Illinois Environmental Protection Agency

Bureau of Water

Document Control Number 184

Standard Operating Procedure for Stream Water Quality Sample Monitoring

Surface Water Section

1021 North Grand Avenue East

P.O. Box 19276

Springfield, Illinois 62794-9276

Contact: Bureau of Water, Quality Assurance Officer 217-782-3362

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1.0 Scope and Application

This Standard Operating Procedure (SOP) provides guidelines for the collection, preservation, and handling of water samples collected by Bureau of Water (BOW) Surface Water Section (SWS) staff from streams. Water samples are analyzed for organic and inorganic constituents and field observations recorded at the time samples are collected. These chemical results and physical findings are used to support a variety of BOW programs. Equipment calibration and maintenance and necessary commodities (bottles, filters, etc.) needed for collection are described. This SOP also includes descriptions of standard Quality Assurance (QA) and Quality Control (QC) practices used by field staff when collecting water samples.

2.0 Summary of Method

2.1 Water quality samples must accurately represent the chemical composition of the stream at the time the sample is collected. To this end, a systematic method for collection of water samples and quality assurance measures are in place for BOW staff to ensure collection of representative samples. Depending on stream depth and flow conditions, samples may be collected by wading, from a bridge or by boat.

2.1.1 To help ensure representativeness, samples generally are collected using a modified Multi Vertical - Equal Trans Rate method (MV- ETR). The MV-ETR requires proportional spacing of sampling points (or verticals) across the stream and an equal rate of transit when lowering and raising the water sampling device through the water column. Due to the uniform transit rate at all verticals, the volume of water collected at each vertical will depend on both the depth and velocity of the stream. Water from each of the verticals is composited into a churn splitter, mixed and then split into the appropriate bottles (total parameters) and filtered (dissolved parameters) which are then placed on ice for shipment to the laboratory for analysis.

2.1.2 Due to unique preservation or the potential for cross-contamination, some samples for specific parameters (e.g., fecal coliform, chlorophyll, etc.) are collected using a direct grab method.

2.2 QA/QC procedures are in-place to assure samples are representative of the stream sampled and not affected by outside contamination. Equipment blanks are routinely collected to verify the purity of commodities and equipment that contact the sample. Sample bottles for each parameter are provided by the appropriate laboratory and distributed to the field offices for use. Field meters are calibrated daily as per manufacturers' specifications and the results of the calibration are recorded in a bound log book.

2.3 In-stream measurements of Dissolved Oxygen, pH, Specific Conductance and Temperature are determined using a multi-parameter meter and recorded at the time of sample collection. Additional observations of conditions that may affect the water sample are recorded.

3.0 Interferences and Corrective Action

3.1 Dirt, oils and other foreign substances on equipment used to collect a water sample can cause contamination to the sample and bias the laboratory result. Sample collection bottles, churn splitter, peristaltic pump tubing and any other equipment that comes into contact with the sample at the time of collection and subsequent processing are cleaned and rinsed with ambient stream water prior to sample collection.

3.2 Field meters used to assess the phisio/chemical condition of the stream need routine calibration. All field meters are calibrated per program requirements prior to use, following manufacturers guidelines and using certified standards and buffers.

3.3 Established sample locations may at times be affected by local disruption that block the technician's access to the stream, and/or cause an unusual condition in the stream. Typically this is a result of road and bridge construction that force the closing of roads and also may result in unusual in-stream conditions (e.g., an unrepresentatively high level of sediment due to in-stream construction). If the stream is impacted, attempt to re-locate the collection location upstream. Note any change of sample collection location. If a sample cannot be collected a short distance upstream, the conditions should be noted and the sample collection postponed.

4.0 Safety

Collection of a water sample requires staff to be exposed to the elements and in, on or over bodies of water for each sampling event. Safety in these situations requires an awareness of your surroundings. Consult the currently approved BOW Field Safety Manual for general safety guidelines and precautions applicable to stream water samples.

4.1 Collecting a stream water sample often requires wading into or being on the water. Prior to wading to collect a sample, determine the safety of entering the stream. Be aware that stream depth, velocity and substrate all influence the ability to safely wade a stream. Collecting a sample by boat requires following all guidelines of safe boating.

4.2 Field personnel routinely come into direct contact with waterborne pathogens. Wash hands with soap and water and/or an appropriate hand sanitizer routinely after handling samples. Verify that immunizations are current.

4.3 Acid or base compounds are used as preservatives in some sample bottles. Acid is used as a decontamination rinse for sampling equipment. Both compounds will cause burns to skin and clothing. Wear safety glasses and an apron when handling. Flush skin with copious amounts of water if contacted.

