily	5% or a minimum of once a year	twice a year	twice a year

15. Instrument/Equipment Testing, Inspection and Maintenance Requirements

The SBCK group leader keeps an instrument, methodology and calibration log. These logs record the dates of instrument and sampling gear purchase, inspection, calibration, battery replacement, the dates reagents and standards are replaced, and any problems noted with instruments, samples or reagents. Instruments are calibrated within a day of the monitoring event, except for the pH meters that are calibrated immediately beforehand. Calibration information is recorded on the datasheets.

15.1. Temperature

Before each use, thermometers are checked for breaks in the column. If a break is observed, the alcohol thermometer will be placed in nearly boiling water so that the alcohol expands into the expansion chamber, and the alcohol forms a continuous column. Verify accuracy by comparing with a calibrated or certified thermometer.

15.2. Dissolved oxygen

Before each use, DO meters are checked to see if they are clean and in good working order. Membranes are replaced each month before the scheduled sampling event, according to manufacturer's recommendation.

15.3. pH and conductivity

Before each use, pH and conductivity meters are checked to see if they are clean and in good working order. pH and conductivity meters are calibrated before each use. pH buffers and conductivity standards are replaced at least annually. Conductivity standards are stored with the cap firmly in place and in a dry place kept away from extreme heat. Do not re-use pH or conductivity standards.

15.4. Turbidity

Turbidity meters are calibrated to two standards each month. The turbidity standard will be replaced annually. Before each use, turbidity tubes are checked to ensure that they are clean. Wipes for removing smudges and fingerprints are supplied in each case.

16. Instrument Calibration and Frequency (chemical and physical parameters)

Instruments will be calibrated accordingly to the following schedule. Standards will be purchased from a chemical supply company or prepared by a laboratory certified by U.S. EPA for chemical analysis of water or wastewater. Calibration records will be kept at the SBCK office, where they can be easily accessed before and after equipment use.

Table 16.1. Instrument Calibration and frequency

Conventional Water quality Parameters

Equipment Type	Calibration Frequency	Standard or Calibration Instrument Used
Temperature	Every 6 months	NIST calibrated or certified thermometer

Dissolved Oxygen meter	Calibrated to elevation at each sampling site	At a minimum, water saturated air, according to manufacturer's instructions.
pH	Every sampling day	pH buffer 7.0 and 10.0
conductivity	Every sampling day	conductivity standard 700 µS and 2060 µS
Turbidity meter (nephelometer)	Every sampling day	For clear ambient conditions use an 1.0 NTU standard, for turbid conditions use an 10.0 NTU standard

17. Inspection/Acceptance Requirements

Upon receipt, buffer solutions, standards, and reagents used in the field kits will be inspected by the citizen monitoring leader for leaks or broken seals, and to compare the age of each reagent to the manufacturer's recommended shelf-life. All other sampling equipment will be inspected for broken or missing parts, and will be tested to ensure proper operation.

Before usage, thermometers are inspected for breaks. Breaks can be eliminated by heating (see Section 15.1). If not, they will be returned to the manufacturer.

Reagents are replaced before they exceed manufacturer's recommended shelf life. These shelf lives are typically one to two years. However, specific replacement dates can determined by providing the reagent lot number to the Hach Company by phone at (800) 227-4224. Reagent replacement dates are noted in the maintenance log.

18. Data Acquisition Requirements

18.1. Professional Analytical Data

Only certified analytical laboratories or academic laboratories (with approval of State and/or Regional Board staff) will be used for quality assurance checks. The Technical advisory Committee (TAC) or technical advisors will review these laboratories' data as well as the volunteers. They may also review the lab's own quality control data to ensure data validity.

18.2. Geographical Information/ Mapping

The discrete location of each sampling site will be mapped by SBCK with a hand-held GPS unit. USGS maps will be used to verify watershed boundaries and river courses. Photo catalogues of each sampling station are maintained by the monitoring leader. Additional information on distribution of natural resources will be obtained from the National Park Service and the CDFG's Biodiversity database. Land use information will be obtained from local planning offices. When information is requested, the agency will be asked to provide appropriate megadata and any information on data limitations. This information will be maintained with the data files.

19. Data Management

Field data sheets are checked for completeness in the field by each Team Captain before leaving each site. The citizen monitoring leader will identify any results where holding times have been exceeded, sample identification information is incorrect, samples were inappropriately handled, or calibration information is missing or inadequate. Such data will be marked as unacceptable by the monitoring leader and will not be entered into the electronic database.

Independent laboratories will report their results to Santa Barbara Channelkeeper. Monitoring leaders will verify sample identification information, review the chain-of-custody forms, and identify the data appropriately in the database. These data are also reviewed by the technical advisors quarterly.

The data management coordinator will review the field sheets and enter the data deemed acceptable by the citizen monitoring leader and the technical advisors. Data will be entered into either a spreadsheet or a database, or both. Once the data is entered, the data sheets will be archived. The data coordinator will review electronic data, compare to the original data sheets and correct entry errors. After performing data checks, and ensuring that data quality objectives have been met, data analysis will be performed.

