Appendix D
Field Monitoring and Analysis Guidance

1.0 Purpose of Document, Compliance Notification, and Limitations

The purpose of this guidance document is to assist dischargers subject to the General Permit. Dischargers who have questions about specific requirements of the General Permit, or this guidance document are advised to consult with the appropriate Regional Water Quality Control Board (RWQCB). Failure to comply with the General Permit can result in significant administrative, civil, and criminal penalties.

Users of this document should note the following:

- The scope of this document is limited to providing guidance on developing a Construction Site Monitoring Program (CSMP) required by the General Permit.
- The scope of this document is limited to traditional construction projects and does not address the monitoring requirements for Linear Underground/Overhead Projects (LUPs). While general information such as sampling techniques is transferrable, LUP operators should refer to Attachment A of the General Permit for details of the monitoring requirements.
- The purpose of this document is to provide general information to assist dischargers through the process of developing a CSMP. Sampling and analysis strategies must be site-specific for each individual project.
- This guidance document identifies the key elements of Active Treatment System (ATS) monitoring. Dischargers choosing to implement an ATS should work with the ATS provider to develop and implement a detailed ATS monitoring program tailored to the site specific ATS design.
- Bioassessment monitoring is covered briefly in the text of this guidance document. Additional details are provided in Appendix E of the handbook.
- Regulatory interpretations may change over time as a result of new information, new court cases, or new laws. Dischargers should consult with their regulators for current interpretations.
- RWQCBs and local agencies may require additional monitoring that is not addressed by this document. Dischargers should consult with the RWQCB and local agencies to determine if there are additional requirements.
- The sampling and analysis requirements of General Permit are governed by National Pollutant Discharge Elimination System (NPDES) regulations. These regulations and state regulations implementing the NPDES program contain significant requirements regarding quality assurance, quality control, qualifications of analytical laboratories, etc., which may not be explicitly addressed in this document. Consult with the NPDES regulations or RWQCB staff to determine any additional requirements.

- Compliance with this guidance document does not automatically equate to compliance with the General Permit.

1.1 Structure of Document

This document is organized to assist a discharger through the process of developing a site-specific CSMP and provides tools to assist the discharger conducting monitoring. Table D-1 provides a quick reference to the sections of the document.

A CSMP outline is included in the annotated Stormwater Pollution Prevention Plan (SWPPP) outline in Appendix B of this handbook.

Table D-1 Quick Section Reference

Topic	Section
Traditional construction site monitoring	3
Active treatment system monitoring	4
Quality assurance/quality control	5
Reporting and records retention	6
Guidance on field measurements	7
Example data collection forms	8

2.0 Summary of Construction Site Monitoring Requirements and Purpose of Monitoring

The General Permit requires that all construction projects develop and implement a site-specific CSMP. The CSMP must include the monitoring procedures and instructions, location maps, forms, and checklists necessary to implement the visual and water quality monitoring required for the site. The CSMP is developed prior to the start of construction activities and is part of the SWPPP. Like the SWPPP, the CSMP may need to be revised to reflect and adapt to changes in the project.

2.1 Types of Monitoring Required by the General Permit

The General Permit requires the following types of monitoring:

- Visual inspections of Best Management Practices (BMPs);
- Visual monitoring of the site related to qualifying storm events;
- Visual monitoring of the site for non-stormwater discharges;
- Sampling and analysis of construction site runoff;
- Sampling and analysis of receiving waters;
- Sampling and analysis of non-stormwater discharges;
- Bioassessment monitoring of receiving waters;
- Sampling and analysis of ATS operations; and
- Soil particle size analysis.

The specific monitoring required for each construction site depends upon the project risk level, project size, BMPs implemented and effluent quality. Tables D-2, D-3, and D-4 summarize the monitoring requirements by risk level.

Table D-2 Summary of Risk Level 1 Monitoring Requirements

Type of Monitoring		When
Sampling & Analysis	Non-visible pollutants: spill/BMP failure based on pollutant source assessment	Within first two hours of discharge from site. Collect samples of runoff affected by the spilled or released material(s) and runoff that is unaffected by the spilled or released material(s).
	Particle size	When sediment basins are used. If needed to justify site specific sediment risk using the Revised Universal Soil Loss Equation (RUSLE).
	Other	RWQCB or Total Maximum Daily Loads (TMDLs) may require other monitoring.
Visual Inspections	Non-stormwater inspection	Quarterly for each drainage area.
	Qualifying rain event: Pre-rain inspection	All drainage areas, BMPs, and stormwater containments within two business days of each qualifying rain event.
	Qualifying rain event: Post-rain inspection	All discharge locations within two business days after each qualifying rain event. Visually observe discharge of contained stormwater when discharged.
	During rain inspection	See BMP inspection below.
	BMP	Weekly and every 24 hours during extended storm events.

Table D-3 Summary of Risk Level 2 Monitoring

Type of Monitoring		When
Sampling & Analysis	Effluent sampling: Turbidity	Collect a minimum of three samples per day. Collect samples at all discharge locations. Collect runoff samples representative of site discharges.
	Effluent sampling: pH	Only during construction phases with high risk of pH altering discharge. Collect a minimum of three samples per day. Collect samples at all discharge locations affected by potential pH altering activities. Collect runoff samples representative of site discharges.
	Non-visible pollutants: spill/BMP failure based on pollutant source assessment	Within first two hours of discharge from site. Collect samples of runoff affected by the spilled or released material(s) and runoff unaffected by the spilled or released material(s).
	Contained rain water	At time of discharge.
	Non-stormwater	At locations where discharged off the site.
	Particle size	When sediment basins are used. If needed to justify site specific sediment risk using RUSLE.
	Other	RWQCB or TMDLs may require other monitoring.
Visual Inspections	Non-stormwater inspection	Quarterly for each drainage area.
	Qualifying rain event: Pre-rain inspection	All drainage areas, BMPs, and stormwater containments within two business days of each qualifying rain event.
	Qualifying rain event: Post-rain inspection	All discharge locations within two business days after each qualifying rain event. Visually observe discharge of contained stormwater when discharged.
	During rain inspection	See BMP inspection below.
	BMP	Weekly and every 24 hours during extended storm events.

Table D-4 Summary of Risk Level 3 Monitoring

Type of Monitoring		When
Sampling & Analysis	Effluent sampling: pH, Turbidity	Collect a minimum of three samples per day. Collect samples at all discharge locations. Collect runoff samples representative of site discharges.
	Effluent sampling: pH	Only during construction phases with high risk of pH altering discharge. Collect a minimum of three samples per day. Collect samples at all discharge locations affected by potential pH altering activities. Collect runoff samples representative of site discharges.
	Non-visible pollutants: spill/BMP failure based on pollutant source assessment	Within first two hours of discharge from site. Collect samples of runoff affected by the spilled or released material(s) and runoff unaffected by the spilled or released material(s).
	Contained rain water	At time of discharge.
	Receiving water sampling	If a Receiving Water Monitoring Trigger is exceeded at a project that has a direct discharge to the receiving water, subsequently sample receiving water for turbidity and SSC (if turbidity Receiving Water Monitoring Trigger is exceeded), and pH (if pH Receiving Water Monitoring Trigger exceeded). Sample upstream and downstream of point of discharge in to receiving water.
	Bioassessment	Projects greater than 30 acres that directly discharge to wadeable stream. See Appendix E of the handbook for more information on bioassessment monitoring. Conduct monitoring up- and down-stream of point of runoff discharge into the receiving water. Conduct monitoring before start of construction activity and after completion.
	Non-stormwater	At locations where discharged off the site.
	Particle size	When sediment basins are used. If needed to justify site specific sediment risk using RUSLE.
	Other	RWQCB or TMDLs may require other monitoring.