5.0 Instrument Calibration

Calibrate instruments used to determine in situ water parameter values as scheduled in the appropriate BOW SOP.

5.1 Multi-parameter meters are used to determine spot in situ values for water temperature, pH, specific conductance, and dissolved oxygen. These meters consist of a hand-held surface unit (read-out), cable and sonde unit which house the sensors. These are intricate but generally durable field instruments and require routine calibration. BOW/SWS requires daily calibration prior to using these meters. Several models of meters are currently being used by SWS. Refer to the appropriate BOW SOP, as well as the manufacturers Operating Manual for calibration, operation and trouble-shooting measures.

5.2 Specialized multi-parameter meters with internal memory are deployed for extended periods of time to record in situ water parameter values. These meters consist of a sonde unit that houses sensors which measure parameters such as temperature, pH, specific conductance and dissolved oxygen. Parameters to be recorded and time interval are determined at calibration. Internal memory stores the values for the deployment duration. Several models of meters are currently being used by SWS. BOW/SWS requires calibration of these multi-parameter meters both pre and post deployment. Refer to the currently approved BOW/SWS SOP for Continuous Monitoring of Water Quality as well as the manufacturers Operating Manual for calibration, operation and trouble-shooting measures.

5.3 Turbidity of the water sample is a standard parameter determined and recorded for BOW/SWS programs. The HF Scientific DRT-15CE Portable Turbidimeter is used by SWS for turbidity measurement. These are self contained units powered by internal battery or AC power. BOW/SWS requires daily calibration prior to use for these meters. Refer to the currently approved BOW/SWS SOP for Measurement of Turbidity in Water as well as the manufacturers Operating Manual for calibration, operation and troubleshooting measures.

6.0 Cleaning of Sampling Equipment

Clean all equipment that comes into contact with sample water in order to avoid cross-contamination from previous samples. Conduct a thorough cleaning each week prior to QA/QC sampling (see section 7.0). Where applicable, scrub equipment with a nylon bristle brush, non-phosphate detergent (i.e., Liqui-Nox) and rinse with 5% Hydrochloric Acid (HCl) and de-ionized water (DIW). Rinse all equipment and commodities with a volume of ambient water prior to use.

> **Note**: Use caution when handling Hydrochloric Acid (HCl). HCl can cause burns to skin and clothing, flush with copious amounts of fresh water if contacted.

6.1 Clean the interior of the churn splitter by using a small amount of non-phosphate detergent, a nylon bristle brush and rinsing with DIW. Use a small volume (~ 150mL) of 5% HCl to rinse the churn splitter and discharge the HCl through the spigot. Triple rinse the churn using DIW, discharging the water through the spigot of the churn. Rinse the churn (discharge a volume through the spigot) with ambient water immediately prior to use.

6.2 Run a volume (~100mL) of Liqi-Nox and water solution through the silicone tubing in the peristaltic pump used to filter for dissolved constituents. Rinse the tubing with DIW and then with a volume (~ 100mL) of HCl. Rinse with a volume (~ 250mL) of DIW. Place the tubing ends in a clean plastic bag for storage.

6.3 Rinse the churn splitter and pump tubing with DIW after use at each station.

7.0 Quality Assurance/Quality Control Samples

Quality Assurance/Quality Control (QA/QC) Blank Samples are routinely collected in order to verify that samples accurately represent the stream at time of collection and are not altered during processing prior to delivery to the appropriate lab for analysis. Equipment used for sample collection and processing, commodities and the bottles used to transport the sample to the lab are tested for residual contamination. Prior to the first water sample collection of each week, a set of QC samples ("Blanks") is prepared to check for cleanliness of the sample collection process and the bottles, equipment, de-ionized water and filters to be used for that week of environmental sample collection. De-ionized water prepared in the regional offices is used to produce all blank samples. The parameters for analysis in the blank samples are program dependant.

7.1 Blank sample ”A”, a field blank, is prepared at the site of environmental sample collection by pouring de-ionized water known to be free of the parameters being monitored for into sample containers supplied by the laboratory. Blank A is used to check that the general sample collection procedures used and the environment at the site are not contributing parameters of interest to the environmental water sample.

- ~ Mark each bottle to be submitted for analysis appropriately.
- ~ Complete a Request For Laboratory Analysis (RFLA) sheet for each blank sample.
- ~ Fill bottle to the shoulder and securely tighten the cap of each sample bottle to be submitted for analysis

7.2 Blank sample “B”, a filter blank (one type of equipment blank), is prepared by passing a volume of the de-ionized blank water through the peristaltic pump tubing and a 45 filter.