Raw data will be provided electronically to the California SWB and Los Angeles RWB at least once every two years so that it can be included in the 305(b) report. Appropriate quality assurance information may be provided upon request.

20. Assessment and Response Actions

Review of all field and data activities is the responsibility of the citizen-monitoring leader, with the assistance of the technical advisory committee. Volunteers will be accompanied by the citizen monitoring leader or a technical advisor on at least one of their first 5 sampling trips. If possible, volunteers in need of performance improvement will be retrained on-site. If errors in sampling technique are consistently identified, retraining may be scheduled more frequently. Volunteers' ability to perform sampling will be continuously reviewed by the monitoring leader.

Annually, SWRCB staff, or its designee, will evaluate field and laboratory performance and provide a report to the citizen monitoring group. All field and laboratory activities, and records may be reviewed by state and EPA quality assurance officers as requested.

21. Reports

The technical advisors will review draft reports to ensure the accuracy of data analysis and data interpretation. Raw data will be made available to data users per their request**.** SBCK will report their data to their constituents after quality assurance has been reviewed and approved by their technical advisors. Every effort will be made to submit data and/or a report to the SWRCB and/or RWQCB staff in a fashion timely for their data uses, e.g. 305(b) report or special watershed reports.

22. Data Review, Validation and Verification

Data sheets or data files are reviewed twice a year by the technical advisors to determine if the data meet the Quality Assurance Project Plan objectives. They will identify outliers, spurious results or omissions to the citizen monitoring leader. They will also evaluate compliance with the data quality objectives. They will suggest corrective action that will be implemented by the citizen monitoring leader. Problems with data quality and corrective action will be reported in final reports.

23. Validation and Verification Methods

As part of standard field protocols, any sample readings out of the expected range will be reported to the citizen monitoring leader. A second sample will be taken as soon as possible to verify the condition. If the data is invalid, then the point will be noted (flagged) on the datasheet. We will take further actions to trace the sources of error, and to correct these problems. If the error is a result of improper monitoring procedures, then we may re-train volunteer monitors until their performance is acceptable. It is the responsibility of the citizen monitoring leader to re-train volunteers until performance is acceptable.

24. Reconciliation with Data Quality Objectives

The Technical Advisory Committee working with the Volunteer Leader will review data at least twice a year to determine if the data quality objectives (DQOs) have been met. They will suggest corrective action. If data do not meet the project's specifications, the following actions will be taken. First, the technical advisors will review the errors and determine if the problem is equipment failure, calibration/maintenance techniques, or monitoring/sampling techniques. If the problem cannot be corrected by training, revision of techniques, or replacement of supplies/equipment, then the technical advisors and the TAC will review the DQOs and determine if the DQOs are feasible. If the specific DQOs are not achievable, they will determine whether the specific DQO can be relaxed, or if the parameter should be eliminated from the monitoring program. Any revisions to DQOs will be appended to this QA plan with the revision date and the reason for modification. The appended QA plan will be sent to the quality assurance panel that approved this plan. When the appended QA plan is approved, the citizen monitoring leader will work with the data coordinator to ensure that all data meeting the new DQOs are entered into the database. Archived data can also be entered.

APPENDIX 1. Data Quality Forms

Data Quality Form: Accuracy — Quality Control Session

Ventura River Watershed Monitoring Program Team #_____	Type of Session (field or lab)
Your Name	Quality Assurance Leader
Date	

Parameter/ units	Sensitivity	Accuracy Objective	Standard Conc.	Analytical Result	Estimated Bias	Meet Objective? Yes or No	Corrective action planned	Date Corrective Action taken
Temperature °C								
Dissolved Oxygen (mg/l)								
pH standard units								
Conductivity (µmhos/cm)								

Comments:

Data Quality Form: Completeness — Quality Control Session

Ventura River Watershed Monitoring Program Team #_____			Type of Session (field or lab)	
Your Name			Quality Assurance Leader	
Date				
Parameter	**Collection Period**	**No. of Samples Anticipated**	**No. Valid Samples Collected and Analyzed**	**Percent Complete**
Temperature °C				
Dissolved Oxygen (mg/l)				
pH standard units				
Conductivity (µmhos/cm)				

Comments:

Data Quality Form: Precision — Quality Control Session

Ventura River Watershed Monitoring Program Team #_____	Type of Session (field or lab)
Your Name	Quality Assurance Leader
Date	

Parameter/ units	Mean (x)	Standard Deviation (s.d.)	s.d./x	Precision Objective	Meet Objective? Yes or No	Corrective action planned	Date Corrective Action taken
Temperature °C							
Dissolved Oxygen mg/l							
pH standard units							
Conductivity (µmhos/cm)							

Comments:

APPENDIX 2. Data and Observation Sheets

Stream Team Water Chemistry Testing

Site Conditions Field Sheet

Date:_____ Site Number:_____ Location:_____

Time:_____ Team 1 2 3 Recorder:_____

Team members:

Weather Conditions:

