BASMAA

Regional Monitoring Coalition

Creek Status Monitoring Program
Standard Operating Procedures

Prepared for:

The Bay Area Stormwater Management Agencies Association (BASMAA)

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TABLE OF CONTENTS

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP.

This compilation of standard operating procedures (SOPs) is part of the RMC's regional coordination effort. SOPs are provided to support effective implementation of the various monitoring activities specified for creek status monitoring in MRP Table 8.1.

The purpose of this SOP compilation is to provide RMC participants with a common basis for application of consistent monitoring protocols across jurisdictional boundaries. These protocols form part of the RMC's quality assurance program, to help ensure validity of resulting data and comparability with the state of California's Surface Water Ambient Monitoring Program (SWAMP) protocols.

These SOPs complement the comprehensive Quality Assurance Project Plan (QAPP) developed by the RMC to address the Table 8.1 requirements, covering procedures for bioassessment monitoring as well as various other means of water quality monitoring.

List of Acronyms

ASTM	American Society for Testing and Materials
BASMAA	Bay Area Stormwater Management Agencies Association
CCCWP	Contra Costa Clean Water Program
CEDEN	California Environmental Data Exchange Network
CIMCC	Central Information Management Coordinator
CQAO	Central Quality Assurance Officer
CWA	Clean Water Act
CWP	Clean Water Program of Alameda County
DMT	Data Management Team
DOC	Dissolved Organic Carbon
DQO	Data Quality Objective
EDD	Electronic Data Deliverable
EPA	Environmental Protection Agency (U.S.)
FC	Field Crew
FSURMP	Fairfield-Suisun Urban Runoff Management Program
IATA	International Air Transport Association
IDL	Instrument Detection Limits
IDW	Investigation-Derived Waste
IMC	Information Management Coordinator
LIMC	Local Information Management Coordinator
LPM	Laboratory Project Manager
LQAO	Local Quality Assurance Officer
MCC	Creek Status Monitoring Coordinator
MDL	Method Detection Limit
MPC	Monitoring and Pollutants of Concern Committee
MQO	Measurement Quality Objective
MRP	Municipal Regional Permit
NPDES	National Pollutant Discharge Elimination System
OC	Organochlorine
OERR	Office of Emergency and Remedial Response
PAH	Polycyclic Aromatic Hydrocarbon
PBDE	Polybrominated Diphenyl Ether
PCB	Polychlorinated Biphenyl
PM	Program Manager
PML	Stormwater Program Local Project Managers
PPE	Personal Protective Equipment
QA	Quality Assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
QC	Quality Control
RL	Method Reporting Limit
RMC	Regional Monitoring Coalition
RMP	Regional Monitoring Program for Water Quality in the San Francisco Estuary
RP	Report Preparer
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SMSTOPPP	San Mateo Countywide Stormwater Pollution Prevention Program
SOP	Standard Operating Procedure
SSC	Suspended Sediment Concentration
SWAMP	California Surface Water Ambient Monitoring Program
TOC	Total Organic Carbon
TMDL	Total Maximum Daily Load
USA	Unified Stream Assessment
VSFCD	Vallejo Sanitation and Flood Control District

STANDARD OPERATING PROCEDURES
for
BMI and Algae Bioassessments and Physical Habitat Assessments
(SOP FS-1)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This standard operating procedure (SOP) is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:

Biological Assessment

SOP Background and Application

This document is intended to summarize how the RMC will apply existing Surface Water Ambient Monitoring Plan (SWAMP) SOPs for benthic macroinvertebrate and algae bioassessments to specifically meet monitoring requirements identified in the MRP. These SOPs also document field procedures for bioassessments, including physical habitat assessments, but do not include the laboratory SOPs for the processing and identification of benthic macroinvertebrates or algae organisms. However, measurement quality objectives (MQOs) for BMIs have been documented in the Quality Assurance Project Plan (QAPP) for bioassessment data collection in Southern California (SCCWRP 2009). SWAMP is planning to develop laboratory SOPs for BMIs in 2012 and laboratory SOPs in 2013.

References to Existing SOPs

This SOP is based on information provided in two separate SOPs developed by SWAMP:

(1) **Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California,** February 2007 (Ode 2007)

(2) **Standard Operating Procedures for Collecting Stream Algae Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California,** May 2010 (Fetscher et al. 2010).

(3) **Standard Operating Procedures for Laboratory Processing and Identification of Benthic Macroinvertebrates in California,** October 2012 (Woodward et al. 2012).

Relevant QA/QC protocols are also referenced in the associated RMC QAPPs for bioassessment and water quality monitoring: **BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan**, version 2, January 2014 (BASMAA 2014).

Special Cautions and Considerations; Health and Safety

Proper gloves must be worn to both prevent contamination of the sample and to protect sampling personnel from environmental hazards. The user should wear at least one layer of gloves, but two layers help protect against leaks. All gloves must be powderfree. Disposable polyethylene, nitrile, or non-talc latex gloves are acceptable for many types of sampling; however, samples for low level metals and mercury analysis can only be collected and handled using polyethylene gloves as the outer layer.

CAUTIONS

When conducting sampling in areas of unknown water quality, especially in waters that are suspected to contain hazardous substances, bacteria, or viruses, it is preferable that at least one layer of gloves be of shoulder length, to limit skin contact with the source water.

Proper eye, hand and body protection should be worn at all times when working with preservatives to fix biological samples. Glutaraldehyde should never be transported into the field and during fixation of samples, be used only under a laboratory fume hood. Formalin should be properly sealed and stored during field sampling and fixation of samples should occur in a well-ventilated area. Refer to Appendices D and E in Fetcher et al. (2010) for detailed SOPs on the use of glutaraldehyde and formalin.

When using chemical cleaners, as required as part of the equipment cleaning and decontamination protocols (see SOP FS-7, Field Equipment Cleaning Procedures and SOP FS-8, Field Equipment Decontamination Procedures), always read the product label and adhere to all printed cautions and safety measures.

Methods / Procedures

Bioassessments conducted as part of the RMC Ambient Creek Status Monitoring Program will consist of the collection of benthic macroinvertebrate and algae samples. Physical habitat assessments will consist of the measurement of physical parameters related to BMI habitat, physical water quality and collection of water samples for analyses of nutrients and other constituents. Bioassessments will be conducted one time each year during spring index period (approximately April 15 – July 15), with the goal of assessing all sites within a two month period each year. To the extent practical, the RMC will conduct sampling approximately 30 days following any significant storm event that occurs during the index period or prior to the start of the index period.

TRAINING

All field crews will be required to be trained in sampling procedures described in both BMI and Algae Bioassessment SOPs. It is strongly recommended that crews contain no fewer than three members because the RMC measures several indicators at each site

(i.e., BMI and benthic algae communities, physical habitat and water chemistry). Inadequate staffing of field crews is one of the most common sources of data errors, and may result in costly corrective actions or data deficiencies. Bioassessment training is offered several times each year by the California Department of Fish and Wildlife (CDFW). Crew chiefs are responsible for ensuring the safety of the crew and must use his or her discretion to terminate sampling if conditions become unsafe.

Laboratory analysis requires years of experience and mentoring by a qualified taxonomist. Although there are no current training requirements associated with laboratory personnel, it is strongly recommended that all benthic macroinvertebrates taxonomists become a member of the Southwest Association of Freshwater Invertebrate Taxonomists (www.SAFIT.org). Membership in organizations like SAFIT offers several benefits to project participants, such as opportunities for continuing education, taxonomic workshops, reviews of current literature, and intercalibration exercises. Taxonomists are expected to participate in at least one taxonomic workshop focusing on benthic macroinvertebrates per year. Similar requirements for training will be applied to RMC contracted algal taxonomists when laboratory protocols and training workshops become available.

SITE SELECTION

The RMC will be applying a probabilistic monitoring design to identify bioassessment sampling locations for the Ambient Creek Status Monitoring Program. Sample sites will be selected using the Generalized Random Tessellation Stratified (GRTS) approach from a sample frame that consists of a stream network geographic information system (GIS) data set within the RMC boundary. The RMC sampling frame includes non-tidally influenced perennial and non-perennial creeks within five management units representing areas managed by the storm water programs associated with the RMC. The sample frame was stratified by management unit to ensure that a predetermined number of sites would be sampled by each Program to meet requirements described in Table 8.1 of the MRP. In addition, the sampling frame was weighed so approximately 80% of sites would occur in urban land use and 20% of sites in non-urban land use.

All potential sites will be evaluated using the RMC Ambient Creek Status Monitoring Site Evaluation SOP (FS-12) to ensure site criteria defining "targeted, sampleable" are met. These criteria include site accessibility and stream characteristics that satisfy conditions that are applicable to the sampling protocols. Evaluations will be conducted in the field to ensure each site meets the criteria. It is recommended that sites are evaluated once during the fall season to conduct a field evaluation of site access issues and document flow status. In some cases, a second site evaluation may need to be conducted during the spring, prior to sampling events, to confirm site is sampleable (i.e., site has flowing water or is wadeable). During the site evaluations, the location of the monitoring reach may be modified (within 300 meter length of stream) following criteria provided in FS-12.

MOBILIZATION

The field equipment to be mobilized by field personnel in advance of deployment is provided in each of the following SOPs:

- Benthic macroinvertebrate SOP: Section1, Table 2 (Ode 2007)
- Algae SOP: Appendix A (Fetcher et al. 2010)
- Site access materials (maps, directions, keys, permits)

Prior to field sampling, all sampling equipment must be decontaminated following procedures described in RMC SOP FS-8, Field Equipment Decontamination Procedures.

Check with contract labs to ensure field staff has proper sampling containers and is familiar with all sample storage and transportation requirements.

REACH DELINEATION

Once in the field, the first task will be to delineate the monitoring reach. The standard BMI and algae sampling layout consists of a 150 m reach (streams $\leq$ 10 m) or a 250 m reach (streams > 10 m). The reach length may be less than 150 m for sites where standard reach length is constrained by factors related to site access or potentially significant changes to water quality (e.g., storm drain outfall or tributary confluence).

The reach length is divided into 11 evenly spaced main transects, and 10 inter-transects (between each of the main transects), for a total of 21 transects per monitoring reach. Transects should be perpendicular to the flow direction. Each transect is marked with flagging. It is important to limit the amount of disturbance to the streambed while delineating the reach.

Fill out all pertinent information on field data sheets or field computer data entry form, including GPS coordinates, site information, reach length, and notable field conditions.

WATER CHEMISTRY

When possible, general water quality is measured, and water samples are collected or tested, at the downstream end of the bioassessment reach. An alternative sampling location within the reach should be selected when channel conditions do not permit access to the downstream end of the reach without disturbing the creek and potentially affecting water quality samples. At each location, general water quality (temperature, pH, specific conductance and dissolved oxygen) will be measured following RMC SOP FS-3, Performing Manual Field Measurements. Water samples will be collected for analyses of nutrients, silica, chlorine (free and total), TOC and suspended sediment concentrations following RMC SOP FS-2, Manual Collection of Water Samples for Chemical Analysis, Bacteriological Analysis, and Toxicity Testing.

COLLECT SAMPLES

Each bioassessment sampling site consists of an approximately 150-meter stream reach that is divided into 11 equidistant transects placed perpendicular to the direction of flow.

The sampling positions within each transect alternate between 25%, 50% and 75% the distance of the wetted width of the stream. Benthic macroinvertebrates (BMIs) will be collected from a 1 ft^2 area approximately 1 m downstream of each transect. The benthos is disturbed by manually rubbing coarse substrate followed by disturbing the upper layers of substrate to a depth of 4-6 inches to dislodge any remaining invertebrates into the net. Slack water habitat procedures will be used at transects with deep and/or slow moving water (Ode 2007). In cases where filamentous algae occurs in the water column above the sampling location, the algae will be collected, gently squeezed to remove excess water, and placed into sampling jars along with benthos. Material collected from the eleven subsamples are composited in the field by transferring entire sample into one to two 1000 ml wide-mouth jar(s) and preserved with 95% ethanol.

Filamentous algae and diatoms will be collected using the Reach-wide Benthos (RWB) method described in Fetscher et al. (2009). Algae samples will be collected synoptically with BMI samples. The sampling position within each transect is the same as used for BMI sampling, however, algae samples will be collected ¼ m upstream of the BMI sampling area and after BMI collection.

The algae will be collected using a range of methods and equipment, depending on the particular substrate occurring at the site (i.e., erosional, depositional, large and/or immobile, etc). Erosional substrates included any material (substrate or organics) that is small enough to be removed from the stream bed, but large enough in size to isolate an area equal in size to a rubber delimiter (12.6 cm^2 in area). When a sample location along a transect is too deep to sample, a more suitable location will be selected along the same transect. Algae samples will be collected at each transect prior to moving on to the next transect.

Sample material (substrate and water) from all eleven transects is combined into a sample bucket, agitated, and a suspended algae sample is poured into a 500 mL cylinder, creating a composite sample for the site. A 45 mL subsample is taken from the algae composite sample and combined with 5 mL glutaraldehyde into a 50 mL sample tube for taxonomic identification of soft algae. Similarly, a 40 mL subsample is extracted from the algae composite sample and combined with 10 mL of 10% formalin into a 50 mL sample tube for taxonomic identification of diatoms. Laboratory processing includes the identification and enumeration of 300 natural units of soft algae and 600 diatom valves to the lowest practical taxonomic level.

The algae composite sample is also used for collection of chlorophyll a and ash free dry mass (AFDM) samples following methods described in Fetscher et al (2009). For chlorophyll a sample, 25 mL of the algae composite volume will be removed and run through glass fiber filter (47 mm, 0.7 um pore size) using a filtering tower apparatus. The AFDM sample is collected using a similar process using pre-combusted filters. Both samples are placed in whirlpaks, covered in aluminum foil and immediately placed on ice or dry ice for transportation to laboratory.

PHYSICAL HABITAT ASSESSMENT

Physical habitat assessments (PHAB) incorporate quantitative and qualitative measurements taken at each of the 11 transects and 10 inter-transects. RMC will collect PHAB measurements following procedures defined in the BASIC level of effort (Ode 2007), with the following exceptions as defined in the FULL level of effort (as prescribed in the MRP): stream depth and pebble count + CPOM, cobble embeddedness, discharge measurements and in-stream habitat score. In addition, the percent algal cover (measured during point intercept with pebble count), will be measured at each transect. The RMC crew will also assess the Human Disturbance Index (HDI) (not a MRP requirement) at each transect. The HDI scoring will be done within the creek during the physical habitat assessment and will not involve additional desktop analysis or upland investigations.

DEMOBILIZATION

Before leaving the sampling site, field personnel should perform the following tasks:

- Review datasheets to ensure they are complete and legible,
- Preserve samples as described in SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures,
- Ensure that all containers are capped tightly and stored in an upright position to prevent leaking. Algae samples should be placed in cooler on double bagged cubed ice (per SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures),
- All flagging marking each transect are removed from sample reach,
- Verify that all sampling-related materials and equipment have been collected, and
- Clean sampling equipment as described in SOP FS-7, Field Equipment Cleaning Procedures, and decontaminate equipment as described in SOP FS-8, Field Equipment Decontamination Procedures before sampling at a new site.

Chain of Custody Forms

Every set of samples delivered to a laboratory must contain a complete Chain of Custody (COC) Form that lists all samples collected, the date/time of collection for each sample, and the analyses to be performed on those samples, as well as any special instructions to the laboratory (see SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures). A separate COC is required for each laboratory, for every shipment of samples. Electronic COCs may also be emailed to analytical laboratories, but the COCs must be sent before the samples arrive at their destinations. The original COC sheet (not the copies) is included with the shipment to the laboratory (inserted into a zip-top bag for protection), and the sampling crew retains a copy.

Sample Delivery and Shipping

After collection, biological samples are submitted to the respective analytical laboratories in containers as identified in SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures. Samples should be delivered to the analytical laboratory as soon as possible after conclusion of sampling activities, but always sufficiently within sample

hold time requirements (see SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures). Shipping personnel should pay particular attention to the regulations regarding shipment of dangerous goods as applicable.

Quality Assurance / Quality Control

Performance-based MQOs and protocols have been established for benthic macroinvertebrate bioassessments in the SMC Bioassessment QAPP (SCCWRP 2009), which can provide the necessary guidance for RMC laboratories to produce quality data. SWAMP has developed laboratory SOPs for BMI taxonomic identification (Woodward et al. 2012), which provide even greater detail on standard protocols provided in the Bioassessment QAPP.

The SWAMP bioassessment group is also currently developing guidelines for quality assurance and quality control for algae data. SWAMP has developed draft laboratory SOPs and on-line identification tools to assist contracting laboratories identify organisms. SWAMP is currently developing a standard taxonomic level of effort (similar to what SAFIT develops for BMIs). It is anticipated that SWAMP will incorporate forthcoming tools and documentation into a statewide QAPP for benthic algae. The RMC will update this QAPP to include MQOs for algae as they become available.

There are no SWAMP data quality objectives for physical habitat data that is collected synoptically with benthic macroinvertebrate and algae data. Similar to algae, the RMC will update this QAPP to include MQOs for physical habitat as they become available. SWAMP is currently developing additional guidance to assist

Until a statewide SWAMP QAPP is developed that addresses both algae and physical habitat, the **RMC will place strong emphasis on training and oversight for both field and laboratory personnel to ensure highest data quality**. Field personnel are expected to participate in annual training workshops provided by the Department of Fish and Wildlife. In addition, bioassessment teams will be assessed during annual field audits performed by SWAMP or equivalent.

References

BASMAA. 2014. BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Prepared for Bay Area Stormwater Management Agencies Association. Version 2, January 2014.

Fetscher, A.E., L. Busse, and P. R. Ode. 2009. Standard Operating Procedures for Collecting Stream Algae Samples and Associated Physical Habitat and Chemical Data for Ambient Bioassessments in California. California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 002. (updated May 2010).

Ode, P.R., 2007. Standard Operating Procedures for Collecting Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California. California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 001.

SCCWRP. 2009. Southern California Regional Watershed Monitoring Program Bioassessment Quality Assurance Project Plan. Version 1. June 25, 2009. Prepared by Southern California Coastal Water Research Project.

Woodard, M.E., J. Slusark, and P.R. Ode. 2012. Standard Operating Procedures for Laboratory Processing and Identification of Benthic Macroinvertebrates in California. California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 003.

STANDARD OPERATING PROCEDURES
for
Manual Collection of Water Samples for Chemical Analysis, Bacteriological Analysis, and Toxicity Testing
(SOP FS-2)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This SOP is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:

Biological Assessment (re: water chemistry data)
General Water Quality
Chlorine
Toxicity – Water Column
Pathogen Indicators (bacteriological analysis)

SOP Background and Application

RMC participants intend to collect water quality samples using consistent protocols across jurisdictional boundaries, to the extent reasonable and feasible. These sample collection and handling protocols form part of the RMC field quality assurance program, to help ensure validity of resulting data and comparability with SWAMP protocols. This protocol describes the techniques used to collect water samples in the field in a way that neither contaminates, loses, or changes the chemical form of the analytes of interest.

References to Existing SOPs

This SOP is adapted from information provided in the following SOPs:

(1) For water sampling: **Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in the Surface Water Ambient Monitoring Program (SWAMP)**, version 1.0, released October 15, 2007 (SWAMP 2007). A pdf of the SOP is available for download at:
http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/standard-operating-procedures

Relevant QA/QC protocols are also referenced in the associated RMC Quality Assurance Project Plans for targeted parameters: **BASMAA Regional Monitoring Coalition**

Creek Status Monitoring Program Quality Assurance Project Plan, version 2, January 2014 (BASMAA 2014).

Special Cautions and Considerations; Health and Safety

Proper gloves must be worn to both prevent contamination of the sample and to protect sampling personnel from environmental hazards. The user should wear at least one layer of gloves, but two layers help protect against leaks. All gloves must be powder-free. Disposable polyethylene, nitrile, or non-talc latex gloves are acceptable for many types of sampling; however, samples for low level metals and mercury analysis can only be collected and handled using polyethylene gloves as the outer layer.

CAUTIONS

When conducting sampling in areas of unknown water quality, especially in waters that are suspected to contain hazardous substances, bacteria, or viruses, it is preferable that at least one layer of gloves be of shoulder length, to limit skin contact with the source water.

When using chemical cleaners, as required as part of the equipment cleaning and decontamination protocols (see SOP FS-7, Field Equipment Cleaning Procedures and SOP FS-8, Field Equipment Decontamination Procedures), always read the product label and adhere to all printed cautions and safety measures.

When using acid preservatives, as required for certain nutrient analytes (see SOP FS-9, Sample Container, Handling, and Chain of Custody Procedures), be extremely careful not to spill or splash acid. Wear gloves, long-sleeved clothing, and protective eyewear at all times when handling acid.

Methods / Procedures

These SOPs pertain to manual collection of water quality samples only.

MOBILIZATION

At least one week prior to sample collection, contact the laboratory to notify them of the planned activity, order the necessary sample containers and analyte-free blank water provided by lab performing the analyses for blanks, and coordinate sample preservation and analysis for analytes with short holding times. Discuss with the laboratory the planned analyses and required sample containers as specified in the QAPP and SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures. Request that the lab provide most bacteriological sample bottles without the preservative sodium thiosulfate, but also request a few pre-preserved bacti sample bottles, in the event that chlorine is present in the sample stream at a particular site.

Following is a recommended list of equipment to be mobilized by field personnel in advance of sampling operations; field crews are able to modify this list to account for site- and event-specific conditions. This list assumes that sampling will be conducted via manual grab sampling technique.

Sampling containers (with labels)

- Sample filtration device (if needed)
- Concentrated H_2SO_4 for nutrient sample preservation, or sample bottles with preservative added
- Cooler(s)
- Cube ice, with zip-top bags for double-bagging
- Zip-top bags for individual sample containers
- Sampling pole (if needed) with device to hold sample bottles
- Rope (if needed) with device to hold sample bottles
- Detergent (Micro™, Liqui-Nox™, or equivalent)
- Reagents (5% HCL, methanol, both reagent-grade)
- Aluminum foil
- Deionized water for rinsing of field equipment
- Analyte-free blank water provided by lab(s) performing the analyses
- Scrub brushes, minimum 2
- Sample gloves (powder-free PE or vinyl, including shoulder-length gloves)
- Dunnage material for protecting sample containers
- Transparent tape "(tear-by-hand") to cover labels
- Containers for collecting liquid waste
- Receptacle for collecting solid waste
- GPS
- Camera
- Cell phone
- Spare batteries for all electronics (GPS, cell phone, camera, etc.)
- Paperwork (sampling plan, SOPs, COCs, datasheets, maps, permits, etc. as required)

All equipment coming into contact with sample material should be pre-cleaned per protocols in SOP FS-7, Field Equipment Cleaning Procedures.

SAMPLE COLLECTION

Sample Container Labels

Label each sample container with the station ID, sample code, matrix type, analysis type, project ID, and date and time of collection. To the extent feasible, pre-label containers prior to sampling, as it is difficult to write on labels once they are wet. See SOP FS-11, Site and Sample ID Naming Conventions for sample identification and labeling protocols.

Sample Location

Water samples are collected from a location in the stream where the stream visually appears to be completely mixed. Ideally this would be at the centroid of the flow (*Centroid* is defined as the midpoint of that portion of the stream width, which contains 50% of the total flow), but depth and flow do not always allow centroid collection. For stream samples, the sampling spot must be accessible for sampling physicochemical parameters, either by boat or wading. Sampling from a bridge or from the shoreline of any water body is the least acceptable method, but in some cases will be necessary.

Sample Collection Depth

- **Sub-Surface Grab Sample:** Samples are typically collected at 0.1 m (~4 inches) below the water surface. This permits containers to be opened, filled, and re-capped under water in most cases.
- **Surface Grab Sample:** Samples are collected at the surface when water depth is <0.1 m. Because there can be differences in water chemistry on the surface, compared to subsurface, surface samples should be noted on the field data sheet as collected at 0 m.

Sample Collection Methods

Grab samples for most constituents are collected simply by direct submersion of the sample container into the stream whenever possible. When feasible, the sample containers should be opened, filled and recapped below the water surface. Samples always should be collected upstream of sampling personnel and equipment, and with the sample container pointed upstream when the container is opened for sample collection. See additional procedures described below for "clean sampling techniques" that must be used for collection of trace metals samples.

Water samples are collected before any bed sediment (sediment) samples are collected, where water and sediment samples are taken in the same reach. Care must be taken not to sample water downstream of areas where sediments have been disturbed in any manner by field personnel.

If the centroid of the stream cannot be sampled by wading, sampling devices can be used to reach the sampling location. Such devices typically involve a means to extend the reach of the sampler, with the sample bottle attached to the end of the device for filling at the desired location. These methods do not allow opening of the sample container under water, so there is some potential for contamination when the container is opened prior to lowering the sample container into the stream.

When sampling from a stream bank, the sample container is attached to a device which is attached in turn to the end of an extendable sampling pole. When no other option is available, sites may be accessed by bridge and sampled with a sample container-suspending device, lowered into the stream at the end of a pole or rope. Extreme care must be taken to avoid contaminating the sample with debris from the rope and bridge. Care must also be taken to clean all sampling devices between stations, according to protocols specified in SOP FS-8, Field Equipment Decontamination Procedures.

An intermediate container may be used for sample collection for some constituents, provided the intermediate container material matches that required for the particular analysis to be performed. See SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures, for details. Exceptions include bacteriological samples, which must be collected directly into a sterile container; intermediate containers are therefore not often used (as they must be sterile). Trace metals samples collected via clean sampling techniques (see below) also typically do not involve use of an intermediate container.

Clean Sampling Technique
Samples to be analyzed for trace metals – including mercury – should be collected using "clean sampling techniques". The specially-cleaned sample bottles should be received from the container cleaning facility (usually the analytical laboratory) double-bagged in zip-top plastic bags.

The "clean hands" person touches only the sample container and the inner bag; these items have had no contact with the environment. The "dirty hands" person touches the outer bag, cooler, etc. The dirty hands person opens the outer bag, and the clean hands person opens the inner bag around the bottle. The clean hands person then removes the bottle from the inner bag. The clean hands person dips the bottle into the ambient water, with the cap on, to a depth of approximately 0.1 m (avoiding disturbing surface scum) when feasible, and fills the bottle to the top, placing the cap back on the bottle before being removed from the water. The lid is secured and the bottle is put back into the inner clean bag, which is sealed by the clean hands person. The dirty hands person then seals the outer bag, and places the double-bagged sample on ice in the cooler.

Sample Filtration
Per USEPA protocols, filtration of water samples for orthophosphate and trace metals (including mercury) analysis must be performed within 15 minutes of sample collection. As a practical matter, filtration for DOC should be performed along with filtration for orthophosphate. It is therefore necessary to use a **field** filtration system, such as a peristaltic pump with in-line filter, or a syringe filter, for sample filtration. Samples are pumped or drawn via syringe and filtered directly into the sample container. This minimizes contamination by excluding the intermediate sampling device.

Syringe Filtration Method
The syringe (60 cc size, pre-cleaned in the laboratory) and in-line filter are pre-packed in two ziplock bags. The syringe and filter are taken out of the bags using "Clean Hands/Dirty Hands" technique when filtering samples for metals analysis, as previously described. The sub-surface water sample is collected by 1) wading out into the centroid portion of the stream, or by leaning over the edge of the boat, and aspirating water into the syringe, filling and rinsing the syringe three times with ambient water; 2) attaching the filter onto the syringe and filling the syringe body; 3) rinsing the filter with a few milliliters of the sample; 4) rinsing the sample bottle three times with the "analyte-free" water; and 5) extruding the sample through the syringe filter and completely filling each bottle. The bottles are taken out of and put back into their bags using "Clean Hands/Dirty Hands" when filtering samples for metals analysis.

Peristaltic Pump Method
The basic "Clean Hands/Dirty Hands" technique is also applied in the use of a peristaltic pump with an in-line filter cartridge for metals-in-water sample collection. Dirty Hands removes the plastic cover from the end of the pump tubing and inserts the tubing into the sampling container. Dirty Hands holds the tubing in place. The in-line cartridge filter is attached to the outlet end of the tubing.
Clean Hands takes the plastic cover off the other end of the tubing, and inserts that end into the sample stream. Dirty Hands turns on the pump and flushes l L of ambient water through the tubing to purge it for dissolved metals. Clean Hands removes the cap from

the sample bottle and uses the pump to fill it with ambient water. Clean Hands puts the cap back on the bottle and places it in the plastic bag.

Sample Preservation

Samples for certain constituents (principally nutrients; see SOP FS-9 for details) must be preserved with acid. Acidify samples in the field when possible. Preservative may be added to sample bottles in advance by laboratory. When field acidification is not possible, deliver samples to lab as soon as possible on day of collection, and instruct lab to acid-preserve samples immediately upon receipt.

Bacteriological Samples

Collect the bacteria grab samples by direct submersion as described above, being very careful not to touch the inside of the bottle or cap, and without rinsing the sample container.

Ask the lab to provide most bacti sample bottles *without the preservative* sodium thiosulfate, which is required only in the presence of excess chlorine. If there is reason to believe that excess chlorine may be present in the sample stream (from a wastewater treatment plant effluent or swimming pool discharge upstream, for example), a simple field test kit may be used to determine whether chlorine is present in the water prior to sample collection. If chlorine is found to be present, collect bacti samples in sample bottles that have the sodium thiosulfate preservative added.

If all the bacteria sample bottles contain sodium thiosulfate, remove the sodium thiosulfate by dumping it out of the container prior to sample collection into an appropriate waste container, unless the sample stream has tested positive for chlorine.

If using an extension pole, remove the bacteria bottle cap, turn the bottle upside down, and plunge it into the water, facing upstream. Collect a water sample approximately four inches (4") beneath the surface. Turn the bottle underwater into the current and away from you. In slow moving stream reaches, push the bottle underneath the surface and away from you in an upstream direction.

Note that bacteria samples must be delivered to the analytical laboratory within six (6) hours of collection, and the lab must begin the analysis within an additional two (2) hours following delivery (for a nominal maximum of eight (8) hours following collection), per USEPA rule – therefore prior coordination with the laboratory on sample delivery timing is important.

Toxicity Test Samples

Using the standard grab sample collection method described previously for water samples, fill (for a typical suite of water toxicity tests conducted) the required amount of 2.25-L (half gallon) amber glass bottles with water, put on ice, and cool to $\leq$6 °C. Prior to filling each bottle, rinse bottle with cap on three times in ambient water, being careful to avoid any surface scum. Label the containers as described above and notify the laboratory of the impending sample delivery, given the 36-hr holding time requirement. Sample collection must be coordinated with the laboratory at least one week in advance of the monitoring event to guarantee appropriate scheduling.

DEMOBILIZATION

Before leaving the sampling site, field personnel should perform the following tasks:

- Review datasheets to ensure they are complete and legible,
- Preserve samples as described in SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures,
- Ensure that all containers are capped tightly and stored in a cooler on double-bagged cubed ice (per SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures),
- Verify that all sampling-related materials and equipment have been collected, and
- Clean sampling equipment as described in SOP FS-7, Field Equipment Cleaning Procedures, and decontaminate equipment as described in SOP FS-8, Field Equipment Decontamination Procedures before sampling at a different site.

Sample Short-term Storage and Preservation

Properly store and preserve samples as soon as possible. Usually this is done immediately after sample collection by placing the filled containers on bagged, cube ice in an ice chest. Sufficient ice is needed to lower the sample temperature to $\leq$6°C within 45 minutes after time of collection. Sample temperature is maintained at $\leq$6 °C until delivered to the laboratory. Care is taken at all times during sample collection, handling and transport to prevent exposure of the sample to direct sunlight.

Chain of Custody Forms

Every set of samples delivered to a laboratory must contain a complete Chain of Custody (COC) Form that lists all samples collected, the date/time of collection for each sample, and the analyses to be performed on those samples, as well as any special instructions to the laboratory (see SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures). A separate COC is required for each laboratory, for every shipment of samples. Electronic COCs may also be emailed to analytical laboratories, but the COCs must be sent before the samples arrive at their destinations. The original COC sheet (not the copies) is included with the shipment to the laboratory (inserted into a zip-top bag for protection), and the sampling crew retains a copy.

Sample Delivery and Shipping

After collection, water samples are submitted to the respective analytical laboratories in containers as identified in SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures.

Samples should be delivered to the analytical laboratory as soon as possible after conclusion of sampling activities, but always sufficiently within sample hold time requirements (see SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures). Note the especially short (six hour) timeframe for delivery of bacteriological samples to the lab.

Samples being sent via a freight carrier require additional packing. Although care is taken in sealing the ice chest, leaks can occur. Leaking ice chests can cause samples to

be returned or arrive at the lab beyond the holding time. Samples and ice should be bagged separately using zip-top bags, and then placed in a large trash bag inside the ice chest for shipping. Bubble wrap or other suitable protective packing material must be used to protect glass sample bottles. Ice should be double bagged to prevent melted ice water from leaking into the cooler. The large trash bag can be sealed by simply twisting the bag closed (while removing excess air) and taping the tail down. Prior to shipping, the drain plug of the ice chests should be taped shut, and packing tape should be used to secure the cooler lid.

Quality Assurance / Quality Control

Readiness reviews, post-event sampling reviews, and field audits will be performed as part of the programmatic quality assurance program to help ensure that appropriate protocols are followed.

Field crews must ensure that all sampling-derived wastes are contained and disposed of properly to prevent entry into the water body.

Consistent with the QAPP, reagents should be inspected upon receipt and usage to ensure that they are of appropriate grade (e.g., reagent-grade or better) for cleaning purposes.

Field Blank Samples

When required, field blank samples are collected in the same manner as the environmental samples, as described below. For grab samples, bottles full of analyte-free blank water provided by lab performing the analyses or Milli-Q water are opened at the site for the same length of time the sample bottles are open. The analyte-free blank water is poured directly into the blank sample container.

When samples are filtered for dissolved metals analysis, field blanks are typically collected at the last site of a sampling trip, with the same tube and filter used to collect the last dissolved metals-in-water sample of the day (before the ambient sample is collected); and with the tube used for the last total metals-in-water sample of the day. If each sample is taken using a new set of tubing, a separate tubing-set should be used for the blank.

Pumping Method

The same Clean Hands/Dirty Hands collection techniques are followed for the field blank as the samples, pumping analyte-free blank water provided by the lab(s) performing the analyses from a clean container supplied by the laboratory.

Syringe Method

Field blanks are collected in much the same way as in the pumping method. "Clean Hands/ Dirty Hands" techniques are used. The syringe is taken out of the double bags, analyte-free blank water is aspirated into the syringe, syringe is rinsed five times with ambient water, the filter is attached, and the blank water is extruded into a sample bottle. A minimum of one blank per trip is taken, if required.

Adherence to the procedures described above, along with adherence to referenced SOPs for cleaning sampling equipment, handling samples, and decontaminating field equipment, will help ensure that water samples are collected in a manner that is representative of environmental conditions, and help ensure comparability of data with SWAMP protocols and MRP requirements.

References

BASMAA. 2014. BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Prepared for Bay Area Stormwater Management Agencies Association. Version 2, January 2014.

MPSL-DFG Field Sampling Team. 2007. Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in SWAMP. Version 1.0. October 15, 2007.

STANDARD OPERATING PROCEDURES
for
Performing Manual Field Measurements
(SOP FS-3)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This SOP is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:

Biological Assessment (re: field-measured water quality parameters)
Chlorine

SOP Background and Application

RMC participants intend to collect perform water quality measurements using consistent protocols across jurisdictional boundaries, to the extent reasonable and feasible. These field measurement protocols form part of the RMC field quality assurance program, to help ensure validity of resulting data and comparability with SWAMP protocols.

References to Existing SOPs

This SOP is adapted from information provided in the following SOPs:

(1) For field measurements of dissolved oxygen, temperature, conductivity, and pH: **Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in the Surface Water Ambient Monitoring Program (SWAMP)**, version 1.0, released October 15, 2007 (SWAMP 2007). A pdf of the SOP is available for download at: http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/standard-operating-procedures

The SWAMP Field Measurements SOPs portion of the above-referenced document is included in this RMC SOP FS-3 as Attachment 1.

Relevant QA/QC protocols are also referenced in the associated RMC Quality Assurance Project Plans for targeted parameters: **BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan**, version 2, January 2014 (BASMAA 2014).

Special Cautions and Considerations; Health and Safety

Proper gloves must be worn to both prevent alteration of the field measurements, and to protect sampling personnel from environmental hazards. The user should wear at least one layer of gloves, but two layers help protect against leaks. All gloves must be powder-free. Disposable polyethylene, nitrile, or non-talc latex gloves are acceptable for field measurements.

CAUTIONS

When performing measurements in areas of unknown water quality, especially in waters that are suspected to contain hazardous substances, bacteria, or viruses, it is preferable that at least one layer of gloves be of shoulder length, to limit skin contact with the source water.

When using chemical cleaners, as required as part of the equipment cleaning and decontamination protocols (see SOP FS-7, Field Equipment Cleaning Procedures and SOP FS-8, Field Equipment Decontamination Procedures), always read the product label and adhere to all printed cautions and safety measures.

Methods / Procedures

These SOPs pertain to manual measurement of water quality parameters only. Automated field measurement is covered in SOP FS-4, Continuous General Water Quality Measurements.

Field measurement of dissolved oxygen (DO), temperature, conductivity, and pH are required during the annual bioassessment monitoring. Specific protocols for these measurements are to be found in the SWAMP Field Measurement SOPs, Attachment 1.

Measurement of free and total chlorine is required twice annually, during the spring and dry weather seasons. Specific instructions for use of the Chemetrics test kits (K-2511 for low range, and K-2504 for high range) will be provided with individual test kits.

Field Meter Calibration

All field meters must be calibrated prior to use; this is typically done on a daily basis, prior to the first measurements of the day. Record the results of the field meter calibration on the Field Meter Calibration Record form, Attachment 2.

Sample Location

Direct field measurements or grab samples for field measurement purposes are collected from a location where the sample stream visually appears to be completely mixed. Ideally this is at the centroid of the flow (*Centroid* is defined as the midpoint of that portion of the stream width, which contains 50% of the total flow), but site conditions do not always allow centroid collection. The location must be accessible by boat or wading. Sampling from a bridge or from the shoreline of any water body is the least acceptable method, but in some cases will be necessary.

Sample Collection Depth

- **Sub-Surface Sample:** Grab samples for field measurements are typically collected at 0.1 m (~4 inches) below the water surface. When the field probe is inserted directly into the stream, a measurement depth of 0.8 m (~8 inches) should be used to ensure that the probe is appropriately submerged.
- **Surface Sample:** Grab samples for field measurements are collected at the surface when water depth is <0.1 m. Because there can be differences in water chemistry on the surface, compared to subsurface, surface samples should be noted on the field data sheet as collected at 0 m.

Field Measurement Methods

For DO, conductivity, temperature and pH, measurements may be made either by direct submersion of the instrument probe into the sample stream, or by collection of grab samples and immediate analysis of the grab sample in the field. Conductivity should be reported as specific conductivity/conductance (SC).

When using the Chemetrics test kits for measurement of free and total chlorine, grab samples must be collected using a clean container, and the relevant instructions provided with the kits must be followed for sample preparation and analysis.

Grab samples for field measurements are collected simply by direct submersion of the sample container into the stream whenever possible. Samples always should be collected upstream of sampling personnel and equipment, and with the sample container pointed upstream when the container is opened for sample collection.

Grab samples are collected before any bed sediment (sediment) samples are collected, where water and sediment samples are taken in the same reach. Care must be taken not to sample water downstream of areas where sediments have been disturbed in any manner by field personnel.

If the centroid of the stream cannot be sampled by wading, sampling devices can be used to reach the sampling location. Such devices typically involve a means to extend the reach of the sampler, with the sample bottle attached to the end of the device for filling at the desired location. These methods do not allow opening of the sample container under water, so there is some potential for contamination when the container is opened prior to lowering the sample container into the stream.

When sampling from a stream bank, the sample container is attached to a device which is attached in turn to the end of an extendable sampling pole. When no other option is available, sites may be accessed by bridge and can be sampled with a sample container-suspending device, lowered into the stream at the end of a rope. Extreme care must be taken to avoid contaminating the sample with debris from the rope and bridge. Care must also be taken to clean all sampling devices between stations, according to protocols specified in SOP FS-8, Field Equipment Decontamination Procedures.

Before leaving the sampling site, field personnel should do the following:

- Review datasheets to ensure they are complete and legible,

- Ensure that all sampling-related materials and equipment have been collected, and
- Clean sampling equipment as described in SOP FS-7, Field Equipment Cleaning Procedures, and decontaminate equipment as described in SOP FS-8, Field Equipment Decontamination Procedures before sampling at a different site.

