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ENVIRONMENTAL MONITORING AND ASSESSMENT PROGRAM-SURFACE WATERS:

FIELD OPERATIONS AND METHODS FOR MEASURING THE ECOLOGICAL CONDITION OF WADEABLE STREAMS

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SECTION 3
BASE LOCATION ACTIVITIES

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Field teams conduct a number of activities at a "base" location before and after visiting each stream site. These activities are generally conducted on the same day as the sampling visit. Close attention to these activities is required to ensure that the field teams know where they are going, that access to the stream site is possible and permissible, that all the necessary equipment and supplies are in good order to complete the sampling effort, and that samples are packaged and shipped correctly and promptly.

Figure 3-1 illustrates operations and activities that are conducted before and after each visit to a stream site. Activities that are conducted after a stream visit include equipment cleanup and maintenance, packing and shipping samples, and communications with project management to report the status of the visit.

3.1 ACTIVITIES BEFORE EACH STREAM VISIT

Before each stream visit, each field team should confirm access to the stream site, develop a sampling itinerary, inspect and repair equipment, check to make sure all supplies required for the visit are available, and prepare sample containers. Procedures to accomplish these activities are described in the following sections.

3.1.1 Confirming Site Access

Field crews should be provided with dossiers containing important locational and access information for each stream they are scheduled to visit. Before visiting a stream, the crew should review the contents of the specific stream dossier. The landowner(s) listed in

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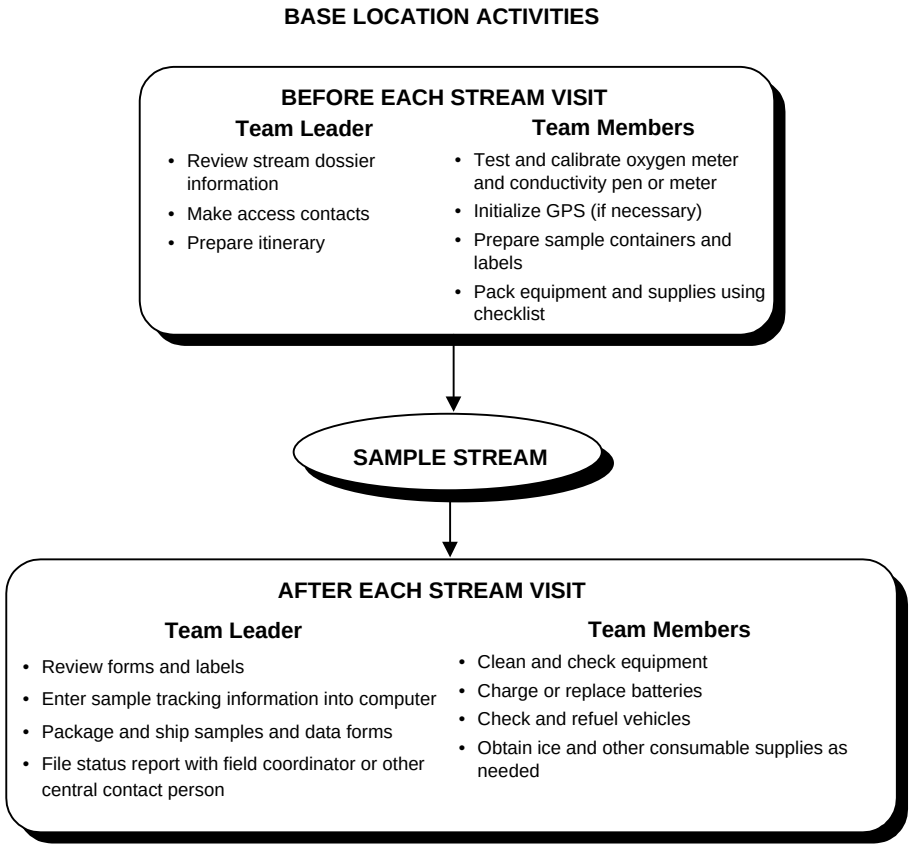

Figure 3-1. Activities conducted at base locations.

the dossier should be contacted to confirm permission to sample and identify any revisions to the information contained in the dossier.