Continued

Table D-4 Summary of Risk Level 3 Monitoring

Type of Monitoring		When
Visual Inspections	Non-stormwater inspection	Quarterly for each drainage area.
	Qualifying rain event: Pre-rain inspection	All drainage areas, BMPs, and stormwater containments within two business days of each qualifying rain event.
	Qualifying rain event: Post-rain inspection	All discharge locations within two business days after each qualifying rain event. Visually observe discharge of contained stormwater when discharged.
	During rain inspection	See BMP inspection below.
	BMP	Weekly and every 24 hours during extended storm events.

2.2 Purpose of the Construction Site Monitoring Program

The purpose of the CSMP is to address the following objectives:

- To demonstrate that the site is in compliance with the applicable discharge prohibitions, Numeric Action Levels (NALs);
- To determine whether non-visible pollutants are present at the construction site and are causing or contributing to exceedances of water quality objectives;
- To determine whether immediate corrective actions, additional BMP implementation, or SWPPP revisions are necessary to reduce pollutants in stormwater discharges and authorized non-stormwater discharges; and
- To determine whether BMPs included in the SWPPP and/or Rain Event Action Plan (REAP) are effective in preventing or reducing pollutants in stormwater discharges and authorized non-stormwater discharges.

2.3 Implementing a CSMP

The General Permit includes specific requirements regarding the implementation of SWPPPs and CSMPs. Each construction site must have a Qualified SWPPP Practitioner (QSP) to oversee the implementation of the CSMP including the BMP inspections, rain-event triggered inspections, and the collection of water quality samples. The QSP may delegate any or all of these activities to an employee trained to do the task(s) but the QSP must supervise the delegated tasks.

3.0 Traditional Construction Site Monitoring

The General Permit distinguishes between traditional construction projects and LUPs. This section addresses the requirements of traditional site monitoring (as identified in General Permit Attachments C, D, and E). While general information such as sampling techniques is transferrable, LUP operators should refer to General Permit Attachment A for details of the LUP monitoring requirements. Requirements specific to ATS, as identified in General Permit Attachment F, are addressed in Section 4 of this guidance document.

Monitoring at construction sites includes visual monitoring (inspections) and sampling and analysis. As noted in Section 2, monitoring requirements vary based on the project risk level.

3.1 Visual Monitoring (Inspection)

All sites (Risk Levels 1, 2, and 3) are required to conduct visual monitoring (inspections). Visual monitoring includes inspections of BMPs, inspections before and after qualifying rain events, and inspection for non-stormwater discharges. Visual inspections are required for the duration of the project with the goal of confirming that appropriately selected BMPs have been implemented, are being maintained, and are effective in preventing potential pollutants from coming in contact with stormwater.

3.1.1 BMP Inspections

The General Permit requires that BMPs be inspected weekly and once each 24-hour period during extended storm events. The purpose of these inspections is to identify BMPs that:

- Need maintenance to operate effectively;
- Failed; or
- Could fail to operate as intended.

If deficiencies are identified during BMP inspections, repairs or design changes to BMPs must be initiated within 72 hours of identification and need to be completed as soon as possible.

All BMP inspections must be documented on an inspection checklist. Check with the State Water Resources Control Board (SWRCB) or local RWQCB to see if they have a preferred inspection checklist to use as a template or guide for the BMP checklist. The checklist should be made site specific based on the BMPs and outfalls for each construction project, but at minimum the form should include:

- Inspection date and date the inspection report was written;
- Weather information, including presence or absence of precipitation, estimate of the beginning of qualifying storm event, duration of event, time elapsed since last storm, and approximate amount of rainfall in inches;
- Site information, including stage of construction, activities completed, and approximate area of the site exposed;
- A description of the BMPs evaluated and any deficiencies noted;
- If the construction site is safely accessible during inclement weather, list the observations of all BMPs: erosion controls, sediment controls, chemical and waste controls, and non-stormwater controls. Otherwise, list the results of visual inspections at all relevant outfalls, discharge points, downstream locations, and identify any projected maintenance activities;
- Report the presence of noticeable odors or any visible sheen on the surface of any dischargers;
- Any corrective actions required, including any necessary changes to the SWPPP and the associated implementation dates;
- Photographs taken during the inspection, if any; and
- Inspector's name, title, and signature.

An example Visual Inspection Field Log Sheet is included in Section 8.0 of this guidance document, and an electronic copy of the form (Microsoft Word®) can be downloaded from the CASQA BMP Handbook Portal at http://www.casqa.org. This form is suitable to document the basic information needed for BMP inspection, but must be supplemented with a site-specific BMP inspection checklist.

3.1.2 Qualifying Rain Event Inspections

The General Permit requires that the construction site be inspected within two days prior to a predicted qualifying rain event is and within two days after a qualifying rain event. These inspections are only required during normal business hours of the construction site.

The General Permit requires that dischargers only use weather forecasts from the National Oceanographic and Atmospheric Administration (NOAA). These forecasts can be obtained at http://www.srh.noaa.gov/.

> **Qualifying Rain Event**
>
> The General Permit defines a *qualifying rain event* as one that produces ½-inch or more of precipitation with a 48 hour or greater period between rain events.

Records must be kept of all qualifying rain event inspections. Records need to be maintained on site and document:

- Personnel performing the observations;
- Observation dates (time and date);
- Weather conditions (including the rain gauge reading for the qualifying rain event);
- Locations observed; and
- Corrective actions taken in response to observations.

An example of a Visual Inspection Field Log Sheet is included in Section 8.0 of this guidance document.

3.1.2.1 Pre-Rain Event Inspection

The purpose of the pre-rain event inspection is to make sure the site and the BMPs are ready for the predicted rain. The pre-rain event inspection needs to cover:

- All stormwater drainage areas to identify any spills, leaks, or uncontrolled pollutant sources;
- All BMPs to identify whether they have been properly implemented per the SWPPP and/or REAP;
- Stormwater storage and containment areas to detect leaks and ensure maintenance of adequate freeboard; and
- The presence or absence of floating and suspended materials, a sheen on the surface, discolorations, turbidity, odors, and source(s) of any observed pollutants within stored stormwater.

3.1.2.2 Post-Rain Event Inspection

The purpose of the post-rain event inspection is to observe the discharge locations and the discharge of any stored or contained rainwater; determine if BMPs functioned as designed; and identify if any additional BMPs are required. The post-rain event inspection needs to cover:

- All stormwater discharge locations;

- The discharge of stored or contained stormwater that is derived from and discharged subsequent to a qualifying rain event; and
- All BMPs to determine if they were adequately designed, implemented, and effective. After assessing BMPs it should be noted on the inspection form whether the BMPs need maintenance.

3.1.3 Non-Stormwater Discharges Inspections

The General Permit requires that construction sites, regardless of risk level, be inspected quarterly for the presence of non-stormwater discharges. Records must be kept of all inspections and must be maintained on site.

Non-stormwater discharge inspections are only required during normal business hours of the construction site. The purpose of these inspections is to detect unauthorized non-stormwater discharges and observe authorized non-stormwater discharges. Quarterly inspections need to include each drainage area of the project and document:

- Presence or indications of unauthorized and authorized non-stormwater discharges and their sources;
- Pollutant characteristics of the non-stormwater discharge (floating and suspended material, sheen, discoloration, turbidity, odor, etc;
- Personnel performing the observations;
- Dates and approximate time each drainage area and non-stormwater discharge was observed; and
- Response taken to observations.

If the site is Risk Level 2 or 3 and there are non-stormwater discharges, then samples must be collected and analyzed.

An example Visual Inspection Field Log Sheet is included in Section 8.0 of this guidance document.

3.2 Water Quality Sampling and Analysis Procedures

The purpose of sampling is to determine whether BMPs implemented on a construction site are effective in controlling potential construction site pollutants, which come in contact with stormwater or non-stormwater, and to demonstrate compliance with the applicable NALs.