- ~ Mark each bottle to be submitted for analysis appropriately.
- ~ Complete a RFLA sheet for each blank sample.
- ~ Affix a clean cartridge filter to the outlet end of the pump hose and using the supply of DIW run approximately 100 ml of DIW through the filter to thoroughly flush the filter.
- ~ Using the supply of DIW, fill to the shoulder and securely cap each sample bottle to be submitted for analysis after the water has passed through the peristaltic pump tubing and filter.

7.3 Blank sample “C”, an equipment blank, is prepared by passing a volume of the de-ionized blank water through the churn splitter or sample bottle.

- ~ Mark each bottle to be submitted for analysis appropriately.
- ~ Complete a RFLA sheet for each blank sample.
- ~ Pour a suitable volume of DIW into the churn splitter. Using the spigot on the churn splitter, fill to the shoulder and securely cap each sample bottle. Alternately, if using a sample bottle rather than a churn splitter, pour a suitable amount of DIW into the bottle and fill to the shoulder and securely cap each sample bottle.

7.4 Blank “D”, an equipment blank, is prepared by passing de-ionized blank water through a stainless-steel Kemmerer sample bottle.

- ~ Mark each bottle to be submitted for analysis appropriately.
- ~ Complete a RFLA sheet for each blank sample.
- ~ Pour a suitable volume of DIW into the Kemmerer. Using the valve on the Kemmerer, fill to the shoulder and securely cap each sample bottle.

7.5 Blank “E”, an equipment blank, is prepared by passing de-ionized blank water through the peristaltic pumps’ Teflon tubing used while collecting a sample by the Moving Boat Method (see section 10.5).

- ~ Mark each bottle to be submitted for analysis appropriately.
- ~ Complete a RFLA sheet for each blank sample.
- ~ Pump a suitable volume of de-ionized blank water through the tubing and fill to the shoulder and securely cap each sample bottle to be submitted for analysis.

8.0 Equipment and Supplies

The following is a list of equipment and supplies needed to complete a routine sample collection. Use of the equipment and supplies is described in separate sections in this SOP.

Appropriate BOW/SWS sampling SOP documents
Appropriate Request for Laboratory Analysis sheets
Field Parameter Form
Clipboard
Waterproof black pen
Waterproof marker
Waterproof paper
Weighted Bottle Sampler (WBS) with rope
Plastic 1/2 gallon bottles (or other appropriate sample collection containers)
Quart laboratory rinsed narrow mouth amber glass sample collection bottles
Churn Splitter
Sample Bottles (for submittal to the lab) as required for the days collection
Multi-parameter meter (i.e. Hydrolab) and spare

Multi-parameter meter calibration/maintenance kit
Appropriate pH Buffers (7.00 and 4.00 or 10.00)
Appropriate Specific Conductance Standards: high (± 1400 S/cm) and mid (± 700 S/cm)
Barometer
Multi-parameter Meter Calibration Log with Temperature and D.O. Chart
Peristaltic Pump & Dissolved Parameter In-Line Filters
Additional special equipment needed for a particular survey:
    Field Bacteria Kit (includes vacuum filter aparatus, filters, pertri dishes, media and incubator)
    Turbidimeter and logbook,
    Chlorophyll filter/pump and filters
Cooler(s) with Ice
De- ionized water (DIW)
5% HCl
Alcohol thermometer and spare
Non Phosphate Detergent (Liqui-Nox)
Kim-wipes and paper towels
Whirl-pac and zip-loc plastic bags
Tap Water and hand soap
Alcohol
Long Rubber Gloves
Chest waders and hip boots
Rain Gear
First Aid Kit, change of clothing and flashlight
Traffic warning devices (i.e. cones or signs)
High-Visibility Safety Vest
Life Jacket
USGS Stream Gage Keys
Station Description Book
Watch

9.0 Unique Sampling Equipment Description

9.1 A Weighted Bottle Sampler (WBS) is a metal framed sampling device that is attached to a rope hand-line to allow sample collection from a bridge or boat. An adjustable lock-ring encircles the mouth of a narrow-mouth bottle and holds the bottle upright while collecting a water sample. Narrow mouth plastic, glass or sterile plastic bottles are used as appropriate for the sample volume and constituent being analyzed. The bare metal surface of the WBS should be painted with epoxy paint to reduce potential metal contamination to the sample.