Clear ☐ Partly Cloudy☐ Overcast☐ Showers ☐ Rain☐ other_____

Wind speed and direction (est.)_____

Starting Air Temperature _____C / F at _____am / pm @ **start** of testing

Ending Air Temperature _____C / F at _____am / pm @ **end** of testing

Comments:

Type of Flow:

None ☐ intermittent ☐ trickle ☐ steady ☐ heavy☐ flooding☐

Comments:

PROPERTIES OF STREAM

Water Clarity:

clear☐ cloudy☐ milky☐ muddy☐ other_____

Water Color:

clear☐ red ☐ brown☐ yellow☐ green☐ grey☐ other_____

Odors:

none ☐ rotten eggs☐ sewage☐ chlorine ☐ musty☐ ammonia☐ other_____

Floatables:

none ☐ oily sheen (rainbow colored) ☐ garbage☐ sewage☐ other_____

Biological Floatables:

algae suspended ☐ only on rocks☐ est.% coverage in stream_____ color_____

foam color_____ height_____ %coverage_____ consistency_____

comments:

DEBRIS

Density of Trash in general site area:

None ☐ Light☐ Moderate ☐ High ☐ Approx. # of pieces_____

Type of Trash: (% type of item)

_____% organic (food items) _____% plastics

_____% Recyclables (non plastic) _____%large items (cars, appliances, etc.)

comments:

Density of trash on stream banks or in water:

None ☐ Light ☐ Moderate ☐ High ☐ Approx. # of pieces_____

Type of Trash: (% type of item)

_____% organic (food items) _____% plastics

_____% Recyclables (non plastic) _____%large items (cars, appliances, etc.)

comments:

Stream Team Water Chemistry Testing

Chemical Parameters Field Sheet

Date:_____ Site Number:_____ Site Name:_____

Time:_____ Team 1 2 3 Name of Recorder:_____

List all Team members:

_____

_____

***** For all parameters Take THREE readings in different (but similar) stretches of stream*****

Dissolved Oxygen calibrate to Site Elevation:_____ Comments:_____

reading	Mg/L	% Saturation	Water Temp	Time	Name of Sampler
1					
2					
3					

pH: take 3 measurements, please from stream☐ or sample bottle☐

1._____ 2._____ 3._____ Sampler Name:_____

TURBIDITY (TSS): *make sure bottle is clean and aligned properly!
Fill two Sample Vials, take three readings each. Units are in NTU

Vial#1 1._____ 2._____ 3._____ Sampler:_____
Vial#2 1._____ 2._____ 3._____ Sampler:_____

CONDUCTIVITY and TDS: These are two different parameters, with the same instrument.
** press the MODE button once to get TDS readings (ppm or ppt), and twice to get back to CONDUCTIVITY
* if screen reads 9.99 or 99.9, etc., the instrument may not be auto-adjusting the range. Try pressing "range"

Readings taken from stream ☐ *or* from sample bottle ☐ Sampler Name_____

Conductivity (Circle) **uS** or **mS**	**Water temp C / F**	**Time am / pm**	**TDS** (circle) **ppm** or **ppt**
1._____	_____	_____	_____
2._____	_____	_____	_____
3._____	_____	_____	_____

COLLECT SAMPLE FOR NUTRIENT TESTING: ☐ bottle #____ time collected_____
time put on ice_____ Relinquished by:_____ time:_____

COLLECT SAMPLE FOR BACTERIA: ☐ bottle #_____ time collected:_____
time put on ice_____ Relinquished by:_____ time:_____

Sample bottles received by:_____ time:_____

Comments:

Stream Team Water Chemistry Testing

Stream Flow

Velocity and cross sectional area of the stream need to be determined in order to calculate stream flow. The data you gather will be helpful in understanding the relationship between stream flow, sedimentation, dissolved oxygen, and pollution concentrations. The results after calculation will be stream flow in Cubic Feet per Second (CFS).

Team #: _____

Date: _____ **Site #_____ Site Name: _____**

Time: _____ **Recorder: _____**

UPSTREAM Wetted Width of Stream _____ (feet, inches)

Cross Sectional Area (measure points at every foot across width of stream, start at opposing side)

Point #	depth	Point #	depth	Point #	depth	Point #	depth
1		11		21		31	
2		12		22		32	
3		13		23		33	
4		14		24		34	
5		15		25		35	
6		16		26		36	
7		17		27		37	
8		18		28		38	
9		19		29		39	
10		20		30		40	

DOWNSTREAM Wetted Width of Stream _____ (feet, inches)

Cross Sectional Area (measure points at every foot across width of stream, start at opposing side)

Point #	depth	Point #	depth	Point #	depth	Point #	depth
1		11		21		31	
2		12		22		32	
3		13		23		33	
4		14		24		34	
5		15		25		35	
6		16		26		36	
7		17		27		37	
8		18		28		38	
9		19		29		39	
10		20		30		40	

Velocity Float Trials length of reach (distance along stream) _____should be 20ft

Trial#	1	2	3	4	5
Time					

comments:_____

_____

APPENDIX 3. Map of Sampling Sites

VENTURA RIVER DRAINAGE AREA