This section discusses the procedures and the information that need to be included in the CSMP for water quality sampling and analysis. This section is divided into the following:

- Potential pollutant sources;
- Monitoring constituents by risk level;
- Sampling locations;
- Sample collection and handling; and
- Analytical methods, laboratories, and field meters.

Water quality sampling and analysis is required for all Risk Level 2 and 3 projects. Typically, Risk Level 1 projects are not required to conduct water quality sampling and analysis unless there is a risk of non-visible pollutant discharge.

3.2.1 Potential Pollutant Sources

3.2.1.1 Sediment and Turbidity

Conditions or areas at a construction site that may cause sediment, silt, and/or turbidity in site runoff include:

- Exposed soil areas with inadequate erosion control measures;
- Areas of active grading;
- Poorly stabilized slopes;
- Lack of perimeter sediment controls;
- Areas of concentrated flow on unprotected soils;
- Poorly maintained erosion and sediment control measures;
- Tracking sediment onto roads and paved surfaces;
- Unprotected soil stockpiles; and
- Failure of an erosion or sediment control measure.

3.2.1.2 pH Alterations

Conditions or areas at a construction site that may cause pH alterations in site discharges include:

- Concrete pours and curing;
- Acid washes;
- Concrete waste management areas;
- Soil amendments (e.g. fly ash and lime); and
- Mortar and stucco mixing, application, and waste management areas.

3.2.1.3 Non-Visible Pollutants

Monitoring for pollutants not visually detectable is only required if those pollutants are determined to be potentially present in stormwater leaving the construction site; and is typically the result of a BMP failure or spill on the construction site. This determination is documented in the pollutant source assessment in the SWPPP.

Projects should attempt to eliminate the exposure of construction materials to prevent stormwater pollution and limit sampling and analysis requirements. It is important to note that covered construction materials or those that are in their final constructed form, do not need to be monitored. Materials that are stored exposed to precipitation and may generate runoff need to be considered for non-visible pollutant monitoring.

Non-visible pollutants may also exist on the project site as a result of the land use prior to the start of the construction activity. To determine the potential of pollutants to exist on the construction site as a result of past land use activities, dischargers should review existing environmental and real estate documentation. Good sources of information on previously existing contamination and past land uses include, but are not limited to, the following:

- Initial Studies or Environmental Impact Reports (EIRs) prepared under the requirements of the California Environmental Quality Act (CEQA);

- Environmental Assessments or Environmental Impact Statements (EIS) prepared under the requirements of the National Environmental Policy Act (NEPA); and
- Phase I Assessments prepared for property transfers.

Non-visible pollutants in site discharges may result from materials that:

- Are being used in construction activities;
- Are stored on the construction site;
- Were spilled during construction operations and not cleaned up;
- Were stored (or used) in a manner that presented the potential for a release of the material during past land use activities;
- Were spilled during previous land use activities and not cleaned up; or
- Were applied to soil as part of past land use activities.

3.2.2 Monitoring Constituents by Risk Level

Risk Level 1

- Risk Level 1 projects are only required to collect water quality samples if there is a BMP breach, malfunction, leakage, or spill. Water quality samples should be taken for non-visible pollutants that may have been discharged from the site as identified in the site pollutant source assessment (see Section 3.2.1 of this guidance document).
- Particle size analysis may be needed if a Risk Level 1 project is using a sediment basin or if needed to justify a site specific risk level calculation using the Revised Universal Soil Loss Equation (RUSLE). The particle size analysis provides the information needed to determine the K-factor.

Risk Level 2

- At a minimum, Risk Level 2 projects are required to collect water quality samples for pH (during construction phases with a High Risk of pH Altering Discharge) and turbidity (all phases). Additional monitoring may be required by the RWQCB.
- Risk Level 2 projects are required to collect water quality samples if there is a BMP breach, malfunction, leakage, or spill. Water quality samples should be taken for non-visible pollutants that may have been discharged from the site as identified in the site pollutant source assessment (see Section 3.2.1 of this guidance document).
- Particle size analysis may be needed if a Risk Level 2 project is using a sediment basin or if needed to justify a site specific risk level calculation using RUSLE. The particle size analysis provides the information needed to determine the K-factor.

Risk Level 3

- Risk Level 3 projects are required to collect water quality samples for pH (during construction phases with a high risk of pH altering discharge) and turbidity (all phases). Additional monitoring may be required by the RWQCB.
- Risk Level 3 projects are required to collect water quality samples if there is a BMP breach, malfunction, leakage, or spill. Water quality samples should be taken for non-

visible pollutants that may have been discharged from the site as identified in the site pollutant source assessment (see Section 3.2.1 of this guidance document).

- Particle size analysis may be needed if a Risk Level 3 project is using a sediment basin or if needed to justify a site specific risk level calculation using RUSLE. The particle size analysis provides the information needed to determine the K-factor.
- Risk Level 3 projects must collect water quality samples from the receiving water for pH (if the pH Receiving Water Monitoring Trigger is exceeded), and for turbidity and suspended sediment concentration (SSC) (if the turbidity Receiving Water Monitoring Trigger is exceeded). Once triggered, Receiving Water Monitoring Trigger is exceeded the monitoring must continue until the project has been completed.
- Additionally, Risk Level 3 projects must conduct a bioassessment study consistent with the General Permit (See Appendix E of the handbook for more information on bioassessment monitoring.)

3.2.3 Sampling Locations

3.2.3.1 Stormwater Runoff

Risk Level 2 and 3 projects are required to collect water quality samples of runoff that is discharged off-site. Samples must be representative of the runoff flow and characteristics of the site's discharges. All locations discharging runoff from the site must be sampled. .

3.2.3.2 Non-Stormwater Runoff

Risk Level 2 and 3 projects are also required to collect water quality samples to characterize authorized and unauthorized non-stormwater discharged from the site.

3.2.3.3 Receiving Water

Following the exceedance of a Receiving Water Monitoring Trigger at a Risk Level 3 project that has a direct discharge to the receiving water, the project is required to collect receiving water samples for the duration of the construction project. Samples must be taken at representative upstream/upgradient and downstream/downgradient locations as close as possible to the point where the site's runoff enters the receiving water. If there are two or more discharge locations discharging to the same receiving water, only one upstream and one downstream sampling locations is required. Samples should only be collected from safe accessible locations.

Projects required to conduct bioassessment monitoring must identify monitoring locations up-stream and downstream of the point where construction site runoff enters the wadeable stream. Sampling events must occur before the start of ground disturbing activities during the appropriate index period and must be repeated after the completion of construction (at least one winter season after project related ground disturbance has ceased).

3.2.3.4 Non-Visible Pollutant Monitoring

In situations where a breach, malfunction, leakage, or spill has occurred, dischargers must collect a sample of runoff that has come into contact with the materials and must also collect a runoff sample that has not come into contact materials (uncontaminated sample) for comparison.

3.2.4 Sample Collection and Handling

It is important to use the correct methods to collect and handle samples to ensure the samples are valid. While the handling requirements apply primarily to grab samples collected for laboratory analysis, field measurements can be affected by sample collection procedures.

The General Permit requires dischargers to designate and train personnel to collect, maintain, and ship water quality samples in accordance with the *Surface Water Ambient Monitoring Program (SWAMP) 2008 Quality Assurance Program Plan (QAPrP)*, which is available at http://www.swrcb.ca.gov/water_issues/programs/swamp/tools.shtml#qa. Sample collection and handling described in this document are consistent with the QAPrP, but have been simplified for construction monitoring and may not address every aspect of the QAPrP or anticipate every sampling scenario.

Sampling methods, handling procedures, and locations should be identified in advance of the sampling event in order to provide sufficient time to gather the supplies and equipment necessary to sample and plan for safe access by the sampling crew(s).