9.2 The churn splitter is a bucket-like container used to produce a composite sample and keep particles in suspension while distributing sub-sample volumes into appropriate containers. The composited samples are taken from the churn splitter for analysis of all total and dissolved and suspended inorganic constituents, including metals. By moving a rod protruding from the removable top attached to an internal disk up and down (hence the term churn), the volume of sample water in the bucket is well mixed (homogenized) and particulates remain suspended. The well mixed sample is drawn into the appropriate individual sample parameter bottles through a spigot near the bottom of the churn. Use a slow steady pace while churning.

9.3 A peristaltic pump complete with Teflon tubing is used to draw a volume of sample water. Generally, the pump is used to pass sample from the churn splitter through a 45 filter to obtain a sample to be analyzed for dissolved parameters. The filters are single use, disposable capsules that are attached to the outlet end of the Teflon hose for direct filling of the sample bottle. The pump is also used to draw a sample from the stream into the churn splitter when collecting a sample by boat.

10.0 Water Quality Sample Collection

It is essential for all water quality samples to represent the condition of the stream at the time a sample is collected. Generally, samples are collected while wading the stream using a hand held bottle (HHB) or from a bridge using a weighted bottle sampler (WBS) suspended by a rope. Also, programmatic or environmental conditions may require using unique sampling procedures such as a grab sample or collection of a sample from a boat while traversing the stream.

10.1 Hand Held Bottle: If stream depth and flow conditions allow, collect a representative sample by wadding the stream along a transect perpendicular to stream flow by immersing a hand-held bottle at multiple evenly-spaced verticals. Multiple dips of the bottle at each interval may be necessary to collect a suitable amount of sample. Each individual sub-sample volume is composited into a churn splitter. Use one clean bottle for the entire cross section at each site.

~ Prior to sampling, choose a cross section (transect) of stream that can be waded safely. Be aware that stream depth, velocity and substrate all influence the ability to safely wade a stream.
~ Determine the number of sample verticals to collect water sub-samples at along the transect. Generally, locate the sample transect in the stream that provides a well mixed sample both across the stream width as well as within the water column. The number of sample verticals is dependent on the stream width. Collect a sample using one (1) vertical at the center of flow for streams less than 10’ wide. Three (3) verticals should be sampled on streams ranging in width from 10-30’. Collect samples at five (5) verticals on streams over 30 feet wide. Additional vertical sub-samples may be collected at the samplers discretion. The total number of verticals and dips per vertical is based on the amount of sample volume needed. In narrow or very shallow streams each vertical will require

multiple dips to get a sufficient amount of water.

~ Prior to commencing the sample collection, determine the transit rate for the bottle to be used to collect each sub-sample at each vertical. At the center of flow; face upstream, hold the bottle so as not to obstruct the opening and with the bottle out in front (upstream) of sampling technicians body, submerge the sample bottle to the stream bed and without hesitating at the stream bed raise it to the surface prior to the bottle completely filling. Note this equal transit rate (ETR) and use it for each sub-sample collection at each sample interval. Use this test-rate sample as a rinse for the sample bottle and churn splitter.
~ Use care in ensuring that the mouth of the bottle does not come into contact with the stream bed and/or the bed is not disturbed immediately upstream of the sample bottle.
~ Sample all verticals at each station the same number of times. At each vertical, lower the bottle from water surface to bottom and up again at a constant ETR and composite into the churn splitter.
~ Tip the churn splitter slightly and slowly pour the sub-sample on the wall of the churn to avoid artificially aerating the sample.
~ Return to the center of flow to deploy the multi-parameter meter and collect single point grab samples (i.e., TOC, Phenol, bacteria, chlorophyll, etc., see section 10.4).

10.2 Weighted Bottle Sampler: If the stream is non-wadable (due to depth, unsafe velocity, inability to access stream, etc.) collect a sample from a bridge using a weighted bottle sampler (WBS). The stream is sampled at equal width intervals from the bridge by lowering and raising the WBS at each transect interval. Multiple dips of the bottle may be necessary to collect a suitable amount of sample. Composite each individual sub-sample volume into the churn splitter. Use a clean collection bottle for the entire cross section at each site.