3.1.2 Daily Sampling Itinerary

Based upon the sampling schedule provided to each team, team leaders are responsible for developing daily itineraries. The team leader reviews each stream dossier to ensure that it contains the appropriate maps, contact information, copies of permission letters, and access instructions. Additional activities include determining the best access routes, calling the landowners or local contacts to confirm permission, confirming lodging plans for the upcoming evening, and coordinating rendezvous locations with individuals who must meet with field teams prior to accessing a site. This information is used to develop an itinerary for the stream. The itinerary should include anticipated departure time, routes of travel, location of any intermediate stops (e.g., to drop off samples, pick up supplies, etc.) and estimated time of arrival at the final destination after completing the stream visit. This information (and any changes that occur due to unforeseen circumstances), should be provided to the field coordinator or other central contact person identified for the specific field study. Failure to adhere to the reported itinerary can result in the initiation of expensive search and rescue procedures and disruption of carefully planned schedules. In addition, each team should carry individual emergency medical and personal information with them, possibly in the form of a "safety log" that remains in the vehicle (see Section 2).

3.1.3 Instrument Inspections and Performance Tests

Each field team is required to test and calibrate instruments prior to departure for the stream site. Field instruments include a global positioning system (GPS) receiver, a current velocity meter, a conductivity pen (or a conductivity meter), and a dissolved oxygen meter. Backup instruments should be available if instruments fail the performance tests or calibrations described in the following subsections.

3.1.3.1 Global Positioning System Receiver--

Specific performance checks will vary among different brands of GPS receivers. Follow the instructions in the receiver’s operating manual to make sure the unit is functioning properly. Turn on the receiver and check the batteries. Replace batteries immediately if a battery warning is displayed. Make sure extra batteries are stored with the receiver and will be available in the field if necessary.

Before the initial use, or, in some cases, if batteries are replaced, the receiver may require inputting the coordinates of a positional reference point that is nearby (e.g., a U.S. Geological Survey benchmark identified on a topographic map). Follow the manufacturer's instructions for initializing the receiver.

3.1.3.2 Dissolved Oxygen Meter--

As an initial performance test before use each year, dissolved oxygen (DO) meters should be tested for accuracy against the Winkler titration method, In addition, inspect and test the dissolved oxygen meters at the base location before each stream site visit. The inspection and testing procedure, based on the use of Yellow Springs Instruments (YSI) Model 53 oxygen meters, is summarized in Figure 3-2. Some modification to the procedure may be necessary for other models or types of dissolved oxygen meters.

Inspect the meter by checking the status of the batteries, and the functioning of the electronics. Confirm the meter is adjusted correctly for measurements in fresh water. Inspect the membrane of the probe. If bubbles are present, if the membrane is discolored, or if the membrane is torn, use a backup probe and/or replace the membrane on the original probe. (NOTE: For older models of meters, new membranes may require conditioning for 24 hours before use).

After inspecting the meter and probe, attempt to calibrate it, following the instructions in the instrument operating manual. Do not record the calibration information obtained during the performance test. The meter is calibrated again at each stream site, at which time the calibration information is recorded on the field data form. If the meter cannot be successfully calibrated, replace the meter and/or probe. After the test, turn the meter off, and store the probe according to the manufacturer's instructions.

3.1.3.3 Conductivity Pens or Conductivity Meters--

If conductivity "pens" are being used, check the pen for outward signs of fouling daily. Refer to the instrument manual for probe cleaning instructions. Do not touch the electrodes inside the probe with any object. Always keep the pen's electrode moist by keeping deionized water in the pen cap. If deionized water is not available, use streamwater or tap water rather than let the electrode dry out. Before using a pen which has been stored dry, soak the electrodes in deionized water (by filling the caps) for 24 hours. If conductivity meters are used, follow the operating manual provided with the instrument to check the batteries, the electronics, and to inspect the probe. New probes or probes that have been stored dry may require conditioning before use.