Adherence to SWAMP sampling guidance and proper development of a sampling plan provides for consistent, reproducible, and accurate results. For some constituents, especially trace metals, trace organics, and organic carbon, sampling protocols are very important as contamination of samples due to incorrect sampling protocols is possible. Design of the field sampling procedures should carefully consider contamination potential from sample location (e.g., sediment disturbances, equipment exhaust), sampling techniques, and sample handling. Field crews should be trained in the appropriate site specific methods specified in the sampling plan. “Clean sampling” based on the US Environmental Protection Agency (EPA) Method 1669 should be used when sufficiently low detection concentrations are expected for at least trace metals and mercury. However, it is recommended that all sampling plans incorporate a “clean technique” approach including the following protocols:

- Samples (for laboratory analysis) are collected only in analytical laboratory-provided sample containers;
- Clean, powder-free nitrile gloves should be worn for collection of samples;
- Gloves are changed whenever something not known to be clean has been touched;
- Decontaminate all equipment (e.g. bucket, tubing) except laboratory provided sample containers, prior to sample collection using a trisodium phosphate (TSP)-soapy water wash, distilled water rinse, and final rinse with distilled water. (Dispose of wash and rinse water appropriately, i.e., do not discharge to storm drain or receiving water); and
- To reduce potential contamination, sample collection personnel must adhere to the following rules while collecting samples:
  - No smoking;
  - Never sample near a running vehicle;
  - Do not park vehicles in the immediate sample collection area (even non-running vehicles);
  - Do not eat or drink during sample collection; and
  - Do not breathe, sneeze, or cough in the direction of an open sample container.

Water quality samples should be collected in appropriate sample containers and be of adequate volume to conduct the required measurements or laboratory analyses.

The most important aspect of grab sampling is to make sure that the sample best represents the entire runoff stream. Typically, samples are collected by dipping the collection container in the runoff flow paths and streams as noted below. Note, however that depending upon the specific test that is required, some bottles may contain preservatives. These bottles should never be dipped into the stream, but filled indirectly from the collection container.

i. For small streams and flow paths, simply dip the bottle facing upstream until full.

ii. For larger stream that can be safely accessed, collect a sample in the middle of the flow stream by directly dipping the mouth of the bottle. Once again making sure that the opening of the bottle is facing upstream as to avoid any contamination by the sampler.

iii. For larger streams that cannot be safely waded, pole-samplers may be needed to safely access the representative flow.

iv. Avoid collecting samples from ponded, sluggish or stagnant water.

v. Avoid collecting samples directly downstream from a bridge as the samples can be affected by the bridge structure or runoff from the road surface.

All sampling and sample preservation must be in accordance with the current edition of *Standard Methods for the Examination of Water and Wastewater* (American Public Health Association).

SSC samples should be taken as a normal grab sample, where the bottle is submerged facing upstream and filled. SSC samples need to be collected in a separate bottle because the analysis requires the entire volume of the bottle. Many grab samples can be partitioned out of a larger container used to collect the samples for various analyses but that is not the case for SSC.

All samples must be maintained between 0-6 degrees Celsius during delivery to the laboratory. Samples must be kept on ice, or refrigerated, from sample collection through delivery to the laboratory. Shipped samples should be placed inside coolers with ice. Make sure the sample bottles are well packaged to prevent breakage and secure cooler lids with packaging tape.

Ship samples that will be laboratory analyzed to the analytical laboratory right away. Many analytical methods have short hold-times before which the analysis must be started. Hold times are measured from the time the sample is collected to the time the sample is analyzed. The General Permit requires that samples be received by the analytical laboratory within 48 hours of the physical sampling (unless otherwise required by the analytical laboratory).

Most sites will require the use of some sort of field meter to measure turbidity and pH. Some field meters can be placed directly in the flow of water and gather instantaneous data. Meters with probes that can be directly placed into the flow are ideal, however low flow conditions may not allow for this type of measurement. In this case, grab samples can be collected and placed within the field meter's recording container. Section 7.0 of this guidance document provides step-by-step instructions using an example field meter.

All monitoring instruments and equipment (including a discharger's own field instruments for measuring pH and turbidity) should be calibrated and maintained in accordance with manufacturers' specifications to ensure accurate measurements. Many manufacturers provide step-by-step instructions for the use and calibration of their meters and these instructions should be followed.

If using field meters, pH and turbidity measurements should be conducted immediately (i.e. samples should not be stored for later measurement).

Collect proper information regarding time and sampling conditions, appropriately label the bottles, and fill out the required chain of custody forms and field logs.

3.2.5 Analytical Methods, Laboratories, and Field Meters

All laboratory analyses must be conducted according to analytical procedures specified in 40 Code of Federal Regulations (CFR) Part 136, unless other analytical procedures have been specified in the General Permit or by the RWQCB. With the exception of field analyses conducted by the discharger for turbidity and pH, all analyses must be sent to and conducted by a state-certified analytical laboratory. Currently, the SSC method is not state certified and a limited number of laboratories have the capability of doing this analysis.

Analytical laboratories should be contacted and a contract should be worked out before the wet season to minimize potential disruptions during the critical sampling period. A laboratory should be chosen foremost by their accreditation, ability to perform the required samples in the desired turn-around-time, and then by their proximity for ease of sample delivery. Although with overnight mail delivery, proximity is less important, it may still be an important factor to avoid bottle breakage during shipment.

State-certified analytical laboratories can be found by using the Environmental Laboratory Accreditation Program's (ELAP) website at: http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx.

The analytical method/protocol, minimum detection limits, and reporting units for the water quality constituents specifically identified in the General Permit are presented in Table D-5.

Table D-5 Water Quality Constituent Analytical Method/Protocol, Minimum Detection Limits, Sample Size and Container Requirements

Parameter	Test Method/Protocol	Minimum Detection Limit	Minimum Sample Volume	Container Type
pH	Field meter or pH test kit	0.2 pH Units	NA	Plastic
Turbidity	Field meter or EPA 180.1	1 NTU	500 mL	Plastic
SSC	ASTM Method D 3977-97	5 mg/L	200 mL	Contact Lab

Non-visible pollutants may include a wide range of analytical methods. A list of potential non-visible pollutants based on common construction activities is shown in Table D-6. This list is not meant to be inclusive but to provide general guidance for projects. Consult with the analytical laboratory or 40 CFR Part 136 to identify specific analytical methods, sample volume, and containers needed for the expected non-visible pollutants.

Dischargers can perform pH analysis on site with a calibrated pH meter, or pH test kit. Dischargers can perform turbidity analysis using a calibrated turbidity meter (turbidimeter), either on site or at an accredited analytical laboratory.

Many manufacturers offer single parameter meters or multiple parameter meters with various optional probes. Dischargers will need to determine the best type of meter for their individual situation. Any meter selected for field monitoring should have the ability to be calibrated, be accompanied by detailed operation instructions, and should be ruggedly designed for field use and long term storage (you are unlikely to need it during the dry season).

Table D-6 Potential Non-Visible Pollutants based on Common Construction Activities

Activity	Potential Pollutant Source	Laboratory Analysis
Water line flushing	Chlorinated water	Residual chlorine
Portable toilets	Bacteria, disinfectants	Total/fecal coliform
Concrete & Masonry	Acid wash	pH
	Curing compounds	pH, alkalinity, Volatile organic compounds (VOCs)
	Concrete rinse water	pH
Painting	Resins	Semi-volatile organic compounds (SVOCs)
	Thinners	Phenols, VOCs
	Paint Strippers	VOCs
	Solvents	Phenols, VOCs
	Adhesives	Phenols, SVOCs
	Sealants	SVOCs
Cleaning	Detergents	Methylene Blue Activated Substances (MBAS), phosphates
	Bleaches	Residual chlorine
	Solvents	VOCs
Landscaping	Pesticides/Herbicides	Check with analytical laboratory
	Fertilizers	NO_3/NH_3/P
	Lime and gypsum	Acidity/alkalinity
	Aluminum sulfate, sulfur	Total dissolved solids (TDS), alkalinity
Treated wood	Copper, arsenic, selenium	Metals
Soil amendments & dust control	Lime, gypsum	pH
	Plant gums	Biochemical oxygen demand (BOD)
	Magnesium chloride	Alkalinity, TDS
	Calcium chloride	Alkalinity, TDS
	Natural brines	Alkalinity, TDS
	Lignosulfonates	Alkalinity, TDS

Hand held single parameters are usually the least costly and are designed with a user friendly interface. Multi-parameter meters are more costly, but provide increased versatility, have user friendly interfaces, and can provide instantaneous readings of multiple parameters. Probes for the multi-parameter meters can be attached to cables of varying lengths that make it possible to sample at a greater distance from the runoff flow.