~ Generally, the sample is collected from the up-stream side of the bridge unless safety or other issues (bridge construction, tall guardrails, etc) require the sample to be collected from the down-stream side of the bridge.
~ Determine the number of verticals to be sampled. The number of sample verticals is dependent on stream width. Collect a sample using one (1) vertical at the center of flow for streams less than 10' wide. Three (3) verticals should be sampled on streams ranging in width from 10-30'. Collect samples at five (5) verticals on streams over 30 feet wide. Additional vertical sub-samples may be collected at the samplers discretion.
~ Prior to sample collection determine the transit rate for the bottle to be used to collect each sub-sample at each vertical. At the center of flow, submerge the sample bottle to the stream bed and without hesitating at the stream bed raise it back to the surface prior to the bottle completely filling. Note this equal transit rate (ETR) and use it for each sub-sample collection at each sample interval. Use this test-rate sample as a rinse for the sample bottle and churn splitter. The total number of dips per vertical is determined by the sample volume needed. On very shallow streams each vertical may require multiple dips to get a sufficient amount of water.
~ Use care to ensure that if fine material is re-suspended when the WBS comes in contact with the stream bed they are not collected as part of the sub-sample. If this is the case when sampling, discard the collected sample and resample at that vertical.
~ Collect an equal number of dips at each vertical. At each vertical, lower bottle from water surface to bottom and up again at a constant ETR and composite into the churn splitter.
~ Maximum sampling depth is dependent upon the capacity of the bottle and the rate of filling. In the event the depth at a site is such that a suitable equal transit rate (ETR) cannot be established (i.e., the bottle fills too rapidly) the opening of the bottle should be reduced with the appropriate bottle lid with a hole drilled in it. Keep a supply of lids with various sizes of holes in the vehicle.

~ Tip the churn splitter slightly and slowly pour the sub-sample on the wall of the churn to avoid artificially aerating the sample.
~ Return to the center of flow to deploy the multi-parameter meter and collect single-point grab samples (i.e., TOC, Phenol, bacteria, chlorophyll, etc., see section 10.4).

10.3 Grab Sample: A single point sample (or grab) is collected when specific parameter requirements, field conditions or program guidelines dictate. A grab sample is collected by submerging a sample bottle to one (1) foot below the water surface (if stream depth allows) at the center of flow in the stream. Use a hand held bottle when wading the stream and a rope suspended WBS when collecting a sample from a bridge. Multiple dips of the bottle may be necessary to collect a suitable amount of sample. If appropriate for the sample parameter(s), composite each sub-sample volume into the churn splitter. For those parameters that need to be sampled discretely, sample and pour off directly to the lab sample bottle or sample directly using the lab sample bottle. Use a clean collection bottle at each site.
~ Prior to sampling by wading, choose a cross section (transect) of stream that can be traversed safely. Be aware that stream depth, velocity and substrate all influence the ability to safely wade a stream.
~ If sampling from a bridge using a WBS, generally, the sample is collected from the up-stream side of the bridge unless safety or other issues (bridge construction, tall guardrails, etc) require the sample to be collected from the downstream side of the bridge.
~ At the center of flow, submerge the sample bottle to a depth of approximately one (1) foot and raise it out of the water prior to the bottle completely filling. Use this sample as a rinse for the sample bottle and churn splitter.
~ At the center of flow, submerge the sample bottle to a depth of approximately one (1) foot and raise it out of the water prior to the bottle completely filling. Repeat the grab sample (multiple dips) to get a sufficient amount of water.
~ Tip the churn splitter slightly and slowly pour the sub-sample on the wall of the churn to avoid artificially aerating the sample.
~ Return to the center of flow to deploy the multi-parameter meter and collect single point grab samples (i.e., TOC, Phenol, bacteria, chlorophyll, etc., see section 10.4).

10.4 Several water parameter samples are collected at the center of flow independent of the multi-transect composite collection that is placed in the churn splitter. The parameters requiring discrete sample collection are:
~ Bacteria - Requires collection in a sterile bottle to avoid cross-contamination. Collect directly in a fresh bacteria bottle using either a HHB or WBS. If collecting by HHB, remove bacteria bottle cap and hold in one hand while collecting sample with the bottle in the other hand. If collecting using a WBS, remove bacteria bottle cap and place in fresh whirl-pac bag to avoid contamination while collecting the sample.
~ Total Organic Carbon (TOC) and Phenol - Require collection in a glass bottle to avoid contact with plastic material. Collect sample using a laboratory provide rinsed glass bottle (amber rinsed narrow mouth) using either WBS or HHB. Cap glass collection bottle and pour off into TOC and Phenol sample bottles as per Section 12.3.
~ Chlorophyll – Collect in plastic bottle at one foot depth using either a WBS or a HHB. Pour directly into preserved foil wrapped sample bottle.

10.5 Moving Boat Method: On large streams, where a bridge crossing is not available, a water sample can be collected by boat. The moving boat method uses a peristaltic pump connected to a length of submerged tubing that draws water from about one (1) foot depth and discharges to a churn splitter. The boat follows a transect perpendicular to stream flow across the stream.