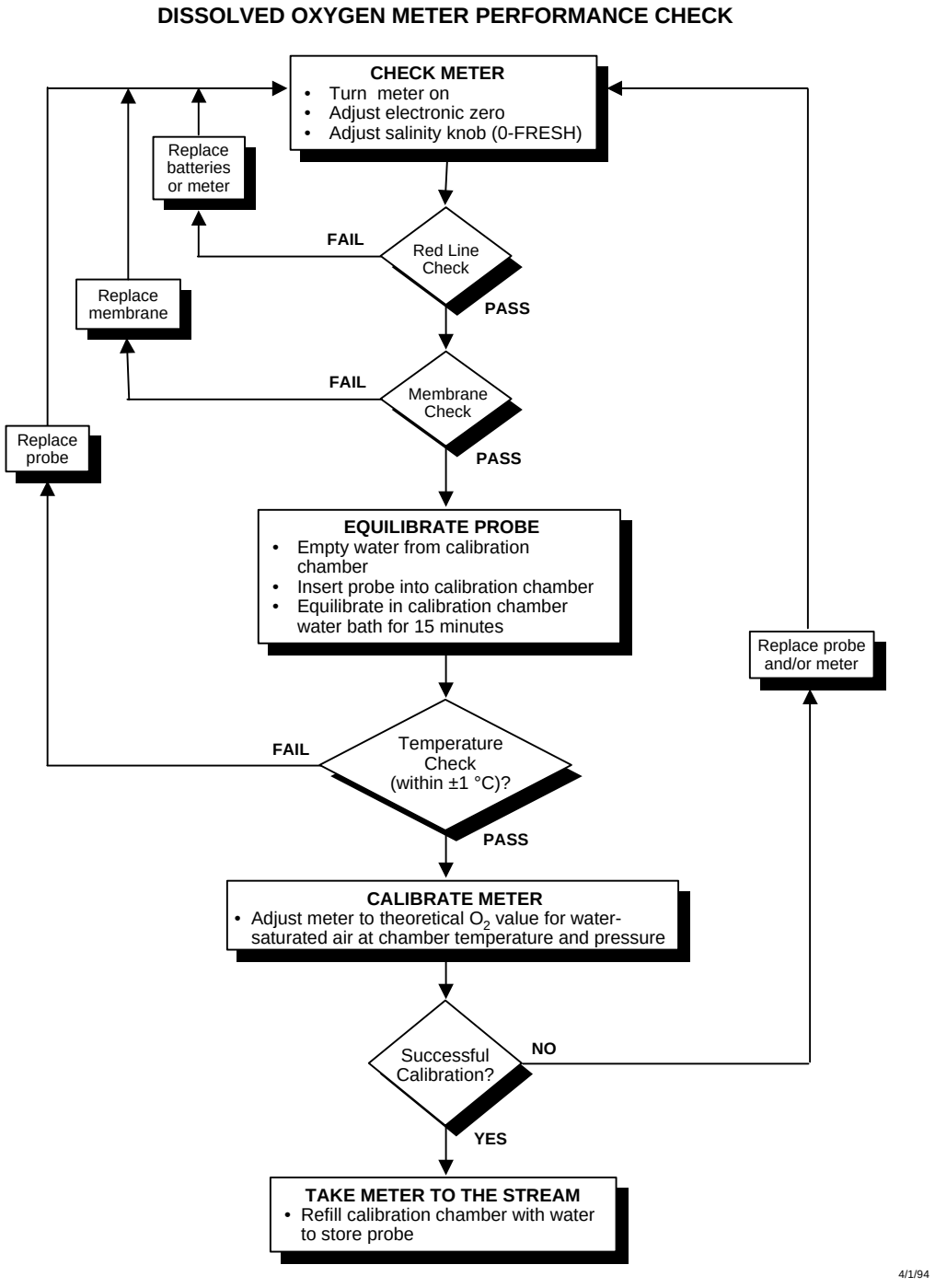

Figure 3-2. Performance test procedure for a dissolved oxygen meter.