Hach, Hydrolab, Global Water, Fisher Scientific, and LaMott are some known manufacturers and/or vendors of turbidity and pH meters. Whichever turbidimeter is selected, it is important to use the same meter; different meters may have different results even if properly calibrated. If you need to use several turbidimeters, then assign to each meter to a specific location.

Bioassessment sampling and analysis is conducted according to Appendix 5 of the General Permit. Bioassessment sampling protocols are defined by *Standard Operating Procedures for Collecting Benthic Macroinvertebrate Samples and Associated Physical and Chemical Data for Ambient Bioassessments in California* (Ode, 2007). Bioassessment laboratory protocols are defined by Standard Taxonomic Effort (STE) Level I of the Southwestern Association of Freshwater Invertebrate Taxonomists (Richards and Rogers, 2006). Bioassessments are conducted before the start of ground disturbing activities and after these activities are completed. More information on bioassessment monitoring is provided in Appendix E of this handbook.

Dischargers utilizing a sediment basin are required to conduct a soil particle analysis. Dischargers may also want to conduct this analysis to establish site-specific particle size information, which can be used to justify the project risk level using RUSLE. (The particle size analysis provides the K factor.) The soil particle analysis is conducted using the American Society for Testing and Materials (ASTM) test method ASTM D-422 (Standard Test Method for Particle-Size Analysis of Soils), as revised, to determine the percentages of sand, very fine sand, silt, and clay on the site. The percentages of particles less than 0.02 mm in diameter must also be determined. This analysis is conducted before construction starts and is reported with the Permit Registration Documents (PRDs).

3.3 Watershed Monitoring Option

Dischargers who are part of a qualified regional watershed-based monitoring program may be eligible for relief from the sampling and analysis requirements. The RWQCB may approve proposals to substitute an acceptable watershed-based monitoring program by determining if the watershed-based monitoring program will provide substantially similar monitoring information in evaluating discharger compliance with the requirements of the General Permit.

3.4 Monitoring Exemptions

Dischargers are not required to physically collect samples or conduct visual observations during dangerous weather conditions (flooding, electrical storms, etc.) or outside of scheduled construction site business hours. An explanation must be provided in the Annual Report if a project was unable to collect required samples or visual observations because of dangerous weather conditions.

4.0 Active Treatment System Monitoring

4.1 Introduction

Projects choosing to use ATS are subject to additional monitoring requirements specific to operation of the ATS. An ATS is defined in the General Permit as any system that utilizes chemical coagulation, chemical flocculation, or electrocoagulation to reduce turbidity caused by fine suspended sediment. Typically an ATS is considered for use as a BMP at sites with sediment sensitive receiving waters, high concentrations of fine clayey soils, limited space for sediment control structures, or long and steep slopes.

The General Permit specifies a turbidity NEL for ATS discharges, and sets limits for chemical residual and toxicity (Table D-7).

Table D-7 Summary of ATS discharge limitations

Parameter	Limitation	ATS Type
Turbidity	10 NTU daily flow-weighted average and 20 NTU single sample maximum	All
Chemical residual	10% or less of Maximum Allowable Threshold Concentration (MATC)	Flow-through systems
Toxicity	no allowable toxic effects	Batch systems

This section identifies special inspection and sampling requirements, protocols, and methodologies required for operation of an ATS. These generally include:

- Influent and effluent flow, turbidity, and pH monitoring;
- Effluent toxicity and chemical residuals testing;
- Dose-rates and adjustments for chemical treatment and pH adjustment;
- Laboratory and field Quality Assurance (QA) requirements specific to ATS; and
- Recordkeeping and reporting requirements.

4.1.1 Types of ATS

An ATS can be designed as a batch treatment system using either ponds or portable trailer-mounted tanks, or as a flow-through system using any number of proprietary system designs.

4.1.1.1 Batch Treatment

Batch treatment systems consist of the stormwater collection system (either temporary diversion or the permanent site drainage system); a sediment basin, trap or holding tanks for untreated runoff; pumps; a chemical feed system; treatment cells; and, interconnecting piping. Batch treatment systems should use a minimum of two lined treatment cells. Generally, untreated runoff is pumped from the holding basins/tanks, through a chemical injection system into treatment cells. Multiple treatment cells allow for clarification of treated water while other cells are being filled or emptied. Treatment cells may be basins, traps, or tanks. Portable tanks may also be suitable for some sites. The General Permit requires that batch treatment systems have a filtration step to remove residual floc prior to discharge.

4.1.1.2 Flow-through Treatment

At a minimum, a flow-through ATS system consists of the stormwater collection system (either temporary diversion or the permanent site drainage system), an untreated stormwater storage pond or holding tank, and a chemically enhanced filtration system.

Stormwater is collected throughout the site and is diverted by gravity or by pumping to an untreated stormwater storage pond or other untreated stormwater holding area. The stormwater is stored until treatment occurs. It is important that the holding pond be large enough to provide adequate storage.

Stormwater is then pumped from the untreated stormwater storage pond to the chemically enhanced filtration system where polymer is added. Adjustments to pH may be necessary before chemical addition. The filtration system continually monitors the stormwater for turbidity and pH. If the discharge water is out of the acceptable turbidity or pH range, the water is recycled to the untreated stormwater pond (or holding tank) where it can be retreated.

Figure D-1 provides a schematic of a typical flow-through ATS.

In order to use a flow through system, the General Permit requires that their be a chemical residual test for the coagulation that provides a level of detection at least 10% below than the maximum allowable threshold concentration (MATC). See Section 4.3.1 below.

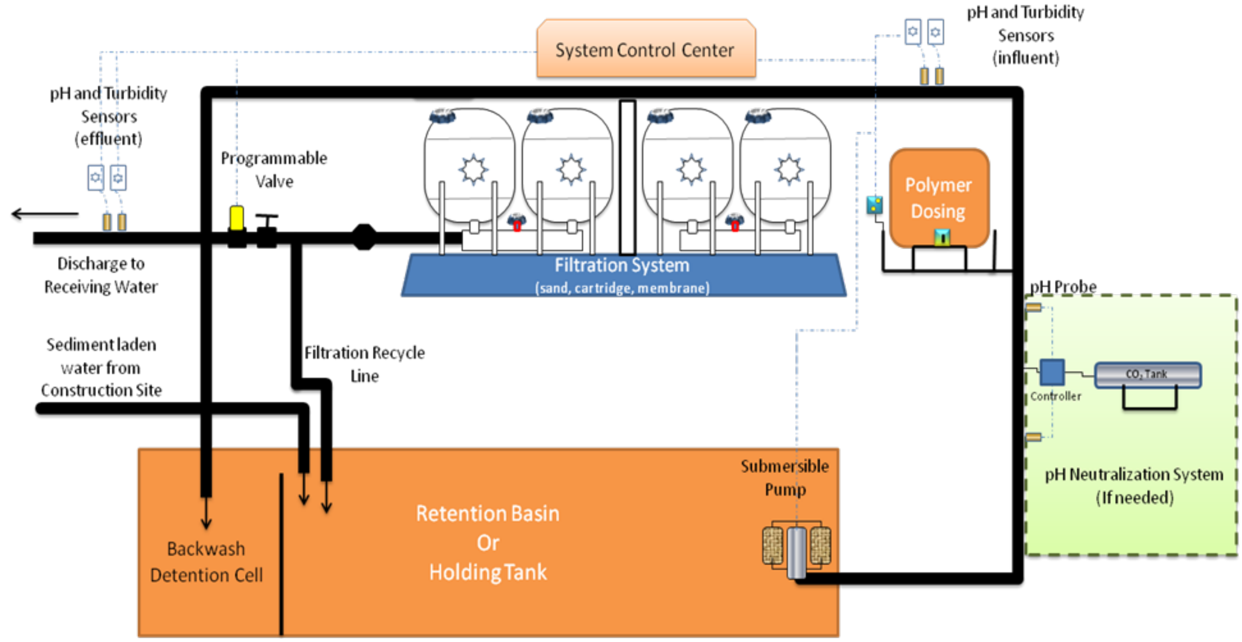

Figure D-1. Typical Flow Through ATS. (Figure adapted from Feldman, 2006.)