~ Prior to sampling, review and follow all safe boating practices as detailed in currently approved BOW/SWS Field Safety Manual.
~ Identify the transect of stream to sample. Generally, the sample is collected at a constricted transect with uniform flow, free from side channels or bays.
~ Prior to starting the transect water collection; operate the pump to collect a volume of water in the churn splitter. This volume of water is used to rinse the pump tubing and to rinse the churn.
~ With the boat near one bank and sampling equipment in place, motor to the opposite bank along a transect that is perpendicular to the stream. Once underway along the transect, turn on the pump to start drawing water into the churn splitter. Proceed at a slow and uniform speed in order to keep the intake hose submerged.
~ Depending on the width of the stream and speed of the boat, multiple passes may be needed to collect sufficient sample in the churn. Given that this is a composite sample, an entire pass of the transect (bank to bank) must be completed once started.
~ Return to the center of flow to deploy the multi-parameter meter and collect single point grab samples (i.e., TOC, Phenol, bacteria, chlorophyll, etc., see section 10.4).

11.0 Water Samples for Organic Constituents

Collect a water sample to be analyzed for organic constituents using a laboratory pre-rinsed 1L amber glass bottle either by the HHB or WBS method (see section 10.1 or 10.2, respectively). In order to avoid cross-contamination with any plastic material, each sub-sample is collected in a laboratory pre-rinsed amber glass bottle and composited directly into a 1 gallon amber pre-rinsed bottle. Use a clean collection bottle for each station.

12.0 Sample Processing

Sample bottles to be delivered to the laboratory for specific constituent analysis are filled from the water in the churn splitter upon returning to the sampling vehicle. Bottles needed for specific parameters are listed below in Table 1. Programmatic requirements dictate the bottles needed for each station; however the sample preparation process remains consistent.

12.1 Using a waterproof marker, clearly mark each sample bottle for analysis with an appropriate identifying code unique to the station. Complete all RFLA sheets associated with the station.

12.2 To fill the “total” constituent bottles: Start the churning process and while churning, open the spigot to flush the spout with approximately 20mL of sample and while continuing to churn and dispense sample, move an empty sample bottle into the sample stream and fill the bottle to the shoulder. Securely cap the bottle and place in a cooler with ice. Repeat for each of the sample bottles needed for “total” analysis. Avoid breaking the surface of the sample water in the bucket when raising the paddle so the sample is not artificially aerated. See Section 9.2 for additional information on the churn splitter. Sample should not be removed for total constituents when the level falls below the churn spigot level. However, sample remaining in the churn (below the spigot level) may be used for filtered subsamples. Churn splitters are made of polyethylene, and therefore, are not used in compositing samples for analyses of organic substances. Bacteria samples are not taken from the splitter churn because it cannot be sterilized.

12.2 To fill the “dissolved” constituent bottles: A peristaltic pump is used to pass sample water through a filter. See Section 9.3 for general information and Section 6.2 for the procedure to clean the pump tubing. Ensure that the peristaltic pump tubing is clean and place a clean cartridge filter into the outlet end of the peristaltic pump tubing. Place the inlet end of the tubing into a clean receptacle with approximately 100mL of DIW and pass through the filter to rinse any residue from the filter. Place the intake end of the tubing into the churn splitter and allow approximately 100mL of filtered sample to pass. Place an empty sample bottle into the sample stream and fill the bottle to the shoulder. Securely cap the bottle and place in a cooler with ice. Repeat for each of the sample bottles needed for "dissolved" analysis.

12.3 To fill the Total Organic Carbon (TOC) vials: Only use sample from a glass bottle filled directly from the stream (see Section 10.4). Three (3) vials are submitted to the lab per sample. Fill each of the 40mL vials to the shoulder. Securely cap the bottle and place in a cooler with ice. Repeat for each of the vials.

12.4 To fill the Phenol bottle: Only use sample from the glass bottle filled directly from the stream (see Section 10.4). Fill bottle to the shoulder. Securely cap the bottle and place in a cooler with ice.

13.0 Sample Handling

13.1 Samples are subject to degradation due to several factors after collection and during transport to the laboratory for analysis. In order to minimize this change, some of the sample bottles used for delivery to the lab contain preservatives to stabilize the sample in transport. The holding and transport time prior to analysis is also a critical factor in sample stability. Refer to Table 1 (below) for preservation method and holding time requirements for specific samples.