The operation of the conductivity pen or conductivity meter is checked at the base location using a standard solution of known conductivity. A daily quality control check sample (QCCS) is prepared as described in Table 3-1. The daily QCCS can be prepared as either of two dilutions of the stock standard, depending on the theoretical conductivity desired. A 1:100 dilution of the stock provides a QCCS with a conductivity of 75.3 :S/cm at 25 /C (Metcalf and Peck, 1993). A 1:200 dilution results in a QCCS with a conductivity of 37.8 :S/cm at 25 /C (Peck and Metcalf, 1991). A fresh lot of the daily QCCS should be prepared every two weeks from the stock standard solution. Check the performance of the conductivity pen or conductivity meter by following the procedure presented in Table 3-2.

3.1.3.4 Current Velocity Meters--

Field teams may be using one of three types of current velocity meters, a vertical axis meter (e.g., Price type AA), an electromagnetic type meter (e.g., Marsh McBirney Model 201D), or a photo-optical impeller type meter (e.g., Swoffer Model 2100). General guidelines regarding performance checks and inspection of current meters are presented in Table 3-3. Consult the operating manual for the specific meter and modify this information as necessary.

3.1.4 Preparation of Equipment and Supplies

To ensure that all activities at a stream can be conducted completely and efficiently, field teams should check all equipment and supplies before traveling to a stream site. In addition, they should prepare sample containers and labels for use to the extent possible.

Check the inventory of equipment and supplies prior to departure using the stream-visit checklists presented in Appendix A. Pack meters, probes, and sampling gear in such a way as to minimize physical shock and vibration during transport. If necessary, prepare stock preservative solutions as described in Table 3-1. Follow the regulations of the Occupational Safety and Health Administration (OSHA) for handling and transporting hazardous materials such as formalin and ethanol. Regulations pertaining to formalin are in the Code of Federal Regulations (CFR; specifically 29 CFR 1910.1048). These requirements should be summarized for all hazardous materials being used for the project and provided to field personnel. Transport formalin and ethanol in appropriate containers with absorbent material.

TABLE 3-1. STOCK SOLUTIONS, USES, AND INSTRUCTIONS FOR PREPARATION

SOLUTION	USE	PREPARATION
Bleach (10%)	Clean seines, dip nets, kick nets, or other equipment that is immersed in the stream	Dilute 400 mL chlorine bleach solution to 4 L with tap water.
Conductivity Standard Stock Solution[a]	To prepare conductivity quality control check sample solution	Dissolve 3.4022 g KH_2PO_4 and 3.5490 g Na_2HPO_4 (analytical grade; dried at 120 /C for 3 h and stored desiccated) in 1000.0 g (1.0018 L at 20 /C, 1.0029 L at 25 /C) reagent water.
Quality Control Check Sample	To check operation of conductivity pen or conductivity meter	1:100 dilution of standard stock solution with reagent water (theoretical conductivity = 75.3 :S/cm at 25 /C)[a] 1:200 dilution of standard stock solution with reagent water (theoretical conductivity = 37.6 :S/cm at 25 /C)[b]
Formalin, borax buffered[c] (pH 7-8)	Preservative for fish specimens and periphyton samples	Add 400 g borax detergent (e.g., Twenty Mule Team®) to each 20-L container of 100% formalin. Test with pH paper.
Ethanol	Preservative for benthic macroinvertebrate samples.	None.

[a] Metcalf and Peck (1993)
[b] Peck and Metcalf (1991)
[c] Handle formalin according to 29 CFR 1910.1048.

TABLE 3-2. PERFORMANCE CHECK OF CONDUCTIVITY PENS OR CONDUCTIVITY METERS

1. Check the functioning of the pen or meter according to the manufacturer's operating manual (e.g., zero and "red line" of the meter).

2. Swirl the electrodes (pen) or probe (meter) for 3-5 seconds in a 250-mL bottle containing the daily QCCS solution labeled "RINSE".

3. Transfer the probe from the "RINSE" bottle to a second 250-mL bottle of QCCS labeled "TEST". Let stabilize for 20 seconds.

4. If the measured value of the QCCS is within ±10% or ±10 :S/cm of the theoretical value, rinse the pen or probe in deionized water. Store as described in the operating manual and package the pen or meter for transport to the stream site.

   If the measured value of the QCCS is not within ±10% or ±10 uS/cm of theoretical value, repeat Steps 1 through 3.

   If the value is still unacceptable, replace the QCCS in both the "rinse" and "test" bottles and repeat the measurement process.

   If the measured value is still not acceptable, clean the pen or conductivity probe as described in the manual, check the batteries, soak in deionized water for 24 hours, and repeat Steps 1 through 3.

   If the measured value is still unacceptable, replace the pen or meter.

TABLE 3-3. GENERAL PERFORMANCE CHECKS FOR CURRENT VELOCITY METERS

Vertical-axis Meters (from Smoot and Novak, 1968)
! Inspect the bucket and wheel hub assembly, yoke, cups, tailpiece, and the pivot point each day before use.
! Inspect the bearings and check the contact chamber for proper adjustment.
! Periodically conduct a spin test of the meter. The minimum spin time is 1.5 minutes, while the recommended time is between 3 and 4 minutes.
Electromagnetic Meters
! Check the meter calibration daily as part of morning routine. Calibration value should be 2.00 $\pm$ 0.05.
! Once per week, check the zero value using a bucket of quiescent water. Place the probe in the bucket and allow to sit for 30 minutes with no disturbance. The velocity value obtained should be 0.0 $\pm$ 0.1. Adjust the meter zero if the value is outside this range.
Photoelectric Impeller Meters
! Check that the calibration adjustment cover screws are tightly fitted on the display case.
! Periodically check the condition of the connector fitting between the display unit and the sensor.
! Connect the sensor to the display unit and check the calibration value stored in memory. If this value is less than the correct value for the display unit-sensor rotor combination, replace the batteries.
! Periodically perform a spin test of the rotor assembly, following the instructions in the meter's operating manual. A displayed count value of 300 or greater is indicative of satisfactory performance at low current velocities.
! If a buzzing sound occurs when the rotor assembly is spun by hand, or if the shaft shows visible wear, replace the rotor assembly.
! Periodically examine the thrust-bearing nut on the rotor assembly. If a "cup" begins to form on the bottom surface of the nut, it should be replaced.

Inspect the vehicles every morning before departure. Refuel vehicles and conduct maintenance activities the night before a sampling trip. Check vehicle lights, turn signals, brake lights, and air pressure in the tires.

Some sample containers can be labeled before departing from the base site. Figure 3-3 illustrates the preprinted labels. A set of three water chemistry sample containers all having the same ID number (one for the 4-L cubitainer and two for the 60-mL syringes) can be pre-labeled with the appropriate information (described in Section 5). After labeling, place the syringes in their plastic container, and place the cubitainer and beakers in a clean self-sealing plastic bag to prevent contamination. Sample containers for biological and sediment samples should **NOT** be pre-labeled before reaching the stream site. Problems in sample tracking can result if jars are labeled and then are not used at a stream.

3.2 ACTIVITIES AFTER EACH STREAM VISIT

Upon reaching a lodging location after sampling a stream, the team reviews all completed data forms and sample labels for accuracy, completeness, and legibility, and makes a final inspection of samples. If information is missing from the forms or labels, the team leader should fill in the missing information as accurately as possible. The team leader initials all data forms after review. The other team member should inspect and clean sampling equipment, check the inventory of supplies, and prepare samples for shipment. Other activities include shipping samples and communicating with the field coordinator or other central contact person.