4.1.2 ATS Plan

Prior to utilizing an ATS system, the discharger is required to submit an ATS Plan to the SWRCB, which contains the following components:

- ATS Operation and Maintenance Manual for All Equipment;
- ATS Monitoring, Sampling & Reporting Plan (MSRP), including Quality Assurance (QA)/Quality Control (QC);
- ATS Health and Safety Plan;
- ATS Spill Prevention Plan.

As part of the ATS MSRP, and prior to implementing an ATS on a construction site, jar tests are required to be conducted for any chemical/coagulant proposed to be utilized. Jar tests must be conducted according to ASTM D-2035-08, which generally requires simultaneous introduction of an aqueous chemical solution (in different concentrations) to turbid water samples created with site-specific soils contained in six jars set at a specified distance apart, all being actively mixed. Time until particle settling is recorded, and samples from each jar are tested for turbidity, pH, and chemical residual (if test is available). Refer to the ASTM standard for specific requirements. Commercial ATS providers will generally perform jar testing on site-specific soils prior to ATS set-up to determine the appropriate chemical and dosage to optimize settling.

A QA/QC Plan should be prepared as part of the MSRP that is consistent with the QA/QC elements that apply to general field monitoring identified in Section 5.0 of this guidance document. Additional QA/QC requirements specific to ATS include monthly laboratory duplicates to verify chemical residual levels obtained from field measurements, calibration schedules of automated instrumentation (see Section 7.1 of this guidance document), and method detection limits for chemicals being used. These elements should also be included in the required QA/QC Plan.

4.1.3 Required Training for ATS Operation and Monitoring

The General Permit requires that ATS Operators have training specific to using an ATS and liquid coagulants for stormwater discharges. The training is required to consist of a formal class with a certificate and requirements for testing and certificate renewal and include a minimum of eight hours classroom and 32 hours field training. Within the classroom training, the following monitoring components are required:

- ATS Control Systems;
- Coagulant Selection – Jar testing, dose determination, etc.;
- Aquatic Safety/Toxicity of Coagulants – proper handling and safety;
- Monitoring, Sampling, and Analysis;
- Reporting and Recordkeeping; and
- Emergency Response.

4.2 Visual Monitoring (Inspection)

A designated responsible person is required to be on site daily at all times during treatment operations. Daily on site visual monitoring of the system for proper performance is required to be conducted and recorded in a project field data log. Minimum requirements for the log include:

- Name and phone number of the person responsible for system operation and monitoring;
- Documentation of required training;
- Visual observations of system operation and discharge;
- Date and time of sample collection and flow measurements; and
- Results of field-measured parameters.

4.3 Operational and Compliance Monitoring Procedures

All ATS systems (both batch and flow-through) must have instrumentation that automatically measures and records effluent water quality and flow data. This instrumentation typically will include (1) mounted submersible pH and turbidity probes; (2) data loggers (field-read or internet-based); and (3) a system control panel that provides automatic shut off or recirculation in case of water quality or effluent limitation violation, power-loss, or other catastrophic event. The system control panel must also control coagulant dosing to prevent accidental overdosing. The majority of ATS (including both flow-through and batch systems) will likely be designed, supplied, or monitored by established commercial ATS providers, and these systems must be been designed and instrumented to meet the General Permit criteria. Dischargers choosing to implement a non-proprietary ATS must obtain appropriate equipment to ensure all requirements of the General Permit are met. The following parameters must be monitored continuously and recorded in the project field data log (see Section 5.1 of this guidance document) in no less than 15 minute intervals:

- Flow rate and volume of treated discharge;
- Influent and effluent pH; and
- Influent and effluent turbidity.

The following additional parameters must also be monitored and recorded at the intervals specified below:

- Cumulative flow volume – daily;
- Type and amount of pH adjustment chemical – as utilized;
- Dose rate of treatment chemical – 15 minutes after startup and every 8 hours of operation;
- Residual chemical/additive levels – as proposed in ATS Plan for flow-through systems (see Section 4.3.1 below); and
- Effluent toxicity – for each proposed batch discharge (see Section 4.3.2 below).

All instrumentation used for continuous monitoring must be calibrated on a regular basis with calibration requirements stated in the QA/QC section of the ATS Plan. Calibration is further described in Section 7.1 of this guidance document.

4.3.1 Effluent Residual Chemical Testing – Flow-through systems

The General Permit requires that the effluent from a flow-through system be tested for residual treatment chemicals; however, sample collection frequency is not specified. The residual chemical treatment test must be conducted in accordance with a methodology that is approved by a state-certified laboratory. All sample collection for residual chemical testing should be performed in accordance with sample collection procedures outlined in Section 3.2.4 of this guidance document and should be representative of the discharge from the ATS. Specific protocol for performing the residual test, including required frequency and method detection limits, will need to be developed for each proposed chemical and provided as part of the ATS Plan.

The General Permit requires that a residual chemical test method shall be used that has a method detection limit (MDL) of 10% or less than the maximum allowable threshold concentration (MATC) for the species that is most sensitive to the chemical used and that the test be able to be completed within one hour of sample collection (i.e., a short-duration field test). The MATC is equal to the geometric mean of the No Observed Effect Concentration (NOEC) and Lowest Observed Effect Concentration (LOEC) Acute and Chronic toxicity results for the most sensitive species determined for the specific chemical.

4.3.2 Effluent Toxicity Testing – Batch systems

For batch treatment systems that typically use coagulants for which no chemical residual test has currently been developed (and therefore dischargers cannot use flow-through treatment), dischargers are required to perform Whole Effluent Toxicity (WET) testing on the treated water prior to discharge. All samples collected and shipped for WET testing should be performed in accordance with sample collection and shipping procedures outlined in Section 3.2.4 of this guidance document and other requirements specified by the toxicity laboratory and should be representative of the batch discharge. Samples must be sent to a laboratory certified by the Department of Public Health ELAP to perform WET testing (identifier - E113) in accordance with the 96-hour acute test in *Methods for Measuring the Acute Toxicity of Effluents and Receiving Water to Freshwater and Marine Organisms, EPA-841-R-02-012* (USEPA, 2002) for Fathead minnow (*Pimephales promelas)*. Acute toxicity testing for Rainbow trout (*Oncorhynchus mykiss*) may be substituted.

The General Permit only requires that the toxicity test be initiated prior to discharging each treated batch.

4.3 Reporting and Record Retention

The General Permit requires the electronic submission of all ATS related field monitoring data, including chemical residual and effluent toxicity testing, to the SWRCB's Stormwater Multi-Application and Report Tracking System (SMARTS) every 30 days, at minimum.

Any monitoring data that violate water quality standards must be reported to the RWQCB. An NEL Violation Report must be electronically filed in SMARTS within 24 hours of identifying an exceedance of an NEL. See Section 6.2 of this guidance document for a discussion of NEL Violation Reports.

All ATS records must also be kept for a minimum of three years after the conclusion of the project (see discussion in Section 6.4 of this guidance document).