13.2 All water samples must be cooled as soon as possible after collection to $\leq 6^{o}$C. Bring a sufficient number of coolers in the field to adequately hold the bottles scheduled for collection. Use a volume of ice equal to the volume of sample bottles in each cooler to reduce and/or hold the temperature at $\leq 6^{o}$C. Current air temperature dictates the amount of cooling necessary to hold the samples at the appropriate temperature. In extremely hot summer weather, drain melt water and re-fill each cooler with ice throughout the day as necessary. Conversely, if holding samples overnight in cold temperatures, the coolers may have to be moved indoors to protect the samples from freezing.

13.3 Chlorophyll samples are unique in that the sample is field filtered within 24 hours of collection (see Table 1) and the filter is wrapped in foil and frozen prior to delivery to the lab for analysis. If a freezer is not available, keep the filter in direct contact with ice while transporting to a freezer. Please see the currently approved SOP for Field Procedures for Chlorophyll Samples.

13.4 Turbidity samples must be analyzed within 48 hours of collection (see Table 1). Field turbidimeters are available for determination of sample turbidity after arriving back at the office or overnight accommodations. Please see the currently approved SOP for Measurement of Turbidity in Water for a description of processing method.

13.5 Fecal Coliform bacteria samples should be delivered to the appropriate laboratory for analysis or field processed and incubated as soon as possible after collection. The holding time requirement for Fecal Coliform bacteria is six (6) hours (see Table 1). Please see the currently approved SOP for Fecal Coliform Bacteria Determination.

Table 1. Container, Preservation Technique and Holding Time Requirements for Water Samples Collected in Conjunction with SWS Programs

IMPORTANT -- HOLD ALL SAMPLES AT ≤ 6° C -- IMPORTANT

Parameter	Container and Preservative	Holding Time
Alkalinity	500 mL HDPE, none	14 days
Chloride	500 mL HDPE, none	28 days
Flouride	500 mL HDPE, none	28 days
Sulfate	500 mL HDPE, none	28 days
Total Dissolved Solids (TDS)	500 mL HDPE, none	7 days
Total Suspended Solids (TSS)	500 mL HDPE, none	7 days
Volatile Suspended Solids (VSS)	500 mL HDPE, none	7 days
Total Organic Carbon (TOC)	40 mL Amber Glass, $Na_2S_2O_3$	28 days
Phosphorus (Total)	1000 mL HDPE, H_2SO_4	28 days
Ammonia	1000 mL HDPE, H_2SO_4	28 days
Nitrite-Nitrate Nitrogen	1000 mL HDPE, H_2SO_4	28 days
Kjeldahl Nitrogen	1000 mL HDPE, H_2SO_4	28 days
Phosphorus (Dissolved)	250 mL HDPE, H_2SO_4	28 days
Metals (ICAP) (Total)	250 mL HDPE, none	6 months
Metals (ICAP) (Dissolved)	250 mL HDPE, none	6 months
Cyanide	250 mL HDPE, NaOH	14 days
Phenols	250 mL Glass, H_2SO_4	28 days
Oil and Grease	1000 mL Glass, H_2SO_4	28 days
Volatile Organics	40 mL Amber Glass, No Headspace, H_2SO_4	7 days
Fecal Coliform	100 mL Plastic, $Na_2S_2O_3$	6 hours
BOD and CBOD	½ Gallon Plastic	48 hours
Pesticides	1 Gallon Amber Glass, Lab Rinsed	7 days
Turbidity	250 mL Plastic	48 hours
Chlorophyll (to filter)	1000mL Foil Wrapped Plastic, $MgCO_3$	24 hours
(post filter)	Foil wrapped, frozen	30 days

14.0 Field Observations

In situ measurement for determining water temperature, pH, specific conductance, and dissolved oxygen are obtained using a multi-parameter meter. These meters consist of a hand-held surface unit (read-out), cable and sonde unit which houses the sensors. Air temperature is determined using an alcohol filled stick thermometer. Record field measurements and all other pertinent field observations on a Field Parameter Form (see example Appendix A).

14.1 To measure in situ parameters: Affix the protective housing on the sonde around the sensors. Submerge the sonde to one foot depth in the center of stream flow, turn on the meter, start the stirrer (if so equipped) and allow the probes to equilibrate to the ambient stream conditions. When the readings stabilize, record the water temperature, specific conductance, pH and dissolved oxygen values on a Field

Parameter Form.

14.2 Hang the air temperature thermometer in the shade and out of the influence of any large heat source (i.e., vehicle, bridge rail, etc.) and allow it to equilibrate to ambient temperature. Record the air temperature value to nearest degree C on the Field Parameter Form.

14.3 In situ water parameters, sampling method employed, location of sample collection and weather conditions all influence the water sample collected for analysis. The Field Parameter Form provides a systematic outline for recording all the pertinent information for each sample collection. Ideally, each sample is collected as per the procedures outlined in this SOP; however, there are times when conditions mandate sampling outside of these guidelines. Properly document the sample collection method used and any variation from the prescribed method for each station sampled.

15.0 Field Trip Checklist

~ Have all BOW/SWS SOPs pertinent to the sample collection being conducted in the vehicle at the time of sampling. See Section 17.0 for SOP's referenced in this procedural document.
~ Review the equipment and supply list while preparing for a trip.
~ Before departing on a field trip, check the operation, calibration and battery condition of field instruments to insure they are in good working condition.
~ Sufficient sample collection bottles (allowing for a fresh bottle for each station) should be cleaned and available. Unless pre-rinsed or preserved, rinse these bottles thoroughly with ambient stream water before using to collect a sample.
~ Start the day with sufficient coolers and ice to store and chill all samples to $\leq 6^{o}$ C.
~ Complete the appropriate Request for Laboratory Analysis Sheets and record all field values, weather conditions and special notes on a Field Parameter Form.
~ Remove all field instruments from an unheated vehicle during very cold weather to prevent freezing. Protect all calibration buffers and standards, reference solutions, distilled water and rinse acid from freezing. Likewise, remove samples from the vehicle to prevent freezing.
~ A documented improperly collected sample is better than no sample at all. If stream conditions are such that you are not able to follow the proper sampling procedure, you may modify methods in order to collect a sample. If it is necessary to deviate from the normal sampling procedure, document the sample collection method on all field data sheets.
~ If a site cannot be sampled as scheduled or you encounter any other problems in the field, notify your supervisor.

16.0 Sample Chain of Custody

16.1 Samples collected by the Illinois EPA may be used as evidence in regulatory or enforcement proceedings. Therefore, it is important that a traceable chain of custody be observed from the time the sample is collected to the time it is delivered to the laboratory for analysis. Station code and location are generally completed on the Request For Laboratory Analysis (RFLA) forms in the office and the balance of the information (date, time, etc.) is completed at the site when the samples are collected. The RFLA form and bottles representing that sample are identified by the sample collector with a code marked on the sheet and on the bottles

16.2 Lock the vehicle when it contains samples.

16.3 Include the completed RFLA's with the samples when delivered to the laboratory.

16.4 If the samples are not hand delivered to the laboratory, they should be shipped (UPS, Fed-Ex, etc.) in a locked cooler to ensure they are not altered.

17.0 Standard Operating Procedure Documents Referenced:

Field Safety Manual
Calibration and Use of Hydrolab MiniSonde 5
Calibration and Use of Hydrolab Quanta
Continuous Monitoring of Water Quality
Measurement of Turbidity in Water
Field Procedures for Chlorophyll Samples
Field Fecal Coliform Bacteria Determination

18.0 References

Federal Register. March 12, 2007. Table II. Required containers, preservation techniques and holding times. Vol. 72. No. 47. Pp. 11236-11238.

Illinois EPA. Ambient Stream Water Quality Monitoring. 1987. Section B. Quality Assurance and Field Methods Manual. Division of Water Pollution Control. Springfield, IL

Celeste Crowley. Illinois EPA Laboratory. E-mail to Bill Ettinger with Subject line: TOC sampling dated March 27, 2012.

Appendix A. Field Form:

IEPA FIELD PARAMETERS FORM

Station Code:			
Office:	Des Plaines	Des Plaines	Des Plaines
Collector Name:			
Date (mm/dd/yyyy) :			
Time (24:00) :			
Trip ID:			
Visit No. :			
Field Meter No. :			
Air Temp °C :			
Water Temp °C :			
D. O. mg/L :			
Conductivity :			
pH :			
Gage Height :			
Flow (f/sec) :			
Sampler Used (WBS, etc.)			
No. of Verticals/ Dips :	v d	v d	v d
Bridge Side (u/s, d/s) :			
Precip. in last 24 hrs:	☐ < 1 in ☐ 1 - 2 in ☐ > 2 in	☐ < 1 in ☐ 1 - 2 in ☐ > 2 in	☐ < 1 in ☐ 1 - 2 in ☐ > 2 in
Weather :			
Turbidity Meter No. :			
Turbidity :			
Chlorophyll (yes or no) :	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
Volume Filtered (mL) :			
Pesticide (yes or no) :	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

Comments :