3.2.1 Equipment Care

Equipment cleaning procedures are given in Table 3-4. Inspect all equipment, including nets, and clean off any plant and animal material. This effort ensures that introductions of nuisance species do not occur between streams, and prevents possible cross-contamination of samples. If nets cannot be cleaned thoroughly using water and detergent, clean and disinfect them with a 10 percent chlorine bleach solution (Table 3-1). Use bleach only as a last resort, as repeated use will destroy the net material. Take care to avoid damage to lawns or other property.

Figure 3-3. Sample container labels.

3.2.2 Sample Tracking, Packing, and Shipment

Each field team packs and ships samples from each stream visit as soon as possible after collection, normally the day following a stream visit. Field teams must be provided with specific information for the shipping destinations, contact persons, and the required shipping schedule for each type of sample.

Sample tracking information (including sample types, sample ID numbers, and other field-related information that is required by the laboratory to conduct analyses and associate results to a specific sample and stream site) is recorded during the packing process.

TABLE 3-4. EQUIPMENT CARE AFTER EACH STREAM VISIT

1. Clean for biological contaminants (e.g., plant and animal material).

    - Prior to departing a stream, drain all water from live wells and buckets used to hold and process fish.
    - Inspect sampling gear for evidence of plant fragments and remove any fragments observed.
    - At the stream or base site, dry out seines, dip nets, and kick nets, and inspect and remove any remnant vegetation or animal life. If the weather is rainy and gear cannot be dried out, then use a different (backup) set of gear, if available. If an additional set of gear is not available, disinfect gear with 10 percent bleach solution.

2. Clean and dry other equipment prior to storage.

    - Rinse chlorophyll filtration chamber three times with distilled water after each use.
    - Rinse periphyton sampling equipment with tap water at the base site.
    - Rinse coolers with water to clean off any dirt or debris on the outside and inside.
    - Make sure conductivity pens or conductivity meter probes are rinsed with deionized water and are stored moist.
    - Rinse all beakers used to collect water chemistry samples three times with deionized water to prevent contamination of the next stream sample. Place the beakers in a 1-gallon self-sealing plastic bag with a cubitainer for use at the next stream.

3. Check fish nets for holes and repair, if possible; otherwise, set damaged gear aside and locate replacements.

4. Inventory equipment and supply needs and relay orders to the Field Coordinator through the Communications Center.

5. Remove DO meters and GPS receivers from carrying cases and set up for pre-visit inspections and performance tests. Examine the DO membrane for cracks, wrinkles, or bubbles; replace if necessary.

6. Recharge all batteries overnight if possible (12-V wet cells, current meter, computer battery). Replace others (GPS, DO meter) as necessary.

7. Recheck field forms from the day's sampling activities. Make corrections and completions where possible, and initial each form after review.

8. Replenish fuel in vehicles and/or electrofishing generator (if necessary).

Depending upon the project, this information may be recorded manually onto paper forms, or otherwise recorded electronically into a portable computer, using such tools as barcode scanners and customized entry and reporting software. Procedures for conducting sample tracking activities should be provided to each field team by the information management staff, possibly as a separate operations manual or handbook.

The sample tracking system should also identify the intermediate and final destinations for each sample. In some cases, intermediate storage "depots" may be used to accumulate samples prior to shipment to the support laboratory. The tracking system should provide an informal "chain-of custody" to prevent the loss of samples and associated information.

General guidelines for packing and shipping the various types of samples described in this manual are presented in Table 3-5. When shipping samples using ice, use fresh ice. Use block ice when available; it should be sealed in a large plastic bags. If block ice is not available, contain the ice in several self-sealing plastic bags. Label each bag of ice as "ICE" with an indelible marker to prevent any leakage of meltwater from being misidentified by couriers as a possible hazardous material spill.

Water chemistry samples must be shipped as soon as possible after collection in order to meet holding time requirements for some laboratory analyses. To ship water chemistry samples, place a large (30-gallon) plastic bag in an insulated shipping container (e.g., a plastic or metal cooler). The sample labels on the cubitainer and syringes should be completely covered with clear tape to prevent damage from water or condensation during shipment. Place the four syringes into a separate plastic container for shipment. Place the cubitainer and syringe container into a second large plastic bag and close. Place the bag containing the samples inside the plastic bag lining the shipping container. Place bags of ice around the bag of samples, but inside the plastic bag lining the shipping container. Then close the outer plastic bag. Seal the cooler with clear tape. Place the required sample tracking forms in the shipping container and close it. Seal the container with shipping tape and affix any required shipping-related labels to the outside of the container. Attach an adhesive plastic sleeve to the lid of the container and insert any required shipping forms.

Sediment toxicity samples can be held for extended periods (e.g., a week), if they can be kept refrigerated in the field. Transport or ship sediment toxicity samples in a separate container from water chemistry samples if possible to avoid possible contamination of

TABLE 3-5. GENERAL GUIDELINES FOR PACKING AND SHIPPING SAMPLES

Sample Type (container)	Guidelines
Samples requiring refrigeration (4 *I*C)	
Water Chemistry (4-L cubitainer and 60-mL syringes)	Ship on day of collection or within 24 hr by overnight courier. Use fresh ice in labeled plastic bags for shipping. Line each shipping container with a large plastic bag. Place syringes in a plastic container. Place syringe container and cubitainer inside of a second plastic bag. Cover labels completely with clear tape. The cubitainer and syringes should have same sample ID number assigned. Confirm the sample ID assigned on the labels matches the ID number recorded on the field collection form (or other sample tracking report).
Sediment Toxicity (1-gal plastic bag)	Ship on day of collection or within 24 hr by overnight courier. Keep chilled if extended storage time in the field is necessary. Use a separate shipping container from water chemistry samples. Package and ship using the same instructions as for water chemistry samples. If available, place the plastic bag containing the sample into a plastic container to protect it during transport and shipment. Cover labels completely with clear tape. Confirm the sample ID assigned on the label matches the ID number recorded on the field collection form (or other sample tracking report).
Samples requiring freezing (-20 *I*C) within 24 hours of collection	
Periphyton chlorophyll (filter in aluminum foil)	If samples cannot be kept frozen in the field, ship on day of collection or within 24 h by overnight courier. Cover the label completely with clear tape. Protect samples from meltwater if ice is used by double bagging ice and placing samples in a plastic container. Confirm the sample ID assigned on the label matches the ID number recorded on the field collection form (or other sample tracking report). If dry ice is used to transport or ship samples, special shipping containers, outside labeling, and shipping forms may be required.
Periphyton biomass (filter in a numbered container)	
Periphyton activity (50-mL centrifuge tube)	
Sediment metabolism (50-mL centrifuge tubes)	
Fish Tissue (aluminum foil; two 30-gal plastic bags)	If samples cannot be kept frozen in the field, ship on day of collection or within 24 h by overnight courier. Cover labels completely with clear tape. Label on each bag should have identical Sample ID number assigned. Confirm the sample ID assigned on the label matches the ID number recorded on the field collection form (or other sample tracking report). Protect samples from meltwater if ice is used by double bagging ice. Special shipping containers, outside labeling, and shipping forms may be required for shipments containing dry ice.

(continued)

TABLE 3-5. (Continued)

Sample Type (container)	Preservative	Guidelines
Samples requiring preservation in formalin		
Periphyton ID (50-mL centrifuge tube)	10% buffered formalin	Labels or tags placed inside of the jar must be of water-resistant paper or 100% rag content paper. The label on outside of the container should be completely covered with clear tape. Confirm the sample ID assigned on the label matches the ID number recorded on the field collection form (or other sample tracking report). Special shipping containers, outside labeling, and shipping forms may be required for shipments containing formalin.
Fish Specimens (1-L and/or 4-L jars)	10 % buffered formalin	
Samples requiring preservation in ethanol		
Benthic Macro-invertebrates (500-mL or 1-L jars)	70 % ethanol	Confirm the sample ID assigned on the label matches the ID number recorded on the field collection form (or other sample tracking report). Special shipping containers, outside labeling, and shipping forms may be required for shipments containing ethanol.

the water samples. Pack and ship sediment toxicity samples using the same type of insulated container and plastic bag arrangement as described above for water chemistry samples. If available, sediment toxicity samples can be placed inside a plastic container (similar to the one used for syringe samples) to protect it during shipment.

Samples requiring freezing (Table 3-5) may be stored in the field in a portable freezer or on dry ice for a short period (e.g., one week). If only ice is available for field storage, the samples should be shipped to the laboratory as soon as possible after collection, using fresh ice to keep them as cold as possible. When using ice, double bag the ice and tape the last bag shut to prevent contamination of samples by melting ice. If possible, place samples into a sealed plastic container to protect them from meltwater. Dry ice may also be used for shipping. Note that dry ice is considered a hazardous material, and requires special shipping containers, shipping labels, and shipping forms for ground or air transport. If dry ice is used, the requirements and directions for packing and shipping samples ice should be provided to each field team.

Samples that are preserved in buffered formalin (periphyton ID samples and fish voucher specimens) or ethanol (benthic macroinvertebrate samples) should be transported in appropriate containers and surrounded with some type of acceptable absorbent material (e.g., vermiculite). The total volume of formalin in the periphyton ID samples (2 mL per 50-mL centrifuge tube) may be small enough that they may be shipped without designating them as a hazardous material. Specific directions for packing, labeling, transporting, and shipping samples containing formalin or ethanol should be provided to each field team.

Each team leader should contact the field coordinator or other central contact person after each stream visit to provide a brief update of each sampling visit, and to request replenishment of supplies if necessary. For each shipment, provide the stream identification number, date sampled, date that samples are being shipped, and the airbill number from the courier's shipping form. If the shipment date is on a Friday, call the contact person or leave a message that a Saturday delivery is coming. Teams should inventory their supplies after each stream visit and submit requests for replenishment well in advance of exhausting on-hand stocks.

3.3 EQUIPMENT AND SUPPLIES

A checklist of equipment and supplies required to conduct the activities described in Section 3 is presented in Figure 3-4. This checklist is similar to the checklist in Appendix

BASE LOCATION ACTIVITIES

QTY.	ITEM	
Before Departure for Stream		
1	Dossier of access information for scheduled stream site	
1	Sampling itinerary form or notebook	
1	Safety log and/or personal safety information for each team member	
1	GPS receiver with extra batteries	
1	Dissolved oxygen/temperature meter with probe	
1	Conductivity meter with probe, or conductivity pen	
1	500-mL plastic bottle containing deionized water	
2	500-mL plastic bottles containing conductivity QCCS, labeled “Rinse” and “Test”	
1	Current velocity meter with probe and wading rod	
	Assorted extra batteries for dissolved, conductivity, and current velocity meters	
1 set	Completed water chemistry sample labels (3 labels with same barcode)	
1 set	Water chemistry sample containers (one 4-L Cubitainer and two 60-mL syringes with a plastic storage container	
1 box	Clear tape strips to cover completed sample labels	
1	Checklist of all equipment and supplies required for a stream visit	
Packing and Shipping Samples		
	Ice (also dry ice if it is used to ship frozen samples)	
1 box	1-gal heavy-duty sealable plastic bags	
1-box	30-gal plastic garbage bags	
2	Insulated shipping containers for frozen samples and sediment toxicity sample (special containers may be needed if dry ice is used)	
2	Containers and absorbent material suitable to transport and/or ship samples preserved I formalin and ethanol	
1	Plastic container to hold the sediment toxicity sample	
	Shipping airbills and adhesive plastic sleeves	

Figure 3-4. Equipment and supply checklist for base location activities.

A, which is used at the base location to ensure that all of the required equipment is brought to the stream. Use this checklist to ensure that equipment and supplies are organized and available at the stream site in order to conduct the activities efficiently.

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