4.3.1 ATS NEL Violation Reports

ATS dischargers must submit an NEL Violation Report to the SWRCB's SMARTS within 24 hours after the ATS NEL exceedance has been identified. The discharger must certify each NEL Violation Report in accordance with the General Permit's Special Provisions for Construction Activity.

An ATS NEL Violation Report contains the following information:

- Analytical method(s), method reporting unit(s), and MDL(s) of each analytical parameter;
- Date, place, time of sampling, visual observation (inspections), and/or measurements, including precipitation; and
- Description of the current BMPs associated with the effluent sample that exceeded the NEL and the proposed corrective actions taken.

In the event that an applicable NEL was exceeded during a storm event equal to or larger than the ATS Compliance Storm Event (10-year, 24-hour event), ATS dischargers must report the on-site rain gauge reading and nearby governmental rain gauge readings for verification. Exemption justifications must be entered in to SMARTS.

5.0 Quality Assurance/Quality Control

An effective QA/QC plan will be implemented as part of the CSMP to ensure that analytical data can be used with confidence. QA/QC procedures to be initiated include the following:

- Field logs;
- Clean sampling techniques;
- Sample Chains of Custody (COCs); and
- Data verification.

Each of these procedures is discussed in more detail in the following sections.

5.1 Field Logs

The purpose of field logs is to record sampling information and field observations during monitoring that may explain any uncharacteristic analytical results. Sampling information to be included in the field log include the date and time of water quality sample collection, sampling personnel, sample container identification numbers, and types of samples that were collected. Field observations should be noted in the field log for any abnormalities at the sampling location (color, odor, BMPs, etc.). Field measurements for pH and turbidity should also be recorded in the field log.

Examples of field logs to record visual inspections and sample collection and field measurements are provided in Section 8.0 of this guidance document and electronic copies of the forms (Microsoft Word®) can be downloaded from the CASQA BMP Handbook Portal at http://www.casqa.org.

5.2 Clean Sampling Techniques

Clean sampling techniques involve the use of certified clean containers for sample collection and clean powder-free nitrile gloves during sample collection and handling. As discussed previously, adoption of a clean sampling approach will minimize the chance of field contamination and questionable data results.

5.3 Sample Chain-of-Custody

The sample COC is an important documentation step that tracks samples from collection through analysis to ensure the validity of the sample. Sample COC procedures include the following:

- Proper labeling of samples;
- Use of COC forms for all samples; and
- Prompt sample delivery to the analytical laboratory.

Analytical laboratories usually provide COC forms to be filled out for sample containers.

5.4 Data Verification

After analytical results are received from the analytical laboratory, the data should be verified to ensure that it is complete, accurate, and the appropriate QA/QC requirements were met. Data should be verified as soon as the data reports are received.

The COC and laboratory reports need to be checked to make sure all requested analysis were performed and all samples are accounted for in the reports.

Check laboratory reports to make sure hold times were met and that the reporting levels meet or are lower than the reporting levels agreed to in the contract.

Check data for outlier values and follow up with the laboratory. Occasionally typographical errors, unit reporting errors, or incomplete results are reported and should be easily detected. These errors need to be identified, clarified, and corrected quickly by the laboratory. Attention should be paid to data that is an order of magnitude or more different than similar locations, or is inconsistent with previous data from the same location.

For laboratory analyses, EPA establishes QA/QC checks and acceptable criteria. These data are typically reported along with the sample results. Data reviewers should evaluate the reported QA/QC data to check for contamination (look at method, field, and equipment blanks), precision (laboratory matrix spike duplicates), and accuracy (matrix spikes and laboratory control samples). When QA/QC checks are outside acceptable ranges, the laboratory must flag the data, and usually provides an explanation of the potential impact to the sample results.

Check the data set for outlier values and, accordingly, confirm results and re-analyze samples where appropriate. Sample re-analysis should only be undertaken when it appears that some part of the QA/QC resulted in a value out of the expected range. Initial data, even if outside the expected range may not be discounted unless the analytical laboratory identifies the required QA/QC criteria were not met. If this occurs, the project should obtain a written statement from the analytical laboratory regarding the validity of the sample result.

Similarly, field data needs to be checked as soon as possible to identify potential errors. Reported data and observations should be verified to ensure that it is complete and accurate and as soon as the field logs are received.

Field logs should be checked to make sure all required measurements were completed and appropriately documented. Crews may occasionally miss-record a value. Reported values that appear out of the typical range or inconsistent, should be followed up on immediately to identify potential reporting or equipment problems.

Equipment calibration notations should be verified for outlier data, and if appropriate equipment calibrations should be checked after sampling. Observations noted on the field logs can also help to identify potential interferences. Notations should be made of any errors and actions taken to correct the equipment or recording errors.

When using a field meter it is important to record the value and then make note of any possible meter failures or interferences that could have led to an exceedance. Some possible instrument problems may include the need to recalibrate; the need to replace the battery; problems with the sample container (such as scratches on glass or plastic optical sample cells or particles on the outside of the optical sample cells); or fouled probes.

6.0 Reporting and Records Retention

Most reporting will typically occur in the Annual Report. However, Risk Level 3 dischargers must electronically submit all storm event sampling results (pH and turbidity) to the SWRCB's SMARTS no later than ten days after the conclusion of the storm event. Field data related to ATS monitoring must be filed every 30 days.

Additional reporting is required if NALs or ATS NELs are exceeded. The requirements for NAL Exceedance Reports as well as records retention are discussed in the following sections. ATS NEL Violation Reports are discussed in Section 4.

6.1 Numeric Action Level Exceedance Report

In the event that the daily average of the pH[8] or turbidity samples exceeds an applicable NAL, Risk Level 2 and 3 dischargers must electronically submit all storm event sampling results to the SWRCB's SMARTS no later than 10 days after the conclusion of the storm event. In addition, the RWQCBs may request the submittal of an NAL Exceedance Report. The discharger must certify each NAL Exceedance Report in accordance with the General Permit's Special Provisions for Construction Activity.

An NAL Exceedance Report must contain the following information:

- Analytical method(s), method reporting unit(s), and MDL(s) of each analytical parameter;

[8] Daily average pH values must be calculated through the logarithmic method. In order to calculate an average, you must: (1) Convert the pH measurements from logarithms to real numbers; (2) Take the average of the real numbers; and (3) Convert the average of the real numbers back to a logarithm.

- Date, place, time of sampling, visual observation (inspections), and/or measurements, including precipitation; and
- Description of the current BMPs associated with the sample that exceeded the NAL and the proposed corrective actions taken.

6.3 Annual Report

All dischargers are required to prepare and electronically submit an Annual Report no later than September 1 each year. The Annual Reports must be certified in accordance with the Special Provisions in the General Permit. The Annual Report must include the following stormwater monitoring information:

- A summary and evaluation of all sampling and analysis results, including original laboratory reports;
- The analytical method(s), method reporting unit(s), and MDL(s) of each analytical parameter (analytical results that are less than the MDL must be reported as "less than the MDL" or "<MDL");
- A summary of all corrective actions taken during the compliance year;
- Identification of any compliance activities or corrective actions that were not implemented;
- A summary of all violations of the General Permit;
- The individual(s) who performed facility inspections, sampling, visual observation (inspections), and/or measurements;
- The date, place, time of facility inspections, sampling, visual observation (inspections), and/or measurements, including precipitation (rain gauge); and
- The visual observations and sample collection exception records and reports.