Quality Assurance / Quality Control

Readiness reviews, post-event sampling reviews, and field audits will be performed as part of the programmatic quality assurance program to help ensure that appropriate protocols are followed.

Field crews must ensure that all sampling-derived wastes are contained and disposed of properly to prevent entry into the water body.

Consistent with the QAPP, calibration reagents should be inspected upon receipt and usage to ensure that they are not expired. Similarly, as part of mobilization efforts, field crews should verify Chemetrics test kits are not expired, as the relevant comparators typically have a shelf life of one year from date of manufacture.

Adherence to the procedures described above, along with adherence to referenced SOPs for cleaning sampling equipment and decontaminating field equipment, will help ensure that field measurements are made in a manner that is representative of environmental conditions, and help ensure comparability of data with SWAMP protocols and MRP requirements.

References

BASMAA. 2014. BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Prepared for Bay Area Stormwater Management Agencies Association. Version 2, January 2014.

MPSL-DFG Field Sampling Team. 2007. Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in SWAMP. Version 1.0. October 15, 2007.

Attachment 1 – Standard Operating Procedures (SOPs) for Conducting Field Measurements of Water Samples in the Surface Water Ambient Monitoring Program (SWAMP)

Marine Pollution Studies Laboratory – Department of Fish and Game (MPSL-DFG) Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in the Surface Water Ambient Monitoring Program (SWAMP)

The SOPs below are for reference and information purposes only, the documents are not required by the Surface Water Ambient Monitoring Program (SWAMP). Please see the SWAMP Quality Assurance Management Plan (http://www.swrcb.ca.gov/swamp/qamp.html) for more information regarding SWAMP QA/QC requirements.

Table of Contents

Field Measurements

Field Data Sheets

Field data sheets are used to record field observations, probe measurements, and water and sediment chemistry sampling. Field data sheets are provided through the Marine Pollution Studies Laboratory website at:
http://mpsl.mlml.calstate.edu/swdwnlds.htm
Click on the *Field Data Sheets* for the most recent versions. There are guidelines provided below to standardize what is recorded on all data sheets and that should be helpful in completing each form. The Beaufort Scale (see at the end of this document) is also used for specifications and equivalent wind speeds for water conditions. The entries discussed below and on the field data sheets are recorded at each sampling site.

Notes to Standardize SWAMP Field Data Sheets (For in the field use)

Upon arrival at a sampling site, record visual observations on the appearance of the water and other information related to water quality and water use.

Key Reminders to identify samples:

1. **Sample Time** is the SAME for all samples (Water, Sediment, & Probe) taken at the sampling event. Use time of FIRST sample as it is important for the chain of custody (COC).
2. **Left Bank/Right Bank**
   Left bank is defined as the bank to the left of the observer when facing downstream, and the *right bank* is to the right of the observer when facing downstream

FIELD OBSERVATIONS: (each one of these observations has a *Comment* field in the database so use comment space on data sheet to add information about an observation if necessary)

1. **DOMINANT SUBSTRATE**: if possible; describe DOMINANT substrate type; use UNK if you cannot see the dominant substrate type
2. **WADEABILITY**: in general, is the water body being sampled wadeable to the average person AT the POINT of SAMPLE
3. **BEAUFORT SCALE**: use scale 0-12; refer to scales listed at the end of this document.
4. **WIND DIRECTION**: records the direction from which the wind is blowing
5. **PICTURES:** Digital photos are taken to help document the actual sampling site. The convention is to take photos facing DOWNSTREAM, overlooking the site. Right bank and left bank are thus defined in this downstream-facing direction. Document any discrepancies from this convention. Only one photo is necessary, if both, left and right

bank, fit into one frame. Record all photos in the field data sheet space to record picture numbers given by camera; be sure to rename accordingly back in the office. All photos should be renamed and saved with the StationCode_yyyy_mm_dd_uniquecode (e.g. 123ABC123_2007_07_01_BBDS).

6. **SITE ODOR**: Note if hydrogen sulfide odor, musty odor, sewage odor, etc. is in the sampling reach
7. **SKY CODE**: Note recent meteorological events that may have impacted water quality
8. **OTHER PRESENCE**: VASCULAR refers to terrestrial plants or submerged aquatic vegetation (SAV) and NONVASCULAR refers to plankton, periphyton etc.
9. **PRECIPITATION**: Note if any precipitation is occurring during sampling
10. **PRECIPITATION LAST 24 HOURS**: Note how much precipitation has occurred within the last 24-h of sampling
11. **WATER ODOR**: Note if the sample water being collected has odor
12. **WATER CLARITY**: this describes the clarity of the water while standing creek side; clear represents water that is clear to the bottom, cloudy may not be clear to bottom but greater than 4" can be seen through the water column.
13. **WATER COLOR**: This is the color of the water from standing creek side
14. **OBSERVED FLOW**: Visual estimates in cubic ft/s.

SAMPLE DETAILS:

1. **EVENT TYPE**: Note the event type based which type of media is being collected
2. **SAMPLE TYPE**: GRAB samples are when bottles are filled from a single depth; INTEGRATED sample are taken from MULTIPLE depths and combined.
   a. GRAB: use 0.1 for subsurface samples; if too shallow to submerge bottle; depth =0
   b. INTEGRATED: -88 in depth sampled, record depths combined in sample comments
3. **SAMPLING CREW**: J. Smith, S. Ride (first person listed is crew leader)
4. **STARTING BANK**: Which side of the stream was accessed first. Bearings are always recorded looking downstream
5. **OCCUPATION METHOD**: What media was used to access the site
6. **TARGET LAT/LONG**: Refers to the existing station location that the sampling crew is trying to achieve; can be filled out prior to sampling
7. **ACTUAL LAT/ LONG**: is the location of the current sample event.
8. **SAMPLE LOCATION**: describes from where IN water body sample was taken: Can be combined; ex: bank/thalweg or midchannel /thalweg
9. **HYDROMODIFICATION:** Describe existing hydromodifications such as a grade control, drainage pipes, bridge, culvert
10. **HYDROMOD LOC**: if there was an IMMEDIATE (with in range potentially effecting sample) hydromodification; was sample taken upstream or downstream of modification; if there is no hydromodification, NA is appropriate
11. **STREAM DEPTH, WIDTH & DISTANCE FROM BANK**: describe in meters at point of sample. Distance from bank should be recorded from the starting bank

Field Data Logbook

A Field Data Logbook or a Field Folder is taken into the field on each sampling trip. The use of bound or loose-leaf notebooks is left up to the entity conducting the monitoring. A good safety precaution against the loss of a bound field data logbook is to photocopy the current pages upon returning from the field. These pages are kept on file at the specific sample collection entity's office. If a loose-leaf notebook is used, take care to remove original field data log sheets from the notebook and file in the office. Copies of the field data log sheets may be left in the notebook for future reference.

Field Data Logbooks (bound or loose leaf sheets) are maintained on file indefinitely in each regional office or contract laboratory office. They are never discarded, since the logbook may be the only written record of field measurements. Field Data Logbooks are reviewed periodically during SWAMP QA site visits. At this point, these field notes are not inclusive of the information that would be collected for biological assessment work, and several other data measurement types.

Flow

Sampling crews should be notified on reconnaissance forms if it is known that there is an operational United States Geological Survey (USGS) gage is located at or nearby a sampling site. If there is a USGS gage nearby, a gage height in feet is recorded and later converted to an instantaneous flow value and recorded in the logbook. The gage height is always to be reported to the USGS for conversion to flow. If a USGS gage is not available, a flow measurement should be taken, if requested. See Instantaneous Flow Measurement information starting on page 13 in this document. In addition, it is recommended that a flow severity value is recorded at each stream or river station that is not tidally influenced. See the Flow Severity section starting on page 13 of this document. Centroid velocity measurements may also be taken as a minimum acceptable rough characterization of the stream flow as requested, although this measurement is not to be recorded as a flow, since it is only a velocity measurement.

Record of Samples Collected for Purposes of Chemical Analysis

The general types of chemical samples to be collected are listed for each site, since this may vary from site-to-site (e.g., metals-in-water, pesticides-in-sediments, routine water quality). Analyses authorization forms are recommended since different authorized laboratories perform different chemical analyses. The method of preservation for each chemical sample is recorded, as appropriate.

Record of Data Submission

The *Logbook* field must indicate in some manner whether data recorded in the logbook has been transcribed onto data forms and submitted to the SWAMP data management staff.

Other Observations

Water Appearance	Note general appearance (e.g., color, unusual amount of suspended matter, debris or foam)
Sediment Appearance	Color, Odor and sediment composition should be noted.
Weather	Note recent meteorological events that may have impacted water quality; (e.g., heavy rains, cold front, very dry, very wet)
Biological Activity	Note excessive macrophyte, phytoplankton or periphyton growth. The observation of water color and excessive algal growth is very important in explaining high chlorophyll a values. Other observations such as presence of fish, birds and spawning fish are noted.
Watershed or Instream Activities	Note instream or drainage basin activities or events that are impacting water quality (e.g., bridge construction, shoreline mowing, livestock watering upstream).
Record of Pertinent Observations Related to Water Quality and Stream Uses	If the water quality conditions are exceptionally poor, note that standards are not met in the observations, (e.g., dissolved oxygen is below minimum criteria). Note uses (e.g., swimming, wading, boating, fishing, irrigation pumps, navigation). Eventually, for setting water quality standards, the level of use will be based on comments related to the level of fishing and swimming activities observed at a station.
Specific Sample Information	Note specific comments about the sample itself that may be useful in interpreting the results of the analysis (e.g., number of sediment grabs, or type and number of fish in a tissue sample). If the sample was collected for a complaint or fish kill, make a note of this in the observation section.
Missing Parameters	If a scheduled parameter or group of parameters is not collected, make some note of this in the comments.

Field Data Measurements

While collecting water samples (see Field Collection Procedures for Water Samples section), record appropriate field measurements. When field measurements are made with a multiparameter instrument, it is preferable to place the sonde in the body of water to be sampled and allow it to equilibrate in the dissolved oxygen (D.O.) mode while water samples are collected. Field measurements are made at the centroid of flow, if the stream visually appears to be completely mixed from shore to shore. *Centroid* is defined as the midpoint of that portion of the stream width which contains 50% of the total flow. For routine field measurements, the date, time and depth are reported as a grab. Measure Quality Objectives (MQO's) for field measurements are listed in appendix C of the SWAMP QAMP.

Recommended Depths for Conducting Field Data Measurements

Water Depth Less than 5 ft (<1.5 m) If the water depth is less than 5 ft (1.5 m), grab samples for water are taken at approximately 0.1 m (4 in.), and multi-probe measurements are taken at approximately 0.2 m (8 in.). This is because all sensors have to be submerged, so 0.1 m would not be deep enough. But taking a grab sample at 0.2 m is not always feasible, as it is difficult to submerge bottles to that depth, and in many cases the bottle will hit the stream bottom.

Water Depth Greater than 5 ft (>1.5 m) If the water depth at the sampling point exceeds 5 ft (1.5 m) in depth, a vertical profile of dissolved oxygen, temperature, pH and specific conductance are made using the multiparameter probe equipment. The depth of the sonde at the time of measurement is most accurately determined from the depth sensor on the multiparameter sonde rather than depth labels on the cable.

Vertical Depth Profiles and Depth-Integrated Sample Collection If depth integration sampling is being conducted, or if vertical profile measurements are requested, multi-probe measurements are made starting at a depth of 0.2 m, and are then conducted at 1.0, 2.0, 3.0, 4.0, and 5.0 m depths after that until 5.0 m depth is reached. Beginning at 5.0 m, measurements are made every 5.0 m through depth profile.

Field data for multiparameter vertical depth profiles are recorded in final form on the SWAMP Field Data Sheets and submitted to the SWAMP data management staff.
Go to http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting.

Water Temperature (^{O}C)

Water temperature data are recorded for each SWAMP visit in final form in a Field Data Logbook and submitted to the SWAMP data management staff.
See http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting.

Temperature Sampling Procedures

Temperature is measured in-stream at the depth(s) specified above. Measuring temperature directly from the stream by immersing a multiprobe instrument or thermometer is preferred.

Hand Held Centigrade Thermometer

If an electronic meter is not available, the temperature is measured with a hand-held, centigrade thermometer (Rawson, 1982).

- < In wadeable streams, stand so that a shadow is cast upon the site for temperature measurement.

- Hold the thermometer by its top and immerse it in the water. Position the thermometer so that the scale can be read.
- Allow the thermometer to stabilize for at least one minute, then without removing the thermometer from the water, read the temperature to the nearest 0.1^{o} C and record.
- Do not read temperature with the thermometer out of the water. Temperature readings made with modern digital instruments are accurate to within $\pm 0.1^{o}$ C.

Temperature Measurement from a Bucket
When temperature cannot be measured in-stream, it can be measured in a bucket-Nalgene or plastic. Care must be taken to insure a measurement representative of in-stream conditions.

The following conditions must be met when measuring temperature from a bucket:

- The bucket must be large enough to allow full immersion of the probe or thermometer.
- The bucket must be brought to the same temperature as the water before it is filled.
- The probe must be placed in the bucket immediately, before the temperature changes.
- The bucket must be shaded from direct sunlight and strong breezes prior to and during temperature measurement.
- The probe is allowed to equilibrate for at least one minute before temperature is recorded.
- After these measurements are made, this water is discarded and another sample is drawn for water samples which are sent to the laboratory.

pH (standard units)

pH data is recorded for each SWAMP visit in final form on the Field Data Sheets and submitted to the SWAMP data management staff. See http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting.

pH Sampling Equipment
The pH meter should be calibrated according to the recommended procedures for calibration and maintenance of SWAMP field equipment. Calibration directions are listed in the manufactures field equipment operations manual. The pH function is pre and post calibrated every 24 h of use for multiparameter instruments.

pH Sampling Procedures
In-stream Method
Preferably, pH is measured directly in-stream at the depth(s) specified earlier in this document. Allow the pH probe to equilibrate for at least one minute before pH is recorded to the nearest 0.1 pH unit.

pH Measurement from a Bucket
When pH cannot be measured in-stream, it can be measured in a bucket-Nalgene or plastic. The following precautions are outlined above; “Temperature Measurement from a Bucket”.

Potential Problems

- If the pH meter value does not stabilize in several minutes, out gassing of carbon dioxide or hydrogen sulfide, or the settling of charged clay particles may be occurring (Rawson, 1982).
- If out gassing is suspected as the cause of meter drift, collect a fresh sample, immerse the pH probe and read pH at one minute.
- If suspended clay particles are the suspected cause of meter drift, allow the sample to settle for 10 min, then read the pH in the upper layer of sample without agitating the sample.
- With care, pH measurements can be accurately measured to the nearest 0.1 pH unit.

Dissolved Oxygen (mg/L)

Dissolved oxygen (D.O.) data is recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff.
See http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting.

Dissolved Oxygen Sampling Equipment

The dissolved oxygen meter should be calibrated according to the recommended procedures for calibration and maintenance of SWAMP field equipment. Calibration directions are listed in the manufactures field equipment operations manual.

Multiprobe Instrument

Pre and post calibrate the D.O. sensor every 24 h and for elevations greater than 500 ft on the multiprobe instrument. Preferably, D.O. is measured directly in-stream at the depth(s) specified in the Field Measurements section above. The D.O. probe must equilibrate for at least 90 s before D.O. is recorded to the nearest 0.1 % saturation or mg/L. Care must be taken at profile stations to insure that the reading is stable for each depth. Since dissolved oxygen takes the longest to stabilize, record this parameter after temperature, conductivity and pH. If the D.O. probe has an operable, automatic stirrer attached, the D.O. probe does not have to be manually stirred. However, if the probe is not equipped with an automatic stirrer, manual stirring must be provided by raising and lowering the probe at a rate of 1 ft/s (0.3m/s) without agitating the water surface. If the stream velocity at the sampling point exceeds 1 ft/s, the probe membrane can be pointed upstream into the flow and manual stirring can be avoided (Rawson, 1982).

D.O. Measurement from a Bucket

When D.O. cannot be measured in-stream, it can be measured in a bucket-Nalgene or plastic, following precautions outlined in the Temperature Measurement from a Bucket listed above. During equilibration and reading, water should be moved past the membrane surface at a velocity of 1 ft/s (0.3 m/sec), either by automatic stirrer or manual stirring. If stirred manually in a bucket, the water surface is not agitated (Rawson, 1982).

24-Hour Average D.O. (if requested in special study)

Unattended 24-Hour D.O. Data Collection

Why Collect 24-Hour Data

Dissolved oxygen sampling for standards compliance is targeted to water bodies where low instantaneous D.O. levels indicate partial or nonsupport of designated aquatic life uses. Intensive monitoring is conducted with automated equipment that is preset to record and store field measurements hourly over one 24-h period. Four or more dissolved oxygen measurements may also be made manually at 4-6-h intervals over one 24-h period, as long as one is made near sunrise (0500-0900 h) to approximate the daily minimum. However, data collected with automated equipment is preferred.

When to Take Measurements

All 24-h D.O. monitoring events must be spaced over an index period representing warm-weather seasons of the year (approx March 15-October 15), with between one-half to two-thirds of the measurements occurring during the critical period (July 1-September 30). The ***critical period*** of the year is when minimum stream flows, maximum temperatures, and minimum dissolved oxygen concentrations typically occur in area streams. **A flow measurement must be taken at the time of deployment.** In a perennial stream, a 24-h data for standards compliance can not be used if the flow is less than the 7Q2. In perennial streams, the D.O. criterion to do not apply for flows under the 7Q2. A period of about one month must separate each 24-h sampling event. Additional samples may be collected outside the index period to further characterize a water body, but that information is generally not used for assessing standards compliance.

Frequency of Measurements

The measurement interval should be no more than once per 15 min and no less than once per hour.

Where to Take Measurements

For purposes of determining standards compliance with the 24-h average criteria, samples collected near the surface will be considered representative of the mixed surface layer. In deep streams, reservoirs, and tidally influenced water bodies, automated equipment is positioned between 1 foot (from the surface) to one-half the depth of the mixed surface layer. At least 10 24-h monitoring events (using the 24-h criteria and/or absolute minimum criteria) at each site within a 5-year period are recommended to provide adequate data for assessment.

When to Collect Other Routine Samples, if doing 24-hour D.O. measurements

Other routine field measurements and water samples should be collect at either the time of deployment, at the reference check, or when the multiprobe recording 24-h data is retrieved. When ever possible, flow must be measured at the 24-h site.

Priority for Scheduling 24-Hour Sampling Events

- < 303d listed waterbodies
- < Waterbodies with Concerns for DO problems (too few samples available for full use assessment).

- < Occurrence of low D.O. concentrations observed during the day
- < Waterbodies with trends indicating declining D.O. concentrations
- < Waterbodies which would contribute to an Ecoregion data set

Data Reporting for 24-hour D.O. measurements
Dissolved oxygen values recorded over the 24-h period are summed and divided by the number of measurements to determine the average concentration, which is compared to the 24-h criterion. The lowest D.O. value from each 24-h set is compared to the minimum criterion. There will be occasions when a complete 24-h data set won't be possible. For example, if there are 18 measurements instead of 24, a time weighted diurnal average needs to be calculated. This can be easily done using GW Basic.

Support of assigned aquatic life use is based on 24-h D.O. average and minimum criteria for each monitoring event. Report the 24-h average D.O. value, number of measurements over a 24-h period, and the minimum, and maximum values. Report data as a time composite sample with a beginning and ending date and time, covering the 24-h period measured.

Specific Conductance (µS/cm)

Specific conductance should be recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff.
See http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting.

Specific Conductance Sampling Equipment
The conductivity meter should be calibrated according to the recommended procedures for calibration and maintenance of SWAMP field equipment. Calibration directions are listed in the manufactures field equipment operations manual.

Specific Conductance Sampling Procedure
Preferably, conductivity is measured directly in-stream at the depth(s) specified earlier in this document. Allow the conductivity probe to equilibrate for at least one minute before specific conductance is recorded to three significant figures (if the value exceeds 100). The primary physical problem in using a specific conductance meter is entrapment of air in the conductivity probe chambers. The presence of air in the probe is indicated by unstable specific conductance values fluctuating up to $\pm$100 µS/cm. The entrainment of air can be minimized by slowly, carefully placing the probe into the water; and when the probe is completely submerged, quickly move it through the water to release any air bubbles.

If specific conductance cannot be measured in-stream, it should be measured in the container it can be measured in a bucket-Nalgene or plastic. The following precautions are outlined above; "Temperature Measurement from a Bucket".

Salinity (parts per thousand--ppt, or ‰)
The value for salinity is computed from chloride concentration or specific conductance. The calculation assumes a nearly constant ratio for major ions in an estuary when seawater is diluted

by river water. This assumption does not hold for cases where salinity is less than about three parts per thousand. Salinity determinations at such low values are only approximate. In estuarine waters, salinity is a relevant and meaningful parameter. Often the salinity may be low, approaching that of freshwater. Nevertheless, this is useful information. Determine if a station is estuarine from historical records (i.e., experiences cases where salinity is >2.0 ppt) and always report salinity at this station, regardless of the salinity during periods of high flow.

Salinity is measured directly in-stream at the depth(s) specified earlier in this document. Salinity data should be recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff. See http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting.

Values between 2.0 ppt and 1.0 ppt should be reported as <2.0 ppt rather than the actual value and values <1.0 ppt should be reported as <1.0 ppt. The field instruments compute salinity from specific conductance and temperature, and display the value in parts per thousand. Report salinity values above 2.0 ppt to the nearest 0.1 ppt.

Secchi Disc Transparency (meters)--if requested in special study

Secchi disk transparency should be recorded for each SWAMP visit in final form on a Field Data Sheet and submitted to the SWAMP data management staff. See http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting.

Secchi Disk Sampling Equipment

- Secchi disk, 20 cm in diameter
- Measuring tape

Secchi Disk Transparency Sampling Procedures

Preferably, Secchi disk transparency is measured directly in-stream wherever conditions allow. The Secchi disk should be clean, weighted and suspended with chain, wire, or Dacron line (the line used to suspend the Secchi disk should not be nylon or cotton; stretching may cause erroneous readings). Another option is to attach the Secchi disk to a metal rod calibrated in metric units.

Average Turbidity

The Secchi disk should be lowered vertically in a location shielded from direct sunlight. Glare from the water's surface will affect the accuracy of the measurement. Don't wear sunglasses.

Slowly lower the disk until it disappears from view. The person viewing the disk should maintain an eye level of less than two meters above the water's surface. Note the depth at which the disk disappears from view.

Slowly raise the disk until it becomes visible. Note the depth at which the disk reappears.

Compute the mathematical average of the two depths noted and record the average value to two significant figures in the field logbook. The recorded average value is the Secchi disk transparency.

High Turbidity (Muddy Water)

In streams with very high turbidity, high velocity, and/or poor access, it may be necessary to measure Secchi disk transparency in a bucket. Fill the bucket from the centroid of flow being careful not to disturb the substrate.

Follow steps above for measuring the Secchi disk depth within 30 s after raising the filled bucket from the water's surface. Or, re-suspend the solids by stirring, then quickly make the measurement.

Record Secchi disk transparency to two significant figures.

Low Turbidity (Clear Water)

Some bodies of water will be so clear and shallow that it will not be possible to lower the Secchi disk until it disappears from view.

Measure and record the depth at the deepest point accessible. Report Secchi disk transparency as greater than the deepest depth measured.

Example (Low Turbidity): South Fork Rocky Creek is a small (<1 ft^3/s) clear stream. The stream in the vicinity of the sampling site was less than 1 m deep and the bottom was clearly visible everywhere. However, a pool was located in the stream next to a bridge. The maximum depth of the pool was 2.6 m at which depth the Secchi disk was still visible. Therefore, Secchi disk transparency for South Fork Rocky Creek was recorded as > 2.6 m.

Importance of Secchi Disk Data

Eutrophication, the natural aging process in reservoirs and lakes is accelerated by human activities which add nutrients to lakes, reservoirs, and the surrounding watersheds. Section 314 of the Clean Water Act (CWA) of 1987 requires all states to classify lakes and reservoirs according to trophic state. Although chlorophyll a is the most direct measure of algal biomass, other indices and programs utilize Secchi disk depth as the primary factor.

Turbidity Measurement with Turbidity Meter

Nephelometric Turbidity can be determined by measuring the amount of scatter when light is passed through a sample using a turbidity meter. The LaMotte 2020 Turbidity meter is a suitable instrument for example.

Meters should be calibrated using a standard close to the expected sample value.

For instructions on how to operate the instruments refer to the manufacturer's manual. Turbidity measurements can be executed together with water sampling. The turbidity sample has to be representative for the sampled water mass. Make sure that no gas bubbles are trapped in the vial for the reading and that the outside of the vial is wiped completely clean (i.e., meaning free of moisture, lint and fingerprints). Take several measurements to assure an accurate reading. Do not record values that vary greatly. If variations are small, record an average. If settling particles are present, record a reading before and one after settling. The meter might have to be recalibrated with a different standard, if the sample water readings are outside of the calibration standard limits.

Days Since Last Significant Precipitation

Significant precipitation is defined as any amount that visibly influences water quality. Water quality in small to medium streams and in the headwaters of many reservoirs is influenced by runoff during and immediately after rainfall events. This influence is site specific and poorly studied. As part of a new initiative to understand and regulate the adverse effects of runoff, SWAMP would like to associate recent rains or melted snow with ambient water quality, using a parameter defined as "days since last significant precipitation". Record the number of days, rounded to the nearest whole number, since a rain has occurred that, in the best professional judgment of monitoring personnel, may have influenced water quality. If it is raining when the sample is collected, or has rained within the last 24-h, report a value of <1. If it has been a long time since a significant rain, record this as greater than that particular value, for example >7 days. If confidence about the recent history of precipitation is low, draw a line through the space on the data form.

Flow Severity -- recommended new parameter

Flow severity should be noted for each SWAMP visit to non-tidally influenced flowing streams and submitted in the comments on the SWAMP Field Data Sheet. It should be recorded even if flow is visible but not measurable on that sampling visit. There are no numerical flow guidelines associated with flow severity. This is an observational measurement that is highly dependent on the knowledge of monitoring personnel. It is a simple but useful piece of information when assessing water quality data. For example, a bacteria value of 10,000 with a flow severity of 1 would represent something entirely different than the same value with a flow severity of 5. The six flow severity values are; 1=No Flow, 2= Low Flow, 3 = Normal Flow, 4 = Flood, 5 = High Flow, and 6 = Dry. The following are detailed descriptions of severity values:

1 **No Flow** When a flow severity of one (1 = no flow) is recorded for a sampling visit, then a flow value of zero ft^3/s should also be recorded for that sampling visit. **A flow severity of one (1) (no flow) describes situations where the stream has water visible in isolated pools.** There should be no obvious shallow subsurface flow in sand or gravel beds between isolated pools. Low flow does not only apply

to streams with pools. It also applies to long reaches of bayous and streams that have no detectable flow but may have water from bank to bank.

2 **Low Flow** When stream flow is considered low a flow severity value of two (2) is recorded for the visit and the corresponding flow measurement is also recorded for that visit. In streams too shallow for a flow measurement but with detected water movement, record a value of < 0.10 cfs. Note: Use a stick or other light object to verified the direction of water movement (i.e., movement is downstream and not the affect of wind.) What is low for one stream could be high for another.

3 **Normal Flow** When stream flow is considered normal, a flow severity value of three (3) is recorded for the visit and the corresponding flow measurement is also be recorded for that visit. Normal is highly dependent on the stream. Like low flow, what is normal for one could be high or low for another stream.

4 and 5 **Flood and High Flow** Flow severity values for high and flood flows have long been established by EPA and are not sequential. Flood flow is reported as a flow severity of four (4) and high flows are reported as a flow severity of five (5). High flows would be characterized by flows that leave the normal stream channel but stay within the stream banks. Flood flows are those which leave the confines of the normal stream channel and move out on to the flood plain.

6 **Dry** When the stream is dry a flow severity value of six (6 = dry) is recorded for the sampling visit. In this case the flow is not reported. This will indicate that the stream is completely dry with no visible pools.

Flow information for over 200 USGS sites is available on the Internet. The address is **http://water.usgs.gov/index.html**. This is useful information in determining flow conditions prior to sampling. This information may be included in general observations.

Flow Measurement Method (Reporting)

The method (or instrument) used to measure flow is noted by reporting a method number. The method numbers are:

1- Flow Gage Station (USGS/IBWC)	3- Electric (ex. Marsh-McBirney)
2- Mechanical (ex. Pigmy meter)	4- Weir/Flume
5- Other (orange peel, etc.)	

Flow (ft^3/s)

If requested, flow data should be recorded for each monitoring visit to non-tidal, flowing streams. Flow data should be recorded in final form on a Field Data Sheet and submitted to the SWAMP data management staff. See http://mpsl.mlml.calstate.edu/swdwnlds.htm for detailed information on data reporting. The following are two exceptions to the flow reporting requirement:

No Flow/ Pools — If there is no flow at a stream site and accessible, isolated pools remain in the stream bed, collect and report the required field data and laboratory samples from the pools and report instantaneous flow. Under these conditions, flow (ft^3/s) should be reported as zero. The reported flow severity value should be one. Pools may represent natural low-flow conditions in some streams and the chemistry of these pools will reveal natural background conditions.

Dry — If the stream bed holds no water, the sampling visit is finished. Report that the stream was "dry" in the observations and record a value of six (meaning "dry") for flow severity. No value is reported for flow since there is no water.

Flow Measurement

If a flow measurement is required at a site, measure and record flow after recording visual observations. The intent of measuring flow first is to delay collection of chemical and biological water samples with limited holding times. Care must be taken not to collect water samples in the area disturbed during flow measurement. There are several acceptable flow measurement methods that can be used.

U.S. Geological Survey (USGS) Gaging Station

Some SWAMP Stations are sampled at sites where the USGS maintains flow gaging equipment. On any type of sampling visit to a site that has a USGS flow gage, observe and record the gage height to the nearest hundredth of a foot in the field logbook. Upon return to the office, contact the USGS office responsible for maintaining the gage. USGS personnel can provide the flow value in cubic feet per second (ft^3/s) that corresponds to the gage height. Although SWAMP personnel may have a rating curve available to them, shifts associated with changes in the stream bed may occur over time. Always call the USGS to determine the shift. At some sites the shift changes frequently. At others, the relation between stream flow and gage height is almost unchanging. If a gage is no longer maintained by USGS, cross out the recorded gage height and be prepared to measure flow by another method on the return visit to that site.

Several factors may influence the accuracy of the USGS rating curves that are used to convert gage height to flow. If there is any doubt about the accuracy of a USGS gage height reading or flow rating curve, sampling personnel should measure the flow if possible.

Gage height may be indicated at a USGS gage by one of three methods:

Staff Gage

Staff gages are enameled steel plates (with the appearance of large measuring tapes) bolted to some stable structure. For example, staff gages may be bolted to concrete bridge abutments, pillars, or docks. The staff gage face is white with black lettering and gradations. The gradations shown are feet, tenths of a foot, and 0.02 of a foot. The point at which the water level crosses the staff gage should be recorded to the nearest hundredth of a foot.

Wire Weight Gage

Wire weight gages are locked, metal boxes with approximate dimensions of 15 in. long x 12 in. tall x 12 in. deep. Wire weight gages are usually affixed to bridge rails near mid-stream. They must be unlocked with a USGS key. The wire weight gages house a weight attached by wire cable to a graduated reel (gradations are tenths and hundredths of feet) with a counter at one end.

When the reel is released the weight can be gradually lowered until the bottom of the weight contacts the water surface. At the point of contact, the weight causes the water surface to ripple slightly. Maintaining the weight in that position, record the counter value to the nearest whole number and the point indicated by the stylus on the graduated reel to the nearest hundredth of a foot. Determine if the gage is the movable type that can be moved to multiple locations on the bridge. This type is common on braided streams. A correction value is stamped on the bridge near each point that the gage can be attached. Record the corrected value as the gage height in feet.

Bubble Gage

Bubble gages are locked in metal sheds that are approximately 4 ft wide x 4 ft deep x 6.5 ft tall. The gage houses are most frequently located on the shore near a bridge but sometimes are attached to bridge pillars near mid-stream or established on the stream bank far from any bridge. The gage house must be unlocked with a USGS key. Bubble gages in gage houses usually indicate the gage height in two or three locations. A counter attached to the manometer system indicates gage height in feet. Some gage houses have stilling wells that can be entered. Often there is a staff gage on the inside wall.

Most bubble gages are also equipped with digital recorders. Digital recorders consist of two white, coded discs, approximately 4 in. in diameter with a punch tape overlapping a portion of each disc. The discs are marked with 100 gradations. As the front of the digital recorder is viewed, the stylus at the disc on the left indicates height in feet. The stylus at the disc on the right indicates gage height in hundredths of feet. The gage height from both discs should be added and the number recorded in the field logbook as gage height to the nearest hundredth of a foot.

Many USGS metal sheds also contain a surface level recorder. This devise can be opened to determine how stable stream flow has been prior to the sampling event. Record observations concerning the flow hydrograph.

Instantaneous Flow Measurement

Water quality monitoring visits to sites where there are no nearby USGS flow gauges will require water quality monitoring personnel to measure flow, when requested by Regional Water Quality Control Boards (Regional Boards).

Flow Measurement Equipment

Flow meter

One of the following or an equivalent:

- Marsh-McBirney Electronic meter
- Montedoro-Whitney Electronic meter
- Price Pigmy meter (with timer and beeper)
- Price meter, Type AA (with Columbus weight)

Additional Equipment

- Top-setting wading rod (preferably measured in tenths of feet)(see Figure 1).
- Tape measure (with gradations every tenth of a foot).

Flow Measurement Procedure (USGS, 1969)

Select a stream reach with the following characteristics:

- Straight reach with laminar flow (threads of velocity parallel to each other) and bank to bank. These conditions are typically found immediately upstream of riffle areas or places where the stream channel is constricted.
- The site should have an even streambed free of large rocks, weeds, and protruding obstructions that create turbulence. The site should not have dead water areas near the banks, and a minimum amount of turbulence or back eddies.

Flat Streambed Profile (cross section)

Stretch the measuring tape across the stream at right angles to the direction of flow. When using an electronic flow meter, the tape does not have to be exactly perpendicular to the bank (direction of flow). When using a propeller or pigmy type meter, however, corrections for deviation from perpendicular must be made.

If necessary and possible, modify the measuring cross section to provide acceptable conditions by building dikes to cut off dead water and shallow flows, remove rocks, weeds, and debris in the reach of stream one or two meters upstream from the measurement cross section. After modifying a streambed, allow the flow to stabilize before starting the flow measurement.

Record the following information on the flow measurement form (see example Flow Measurement Forms at end of this document):

- Station Location and Station ID
- Date
- Time measurement is initiated and ended
- Name of person(s) measuring flow
- Note if measurements are in feet or meters
- Total stream width and width of each measurement section
- For each cross section, record the mid-point, section depth and flow velocity

Measuring the Stream Width

Measure and record the stream width between the points where the tape is stretched (waters edge to waters edge).

Determining the Number of Flow Cross Sections

Determine the spacing and location of flow measurement sections. Some judgment is required depending on the shape of the stream bed. Measurements must be representative of the velocity within the cross-section. If the stream banks are straight and the depth is nearly constant and the bottom is free of large obstructions, fewer measurements are needed, because the flow is homogeneous over a large section. Flow measurement sections do not have to be equal width. However, they should be unless an obstacle or other obstruction prevents an accurate velocity measurement at that point. ***No flow measurement section should have greater than 10% of the total flow.***

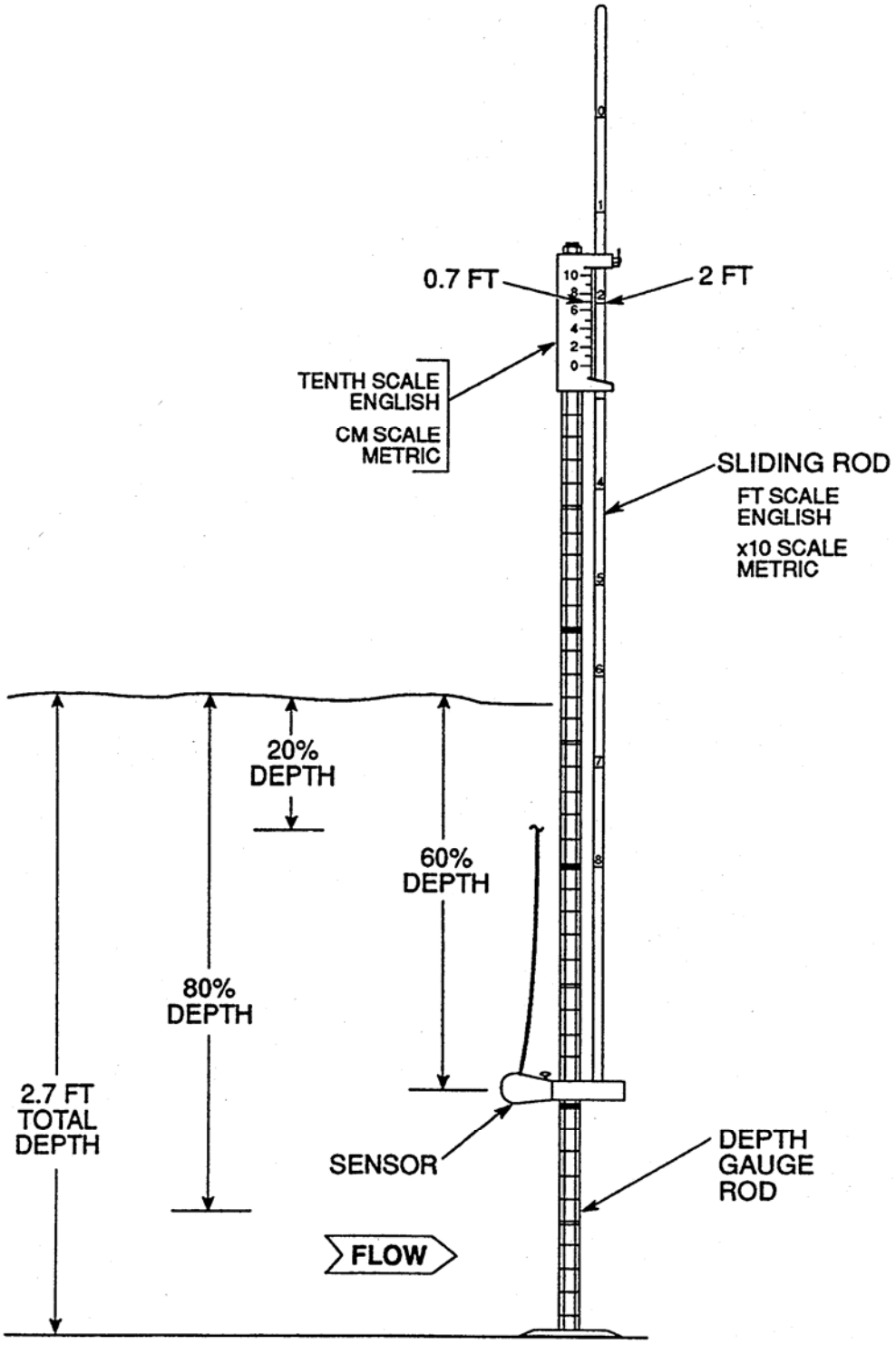
If the *stream width is less than 5 ft*, use flow sections with a width of 0.5 ft (See example 1 on page 23 of this document). If the *stream width is greater than 5 ft*, the minimum number of flow measurements is 10. The preferred number of flow measurement cross sections is 20-30 (See Example 2 on page 24 on this document). The total stream width is 26 ft with 20 measurements, section widths will be 1.3 ft (26/20 = 1.3).

Determining the Mid-Point of the Cross Section

To find the mid-point of a cross section, divide the cross section width in half. Using Example 2 (see forms at end of document);

- The total stream width is 26 ft with 20 cross sections and each cross section width is equal to 1.3 ft.
- Divide 1.3 ft in half and the mid-point of the first section is 0.65 ft. In this example the tape at waters edge is set at zero (0) ft.
- By adding 0.65 to zero the mid-point of the first section is 0.65 ft.
- Each subsequent mid-point is found by adding the section width (1.3 ft) to the previous mid-point. For example; MIDPOINT #1 is 0.65 + 0.0 = 0.65; MIDPOINT #2 is 0.65 + 1.3= 1.95 ft; MIDPOINT #3 is 1.95 + 1.3 = 3.25 ft and ....MIDPOINT # 20 is 24.05 +1.3.
- Place the top setting wading rod at 0.65 ft for the first measurement.
- Using a top setting wading rod, measure the depth at the mid-point of the first flow measurement section and record to the nearest 0.01 ft.

Figure 1. Top-Setting Wading Rod (Marsh-McBirney)



Adjusting the Sensor Depth at a Cross Section

Adjust the position of the sensor to the correct depth at each mid-point. The purpose of the top setting wading rod is to allow the user to easily set the sensor at 20%, 60%, and 80% of the total depth. The total depth can be measured with the *depth gage rod*. Each single mark represents 0.10 foot, each double mark represents 0.50 foot, and each triple mark represents 1.00 foot (see Figure 2).

For Depths < 2.5 Ft	If the depth is less than 2.5 ft, only one measurement is required at each measurement section. To set the sensor at 60% of the depth, line up the foot scale on the *sliding rod* with the *tenth scale*, located on top of the depth gage rod. If, for example, the total depth is 2.7 ft (as shown on Figure 2), then line up the 2 on the foot scale with the 7 on the tenth scale (Marsh-McBirney 1990).
For Depths > 2.5 Ft	If the depth is greater than 2.5 ft, two measurements should be taken at 20% and 80% of the total depth. To set the sensor at 20% of the depth, multiply the total depth by two. For example, if the total depth is 2.7 ft, the rod would be set at 5.4 ft (2.7 x 2). Line up the 5 on the sliding rod with the 4 on the tenth scale.
For Depths > 2.5 Ft (cont)	To set the sensor at 80% of the depth, divide the total depth by two. For example, the total depth is 2.7 ft the rod would be set at 1.35 ft (2.7/2). Line up the 1 on the sliding rod with the 0.35 on the tenth scale. The average of the two velocity measurements is used in the flow calculation. See page 2-36 for an example of a flow form recording measurements for depths greater than 2.5 ft. NOTE: The point where the rod is set for 20 and 80% of the depth will not equal values derived by calculating 20 and 80% of the total depth.

Measuring Velocity (this has typically been measured at 6/10 of the total depth, for velocity-only measurements)

- Position the meter at the correct depth and place at the mid-point of the flow measurement section. Measure and record the velocity and depth. The wading rod is kept vertical and the flow sensor kept perpendicular to the tape rather than perpendicular to the flow while measuring velocity with an electronic flow meter. When using a propeller or pigmy-type meter, however, the instrument should be perpendicular to the flow.
- Permit the meter to adjust to the current for a few seconds. Measure the velocity for a minimum of 20 s with the Marsh-McBirney and Montedoro-Whitney meters. Measure velocity for a minimum of 40 s (preferably 2 min with the Price and pigmy meters).
- When measuring the flow by wading, stand in the position that least affects the velocity of the water passing the current meter. The person wading stands a minimum of 1.5 ft downstream and off to the side of the flow sensor.

- A flow sensor, equipped with cable and weight may be used to measure flows where the water is too deep to wade. Follow the procedure involving meters attached to wading rods.
- Report flow values less than 10 ft^2/s to two significant figures. Report flow values greater than 10 ft^3/s to the nearest whole number, but no more than three significant figures.
- In cases where the flow is low and falling over an obstruction, it may be possible to measure the flow by timing how long it takes to fill a bucket of known volume.

Avoid measuring flow in areas with back eddies. The first choice would be to select a site with no back eddy development. However, this can not be avoided in certain situations. Measure the negative flows in the areas with back eddies. These negative values will be included in the final flow calculation.

Calculating Flow

To calculate flow, multiply the width x depth (ft^2) to derive the area of the flow measurement section. The area of the section is then multiplied by the velocity (ft/s) to calculate the flow in cubic feet per second (cfs or ft^3/sec) for that flow measurement section. When flow is calculated for all of the measurement sections, they are added together for the total stream flow (see Figure 2).

Q=Total Flow (or discharge), W=Width, D=Depth, V=Velocity.

$$Q = (W_1 * D_1 * V_1) + (W_2 * D_2 * V_2) + ... (W_n * D_n * V_n)$$

What to Do with Negative Values

Do not treat cross sections with negative flow values as zero. Negative values obtained from areas with back eddies should be subtracted during the summation of the flow for a site.

Flow Estimate (ft^3/s)

Flow estimate data may be recorded for a non-tidally influenced stream when it is not possible to measure flows by one of the methods described above. Flow estimates are subjective measures based on field personnel's experience and ability to estimate distances, depths, and velocities. If flow can not be measured at a routine non-tidal station, a new site should be selected where flow can be measured.

Flow Estimate Procedure

- Observe the stream and choose a reach of the stream where it is possible to estimate the stream cross section and velocity.
- Estimate stream width (ft) at that reach and record.
- Estimate average stream depth (ft) at that reach and record. Estimate stream velocity (ft/s) at that reach and record. A good way to do this is to time the travel of a piece of floating debris. If doing this method from a bridge, measure the width of the bridge. Have one person drop a floating object (something that can be distinguished from other

floating material) at the upstream side of the bridge and say start. The person on the downstream side of the bridge will stop the clock when the floating object reaches the downstream side of the bridge. Divide the bridge width by the number of seconds to calculate the velocity. The velocity can be measured at multiple locations along the bridge. These velocities are averaged. If this is done alone, watch for road traffic.

< Multiply stream width (ft) times average stream depth (ft) to determine the cross sectional area (in ft^2) which when multiplied by the stream velocity (in ft/s) and a correction constant, gives an estimated flow (ft^3/s).

Example: A stream sampler conducted a sampling visit to a stream while the flow meter was being repaired. The sampler looked at the creek downstream from the bridge and saw a good place to estimate flow. The stream width was around 15 ft. It appeared the average depth on this reach was about 0.75 ft. The sampler timed a piece of floating debris as it moved a distance of 10 ft in 25 s downstream over the reach. An estimated flow with a smooth bottom was calculated using the following formula.

Width x Depth x Velocity x A (correction factor)= estimated flow
15 ft (width) x 0.75 ft (depth) x 2.5 ft/s (velocity) x A =25 ft^3/s (cfs)

A is a correction constant: 0.8 for rough bottom and 0.9 for smooth bottom

Estimated flow should be reported to one or two significant figures.

Experienced field personnel are able to estimate flow to within 20% of actual flow for total flows less than 50 ft^3/s. The best way to develop this skill is to practice estimating flow before making measurements at all monitoring visits to non-tidally influenced flowing streams and then compare estimated flows with those obtained from USGS gages or from instantaneous flow measurements

Figure 2. Stream Flow (Discharge) Measurement

Example 1.
Stream Flow (Discharge) Measurement
Small Stream < 5 Ft Wide and #2.5 Ft Deep

Stream:___**_OAK CREEK**_____Date:__**5/29/91**___
Station Description:_____**at US Hwy 90A**_____
Time Begin:__**1545**_____Time End:__**1630**_____Meter Type:_**_Marsh-McBirney**_____
Observers:_____**BK/MK**_____Stream Width*:____**5 ft**_____ Section Width:____**0.5 ft**_____
Observations:_____

Section Midpoint (ft)	Section Depth (ft)	Observational Depth** Ft	Velocity		Area W x D (ft^2)	Discharge (Q) V x A (ft^3/s)
			At Point (ft/s)	Average (ft/s)		
0.25	**0.55**			**0.05**		**0.01375**
0.75	**0.80**			**0.11**		**0.044**
1.25	**0.85**			**0.27**		**0.42635**
1.75	**0.90**			**0.49**		**0.2205**
2.25	**1.10**			**0.58**		**0.275**
2.75	**1.50**			**0.72**		**0.540**
3.25	**1.20**			**0.76**		**0.456**
3.75	**0.90**			**0.76**		**0.342**
4.25	**0.75**			**0.44**		**0.165**
4.75	**0.30**			**0.00**		**0.00**

m^3/s x 35.3 = ft^3/s

Total Discharge (3Q) (ft^3/s)	**2.4826**

Example 2.

Stream Discharge Measurement Example (Larger Stream > 5 Ft and #2.5 Ft Deep)

Stream:___**_RED RIVER**_____Date:__**5/28/91**___

Station Description:_____**Post Oak Creek 40 m Below Sherman WWTP Outfall**_____

Time Begin:__**1542**_____Time End:__**1601**_____Meter Type:_**Marsh-McBirney**_____

Observers:_____**CM, EW, DO**_____Stream Width*:____**26 ft**___ Section Width:___**1.3 ft**_____

Observations:_____

Section Midpoint (ft)	Section Depth (ft)	Observational Depth** ft	Velocity		Area W x D (ft^2)	Discharge (Q) V x A (ft^3/s)
			At Point (ft/s)	Average (ft/s)		
0.65	0.55			2.03	0.715	1.451
1.95	0.40			2.04	0.520	1.061
3.25	0.42			2.02	0.546	1.103
4.55	0.38			1.77	0.494	0.874
5.25	0.40			1.75	0.520	0.910
7.15	0.42			1.93	0.546	1.054
8.45	0.40			1.99	0.52	1.035
9.75	0.37			1.92	0.481	0.924
11.05	0.37			1.56	0.481	0.750
12.35	0.43			1.32	0.559	0.738
13.65	0.40			1.36	0.520	0.707
14.95	0.42			1.33	0.546	0.726
16.25	0.40			1.35	0.520	0.702
17.55	0.45			1.64	0.585	0.959
18.85	0.48			1.70	0.624	1.061
20.15	0.48			2.00	0.624	1.248
21.45	0.50			1.95	0.650	1.268
22.75	0.40			2.18	0.520	1.134
24.05	0.48			1.71	0.624	1.067
25.35	0.50			0.60	0.650	0.390
				Total Discharge (3Q) (ft^3/s)		**19.162**

m^3/s x 35.3 = ft^3/s

Example 3.

Stream Flow (Discharge) Measurement (Larger Stream > 5 Ft and >2.5 Ft Deep)

Stream:____ARROYO COLORADO_____Date:__**6/16/98**__

Station Description:_____Downstream of Harlingen WWTP_____

Time Begin:__**1400**_____Time End:__**1445**_____Meter Type:__**Marsh-McBirney**_____

Observers:_____**JD, CK**_____Stream Width*:___**47.5 ft**___ Section Width:___**2.375 ft**_____

Observations: *Note that the starting point is at 4.7 ft on the measuring tape and not zero.

Section Midpoint (ft)	Section Depth (ft)	Observational Depth** ft	Velocity		Area W x D (ft^2)	Discharge (Q) V x A (ft^3/s)
			At Point (ft/sec)	Average (ft/sec)		
4.70	0.73			0.65	1.73	1.127
7.08	1.10			1.08	2.61	2.822
9.45	1.85			0.90	4.39	3.954
11.83	2.20			1.05	5.23	5.486
14.20	2.20			1.44	5.23	7.531
16.58	2.45			1.09	5.82	6.342
18.95	2.55	0.20	1.75	1.76	6.06	10.659
		0.80	1.76			
21.33	2.60	0.20	1.79	1.56	6.18	9.633
		0.80	1.32			
23.70	2.70	0.20	1.63	1.45	6.41	9.298
		0.80	1.26			
26.10	3.05	0.20	1.68	1.42	7.24	10.286
		0.80	1.15			
28.48	3.10	0.20	1.23	0.96	7.36	7.068
		0.80	0.69			
30.85	2.90	0.20	1.22	1.06	6.89	7.301
		0.80	0.89			
33.23	2.84	0.20	0.60	0.49	6.75	3.305
		0.80	0.37			
35.60	2.65	0.20	0.80	0.51	6.29	3.210
		0.80	0.21			
37.98	2.65	0.20	0.85	0.91	6.29	5.727
		0.80	0.96			
40.35	2.20			0.28	5.23	1.464
42.73	2.30			0.16	5.46	0.874
45.10	2.05			0.51	4.87	2.483
47.48	1.10			0.49	2.61	1.280
49.86	0.65			0.62	1.54	0.957

m^3/s x 35.3 = ft^3/s | **Total Discharge (3Q) (ft^3/s)**

Stream Flow (Discharge) Measurement Form

Stream:______________________________ Date:__________

Station Description:______________________________

Time Begin:________ Time End:________ Meter Type:______________

Observers:______________ Stream Width*:__________ Section Width:________

Observations:______________________________

Section Midpoint (ft) (m)	Section Depth (ft) (m) (cm)	Observational Depth** ft-m-cm	Velocity		Area W x D (ft^2) (m^2)	Flow (Q) V x A (m^3/s) (ft^3/s)
			At Point (ft/s) (m/s)	Average (ft/s)(m/s)		

m^3/s x 35.3 =ft^3/s

Total Flow (Discharge) (3Q) (ft^3/s)	

* Make a minimum of 10 measurements when the total width is > 5.0 ft, 20 measurements preferred.

** When water is < 2.5 ft deep take one measurement at each cross section. When water is > 2.5 ft deep, take two measurements at each cross section; one at 2 the total depth and the other at 2 x the total depth. Average the two velocity measurements. See SWAMP Procedures Manual for a detailed flow measurement method.

Summary of Significant Figures for Reporting Field Parameters

Parameter	Field Data Reporting Requirements
Water Temperature (^oC)	Report temperature to the nearest tenth of a degree. Round insignificant figures 0 through 4 down and 5 thru 9 up.
pH (s.u.)	Report pH to the nearest tenth of a pH standard unit.
D.O. mg/L **D.O.** (% saturation)	Report dissolved oxygen to the nearest tenth of a mg/L. Report % saturation to the nearest tenth of a percent
Specific Conductance (micro siemens/cm)	Report specific conductance to only three significant figures if the value exceeds 100. Do not report ORP which is displayed by some multiprobes.
Salinity (ppt)	Report salinity values above 2.0 ppt to the nearest tenth of a part per thousand. In estuarine waters report the actual values displayed by the multiprobe above 2.0 ppt and values less than 2.0 as <2.0 or <1.0 only. Determine if a station is estuarine (i.e., experiences cases where salinity is >2.0 ppt) and always report salinity at this station, regardless of the salinity during periods of high flow.
Secchi Disk (meters)	Report Secchi depth transparency in meters to two significant figures.
Days Since Last Significant Precipitation(days)	Report whole numbers. If it is raining when the sample is collected or has rained within the last 24 h, report a value of <1. If it has been over a week since a rainfall event, report a value of > 7.
Flow (ft^3/s)	Report instantaneous flow values less than 10 ft^3/s to two significant figures. Report flow values greater than 10 ft^3/s to the nearest whole number, but no more than three significant figures. When there is no flow (pools), report as 0.0. When there is no water, don't report a value, but report as "dry" in the observations.
Flow Severity (1-no flow, 2-low, 3-normal, 4-flood, 5-high, 6-dry)	When there is no flow (pools), report the severity as 1, and the instantaneous flow as 0.0 ft^3/s. If the stream is dry, record only flow severity, as a value of 6.

BEAUFORT SCALE: Specifications and equivalent speeds for use at sea

FORCE	EQUIVALEN SPEED 10 m above ground		DESCRIPTION	SPECIFICATIONS FOR USE AT SEA
	Miles/hour	knots		
0	0-1	0-1	Calm	Sea like a mirror
1	1-3	1-3	Light air	Ripples with the appearance of scales are formed, but without foam crests.
2	4-7	4-6	Light Breeze	Small wavelets, still short, but more pronounced. Crests have a glassy appearance and do not break.
3	8-12	7-10	Gentle Breeze	Large wavelets. Crests begin to break. Foam of glassy appearance. Perhaps scattered white horses.
4	13-18	11-16	Moderate Breeze	Small waves, becoming larger; fairly frequent white horses.
5	19-24	17-21	Fresh Breeze	Moderate waves, taking a more pronounced long form; many white horses are formed. Chance of some spray.
6	25-31	22-27	Strong Breeze	Large waves begin to form; the white foam crestsare more extensive everywhere. Probably some spray.
7	32-38	28-33	Near Gale	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind.
8	39-46	34-40	Gale	Moderately high waves of greater length; edges of crests begin to break into spindrift. The foam is blown in well-marked streaks along the direction of the wind.
9	47-54	41-47	Severe Gale	High waves. Dense streaks of foam along the direction of the wind. Crests of waves begin to topple, tumble, and roll over. Spray may affect visibility.
10	55-63	48-55	Storm	Very high waves with long over- hanging crests. he resulting foam, in great patches, is blown in dense white streaks along the direction of the wind. On he whole the surface of the sea takes on a white appearance. The 'tumbling' of the sea becomes heavy and shock-like. Visibility affected.

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http://www.zetnet.co.uk/sigs/weather/Met_Codes/beaufort.htm

Attachment 2 – Field Meter Calibration Record Form

Form 1: Calibration Record Sheet

Pre-run Calibration					For DO Calibration (Value of DO Standard)	
Date:		Time:		Altitude (ft):	Barometric Presssure: (uncorrected)	**mm Hg**
S/N:				Battery Voltage (%):	O_2 100% Saturation Value at Ambient Temperature:(2)	**mg/L**
Calibrated by:					Altitude Correction Factor : (Table 2)	

Instrument Function	Temp. of Standard	Value of Standard (1)	Initial Reading:	Calibrated to:	Please record calibration standard lot numbers. **Record pH millivolts after each pH calibration.**	
Sp.Cond. uS/cm					Lot #:	pH Millivolts/Wiper Ck
pH Buffer 4.00					Lot #:	mv
pH Buffer 7.00					Lot #:	mv
pH Buffer 10.00					Lot #:	mv
Turbidity 0 NTU					Lot #	Wiper OK
Turbidity 10.0 NTU					Lot #	Wiper OK
Dissolved Oxygen (mg/L) (1) Minimum 10 min equilibration time	Ambient Temp (2)		**mg/L**	**mg/L**	**DO Charge:**	Wiper OK

(1) Value of DO Standard = 100% Saturation Value X Altitude Correction Factor

Calibration Information			
Record the following diagnostic numbers <u>after</u> calibration			Comments
Conductivity Cell Constant		Range 4.5 to 5.5	(Sonde Menu - Advanced - Cal Constants)
DO Charge **(N/A for ROX Probe)**		Range 25 to 75	(Sonde Menu - immediately after DO calibration)
DO Gain		Range 0.7 to 1.5	(Sonde Menu - Advanced - Cal Constants)
pH MV Buffer 4.00		Range 177 +-50 MV	(Sonde Menu - immediately after pH 4calibration)
pH MV Buffer 7.00		Range 0 +- 50 MV	(Sonde Menu - immediately after pH 7 calibration)
pH MV Buffer 10.00		Range -177 +- 50 MV	(Sonde Menu - immediately after pH 10 calibration)
pH Slope (pH 7 MV - pH 10 MV)		Range 162 to 180 MV	If slope is very near lower limit, use only for spot-checking, not long-term deployment

Post-run Calibration Check					For DO Calibration Value	
Date:		Time:		Altitude (ft):	Barometric Pressure: (uncorrected)	**mm Hg**
Calibration Check by:				Battery Voltage (%):	O_2 100% Saturation Value at Ambient Temperature:	**mg/L**
DO Calibration Value = O_2 100% Sat. Value X Altitude Correction Factor					Altitude Correction Factor : (Table 2)	

Instrument Function	Temp. of Standard	Value of Standard	Instrument Reading	DO Calib. Value	Drift (+ -)	Post Calibration Error Limits and Q/A Check	
Sp.Cond. uS/cm				DO Calibration Value = O_2 100% Sat. Value X Altitude Correction Factor		+- 5%	Q/A Ck:
pH Buffer 4.00						+- 0.3 units	Q/A Ck:
pH Buffer 7.00						+- 0.3 units	Q/A Ck:
pH Buffer 10.00						+- 0.3 units	Q/A Ck:
Turbidity						+-0.3 NTU	Q/A Ck:
Dissolved Oxygen (mg/L)		N/A	mg/L	mg/L		+- 0.5 mg/l	Q/A Ck:

Notes: _____

Rev.2/21/2008

STANDARD OPERATING PROCEDURES
for
Continuous General Water Quality Measurements
(SOP FS-4)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This standard operating procedure (SOP) is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:
General Water Quality

SOP Background and Application

This SOP is intended to standardize procedures for the maintenance, calibration, deployment, post-deployment and data evaluation of multi-probe instrument YSI 6600 or 6920 series sonde or equivalent equipment.

References to Existing SOPs

This SOP is based on information provided in the document "**Standard Operating Procedures for Conducting Time-Series Field Monitoring of Ambient Water Quality Measurements with a Multiparameter Instrument (YSI 6600 or 6920 Sonde)**", March 2011, developed by Water Board Region 2.

Relevant QA/QC protocols are also referenced in the associated RMC QAPPs for bioassessment and water quality monitoring: **BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan**, version 2, January 2014 (BASMAA 2014).

Special Cautions and Considerations; Health and Safety

Proper gloves must be worn to both prevent contamination of the sample and to protect sampling personnel from environmental hazards. The user should wear at least one layer of gloves, but two layers help protect against leaks. All gloves must be powder free. Disposable polyethylene, nitrile, or non-talc latex gloves are acceptable for many types of sampling; however, samples for low level metals and mercury analysis can only be collected and handled using polyethylene gloves as the outer layer.

CAUTIONS

When conducting sampling in areas of unknown water quality, especially in waters that are suspected to contain hazardous substances, bacteria, or viruses, it is preferable that at least one layer of gloves be of shoulder length, to limit skin contact with the source water.

When using chemical cleaners, as required as part of the equipment cleaning and decontamination protocols (see SOP FS-7, Field Equipment Cleaning Procedures and SOP FS-8, Field Equipment Decontamination Procedures), always read the product label and adhere to all printed cautions and safety measures.

Methods / Procedures

The following standard procedures are provided for collecting general water quality data using multi-parameter probes. Parameters include temperature, dissolved oxygen (DO), specific conductivity, and pH. Water quality measurements will be collected once during the spring (concurrent with bioassessment sampling) and once during late summer (August – September) for 15 minute intervals over 1-2 week time period.

CALIBRATION

The accuracy of sonde probe readings must be checked against calibration standard solutions. Calibration of these probes to these standards must be performed prior to initial deployment, during interruptions in the deployment (i.e., field checks) and after the sonde is retrieved. The post-run calibration allows the data collected to be checked for accuracy and flagged as not meeting measurement quality objectives if necessary.

It is recommended that both pre- and post-deployment calibrations be conducted in the laboratory. Field calibrations are only recommended when equipment is deployed for longer than 2-3 weeks and field checks are necessary either due to need for battery replacement or potential for fouling. If field calibrations are necessary, to the extent possible, work in the shade and maintain standard solutions at the same temperature. Example calibration data sheet is provided in Attachment 1.

The following reagents and volumes are required to calibrate YSI 6600 sonde probes:

Sensor	Standard Solution	Volume (ml)	
		Upright	Inverted
DO (optical)	Tap water	200	NA
Specific conductivity	1000 uS	650	250
pH	7.0 buffer	500	250
pH	10.0 buffer	500	250

A calibration option that reduces the volume of solution needed to calibrate sondes is the inverted position. Refer to Section 2 in YSI (2009) User Manual for specific instructions on calibrating YSI 6600 sonde probes or the specifications given in user manual for equivalent monitoring equipment.

SITE SELECTION

Site selection should be completed during field reconnaissance prior to the planned deployment date. There are several factors to consider in the placement and installation of continuous water quality equipment, including:

- Potential for water quality measurements at the site to be representative of the location being monitoring;
- Potential for cross-section variation and/or vertical stratification;
- Variability in stream stage than can be expected during deployment;
- Conditions that may enhance rate of fouling (e.g., excessive fine sediment);
- Need to protect equipment from high flow conditions; and
- Need to protect from vandalism and theft.

Refer to Wagner et al. (2007) for United States Geological Survey guidelines on selecting appropriate sites for the deployment of continuous water quality equipment.

Once the monitoring site has been established, the deployment location needs to be determined. The location should provide limited access and visibility of equipment to prevent human interference. Ideally the deployment location should be partially shaded to reduce influence of direct sunlight on temperature readings. The site should also ensure that sondes are continually submerged during any anticipated change in flow stage.

Monitoring objectives should guide site selection process so that sondes can be used to collect the most useful and relevant data. For example, if the objective is to evaluate potential factors limiting salmonid fish production, sondes could be deployed to measure temperature and DO in suitable spawning and/or rearing habitats that are utilized for key life stages (e.g., pool refugia during later summer season).

MOBILIZATION

The following equipment is mobilized by field personnel in advance of deployment.

- YSI 6600 or equivalent (calibrated less than 24 hours before deployment event)
- YSI 650 Multi-parameter Display System and Cable or field computer
- Sonde Deployment Field Sheet
- Pencils and clipboard
- GPS
- Camera
- Toolkit (see SONDE INSTALLATION)
- Clean probe guard
- Wading gear
- Site access materials (maps, directions, keys, permits)
- Spare or Replacement sonde parts

Assemble needed equipment and go to site. Obtain GPS coordinates of site location and record the sampling event information on standard field sheet for sonde data provided

in SOP FS-10, Completion and Processing of Field Data Sheets. Prior to installation, remove calibration/transport cup and install probe guard. Connect sonde to 650 Display System or laptop computer and program the sonde at specified time interval to start logging water quality measurements following instructions provided in Section 3.3 in Water Board (2011).

SONDE INSTALLATION

There are many different methods for securing water quality equipment. Two methods of deployment of continuous water quality equipment are provided here: (1) attached to a metal cage and (2) anchored to an existing structure in a channel. Sondes can be attached to metal cages, constructed with heavy gage 2-3 inch diameter metal tubing, with weights attached to the base (Figure 1). The monitoring equipment is attached to the metal cage using hose clamps. The metal cage can be placed in deepest part of the channel and anchored to a fixed location on the streambank (e.g., tree) using stainless steel cables and key locks. The cage protects the equipment and keeps sensors about 6 inches off the stream bottom to reduce potential for fouling by fine sediment.

Figure 1. Metal cage used to secure sonde during deployment.

An alternative method is to use place a sonde inside a section of 4-inch diameter PVC pipe modified with holes to allow water to flow around the probes. Screw caps containing eyebolts are secured at each end. Steel cables and key locks are used to attach the PVC pipe (at eyebolt) to a fixed location in the streambed or on the bank (e.g., existing tree). PVC tubing can be placed at different depths depending on the structures used for anchoring the tubing.

Measure the following and record on the site field sheet: Stream Depth (at sonde probes), Stream Width and Distance from Bank (always measure from left streambank - LB). Take a couple pictures of the sonde deployed (from the streambank as well as a close up) and record them on the field sheet. Document detailed instructions about how to access the site and find the sonde deployment location so that someone with little or no knowledge of the site can find the instrument with minimal effort.

FIELD CHECK

At locations suspected of variable water stages or potential for fouling during the deployment period, a field check of the sonde may be necessary to ensure that its probes remain submerged under the water and/or the sensors are operating efficiently. If the stream flow drops significantly between field checks, especially in non-perennial creeks, the field operator(s) need to re-evaluate conditions and decide whether or not to retrieve the instrument from its original deployment location. In the event that the field

crew decides to retrieve the sonde from its current deployment location, they will also need to evaluate if there is another suitable deployment location within the reach. If a sonde is re-deployed in the field, data should be downloaded and sonde should be calibrated following instructions provided in Section 2.2 Water Board (2011).

SONDE RETRIEVAL

Retrieve the data sonde and connect to the 650 MDS or field computer. End data logging using procedures outlined in Section 5.2 Water Board (2011). Remove the cable from the sonde and replace the waterproof cap. Remove the sonde from the creek, detaching it from its anchor and collecting any wire or fasteners. Remove the probe guard and secure the calibration cup over the probes, making sure there is a little water in the bottom to keep the air damp. Gather all equipment and exit site.

POST-DEPLOYMENT ACCURACY CHECK

Complete a post-deployment accuracy check on the retrieved sonde as soon as possible after data retrieval. A post-deployment accuracy check is conducted in the field **before** cleaning the probes. To do this, follow the directions in Section 2.2 Water Board (2011) but **without selecting Calibrate**. The sonde probes are placed in each standard solution and all pertinent information including initial readings are recorded.

After the field accuracy check, the instrument should be transported back to the lab and cleaned before performing an additional accuracy check/calibration. This provides information about the amount of influence that fouling may have had on the field measurements. The first accuracy check is performed in the field to minimize the disturbance of the buildup. If instrument fouling is minimal, the double accuracy check may be unnecessary.

Quality Assurance / Quality Control

There are two processes for reviewing and validating YSI multi-probe water chemistry data. The first process is to export YSI EcoWatch data to Excel and review the raw data to flag potential outliers and removed "out-of-water" data. Refer to Section 7 in Water Board (2011) for specific instructions on downloading and formatting data.

The second process is to review the pre- and post-deployment calibration data to determine if the data are within acceptable ranges of accuracy and precision. Calculate the drift between the two measurements to determine if it meets SWAMP Measurement Quality Objectives (MQOs) (see SWAMP Quality Assurance Project Plan - Table A25). Any parameters that drifted significantly must be noted. Data must be flagged as estimated or rejected depending on how severely they exceed the MQOs.

A calibration record spreadsheet is available that automatically calculates drift as well as percent accuracy or bias for post-deployment accuracy checks or calibration events:

http://www.swrcb.ca.gov/water_issues/programs/swamp/docs/cwt/toolbox/15_21_dqmprojectfile.xls

Navigate to the Calibration & Accuracy Checks tab and enter post-deployment accuracy checks and calibrations. The formula will calculate the differential or drift and the percent accuracy. The Field Precision tab uses the repeated field measurements to calculate reproducibility (RPD) and determines the maximum RPD.

References

BASMAA. 2014. BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Prepared for Bay Area Stormwater Management Agencies Association. Version 2, January 2014.

Wagner, R.J., Boulger, R.W., Jr., Oblinger, C.J., and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors—Station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1–D3, 51 p. + 8 attachments; accessed April 10, 2006, at *http://pubs.water.usgs.gov/tm1d3*

Water Board. 2011. Standard Operating Procedures for Conducting Time-Series Field Monitoring of Ambient Water Quality Measurements with a Multiparameter Instrument (YSI 6600 or 6920 Sonde). March 2011.

YSI. 2009. 6-Series Multiparameter Water Quality Sondes User manual. Revision E. April 2009.

Attachment 1 – Calibration Work Sheet for Multiparameter Probes

Form 1: Calibration Record Sheet

Pre-run Calibration					For DO Calibration (Value of DO Standard)	
Date:		Time:		Altitude (ft):	Barometric Presssure: (uncorrected)	**mm Hg**
S/N:				Battery Voltage (%):	O_2 100% Saturation Value at Ambient Temperature:(2)	**mg/L**
Calibrated by:					Altitude Correction Factor : (Table 2)	

Instrument Function	Temp. of Standard	Value of Standard (1)	Initial Reading:	Calibrated to:	Please record calibration standard lot numbers. **Record pH millivolts after each pH calibration.**	
Sp.Cond. uS/cm					Lot #:	pH Millivolts/Wiper Ck
pH Buffer 4.00					Lot #:	mv
pH Buffer 7.00					Lot #:	mv
pH Buffer 10.00					Lot #:	mv
Turbidity 0 NTU					Lot #	Wiper OK
Turbidity 10.0 NTU					Lot #	Wiper OK
Dissolved Oxygen (mg/L) (1) Minimum 10 min equilibration time	Ambient Temp (2)		**mg/L**	**mg/L**	**DO Charge:**	Wiper OK

(1) Value of DO Standard = 100% Saturation Value X Altitude Correction Factor

Calibration Information			
Record the following diagnostic numbers <u>after</u> calibration			Comments
Conductivity Cell Constant		Range 4.5 to 5.5	(Sonde Menu - Advanced - Cal Constants)
DO Charge **(N/A for ROX Probe)**		Range 25 to 75	(Sonde Menu - immediately after DO calibration)
DO Gain		Range 0.7 to 1.5	(Sonde Menu - Advanced - Cal Constants)
pH MV Buffer 4.00		Range 177 +-50 MV	(Sonde Menu - immediately after pH 4calibration)
pH MV Buffer 7.00		Range 0 +- 50 MV	(Sonde Menu - immediately after pH 7 calibration)
pH MV Buffer 10.00		Range -177 +- 50 MV	(Sonde Menu - immediately after pH 10 calibration)
pH Slope (pH 7 MV - pH 10 MV)		Range 162 to 180 MV	If slope is very near lower limit, use only for spot-checking, not long-term deployment

Post-run Calibration Check					For DO Calibration Value	
Date:		Time:		Altitude (ft):	Barometric Pressure: (uncorrected)	**mm Hg**
Calibration Check by:				Battery Voltage (%):	O_2 100% Saturation Value at Ambient Temperature:	**mg/L**
DO Calibration Value = O_2 100% Sat. Value X Altitude Correction Factor					Altitude Correction Factor : (Table 2)	

Instrument Function	Temp. of Standard	Value of Standard	Instrument Reading	DO Calib. Value	Drift (+ -)	Post Calibration Error Limits and Q/A Check	
Sp.Cond. uS/cm				DO Calibration Value = O_2 100% Sat. Value X Altitude Correction Factor		+- 5%	Q/A Ck:
pH Buffer 4.00						+- 0.3 units	Q/A Ck:
pH Buffer 7.00						+- 0.3 units	Q/A Ck:
pH Buffer 10.00						+- 0.3 units	Q/A Ck:
Turbidity						+-0.3 NTU	Q/A Ck:
Dissolved Oxygen (mg/L)		N/A	mg/L	mg/L		+- 0.5 mg/l	Q/A Ck:

Notes: _____

Rev.2/21/2008

STANDARD OPERATING PROCEDURES
for
Continuous Temperature Measurements
(SOP FS-5)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This standard operating procedure is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:

Temperature

SOP Background and Application

This SOP is intended to standardize procedures for the collection of time series temperature data using the Onset HOBO ® Water Temp Pro V2 temperature data loggers (hereafter referred to as Hobos) or equivalent equipment.

References to Existing SOPs

This SOP is based on information provided in the document "**Standard Operating Procedures for Conducting Time-Series Field Monitoring of Ambient Water Temperature Measurements with an Onset HOBO ® Water Temp Pro V2",** April 2013, developed by Water Board Region 2.

Relevant QA/QC protocols are also referenced in the associated RMC Quality Assurance Project Plans for bioassessment and water quality monitoring: **BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan**, version 2, January 2014 (BASMAA 2014).

Special Cautions and Considerations; Health and Safety

Proper gloves should be worn to protect sampling personnel from environmental hazards.

CAUTIONS

When conducting sampling in areas of unknown water quality, especially in waters that are suspected to contain hazardous substances, bacteria, or viruses, it is preferable that at least one layer of gloves be of shoulder length, to limit skin contact with the source water.

When using chemical cleaners, as required as part of the equipment cleaning and decontamination protocols (see SOP FS-7, Field Equipment Cleaning Procedures and SOP FS-8, Field Equipment Decontamination Procedures), always read the product label and adhere to all printed cautions and safety measures.

Methods/Procedures

The following standard procedures are provided for the collection of time series water temperature data. Temperature measurements will be collected for 60 minute intervals between April and September one time each year.

CALIBRATION

The accuracy of HOBOs or equivalent equipment should be checked against a certified NIST-traceable reference thermometer in water baths at two temperatures: room temperature and ice water. The NIST-traceable reference thermometer should be sent to an authorized specialist annually for at least a 2-point accuracy check and re-certification. Accuracy of the reference thermometer must be within $\pm$ 0.2 °C. HOBOs must be fully immersed in water in order to perform a proper accuracy check (Water Board 2011). Temperature sensors should be within 0.5 °C at both temperatures (see QA/QC section below for additional detail). If they do not meet this requirement, they should not be considered suitable for deployment.

Ice water accuracy check procedures documented here are based on the recommendations from the manufacturer and from Water Board staff. Onset documentation suggests allowing 15 minutes minimum for temperature to stabilize before proceeding with the accuracy check. HOBO models requiring waterproof housings for underwater deployment have been shown to exhibit much longer lag times for full equilibration. Consequently, allow more time for temperature stabilization with HOBOs that require separate waterproof housings.

SITE SELECTION

Site selection should be completed during field reconnaissance prior to the planned deployment date. There are several factors to consider in the placement and installation of equipment, including:

- Potential for temperature measurements at the site to be representative of the location being monitoring
- Potential for cross-section variation and/or vertical stratification
- Variability in stream stage than can be expected during deployment
- Need to protect from vandalism and theft

Once the monitoring site has been established, the deployment location needs to be determined. The location should provide limited access and visibility of equipment to prevent human interference. Ideally the deployment location should be partially shaded to reduce the influence of direct sunlight on temperature readings and allow HOBOs to be continually submerged during any anticipated change in flow stage.

Monitoring objectives should guide site selection process so HOBOs can collect the most useful and relevant data. For example, if the objective is to evaluate potential factors limiting salmonid fish production, equipment could be deployed to measure temperature in suitable spawning and/or rearing habitats that are utilized for key life stages (e.g., pool refugia during later summer season).

MOBILIZATION

The following equipment is mobilized by field personnel in advance of deployment.

- Onset HOBO Water Temp Pro V2 or equivalent (pre-programmed in office)
- Blank HOBO Deployment Field Sheet
- Handheld water quality instrument to take field measurements (water temp, DO, pH, and conductivity).
- HOBO deployment schedule
- Pencils and clipboard
- GPS
- Camera
- Toolkit (see HOBO INSTALLATION)
- Wading gear
- Site access materials (maps, directions, keys, permits)
- Spare HOBOs (or equivalent)

Prior to a field visit, program HOBOs, or equivalent equipment, to collect data at minimum of 60-minute intervals following instructions provided in Section 3.2: Instrument Programming of Water Board (2011) or specifications in user manual. For HOBOs, this programming step will require accessing the most current version of HOBOware Pro software on a computer.

Assemble needed equipment and go to deployment site. Obtain GPS coordinates of the site location and record the sampling event information on a field sheet. Using handheld water quality instrument, take two measurements of temperature, pH, dissolved oxygen (mg/L & %) and specific conductivity approximately 2 minutes apart. Prepare for HOBO installation following procedures provided in next section.

INSTALLATION

Secure the HOBO or equivalent device, at deployment site using weights (u-bolts, fish weights), cable and clamps, zip ties or other equipment. Measure the following and record on the field sheet: Stream Depth (at HOBO location), Stream Width and Distance from Bank ((always measure from left streambank - LB). Take a couple pictures of the sonde deployed (from the streambank as well as a close up) and record them on the field sheet. Document detailed instructions about how to access the site and find the Sonde deployment location so that someone with little or no knowledge of the site can find the instrument with minimal effort.

If multiple devices are being deployed within one reach, repeat previous steps to deploy any additional HOBOs. Assemble equipment and return to the office. The equipment will

not be harmed if the flow decreases or their deployment location goes dry so field checks are not necessary.

Upon returning to the office, locate deployment site on Google Earth or anther satellite program and print screen image(s) to be included in the site file. These will be valuable to the retrieval team.

RETRIEVAL

Before leaving office to retrieve the instrument, make sure that the crew is familiar with the current deployment location – review pictures and notes from deployment. Assemble all necessary keys or combinations to access the site as well as necessary equipment, and go to the site. Once at site, obtain GPS coordinates of the site location and record the sampling event information on a field sheet. Using a handheld water quality instrument, take two measurements of temperature, pH, dissolved oxygen (mg/L & %) and specific conductivity approximately 2 minutes apart. Gather all equipment and exit site.

Quality Assurance / Quality Control

Accuracy checks on HOBO devices, or equivalent, are conducted prior to deployment and typically done one time each year (i.e., accuracy checks are not necessary for subsequent deployments within year time period). **No post-deployment checks are necessary.**

The following steps are necessary to check instrument measurement accuracy for HOBOs:

- Program HOBO(s) and record temperatures in water, taken at room temperature and in an ice bath, for a 15-minute period following procedures described in Section 2.2 of Water Board (2011)
- Download data from HOBO to computer using HOBOware Pro software
- Create an Excel file that includes the NIST thermometer readings, transcribed from the hardcopy, and each of the HOBO temps data for the room temperature and ice water accuracy checks.
- To determine if all the HOBOs meet manufacturer's accuracy specifications, calculate the mean difference and standard deviation for each HOBO using form in Attachment 1 and following instructions provided in Section 2.2 of Water Board (2011).

A mean difference exceeding 0.5 °C indicates that a particular HOBO unit exceeds the manufacturer's accuracy specification and should be repaired or replaced. Measurements should not exceed 2 standard deviations. **Once the accuracy check and analysis is complete, any HOBOs that meet the accuracy specifications mentioned above are ready to prepare for deployment in the field.**

References

BASMAA. 2014. BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Prepared for Bay Area Stormwater Management Agencies Association. Version 2, January 2014.

Onset Computer Corporation. 2001. HOBO Water Temp Pro User's Manual.

Onset Computer Corporation. undated. Quick accuracy check. Available online: http://www.onsetcomp.com/Support/HS_Support/5317_acc_test.html

Water Board. 2013. Standard Operating Procedures for Conducting Time-Series Field Monitoring of Ambient Water Temperature Measurements with an Onset HOBO ® Water Temp Pro V2. April 2013.

Attachment 1 – HOBO accuracy worksheet

Form 1: HOBO Accuracy Check Record Sheet

HOBO Temp. Accuracy Check
NIST Thermometer ID:
Operator:
Date:

Room Temp: NIST started:
Room Temp: Hobo started:

Time (min:sec)	NIST reading (°C)
0:00	
0:30	
1:00	
1:30	
2:00	
2:30	
3:00	
3:30	
4:00	
4:30	
5:00	
5:30	
6:00	
6:30	
7:00	
7:30	
8:00	
8:30	
9:00	
9:30	
10:00	

Ice Bath: NIST started:
Ice Bath:Hobo started:

Time (min:sec)	NIST reading (°C)
0:00	
0:30	
1:00	
1:30	
2:00	
2:30	
3:00	
3:30	
4:00	
4:30	
5:00	
5:30	
6:00	
6:30	
7:00	
7:30	
8:00	
8:30	
9:00	
9:30	
10:00	

STANDARD OPERATING PROCEDURES
for
Collection of Bedded Sediment Samples for Chemical Analysis & Toxicity
(SOP FS-6)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This SOP is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:

Toxicity – Bedded Sediment, Fine-Grained
Pollutants – Bedded Sediment, Fine-grained

SOP Background and Application

Consistent techniques to collect, aliquot, and handle sediment samples are employed as part of the RMC field quality assurance program to ensure validity of resulting data and comparability with SWAMP protocols.

References to Existing SOPs

This SOP is adapted from information provided in the following SOPs:

(1) For sediment sampling: **Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in the Surface Water Ambient Monitoring Program (SWAMP)**, version 1.0, released October 15, 2007 (SWAMP 2007). A pdf of the SOP is available for download at:
http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/standard-operating-procedures

Relevant QA/QC protocols are also referenced in the associated RMC QAPP for targeted parameters: **BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan**, version 2, January 2014 (BASMAA 2014).

Special Cautions and Considerations; Health and Safety

CAUTIONS

When using chemical cleaners, as required as part of the equipment cleaning proocols (see SOP FS-7, Field Equipment Cleaning Procedures and FS-8, Field Equipment Decontamination Procedures), always read the product label and adhere to all printed cautions and safety measures. Proper gloves must be worn to both prevent contamination of the sample and to protect the sampler from environmental hazards (disposable polyethylene, nitrile, or non-talc latex gloves are recommended, however, metals and mercury sample containers can only be sampled and handled using polyethylene gloves as the outer layer). The user should wear at least one layer of gloves, but two layers help protect against leaks.

When conducting sampling in areas of unknown water quality, it is preferable that at least one layer be of shoulder length when conducting sampling to limit skin contact with water source.

Methods / Procedures

Sampling methods employed for collection of sediment toxicity and sediment chemistry samples are identical, and in the interests of efficiency and representativeness, sampling for the two should be conducted concurrently. Bed sediment (sediment) samples are collected after any water samples are collected where water and sediment are taken in the same reach. Care must be taken not to sample sediments that have been disturbed in any manner by field personnel.

Sediment samples are collected into a compositing bucket or container, where they are thoroughly homogenized in the field, and then aliquotted into separate jars for chemical or toxicological analysis. After collection and homogenization, sediment samples are submitted to the respective analytical laboratories in containers as identified in SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures.

MOBILIZATION

Following is a recommended list of equipment to be mobilized by field personnel in advance of sampling operations; field crews are able to modify this list to account for site- and event-specific conditions present. This list assumes that sampling will be conducted via the preferred sediment scoop method. If reconnaissance indicates that an alternative method is required, additional equipment will need to be mobilized and prepared.

- Compositing bucket (glass or inert-coated[1] stainless steel)
- Sampling scoops, 2 minimum (polyethylene or inert-coated[2] stainless steel)
- Detergent (Micro™, Liqui-Nox™, or equivalent)
- Reagents (5% HCL, methanol, both reagent-grade)
- Aluminum foil
- Deionized water

[1] Kynar or similar
[2] Ibid

- Scrub brushes, minimum 2
- Sample gloves (PE or vinyl, including shoulder-length gloves)
- PPE (properly decontaminated)
- Sampling containers (with labels)
- Coolers
- Wet ice, with zip-top bags for double-bagging
- Zip-top bags for individual sample containers
- Dunnage material for protecting sample containers
- Container for collecting liquid waste
- Receptacle for collecting solid waste
- GPS (with spare batteries)
- Camera (with spare batteries)
- Cell phone (with spare batteries / backup)
- Paperwork (sampling plan, SOPs, COCs, datasheets, maps, permits, etc. as required)
- Tear by hand transparent tape (for sample labeling)

All equipment coming into contact with sample material should be pre-cleaned per protocols in FS-7, Field Equipment Cleaning Procedures.

SITE SELECTION

Many of the chemical constituents of concern are adsorbed onto fine particles. One of the major objectives in selecting a sample site, and in actually collecting the sample while on site, is to obtain recently deposited fine sediment, to the extent possible. Field personnel should avoid hard clay, bank deposits, gravel, disturbed and/or filled areas. Any sediment that resists being scooped is probably not recently deposited fine sediment material. In following this guidance, the collection of sediment is purposefully being biased for fine materials, which must be discussed thoroughly in any subsequent interpretive reporting of the data, in regards to representation of the collected sample to the environment from which it was collected. Field personnel should select a sampling site with lower hydrologic energy, looking first at areas such as the leading edges of point bars, around emergent vegetation, near the toe of bank in slight bays, beneath undercuts and root wads at bank (also where scoured below old channel structures), and behind large rocks or other obstructions. Field personnel should take care to sample only sediments deposited by stream processes, not sediments deposited by other processes such as local landslides and bank sloughing.

As described in the following sections, field personnel will conduct a qualitative assessment of the proposed sampling site to identify appropriate sampling locations. If a suitable site for collecting sediments cannot be found at a station, sampling personnel should not collect the sediment sample, and should instead attempt to reschedule the sample collection. If this is not possible or unlikely to yield positive results, field personnel should make a note so that the missing sample is accounted for in the reconciliation of monitoring events during reporting phase. Sites that are routinely difficult to collect should be considered for elimination or relocation from the sample schedule, if appropriate.

SEDIMENT COLLECTION

Field personnel should collect no deeper than the top 2 cm of sediment for analysis. Five or more (depending on the volume of sediment needed for conducting analyses) fine-sediment sub-sites within a 100-m reach are sampled into the compositing bucket prior to aliquotting.

Before conducting sampling, field personnel should survey the proposed sampling area for appropriate fine-sediment depositional areas before stepping into the stream, to avoid disturbing possible sediment collection sub-sites. Personnel should then carefully enter the stream and start sampling at the closest appropriate reach, then continue sampling upstream. If sampling sites that passed the visual assessment do not in fact contain a sufficient volume of suitable sediments, then field personnel should follow the above-identified steps for rescheduling/reporting. In some cases, access restrictions may require that field personnel enter the creek upstream of likely sampling locations. In this case, field personnel should attempt to walk on hard substrate and avoid areas of fine sediments. Three possible sampling methods may be selected from, depending on site-specific conditions present:

SEDIMENT SCOOP METHOD

This is the preferred method for sampling within shallow streams. Field personnel submerge a pre-cleaned scoop no more than 2cm into the substrate and transfer sediment to the homogenizing bucket and aliquot samples as detailed below. Care should be taken to move slowly to best ensure that a minimal amount of fine materials escape with overlying water from the scoop during this process. Should the sample collector determine that a particular scoop of sediment is unacceptable due to loss of fine material in the sampling process, or inappropriate substrate collected, the sediment should be discarded in the stream or on the bank, downstream of the sampling area. Once a sufficient volume of material is collected, field personnel should homogenize and aliquot samples as described below.

HAND CORE METHOD

A hand core may be used in wadeable streams where there is very fine sediment. The hand core sampler consists of a 3-in. diameter polycarbonate core that is 8 inches long. Field personnel push the core into the sediment to the desired depth, pull the core out of the sediment, and cap the bottom by placing their gloved hand underneath the core to hold the sediment in place. Hand cores are usually measured and marked at 2 cm length so the sampler knows how far to deploy the core into the sediment. The grab may be rejected by the collector if material is observed slumping out of the bottom or if the core overpenetrates. The sample collector should then empty the collected sediment into a homogenizing bucket and aliquot samples as detailed below.

MECHANICAL GRAB METHOD

A mechanical sediment grab (e.g., Ekman grab) may be used be used to collected sediment from deeper, non-wadeable streams, or from locations where access to the creek is limited. Field personnel should slowly lower the grab to the bottom with a minimum of substrate disturbance, trigger the device, and retrieve the closed grab at a moderate speed. Upon retrieval, field personnel should examine the sample to ensure that the sample is acceptable. Criteria for accepting / rejecting grabs include:

- Mud surface must not be pressing out of the top of the sampler. If it is, lower the grab more slowly.
- Sediment surface should be flat and level in the sampler. If it is not level, the grab has tilted over before closing.
- Sediment surface should appear undisturbed.

Upon collection of an acceptable grab, the sediment is next examined for depth of penetration, color and thickness of top aerobic zone, and texture. These observations are recorded in the logbook. Field personnel then collect the top 2cm of sediment using sampling scoops, transfer to homogenizing bucket, and follow instructions for aliquotting as described below. All adhering sediments should be scrubbed away prior to using the grab again at the same site.

SAMPLE PREPARATION

The process of homogenizing and aliquotting material into sample containers requires two field personnel, both gloved and observing standard clean sampling technique protocols. One member of the field team homogenizes and aliquots sample material, while the second member retrieves sample containers, opens them, and caps after filling.

Field personnel should stir the collected sediment within the homogenizing bucket with a sample scoop until sample material attains a homogeneous nature. Field personnel should then quickly scoop sediment out of the homogenizing container and place into desired sampling containers, making sure to stir the sediment in the homogenizing jar in between each aliquot. Before leaving the site, field personnel should ensure that all containers are capped tightly and stored in a cooler on double-bagged cubed ice (SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures). Samples should be returned to an appropriate sample refrigerator or transferred to analytical laboratory as soon as possible after conclusion of daily sampling activities, but always sufficiently within sample hold time requirements (SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures).

DEMOBILIZATION

Before leaving the sampling site, field personnel should review datasheets to ensure they are complete and legible, and should verify that all sampling-related materials have been collected. After completing sampling operations, field personnel should preserve samples as described in SOP FS-9, Sample Containers, Handling, and Chain of Custody Procedures. Field personnel should also clean sampling equipment as described in SOP FS-7, Field Equipment Cleaning Procedures, and decontaminate PPE as described in SOP FS-8, Field Equipment Decontamination Procedures before sampling at a different site.

Quality Assurance / Quality Control

Readiness reviews, post-event sampling reviews, and field audits will be performed as part of the programmatic quality assurance program as a means to ensure that appropriate protocols are followed.

Field crews should ensure that all sampling-derived wastes are contained and disposed of properly to best ensure against loss to the water body.

Consistent with the QAPP, reagents should be inspected upon receipt and usage to ensure that they are of appropriate grade (e.g., reagent-grade or better) for cleaning purposes.

Adherence to procedures for locating and accessing sample sites, and for rejecting grabs as described above, will best ensure that fine materials are collected in a manner that is representative of environmental conditions present. Adherence to referenced SOPs for cleaning sampling equipment, handling samples, and decontaminating field equipment will best ensure comparability of data with SWAMP.

References

BASMAA. 2014. BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Prepared for Bay Area Stormwater Management Agencies Association. Version 2, January 2014.

MPSL-DFG Field Sampling Team, 2007. Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in SWAMP. Version 1.0. October 15, 2007.

STANDARD OPERATING PROCEDURES
for
Field Equipment Cleaning Procedures
(SOP FS-7)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This SOP is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:

Biological Assessment (WQ monitoring elements)
Toxicity – Water Column
Toxicity – Bedded Sediment, Fine-Grained
Pollutants – Bedded Sediment, Fine-grained
Pathogen Indicators

SOP Background and Application

Contaminant-specific decontamination and cleaning of field sampling equipment used in collection of samples for chemical and toxicological analysis is required as part of a quality assurance program to best ensure samples collected are representative of environmental conditions present, and not an artifact of the equipment used.

References to Existing SOPs

This SOP is adapted from information provided in the following SOPs:

(1) For sediment sampling: **Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in the Surface Water Ambient Monitoring Program (SWAMP)**, version 1.0, released October 15, 2007 (SWAMP 2007). A pdf of the SOP is available for download at:
http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/standard-operating-procedures

(2) For pathogen indicators (bacteria): **Fecal indicator bacteria (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A7, section 7.1,** A pdf of the SOP is available for download at:
http://pubs.water.usgs.gov/twri9A7/

Relevant QA/QC protocols are also referenced in the associated RMC QAPP for bioassessment and water quality monitoring: **BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan**, version 2, January 2014 (BASMAA 2014).

Special Cautions and Considerations; Health and Safety

CAUTIONS

When using chemical cleaners, always read the product label and adhere to all printed cautions and safety measures. Proper gloves must be worn to both prevent contamination of the sample and to protect the sampler from environmental hazards (disposable polyethylene, nitrile, or non-talc latex gloves are recommended, however, metals and mercury sample containers can only be sampled and handled using polyethylene gloves as the outer layer). The user should wear at least one layer of gloves, but two layers help protect against leaks.

Methods / Procedures

Cleaning methods are determined by type of equipment used, media sampled, and constituent analyzed. Appropriate protocols are discussed below, by media:

WATER SAMPLING

Water samples may be collected via direct immersion of sample container or by use of sampling equipment to collect water and transfer to sample containers (e.g., peristaltic pump with Masterflex™ tubing). It is assumed that all water samples collected associated with RMC targeted sampling and bioassessments will be collected via direct immersion in small, wadeable streams, and that analytical laboratories or commercial suppliers will provide appropriately cleaned sample containers. Therefore, no additional sampling equipment is required to be prepared for most if not all water samples to be collected through RMC.

The one likely exception to the above is in the case of pathogen indicators in waters where excess chlorine levels have been detected or are suspected (see FS-2, Manual Collection of Water Samples for Chemical Analysis, Bacteriological Analysis, and Toxicity Testing, for procedures regarding collection of bacteriological samples). Direct immersion of sample containers pre-filled with sample preservative (sodium thiosulfate), especially in fast-moving waters, may cause loss of preservative to the waterbody. In this case, it is often preferred to collect water samples using a pre-cleaned bottle into the sample container. For this application, intermediary containers used for collection of pathogen indicators should be cleaned in the following fashion (Myers et al, 2007):

- Wash equipment thoroughly with a dilute, non-phosphate, laboratory-grade detergent in tap water. A liquid detergent (e.g., Liqui-Nox™) is preferred over powder detergent due to its ability to dissolve more readily.
- Rinse the equipment three times with tap water.
- Rinse the equipment three times with distilled water.
- Place the cleaned equipment in a clean zip-top bag until use in the field.

SEDIMENT SAMPLING

The sediment sampling equipment (e.g., scoop) will be cleaned prior to sampling each site (pre-cleaned) by use of the following procedure:

- Rinse all surfaces with ambient (or tap) water
- Scrub all sediment sample contact surfaces with Micro™, Liqui-Nox™, or equivalent detergent
- Rinse all surfaces with ambient (or tap) water
- Rinse sediment sample contact surfaces with 5% HCl
- Rinse all sediment sample contact surfaces with reagent-grade methanol
- Wrap the sampling equipment in clean aluminum foil and place into a clean zip-top bag until use in the field.

If applicable, the sediment sampling equipment will be scrubbed with ambient water between successive deployments within a site, in order to remove adhering sediments from contact surfaces possibly originating below the sampled layer, thus preventing contamination from areas beyond target sampling area.

Quality Assurance / Quality Control

Readiness reviews, post-event sampling reviews, and field audits will be performed as part of the programmatic quality assurance program as a means to ensure that appropriate cleaning protocols are followed.

Field crews should ensure that all sampling-derived wastes are contained and disposed of properly to best ensure against loss to the waterbody.

Consistent with the QAPP, reagents should be inspected upon receipt and usage to ensure that they are of appropriate grade (e.g., reagent-grade or better) for cleaning purposes.

References

BASMAA. 2014. BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Prepared for Bay Area Stormwater Management Agencies Association. Version 2, January 2014.

MPSL-DFG Field Sampling Team, 2007. Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in SWAMP. Version 1.0. October 15, 2007.

Myers, D.N., Stoeckel, D.M., Bushon, R.N., Francy, D.S., and Brady, A.M.G., 2007, Fecal indicator bacteria (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A7, section 7.1, February, accessed *June 17, 2011* from http://pubs.water.usgs.gov/twri9A7/

STANDARD OPERATING PROCEDURES
for
Field Equipment Decontamination Procedures
(SOP FS-8)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This SOP is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:

Biological Assessment
General Water Quality
Chlorine
Temperature
Toxicity – Water Column
Toxicity – Bedded Sediment, Fine-Grained
Pollutants – Bedded Sediment, Fine-grained
Pathogen Indicators
Stream Survey

SOP Background and Application

Invasive species, such as the New Zealand Mudsnail (see Attachment 1), can be transported unintentionally from site to site on field equipment and clothing, especially footwear. This SOP is designed to help avoid unintentional spreading of invasives by inspecting, removing, and treating apparel and equipment before moving to a new site or water body.

References to Existing SOPs

This SOP is based on information provided in the following documents:

(1) "**How to Prevent the Spread of New Zealand Mudsnails through Field Gear**", second edition, Feb., 2010, produced by the Oregon Department of Fish and Wildlife. Copies of this brochure, call 541-737-4849 or e-mail Oregon Sea Grant at: sea.grant.communications@oregonstate.edu

A pdf of the brochure is available for download at:
http://seagrant.oregonstate.edu/sgpubs/onlinepubs.html

and is also available on the Oregon DFW web site:
http://www.dfw.state.or.us/conservationstrategy/invasive_species/docs/NZ_Mudsnails_10-page.pdf

(2) California Department of Fish and Game (CDFG) Aquatic Invasive Species Decontamination Protocol, dated September 17, 2010.

Relevant QA/QC protocols are also referenced in the associated RMC QAPPs for bioassessment and water quality monitoring: **BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan**, version 2, January 2014 (BASMAA 2014).

Special Cautions and Considerations; Health and Safety

CAUTIONS

When using chemical cleaners, always read the product label and adhere to all printed cautions and safety measures. Wear rubber gloves and eye protection when using chemical cleaners.

Treating field gear with chemical methods may result in unintended contamination of the environment. In particular, extreme caution must be taken to avoid contamination of waterways and wetlands. DO NOT rinse your treated gear in a water body.

Treating rubber gear or boots with Formula 409® and other disinfectants with quaternary ammonium compounds (QACs) may result in surface cracking of the rubber and loss of water repellency.

Chemical methods are not always effective in killing mudsnails. Always scrub your gear and consider using physical methods before resorting to chemical methods.

Methods / Procedures

To prevent the survival of mudsnails or other invasives on field clothing and equipment, it is necessary to first clean all field gear and then to treat it, using either the physical or chemical methods listed below. The following steps are recommended:

- If possible, keep different sets of field gear for use in different bodies of water.
- **Clean** all gear before leaving a site, scrubbing with a stiff-bristled scrub brush and rinsing with water, preferably high-pressure. This is often the simplest and most effective measure for prevention.
- **Inspect** gear before it is packed for transport. Visible traces of sand, mud, gravel, and plant fragments are signs that gear has not been properly cleaned and mudsnails may have been retained.
- **Select** a treatment method in addition to scrubbing and rinsing if mudsnails are present or suspected to be present. Two general categories of treatment are available - physical methods and chemical methods:

    - **Freezing, hot water, or drying treatments** are recommended over chemical treatments because they are usually less expensive, more environmentally sound, and possibly less destructive to gear. However,

most physical methods require longer treatment times and often cannot be performed in the field.

- **Chemical treatments** require a 10-minute soak in a special solution (see "CHEMICAL," page 5). After chemical treatment, gear must be rinsed thoroughly with tap water away from all bodies of water, and all soak solutions and rinse water must be properly disposed of.

PHYSICAL TREATMENT

These methods for cleaning gear are effective as well as environmentally sound. Use *one* of the following methods:

- **Freeze** your gear for a minimum of 4 hours to kill all mudsnails. Freezer temperatures should be at 26°F (-3°C) or below.
- **Soak** gear in a bath of hot water (at least 120°F, 46°C) for 10 minutes.
  NOTE: This method is not advised for Gortex.
- **Dry** your gear before reuse. A drying time of at least 48 hours under low humidity is recommended to remove all pockets of dampness.
  Gear must be completely dry for a minimum of 24 hours. Check to ensure that boots are totally dry.

CHEMICAL TREATMENT

Common disinfecting cleaners containing quaternary ammonium compounds (QACs, e.g., alkyl dimethyl benzylammonium chloride [ADBAC]; diecyl dimethyl ammonium chloride [DDAC]) are effective for decontaminating gear.

Disinfectants listed below will kill other aquatic invasive species but may not result in 100% mortality.

Gear should be soaked in *one* of the following solutions for 5 minutes and then rinsed thoroughly with tap water, away from the water body:

- Commercial disinfectant solutions containing quaternary ammonium compounds (e.g., Formula 409® Cleaner Degreaser Disinfectant, alkyl dimethyl benzylammonium chloride [ADBAC]; diecyl dimethyl ammonium chloride [DDAC]). Formula 409®. Cleaner Degreaser Disinfectant has been proven effective for killing mudsnails at 50% dilution.
- The compounds Quat 128® and Sparquat 256® are commercial disinfectants with an active ingredient (QAC) similar to that of Formula 409® Cleaner Degreaser Disinfectant, which has proven effective for killing mudsnails and other aquatic invasive species (see the table on the foldout page of the brochure for dilution rates).
- Many household bath and kitchen disinfectants contain quaternary ammonium compounds (check the label for active ingredients containing alkyl dimethyl benzylammonium chloride [ADBAC]; diecyl dimethyl ammonium chloride [DDAC]).

These and other chemical treatments are constantly being evaluated and are updated online at: seagrant.oregonstate.edu/themes/invasives/

Store and dispose of solution and used rinse water properly.

Quality Assurance / Quality Control

If chemical treatments are used, ensure that rinsing is performed thoroughly, to prevent contamination of water courses.

References

BASMAA. 2014. BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Prepared for Bay Area Stormwater Management Agencies Association. Version 2, January 2014.

For more information on the testing of chemical treatment methodology, see:
R. C. Hosea, and B. Finlayson, 2005, *Controlling the Spread of New Zealand Mud Snails on Wading Gear,* Administrative Report 2005-02, Rancho Cordova, California: Resources Agency, California Department of Fish and Game.

For more information on identification and prevention of spread of aquatic invasive species within California creeks, see: *California Department of Fish and Game Aquatic Invasive Species Decontamination Protocol*, dated September 17, 2010.

STANDARD OPERATING PROCEDURES
for
Sample Container, Handling, and Chain of Custody Procedures
(SOP FS-9)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This SOP is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:

Biological Assessment
General Water Quality
Chlorine
Toxicity – Water Column
Toxicity – Bedded Sediment, Fine-Grained
Pollutants – Bedded Sediment, Fine-grained
Pathogen Indicators

SOP Background and Application

While there are a variety of different media being sampled through the RMC, as referenced above, sample handling and chain of custody techniques are relatively consistent across different media types. Following the recommended sample handling techniques will go a long way toward ensuring comparability with SWAMP QAPP.

References to Existing SOPs

This SOP is adapted from information provided in the following SOPs:

(1) **Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in the Surface Water Ambient Monitoring Program (SWAMP)**,version 1.0, released October 15, 2007 (SWAMP 2007). A pdf of the SOP is available for download at: http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/standard-operating-procedures

(2) **Quality Assurance Project Plan for Monitoring and Mitigation to Address Fecal Pathogen Pollution along California Coast.** Proposition 50 Coastal Management Program Agreement No. 06-076-553-0.

Relevant QA/QC protocols are also referenced in the associated RMC QAPP for bioassessment and water quality monitoring: **BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan**, version 2, January 2014 (BASMAA 2014).

Special Cautions and Considerations; Health and Safety

CAUTIONS

Sample preservation may require use of reagents posing an environmental health or human health concern. When using such chemicals, read the product label and MSDS sheets for the material being used, always wear appropriate PPE as identified either on the label or in the MSDS sheet, store reagents appropriately, and adhere to all printed cautions and safety measures.

Methods / Procedures

All samples will be handled, prepared, transported and stored in a manner so as to minimize bulk loss, analyte loss, contamination, or biological degradation of sample material. Appropriate safeguards should be implemented at the time of sample collection through shipping and receipt at the laboratory to ensure integrity of samples.

Details associated with different phases of the sample handling process are described below:

FIELD SAMPLING

One member of each sampling team will be identified as "Team Lead", and will be responsible for overall collection and custody of samples during field sampling.

Field crews should properly store and preserve samples as soon as possible after collection (see requirements, Attachment 1). See SOP FS-2 for a description of protocols for field filtration and sample preservation. Following any required field filtration or preservation, but as soon as possible after sample collection, sample containers should be placed on crushed or cube ice in an insulated ice chest; ice should be placed into sealed, double-bagged zip-top bags prior to sampling to prevent any contamination of samples by meltwater. Sufficient ice will be needed to lower the sample temperature to $\leq$6°C within 45 min after time of collection. Sample temperature should be maintained at $\leq$6°C until delivered to the laboratory.

In addition, care is taken at all times during sample collection, handling and transport to prevent exposure of the sample to direct sunlight. Samples are preserved, if necessary, according to protocol for specific analysis (acidification in most cases). In the case of some samples, the sample preservative may be pre-loaded into the sample container by the laboratory. In these cases, care should be taken not to overfill the sample container and thereby spill preservative.

SAMPLE SHIPPING

Sample transport should be arranged so that samples arrive at the laboratory well within hold time requirements (Attachment 1). For analytes with relatively short holding times, analytical laboratories should be informed in advance and reminded at time of sample delivery of the holding time requirements, so that required preservation or analyses are initiated as soon as possible.

All sample containers will be placed in appropriate shipping containers. Shipping procedures to be followed are divided into one of two categories, based upon whether a potentially hazardous preservative has been used or the manner of packaging and shipment (i.e., using dry ice) classifies the package as a hazardous material shipment per DOT (ground) or IATA (Air) shipment regulations.

Aqueous Samples, No Dangerous Goods

The following summarizes the packaging procedures that will be followed for low concentration samples that are to be shipped cold (i.e., not frozen).

- When ice is used, pack it in zip-locked, double plastic bags. If applicable, seal the drain plug of the cooler with duct tape to prevent melting ice from leaking out of the cooler.
- The bottom of the cooler should be lined with bubble wrap or other shock absorbing packaging material to prevent breakage during shipment.
- Check screw caps for tightness.
- Ensure sample labels are securely fastened and legible.
- Wrap all glass sample containers in bubble wrap / bubble bags or use laboratory supplied foam bottle dividers to prevent breakage.
- Place samples in a sturdy cooler(s). Enclose the appropriate COC(s) in a zip-lock plastic bag affixed to the underside of the cooler lid.

Aqueous Samples, Dangerous Goods

Preservatives used in environmental sampling often fall under the category of dangerous goods in regards to shipping regulations. If shipping of dangerous goods is required, the individual preparing the samples for shipment and the shipping documentation and waybill must be trained in the handling and shipping of the hazardous material contained in the shipment. This person is then responsible for ensuring that proper sample handling is performed in conformance with the shipping organization's policies and procedures as well as current DOT (ground) and IATA (Air transport) shipping regulations. When shipping hazardous materials, shippers should follow the shipping instructions and guidance contained in their individual organizations hazardous material handling and shipping programs. The following is provided for informational purposes only.

When shipping hazardous materials:

1. The shipper must provide information and training to their employees so that they may carry out their responsibilities with regard to transport of the dangerous goods as required by DOT and IATA.
2. The shipper must ensure that the substances they are shipping are not prohibited by the regulations.
3. The substances must be properly identified, classified, marked, labeled, documented and in the condition for transport according to the regulations.
4. All persons involved the preparation for transport (or those acting as the shipper's agent) must have received documented training, including security training, to enable them to carry out their responsibilities.
5. The dangerous goods must be packaged in compliance with all applicable air transport requirements.

Acids When shipping bottles containing acid, if you ship more than 30 ml of acid in a single sample bottle or more than 500 ml total per package you are violating US DOT regulations. For packages with bottles containing less than 30 ml of acid per bottle, the following procedures should be followed:

- Each package must have an 'Excepted Quantities' label (Figure 1), which must be placed on the outside of the package on two opposing sides, be at least 100 mm (3.9 inches) x 100 mm (3.9 inches) in size, and be clearly visible on the package.
- For transport by air, the air waybill must include the statement "Dangerous Goods in Excepted Quantities" in the "Nature and Quantity of Goods" space. Also indicate the number of packages being shipped.
- Each person who offers or transports excepted quantities of hazardous materials must read the requirements of 49 Code of Federal Regulations 173.4a

Ethanol. When shipping ethanol-preserved samples, it is recommended to contact the analytical laboratory in advance to discuss transport options. Shipping of ethanol-preserved BMI samples at concentrations likely to be present within RMC samples are regulated by the US Department of Transportation (DOT). The shipper should ensure that containers are tightly closed and contain at least double containment (e.g., double-bagged), and the package contains some sort of absorbent. Ethanol-preserved samples should be shipped via ground transport whenever possible, and shipment should include relevant MSDS. Shipment should be labeled consistent with MSDS transport information as follows (applicable to both air and ground transport):

- Hazard Class 3
- Identification Number: UN 1170
- Packing Group: 2
- Proper Shipping Name: Ethyl Alcohol Solution

Glutaraldehyde. With regard to shipping glutaraldehyde, Section 4.1.3.3 of the IATA Regulations reference guide states that if a mixture or formulation has a name that appears in the regulations but does not meet the definition of the class shown because of concentration (e.g. via dilution) it is not regulated. In such a case, the words "Not Restricted" should then be included in the description on the shipping documents to indicate it has been checked. The shipper should ensure that sample bottles are tightly closed and at least double bagged, and the package contains some sort of absorbent. Glutaraldehyde-preserved samples should be shipped via ground transport whenever possible, and shipment should include relevant MSDS.

Formalin. Similarly, samples preserved with formalin (10% Formaldehyde solution) are not restricted. In such a case, the words "Not Restricted" should then be included in the description on the shipping documents to indicate that samples have been checked. The shipper should ensure that sample bottles are tightly closed and at least double bagged, and the package contains some sort of absorbent. Formalin-preserved samples should be shipped via ground transport whenever possible, and shipment should include relevant MSDS.

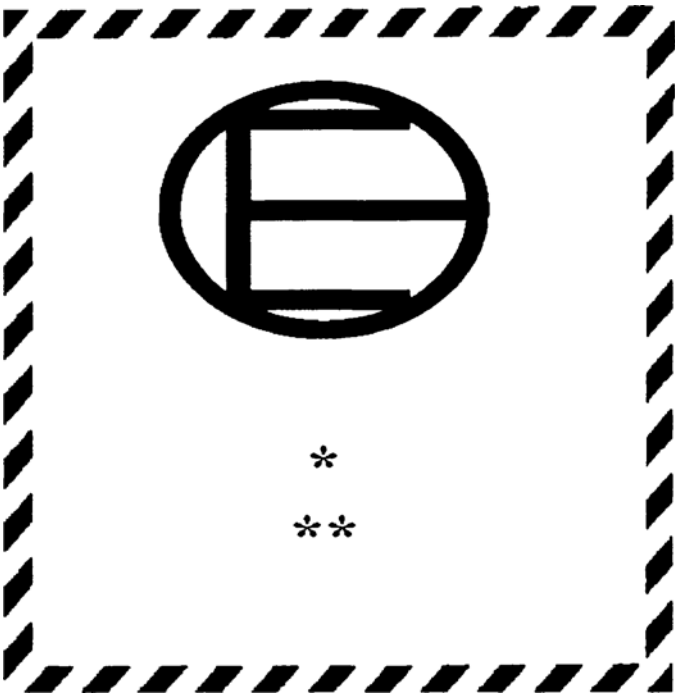

Figure 1. Excepted Quantities Shipping Label (* = primary hazard class, or when assigned, the division of hazardous material in the package (Hazard Class 8 for hydrochloric acid (HCl) and sulfuric acid (H_2S0_4)); ** = Name of shipper and organization)

CHAIN OF CUSTODY PROCEDURES

Chain-of-custody (COC) procedures require that possession of samples be traceable from the time the samples are collected until completion and submittal of analytical results. Individual stormwater programs will be expected to supply their own COC form, or to use forms supplied by contract laboratories. COCs will be completed and sent with the samples for each laboratory and each shipment. If multiple coolers are sent to a single laboratory on a single day, form(s) will be completed and sent with the samples for each cooler, either placed in an envelope and taped to the inside of the top of the cooler, or placed into a zip-top bag and placed within the cooler.

The COC will identify the contents of each shipment and maintain the custodial integrity of the samples. Generally, a sample is considered to be in someone's custody if it is either in someone's physical possession, in someone's view, locked up, or kept in a secured area that is restricted to authorized personnel. Until the samples are shipped, the custody of the samples will be the responsibility of the field crew. The sampling team leader or designee will sign the COC in the "relinquished by" box and note date and time.

A self-adhesive custody seal will be placed across the lid of each sample at a point of closure. The shipping containers in which samples are stored (usually an ice chest) will be sealed with self-adhesive custody seals any time they are not in someone's possession or view before shipping. All custody seals will be signed and dated.

Each receiving laboratory has a sample custodian who examines the samples for correct documentation, proper preservation and holding times. Contract laboratories will follow sample custody procedures outlined in their QA plans. Contract laboratory QA plans are on file with each respective laboratory.

Quality Assurance / Quality Control

MCLs should review shipping procedures as part of Readiness Reviews conducted prior to specific sampling events. MCLs should also review practices implemented as part of Post Sampling Event reviews and communicate any deficiencies identified to PMLs.

References

AMS, 2007.Quality Assurance Project Plan for Monitoring and Mitigation to Address Fecal Pathogen Pollution along California Coast. Proposition 50 Coastal Management Program Agreement No. 06-076-553-0. February 15, 2007.

BASMAA. 2014. BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Prepared for Bay Area Stormwater Management Agencies Association. Version 2, January 2014.

MPSL-DFG Field Sampling Team, 2007.Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in SWAMP. Version 1.0. October 15, 2007.

Attachment 1 –Sample Handling Requirements for RMC Analytes

Table 1. Specifications for Sample Handling for RMC Analytes in Water, Bioassessment Samples

Analyte	Analyte Group	Sample Container Material and Property	Minimum Container Amount	Preservative	Holding Time (at ≤6 C)
Phosphorus (Total as P), TKN, Ammonia as N	Conventional	1 L PE	1 L	Cool to ≤6º C and store in the dark. Acidify with H_2SO_4 to pH<2 [1]	28 days
Nitrate (as N), Nitrite (as N), Chloride, Alkalinity	Conventional	1 L PE	1 L	Cool to ≤6º C and store in the dark.	48 hrs (28 days for chloride)
Suspended Sediment Concentration (SSC)	Conventional	500 mL PE	500 mL	Cool to ≤6º C and store in the dark.	NA
Silica	Conventional	250 mL PE	250 mL	Cool to ≤6º C and store in the dark.	28 days
Orthophosphate (Dissolved, as P)	Conventional	250 mL PE (filled from 1L transfer container)	250 mL (filled from transfer container)	Filter within 15 minutes of collection, Cool to ≤6°C and store in the dark	48 hours
Dissolved Organic Carbon (DOC)	Conventional	40 mL VOA vial	120 mL (filled from transfer container)	Filter within 15 minutes of collection, Cool to ≤6º C and store in the dark. Acidify with HCl to pH<2[1]	28 days
Chlorophyll a	Conventional	Lab-supplied Glass-fiber filter (algae processing)	25 mL	Field filter (0.7 mm GFF), place in snapping petri dish, cover with foil, and place on dry ice (wet ice OK for field)	28 days frozen
Ash Free Dry Mass	Conventional	Lab-supplied Glass-fiber filter (pre-combusted) (algae processing))	25 mL	Field filter (0.7 mm pre-ashed), freeze within 4h on dry ice	28 days frozen

[1] Acidify samples in the field when possible. Preservative may be added to sample bottles in advance by laboratory. When field acidification is not possible, deliver samples to lab as soon as possible on day of collection, and instruct lab to acid-preserve samples immediately upon receipt.

Table 2. Specifications for Sample Handling for RMC Analytes in Water, Non-bioassessment Samples

Analyte	Analyte Group	Sample Container Material & Property	Minimum Container Amount	Preservative	Holding Time (at 6 C)
Pathogen Indicators (Fecal coliform and *E. coli*)	Pathogens	Factory-sealed, pre-sterilized, Whirlpak bags or 125 mL sterile plastic (high density PE or PP) container	200 mL	Cool to ≤6º C and store in the dark. Preserve with sodium thiosulfate only when sample tests positive for chlorine.	6 hours [2]
Toxicity	Toxicity	8 @ 4-L amber glass	32 L	Cool to ≤6º C and store in the dark	36 hrs

Table 3. Specifications for Sample Handling for RMC Targeted Analytes in Sediment

Analyte	Analyte Group	Sample Container Material & Property	Minimum Container Amount	Preservative	Holding Time (at 6 C)
Toxicity	Toxicity	1-L I-Chem HDPE with Teflon lid liner; precleaned	2 L	Cool to ≤6º C and store in the dark	14 days at 6 ºC
Total Organic Carbon (TOC)	Conventional	250-mL clear glass jar; pre-cleaned	500 g (2 jars)	Cool to ≤6º C in the dark up to 28 days	Sample may be frozen at any time during the initial 28 days, for up to 1 year maximum at -20 ˚C.
Grain Size	Conventional	250-mL clear glass jar; pre-cleaned	250 g	Cool to ≤6º C in the field, then refrigerate at 6º	1 year
Metals, Hg	Inorganics	250-mL I-Chem 300 or 200 series clear glass jar with Teflon lid-liner	250 g	Cool to ≤6º C and in the dark	1 year at -20 ˚C; Samples must be analyzed within 14 days of collection or thawing.
PAHs	Synthetic Organics	Pre-cleaned 250-mL I-Chem 300 Series amber glass jar with Teflon lid liner	250 g	Cool to ≤6º C in the dark	1 year at -20 °C; Samples must be extracted within 14 days of collection or thawing and analyzed within 40 days of extraction.
OC Pesticides	Synthetic Organics	Pre-cleaned 250-mL I-Chem 300 Series amber glass jar with Teflon lid	250 g	Cool to ≤6º C in the dark	1 year at -20 °C; Samples must be extracted within 14 days of collection or thawing and analyzed

[2] USEPA allows up to 6 hours for transport of samples to lab, plus an additional 2 hours for sample processing and start of analysis. Per Federal Register, March 26, 2007

Analyte	Analyte Group	Sample Container Material & Property	Minimum Container Amount	Preservative	Holding Time (at 6 C)
		liner			within 40 days of extraction.
Pyrethroid Pesticides	Synthetic Organics	Pre-cleaned 250-mL I-Chem 300 Series polyethylene jar with Teflon lid liner	500 g (two jars)	Cool to ≤6º C in the dark; freeze within 48 hrs.	1 year at -20 °C; Samples must be extracted within 14 days of collection or thawing and analyzed within 40 days of extraction.
Archive, as needed to supplement contracted analyses	N/A	Pre-cleaned 250-mL I-Chem 300 Series amber glass jar with Teflon lid liner	250 g	Cool to ≤6º C in the dark, freeze to -20º C	Indefinite

Table 4. Specifications for Sample Handling for RMC Bioassessment Biota Samples

Analyte	Analyte Group	Sample Container Material & Property	Minimum Container Amount	Preservative	Holding Time (at 6 C)
Benthic Macroinvertebrates	Biological	Plastic Wide Mouth Jars	500mL	95% ethanol	>1 year after preservation
Diatoms	Biological	Plastic Centrifuge Tubes	50mL	Add 10 mL 10% Formalin (buffered with borax) to 40 mL sample	>1 year after preservation
Soft Algae	Biological	Plastic Centrifuge Tubes	50mL	Add 5 mL 25% glutaraldehyde to 45mL sample. Must add within 4 days and keep sample away from heat and in the dark	>1 year after preservation

STANDARD OPERATING PROCEDURES
for
Completion and Processing of Field Datasheets
(SOP FS-10)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This SOP is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:

- Biological Assessment
- General Water Quality
- Chlorine
- Temperature
- Toxicity – Water Column
- Toxicity – Bedded Sediment, Fine-Grained
- Pollutants – Bedded Sediment, Fine-grained
- Pathogen Indicators

SOP Background and Application

In order to ensure SWAMP comparability, datasheets used associated with collection of RMC field samples and measurements will rely upon those developed and updated by Moss Landing for the SWAMP program.

References to Existing SOPs

This SOP is adapted from information provided in the following SOPs:

(1) For water quality, water measurements, and sediment sampling: **Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in the Surface Water Ambient Monitoring Program (SWAMP)**, version 1.0, released October 15, 2007 (SWAMP 2007). A pdf of the SOP is available for download at:
http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/standard-operating-procedures

(2) For bioassessments: **Standard Operating Procedures for Collecting Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California.** California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 001, released February 2007 (Ode, 2007). A pdf of the SOP is available for download at: http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/standard-operating-procedures

(3) For algal sampling: **Standard Operating Procedures for Collecting Stream Algae Samples and Associated Physical Habitat and Chemical Data for Ambient Bioassessments in California.** California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 002, released June 2009 (Fetscher et al, 2009). A pdf of the SOP is available for download at: http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/standard-operating-procedures

Relevant QA/QC protocols are also referenced in the associated RMC QAPPs for bioassessment and water quality monitoring: **BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan**, version 2, January 2014 (BASMAA 2014).

Special Cautions and Considerations; Health and Safety

None

Methods / Procedures

Field datasheets are to be selected from available SWAMP products based upon the type of sampling conducted: (1) water quality measurement and sampling; (2) sediment sampling; (3) bioassessment: and (4) stream survey. These are appended to this SOP as Attachments 1, 2, 3, and 4, respectively. Information for completing field datasheets is included both within the datasheets themselves and within the appropriate SOP referenced above.

MOBILIZATION

As part of mobilization process, Field Crew leaders are responsible for ensuring an adequate number of the appropriate type of datasheets are mobilized as part of the readiness review for a specific field effort.

FIELD SAMPLING

As weather allows, all datasheets should be completed in blue or black ink. Any changes to field datasheets should be made by crossing out the relevant information with a single line and initialing beside the mark out. As inclement weather dictates, field forms may also be printed on Rite in the Rain paper, with information completed in pencil.

Upon completing field efforts at a site, the non-recording member of each field team should review the completed field datasheet(s) prior to leaving the sampling site to ensure completeness and legibility.

DEMOBILIZATION

As soon as possible after returning from the field, information from the field datasheets should be transferred to the LIMC, who will be responsible for reviewing and making required corrections to field datasheets.

Quality Assurance / Quality Control

The RMC MCC should verify that field datasheets are current at a sufficient period prior to implementation of field efforts, and distribute revised sheets as appropriate, to ensure that datasheets employed by field personnel are current.

LIMCs will be responsible for entering information from field datasheets into electronic templates. LIMCs will identify any deficiencies in field datasheets and return to the appropriate field crew for correction. LQAOs will be responsible for ensuring compliance with programmatic DQOs.

Review of field crews' performance in completing field datasheets will be conducted associated with field audits, which will be performed on at least a biennial basis.

References

BASMAA. 2014. BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Prepared for Bay Area Stormwater Management Agencies Association. Version 2, January 2014.

Fetscher, A.E., L. Busse, and P. R. Ode. 2009. Standard Operating Procedures for Collecting Stream Algae Samples and Associated Physical Habitat and Chemical Data for Ambient Bioassessments in California. California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 002.

MPSL-DFG Field Sampling Team, 2007. Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in SWAMP. Version 1.0. October 15, 2007.

Ode, P.R., 2007. Standard Operating Procedures for Collecting Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California. California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 001.

Attachment 1 – Field Datasheets for Collection of Water Quality Measurements and Samples

SWAMP Field Data Sheet (Water Chemistry & Discrete Probe) - EventType=WQ

Entered in d-base (initial/date) | Pg of Pgs

***StationID:** ___ ___ ___ ___ ___ ___ ___ ___ ___ | *Date (mm/dd/yyyy): / / | *Group: | *Agency:

***Funding:** ___ ___ ___ ___ ___ ___ ___ ___ | ArrivalTime: | DepartureTime: | *SampleTime (1st sample): | *Protocol:

***ProjectCode:** | *Personnel: | *Purpose (circle applicable): WaterChem WaterTox Habitat FieldMeas | *PurposeFailure:

***Location**: Bank Thalweg Midchannel OpenWater | *GPS/DGPS | **Lat (dd.ddddd)** | **Long (ddd.ddddd)** | OCCUPATION METHOD: Walk-in Bridge R/V _____ Other

GPS Device: | **Target:** | | - | STARTING BANK (facing downstream): LB / RB / NA

Datum: NAD83 | Accuracy (ft / m): | ***Actual:** | | - | Point of Sample (if Integrated, then -88 in dbase)

Habitat Observations (CollectionMethod = Habitat_generic)

WADEABILITY: Y / N / Unk | BEAUFORT SCALE (see attachment): | DISTANCE FROM BANK (m): | STREAM WIDTH (m):

SITE ODOR: None,Sulfides,Sewage,Petroleum,Smoke,Other_____ | WATER DEPTH (m):

SKY CODE: Clear, Partly Cloudy, Overcast, Fog, Smoky, Hazy | WIND DIRECTION (from): |  | HYDROMODIFICATION: None, Bridge, Pipes, Concrete Channel, GradeControl, Culvert, AerialZipline, Other | LOCATION (to sample): US / DS / WI / NA

OTHER PRESENCE: Vascular,Nonvascular,OilySheen,Foam,Trash,Other_____ | **PHOTOS** (RB & LB assigned when facing downstream; RENAME to StationCode_yyyy_mm_dd_uniquecode): | 1: (RB / LB / BB / US / DS / ##)

DOMINANT SUBSTRATE: Bedrock, Concrete, Cobble, Gravel, Sand, Mud, Unk, Other_____

WATERCLARITY: Clear (see bottom), Cloudy (>4" vis), Murky (<4" vis) | PRECIPITATION: None, Fog, Drizzle, Rain, Snow | 2: (RB / LB / BB / US / DS / ##)

WATERODOR: None, Sulfides, Sewage, Petroleum, Mixed, Other_____ | PRECIPITATION (last 24 hrs): Unknown, <1", >1", None

WATERCOLOR: Colorless, Green, Yellow, Brown, Gray | EVIDENCE OF FIRES: No, <1 year, <5 years | 3: (RB / LB / BB / US / DS / ##)

OVERLAND RUNOFF (Last 24 hrs): none, light, moderate / heavy, unknown

OBSERVED FLOW: NA, Dry Waterbody Bed, No Obs Flow, Isolated Pool, Trickle (<0.1cfs), 0.1-1cfs, 1-5cfs, 5-20cfs, 20-50cfs, 50-200cfs, >200cfs

Field Measurements (SampleType = FieldMeasure; Method = Field)

Record replicate Free and Total Chlorine measurements for any results > 0.08 mg/L

	DepthCollec (m)	Water Temp (°C)	pH	O_2 (mg/L)	Specific Conductivity (uS/cm)	Salinity (ppt)	Free Chlorine (mg/L)	Total Chlorine (mg/L)	Free Chlorine (mg/L)	Free Chlorine (mg/L)			Chlorine Kit Exp. Date
SUBSURF/MID/ BOTTOM/REP													
SUBSURF/MID/ BOTTOM/REP													
Instrument:													
Calib. Date:													

Samples Taken (# of containers filled) - Method=Water_Grab

Field Dup YES / NO: (SampleType = Grab / Integrated; LABEL_ID = FieldQA; create collection record upon data entry

SAMPLE TYPE: Grab / Integrated | COLLECTION DEVICE: Indiv bottle (by hand, by pole, by bucket); Teflon tubing; Kemmer; Pole & Beaker; Other _____

	DepthCollec (m)	P, TKN, NH3	N03, NO2, Cl, Alk	SSC	Si	Ortho-P	DOC	Chl a	AFDM	Bacteria	Toxicity		
Sub/Surface													
Sub/Surface													

COMMENTS:

Notes to Standardize SWAMP Field Data Sheets (For in the field use)

Key Reminders to identify samples:

1. **Sample Time** is the SAME for all samples (Water, Sediment, & Probe) taken at the sampling event. Use time of FIRST sample; important for COC.
2. **Group;** many diffrent ways to do a group, one suggestion is to create groups which assign trips to assess frequency of field QA

Collection Details

1. **Personnel**: S. Mundell, G Ichikawa (first person listed is crew leader)
2. **Location:** Use "openwater" in bay/estuary/harbor only if no distinguishable channel exists
3. **GRAB vs INTEGRATED**: GRAB samples are when bottles are filled from a single depth; INTEGRATED sample are taken from MULTIPLE depths and combined.
   a. GRAB: use 0.1 for subsurface samples; if too shallow to submerge bottle; depth =0
   b. INTEGRATED: -88 in depth sampled, record depths combined in sample comments
4. **TARGET LAT/LONG**: Refers to the existing station location that the sampling crew is trying to achieve; can be filled out prior to sampling
5. **ACTUAL LAT/ LONG**: is the location of the current sample event.
6. **HYDROMODIFICATION:** Describe existing hydromodifications such as a grade control, drainage pipes, bridge, culvert
7. **HYDROMOD LOC**: if there is an IMMEDIATE (with in range potentially effecting sample) hydromodification; Is the hydromodification upstream/downstream/within area of sample; if there is no hydromodification, NA is appropriate
8. **STREAM WIDTH and DEPTH**: describe in meters at point of sample.

FIELD OBSERVATIONS: (each one of these observations has a comment field in the database so use comment space on data sheet to add information about an observation if necessary)

1. **PICTURES:** use space to record picture numbers given by camera; be sure to rename accordingly back in the office. (StationCode_yyyy_mm_dd_uniquecode)
2. **WADEABILITY**: in general, is waterbody being sampled wadeable to the average person AT the POINT of SAMPLE
3. **DOMINANT SUBSTRATE**: if possible; describe DOMINANT substrate type; use UNK if you cannot see the dominant substrate type
4. **BEAUFORT SCALE**: use scale 0-12; refer to scales listed below.
5. **WIND DIRECTION**: records the direction from which the wind is blowing
6. **OTHER PRESENCE**: VASCULAR refers to terrestrial plants or submerged aquatic vegetation (SAV) and NONVASCULAR refers to plankton, periphyton etc. These definitions apply to vegetation IN the water at the immediate sampling area.
7. **OBSERVED FLOW**: Visual estimates in cubic feet/ second.
8. **WATER COLOR**: This is the color of the water from standing creek side
9. **WATER CLARITY**: this describes the clarity of the water while standing creek side; clear represents water that is clear to the bottom, cloudy may not be clear to bottom but greater than 4” can be seen through the water column.
10. **PRECIPITATION LAST24hrs:** refers to field crews best categorization of rainfall in the last 24 hrs; may or may not effect Overland Runoff Last 24 hrs
11. **OVERLAND RUNOFF LAST 24 hrs:** Light Precip = fog, drizzle, and/or light rain with no overland runoff; Mod to Heavy Precip = rain such that site probably or definitely received at least some overland runoff
12. **SedimentComp**: generally described sediments used for chemistry sample

Note: these reminders do not give all details needed to maintain equivalent SWAMP sampling protocols, they are strictly for “infield” use to help insure comparability of field observations.

BEAUFORT SCALE: Specifications and equivalent speeds for use on land

FORCE	EQUIVALENT SPEED 10 m above ground		DESCRIPTION	SPECIFICATIONS FOR USE ON LAND
	miles/hour	knots		
0	0-1	0-1	Calm	Calm; smoke rises vertically
1	1-3	1-3	Light air	Direction of wind shown by smoke drift, but not by wind vanes
2	4-7	4-6	Light Breeze	Wind felt on face; leaves rustle; ordinary vanes moved by wind
3	8-12	7-10	Gentle Breeze	Leaves and small twigs in constant motion; wind extends light flag
4	13-18	11-16	Moderate Breeze	Raises dust and loose paper; small branches are moved.
5	19-24	17-12	Fresh Breeze	Small trees in leaf begin to sway crested wavelets form on inland waters
6	25-31	22-27	Strong Breeze	Large branches in motion; whistling heard in telegraph wires umbrellas used with difficulty
7	32-38	28-33	Neargale	Whole trees in motion; inconvenience felt when walking against the wind
8	39-46	34-40	Gale	Breaks Twigs and generally impedes progress

Source:

Last edited on 09 January, 1999 Dave Wheeler weatherman@zetnet.co.uk

Web Space kindly provided by Zetnet Services Ltd, Lerwick, Shetland.

Attachment 2 – Field Datasheets for Collection of Bedded Sediment Samples

SWAMP Field Data Sheet (Sediment Chemistry) - EventType=WQ			Entered in d-base (initial/date)	Pg of Pgs
***StationID:** ___ ___ ___ ___ ___ ___ ___ ___ ___	*Date (mm/dd/yyyy): / /		*Group:	*Agency:
***Funding:** ___ ___ ___ ___ ___ ___ ___ ___	ArrivalTime:	DepartureTime:	*SampleTime (1st sample):	*Protocol:
***ProjectCode:**	*Personnel:		*Purpose (circle applicable): SedChem SedTox Habitat Benthic	*PurposeFailure:

*Location: Bank Thalweg Midchannel OpenWater	*GPS/DGPS	Lat (dd.ddddd)	Long (ddd.ddddd)	OCCUPATION METHOD: Walk-in Bridge R/V _____ Oth
GPS Device:	**Target:**		-	STARTING BANK (facing downstream): LB / RB / NA
	***Actual:**		-	Point of Sample (if Integrated, then -88 in dbase)
Datum: NAD83 Accuracy (ft / m):	Same as Water/Probe Collection? YES NO			DISTANCE FROM BANK (m): / STREAM WIDTH (m): / WATER DEPTH (m):

Habitat Observations (CollectionMethod = Habitat_generic) ****Only complete Sed Observations (bolded) if WQ Observations are already recorded**		WADEABILITY: Y / N / Unk	BEAUFORT SCALE see Attachtment
SITE ODOR:	None,Sulfides,Sewage,Petroleum,Smoke,Other_____		
SKY CODE:	Clear, Partly Cloudy, Overcast, Fog, Smoky, Hazy	WIND DIRECTION (from):	N W E S
OTHERPRESENCE:	Vascular,Nonvascular,OilySheen,Foam,Trash,Other_____		
DOMINANTSUBSTRATE:	Bedrock, Concrete, Cobble, Gravel, Sand, Mud, Unk, Other_____		

HYDROMODIFICATION: None, Bridge, Pipes, ConcreteChannel, GradeControl, Culvert, AerialZipline, Other
LOCATION (to sample): US / DS / WI / NA

PHOTOS (RB & LB assigned when facing downstream; RENAME to StationCode_yyyy_mm_dd_uniquecode): 1: (RB / LB / BB / US / DS / ##)

SEDODOR:	None, Sulfides, Sewage, Petroleum, Mixed, Other_____	PRECIPITATION: None, Fog, Drizzle, Rain, Snow	2: (RB / LB / BB / US / DS / ##)
SEDCOLOR:	Colorless, Green, Yellow, Brown	PRECIPITATION (last 24 hrs): Unknown, <1", >1", None	
SEDCOMPOSITION:	Silt/Clay, FineSand, CoarseSand, Gravel, Cobble, Mixed, HardPanClay	EVIDENCE OF FIRES: No, <1 years, <5 years	3: (RB / LB / BB / US / DS / ##)
OBSERVED FLOW:	NA, Dry Waterbody Bed, No Obs Flow, Isolated Pool, Trickle (<0.1cfs), 0.1-1cfs, 1-5cfs, 5-20cfs, 20-50cfs, 50-200cfs, >200cfs		

Samples Taken (# of containers filled) - Method=Sed_Grab

Field Dup YES / NO: (SampleType = Grab / Integrated; LABEL_ID = FieldQA; create collection record upon data entry

COLLECTION DEVICE: Scoop (SS / PC / PE, Core (SS / PC / PE), Grab (Van Veen / Eckman / Petite Ponar) COLLECTION DEVICE AREA (m2): _____

Sample Type:	DepthCollec (cm)	Equipment Used	Sediment Only (Y / N)	OC Pests	PAHs	Pyrethroids	TM, Hg	Grain size	TOC	Toxicity	Archive		
Integrated Grab													
Integrated Grab													
Integrated Grab													
Integrated Grab													

COMMENTS:

Attachment 3 – Field Datasheets for Bioassessment

REACH DOCUMENTATION	Standard Reach Length (wetted width ≤ 10 m) = 150 m Alternate Reach Length (wetted width >10 m) = 250 m	Distance between transects = 15m Distance between transects = 25 m
Project Name:	Date: / / 20___	Sample Collection Time:
Stream Name:	Station Name/ Description:	
Station Code:	Crew Members:	
Latitude (actual – decimal degrees): ºN	GPS Device:	**datum:** **NAD83** *other:*
Longitude (actual – decimal degrees): ºW	Accuracy:	
Actual Reach Length (m): *(see reach length guidelines at top of form)*	Explanation:	

NOTABLE FIELD CONDITIONS (check one box per topic)								
Evidence of recent rainfall (enough to increase surface runoff)		**Evidence of fires in reach or immediately upstream (<500 m)**		**Dominant landuse/landcover in area surrounding reach**				
NO		NO		Agriculture		Forest		Notes:
minimal		< 1 year		Urban/ Industrial		Suburb/ Town		
>10% flow increase		< 5 years		Rangeland		Other		

AMBIENT WATER QUALITY MEASUREMENTS					
	Water Temp (°C)	**Air Temp (°C)**	**Oxygen Sat. (%)**	**Dissolved O_2 (mg/L)**	**pH**
Measurement					
Device Name					
Calibration Date	/ /	/ /	/ /	/ /	/ /

	Specific. Conduct (uS/cm)	**Salinity (ppt)**	**Free Chlorine (mg/L)** 1	2	**Total Chlorine (mg/L)** 1	2	Check if a WATER chemistry **grab** sample was collected (nutrients, SSC, etc.) ☐
Measurement							
Device Name							Check if a DUPLICATE WATER chemistry **grab** sample was collected ☐
Calibration Date	/ /	/ /	/ /		/ /		

ADDITIONAL HABITAT CHARACTERIZATION	**High Gradient** ☐	**Low Gradient** ☐		
Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
Epifaunal Substrate/ Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover (50% for low-gradient streams); mix of submerged logs, undercut banks, cobble or other stable habitat	40-70% mix of stable habitat (30-50% for low-gradient streams); well-suited for full colonization potential	20-40% mix of stable habitat (10-30% in low-gradient streams); substrate frequently disturbed or removed	Less than 20% stable habitat (10% in low-gradient streams); lack of habitat is obvious; substrate unstable or lacking
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Sediment Deposition	Llittle or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition (<20% in low-gradient streams)	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected (20-50% in low-gradient streams)	Moderate deposition of new gravel, sand, or fine sediment on bars; 30-50% of the bottom affected (50 -80% in low-gradient streams)	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently (>80% in low-gradient streams)
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern	Some channelization present, (e.g., bridge abutments); evidence of past channelization (> 20yrs) may be present but recent channelization not present	Channelization may be extensive: embankments or shoring structures present on both banks; 40 to 80% of stream reach disrupted	Banks shored with gabian or cement; Over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Station Code:	Date: __ __ / __ __ / 20____

SLOPE FORM

Autolevel		Handlevel	
Clinometer		Other	

Transects Measured (e.g., C → A)	MAIN SEGMENT						
	Stadia rod measurements		Slope (%) or Elevation Difference cm ☐ % ☐	Segment Length (m)	Percent of Total Length (%)	Flag	Comments

DISCHARGE MEASUREMENTS (check all that apply)

Discharge Not Measured		Velocity Too Low to Measure		Too Shallow to Measure		Other explanation:
Discharge Measured at Permanent Gauge		Agency:				Location:

VELOCITY AREA METHOD (preferred)
1st measurement = left bank (looking downstream)

Transect Width (m):

	Distance from Left Bank (cm)	Depth (cm)	Velocity (m/sec)		Distance from Left Bank (cm)	Depth (cm)	Velocity (m/sec)
1				11			
2				12			
3				13			
4				14			
5				15			
6				16			
7				17			
8				18			
9				19			
10				20			

BUOYANT OBJECT METHOD (use ONLY if velocity area method not possible)

	Float 1	Float 2	Float 3
Distance (m)			
Float Time			

Float Reach Cross Section

width (m) depth(cm)	Upper Section	Middle Section	Lower Section
Width			
Depth 1			
Depth 2			
Depth 3			
Depth 4			
Depth 5			

Field sketch of reach: **Additional field sketch page(s) added #___ / back of sheet___.**

Station Code:	Date: __ __ / __ __ / 20____

BENTHIC INVERTEBRATE SAMPLES

Replicate	Collection Method BMI_RWB (standard)	Collection Device D-Frame Kick Net (standard)	# Jars	Notes
1				
2				

ALGAE SAMPLES

Replicate	1		2	
Collection Method (Algae_SWAMP or write new method if applicable)				
Number of transects sampled (0-11)				
Collection Device (sum # of transects per device)	**Total Count**	**Total Area**	**Total Count**	**Total Area**
Rubber Delimiter (area = 12.6cm^2)				
PVC Delimiter (area = 12.6cm^2)				
Syringe Scrubber (area = 5.3cm^2)				
Other Area =				
Total				
Composite Volume (mL)				
Assemblage ID volume **(diatoms)** (50 mL tube)				
Assemblage ID volume **(soft algae)** (50 mL tube)				
Check if Qualitative Algae sample was collected with **soft algae/diatom** sample (required even if macroalgae not visible)	☐		☐	
Check if a water chem. **integrated** sample was collected (chl, AFDM)	☐		☐	
Chlorophyll a volume (use GF/F filter) (25 mL **(**preferred volume)				
Ash Free Dry Mass volume (use GF/F filter) (25 mL (preferred volume)				

ADDITIONAL PHOTOGRAPHS

Photo Code	Description	Photo Code	Description

Notes:

Station Code:	Station Name:	Date: __ __ / __ __ / 20___

Transect A

Wetted Width (m):

TRANSECT SUBSTRATES

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

DENSIOMETER READINGS (0-17)
count covered dots

Center Upstream	Center Left	Center Downstream	Center Right

BANK STABILITY
(score zone 5m upstream and 5m downstream of transect between bankfull - wetted width)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

TAKE PHOTOGRAPHS
(check box if taken & record photo code)

Upstream ☐

INSTREAM HABITAT COMPLEXITY

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Artificial Structures	0 1 2 3 4
Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4

HUMAN INFLUENCE
(circle only the closest to wetted channel)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Inter-Transect: AB

Wetted Width (m):

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type and %

Cascade/ Falls	%	Rapid	%	Riffle	%	Run	%	Glide	%	Pool	%	Dry	%

Station Code:	Station Name:	Date: __ __ / __ __ / 20___

Transect B

Wetted Width (m):

TRANSECT SUBSTRATES

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
- **0** = No microalgae present, Feels rough, not slimy;
- **1** = Present but not visible, Feels slimy;
- **2** = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
- **3** = 1-5mm;
- **4** = 5-20mm;
- **5** = >20mm;
- **UD** = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
- **D** = Dry, not assessed

DENSIOMETER READINGS (0-17)
count covered dots

Center Upstream	Center Left	Center Downstream	Center Right

BANK STABILITY
(score zone 5m upstream and 5m downstream of transect between bankfull - wetted width)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

INSTREAM HABITAT COMPLEXITY

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Artificial Structures	0 1 2 3 4
Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4

HUMAN INFLUENCE
(circle only the closest to wetted channel)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Inter-Transect: BC

Wetted Width (m):

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
- **0** = No microalgae present, Feels rough, not slimy;
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- **3** = 1-5mm;
- **4** = 5-20mm;
- **5** = >20mm;
- **UD** = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
- **D** = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type and %

Cascade/ Falls	%	Rapid	%	Riffle	%	Run	%	Glide	%	Pool	%	Dry	%

Station Code:	Station Name:	Date: __ __ / __ __ / 20___

Transect C

Wetted Width (m):

TRANSECT SUBSTRATES

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
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3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

DENSIOMETER READINGS (0-17)
count covered dots

Center Upstream	Center Left	Center Downstream	Center Right

BANK STABILITY
(score zone 5m upstream and 5m downstream of transect between bankfull - wetted width)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

INSTREAM HABITAT COMPLEXITY

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Artificial Structures	0 1 2 3 4
Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4

HUMAN INFLUENCE
(circle only the closest to wetted channel)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Inter-Transect: CD

Wetted Width (m):

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type and %

Cascade/ Falls	%	Rapid	%	Riffle	%	Run	%	Glide	%	Pool	%	Dry	%

Station Code:	Station Name:	Date: __ __ / __ __ / 20___

Transect D

Wetted Width (m):

TRANSECT SUBSTRATES

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

DENSIOMETER READINGS (0-17)
count covered dots

Center Upstream	Center Left	Center Downstream	Center Right

BANK STABILITY
(score zone 5m upstream and 5m downstream of transect between bankfull - wetted width)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

INSTREAM HABITAT COMPLEXITY

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Artificial Structures	0 1 2 3 4
Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4

HUMAN INFLUENCE
(circle only the closest to wetted channel)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Inter-Transect: DE

Wetted Width (m):

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type and %

Cascade/ Falls	%	Rapid	%	Riffle	%	Run	%	Glide	%	Pool	%	Dry	%

Station Code:	Station Name:	Date: __ __ / __ __ / 20___

Transect E

Wetted Width (m):

TRANSECT SUBSTRATES

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

DENSIOMETER READINGS (0-17)
count covered dots

Center Upstream	Center Left	Center Downstream	Center Right

BANK STABILITY
(score zone 5m upstream and 5m downstream of transect between bankfull - wetted width)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

INSTREAM HABITAT COMPLEXITY

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Artificial Structures	0 1 2 3 4
Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4

HUMAN INFLUENCE
(circle only the closest to wetted channel)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Inter-Transect: EF

Wetted Width (m):

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type and %

Cascade/ Falls	%	Rapid	%	Riffle	%	Run	%	Glide	%	Pool	%	Dry	%

Station Code:	Station Name:	Date: __ __ / __ __ / 20___

Transect F

Wetted Width (m):

TRANSECT SUBSTRATES

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

DENSIOMETER READINGS (0-17)
count covered dots

Center Upstream	Center Left	Center Downstream	Center Right

BANK STABILITY
(score zone 5m upstream and 5m downstream of transect between bankfull - wetted width)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

TAKE PHOTOGRAPHS
(check box if taken & record photo code)

Downstream ☐

Upstream ☐

INSTREAM HABITAT COMPLEXITY

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Artificial Structures	0 1 2 3 4
Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4

HUMAN INFLUENCE
(circle only the closest to wetted channel)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Inter-Transect: FG

Wetted Width (m):

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type and %

Cascade/ Falls	%	Rapid	%	Riffle	%	Run	%	Glide	%	Pool	%	Dry	%

Station Code:	Station Name:	Date: __ __ / __ __ / 20___

Transect G

Wetted Width (m):

TRANSECT SUBSTRATES

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

DENSIOMETER READINGS (0-17)
count covered dots

Center Upstream	Center Left	Center Downstream	Center Right

BANK STABILITY
(score zone 5m upstream and 5m downstream of transect between bankfull - wetted width)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

INSTREAM HABITAT COMPLEXITY

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Artificial Structures	0 1 2 3 4
Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4

HUMAN INFLUENCE
(circle only the closest to wetted channel)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Inter-Transect: GH

Wetted Width (m):

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%) **Channel Type and %**

Cascade/ Falls	%	Rapid	%	Riffle	%	Run	%	Glide	%	Pool	%	Dry	%

Station Code:	Station Name:	Date: __ __ / __ __ / 20___

Transect H

Wetted Width (m):

TRANSECT SUBSTRATES

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

DENSIOMETER READINGS (0-17)
count covered dots

Center Upstream	Center Left	Center Downstream	Center Right

BANK STABILITY
(score zone 5m upstream and 5m downstream of transect between bankfull - wetted width)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

INSTREAM HABITAT COMPLEXITY

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Artificial Structures	0 1 2 3 4
Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4

HUMAN INFLUENCE
(circle only the closest to wetted channel)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Inter-Transect: HI

Wetted Width (m):

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type and %

Cascade/ Falls	%	Rapid	%	Riffle	%	Run	%	Glide	%	Pool	%	Dry	%

Station Code:	Station Name:	Date: __ __ / __ __ / 20___

Transect I

Wetted Width (m):

TRANSECT SUBSTRATES

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

DENSIOMETER READINGS (0-17)
count covered dots

Center Upstream	Center Left	Center Downstream	Center Right

BANK STABILITY
(score zone 5m upstream and 5m downstream of transect between bankfull - wetted width)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

INSTREAM HABITAT COMPLEXITY

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Artificial Structures	0 1 2 3 4
Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4

HUMAN INFLUENCE
(circle only the closest to wetted channel)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Inter-Transect: IJ

Wetted Width (m):

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

Microalgae Thickness Codes
0 = No microalgae present, Feels rough, not slimy;
1 = Present but not visible, Feels slimy;
2 = Present and visible but <1mm; Rubbing fingers on surface produces a brownish tint on them, scraping leaves visible trail.
3 = 1-5mm;
4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type and %

Cascade/ Falls	%	Rapid	%	Riffle	%	Run	%	Glide	%	Pool	%	Dry	%

Station Code:	Station Name:	Date: __ __ / __ __ / 20___

Transect J

Wetted Width (m):

TRANSECT SUBSTRATES

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

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0 = No microalgae present, Feels rough, not slimy;
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4 = 5-20mm;
5 = >20mm;
UD = Cannot determine if microalgae present, substrate too small or covered with silt (formerly Z code).
D = Dry, not assessed

DENSIOMETER READINGS (0-17)
count covered dots

Center Upstream	Center Left	Center Downstream	Center Right

BANK STABILITY
(score zone 5m upstream and 5m downstream of transect between bankfull - wetted width)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

INSTREAM HABITAT COMPLEXITY

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Artificial Structures	0 1 2 3 4
Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4

HUMAN INFLUENCE
(circle only the closest to wetted channel)

0 = Not Present;
B = On Bank;
C = Between Bank & 10m from Channel;
P = >10m+<50m from Channel;
Channel (record Yes or No)

	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

Inter-Transect: JK

Wetted Width (m):

Inter-Transect Substrates

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

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D = Dry, not assessed

FLOW HABITATS
(% between transects, total=100%)

Channel Type and %

Cascade/ Falls	%	Rapid	%	Riffle	%	Run	%	Glide	%	Pool	%	Dry	%

Station Code:	Station Name:	Date: __ __ / __ __ / 20___
Transect K	Wetted Width (m):	

TRANSECT SUBSTRATES

Position	Dist from LB (m)	Depth (cm)	mm/ size class	% Cobble Embed.	CPOM	Microalgae Thickness Code	Macroalgae Attached	Macroalgae Unattached	Macrophytes
Left Bank					P A		P A D	P A D	P A D
Left Center					P A		P A D	P A D	P A D
Center					P A		P A D	P A D	P A D
Right Center					P A		P A D	P A D	P A D
Right Bank					P A		P A D	P A D	P A D
	Note: Substrate sizes can be recorded either as direct measures of the median axis of each particle or one of the size class categories listed on the supplemental page (direct measurements preferred)								

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D = Dry, not assessed

DENSIOMETER READINGS (0-17)
count covered dots

Center Upstream	Center Left	Center Downstream	Center Right

BANK STABILITY
(score zone 5m upstream and 5m downstream of transect between bankfull - wetted width)

Left Bank	eroded	vulnerable	stable
Right Bank	eroded	vulnerable	stable

TAKE PHOTOGRAPHS
(check box if taken & record photo code)

Downstream ☐

INSTREAM HABITAT COMPLEXITY

0 = Absent (0%)
1 = Sparse (<10%)
2 = Moderate (10-40%)
3 = Heavy (40-75%)
4 = Very Heavy (>75%)

Artificial Structures	0 1 2 3 4
Filamentous Algae	0 1 2 3 4
Aquatic Macrophytes/ Emergent Vegetation	0 1 2 3 4
Boulders	0 1 2 3 4
Woody Debris >0.3 m	0 1 2 3 4
Woody Debris <0.3 m	0 1 2 3 4
Undercut Banks	0 1 2 3 4
Overhang. Vegetation	0 1 2 3 4
Live Tree Roots	0 1 2 3 4

HUMAN INFLUENCE
(circle only the closest to wetted channel)

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	Left Bank	Channel	Right Bank
Walls/ Rip-rap/ Dams	P C B 0	Y N	0 B C P
Buildings	P C B 0	Y N	0 B C P
Pavement/ Cleared Lot	P C B 0		0 B C P
Road/ Railroad	P C B 0	Y N	0 B C P
Pipes (Inlet/ Outlet)	P C B 0	Y N	0 B C P
Landfill/ Trash	P C B 0	Y N	0 B C P
Park/ Lawn	P C B 0		0 B C P
Row Crop	P C B 0		0 B C P
Pasture/ Range	P C B 0		0 B C P
Logging Operations	P C B 0		0 B C P
Mining Activity	P C B 0	Y N	0 B C P
Vegetation Management	P C B 0		0 B C P
Bridges/ Abutments	P C B 0	Y N	0 B C P
Orchards/ Vineyards	P C B 0		0 B C P

ADDITIONAL COBBLE EMBEDDEDNESS MEASURES
(carry over from transect forms if needed to attain target count of 25; measure in %)

1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	

Size Class Code	Size Class Range	Size Class Description	Common Size Reference
RS	> 4 m	bedrock, smooth	larger than a car
RR	> 4 m	bedrock, rough	larger than a car
XB	1 - 4 m	boulder, large	meter stick to car
SB	25 cm - 1.0 m	boulder, small	basketball to meter stick
CB	64 - 250 mm	cobble	tennis ball to basketball
GC	16 - 64 mm	gravel, coarse	marble to tennis ball
GF	2 - 16 mm	gravel, fine	ladybug to marble
SA	0.06 - 2 mm	sand	gritty to ladybug
FN	< 0.06 mm	fines	not gritty
HP	< 0.06 mm	hardpan (consolidated fines)	
WD	NA	wood	
RC	NA	concrete/ asphalt	
OT	NA	other	

FLAG	DEFINITION
FCL	Field calibration not performed within 24 hours before use
FDC	Drift check not acceptable
FDR	Dry Channel
FEU	Equipment Unavailable
FIA	Location was inaccessible to obtain a measurement
FIF	Instrument/Probe Failure
FLV	Velocity too low to be measured
FS	Too Shallow for probe measurement
FTD	Location was too deep to obtain a measurement
FTT	Water too turbid to measure
FUD	Unable to deploy instrument
Q	Questionable result
DNQ	Detected Not Quantifiable
JF	Field Estimated

CPOM/ COBBLE EMBEDDEDNESS

CPOM: Record presence (P) or absence (A) of coarse particulate organic matter (>1.0 mm particles) within 1 cm of each substrate particle

Cobble Embeddedness: Visually estimate % embedded by fine particles (record to nearest 5%)

Flow Habitat Type	DESCRIPTION
Cascades	Short, high gradient drop in stream bed elevation often accompanied by boulders and considerable turbulence
Falls	High gradient drop in elevation of the stream bed associated with an abrupt change in the bedrock
Rapids	Sections of stream with swiftly flowing water and considerable surface turbulence. Rapids tend to have larger substrate sizes than riffles
Riffles	Shallow sections where the water flows over coarse stream bed particles that create mild to moderate surface turbulence; (< 0.5 m deep, > 0.3 m/s).
Runs	Long, relatively straight, low-gradient sections without flow obstructions. The stream bed is typically even and the water flows faster than it does in a pool; (> 0.5 m deep, > 0.3 m/s). A **step-run** is a series of runs separated by short riffles or flow obstructions that cause discontinuous breaks in slope
Glides	A section of stream with little or no turbulence, but faster velocity than pools; (< 0.5 m deep, < 0.3 m/s)
Pools	A reach of stream that is characterized by deep, low-velocity water and a smooth surface; (> 0.5 m deep, < 0.3 m/s)

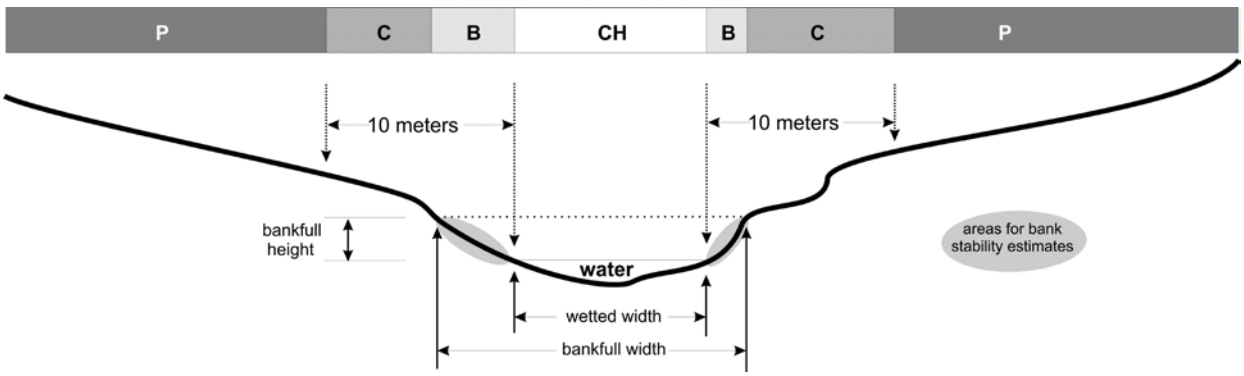
BANK STABILITY

Although this measure of the degree of erosive potential is subjective, it can provide clues to the erosive potential of the banks within the reach. Assign the category whose description best fits the conditions in the area between the wetted channel and bankfull channel (see figure below)

Eroded	Banks show obvious signs of erosion from the current or previous water year; banks are usually bare or nearly bare
Vulnerable	Banks have some vegetative protection (usually annual growth), but not enough to prevent erosion during flooding
Stable	Bank vegetation has well-developed roots that protect banks from erosion; alternately, bedrock or artificial structures (e.g., concrete/ rip-rap) prevent bank erosion

Figure 1. Cross-sectional diagram of stream transect indicating regions for assessing human influence measures:

- The measurement zone extends 5 meters upstream and 5 meters downstream of each transect
- Record one category for each bank and for the wetted channel (3 values possible)
- In reaches with wide banks, region "C" may be entirely overlapped by region "B"; in these cases, circle "B"
- Region "P" extends from 10 meters to the distance that can be seen from the channel, but not greater than 50 m



STANDARD OPERATING PROCEDURES
for
Site and Sample ID Naming Conventions
(SOP FS-11)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This SOP is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:

- Biological Assessment
- General Water Quality
- Chlorine
- Temperature
- Toxicity – Water Column
- Toxicity – Bedded Sediment, Fine-Grained
- Pollutants – Bedded Sediment, Fine-grained
- Pathogen Indicators

SOP Background and Application

The RMC site and sample ID naming convention is designed to ensure consistency across local program monitoring efforts.

References to Existing SOPs

None

Special Cautions and Considerations; Health and Safety

None

Methods / Procedures

SITE NAMING CONVENTION

Site naming convention for RMC sites are dependent upon the monitoring design used to select the sites, and is separated into two categories: (1) probabilistic, and (2) targeted. Naming conventions for both types of monitoring sites are described below:

PROBABLISTIC SITES

RMC identification of sampling sites derived using a probabilistic design will follow similar conventions being used by the California State Water Resources Control Board's Perennial Stream Assessment (PSA) and the Stormwater Monitoring Coalition (SMC) Programs. The naming convention is as follows:

HHHR#####

Where:

HHH = The Water Board Region followed by the two digit California Hydrologic Unit (HUC) Code. The codes for each RMC Program are as follows:

- Contra Costa - 206, 207, 543, 544
- Alameda - 203, 204, 205
- Santa Clara - 204, 205
- San Mateo - 202, 204
- Fairfield-Suisun, Vacaville - 207

R = One letter code that represents the Monitoring Program, in this case "R" stands for the RMC Creek Status Monitoring Program.

= Five digit number that is generated from the sample draw (note: PSA only uses a four digit number).

TARGETED SITES

All targeted sites will be identified by San Francisco Regional Water Quality Control Board staff using standard SWAMP site naming convention as interpreted by BASMAA in Attachment 1 (EOA Inc. 2006):

HHHSSS###

Where:

HHH = The Water Board Region followed by the two digit California Hydrologic Unit (HUC) Code. The codes for each RMC Program are as follows:

- Contra Costa - 206, 207, 543, 544
- Alameda - 203, 204, 205
- Santa Clara - 204, 205
- San Mateo - 202, 204, 205
- Fairfield-Suisun, Vacaville - 207

SSS = Three letter code representing the creek sampled. Unless otherwise requested by Water Board personnel, for one word creek names, the first three letters of the creek name

are used (e.g., ALA for Alameda Creek). For two-word creek names, the first letter of the first word is combined with the first two letters of the second word (e.g., SFR for San Francisquito Creek).

#####	=	Three digit number, beginning at 010 at the creek mouth and increasing by an increment of 10 per station going upstream. Additional sites added between two existing stations are assigned a number between the two existing numbers.

RMC staff will provide Water Board staff with creek name, description of site location (e.g., road intersection) and latitude and longitude of sampling location prior to obtaining SWAMP IDs.

SAMPLE ID NAMING CONVENTION

Sample naming convention for RMC samples is dependent upon type of sample collected, and is separated into two broad categories: (1) biological samples, and (2) chemistry / toxicity samples. Naming conventions for the two types of samples are described below.

BIOLOGICAL SAMPLES

Each sample will be assigned a distinct sample ID code using the following convention:

HHHR#####-M-NN

Where:

HHHR#####	=	Six digit site code, consistent with protocol above
M	=	Media (B for benthic macroinvertebrates, A for algae)
NN	=	Two digit number for each sample collected at a given site on a given day, beginning with 01, with an increment of 01 per sample collected

CHEMISTRY / TOXICITY SAMPLES

Each sample will be assigned a distinct sample ID code using the following convention:

HHHR#####-M-NN

Where:

HHHR#####	=	Six digit site code, consistent with protocol above
M	=	Media (W for water, S for sediment)
NN	=	Two digit number for each sample collected at a given site on a given day, beginning with 01, with an increment of 01 per sample collected

SAMPLE LABELING CONVENTION

Standard SWAMP protocols for collection and analysis of biological samples associated with bioassessment use descriptive sample labels for benthic macroinvertebrates (Figure 1) and benthic algae (Figure 2). Specific instructions on filling out BMI sample labels is provided in Ode (2007) and for filling out algae sample labels in Fetcher et al. (2010).

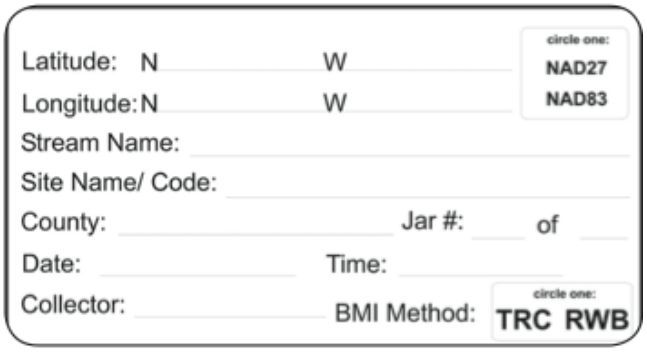


Figure 1. Typical Label for RMC Benthic Macroinvertebrate Samples

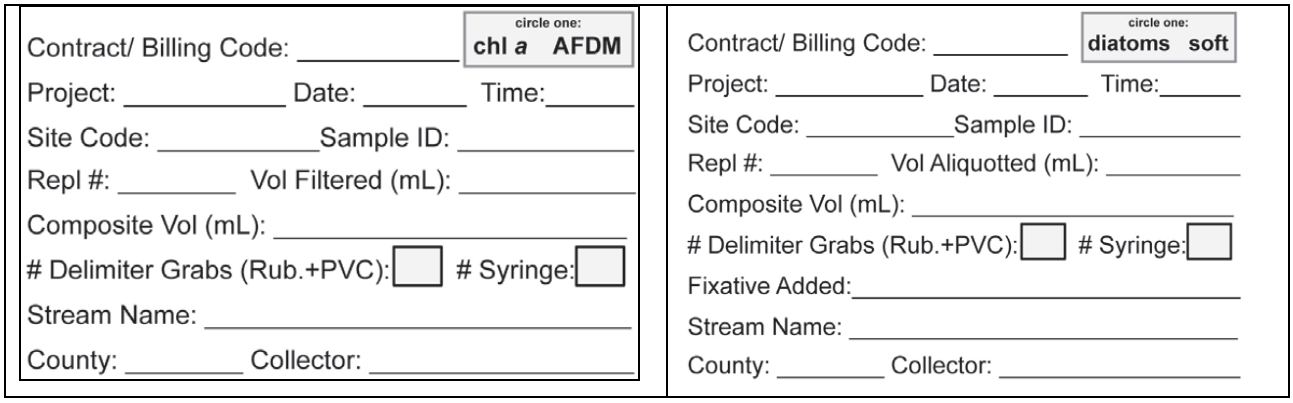


Figure 2. Typical Labels for RMC Benthic Algae Samples

Sample labels to be used with samples collected for analysis of chemistry or toxicity come in a variety of forms. Often the labels are provided by the laboratories.

Quality Assurance / Quality Control

Site codes should be assigned prior to sampling and reviewed as part of readiness reviews.

Sample container labels should be prepared to the extent possible prior to mobilizing for field work, and filled out completely prior to sample collection, as labels are much more difficult to compete when wet. Ensure that sample labels match information that is included on the Chain of Custody forms, which can also be prepared prior to mobilization.

Before leaving a site, field crews will verify presence, accuracy, and legibility of sample labels employed for a particular sample. At the conclusion of sampling, prior to delivery of samples to labs, the sample labels must be checked against the completed chain of custody forms for accuracy and consistency.

References

EOA Inc., 2006. DRAFT Guidance Document: Assigning SWAMP Station IDs. January 24, 2006.

Fetscher, A.E., L. Busse, and P. R. Ode. 2009. Standard Operating Procedures for Collecting Stream Algae Samples and Associated Physical Habitat and Chemical Data for Ambient Bioassessments in California. California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 002. (updated May 2010).

Ode, P.R., 2007. Standard Operating Procedures for Collecting Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California. California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 001.

Attachment 1 – EOA Draft Guidance Document: Assigning SWAMP Station IDs

EOA, Inc.

MEMORANDUM

TO: Chris Sommers

FROM: Terri Fashing

DATE: January 24, 2006

SUBJECT: **DRAFT** Guidance Document: Assigning SWAMP Station IDs

Chris,

A note from Matt Cover with SWAMP: “An important step for us now is to assign a rough numbering system to every stream in the region, so that it is done consistently. Although we don't need to assign exact locations to all the stations right now, we want someone to be able to look at a map or the site list and say, okay, my site is approximately near 090, I'll give it this code since no one else has designated this site yet. When additional sites are added the final digit in the code reflects the relative distance between the upstream and downstream sites, and the potential for other sites to be located nearby.” This step has not been completed and may be a good task for Leslie Perry who now works for SWAMP. She might also be able to turn this into a Final Guidance Document. What I’ve included here is based on feedback from Matt Cover and Steve Moore and on my own experience. What I’ve left out is all of the detail that one encounters in trying to really determine where a site is that may not have be described well or that may or may not be in the same location of an existing SWAMP station. There are always judgment calls that have to be made and the person assigning the Station ID has to sleuth around a bit sometimes.

I. Determine Locations of Existing SWAMP Stations

The first step in assigning SWAMP Station IDs to either existing or new monitoring stations is to obtain an updated Station Table from SWAMP. Region 2 SWAMP maintains a list of all of their monitoring stations and the target latitude and longitudes (in either Nad83 or WGS84). Written station location information can be obtained from SWAMP as well.

Use a mapping program (e.g., ArcView or Topo!) to project all of the SWAMP stations in order to compare SWAMP station locations to existing or new non-SWAMP station locations.

II. Determine Locations of Existing or New Non-SWAMP Stations

Using coordinates and/or written directions, plot existing or new non-SWAMP stations onto map and compare locations with SWAMP station locations. If SWAMP has not established any monitoring stations on a given creek or within a given watershed, create SWAMP-compatible station IDs according to instructions below.

III. SWAMP Station-naming Convention

The proper SWAMP Database format for the StationCode is R##ABC123, where R is one of the 9 watershed regions (For the SF Bay Regional Board the correct watershed region is 2), ## is the Hydrologic Unit number, and ABC123 is an alphanumeric description of the Station. An example is 203BAX030, which is Region 2, Hydrologic Unit 03 and an abbreviated code to indicate "Baxter Creek – Baxter at Booker T. Washington Park".

See SWAMP **Planning Watersheds1.xls** in F:\Sc61\sc61.12\SWAMP stations for the Hydrologic Unit number that corresponds to the location of a given station. Planning Watersheds1.xls should also be consulted for the established and suggested alpha codes based on the Regional Board's (Region 2) Planning Watersheds.

The following link shows a map of the San Francisco Bay Region: http://www.waterboards.ca.gov/sanfranciscobay/basinplan/web/fig_2-02.pdf. There are 7 Hydrologic Units within Region 2 and the map shows the boundaries of those Units. If a given station falls within the South Bay Basin, the first part of the Station ID will be 204 (Region 2 and Hydrologic Unit code 04).

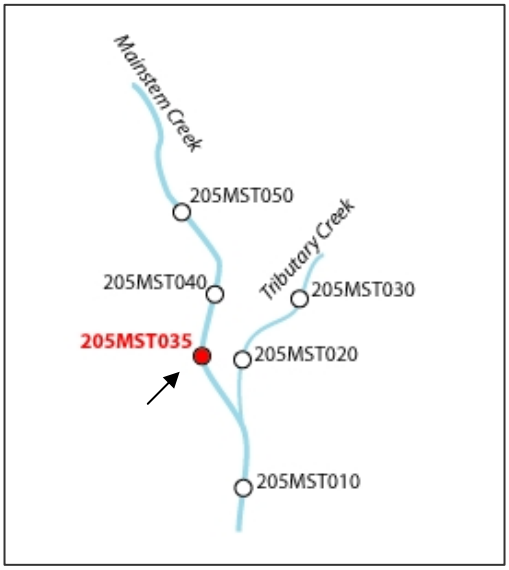
When assigning station names to stations on creeks that have not yet been assigned SWAMP-compatible Station IDs, it is not necessary adhere to the planning watershed name alpha indicators established in Planning Watersheds1.xls file. One rule of thumb is that Water Bodies which drain directly into the San Francisco Bay Estuary or Ocean should have a unique alpha-indicator.

One reminder on choosing an alpha code for station numbering: it's ok to have more than one alpha code in the San Francisco region (e.g., ROD) as long as they are in different hydrologic units. (e.g., Rodeo Creek in Contra Costa and Marin). This is because each station ID includes the three digit hydrologic unit before the alpha characters. It is desirable to minimize this repetition by creating unique alpha codes: e.g., Permanente (PER) and Peralta (PRL). In such cases, the larger water body should get preferential naming treatment. This is why it is good to consult the **Planning Watersheds1.xls** in F:\Sc61\sc61.12\SWAMP stations for the suggested alpha codes, so that the main water bodies receive the most obvious alpha codes. Without question, Alameda Creek has to have ALA, Napa River has to have NAP, Sonoma Creek SON and Walnut Creek WAL. (this is why Walker Creek is WLK, by the way, it's smaller than Walnut Cr.).

IV. Assign the SWAMP ID to the Station

Working downstream to upstream, all the "likely sampling locations" are given a number, with each consecutive number increasing by 10 (e.g. 10, 20, 30). A "likely sampling location" is a location with public access or with permission to access granted by the landholder that can reasonably be expected to serve as a sampling location, based on the site's utility at capturing local and upstream influences (land use). When a tributary is encountered, numbering continues to increase from the bottom to the top of the tributary. Above the tributary, numbering continues to increase on the mainstem (see idealized drawing below). The alpha code that makes up the middle three characters of the entire Station ID (BAX for Baxter Creek, or MST for Mainstream Creek in the example below) does not change as numbering continues up a tributary with a different creek name (like Tributary Creek).

When assigning a Station ID to a creek location that lies upstream or downstream of established stations with SWAMP Station IDs, the final digit in the code reflects the relative distance between the upstream and downstream sites, and the potential for other sites to be located nearby. See idealized drawing below:



V. Station Definition

Provide written directions on station locations including obvious landmarks, street crossings, driving directions and exact on-foot station location directions. Obtain latitude and longitude coordinates in decimal degrees in either WGS84 or NAD83 (datum) to define stations. Riffles move and disappear, so location directions to 20 m accuracy is fine, which is what we get with GPS. If sites are clearly different locations within a reach (e.g. upstream and downstream of a bridge), they get different Station Codes. It is important to provide as much station location

information as possible so that the data analyzer can decide whether or not to clump the data from different stations.

VI. Report new Station Information to SWAMP

In order to establish a Station ID using the SWAMP station-naming convention, it is critical that the new Station IDs are reported to SWAMP at the SF Bay Regional Board. Also, if it is a BMI sampling station, add the new station information to **Master SFBay IBI BMI Station List.xls** in F:\Sc61\sc61.12.

STANDARD OPERATING PROCEDURES
for
Ambient Creek Status Monitoring Site Evaluation
(SOP FS-12)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This standard operating procedure (SOP) is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:

Biological Assessment

SOP Background and Application

The purpose of this document is to record standard operating procedures (SOPs) and guidance for evaluating sites selected for the probabilistic creek status ambient monitoring to be conducted by BASMAA RMC participants. Creek status monitoring is described in the RMC Monitoring Plan (BASMAA 2011) and is being conducted to comply with the monitoring requirements of the Municipal Regional Permit (MRP), specifically provisions C.8.c.

The goal of completing the site evaluation process outlined in this SOP is three-fold:

1. To confirm that the monitoring site of interest meets the RMC's site criteria;
2. To determine if the site is safely accessible; and,
3. To gain permission to access the site for sampling.

References to Existing SOPs

This SOP is based on information developed by the California Department of Fish and Game:

(1) **Perennial Stream and Rivers Assessment Site Evaluation Guidelines,** September 2011 (California Department of Fish and Game 2011).

Special Cautions and Considerations; Health and Safety

Take all precautions to ensure that the field crew has the appropriate vehicle, attire, equipment and supplies to safely access and sample sites (see Part II Materials).

Training in basic first aid is required. Crew chiefs are responsible for ensuring the safety of the crew and must use his or her discretion to end sampling if conditions become unsafe. When contacting water in areas of unknown water quality, especially in waters that are suspected to

contain hazardous substances, bacteria, or viruses, it is preferable that at least one layer of gloves be of shoulder length, to limit skin contact with the source water.

Methods/Procedures

Ambient creek monitoring sites are evaluated through completing three sequential steps: 1) office site evaluation, 2) field reconnaissance (as needed); and 3) population of the RMC Site Evaluation Tracking Spreadsheet (see associated guidance in Attachment 1) – to be submitted to the RMC Coordinator no later than 6 weeks after bioassessments are completed.

This document consists of five additional sections that discuss a standard protocol for conducting the site evaluations and completing the two evaluation forms. These sections address the following topics:

- Part I: Materials and procedures for completing office site evaluations, including how to complete Form 1: Site Evaluation (Office)
- Part II: Materials and procedures for completing field reconnaissance, including how to complete Form 2: Field Reconnaissance

Part I: Office Site Evaluation Procedures

Materials

All original documents, forms and related information should be stored onsite in a secure location. Copies of these documents can be made to take in the field or as necessary. High priority data outputs will be transferred to a spreadsheet following completion of the site evaluation and reconnaissance process. Dossiers should be made by each participating RMC agency and SWAMP to organize all paperwork, letters and forms. A form (FORM #1) has been created to document the site evaluation process.

Materials that may be needed to conduct the site evaluation phase in the office include:

- RMC sample draw site list for the year of interest - provided by the RMC Coordinator and will contain the following information relevant for the site evaluator:
    - Project and individual site codes
    - Site GPS coordinates
    - Geographic region (applicable Regional Water Quality Control Board region)
    - GIS Landcover Type (urban or non-urban)
    - Creek name (if available via NHD)

- Site Evaluation Form for each site (Form #1)
- Aerial or satellite imagery (Google Earth, LandVision, etc.)
- USGS topographic maps (paper or electronic)
- ESRI ArcGIS® software
- County assessor roll (Parcel Quest, Landvision, ArcView, County websites, etc.)

- Google or web based search engines
- Street Maps (DeLorme, Atlas, Thomas Guide, etc.)
- Other topographic maps (USFS, BLM, State Park, NPS, etc.)
- CDEC/USGS stream gage data http://waterdata.usgs.gov/ca/nwis/
- Resource managers and governmental agency phone numbers
- Locations of large stormdrain outfalls (Oakland Museum Creek Maps http://museumca.org/creeks/)

Completing the Site Evaluation Form (Attachment 2)

The Site Evaluation Form is completed in the office and requires no field visit.

STEP 1. Review sample draw (site list) with potential monitoring sites for year of interest

The RMC Coordinator designee will provide you with a site list (sample draw) that will form the list of potential sites that may be monitored in a given year by your program. Once received, the individual(s) conducting the site evaluation phase should review the list and communicate with the RMC Coordinator or designee if there appear to be errors or if there are questions about the sample draw provided. The list of column headings are explained below:

- **Draw SiteID –** the RMC sample ID number
- **RMC Strata Site Order –** The consecutive, numerical order from the sample draw in which sites in that particular strata (county and land use) should be evaluated
- **State Comid –** the creek reach ID from the State's Perennial Stream Assessment sample frame
- **xcoord, xycoord –** latitude and longitude in NAD1983 – California Teale Albers
- **GIS Creek Name –** the name of the creek in the National Hydrography Dataset (NHD), from the Geographic Names Information System (GNIS)
- **fcode –** the type of NHD line work (channel type)
- **rmc_strata –** the code in the RMC sample frame including the county, regional board number and land use type of the site
- **County –** county in which the site lies
- **Regional Board –** the California Regional Water Quality Control Board region number
- **RMC Land Use –** the land use of the site (i.e., urban or nonurban)

VERY IMPORTANT: It is of critical importance to keep your sites in consecutive, numerical order from the sample draw, never leaving out a single site or groups of sites. If this rule is violated, the statistical power is diminished and problems will occur in the final results report.

STEP 2. Locate the site based on coordinates

Determine the location of sites in sample draw via Google Earth, GIS, or appropriate topographic map. It is often the most efficient to display all of the sites for the coming sampling season in a GIS or using Google Earth. A Google Earth file (KML) should have been forwarded to you with the sample draw site list to assist you in this step.

IMPORTANT: Site locations in the sample draw site list represent the most downstream point of the sample reach. Site locations can be moved up to a maximum of 300 meters by a RMC participant in order to meet sample criteria. When moving a site, a new latitude and longitude is required and should be reported to the Monitoring Coordinator. Rules for moving a site within the 300-meter limit are described in Section 2.

STEP 3. Complete site evaluation form

The site evaluation form (Form #1) is completed in the office using the following steps and requires no field visit.

Section I: Background Site Information

On Form #1, complete the fields listed below. Most of the information for this section can be gathered from the sample draw site list or the KML (Google Earth) file provided to you, and transposed to the form.

- Draw Site ID
- Evaluator Name
- Date of Evaluation
- Creek Name, Site Latitude and Longitude (NAD1983 – California Teale Albers)
- Site Location/Description
- City (Optional)County
- Region (Regional Water Quality Control Board Region)
- Land Use Type
- Sampling Agency

Section II: Site Status

For each site, select one of the two site status categories and check the proceeding box that best classifies the channel status.

Provisionally Meets Criteria: check this box if all information gained from Google Earth, maps, aerial photos and resource mangers etc. lead to the possibility that the site is a receiving water body and **MAY** be sampleable. The following criteria for checking the "Provisionally Meets Criteria" box on Form #1 are:

- Permission to access the site MAY be attainable
- The site MAY be physically accessible and entered safely

Assume that a site provisionally meets these criteria unless you have evidence to the contrary as indicated below.

Criteria Not Met: check this box if the evaluator is highly confident that the information gathered meets any of the following and the site cannot be moved up to 300 m (see text box below) to resolve these issues:

- **Watercourse Not Present (NC)-** after coordinates are entered into a mapping program or identified on a map, there is no obvious watercourse present at the site location (within 300 meters and within the same strata)

- **Pipeline (P)** - site is located in a enclosed underground/aboveground pipe;
- **Impoundment (RI)** - site falls on a lake, reservoir or pond;
- **Tidally Influenced (T)-** site is obviously influenced by brackish water at some point of time during a year (i.e., is downstream of the higher high water mark);
- **Aquaduct (A)** – site is in an above-the-ground water conveyance designed to transport drinking water;
- **Non-Wadeable (NW)** - site will obviously be greater than 1 meter deep in 30% or more of its length, and it will not be feasible to sample the eleven bioassessment transects within the wadeable portion of the reach, or will obviously be unsafe for sampling during the spring monitoring event;
- **Inaccessible (I)** – A site is inaccessible if you cannot safely walk to the site from your vehicle, sample and return from the site carrying samples and gear within a single day. Note: having a limited crew size is not a legitimate reason for checking this box.
- **Other (O)**– Includes sites located (Explanation needed on Form):
  - where any other obvious impediment prevents sampling, including a tributary or a large storm drain that discharges into the reach and is deemed to significantly influence surface hydrology, sediment supply, or geomorphology such that the site cannot be moved to avoid it; (see text box below); or
  - on a water conveyance that is not currently and never was a receiving water body. **IMPORTANT:** Only sites that have a significant weight of evidence, e.g., USGS quad maps, NHD, Bay Area Riparian Resource Inventory (BARRI) maps, Oakland Museum Creek Maps, and the San Francisco Bay Water Quality Control Plan (Basin Plan) supporting this determination can be included. Make sure to communicate with the RMC Coordinator before checking this box.

IMPORTANT: A site may be moved up to 300 meters upstream or downstream of the original site location to assist the evaluator in meeting the site evaluation criteria. Situations where a site may be moved up to 300 meters include:

- to allow for access, due to permission limitations by land owners;
- to avoid a tributary or large storm drain outfall (greater than 24 inches in diameter);
- to avoid a bridge or other grade control structure within the reach;
- to the extent possible, to maintaining homogenous channel morphology (e.g. all concrete or all natural channel);
- to avoid pipelines, aquaducts, tidally influenced areas, and non-wadeable reaches;
- to relocate a site that was placed outside the creek channel, within the nearest creek channel.

The reach length that must be available for sampling upstream of the site coordinates depends on the average wetted channel width: 0 – 10 m average wetted channel width requires a 150 m reach length; >10m average wetted channel width requires a 250 m reach length. If moving a site makes it sampleable but the full reach length is not accessible, the reach length may be decreased, but this should be avoided whenever possible. Other reasons to decrease reach length may include safety concerns or physical barriers. If the reach length is other than 150 m or 250 m, it should be noted and explained on the field forms. Under such circumstances field crews will still need to space bioassessment transects at equal distances within the decreased reach length.

Basis of Determination: All sites that have the "Criteria Not Met" box checked must have a justification or verifiable reason to reject these sites and not proceed further. Check the box that best fits the reason for determining that the criteria was not met. If "other" is checked or agency personnel or resource managers have been contacted, please list all relevant information in the "explanation" box in this section.

Information Source: Check the appropriate box identifying the source of information for the basis of determination described above. If "other" is checked, please describe the source of the information in the "explanation" box. Best professional judgment is abbreviated as BPJ and geographic information system is abbreviated as GIS.

Best Month to Sample: All sites that have the "Provisionally Meets Criteria" have the potential to be sampled. Bioassessment sampling has a specific index period when sampling is optimal (May 15 – July 15 and more than four weeks after the last substantial rainfall event. The index period for Bay Area creeks is spring, but may vary between sites depending on flow conditions allowing for safe entry during the spring season. For each site that "Provisionally Meets Criteria", provide a best estimate of the month that sampling would be optimal based on typical rainfall and flow patterns. As a rule, sites that exhibit lower and/or intermittent flow should usually be planned for sampling earlier than sites with higher and/or perennial flow.

Consideration: You may want to continue filling out Sections I and II for a number of sites in the sample draw before starting to obtain landowner information. Completing Sections I and II for a number of sites may improve the efficiency of the site evaluation process.

Section III: Site Ownership Information (Only Completed for sites Identified as "Provisionally Meets Criteria")

Step 1: Property ownership information must be determined and verified for ALL sites identified as "Provisionally Meets Criteria".

Permission from all land owners, land managers, or agencies must be obtained before entering any private property at or surrounding the site. Ownership must also be verified for public lands. There are often private land holdings inside national forest boundaries or other public lands. Crossing onto private land without permission is trespassing.

Ownership information can be obtained in either of the following ways alone or in combination:

1. Visit the county assessor office and utilize their resources.
   At each county assessor's office locate the county index map. The index map will have the UTM township/range grids located on it. The USGS topographical map will also have the township and range of a given site on the border of the map. Correlate the township and range of the site with that of the index map and locate the site. The site will lie in a region on the index map where ownership information can be assessed. This region or area of information can be found in the "plat" map book. The "plat" map book number represents a book of information that contains land parcels for a specific region on the index map. Plat maps also depict parcels, ownership boundaries, tax lot

numbers, and the subsequent acreage contained within a tax lot number. Align the site on the topographic map with that of the plat map book. Record the name, mailing address, site address, and any additional information from the landowner at the site and any adjacent landowners that may provide access. Often multiple owners may need to grant permission in order to reach the site.

2. Use a certified map assessor program (Parcelquest, Landvision).
   There are several companies that offer online services, or have parcel information on CD. These companies offer subscriptions or the ability to purchase information. These Assessor mapping programs offer a slight learning curve, but are much quicker and easier to use and offer greater usability than visiting the assessor's office.

3. Use up-to-date GIS data available from the county.
   GIS data may be obtained by contacting the individual counties and making arrangements to obtain relevant information. Information is generally offered in ESRI ARC GIS format with a database of APN numbers.

4. Online assessor information available from county websites.
   Online assessor information is available for ***some*** counties and is getting better with time and technology development. The assessor's office may be contacted by phone or by visiting the assessor's website to find the most current information available. The county assessor sites operate similarly to ParcelQuest/Landvision but are free on the World Wide Web.

Step 2: For each site identified as "Provisionally Meets Criteria", mark whether it is publicly owned, privately owned, mixed or other. If "other" is marked, please provide an explanation in the space provided.

Section III-1: Public Site Ownership Information

This section only applies if the "public" or "mixed" ownership is checked. During the process of gathering information about the site ownership it should be obvious which county, city, or agency will hold ownership and/or management roles of the creek or river. This information should be entered under "Organization". Potential monitoring sites that are not private and have no public access permission require an encroachment or collection permit to be obtained. It is important to contact the organization to determine whether or not a permit is required. The remaining lines in this section can be completed after contacting the appropriate personnel.

Note: If the land surrounding a site is owned entirely by a public organization, only the first page of Form #1 needs to be completed.

Section III-2: Private Site Ownership Information

For all private properties, each parcel number should be recorded in the specific county format if possible, as they are unique amongst counties. If there are contacts in addition to primary property owners, this may be noted in the "Contact information" box. This field is not necessarily mandatory and need only be used if 1) the space provided in the first line is inadequate to accommodate all contact information or 2) there is a manager or tenant.

Note: Duplicate the second page of Form #1 (Section III-2) if access is required for more than three properties. Remember that monitoring occurs in a 150 meter reach, and property owners along the entire reach and any additional access areas should be contacted.

Obtaining Permission to Access Site

After ownership information is obtained via the Site Evaluation, landowners or land managers are contacted to gain permission to access sites.

STEP 1: Permission packets are sent to the owners of ALL privately owned sites and any agency or company requesting a letter or information about sampling activities.

The permission packet includes:

- a cover letter with a brief description of project goals
- a permission form that the party completes,
- a self-addressed stamped envelope and
- a map of the site (optional).

Record that you sent a permission packet by checking the "sent" box in Form #1.

For public ownership the proper agency and personnel must be contacted to determine if a permit, entry agreement or permission letter is needed. A complete effort needs to be made to determine who and what agency manages the water body where the site is located. Contact all possible agencies and land managers to inform them of sampling activities.

Access permission to sample **can be denied in the following ways**:

- The permission letter is returned denying access to the site, with the "no" permission granted box is checked, or
- Permission is denied over the phone or via email, or
- There is no response from the owners after two attempts to contact them, or
- The letter is returned with no response and a second attempt to contact them does not change this result, or
- The letter is returned unopened and a second attempt to contact them either does not result in permission to access site or contact is not possible.

If the site meets any of these criteria, check the "No" box in the "Access Granted" field on the Office Evaluation Form, stop evaluation of the site AND complete Sections I and II of the Field Reconnaissance Form (Form #2). It is possible for a site to be temporarily inaccessible and it is important to distinguish between temporary and permanent denials. Temporary denials that prohibit access during the biosassessment sampling window one year but not necessarily in a subsequent year's sampling window must be kept on the list for further evaluation the following year.

Consideration: In any of the last three situations, (no-response), the best option may be for the evaluator to follow up with the land owner(s) via telephone in an attempt to gain access permission. Often, the best route is to check the on-line White Pages to locate phone numbers of landowners.

Permission to sample **can be granted in the following ways**:

- The permission letter has been returned with a "yes" marked in the appropriate box, granting access to the site.
- A required permit has been submitted and approved by the agency that manages the water body at the location of the site.
- Permission has been granted over the phone or via email. The sample site has been thoroughly researched and confirmed to be managed by the person who has given the permission.

If the site meets any of the previous criteria, and permission to access the site is granted, the landowner may request further information identified in the site information fields.

If site entry permission is granted, complete the following information on the Site Evaluation Form:

- check the appropriate box in the letter status box in the
- check appropriate box for "wants data". Often the land owner or land manager requests copies of data after the sampling event occurs.
- Gate, key, or special requirements. This information needs to be transferred from the permission letter or from any phone calls. Follow any and all requests from land owners.

It is very important to contact land managers and private property owners to obtain as much information as possible. Most of the time spent in the office will be used making telephone calls and emailing information to scientists and resource managers. The more time spent acquiring office-based information results in less time spent on field reconnaissance, in turn, resulting in more sites being evaluated efficiently prior to the sampling season.

Note: *examples of agencies requiring entry permits are The National Park Service, State Parks, All county and city managed waterways in the state, Sanitation and Water districts, and Utility Districts etc.*

Agencies such as the California Department of Fish and Game are exempt from benthic macroinvertebrate collection. If collecting under University Foundation's or other entities per contract purposes, a permit will be required. Update all permit contact information in the spreadsheet to track which agency needs to be contacted.

All returned owner permission letters should be filed in a "permission returned" folder and a copy should be made and attached to the completed Site Evaluation Form.

Part II: Field Reconnaissance Procedures

Form #2: The information fields included in the Field Reconnaissance Form must be completed for ALL sites that were identified as "Provisionally Meets Criteria" during the office evaluation process. Sites initially identified as Provisionally Meets Criteria will be further assessed during this step to confirm whether a site is sampleable or should be reclassified as "Criteria Not Met" based on additional information gained through the field reconnaissance process. Note that Form #2 may be completed without a new site visit if sufficient knowledge of the site exists to complete Form #2 from prior experience.

Materials

Materials that may be needed to conduct field reconnaissance include:

- Field reconnaissance form for each site (Form #2)
- Site dossiers with all available information to access sites, including copies of Form #1
- Map of area if available (e.g. USFS, BLM, EBRPD, State Park, County Park, Open Space District, City Park)
- Laptop with topographical or other useful maps (optional)
- Map ruler for 7.5 minute topographical maps (optional)
- Agency and landowner information and phone lists
- Geographical Position System (GPS) equipment
- Cell phone
- Digital camera
- Binoculars
- Personal and professional identification
- Proper hiking attire
- Safety and emergency equipment
- Appropriate permits (as needed)
- Private property entry permission letters

Preparing for Field Reconnaissance

STEP 1: Determine if Field Reconnaissance is Necessary

In most cases, a site visit is necessary to confirm site flow status, and if it is wadeable and accessible. Reconnaissance will confirm or contradict any office evaluation information received. Reconnaissance should attempt to get as close as possible to the site without trespassing. If entry permission has been obtained, the evaluator should attempt to visit the site if safety permits.

The following are common situations that require field reconnaissance:

- Contact persons are not knowledgeable of core data requirements found in primary and secondary evaluation forms and a site visit is the only method of determining if criteria are met.
- Digital aerial photos may not show seasonal variations and may be inaccurate regarding the flow status at the site. A site visit in the fall prior to the first rains

of the season will help clarify and confirm flow status.
- Insufficient data were obtained during the office evaluation, and a site visit is required to gain additional information.
- Entry to the site appears to be very complicated. A site visit is required to simplify and document the best way to enter to the site.
- Confirm any information received. Information received from land owners and managers may be incorrect and inaccurate.
- Coordinate a visit to local resource managers with a site visit if possible.

If enough information is known about the site to complete all sections of the Field Reconnaissance Form, then field reconnaissance is not needed. However, field reconnaissance information must be fully documented for each site that received a "Provisionally Meets Criteria" on the Site Evaluation Form (Form #1).

STEP 2: Organize Site Visits
For those sites that require field reconnaissance, complete the following steps:

STEP 2A: Determine the mode of travel (i.e., vehicle 4x4 or 4x2, foot, boat), or combination that is best for locating and reaching each site.

Most sites will be accessible with a vehicle. However, some sites may be very remote and require different forms of transportation to access them, such as hiking.

STEP 2B: Determine proper timing of the reconnaissance phase.

Site reconnaissance visits should be conducted prior to the first significant precipitation event, e.g., typically in August or September, in order to classify the site flow status. Some sites may require a second site visit closer to the scheduled sampling date to ascertain accessibility, wadability and safety conditions. However, flow status determinations based on field reconnaissance may only be determined during the dry season, optimally, the August-September timeframe.

STEP 2C: Determine if a site can be visited for reconnaissance without trespassing.

Every effort should be made to physically observe a stream or river without formal contact to the landowner. Targeting a bridge, adjacent road, cliff, or other vantage point near the site without crossing private land will eliminate the need (and save time) to request permission for access. Depending upon the distance from the site, binoculars might allow site classification.

If reconnaissance requires entering private property, make sure landowner permission has been obtained on or near the property that surrounds or abuts the site. The evaluator may call the land owner directly and informally request access to the site through the owner's property before the field visit. If contact cannot be made and every effort has been attempted to communicate with the landowner then the site must be considered "Meets Criteria – Not Sampleable."

STEP 2D: Plan a route for visiting multiple sites.

To maximize the efficiency of reconnaissance it is advisable to plan routes to visit multiple sites daily, including the 50% additional sites selected as backup sites. Such planning includes

coordinating overnight accommodations, driving directions, obtaining keys, permits, and/or permission to access land, anticipating road closures due to weather conditions or construction, and estimating the time required to complete the trip into and out from the site.

Completing the Field Reconnaissance Form (Attachment 3)

A Field Reconnaissance Form (Form #2) MUST be competed for each site that received a "Provisionally Meets Criteria" on the Site Evaluation Form (Form #1).

Section I: Background Site Information

Using information completed on the Site Evaluation Form (Form #1), fill out all information in section I of the Field Reconnaissance Form.

Section II: Site Status

For each site, select one of the three site status categories and check the proceeding box that best classifies the site status.

Meets Criteria - Sampleable: check this box if all information gained from Site Evaluation and Field Reconnaissance processes identifies the site as sampleable. This box can ONLY be check if the following are true:

- Permission to access has been attained
- The site is physically accessible and can be entered safely at the time of sampling

Basis for Determination: If the site "Meets Criteria – Sampleable", indicate how the determination was made by checking the site visit or office evaluation box.

Site Visit Likely Needed in Spring: If the site "Meets Criteria – Sampleable", indicate whether an additional site visit is likely needed in the spring to reassess accessibility, wadability and safety.

Site Adjustments: To allow for flexibility in site access and relative homogeneity throughout the reach, sites may be moved up to 300 meters up- or downstream from the site location identified in the sample draw site list.

Meets Criteria – Not Sampleable: check the appropriate box if information gained from Office Evaluation and Field Reconnaissance processes identifies the site as sampleable, however, any one of the following are true:

- **Permission Denied**: the permission letter is returned denying access to the site, with the "no" permission granted box checked, or permission has been denied over the phone.
- **No Response**: The permission letter is not returned, returned with no response, or mailed back unopened. Note that communication must be attempted at least twice before checking the Not Sampleable box.
- **Access Granted After Index Period**: any required permits are not received in time to sample.

- **Temporarily Inaccessible**: The site is temporarily inaccessible but can likely be sampled during another year.
- **Other**: Provide an explanation such as site should be sampled in the following year, or site should be reconsidered for sampling in the following year.

If the site meets any of these criteria, check the appropriate box in the letter status field on the Office Evaluation Form (Form #1), stop evaluation of the site AND complete Sections I and II of the Field Reconnaissance Form (Form #2). Remember the sample location can be moved 300 m based on access, so it is feasible to move up or downstream if a single landowner does not give permission.

Important: If the "Access Granted After Index Period" or "Temporarily Inaccessible" boxes are checked, the site should be reconsidered during the next sampling year and be placed in the appropriate order of the sample draw site list for that next year.

Criteria Not Met: check this box if information gathered meets any of the following:

- **Watercourse Not Present** - after coordinates are entered into a mapping program or identified on a map, there is no obvious watercourse present at the site location (within 300 meters and within the same strata)
- **Pipeline** - site is located in a enclosed underground/aboveground pipe
- **Impoundment** - site falls on a lake, reservoir or pond
- **Tidally Influenced** - site is obviously influenced by brackish water content at some point of time during a year (i.e., is downstream of the mean high tidal mark)
- **Aquaduct** – site is an above-the-ground water conveyance designed to transport drinking water.
- **Non-Wadeable** - site will obviously be >1m deep in 30% or more of its length, and it will not be feasible to sample the eleven bioassessment transects within the wadeable portion of the reach, or will obviously be unsafe for sampling during the spring monitoring event.
- **Inaccessible** – A site is inaccessible if you cannot safely walk to the site from your vehicle, sample and return from the site carrying samples and gear within a single day. Note: having a limited crew size is not a legitimate reason for checking this box.
- **No/Low Spring Flow** – A site may be rejected if, during the spring field visit, there is no flow or the flow is too low to completely sample using the standard operating protocols.
- **Other** – Includes sites located:
    - where any other obvious impediment prevents sampling, including a large stormdrain or tributary that was not detected prior to field reconnaissance, and which is deemed to significantly influence surface hydrology, sediment supply, or geomorphology such that the site cannot be moved to avoid it; or
    - on a water conveyance that is not currently and never was a receiving water body. **IMPORTANT:** Only sites that have a significant weight

of evidence, e.g., USGS quad maps, NHD, Bay Area Riparian Resource Inventory (BARRI) maps, Oakland Museum Creek Maps, and the San Francisco Bay Water Quality Control Plan (Basin Plan) supporting this determination can be included. Also, please communicate with the RMC Coordinator before checking this box.

Explanation: all sites that have the "Criteria Not Met" box checked must have a justification or verifiable reason to reject these sites and not proceed further. Provide all relevant information in the "explain" box in this section.

Section III: Site and Access Information

This section should only be completed if the site received a "Meets Criteria – Sampleable" designation in Section II.

Site Accessible by Vehicle: denote whether a site is easily accessible by a vehicle by checking the Yes box. Checking the No box denotes that the site will likely require hiking to access for sampling.

Estimated Wetted Channel Width and Depth: based on a field visit to the site indicate whether the estimated wetted channel width during the spring Index sampling period will be/is 0 – 10 meters wide, or greater than 10 m wide. This information is useful to determine the reach length required to conduct bioassessments, e.g., for 0 – 10 m wetted channel widths, a 150 m reach length is appropriate; for > 10 m wetted channel widths, a 250 m reach length is appropriate. If field reconnaissance verifies that the available sampling reach is less than the required length, the available estimated length should be noted by checking the "other" box and recording the estimated available sampleable reach length. Estimated wetted channel depth may be useful to determine wadeability and whether a site may be safely accessed. Wetted channel depth should be estimated as an average depth of flow throughout the reach. Additional comments about channel depth, e.g., non-wadeable deep pools that may occur within a reach, may be noted in the Additional Comments section on page 2 of the Field Reconnaissance Form.

Flow Status: flow status is one of the most important pieces of information needed during the field reconnaissance portion of the site evaluation process. Based on observations during the dry season, preferably the dry season prior to sampling, or if that's infeasible, then the dry season following sampling , OR considerable knowledge about the flow status of the site based on frequent site visits in the past, check one of the following boxes:

- **Wet Flowing**: Continuously Wet or nearly so, flowing water throughout length and across most of streambed width
- **Wet Trickle**: Continuously wet or nearly so throughout length, with very low flow (trickle, <0.1 L/sec.) across partial streambed width
- **Substantially Wet**: Discontinuously wet, >25% (by length) of stream bed covered with water (isolated pools)
- **Minority Wet**: Discontinuously wet, <25% of stream bed (by length) covered with water (isolated pools)
- **No Water**: No surface water present

Note: if flow status is uncertain, visit the site again the following spring to confirm the flow status prior to sampling. If, during this visit, there is no/low flow, check the appropriate box in Section II under "Criteria Not Met."

Best Month to Sample: Bioassessment sampling has a specific index period when sampling is optimal. The index period for Bay Area creeks is spring, but may vary between sites depending on flow conditions allowing for safe entry during the spring season. Provide a best estimate of the month that sampling would be optimal based on typical rainfall and flow patterns. As a rule, sites that exhibit lower and/or intermittent flow should usually be planned for sampling before sites with higher and/or perennial flow.

Site Suitability for Sampling During Storm: A site may be chosen for water sampling during a storm event if it is accessible and water can be safety sampled during relatively large flows. Based on field reconnaissance, qualitatively determine whether the site appears to be accessible for sampling during a storm event and check either "yes" or "no" box.

Site Suitability for Bedded Sediment Sampling: A site may be chosen for bedded sediment sampling if the recently deposited fine material is present and can be sampled safely. Based on field reconnaissance, qualitatively determine whether the site appears to have fine sediment that was recently deposited on the bed of the creek/river and may provide a good site for sampling bedded sediment.

Directions to the Site and Additional Access Information: Provide directions to access the site and any information that will help the field crews find and access the site most efficiently. Make sure to include which side of the creek is best or the only way to enter. If street names apply please use them. Auto navigation units are very helpful at getting as close to the site as possible.

Use formal terms when writing down direction. For example, use "north", "south", "west" and "east" instead of "left "and "right" as those terms only work if you are heading in the same direction or are approaching the site in the same manner as the crew who may be sampling.

Other special needs such as gates and keys should be noted and written clearly, especially gate combinations. Please enter this info in the box provided.

Guidance: Be as specific as possible when filling out the form. The person performing the reconnaissance may not be the person who will return to sample the site. Giving detailed instructions and site information will help the returning team access the site quickly and efficiently and will be greatly appreciated by other crew members.

References

BASMAA. 2011. Draft RMC Creek Status and Trends Monitoring Plan. Bay Area Stormwater Management Agencies Association. Prepared by EOA, Inc. July.

California Department of Fish and Game. 2011. Perennial Stream and Rivers Assessment Site Evaluation Guidelines. Sacramento, CA. 11 pp.

Attachment 1 – Probabilistic Site Evaluation Data Management and Submittal Guidance

BASMAA Regional Monitoring Coalition

Probabilistic Site Evaluation Data Management and Submittal Guidance

Site evaluation information, including information from non-sampled sites, is critically important for the RMC's Creek Status and Trends Monitoring Program. Site evaluation data for all probabilistic sites that have been evaluated in a given water year shall be submitted by each RMC participant using a single table described in this document. This guidance document defines fields in this table, and is meant to supplement the RMC's Site Evaluation SOP (FS-12). Users are advised to refer to this SOP or contact the RMC Coordinator if questions on the completion or submittal of the site evaluation table should arise.

SUBMITTAL INSTRUCTIONS

Site evaluation information collected by each RMC participant shall be submitted no later than 6 weeks after bioassessments are completed to the RMC's Probabilistic Monitoring Design Manager (PMDM) for a quality control and quality assurance check. Once finalized by the PMDM, site evaluation information must be submitted to the RMC centralized database, which may require coordination with the RMC's Central Information Management Coordinator (CIMC).

The information collected and submitted each year will be contained within a single Site Evaluation Table as described in the following section. This file should be named as a concatenation of sampling agency's name, "siteeval" and fiscal year. For example, for the Alameda Countywide Clean Water Program's submittal in Fiscal Year 2011-12, the file should be named:

ACCWP_siteeval_FY11_12.

The excel sheet tab **MUST** also be given the same name.

SITE EVALUATION TABLE (tblSiteEval)

The purpose of the Site Evaluation table is to document information about sites evaluated as part of the RMC's Creek Status and Trends probabilistic survey. Typically, sites are only evaluated once. However, if a site is evaluated more than once, a single record should be used for each evaluation. Records in the table will be unique based on the following fields: StationCode, DrawCode, ProgramCode, Stratum, AgencyCode and EvalDate. Each of these fields is described in this document.

TABLE STRUCTURE

For the purpose of coordinating with data collection entities outside of the RMC, it is critical to maintain the integrity of the data fields and codes described herein. **Do not change the field**

names or codes on your data submission sheet. The field names and associated information are provided in the following table.

FIELD NAME (* 1°Key)	TYPE	REQUIRED	SIZE	LOOKUP LIST
1. StationCode*	Text	Y	25	luEvalStations
2. DrawCode*	Text	Y	15	tblDraw
3. ProgramCode*	Text	Y	50	luPrograms
4. Stratum	Text	Y	50	luStrata
5. AgencyCode*	Text	Y	20	luEvalAgencies (a subset of luAgency
6. Evaluator	Text	Y	50	
7. EvalDate*	Date	Y	10	
8. EvalStatusCode	Text	Y	15	luEvalStatus
9. EvalStatusDetail	Text	N	255	
10. FieldReconCode	Text	Y	15	luFieldRecon
11. FieldReconDate	Date	N	10	
12. TargetStatusCode	Text	Y	4	luTargetStatus
13. TargetStatusDetail	Text	Y	12	luTargetStatusDetail
14. WaterbodyStatusCode	Text	Y	15	luWaterbodyStatus
15. WaterbodyStatusDetail	Text	N	255	
16. PerennialStatusCode	Text	Y	4	luPerrennialStatus
17. DrySeasonFlowStatusCode	Text	Y	15	luFlowStatus
18. DrySeasonFlowStatusDate	Numeric	Y	10	NA
18. DrySeasonFlowStatusDetail	Text	N	255	
19. WadeableStatusCode	Text	Y	15	luWadeableStatus
20. WadeableStatusDetail	Text	N	255	
21. PhysicalAccessStatusCode	Text	Y	15	luPhysicalAccessStatus
22. PhysicalAccessStatusDetail	Text	N	255	

23. LandPermissionStatusCode	Text	Y	15	luLandPermissionStatus
24. LandPermissionStatusDetail	Text	N	255	
25. SampleStatusCode	Text	Y	15	luSampleStatus
26. SampleStatusDetail	Text	N	255	
27. SampleDate	Date	Y	10	
28. SiteLocationAdjusted	Text	Y	4	
29. SiteAdjDetail	Text	N	255	
30. ActualLatitude	Numeric	y	30	NA
31. ActualLongitude	Numeric	y	30	NA
32. LandUseReclassification	Text	Y	4	luLUReclass
33. LandUseReclassificationDetail	Text	N	255	

EXAMPLE SITE EVALUATION TABLE

The following is an example of a site evaluation table. Those field highlighted in yellow are required and those not highlighted are optional.

	A	B	C	D	E	F	G	H
1	StationCode	DrawCode	ProgramCode	Stratum	AgencyCode	Evaluator	EvalDate	EvalStatusCode
2	204R00004	RMC1	RMC	AI_R2_Nonurb	ACCWP	A. Feng	10/1/2011	E
3	205R00003	RMC1	RMC	SC_R2_Urb	SCVURPPP	P. Randall	10/5/2011	E

	I	J	K	L	M	N	O
1	EvalStatusDetail	FieldReconCode	FieldReconDate	TargetStatus Code	TargetStatusDet ail	Waterbody StatusCode	WaterbodyStatusDetail
2		N		NT	NT_RI	RI	
3		Y		T	Target	S	

	P	Q	R	S	T	U	V
1	Perennial StatusCode	DrySeasonFlow StatusCode	DrySeasonFlow StatusDate	DrySeasonFlow StatusDetail	WadeableStatu sCode	WadeableStatu sDetail	PhysicalAccessStatusCode
2	NA	NA	NA		NA		NA
3	P	WF	##/##/####		W		A

	W	X	Y	Z	AA
1	PhysicalAccessStatusDetail	LandPermissionStatusCode	LandPermissionStatusDetail	SampleStatusCode	SampleStatusDeta
2		NA		NA	
3		G		S	

	AB	AC	AD	AE	AF	AG	AH
1	SampleDate	SiteLocation Adjusted	SiteAdjDetail	ActualLatitude	ActualLongitude	LandUseReclassification	LandUseReclassificationDetail
2		N		NA	NA	N	
3	6/15/2012	Y	moved u/s of tidal influence	##.#####	###.#####	Y_toNonurb	upstream site drainage estimated 0% urban based on quantitative GIS assessment.

FIELD DEFINITIONS

1. **StationCode:** Required. RMC Station Code for a specific probabilistic site. The Station Code is included in the RMC Master Sample Excel Spreadsheet and on the Site Evaluation Forms (see SOP FS-12). The StationCode format is ###R#####.

2. **DrawCode:** Required. Identifies the probabilistic sample draw from which a station was derived. Use [tblDraw]. For the RMC (and any other program/agency using the RMC's Master Sample) use "RMC1" for the draw created in 2011. If another master draw is created in the future a sequential numeral will be specified by the RMC Coordinator.

3. **ProgramCode:** Required. Identifies the program that evaluated the station. For the RMC, use "RMC".

4. **Stratum:** Required. Identifies the stratum that was used to categorize the stations. Strata are unique to each program. For the RMC, use these codes:

STRATUMCODE	STRATUMDESCRIP	PROGRAM
Al_R2_nonurb	Alameda County Region2 Board Nonurban	RMC
Al_R2R5_urb	Alameda County Region2 and Region 5 Board Urban	RMC
CC R2 nonurb	Contra Costa County Region 2 Board Nonurban	RMC
CC R5 nonurban	Contra Costa County Region 5 Board Nonurban	RMC
CC_R2R5_Urb	Contra Costa County Region 2 or 5 Board Urban	RMC
SC R2 nonurb	Santa Clara County Region 2 Nonurban	RMC
SC R2 urb	Santa Clara County Region 2 Urban	RMC
SM R2 nonurb	San Mateo County Region 2 Nonurban	RMC
SM R2 urb	San Mateo County Region 2 Urban	RMC
Sol R2 nonurb	Solano County Region 2 Board Nonurban	RMC
Sol R2 UrbFS	Solano County Region 2 Board Urban for Fairfield- Suisun	RMC
Sol R2 UrbV	Solano County Region 2 Board Urban for Vallejo	RMC

5. **AgencyCode:** Required. Identifies the agency responsible for the evaluation and sampling. For the RMC, use the RMC participating agency, not the agency conducting the site evaluation:

AGENCYCODE	AGENCYNAME
ACCWP	Alameda Countywide Clean Water Program
CCCWP	Contra Costa Clean Water Program
SMCWPPP	San Mateo Countywide Water Pollution Prevention Program
SCVURPPP	Santa Clara County Urban Runoff Pollution Prevention Program
FSURMP	Fairfield Suisun Urban Runoff Management Program
SWAMP	Surface Water Ambient Monitoring Program
Vallejo	City of Vallejo and Vallejo Sanitation and Flood Control District

6. **Evaluator:** Required. Identify the person who evaluated the site. Recommended format is first initial and last name (e.g., A. Feng).

7. **EvalDate:** Required. Date for the season and sampling year for which the evaluation was conducted (e.g., to evaluate spring 2012 sampling season), and NOT the date on which the evaluation occurred (see FieldReconDate to enter this information). Date must be reported, even for sites indicated as "Not Evaluated" under EvalStatusCode. Format is MM/YYYY.

8. **EvalStatusCode:** Required. Indicate whether or not the site was evaluated.

EVALSTATUSCODE	DESCRIPTION
E	Site was evaluated
NE	Site was not evaluated

9. **EvalStatusDetail:** Not Required. Enter any details to explain the EvalStatusCode, particularly if site criteria were not met, then briefly note why.

10. **FieldReconCode:** Required. Indicate whether the evaluation status was derived from field visits.

FIELDRECONCODE	DESCRIPTION
N	No field recon occurred. Use this code for sites that were not evaluated, or rejected without a site visit.
Y	Field recon occurred. Use this code for all sampled sites, and sites that were evaluated based on a site visit.
U	Unknown. Only use for historic data, where it could not be determined if site visits occurred.

11. **FieldReconDate:** Not Required. Date the field visit occurred. Format is MM/DD/YYYY

12. **TargetStatusCode:** Required.

TARGETSTATUSCODE	DESCRIPTION
T	Target sampleable. Meets the following 7 criteria: 1. Draw location provided for a site is on or within 300m of a non-impounded receiving waterbody; 2. Site is not tidally influenced; 3. Site is wadeable (see wadeability criterion) during the sampling period; 4. Site has sufficient flow during the sampling index period to support standard operation procedures for biological and nutrient sampling. 5. Site is physically accessible and can be entered safely at the time of sampling; 6. Site may be physically accessed and sampled within a single day; 7. Landowner(s) grant permission to access the site.
NT	Non-target: if any of criteria 1-4 above are not met.
TNS	Target Non-sampleable: if any of criteria 5-7 above are not met.
U	Unknown: if any of criteria 1-7 are unknown.

13. **TargetStatusDetail:** Required.

TARGETSTATUSDETAIL	DESCRIPTION
Target	Site meets target criteria.
TNS_PD	Site is Target but non-Sampleable because access permanently denied OR no owner response, so access effectively denied.
TNS_NR	Site is Target but non-Sampleable because no Response from owners.
TNS_TD	Site is Target but non-Sampleable because access temporarily denied or temporarily inaccessible for other reasons.
TNS_TNW	Site is Target but non-Sampleable because temporarily no water due to water management activities.
TNS_IA	Site is Target but non-Sampleable because terrain is steep and unsafe for crews, and/or channel is too choked with vegetation to approach and/or walk through and sample.
TNS_DIST	Site is Target but non-Sampleable because physically inaccessible either because cannot hike RT and sample in one day, and/or no good roads to access.
NT_W	Site is non-target because it's a wetland.
NT_NLSF	Site is non-target because no/low spring flow.
NT_NW	Site is non-target because it's not wadeable for an adequate length.
NT_H	Site is non-target due to presence of human hazards; unsafe for field crews.
NT_NC	Site is non-target because it's not a stream channel
NT_AGDITCH	Site is non-target because it's an agricultural ditch; not natural, historic receiving water
NT_P	Site is non-target because it's a pipeline
NT_T	Site is non-target because it's tidally influenced
NT_RI	Site is non-target because it's a reservoir or impoundment
U_AU	Site target status us unknown because accessibility unknown.
U_TD	Site target status is unknown because access was temporarily denied.
U_PD	Site target status is unknown because access was permanently denied.
U_DIST	Site target status is unknown either because physically inaccessible or because cannot hike RT and sample in one day, and/or no good roads to access.
U_IA	Site target status is unknown because terrain is steep and unsafe for crews, and/or channel is too choked with vegetation to approach and/or walk through and sample.
U_TI	Site target status is unknown because site is temporarily inaccessible.

14. **WaterbodyStatusCode:** Required. Indicate the type of water body for the evaluated site. All sites coded as "S" are considered to be streams that are potentially sampleable unless other codes indicate otherwise. If site has been moved to avoid an unsampleable area, indicate the status code of the location to which the point was moved (up to 300m upstream or downstream of the original location). Note: if any code other than "S" is used (i.e., the site is not on a stream), "NA" (Not applicable) will be required for most other fields.

15.

WATERBODYSTATUSCODE	DESCRIPTION
A	Aquaduct
NC	Watercourse not present within 300 m of target coordinates
NLSF	No/low spring flow; insufficient amount of water to implement bioassessments and nutrient sampling.
O	Other. Includes wetlands and seeps. Provide explanation in WaterbodyStatusDetails
P	Pipeline (underground or overground)
RI	Reservoir, lake or other impoundment
S	Stream. Use this code if the point falls on a sampleablestream (**even for highly modified flood control channels, canals, and ditches**).
T	Tidally influenced
U	Unknown

16. **WaterbodyStatusDetails:** Not Required. Provide any details about the water body status, for example if you observed a perennial condition the year you evaluated the site but received reliable information that the status has been different in other water years. NOTE: if this site was reconnoitered in the Fall and Spring seasons, indicate details about the flow status from the Spring reconnaissance event in this field and not in the DrySeasonFlowStatusCode field (see below). The WaterbodyStatus field effectively indicates spring flow status as either flowing and sampleable (coded as S – stream) or no/low spring flow and unsampleable (NLSF).

17. **PerennialStatusCode:** Required. Indicate the perennial status based on the dry season flow. See the table for DrySeasonFlowStatusCode.

18. **DrySeasonFlowStatusCode:** Required. Indicate the flow status of the site **in the Dry Season** based on a field visit or considerable knowledge of the site. NOTE: if a site is reconnoitered in the fall and spring seasons, use this field to characterize flow status during the DRY SEASON reconnaissance event; the Spring reconnaissance event flow status should be recorded under the WaterbodyStatusDetails field (see above).

PERENNIALSTATUSCODE	DRYSEASONFLOWSTATUSCODE	DESCRIPTION
P	WF	Wet Flowing. Continuously wet or nearly so, flowing water.
P	WT	Wet Trickle. Continuously wet or nearly so, very low flow (trickle, <0.1 L/sec.).
P	MajW	Majority Wet. Discontinuously wet, >25% (by length) of stream bed covered with water (isolated pools).
NP	MinW	Minority Wet. Discontinuously wet, <25% of stream bed (by length) covered with water (isolated pools).
NP	NW	No Water. No surface water present.
U	U	Unknown. Flow status not verified.
NA	NA	Not applicable.

19. **DrySeasonFlowStatusDate:** Required. Indicate the date associated with the determination of dry season flow status.

20. **DrySeasonFlowStatusDetail:** Not Required. Provide any necessary details to explain the DrySeasonFlowStatusCode. If dry season flow status is determined by means other than field visit, explain information source and confidence/reliability in this source.

21. **WadeableStatusCode:** Required. Indicate the wadeability of the site.

WADEABLESTATUSCODE	DESCRIPTION
W	Wadeable (Site is typically <1 m deep for>70% of reach) and it is feasible to sample the eleven bioassessment transects within the wadeable portion of the reach.
NW	Nonwadeable (Site is obviously >1 m deep for >30% of reach, or will obviously be unsafe for sampling)
U	Unknown. Wadeability not determined.
NA	Not applicable.

22. **WadeableStatusDetail:** Not Required. Provide any details about the wadeability of the site.

23. **PhysicalAccessStatusCode:** Required. Indicate the physical accessibility of the site.

PHYSICALACCESSSTATUSCODE	DESCRIPTION
A	Accessible (Site can be safely accessed and sampled within a single day)
PI	Permanently Inaccessible (Site cannot be safely accessed and sampled within a single day; concerns may include safety and/or physical accessibility due to terrain and/or vegetation structure/density).
TI	Temporarily inaccessible (Site cannot be safely accessed and sampled in the current sampling year, but conditions are expected to change in the near term (within ~5 years). Examples include road construction or wildfires that prevent short-term access to sites. Site landowners were only contacted unsuccessfully once prior to field deployment; second attempt to contact landowners is still required.
RE	Site is safely accessible, but remote, and requires more than a single day to sample. This code should only be used if safe access has been verified. Otherwise, use "PI".
U	Unknown. Physical accessibility has not been determined.
NA	Not applicable.

24. **PhysicalAccessStatusDetail:** Not Required. Provide any details explaining the PhysicalAccessStatusCode.

25. **LandPermissionStatusCode:** Required. Indicate whether the landowner has granted permission to access the site.

LANDPERMISSIONSTATUSCODE	DESCRIPTION
G	Granted. Landowner has granted permission. Includes lands with public access.
PD	Access Permission Permanently Denied. Landowner permanently denied permission to access site, or has not responded to at least 2 attempts to contact.
TD	Temporarily Denied. Landowner temporarily denied access, but intends to grant permission in future years. Use this code if the landowner permission was granted too late to sample in the current year. Other cases include temporary closures due to conflicting management activity, or to protect sensitive wildlife (e.g., amphibian breeding season). Explain circumstances in LandPermissionStatusDetails.
O	Other. Provide explanation in LandPermissionStatusDetails.
U	Unknown/Undetermined. Landowner permission not determined.Examples include: permission may be been requested but response is unconfirmed; access for site reconnaissance may have been granted but permission to sample is unconfirmed; permission to access land leading to site is unconfirmed. Provide explanation in LandPermissionStatusDetails.
NA	Not applicable.

26. **LandPermissionStatusDetail:** Not Required. Provide details explaining LandPermissionStatusCode.

27. **SampleStatusCode:** Required. Indicate if the site was sampled.

SAMPLESTATUSCODE	DESCRIPTION
S	Site sampled.
NS	Site not sampled
NA	Not applicable.

28. **SampleStatusDetail:** Not required. Provide any details about SampleStatusCode.

29. **SampleDate:** Required. Sample dates can be useful during data interpretation phase. Indicate the date the site was sampled. Use the format MM/DD/YYYY.

30. **SiteLocationAdjusted:** Required. Indicate whether the site location was adjusted within the allowed 300m distance (either upstream or downstream of the original draw location).

SITELOCATIONADJUSTED	DESCRIPTION
Y	Site location adjusted from original location provided by the Probabilistic Draw.
N	Site location not adjusted from original location provided by the Probabilistic Draw.
NA	Not applicable.

31. **SiteAdjDetail:** Not Required. Provide any details about why and how the site location was adjusted.

32. **ActualLatitude:** Required. IF site location is adjusted from the original location designated by the Probabilistic Draw, provide the new, “actual” Latitude coordinate for the site.

33. **ActualLongitude:** Required. IF site location is adjusted from the original location designated by the Probabilistic Draw, provide the new, “actual” Longitude coordinate for the site.

34. **LandUseReclassification:** Required.

LANDUSERECLASSIFICATION	DESCRIPTION
N	Site land use not reclassified; stayed consistent with designation in the Sample Frame.
Y_toUrb	Site land use reclassified from Nonurban to Urban
Y_toNonurb	Site land use reclassified from Urban to Nonurban
NA	Not Applicable

35. **LandUseReclassificationDetail:** Not Required. Provide any details about why and how the site location was adjusted.

Attachment 2 – Office Site Evaluation Form

FORM #1: SITE EVALUATION (OFFICE)

BASMAA REGIONAL MONITORING COALITION (RMC)

CREEK STATUS AMBIENT (PROBABILISTIC) SURVEY

I. BACKGROUND SITE INFORMATION (FROM SAMPLE DRAW SITE LIST)

Draw Site ID:	Evaluator Name:	Date of Evaluation:

Creek Name:

Latitude:	Longitude:

Site Location/Description:	City:

COUNTY					REGION		LAND USE	
☐Alameda	☐ Contra Costa	☐ San Mateo	☐ Santa Clara	☐Solano	☐ Region 2	☐Region 5	☐ Urban	☐ Non-Urban

SAMPLING AGENCY						
☐SWAMP	☐ACCWP	☐ CCCWP	☐ SMCWPPP	☐ SCVURPPP	☐FSURMP	☐Vallejo

II. SITE STATUS

☐ **Provisionally Meets Criteria**

COMMENTS:

☐ **Criteria Not Met**

Basis for Determination (Check all that apply)

- ☐ Watercourse not present within 300 meters
- ☐ Pipeline (underground/overground)
- ☐ Impoundment (e.g., Lake or Reservoir)
- ☐ Tidally Influenced
- ☐ Tributary/large storm drain within creek
- ☐ Aquaduct
- ☐ Non-wadeable
- ☐ Inaccessible
- ☐ Other (provide explanation below)

Information Source (Check all that apply)

☐BPJ ☐Evaluator Knowledge ☐Resource Managers (document)
☐GIS ☐Google Earth ☐Land Owner ☐Other

Explanation:

BEST MONTH TO SAMPLE ☐April ☐May ☐June ☐July ☐Unknown

III. SITE OWNERSHIP INFORMATION

(ONLY COMPLETED FOR SITES MARKED AS PROVISIONALLY MEETS CRITERIA ABOVE)

Ownership (check all that apply) ☐ Private ☐ Public ☐ Mixed ☐ Other (describe):

III-1. PUBLIC SITE OWNERSHIP INFORMATION

Name:	Organization:	Address:	Contact Information:

Access Granted	Call Before Entry	Gate, key, or special requirements	Wants Data
☐ Yes ☐ No	☐ Yes, phone number: ☐ No	☐ Yes, describe: ☐ No	☐ Yes ☐ No

PERMIT(S) NEEDED:

Comments:

Last Updated: 9/9/11

FORM #1: SITE EVALUATION (OFFICE)

BASMAA REGIONAL MONITORING COALITION (RMC)

CREEK STATUS AMBIENT (PROBABILISTIC) SURVEY

III-2. PRIVATE SITE OWNERSHIP INFORMATION

A

Parcel Number:	Name(s):	Address:

City:	State:	Zip:	Letter Status	Access Granted	Wants Data
			☐ Returned ☐ Sent	☐ Yes ☐ No	☐ Yes ☐ No

Gate, key, or special requirements	Call Before Entry
☐ Yes, describe: ☐ No	☐ Yes, phone number: ☐ No

Contact information (optional):	Date:

Comments:

B

Parcel Number:	Name(s):	Address:

City:	State:	Zip:	Letter Status	Access Granted	Wants Data
			☐ Returned ☐ Sent	☐ Yes ☐ No	☐ Yes ☐ No

Gate, key, or special requirements	Call Before Entry
☐ Yes, describe: ☐ No	☐ Yes, phone number: ☐ No

Contact information (optional):	Date:

Comments:

C

Parcel Number:	Name(s):	Address:

City:	State:	Zip:	Letter Status	Access Granted	Wants Data
			☐ Returned ☐ Sent	☐ Yes ☐ No	☐ Yes ☐ No

Gate, key, or special requirements	Call Before Entry
☐ Yes, describe: ☐ No	☐ Yes, phone number: ☐ No

Contact information (optional):	Date:

Comments:

Attachment 3 – Field Reconnaissance Site Evaluation Form

FORM #2: FIELD RECONNAISSANCE

BASMAA REGIONAL MONITORING COALITION (RMC)

CREEK STATUS AMBIENT (PROBABILISTIC) SURVEY

I. BACKGROUND SITE INFORMATION (FROM FORM #1)

Draw Site ID:	Evaluator Name:	Date of Evaluation:
Creek Name:		
Latitude:	Longitude:	
Site Location/Description:	City:	

COUNTY					REGION		LAND USE	
☐Alameda	☐ Contra Costa	☐ San Mateo	☐ Santa Clara	☐Solano	☐ Region 2	☐Region 5	☐ Urban	☐ Non-Urban

SAMPLING AGENCY						
☐SWAMP	☐ACCWP	☐ CCCWP	☐ SMCWPPP	☐ SCVURPPP	☐FSURMP	☐Vallejo

II. SITE STATUS

☐ **Meets Criteria – Target Sampleable (TS)**	☐ **Meets Criteria – Target Not Sampleable (TNS)**	☐ **Criteria Not Met – Non-Target (NT)**
Basis for Determination: ☐ **Office Evaluation** (Site Visit Not Needed) ☐ **Site Visit**	**Basis for Determination:** ☐ **Access Permission Permanently Denied (PD)** (i.e., permission letter is returned denying access to the site, permission denied over the phone). ☐ **No Response after 2 Attempts to Contact** (**PD)(**Permission letter is not returned, returned with no response, or mailed back unopened) ☐ ***Access Granted After Index Period (TD)** (i.e., required permits or permission is not received in time for sampling) ☐ ****Temporarily Inaccessible (TI)**(e.g., temporary closures due to conflicting management activities) ☐ **Other (O) (Provide Explanation)** *Site should be sampled in following year **Site should be reconsidered for sampling in following year	**Basis for Determination** (Check all that apply) ☐ **Watercourse not present within 300 meters (NC)** ☐ **Pipeline (underground/overground) (P)** ☐ **Impoundment (e.g., Lake or Reservoir) (RI)** ☐ **Tidally Influenced (T)** ☐ **Aquaduct (A)** ☐ **Non-wadeable (NW)** ☐ **Inaccessible (PI or RE)** ☐ **No/Low Spring Flow (NLSF)** ☐ **Other (provide explanation) (O)**
Site Visit Likely Needed in Spring to confirm accessibility/wadeability? ☐ YES ☐ NO		
Site location required adjustment of up to 300 meters due to access issues? (New Lat/Long required) ☐ YES ☐ NO ☐MAYBE If Yes, provide explanation in box to right.	**EXPLANATION:**	

III. SITE AND ACCESS INFORMATION

(Only Completed for Sites Marked as "Meets Criteria – Sampleable" Above)

Site Accessible by Vehicle: ☐ YES ☐ NO	**Est. Wetted Channel Width:** ☐0 – 10m ☐ > 10m	**Available Reach Length:** ☐150m ☐250m ☐Other:_____m	**Est. Wetted Channel Depth:**

Dry Season Flow Status:	☐**Wet Flowing:** Continuously Wet or nearl so, flowing water	☐**Wet Trickle**: Continuously wet or nearly so, very low flow (trickle, <0.1 L/sec.)	☐**Majority Wet:** Discontinuously wet, >25% (by length) of stream bed covered with water (isolated pools)	☐**Minority Wet:** Discontinuously wet, <25% of stream bed (by length) covered with water (isolated pools)	☐**No Water:** No surface water present

Best Month to Sample: ☐April ☐May ☐June ☐July ☐Unknown

Last Updated: 4_11_13

FORM #2: FIELD RECONNAISSANCE

BASMAA REGIONAL MONITORING COALITION (RMC)

CREEK STATUS AMBIENT (PROBABILISTIC) SURVEY

Site access appears suitable for sampling water toxicity during storm events ☐YES ☐ NO

Site appears to have suitable amount of deposited sediment for sediment-related sampling ☐YES ☐ NO

DIRECTIONS TO SITE: (Include x-streets and landmarks, address for auto navigation)

Picture Numbers:

Ownership Verified?

Gate, keys, special needs: ☐ Yes, describe: ☐ No	Site Address/Coordinates:
Overnight accommodations required: ☐ Yes, describe options: ☐ No	Comments:

ADDITIONAL COMMENTS:

STANDARD OPERATING PROCEDURES
for
QA/QC Data Review
(SOP FS-13)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This SOP is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:

Biological Assessment (including water chemistry data)
General Water Quality
Chlorine
Temperature
Toxicity – Water Column
Pathogen Indicators (bacteriological analysis)
Toxicity – Bedded Sediment, Fine-Grained
Pollutants – Bedded Sediment, Fine-grained

SOP Background and Application

RMC participants intend to collect water quality samples using consistent protocols across jurisdictional boundaries, to the extent reasonable and feasible. These sample collection and handling protocols form part of the RMC field quality assurance program, to help ensure validity of resulting data and comparability with SWAMP protocols. This protocol describes the techniques used to collect water samples in the field in a way that neither contaminates, loses, or changes the chemical form of the analytes of interest.

References to Existing SOPs

This SOP is adapted from information provided in the following SOPs:

(1) For water quality, field measurements, and sediment sampling: **Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in the Surface Water Ambient Monitoring Program (SWAMP)**, version 1.0, released October 15, 2007 (SWAMP 2007).

(2) For bioassessments: **Standard Operating Procedures for Collecting Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California.** California State Water Resources Control

Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 001, released February 2007 (Ode, 2007).

(3) For algal sampling: **Standard Operating Procedures for Collecting Stream Algae Samples and Associated Physical Habitat and Chemical Data for Ambient Bioassessments in California.** California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 002, released June 2009 (Fetscher et al, 2009).

These SOP documents are available for download in pdf form at:
http://swamp.mpsl.mlml.calstate.edu/resources-and-downloads/standard-operating-procedures

Relevant QA/QC protocols are also referenced in the associated RMC QAPP for targeted parameters: **BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan**, version 2, January 2014 (BASMAA 2014).

Overview of QA/QC Review

A comprehensive QA/QC program is implemented by RMC Program Participants in the course of conducting the Creek Status monitoring required per Provision C.8.c of the Municipal Regional Stormwater NPDES Permit (MRP), as specified in MRP Table 8.1 (SFBRWQCB, 2009). In general, QA/QC procedures should be implemented as specified in the RMC QAPP (BASMAA, 2014), and monitoring performed according to protocols specified in these RMC SOPs, and in conformity with SWAMP protocols (c.f., MPSL-DFG Field Sampling Team, 2007; Ode, 2007).

All findings and data reported by RMC Program Participants should be reviewed by the Program's designated Local Quality Assurance Officer (LQAO) for RMC Creek Status monitoring, to determine whether data quality objectives were met.

The QA/QC review nominally covers the following data quality attributes as described in the RMC QAPP:

- **Representativeness** – whether the data were collected so as to represent actual conditions at each monitoring location. For this program the samples and field measurements are assumed to be representative if they are performed according to protocols specified in the RMC QAPP and SOPs
- **Comparability** – whether the data may be reasonably compared to data from other programs producing similar types of data. For RMC Creek Status monitoring, the key measure of comparability is the CA Surface Water Ambient Monitoring Program (SWAMP). Because the RMC QAPP and SOPs are designed to be comparable to SWAMP protocols, the RMC monitoring data are assumed to be SWAMP-comparable if they are performed according to protocols specified in the RMC QAPP and SOPs.
- **Completeness** – the degree to which all data were produced as planned; this covers both sample collection and analysis. Per the RMC QAPP, an overall completeness of greater than 90% is considered acceptable for RMC chemical data and field measurements, and completeness of 95% is considered

acceptable for bioassessment-related parameters, including BMI and algae taxonomy samples/analysis and associated field measurements.

- **Sensitivity** – whether the data are produced at sufficient levels of analytical acuity. For RMC Creek Status monitoring, chemistry laboratory analytical sensitivity is considered to be adequate if the reporting limits (RLs) comply with the specifications in RMC QAPP Appendix E: RMC Target Method Reporting Limits. For biological data, taxonomic identification sensitivity is acceptable provided taxonomists use standard taxonomic effort (STE) Level I as established by the Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT).

- **Precision** – for chemical data, nominally assessed as the percent recovery of samples spiked with a known amount of a specific chemical constituent. Chemistry laboratories routinely analyze a series of spiked samples; the results of these analyses are reported by the laboratories and evaluated by the RMC Database QA/QC Testing Tool. Acceptable levels of precision are specified for chemical analytes and toxicity test parameters in RMC QAPP Appendix A: Measurement Quality Objectives for RMC Analytes, and for biological measurements in Appendix B: Benthic Macroinvertebrate MQOs and Data Production Process.

- **Accuracy** – assessed as the degree to which replicate measurements agree, nominally determined by calculation of the relative percent difference (RPD) between duplicate measurements. Chemistry laboratories routinely analyze a series of duplicate samples that are generated by the labs internally. The RMC QAPP also requires collection and analysis of field duplicate samples at a rate of 10% of all water quality samples for most chemical parameters, and 5% of all samples for bacteria samples and sediment chemistry samples. The results of the duplicate analyses are reported by the laboratories and evaluated by the RMC Database QA/QC Testing Tool. Acceptable levels of accuracy are specified for chemical analytes and toxicity test parameters in RMC QAPP Appendix A: Measurement Quality Objectives for RMC Analytes, and for biological measurements in Appendix B: Benthic Macroinvertebrate MQOs and Data Production Process.

- **Contamination** – for chemical data, nominally assessed as the presence of analytical constituents in blank samples. Chemistry laboratories routinely analyze a series of blank samples; the results of these analyses are reported by the laboratories and evaluated by the RMC Database QA/QC Testing Tool. For RMC Creek Status monitoring the QAPP only specifies field blanks for DOC and orthophosphate filters (field equipment blanks). Acceptable levels of contamination are specified for chemical analytes and toxicity test parameters in RMC QAPP Appendix A: Measurement Quality Objectives for RMC Analytes.

The QA/QC review should include both field procedures and laboratory results:

- Field data sheets, chain of custody forms, and other field-generated documents should be reviewed; field audits of monitoring activities should be performed as feasible; and field crew interviews should be conducted by the LQAO to assess sample collection procedures, field measurement methods, and record keeping.

- All laboratory results also should be reviewed by the LQAO. Laboratories are responsible for conducting a set of internal QA/QC procedures, as well as adhering to the protocols specified in the RMC QAPP, and for reporting any issues that arise during testing. The RMC QAPP and SOPs also require field generation of certain QA/QC samples.

A generalized set of checklists are provided for the use of monitoring personnel and LQAOs to assist in organizing the QA/QC review and evaluation (Attachment 1).

The results of the QA/QC Data Review should be summarized in a narrative report, with associated tables as needed to document QA/QC performance. Any identified data quality issues should be noted in the QA/QC report narrative, and their relevance for data analysis/interpretation should be noted for any issues that may affect data quality.

Methods / Procedures

The elements of the QA/QC Data Review are summarized below for each of the major elements of Creek Status monitoring that are required pursuant to MRP Table 8.1.

FIELD CREW TRAINING

All field crews are required to receive training in sample collection and related field procedures prior to participating in RMC monitoring activities. The QA/QC Data Review narrative should note when, where, and by whom the field crews were trained, for each major category of Creek Status monitoring.

When possible, RMC bioassessment field personnel should participate in an annual Intercalibration field exercise with SWAMP staff, as a check on consistency of field measurement methods. This should be done as a joint exercise, with the various RMC Programs coordinating and scheduling with the Region 2 SWAMP staff.

It should also be noted whether, as required, RMC SOP documents were brought into the field during sampling events as a protocol reference guide.

FIELD MEASUREMENTS AND SAMPLE COLLECTION

The LQAO should review and evaluate field measurements and sample collection activities in the following three ways:

1) Perform Field Audits as Needed

The LQAO may conduct or arrange for a field audit for any of the major monitoring categories as needed to directly observe field crew activities and determine conformity with the QAPP and SOPs during the monitoring year, when feasible. If a field audit of bioassessment activities is conducted by CA Department of Fish and Wildlife or Water Board personnel, the LQAO should review the DFW or Water Board field audit report to determine whether the field crew performed the field activities according to SWAMP Bioassessment protocols.

2) Review Field Forms

Field crews complete a series of field forms and perform various QA/QC activities according to protocols detailed in the RMC QAPP (especially section 9.1), the RMC

SOPs (especially FS-9), and SWAMP SOP documents. The following field-generated documents should be reviewed by the LQAO:

- Field Logs/Field Data Sheets
- Chain of Custody forms
- Equipment Calibration logs

3) Interview Monitoring Personnel

Following review of all sample collection and field measurement documents, the LQAO should interview field crews regarding all field procedures, and determine whether sampling and field procedures conformed to SWAMP protocols and the RMC SOPs.

The results of the review and evaluation of the field activities should be used for the following purposes:

- The checklists should be used to assess sample collection, field measurements, and recordkeeping for all sites and monitoring types for ***representativeness*** (procedural conformity to QAPP and SOPs), ***comparability*** (procedural conformity to QAPP and SOPs), and ***completeness*** (at least 90% for RMC chemistry samples and field measurements, and 95% for bioassessment-related parameters), per requirements specified by MRP Table 8.1, and in accordance with the RMC QAPP and SOPs. Specific notes are provided below for each major category of RMC creek status monitoring.
- Where issues of non-conformity with QAPP or SOP protocols were identified, the items should be noted in the QA/QC report, and field crews should be informed so that correction action can be taken to avoid similar issues in future monitoring.
- Where identified issues involve deviations from QAPP or SOP protocols that may affect data quality, the results of the review should be applied to data analysis, interpretation, and reporting, and data qualification should be added to the affected data as warranted.

LABORATORY MEASUREMENTS

The LQAO should review and evaluate all laboratory reports and EDDs to ensure ***representativeness*** (procedural conformity to QAPP and SOPs), ***comparability*** (procedural conformity to QAPP and SOPs), and ***completeness*** (at least 90% for RMC chemistry samples and field measurements, and 95% for bioassessment-related parameters), per requirements specified by MRP Table 8.1, and in accordance with the RMC QAPP and SOPs. To those ends, check the laboratory reports for the following specific items:

- **Content**: Check whether:
  - The lab reports contain a narrative indicating any notable quality issues and a signature.
  - Analyses were completed for all environmental samples in conformance with the chain of custody forms submitted to the laboratory.

  - All Laboratory Quality Control analyses were completed at the Frequency of Analysis specified in RMC QAPP Appendix A: Measurement Quality Objectives for RMC Analytes.
  - Results for analytes detected at levels between the Method Detection Limit and Reporting Limit are reported qualified as j-flagged.
  - Any analytical results appear to contain typographical errors, unusual or suspicious values.
  - Report information conforms with the chain of custody forms, including client and project information, date/time samples were received by the lab, Sample IDs and sample collection dates/times.

- **Analytical Methods:** Check that the laboratory reported use of the analytical methods as specified in the contracting agreement.
- **Holding Times:** Check laboratory sample holding times (elapsed time between sample collection and analysis) for conformance with RMC specifications (QAPP Section 12 and SOP FS-9).
- **Reporting Limits:** Check laboratory reporting limits against those specified in RMC QAPP Appendix E: RMC Target Method Reporting Limits to evaluate ***sensitivity***.

Use the **RMC Database QA/QC Testing Tool** to determine whether the laboratory analytical results meet data quality objectives for ***accuracy, precision, and contamination***, and qualify data as required per results of the Testing Tool reports. See Attachment 2 for the list of measurement quality objectives evaluated by the automated QA/QC Tool.

Specific notes are provided below for major categories of RMC creek status monitoring.

BIOASSESSMENT

Field Activities: Review stream characterization data sheets for ***completeness*** to determine whether physical habitat assessments (PHAB) incorporated quantitative and qualitative measurements at each of 11 transects and 10 inter-transects at each bioassessment monitoring site, following procedures defined in the BASIC level of effort (Ode 2007), with the following exceptions as defined in the FULL level of effort (as prescribed in the MRP): stream depth and pebble count + CPOM, cobble embeddedness, discharge measurements and in-stream habitat score, and in addition the percent algal cover (measured during point intercept with pebble count).

Review field data sheets and chain of custody forms for ***representativeness*** (procedural conformity to QAPP and SOPs), ***comparability*** (procedural conformity to QAPP and SOPs) to determine whether BMI and algae sample collection were performed as required, a) at the requisite number of sites for the RMC Program, b) with sub-samples collected from 11 transects at each site, and c) along a 150m reach at each site.

Note any instances where field activities deviated from the protocols as defined in the RMC QAPP and SOPs, such as length of reach, number of transects, completion of stream characterization forms, and availability of photos. Summarize the results in a brief narrative and refer to the review and evaluation of field measurements and sample collection activities per pp. 4-5 of this SOP.

BMI and Algae Taxonomic Data: Review the taxonomic data reports – including laboratory notes – and evaluate ***completeness*** of the taxonomic analysis (number of samples analyzed, number of organisms sorted per sample). Check the taxonomic data for completeness per the RMC QAPP, Appendix B: Benthic Macroinvertebrate MQOs and Data Production Process and Appendix D: Example of MQO Calculations for Biological Data.

Evaluate the results of the replicate samples processed during the BMI taxonomic analysis for ***precision***, and note any counting discrepancies or taxonomic identification differences between the original results (typically from BioAssessment Services) and the QA recount (typically conducted by the California Department of Fish and Wildlife). Determine whether BMI sorting counts met QA/QC criteria for sorting precision of >95% following recount.

WATER CHEMISTRY AND SEDIMENT CHEMISTRY

Field Activities: Review field data sheets and chain of custody forms for ***completeness*** to determine whether sample collection was performed as required per MRP Table 8.1 at each site.

Note any instances where field activities deviated from the protocols as defined in the RMC QAPP and SOPs. Summarize the results in a brief narrative and refer to the review and evaluation of field measurements and sample collection activities previously per pp. 4-5 of this SOP.

Lab Reports: Review the laboratory data reports – including laboratory notes – and evaluate ***completeness*** of the laboratory analysis, including results of field-generated samples as well as the laboratory's internal QA/QC tests. Check whether all data affected by lab QA/QC issues were properly noted as qualified in lab reports and EDDs.

Per the RMC QAPP, perform a check of 10% of the results by comparing the results in the written laboratory reports with the electronic data deliverables (EDDs), to determine whether there are any discrepancies in the content of the two formats. Report any discrepancies to the analytical laboratory.

QA/QC Data Validation: use the RMC Database QA/QC Testing module ("automated QA/QC Tool") to evaluate results of QA/QC tests against RMC QAPP requirements.

Check that the automated QA/QC Tool accurately identifies field-generated QA/QC samples, including field blanks and field duplicate samples, and performs the appropriate evaluations for contamination and precision, respectively. This is especially important for tests performed on field-generated QA/QC samples that were submitted blind to the laboratory. Use the results of this review to qualify SWAMP templates as required.

CONTINUOUS GENERAL WATER QUALITY

Assess whether methods for calibration and deployment, as specified in the RMC QAPP and SOP FS-4, were done appropriately and documented by field crews. Assess whether sondes were installed within the time frame identified in MRP Table 8.1, and whether data are available for the full period of required deployment.

CONTINUOUS TEMPERATURE

Assess whether methods for calibration and deployment, as specified in the RMC QAPP and SOP FS-5, were done appropriately and documented by field crews. Assess whether data loggers were installed within the time frame identified in MRP Table 8.1, and whether data are available for the full period of required deployment.

TOXICITY – WATER COLUMN

Assess whether water toxicity sampling and testing was performed at the required number of sites during wet weather (storm event) conditions and during the dry season. Assess whether all QA/QC measures listed in the QAPP were met, as specified in RMC QAPP Appendix A: Measurement Quality Objectives for RMC Analytes. Check whether all data affected by lab QA/QC issues were properly noted as qualified in lab reports and EDDs.

For samples reported as affected by pathogen-related mortality (PRM) interference, check that all necessary documentation, including photographs of affected fish, is included in an attachment to the laboratory testing report. Apply the qualifier code "PRM" in the QACode field for PRM-affected samples (this is a new code that has been added to the CEDEN Controlled Vocabulary, and that the RMC is requesting be added to the SWAMP “QACode Lookup List”), and add the following comment to the data files for PRM-affected samples: "Low survival resulted from test interference due to pathogen related mortality (PRM). The data should not be used for regulatory purposes." For any re-tests conducted outside of acceptable holding times, apply the qualifier code "VH" in the QACode field, indicating “Holding Time Violation flagged by QA Officer”.

TOXICITY – BEDDED SEDIMENT, FINE-GRAINED

Assess whether sediment toxicity sampling and testing was performed at the required number of sites during the dry season. Assess whether all QA/QC measures listed in the QAPP were met, as specified in RMC QAPP Appendix A: Measurement Quality Objectives for RMC Analytes. Check whether all data affected by lab QA/QC issues were properly noted as qualified in lab reports and EDDs.

PATHOGEN INDICATORS

Assess whether water toxicity sampling and testing was performed at the required number of sites during the dry season. Assess whether all QA/QC measures listed in the QAPP were met, as specified in RMC QAPP Appendix A: Measurement Quality Objectives for RMC Analytes. Check whether all data affected by lab QA/QC issues were properly noted as qualified in lab reports and EDDs.

References

BASMAA. 2014. BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Prepared for Bay Area Stormwater Management Agencies Association. Version 2, January 2014.

Fetscher, A.E., L. Busse, and P. R. Ode. 2009. Standard Operating Procedures for Collecting Stream Algae Samples and Associated Physical Habitat and Chemical Data for Ambient Bioassessments in California. California State Water Resources Control Board

Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 002.

MPSL-DFG Field Sampling Team, 2007. Standard Operating Procedures (SOPs) for Conducting Field Measurements and Field Collections of Water and Bed Sediment Samples in SWAMP. Version 1.0. October 15, 2007.

Ode, P.R., 2007. Standard Operating Procedures for Collecting Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California. California State Water Resources Control Board Surface Water Ambient Monitoring Program (SWAMP) Bioassessment SOP 001.

Attachment 1 – RMC Monitoring Component QA/QC Evaluation Checklist

RMC Monitoring Component QA/QC Evaluation Checklist

Program: _____

Year: _____

Monitoring Component: _____

Evaluator: _____

Activity	Date	Comment
Pre-sampling training / calibration exercises		
Readiness review		
Equipment calibration		
In-field audit		
Review field datasheets		
Post-sampling event report		
10% data entry check		
Lab data review, manual		
Lab EDD manipulations (i.e., for FBs and FDs)		
Lab data review, automated		
Corrective actions taken		
Data storage		

Attachment 2 - Tests performed by the RMC Database QA/QC Testing Tool

Tests performed by the RMC Database QA/QC Testing Tool (with MRQs)

Water, Sediment, and Tissue Chemistry Testing

Conventional Analytes in Water

- Continuing Calibration Verification Percent Recovery (80-120%)
- Laboratory Blank less than RL for Target Analyte
- Reference Material Percent Recovery (80-120%)
- Matrix Spike Percent Recovery (80-120%)
- Matrix Spike Duplicate Percent Recovery (80-120%)
- Matrix Spike Duplicate Relative Percent Difference (0-25%)
- Laboratory Duplicate Relative Percent Difference (0-25%)
- Field Duplicate Relative Percent Difference (0-25%)
- Field, Travel, and Equipment Blanks less than RL for Target Analyte

Conventional Analytes in Water (Solids)

- Laboratory Blank less than RL for Target Analyte
- Laboratory Duplicate Relative Percent Difference (0-25%)
- Field Duplicate Relative Percent Difference (0-25%)
- Field, Travel, and Equipment Blanks less than RL for Target Analyte

Conventional Analytes in Water (Pathogens)

- Reference Material Percent Recovery (80-120%)
- Field Duplicate Relative Percent Difference (0-25%)
- Field, Travel, and Equipment Blanks less than RL for Target Analyte

Conventional Analytes in Sediment

- Continuing Calibration Verification Percent Recovery (80-120%)
- Laboratory Blank less than RL for Target Analyte
- Reference Material Percent Recovery (80-120%)
- Laboratory Duplicate Relative Percent Difference (0-25%)
- Field Duplicate Relative Percent Difference (0-25%)
- Field, Travel, and Equipment Blanks less than RL for Target Analyte

Inorganic Analytes in Water (Bioassessment Sites)

- Continuing Calibration Verification Percent Recovery (80-120%)
- Laboratory Blank less than RL for Target Analyte
- Reference Material Percent Recovery (75-125%, 70-130% for Hg)
- Matrix Spike Percent Recovery (75-125%, 70-130% for Hg)
- Matrix Spike Duplicate Percent Recovery (75-125%, 70-130% for Hg)
- Matrix Spike Duplicate Relative Percent Difference (0-25%)
- Laboratory Duplicate Relative Percent Difference (0-25%)
- Field Duplicate Relative Percent Difference (0-25%)
- Field, Travel, and Equipment Blanks less than RL for Target Analyte

Inorganic Analytes in Sediment

- Continuing Calibration Verification Percent Recovery (80-120%)
- Laboratory Blank less than RL for Target Analyte
- Reference Material Percent Recovery (75-125%, 70-130% for Hg)
- Matrix Spike Percent Recovery (75-125%, 70-130% for Hg)

- Matrix Spike Duplicate Percent Recovery (75-125%, 70-130% for Hg)
- Matrix Spike Duplicate Relative Percent Difference (0-25%)
- Laboratory Duplicate Relative Percent Difference (0-25%)
- Field Duplicate Relative Percent Difference (0-25%)
- Field, Travel, and Equipment Blanks less than RL for Target Analyte

Synthetic Organic Analytes in Water, Sediment, and Tissue

- Continuing Calibration Verification Percent Recovery - Water (85-115%)
- Continuing Calibration Verification Percent Recovery - Sediment (85-115%)
- Continuing Calibration Verification Percent Recovery - Tissue (85-115%)
- Laboratory Blank less than RL for Target Analyte
- Reference Material Percent Recovery (50-150% if certified, 70-130% if uncertified)
- Matrix Spike Percent Recovery (50-150%)
- Matrix Spike Duplicate Relative Percent Difference (0-25%)
- Laboratory Duplicate Relative Percent Difference - Water (0-25%)
- Laboratory Duplicate Relative Percent Difference - Sediments (0-Method Limit)
- Laboratory Duplicate Relative Percent Difference - Tissue (0-Method Limit)
- Field Duplicate Relative Percent Difference - Water (0-Method Limit)
- Field Duplicate Relative Percent Difference - Sediment (0-Method Limit)
- Field Duplicate Relative Percent Difference - Tissue (0-Method Limit)
- Field, Travel, and Equipment Blanks less than RL for Target Analyte

Toxicity Testing

General Toxicity - Laboratory Control Water [1,2]

- Laboratory Control Water Alkalinity - *Pimphales promelas* (57-64 mg/l)
- Laboratory Control Water Conductivity - *Pimphales promelas* (285-340 µS/cm)
- Laboratory Control Water Hardness - *Pimphales promelas* (80-100 mg/l)
- Laboratory Control Water pH - *Pimphales promelas* (7.4-8.3)
- Laboratory Control Water Alkalinity - *Ceriodaphnia dubia* (70-75 mg/l)
- Laboratory Control Water Conductivity - *Ceriodaphnia dubia* (330-370 µS/cm)
- Laboratory Control Water Hardness - *Ceriodaphnia dubia* (85-95 mg/l)
- Laboratory Control Water pH - *Ceriodaphnia dubia* (8.2-8.39)
- Laboratory Control Water Alkalinity - *Hyalella azteca* (45-55 mg/l)
- Laboratory Control Water Conductivity - *Hyalella azteca* (380-420 µS/cm)
- Laboratory Control Water Hardness - *Hyalella azteca* (115-135 mg/l)
- Laboratory Control Water pH - *Hyalella azteca* (7.9-8.2)
- Additional Control Water Sample Statistical Testing (t-test p>=0.05)

96-hour *Selenastrum capricornutum* Chronic Aquatic Toxicity

- Test Acceptability - Control Mean Cell Density (>=1000000 cells/ml)
- Test Acceptability - Control Mean Cell Density Variability (Coef. of Var. <20)
- Performance Criterion - Minimum Significant Difference (<29)
- Initial Dissolved Oxygen Range (4.0-8.6 mg/l) [2]
- Initial pH Range (6-9) [2]
- Initial Conductivity Range (100-2000 µS/cm) [2]

7-day *Pimphales promelas* Acute and Chronic Toxicity

- Test Acceptability - Percent Survival in Controls (80-100%)
- Test Acceptability - Average Dry Weight in Controls (>=0.25 mg/ind)

- Performance Criterion - Minimum Significant Difference (<30)
- Initial Dissolved Oxygen Range (4.0-8.6 mg/l) [2]
- Initial pH Range (6-9) [2]
- Initial Conductivity Range (100-2500 µS/cm) [2]

Ceriodaphnia dubia Acute and Chronic Aquatic Toxicity

- Test Acceptability - Percent Survival in Controls (80-100%)
- Test Acceptability - Average Young per Female in Controls (>=15 number/replicate)
- Performance Criterion - Minimum Significant Difference (<47)
- Initial Dissolved Oxygen Range (4.0-8.6 mg/l) [2]
- Initial pH Range (6-9) [2]
- Initial Conductivity Range (100-2000 µS/cm) [2]

10-day *Hyalella azteca* Acute Aquatic Toxicity

- Test Acceptability - Percent Survival in Controls (90-100%)
- Initial Dissolved Oxygen Range (4.7-8.92 mg/l) [2]
- Initial pH Range (6-9) [2]
- Initial Conductivity Range (100-2000 µS/cm) [2]

10-day *Hyalella azteca* Acute Sediment Toxicity

- Test Acceptability - Percent Survival in Controls (80-100%)
- Initial Dissolved Oxygen Range (4.7-8.92 mg/l) [2]
- Initial pH Range (6-9) [2]
- Initial Conductivity Range (100-2000 µS/cm) [2]

Notes:
[1] There are no EPA recommended ranges for laboratory control water for *Selenastrum capricornutum*.
[2] These are EPA recommended ranges.

STANDARD OPERATING PROCEDURES
for
Reports to RMC Program Managers
(SOP R-1)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This SOP is part of the RMC's regional coordination effort.

MRP Requirements from Table 8.1

This SOP applies to the following activities from MRP Table 8.1:

Biological Assessment
General Water Quality
Chlorine
Temperature
Toxicity – Water Column
Toxicity – Bedded Sediment, Fine-Grained
Pollutants – Bedded Sediment, Fine-grained
Pathogen Indicators
Stream Surveys

SOP Background and Application

Consistent with the RMC programmatic QAPP (reference) and in order to ensure SWAMP comparability, RMC participants must prepare and submit a number of reports to management. These reports can be separated into two main categories: (1) reports prepared for internal use in assessing compliance with the QAPP, and (2) reports prepared for submittal to the Water Board that reports results of specific monitoring activities. This SOP details reports prepared as part of the former.

References to Existing SOPs

QA/QC protocols are also referenced in the associated RMC QAPP for bioassessment and water quality monitoring: **BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan, version 2, January 2014 (BASMAA 2014).**

Special Cautions and Considerations; Health and Safety

None

Methods / Procedures

There are three main types of reports prepared that fall within the category of internal reports: (1) readiness reviews, (2) post sampling event reports, and (3) field activity audits.

READINESS REVIEWS

MCLs will review all field equipment, instruments, containers, and paperwork to ensure that everything is ready prior to each sampling event. All sampling personnel will be given a brief review of the goals and objectives of the sampling event and the sampling procedures and equipment that will be used to achieve them. All equipment will be checked to make sure that it is in proper working order. Equipment maintenance records will be checked to ensure that all field instruments have been properly maintained and that they are ready for use. Adequate supplies of all preservatives, bottles, labels, waterproof pens, etc. will be checked before each field event to make sure that there are sufficient supplies to successfully support each sampling event, and, as applicable, are within their expiration dates.

In the event that a problem is discovered during a readiness review it will be noted in the field log book and corrected before the field crew is deployed. The actions taken to correct the problem will also be documented with the problem in the field log book. This information will be communicated by the MCL to the LQAO and PML prior to conducting relevant sampling. The LQAO will track corrective actions taken, and as appropriate, communicate this information to the RMC Workgroup or other Stormwater Programs for whom it may be relevant. Readiness review templates associated with each monitoring activity are compiled in Attachment 1.

POST SAMPLING EVENT REPORTS

MCLs will be responsible for post sampling event reviews. Any problems that are noted will be documented along with recommendations for correcting the problem. Post sampling event reviews will be conducted following each sampling event in order to ensure that all information is complete and any deviations from planned methodologies are documented. Post sampling event reviews will include field sampling activities and field measurement documentation in order to help ensure that all information is complete. The results of each post event sampling report will be used to identify areas that may be improved prior to the next sampling event. A combined post sampling event report, identifying any deficiencies and corrective actions taken, will be an integral part of the final report on this proposed project. A template for preparation of post sampling event reports is presented in Attachment 2.

FIELD ACTIVITY AUDITS

Field activity audits will assess the sample collection methodologies, field measurement procedures, and record keeping of the field crew in order to ensure that the activities are being conducted as planned and as documented in this QA Plan. In the event that a problem is discovered during a field audit, it will be corrected as soon as possible so that all subsequent samples and field measurements collected are valid. The problems and the actions taken to correct them will become a part of the field audit report. Any field sampling team member has authority to stop any sampling or field measurement activity that could potentially compromise data quality.

Due to the specialized nature of bioassessment work being performed, it is anticipated that CDFW will be responsible for conduct of field activity audits. At least one month prior to initiation of field bioassessments, the MCC will notify CDFW of the planned monitoring activities, and as requested, will coordinate activities with audit staff availability. The standard field audit form used by CDFW, 2010 revision, is included as Attachment 3. Although field activity audits will not be performed by RMC personnel, review of the standard audit form is recommended for all field crews performing bioassessment work.

Each LQAO will be responsible for performance of field activity audits for targeted creek status monitoring components. This will again be performed on at least a biennial basis for individual field crews. The audit results will be delivered to the PML. A template for use with the audits is provided in Attachment 4.

Quality Assurance / Quality Control

Readiness reviews are one tool to be employed by local programs to ensure that all monitoring is conducted in an efficient, SWAMP comparable manner consistent with the programmatic QAPP. Questions or findings raised about procedures implemented at the local level are communicated to LQAO for discussion and resolution. In this way, the three required internal reports form part of a feedback loop between local programs and central RMC organization to communicate and resolve local issues throughout the program in a consistent, SWAMP comparable fashion.

References

BASMAA. 2014. BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Prepared for Bay Area Stormwater Management Agencies Association. Version 2, January 2014.

Attachment 1 – Template for RMC Readiness Reviews

RMC Creek Status Monitoring Readiness Review

LOCAL PROGRAM _____

FIELD TEAM _____

SAMPLING EVENT _____

DATE _____

PARTICIPANTS _____

ITEM	Y	N	N/A	COMMENTS
MOBILIZATION				
Objectives – verify objectives of sampling event				
Notifications – ensure laboratories are provided sufficient notifications (e.g., 48 hrs for toxicity)				
Sampling procedures – review procedures to be implemented				
Sampling Order – discuss sampling order				
Quality Assurance – discuss possible points of error that would jeopardize results				
Paperwork – verify field crews have proper paperwork (SAP, SOP(s), permits, maps, datasheets, COCs, etc.)				
Equipment Availability – verify all required equipment is mobilized				
Eqpt Maintenance – verify equipment is in good working order				
Eqpt Calibration – verify equipment has been calibrated / is in calibration				
Sample Containers – verify appropriate sampling containers (type and quantity) have been mobilized				
Sample Handling – review relevant hold times and handling procedures				
Decontamination – verify all PPE to be used is appropriately decontaminated against invasive species				
Housekeeping – review any safety and housekeeping considerations				

ADDITIONAL COMMENTS

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FOLLOW-UP REQUIRED

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CONDUCTED BY:

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SIGNATURE **DATE**

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NAME

Attachment 2 – Template for RMC Post Event Sampling Reports

RMC Creek Status Monitoring

Post-event Sampling Report

LOCAL PROGRAM _____

MONITORING ACTIVITY _____

FIELD TEAM _____

DATE _____

ITEM	Y	N	N/A	COMMENTS
MOBILIZATION				
Readiness Review – was a readiness review conducted				
Equipment – was the appropriate equipment available in the field, in good working order and calibrated				
Paperwork – was all required paperwork (e.g., datasheets, SOPs, permits, maps, etc.) on-hand				
Decontamination – did the field crew previously decontaminate all equipment, including boots and waders for invasive species				
MONITORING				
Equipment – were there any problems with equipment				
Sample Containers – were the appropriate containers used for the analyses				
Labeling of Samples – were the sample containers labeled according to the SOP and legible				
Sample Handling – were appropriate sample handling techniques employed, consistent with SOP and QAPP				
Photo-Documentation – did the field crew properly record the photo code for all photographs				
Quality Assurance – were there any quality assurance concerns of field crew?				
POST SAMPLING ACTIVITIES				
Sample Handling – were samples transferred to the laboratory in a manner consistent with SOPs and QAPP				
Sampling Team Debriefing – did the field team meet to discuss the post sampling activities and responsibilities				

ITEM	Y	N	N/A	COMMENTS
Field Data Sheets – did the field crew completely and correctly fill out the field forms				
Verification and Agreement – did the field crew resolve all data disputes and discrepancies or record questions to be resolved later				
Chain of Custody Form – was a COC form used correctly				
Aquatic Invasive Species Decontamination – was the equipment, including boots and waders, decontaminated according to the field crew's SOP				
Follow-up – are there any issues that need to be communicated to LQAO and PML				

ADDITIONAL COMMENTS

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FOLLOW-UP REQUIRED

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PREPARED BY:

_____ _____

SIGNATURE **DATE**

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NAME

Attachment 3 – Template for RMC Field Activity Audits, Bioassessment

Revision Date: July 2010

2010 SWAMP Bioassessment Procedure
Biological and Physical Habitat Field Audit

Field Team:_____

Field Location:_____

Date of Audit:_____

Background of Group and Audit Objectives:

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Item	Y	N	N/A	Comments
Field Day and Sampling Site Preparations				
Sampling Team Briefing – did the field crew meet to discuss the project objectives, field conditions, safety procedures and any special situation associated with the site				
Quality Assurance Project Plan – was the field crew familiar with the project QAPP and the assigned QA Officer				
Permits – did the field crew have copies of DFG sampling MOU and LAI				
Permits – did the field crew have a copy of the landowner permission letter				
SOP – did the field crew have a copy of the most recent SWAMP Bioassessment Protocol				

SOP – did the field crew have a project specific SOP which lines out the assignments for all crew members				
SOP – did the field crew have a system for adding, updating, and retiring the SOP, as necessary				
Equipment Inspection – did the field crew ensure that all the field equipment was present and in working order				
Equipment Calibration – did the field crew ensure that all equipment was calibrated according to SOPs and/or manufacturer instructions				
Field Data Sheets – did the field crew have the most recent copy of the SWAMP Bioassessment Field Forms				
Reach Documentation – did the field crew fill in this section of the field forms before starting the actual field work				
Reach Documentation – did the field crew determine the Latitude and Longitude at the proper reach location and record the proper units and type of device use				
Reach Documentation – did the field crew get SWAMP site codes from the Regional SWAMP coordinator				
Reach Length – did the field crew determine the average stream width, decide the reach length according to the SOP and record any discrepancies from the required reach length				
Notable Field Conditions – did the field crew check the appropriate boxes and if necessary obtain the information from outside the reach area				
Decontamination – did the field crew previously decontaminate all equipment, including boots and waders for Aquatic Invasive Species (AIS)				

Describe the Field Team Coordination (number of field personnel, how data is recorded, how the data collection is split among field personnel, how disputes or uncertainties in the data collection are dealt with, etc.):

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Item	Y	N	N/A	Comments
Ambient Water Quality Measurements				
Temperature – did the field crew measure the water temperature at the A transect and record the type of equipment used				
pH – did the field crew measure the pH at the A transect and record the type of equipment used				
Alkalinity – did the field crew measure the alkalinity at the A transect and record the type of equipment used				
Dissolved Oxygen – did the field crew measure DO at the A transect and record the type of equipment used				
Specific Conductance – did the field crew measure conductivity at the A transect and record the type of equipment used				
Equipment – when using colorimetric kits, did the field crew inspect the reagents for expiration dates				
Additional Chemical Measures – when collecting samples for additional chemicals, did the field crew have a copy of the appropriate SWAMP SOP				
Holding Times – was the field crew aware of all appropriate holding times for the additional chemical measures				

Item	Y	N	N/A	Comments
Invertebrate Collection - Reach Wide Benthos Procedure				
Collection Location – did the field crew member properly determine where the net should be placed in relation to the transect				
Net Placement – did the field crew member place the sampling net correctly in the substrate and perpendicular to flow				
Substrate Excavation – did the field crew member adequately disturb and scrub the substrate to collect the invertebrates				
Substrate Excavation Duration – did the field crew member disturb the substrate for a consistent duration (1-3 minutes) and in accordance with the type of substrate				
Substrate Excavation Depth – did the field crew member excavate the substrate to a depth (4-6 inches) adequate to collect all the invertebrates				
Excavated Material Cleaning – did the field crew member take precautions that no invertebrates were lost when removing large material from the net				
Handling of Excavated Material – did the field crew member take precautions that no invertebrates were lost when transporting the net between collection locations				
Compositing of Excavated Material – did the field crew member take precautions that no excavated material was lost when compositing and placing material in jars				
Labeling of Samples – were the invertebrate collection jars labeled according to the SOP				
Collection of Duplicates – when collecting duplicate samples, did the field crew member determine the proper location and ensure the samples were not cross-contaminated				
Sample Integrity – were the sample jars kept out of direct sunlight, away from heat, and protected from desiccation during sampling, sample processing and sample storage				

Item	Y	N	N/A	Comments
Reach-Wide Physical/Habitat Measurements				
Discharge Measurements – when using the Velocity Area Method or Buoyant Object Method (circle one), did the field crew choose an appropriate channel section and record all required measurements				
Additional Cobble Embeddedness Measurements – did the field crew record any additional cobble embeddedness measures to equal a total of 25 and was a random method used to obtain the cobbles				
Slope and Bearing – did the field crew use an auto-level for low gradient channels or a clinometer for high gradient channels and record information for each transect starting at K				
Slope and Bearing – did the field crew record the bearing in degrees on the center of the transect starting at K				
Slope and Bearing – did the field crew understand how and when to use the Supplemental Segment section of the form				
Channel Alteration Visual – did the field crew assess channel alteration for the entire reach and discuss the assessment to come to an agreement on the final estimate				
Sediment Deposition Visual – did the field crew assess sediment deposition for the depositional zones of the entire reach and discuss the assessment to come to an agreement on the final estimate				
Epifaunal Substrate/Cover Visual – did the field crew assess epifuanual substrate/cover for the entire reach and discuss the assessment to come to an agreement on the final estimate				

Item	Y	N	N/A	Comments
Transect Based Physical/Habitat Measurements				
Wetted Width – did the field crew determine the wetted width measurement accurately				
Bankfull Width and Height – did the field crew determine the bankfull width and height measurement accurately				
Depth and Substrate Measurements – did the field crew measure the depth and pick up the substrate in a systematic, unbiased manure				
Transect Substrate Measurements – did the field crew measure the substrate particle properly and use the correct size class categories				
Cobble Embeddedness – did the field crew recognize cobble sized substrate and determine the percent embeddedness accurately				
CPOM – did the field crew recognize the correct material and location in relation to the substrate				
Microalgae Thickness – was the field crew able to determine microalgae presence and correct thickness code				
Macroalgae – was the field crew able to determine the difference between attached and unattached macroalgae presence				
Canopy Cover – was the field crew able to properly use the modified densiometer and obtaining measurements correctly				
Bank Stability – did the field crew estimate the bank stability categories properly and for the correct bank zone				
Riparian Vegetation – did the field crew understand and properly estimate the three canopy categories for the correct area and elevation zones				
Instream Habitat Complexity – did the field crew understand and properly estimate the nine habitat categories for the correct channel area				
Human Influence– did the field crew understand and properly estimate the fourteen human influence categories for the correct zones relative to the channel				

Inter-Transect Substrate Measurements – did the field crew collect all the measurement similar to the major transects				
Flow Habitats – did the field crew recognize all the flow habitat categories and the definition of fast/slow and shallow/deep				
Photo-Documentation – did the field crew take photographs at the A, F and K transect and in the proper orientation to the channel				
Photo-Documentation – did the field crew properly record the photo code for all photographs including any supplemental pictures of the sampling reach				

Item	Y	N	N/A	Comments
Post Sampling Activities				
Sampling Team Debriefing – did the field team meet to discuss the post sampling activities and responsibilities				
Field Data Sheets – did the field crew completely and correctly fill out the field forms				
Verification and Agreement – did the field crew resolve all data disputes and discrepancies or record questions to be resolved later by the ABL				
Invertebrate Sample Integrity – were the invertebrate samples inspected for proper alcohol level, labels and secured for travel				
Chain of Custody Form – was a COC form used for invertebrates samples and was it properly filled out				
Additional Chemical Measures – if samples were collected for additional chemicals, did the field crew ensure the samples were labeled and stored properly for transportation to the Lab according to the appropriate SOP				
Equipment Count – did the field crew account for all the equipment				
Aquatic Invasive Species Decontamination – was the equipment, including boots and waders, decontaminated according to the field crew's SOP				

I CERTIFY THAT THIS FIELD TEAM HAS ADEQUATELY FULLFILLED ALL REQUIRMENTS OF THE FIELD AUDIT FOR THE SWAMP BIOASSESSMENT PROCEDURE

_____

James M. Harrington
Staff Environmental Scientist
California Department of Fish and Game

COMMENTS:

Attachment 4 – Template for RMC Field Activity Audits, Targeted Sampling

RMC Creek Status Monitoring

Sampling Field Audit

LOCAL PROGRAM _____

FIELD TEAM _____

AUDIT LOCATION _____

DATE _____

AUDITOR _____

BACKGROUND AND OBJECTIVES OF AUDIT _____

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ITEM	Y	N	N/A	COMMENTS
MOBILIZATION				
Sampling Team Briefing – did the field crew meet to discuss the project objectives, field conditions, safety procedures and any special situation associated with the site				
Quality Assurance Project Plan – was the field crew familiar with the project QAPP				
SOP – did the field crew have a copy of the most current SOP				
Equipment Inspection – did the field crew ensure that all required field equipment was present, calibrated, and in working order				
Field Data Sheets – did the field crew have the most recent copy of the field forms				
Decontamination – did the field crew previously decontaminate all equipment, including boots and waders for invasive species				
MONITORING				
Sampling Order – did the field crew conduct monitoring activities in the appropriate order				
Equipment – did the field crew use appropriate equipment for collection of samples / measurements				
Sample Containers – were the appropriate containers used for the analyses				
Labeling of Samples – were the sample containers labeled according to the SOP				

ITEM	Y	N	N/A	COMMENTS
Holding Times – was the field crew aware of all appropriate holding times for the additional chemical measures				
Sample Integrity – were the sample jars kept out of direct sunlight, away from heat, and protected from desiccation during sampling, sample processing and sample storage				
Photo-Documentation – did the field crew properly record the photo code for all photographs				
Housekeeping – did the field crew conduct sampling in a manner to minimize disruption to natural environment				
POST SAMPLING ACTIVITIES				
Sampling Team Debriefing – did the field team meet to discuss the post sampling activities and responsibilities				
Field Data Sheets – did the field crew completely and correctly fill out the field forms				
Verification and Agreement – did the field crew resolve all data disputes and discrepancies or record questions to be resolved later				
Chain of Custody Form – was a COC form used correctly				
Aquatic Invasive Species Decontamination – was the equipment, including boots and waders, decontaminated according to the field crew's SOP				

ADDITIONAL COMMENTS

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CONDUCTED BY:

_____ _____

SIGNATURE **DATE**

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NAME

STANDARD OPERATING PROCEDURES
for
Reports to RWQCB
(SOP R-2)

Introduction

The Municipal Regional Stormwater NPDES Permit (MRP) was adopted by the San Francisco Bay Regional Water Quality Control Board on October 14, 2009. The Regional Monitoring Coalition (RMC) provides coordination and oversight of monitoring activities conducted in compliance with Provision C.8 (Water Quality Monitoring) of the MRP. The RMC is comprised of those Bay Area Stormwater Management Agencies Association (BASMAA) participants subject to monitoring requirements in the MRP. This SOP is part of the RMC's regional coordination effort.

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This SOP applies to the following activities from MRP Table 8.1:

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Chlorine
Temperature
Toxicity – Water Column
Toxicity – Bedded Sediment, Fine-Grained
Pollutants – Bedded Sediment, Fine-grained
Pathogen Indicators
Stream Surveys

SOP Background and Application

Consistent with the RMC programmatic QAPP (reference) and in order to ensure SWAMP comparability, RMC participants must prepare and submit a number of reports to management. These reports can be separated into two main categories: (1) reports prepared for internal use in assessing compliance with the QAPP, and (2) reports prepared for submittal to the Water Board that report results of specific monitoring activities (permit-related reports). This SOP details reports prepared as part of the latter.

References to Existing SOPs

This SOP is adapted from information provided in the MRP. Relevant QA/QC protocols are also referenced in the associated RMC QAPP for bioassessment and water quality monitoring: **BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan**, version 2, January 2014 (BASMAA 2014).

Special Cautions and Considerations; Health and Safety

None

Methods / Procedures

There are four main types of reports prepared that fall within the category of permit-related reports: (1) Water Quality Standard Exceedance Reports, (2) Status and Trend Electronic Data Reports, (3) Urban Creeks Monitoring Report, and (4) Integrated Monitoring Report. Each of these reports are summarized in the sections below, and described in more detail within MRP Section C.8.g (SFRWQCB, 2009). The standard content for each report is described as follows:

- The purpose of the monitoring and briefly describe the study design rationale.
- Quality Assurance/Quality Control summaries for sample collection and analytical methods, including a discussion of any limitations of the data.
- Brief descriptions of sampling protocols and analytical methods.
- Sample location description, including waterbody name and segment and latitude and longitude coordinates.
- Sample ID, collection date (and time if relevant), media (e.g., water, filtered water, bed sediment, tissue).
- Concentrations detected, measurement units, and detection limits.
- Permittees who do not participate in the Regional Monitoring Group or in a stormwater countywide program must submit an individual Integrated Receiving Water Impacts Report.
- Assessment, analysis, and interpretation of the data for each monitoring program component.
- Pollutant load and concentration at each mass emissions station.
- A listing of volunteer and other non-Permittee entities whose data are included in the report.
- Assessment of compliance with applicable water quality standards.
- A signed certification statement.

WATER QUALITY STANDARD EXCEEDENCE REPORT

If RMC data indicate that discharges are causing or contributing to an exceedance of an applicable water quality standard (WQS), the applicable PML shall notify the Water Board within 30 days and submit a follow-up report. The report shall describe BMPs that are currently being implemented, and the current level of implementation, and additional BMPs that will be implemented, and/or an increased level of implementation, to prevent or reduce the discharge of pollutants that are causing or contributing to the exceedance of WQSs. The report shall constitute a request to the Water Board for amendment of the MRP. The report and application for amendment shall include an implementation schedule.

STATUS AND TRENDS ELECTRONIC DATA REPORT

The CIMC shall submit an Status and Trends Electronic Data Report to the Water Board no later than January 15 of each year, reporting on all data collected during the foregoing October 1–September 30 period. These reports shall be in a format compatible with the SWAMP database, as described within SOP DM-1 (Field Measurement Data Management), DM-2 (Continuous Monitoring Data Management),

and DM-3 (Lab Data Management). Water Quality Objective exceedances shall be highlighted in the Report.

Electronic data shall also be submitted during the same timeframe to SFEI for entry into the California Environmental Data Exchange Network (CEDEN).

URBAN CREEKS MONITORING REPORT

The RP shall prepare and submit a comprehensive Urban Creeks Monitoring Report no later than March 15th of each year, reporting on all data collected during the preceding October 1st through September 30th period. The initial report is due March 15, 2013. Each report shall contain summaries Status, Long-Term, Monitoring Projects, and Pollutants of Concern Monitoring including, as appropriate, the following:

- Maps and descriptions of all monitoring locations;
- Data tables and graphical data summaries; Constituents that exceed applicable water quality standards shall be highlighted;
- For all data, a statement of the data quality;
- An analysis of the data, which shall include the following:
- Calculations of biological metrics and physical habitat endpoints;
- Comparison of biological metrics to: (1) each other, (2) applicable reference sites, (3) applicable IBIs, and (4) physical habitat endpoints.
- A discussion of the data for each monitoring program component, which shall: (1) discuss monitoring data relative to prior conditions, beneficial uses and applicable water quality standards as described in the Basin Plan, the Ocean Plan, or the California Toxics Rule or other applicable water quality control plans; (2) where appropriate, develop hypotheses to investigate regarding pollutant sources, trends, and BMP effectiveness; (3) identify and prioritize water quality problems; (4) identify potential sources of water quality problems; (5) describe follow-up actions; (6) evaluate the effectiveness of existing control measures, and (7) identify management actions needed to address water quality problems.

INTEGRATED MONITORING REPORT

No later than March 15, 2014, the RP shall be responsible for preparation and submittal of an Integrated Monitoring Report for the RMC. This report shall be in lieu of the Annual Urban Creeks Monitoring Report due on March 15, 2014.

The report shall include a comprehensive analysis of all data collected through the RMC, and may include other pertinent studies. For Pollutants of Concern, the report shall include methods, data, calculations, load estimates, and source estimates for each Pollutant of Concern Monitoring parameter. The report shall include a budget summary for each monitoring requirement and recommendations for future monitoring.

SCHEDULE

Table 1 – Schedule for Preparation of RMC Reports to Water Board

Type of Report	Frequency	Projected Delivery Dates(s)	Person Responsible	Report Recipients
WQ Exceedance	Trigger-based	Vary	PML	WB
S&T Electronic Data	Annually	January 15	CIMC	WB, SFEI
Urban Creeks Monitoring	Annually	March 15	RP	WB
Integrated Monitoring	End of permit	March 15, 2014	RP	WB

Quality Assurance / Quality Control

The measures adopted by the RMC to assure quality of data deliverables are described in detail in the following documents:

- RMC programmatic QAPP (reference when available)
- SOP DM-1 (Field Measurement Data Management)
- SOP DM-2 (Continuous Monitoring Data Management)
- SOP DM-3 (Lab Data Management)

All narrative reports prepared by the RMC or by local programs will be subject to an editorial review process wherein either the PM (for programmatic deliverables) or PML (for local stormwater program deliverables) performs an editorial review of draft materials provided by report preparer(s) and certifies validity of those deliverables.

References

BASMAA. 2014. BASMAA Regional Monitoring Coalition Creek Status Monitoring Program Quality Assurance Project Plan. Prepared for Bay Area Stormwater Management Agencies Association. Version 2, January 2014.

California Regional Water Quality Control Board San Francisco Bay Region, 2009. Municipal Regional Stormwater NPDES Permit Order R2-2009-0074 NPDES Permit No. CAS612008. October 14, 2009.