6.4 Records Retention

Dischargers must retain records of all stormwater monitoring information and copies of all reports (including Annual Reports) for a period of at least three years from date of submittal or longer if required by the RWQCB. ATS dischargers must retain all records for three years after the completion of the construction project. Records are to be kept on site while construction is ongoing. These records include:

- The date, place, and time of facility inspections, sampling, visual observations (inspections), and/or measurements, including precipitation;
- The individual(s) who performed the facility inspections, sampling, visual observation (inspections), and/or measurements;
- The date and approximate time of analyses;
- The individual(s) who performed the analyses;
- A summary of all analytical results from the last three years, the method detection limits and reporting limits, and the analytical techniques or methods used;
- Rain gauge readings from site inspections;

- QA/QC records and results;
- Non-stormwater discharge inspections and visual observations (inspections) and stormwater discharge visual observation records;
- Visual observation and sample collection exemption records
- NAL Exceedance Reports; and
- The records of any corrective actions and follow-up activities that resulted from analytical results, visual observations (inspections), or inspections.

Results of field measurements and laboratory analyses must be kept in the SWPPP. It is also recommended that training logs, COCs, and other documentation related to sampling and analysis be kept with the project's SWPPP.

7.0 Guidance on Field Measurements

This section details the general practices for sampling using field meters. Before any sampling begins it is imperative to wear proper clothing and equipment. This includes the appropriate sampling safety equipment and powder-free nitrile gloves.

7.1 Instrument Calibration

Calibrate field meters and equipment before any sampling. Follow the calibration instructions provided by the manufacturer with your instrument. Calibration standards should be purchased with your instrument and repurchased as needed. The standards have limited shelf life and should not be used beyond the expiration date.

Most pH meters require a two or three point calibration curve; therefore you will need to purchase two or three different standard solutions. Typical solutions have pH values of 4, 7, and 10.

Turbidity measurements are also based on a two or three point curve and should include a zero value. It is very important to make sure that the turbidity standard solution is well mixed before meter calibration. Since turbidity standards sometimes contain suspended solids, inaccurate calibration can result if the standards are not properly mixed.

7.2 Field Meter Sampling

Measurement of turbidity and pH using a field meter is very similar. Figure D-2 shows an example of an all-in-one field meter, which among other things, records pH and turbidity. Since methods for specific field meters vary from model to model carefully follow the instructions provided by the manufacturer. This pictorial guide provides an outline for the methods appropriate for an all-in-one meter.

Figure D-2 Example of an All-In-One meter

7.2.1 Measurements in-stream

The simplest method is to place the sensor directly into the waterway or flow path (Figure D-3) and record the results. This will only work if there is significant runoff with a depth greater than six inches, which may not be the case at a construction site. With this method, it is important to not only to have runoff with a significant depth but to sample in a location that is representative of the entire flow. Avoid puddles that might have formed off of the main drainage.

Figure D-3 Measuring pH and turbidity in-stream measurements

7.2.2 Measurements in a sample container

Most likely the sampling will take place in low flow conditions so an intermediate container must be used. The container should be clean and decontaminated. Make sure to obtain a grab sample that represents site runoff conditions.

If two or more runoff streams originating from the site converge at one location downstream from the construction site, then collect a grab sample at this location.

Collect the field sample by holding the container in the flow path (Figure D-4) until enough water is obtained to fill the field meter's receiving container. In some cases, small, clean cups or sampling syringes may be needed to collect an adequate sample volume.

Figure D-4 Collecting grab samples

Figure D-5 Transferring sample to field meter sample container

Next pour the grab sample into the field meter's receiving container (Figure D-5).

Figure D-6 Inserting meter into sample container

Insert field meter into receiving container with the sample water (Figure D-6). This step will differ based on the design of the meter.

Figure D-7 Measuring pH and turbidity in the sample container

Wait for the pH and turbidity values to stabilize before recording the results, which may take few moments.

Complete the field logs (see examples provided in Section 8.0 of this guidance document) with results and any important information to describe the sampling settings. Include in the documentation any apparent odor, color, clarity, sheen, and other visual characteristics of the water sample.

8.0 Example Data Collection Forms

The following are sample field forms that can be used during inspections and sampling events. These forms should be used as guidelines for the development of site specific forms. Dischargers should customize the forms for each project. Customized information can include listing the sampling or observation locations, identifying specific non-visible pollutants, and other site specific notations for field crews.

When modifying the forms make sure that the minimum information required by the General Permit is listed.

Note that the visual observation sample form is not intended to serve as a detailed BMP inspection checklists. The provided form is intended to be a field log to track the general project and rain event information. Detailed BMP inspection forms should be developed as part of the SWPPP based on the planned BMPs.

Electronic copies of the forms (Microsoft Word®) can be downloaded from the CASQA BMP Handbook Portal at http://www.casqa.org.

Risk Level 1, 2, 3 ***Visual Inspection Field Log Sheet***						
Date and Time of Inspection:				Report Date:		
Inspection Type:	☐ Weekly	☐ Before predicted rain	☐ During rain event	☐ Following qualifying rain event	☐ Contained stormwater release	☐ Quarterly non-stormwater
Site Information						
Construction Site Name:						
Construction stage and completed activities:					Approximate area of exposed site:	
Weather and Observations						
Date Rain Predicted to Occur:				Predicted % chance of rain:		
Estimate storm beginning: ______ (date and time)		Estimate storm duration:_________ (hours)		Estimate time since last storm: _________ (days or hours)	Rain gauge reading: ________ (inches)	
Observations: If yes identify location						
Odors	Yes ☐	No ☐				
Floating material	Yes ☐	No ☐				
Suspended Material	Yes ☐	No ☐				
Sheen	Yes ☐	No ☐				
Discolorations	Yes ☐	No ☐				
Turbidity	Yes ☐	No ☐				
Site Inspections						
Outfalls or BMPs Evaluated		**Deficiencies Noted**				
(add additional sheets or attached detailed BMP Inspection Checklists)						
Photos Taken:	Yes ☐	No ☐	Photo Reference IDs:			
Corrective Actions Identified (note if SWPPP/REAP change is needed)						
Inspector Information						
Inspector Name:				Inspector Title:		
Signature:					Date:	

Risk Level 2 Effluent Sampling Field Log Sheets			
Construction Site Name:		Date:	Time Start:
Sampler:			
Sampling Event Type:	☐ Stormwater	☐ Non-stormwater	☐ Non-visible pollutant

Field Meter Calibration	
pH Meter ID No./Desc.: Calibration Date/Time:	Turbidity Meter ID No./Desc.: Calibration Date/Time:

Field pH and Turbidity Measurements			
Discharge Location Description	pH	Turbidity	Time

Grab Samples Collected		
Discharge Location Description	Sample Type	Time

Additional Sampling Notes:
Time End:

Risk Level 3
Effluent Sampling Field Log Sheets

Construction Site Name:	Date:	Time Start:
Sampler:		

Sampling Event Type:	☐ Stormwater	☐ Non-stormwater	☐ Non-visible pollutant

Field Meter Calibration

pH Meter ID No./Desc.: Calibration Date/Time:	Turbidity Meter ID No./Desc.: Calibration Date/Time:

Field pH and Turbidity Measurements

Discharge Location Description	pH	Turbidity	Time

Grab Samples Collected

Discharge Location Description	Other (specify)	Time

Additional Sampling Notes:

Time End:

Risk Level 3
Receiving Water Sampling Field Log Sheets

Construction Site Name:	Date:	Time Start:
Sampler:		

Receiving Water Description and Observations

Receiving Water Name/ID:

Observations:

Odors	Yes ☐	No ☐
Floating material	Yes ☐	No ☐
Suspended Material	Yes ☐	No ☐
Sheen	Yes ☐	No ☐
Discolorations	Yes ☐	No ☐
Turbidity	Yes ☐	No ☐

Field Meter Calibration

pH Meter ID No./Desc.:	Turbidity Meter ID No./Desc.:
Calibration Date/Time:	Calibration Date/Time:

Field pH and Turbidity Measurements and SSC Grab Sample

Upstream Location

Type	Result	Time	Notes
pH			
Turbidity			
SSC	Collected Yes ☐ No ☐		

Downstream Location

Type	Result	Time	Notes
pH			
Turbidity			
SSC	Collected Yes ☐ No ☐		

Additional Sampling Notes:

Time End: