# QUALITY ASSURANCE AND QUALITY CONTROL DOCUMENT FOR WATER CHEMISTRY MONITORING AT THE BREEWOOD TRIBUTARY

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# 1.0 INTRODUCTION

Montgomery County Department of Environmental Protection (DEP) is conducting a water chemistry monitoring project to characterize and evaluate stormwater impacts to Breewood Road Tributary. Monitoring will support the County's compliance with the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit as issued by the Maryland Department of the Environment (MDE). Monitoring at this location will also aid in determining the effectiveness of Best Management Practice (BMP) retrofits in the drainage upstream of the monitoring stations.

Montgomery County has contracted with Versar, Inc. (Task I, Contract No. 7801000117-AA) to provide field sampling and data management for the County's water chemistry monitoring project. This task involves installation, operation, and maintenance of automated rainfall, flow, and water chemistry monitoring equipment; field sampling; preparation of associated documentation; and compilation of monitoring data as necessary for the County to characterize and evaluate baseflow and storm water quality. Laboratory services will be provided by the Washington Suburban Sanitary Commission (WSSC) Laboratory under a separate contract with the County.

With the approval of MDE, Montgomery County DEP has identified two monitoring sites in the Sligo Creek watershed that will be used to characterize outfall and instream conditions, as specified in the County's third generation permit. Both sites are located in the approximately 45-acre Breewood Road Tributary Watershed. The first site (outfall) is located at the outfall of the storm sewer network draining University Boulevard and points north, near the intersection of Arcola Avenue. The second site (instream) is on the Breewood Tributary, at the downstream end of a culvert underneath Sligo Creek Parkway. Located on Maryland-National Capital Parks and Planning property, both sites afford public access for establishing and maintaining automated flow and water chemistry monitoring stations.

This Quality Assurance and Quality Control (QA/QC) Document was prepared by Versar to fulfill requirements of the task scope of work. This document outlines Versar's quality assurance (QA) management policies, principles, and procedures, and will serve as the manual for field and laboratory operations for the County's water chemistry monitoring project. Specifically, the attached Standard Operating Procedures (SOPs) provide detailed directions for each component of the project. The Versar Field Manager will review the QA/QC document with each field leader and technician to ensure that all steps are understood and accomplished. A copy will be provided to the Mission Support Unit Coordinator of the WSSC Laboratory, who will coordinate laboratory analyses. This QA/QC document includes detailed descriptions of equipment, equipment installation and proper use, field sampling logs and procedures, chain of custody procedures from the field to the laboratory, data management procedures, and problem-solving procedures.

# 2.0 QUALITY ASSURANCE MANAGEMENT PLAN

This section presents Versar's project quality assurance plan, as well as ESA Divisional quality assurance policies, principles, and procedures. The management and quality assurance protocols described below cover all facets of project work, including training, field activities, data collection, data analysis, data interpretation, and reporting.

## 2.1 OVERVIEW OF QUALITY ASSURANCE POLICY AND PROCEDURES

Versar staff is dedicated to achieving, maintaining, and improving high standards of quality in accordance with Division and Corporate client-satisfaction policy. This goal is achieved by adhering to active QA/QC procedures designed to ensure that services and deliverables are precise, accurate, complete, technically superior, and are of a sufficient integrity that they are suitable for their intended use.

The Quality Assurance program is implemented at the project's onset and forms an integral part of each step in the work process, from initial planning (e.g., task definition and scoping), to equipment maintenance, to data validation, and to final report preparation and review. Project performance standards designed to achieve quality objectives are detailed in this QA/QC plan.

Integrating QA throughout the work process is accomplished by:

- Providing effective, committed project management that defines and ensures accountability for the quality of the product;
- Dedicating adequate resources (*i.e.*, trained staff, equipment, and time) to complete the project; and
- Adhering to established quality control (QC) procedures that ensure consistency throughout the work process and maintain standards of excellence.

The QC procedures and detailed standard operating procedures (SOPs) for a particular project are designed to ensure that every Versar project achieves the following criteria for success:

- The client's data quality objectives (DQOs) are identified and met;
- Projects conform to sound principles and standards of science, engineering, and project management;
- The quality of data, information, and assessments used in and produced by a project are well-documented, known with defined certainty, and suitable for their intended use;
- Data, reports, and other documents produced by the project meet the client's expectations and Versar's standards; and

- Specific plans and procedures are implemented to prevent, detect, and correct conditions that would adversely affect the quality of the product.

The Field Manager, under direction of the Project Manager and QA Officer, is responsible for maintaining and revising the QA/QC plan and for ensuring that the plan is implemented.

## 2.2 PROJECT STAFF

Under the centralized management approach for this project, Versar's Project Manager, Nancy Roth, directs project activities and reports to the County's Project Manager, Meosotis Curtis. Versar's Project Manager coordinates quality assurance activities through Versar's independent QA Officer (QAO), Dr. Mark Southerland. Versar's Field Manager Thomas Jones reports directly to the Versar Project Manager for technical, administrative, and QA oversight. Versar's Corporate Principal, Dr. William Richkus, is Vice President and General Manager of Versar's ESA Division in Columbia, MD, serves as contract manager, and is available to resolve any contractual challenges that may arise above the level of the Project Manager.

Experienced technical staff and managers are committed to serve each of the designated roles on this project (Table 2-1). The Field Manager oversees all aspects of field work and bears the responsibility of assuring that field work, laboratory analysis, data management, data analysis, and reporting are successfully completed. The Field Manager or designated Field Leaders head all data collection activities. For this project, the primary Field Leader is Theresa Hage. Presently there are nine field technicians available to support field operations. The Field Manager and Field Leaders confer regularly with Mark Stunder, Senior Meteorologist at Versar's Weather Forecasting Center, within Versar's GEOMET office in Germantown, MD. The Weather Forecasting Center supports storm event sampling by providing project-specific and real-time forecasts of approaching storm systems. The Field Manager and Field Leaders also communicate regularly with Rafiq Qayumi, Mission Support Unit Coordinator of the WSSC Consolidated Laboratory, to discuss laboratory analysis requirements, coordinate sample transfer, and obtain analytical results. Mr. Qayumi oversees sample receipt, tracking, and preparation of analytical result reports. As needed, Versar's Project Manager assists in resolving any laboratory coordination concerns.

The Versar Field Manager and Field Leader oversee day-to-day field operations for the water chemistry monitoring project. Most problems that may arise during field activities can be solved on-the-spot by field staff, but technical problems that cannot be solved by technical staff are brought to the attention of the Field Manager or Project Manager. The Project Manager then works with the Field Manager to decide how best to resolve the problem. Versar staff regularly confers with the County's Field Manager regarding day-to-day operation of the field equipment, invoicing, and reporting. All major problems, particularly those requiring modifications of the scope, schedule, or budget, and steps taken to resolve them are discussed with the County's Project Manager.

Table 2-1. Contact numbers of program staff.

| Name | Affiliation | Title | Contact |
|---|---|---|---|
| **VERSAR** | | | |
| [redacted] | | | |
| **WSSC** | | | |
| [redacted] | | | |
| **MONTGOMERY COUNTY** | | | |
| [redacted] | | | |
| **ISCO TECHNICAL SUPPORT** | | | |
| ISCO | 800-228-4373 | | |
| **VERSAR MOBILE PHONES** | | | |
| [redacted] | | | |

## 2.3 TRAINING

Personnel training activities are divided into four parts: (1) verbal or written instruction of the for a particular procedure, (2) demonstration of the procedure, (3) performance of the procedure by the trainee with the instructor's guidance, and (4) certification of proficiency with a written or practical examination. Verbal instruction is provided by the Field Manager, or a qualified designee, with the assistance of written Standard Operating Procedures and vendor instruction manuals. The training procedure is performed first by the instructor then repeated by the trainee. The employee is allowed to perform the procedure independent of supervision once an acceptable level of proficiency has been demonstrated. QA training also includes instruction

in the proper care and use of equipment as such equipment must be used correctly to ensure accurate and reproducible data.

## 2.4 IMPLEMENTATION AND DOCUMENTATION OF STANDARD OPERATING PROCEDURES

Standard operating procedures (SOPs) have been prepared for individual components of this monitoring project (Section 4.0). The SOPs are tools in Versar's QA/QC plan that ensures a high quality of work. The SOPs outline the specifics for subtask activities defined in the project as well as supplemental activities, such as field preparatory work.

Each staff member is responsible for obtaining and following the SOPs relevant to his/her task. At a minimum, field personnel consult the SOPs for health and safety considerations, operations/oversight, QA/QC procedures, sampling equipment use and maintenance, sample collection, sample transport, and chain of custody procedures.

Field personnel document their adherence to relevant SOPs in a field notebook. The field data sheets contained in the notebooks become part of the project file. Where appropriate and feasible, the Field Manager visits the work site and performs spot checks for proper procedures.

## 2.5 QUALITY CONTROL FOR DATA MANAGEMENT

Data deliverables for this project are gathered from three sources: (1) continuous monitoring data from field instrumentation (e.g., continuous level, flow rate, rainfall), (2) monitoring data collected by field personnel (e.g., sonde data), and (3) laboratory analytical results. All must be converted from their native formats to formats useful to the County, quality checked, and delivered to the County. Any irregularities are described in the comment section of the water chemistry database file or are annotated in the continuous monitoring spreadsheet.

Continuous monitoring data are downloaded twice monthly from field instrumentation and archived. The data are graphed and examined in the field on the laptop PC to verify instrument functionality, stability, and accuracy. Any instrumentation problems evident from data examination are reported to the Field Manager immediately. Continuous data pertinent to the reporting month are extracted and saved as comma-delimited ASCII (*.CSV) files. The files are imported into a spreadsheet program where they are checked again to assure the entire month has been extracted.

Monitoring data collected by field personnel include baseflow and storm event "first-flush" measurements of pH, specific conductivity, water temperature, and dissolved oxygen and post-composite measurements of pH and specific conductivity. The values are checked for usage of proper units and proper calibration prior to measurement. The values are transferred to the designated dBaseV-compatible database file. Also entered into the file are storm flow statistics, quantity of rainfall, and other variables germane to documentation of storm events and baseflow monitoring. Also evaluated at this time are reviews of data for storm validity (e.g., making sure

there was a sufficient quantity of rainfall recorded). All data in the database are reviewed by the Field Manager for accurate transcription of field measurements and for correct computation of total storm volume, limb flow volume, etc.

Analytical results for this project are to be obtained from the WSSC Consolidated Laboratory LIMS system. Data are not be submitted in project deliverables until the appropriate quality control checks have been performed by WSSC reviewers and the data have been approved for release (if WSSC Approval Status = YES). The data downloaded from the WSSC LIMS are in comma-delimited ASCII format and can be readily imported into the submittal format. Since the data require an intermediate, manipulation step, the database is checked to verify that the appropriate results have been entered into the appropriate row/column within the database. The completed database file undergoes final review by the Field Manager or Program Manager prior to submittal to the client.

# 3.0 SITE LOCATION AND STATION INFORMATION

The Breewood Tributary Watershed (Figure 3-1) drains an approximately 45-acre area consisting of open space, institutional, high-density residential, and medium-density residential land uses. Two water chemistry stations have been established, corresponding to required outfall and instream locations. The outfall station is located in Breewood Park, at the outlet of a storm sewer in the wooded area approximately 200 feet south of University Boulevard. The instream station is located in Sligo Creek Park, on the downstream end of a culvert underneath Sligo Creek Parkway, approximately 50 feet upstream of the confluence with Sligo Creek.

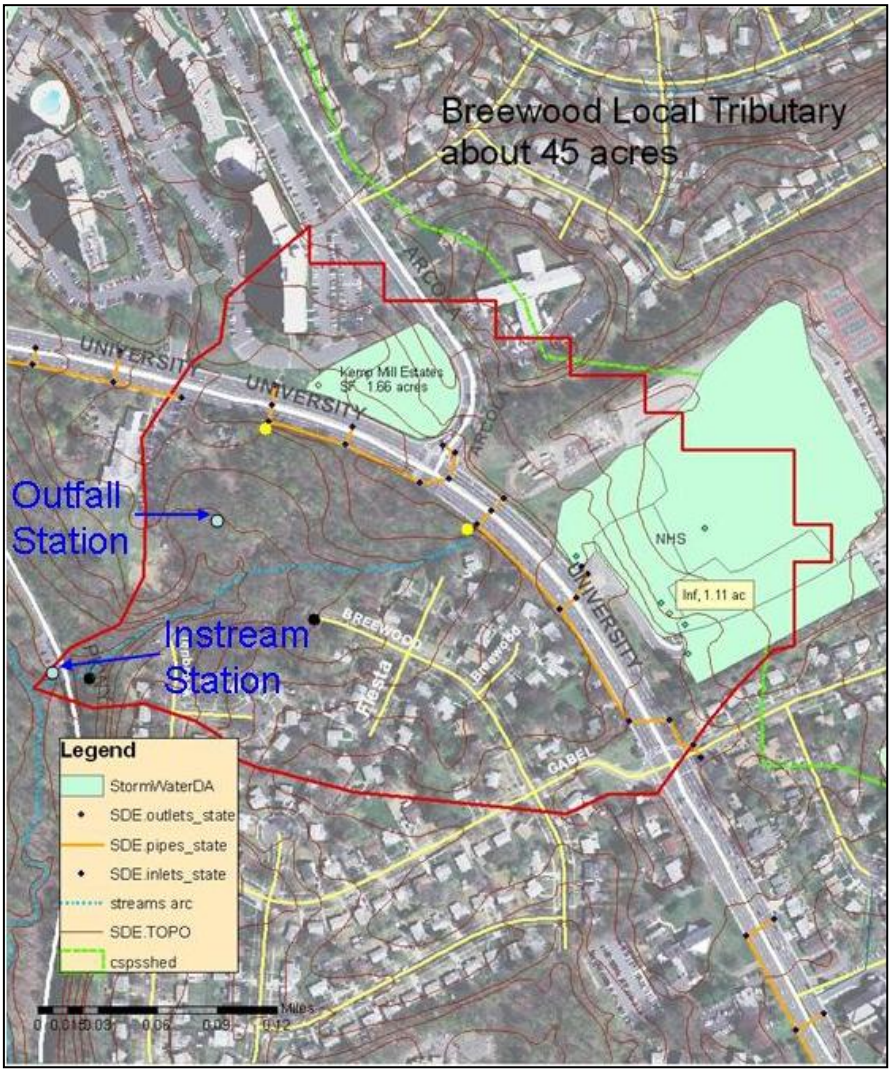


Figure 3-1. Location of the Breewood Tributary water quality monitoring stations.

# 4.0 STANDARD OPERATING PROCEDURES FOR THE BREEWOOD TRIBUTARY MONITORING

## 4.1 EQUIPMENT INSTALLATION AND DEMOBILIZATION

The fiberglass equipment shelter (manufactured by Aquadata, Inc., Figure 4-1) with dimensions 5' x 3' x 4' is weather-proof, secured, and vandal-resistant is bolted to the site platform and is secured with a waterproof padlock. The hasp provided by the manufacturer will be augmented with a stronger, commercially available type if necessary.

Figure 4-1. Storm box mounted on wood platform.

**1. Construction (Day 1):**

a. Survey and determine appropriate area for station (outfall site only). Measure proposed structure area.

b. Assemble plywood deck and supports in Versar loading dock.

c. Dig corner holes to >18" in depth.

d. Mix concrete and pour into holes.

e. Position supports (treated 4" x 4"s) upright in corner holes, 24" to 30" above ground surface and brace.

f. Fasten storm box to platform using carriage bolts through base of box.

g. Install scissors ring in pipe. Rotate scissors ring so that bubbler end on sensor carrier is positioned at the invert of the pipe to record maximum depth (Figure 4-2). Check position of sensor carrier so that it is upstream of backwater caused by downstream topography.

**2. Equipment Installation (Day 2):**

a. Install ISCO 4230 flowmeter, ISCO 3700 automated sampler, and 12V marine battery in fiberglass storm box as shown (Figure 4-3).

b. Attach data cable from flowmeter to sampler. Feed appropriate lengths of suction line and bubbler line through storm box hole and attach to sampler and flowmeter, respectively. There should be no loops in suction line where water can accumulate when not in use. Bubbler line should be free of kinks and be protected as much as possible from heavy objects that could rest on it and skew flow measurements.

c. Coil cable slack neatly inside shelter, away from sampler. Make sure that no instrumentation rests on bubbler line inside shelter.

d. Attach battery cable to sampler power port. DO NOT REVERSE LEADS. Power up equipment and test operation (4.2 WEEKLY INSPECTION).

e. Anchor suction line, strainer, and bubbler line to the scissors ring.

f. Set level in flowmeter to the same level as measured in the pipe.

g. Input Manning equation into flowmeter.

h. Calibrate sample volume on automated sampler by activating manual grab function. Capture sampled volume and adjust sampler volume until desired water volume (ca. 950 mL) is delivered.

At the conclusion of the Task I monitoring program, all equipment and structures will be removed and the site returned to its pre-monitoring condition within 14 days.

Figure 4-3. Storm box with ISCO automated flow monitoring and sampling equipment installed.

Figure 4-2. Scissors ring installed in pipe at outfall station.

## 4.2 WEEKLY SITE INSPECTIONS

To ensure that the automated equipment is operating properly, Versar conducts weekly inspections of each site. This activity includes travel to the sites, checking out all equipment, changing batteries, updating equipment logs, and recalibrating equipment as necessary. All inspection activities and observations are recorded in the field notebook. Inspection visits are planned to coincide with monthly sampling and storm events when possible.

Weekly inspection routine includes:

a. Travel to site (see Appendix C for detailed directions).

b. Inspect area around station and condition of structures.

c. Check battery voltage by using voltage meter on flowmeter. Exchange battery if below 11.9 volts.

d. Run checkout programs for automated equipment (See FACT SHEET on page following).

e. Inspect bubbler line and sample head, clear of debris, and adjust bubbler rate as necessary (to approximately 1 bubble/sec).

f. Test flowmeter level reading monthly by placing small decimal foot measuring tape in flow in pipe. If no water is flowing in pipe, test by removing bubbler line from sensor carrier and place in bucket of water of known depth. If the tape measurement and bubbler level reading differ, adjust level on flowmeter to reflect true staff reading.

g. Record observations and note any problems in field notebook.

h. On the first and third week of each month, download accumulated level and flow data from bubbler/flowmeter.

TO INTERROGATE FLOWMETER (download data):

(1) In Flowlink 4.15 program, select site and Connect. Make sure cable is connected from flowmeter to laptop PC. Alternatively, select Quick Connect and click 4100/4200/6700 Instruments button (especially when name of instrument is unknown).

(2) Select Retrieve Data (data automatically downloads).

(3) After interrogation completes, select Disconnect.

(4) To check downloaded data, click on station ID in left-hand column. Right-click on parameter of interest (*e.g.*, level, flow rate). Select Quick Graph. Flowlink will display graph of previous 24 hours of data.

i. Return to Versar and report to Field Manager.

If any situation requires immediate attention, call the Versar Field Manager from the site to relate the situation. If necessary, Field Manager will contact the County's Project Manager to discuss the situation and decide how action should be taken to correct the problem.

## WEEKLY INSPECTIONS FACT SHEET

Minimum Supply list:

- X Field backpack containing: field notebook, pens, pencils, shelter keys.
- X 12V battery & battery cart (if changing batteries or suspect you may need to)
- X Waders/hip boots/ankle boots
- X Fresh desiccant canisters (obtain from oven in Sediment Lab)
- X Mobile phone (sign out from receptionist)
- X Field Laptop PC (for first or third weekly inspection of the month)

On site:

- X Check condition of site, shelter, suction line, bubbler line, and anchor
- X Change desiccant on 4230 Flowmeter
- X Check battery voltage on flowmeter:
  - Press GO TO PROGRAM STEP
  - Press 1, ENTER
  - Select SETUP, Press ENTER
  - Select STATUS, Press ENTER
  - Press ENTER a second time
  - Record battery voltage, change battery if less than 11.9V
  - Press EXIT twice
- X Run checkout on 3700 Sampler
  - Press ON
  - Press ENTER/PROGRAM
  - Select CONFIGURE
  - Press left arrow until RUN DIAGNOSTICS appears, then select it
  - Keep pressing ENTER when prompted

  Be sure to run check on distributor arm (lift sampler to observe movement, check tightness of center screw, check to be sure tubing on distributor arm hasn't come loose)
  - Press OFF when done
- X Check condition of rain gauge (if applicable) -- remove cover and check for obstructions
- X Note status of everything on weekly inspection log sheet

Upon return to Versar:

- X Remove old desiccant from containers and place in oven
- X Place any changed batteries in battery room for charging

## 4.3 BASEFLOW MONITORING AT TRIBUTARY STATIONS

Baseflow conditions are defined as no measurable precipitation in at least 72 hours prior to sampling. The Field Manager QCs the in-field standard operating procedures established for the sampling every three months during the monitoring program. The Field Manager also troubleshoots, if necessary, any problems that occur during the monitoring.

The procedure for baseflow monitoring is as follows:

1. Preparation at Versar:

   a. Inform analytical laboratory (see Laboratory Contact list) of possible sampling activities 24 hours prior to sampling.

   b. Calibrate sonde and any other necessary equipment (fill out calibration sheets, see 7.0 CALIBRATION OF SONDE).

   c. Label sampling bottles. Note: the sample ID number follows this format BR10XEEYZZZZPAR, where:
      BR = Breewood
      X = 1 for outfall, 2 for instream
      EE = event type (e.g., MM for baseflow, ST for storm)
      Y = 1, 2, or 3, for rising, peak, falling limb of storm, respectively (for baseflow and first flush, leave blank.
      Z = month and date of sampling
      PAR = parameter group (*e.g.*, EC for enterococcus, TPH for total petroleum hydrocarbons, GWQ for general water chemistry)

   d. Gather field notebook.

   e. Pack truck with coolers, equipment, cell phone (see APPENDIX B PROJECT FIELD SUPPLIES AND EQUIPMENT LIST).

   f. Pick up bag ice for coolers (in transit to site) at any quick-mart. Save receipt for reimbursement by Versar.

2. On site:

   a. Conduct equipment inspection as one of the weekly inspection visits (See 4.2 WEEKLY SITE INSPECTIONS).

   b. Measure instream water quality parameters (temperature, pH, specific conductivity, and dissolved oxygen) using calibrated sonde unit (be sure to submerge probe-end of sonde in the middle of stream where there is flow and wait for DO readings to stabilize before recording other readings).

c. Record instream parameter results on field data sheets (see Example Monthly Monitoring Field Data Sheets in Appendix A).

d. Record 24-hour rainfall on field data sheet (from downloaded Wheaton Branch rain gauge).

e. Record stream height (using flowmeter reading) on field data sheet.

f. Before collecting samples, write time and date on bottle label on bottles. Collect grab samples at each site using proper sampling technique filling the appropriate, pre-labeled bottles.

g. Place samples in iced coolers.

h. Complete chain of custody forms. Make sure collection time, date, and sample ID are recorded accurately for each sample.

i. Transport samples to WSSC Consolidated Laboratory (see Appendix C for directions).

j. Obtain photocopy of chain of custody form after being signed by laboratory representative (faxes are acceptable).

## 4.4 STORM EVENT MONITORING AT SAMPLING STATIONS

A maximum of three valid storm events are monitored per site per quarter (*i.e.*, 12 per year). Eligible rainfall events for this project are at least ½ hour in duration. One of the rainfall events in any quarter is of at least 0.3" in quantity in a 24-hour period and at least two in any quarter are of at least 0.6" in quantity in a 24-hour period. Melting snow counts as a valid storm event provided the equivalent quantity in rain inches meets the above requirements. There need not be a period of dry weather prior to any storm event.

The storm event sampling field team is mobilized based on anticipated rainfall as reported by staff meteorologists and/or in the professional determination of the Field Leader or designee.

The following equipment is used to obtain the samples and continuous sampling data needed for storm event monitoring: ISCO 3700 24-bottle capacity automated water sampler with programmable sample interval, ISCO 4230 automatic bubbler/flow meter.

### 4.4.1 CONDUCTING THE MONITORING

The basic procedure for storm event sampling is as follows (See Example Storm Event Field Data Sheets, Appendix A):

1. Preparation at Versar:

   a. Inform laboratory of sampling intent 24 hours prior to estimated sample delivery and coordinate sample or delivery (see contact list for appropriate personnel during off-hours delivery).

   b. Determine approximate onset, duration, and amount of predicted rainfall with company meteorologist (Mark Stunder or Tim Sletten) or by other means (*e.g.*, Weather Channel broadcast or website) when meteorologists are unavailable.

   c. Gather pre-labeled first-flush grab sample bottles (Enterococcus, TPH, see Section 4.3 for sample ID format).

   d. Gather automated sampler holder base and be sure that bottle frames contain clean propak liners and are capped.

   e. Pack truck with coolers, equipment, cell phone (see APPENDIX B PROJECT FIELD SUPPLIES AND EQUIPMENT LIST).

   f. Buy bags of ice for first-flush grab samples and for stocking automated sampler at local quick-mart (in transit to site) or obtain from storage in loading dock.

   g. Place laptop PC on adapter to charge battery.

2. On Site:

   a. Place ice in center of automated sampler bottle holder base and place under sampler. Be sure that sampler is properly aligned with bottle holder base (note position of buckles).

   b. Observe stream level reading on flowmeter to check bubbler line integrity. Perform pump test on sampler (power up the sampler, then press PUMP FORWARD) to check sampler line integrity. Before water reaches sampler, press STOP, then PUMP REVERSE. Press STOP again when water has been pumped out of tubing.

   c. Enable sampler by following these steps:

      (1) Enable sampler on bubbler/flowmeter.
      (2) Enable the plotter on bubbler/flowmeter.
      (3) Set the plotter advance speed according to the amount of resolution desired (*i.e.*, set to higher speed for short, intense storms or to slower speed for longer, less intense storms).

(4) Set scale on plotter for anticipated maximum flow (flow rate graph will wrap around if set too low).
(5) Set sampling interval to reflect storm event duration time (includes allowance for falling limb after rainfall stops) by dividing predicted storm length in minutes by 24 (or, multiply storm length in hours by 2.5 to obtain sampling interval in minutes).

| Length of storm event (hours) | Autosampler interval (minutes) |
|---|---|
| 12 | 30 |
| 10 | 25 |
| 8 | 20 |
| 6 | 15 |
| 4 | 10 |

RULE OF THUMB for determining runoff allowance after cessation of rainfall for Breewood Road Tributary is 1 hour. Note that Breewood Road Tributary is very flashy and sample bottle intervals are required to be short (5 minutes or 10 minutes) for sudden onset storms, therefore targeting the portion of the storm where maximum rainfall is forecast is highly recommended.

(6) Enter sampling start time.
(7) Enable sampler (press START SAMPLING).
(8) Make sure beginning sample number is 1.

Note: after first sample is taken by automated sampler, open sampler top to verify sample has been taken and an appropriate quantity has been taken.

c. Collect first-flush grab samples during first 30 minutes of elevated flow (determined by observing level measurement on flowmeter, or obvious changes in stream characteristics, such as odor or turbidity). At the outfall station, presence of water is sufficient notice for obtaining first flush samples since the pipe is dry during dry weather.

d. Store samples on ice in cooler.

e. Measure instream water quality parameters (temperature, pH, conductivity, and dissolved oxygen) using calibrated sonde unit (be sure to submerge probe-end of sonde in the middle of stream where there is flow and wait for DO readings to stabilize before recording other readings).

f. Complete chain of custody forms for first-flush samples. Make sure time, date, and sample ID are recorded accurately for each sample.

3. Transport samples to WSSC Consolidated Laboratory (see Appendix C for directions). Obtain photocopy of chain of custody form after being signed by laboratory representative (faxes are acceptable).

4. On-site (after storm):

   a. Download storm information from flowmeter (see 4.2 WEEKLY INSPECTIONS). This will assist in accurate compositing and determination of rising/peak/falling limb locations.

   b. Return flowmeter and sampler to pre-storm conditions:

      (1) Change sampler enable status to DISABLE
      (2) Set Printer/Plotter to OFF
      (3) Turn off sampler

   c. Use Flowlink software on laptop PC to prepare table of discrete discharge data.

      (1) Select "vol_calc" from list of Graphs and Tables.
      (2) Select desired data file (*e.g.*, BR Instream flow, BR Outfall flow, etc.)
      (3) Set beginning time of sampling session to one time interval before Bottle 1 time indicated on flowmeter printout.
      (4) Set summary interval to sample interval.
      (5) Set statistical function to "avg".
      (6) Use operation "volume conversion" (set units back to cf).

   d. Select composite samples representative of the rising, peak, and falling limb on discharge table. Using flowmeter plotter date and time stamps for each bottle, determine which 1-liter discrete samples will comprise each composite. At least three consecutive samples should be selected for each limb when possible; one bottle may be used for a limb occasionally and in extreme circumstances. Three bottles for a composite is more likely to provide minimum water volume for the required laboratory analyses.

   e. Enter discrete streamflow volume for each discrete sample bottle selected for compositing in the appropriate area (*e.g.*, rising, peak, falling) on data sheet.

   f. Calculate proportional volume of each discrete sample by using a spreadsheet program on the laptop or pocket calculator by following this example:

      If bottle #6 has the highest interval stream volume of the series #4,#5,#6 representing the rising limb of a hydrograph, then the volume taken from bottle #4 would be given by:

$$v_4 = \frac{v_6 \text{ x } f_4}{f_6}$$

Where v is discrete volume and f is interval stream volume.

Note: If using a 2.5 L jug instead of 4 L, and total of the discrete volumes of the limb exceeds 2.5 L, multiply calculated discrete volume (v) by 0.80 to avoid overfilling jug.

g. Cap discrete sample and agitate (to resuspend settled sediment particles). Remove unnecessary sample volume (total volume minus volume calculated in step f. above) by carefully pouring unneeded liquid out of sample bottle into graduated cylinder. For each composite sample, combine appropriate grabs into one 4-liter (or 2.5-liter) amber jug (provided by laboratory) to obtain the required volume of water for lab analysis. The ratios of the discrete volumes making up each composite will be the same as the ratio of the discharge volumes at the time that the discrete sample was taken (along rising and falling limbs).

h. Pour a small amount of composite sample into beaker (or sonde calibration cap) and measure composite pH and conductivity. Enter result on data sheet. Rinse beaker with sample water between measurements of each composite.

i. Change ISCO plastic sampling bags and exchange sampler tubing (quarterly) with new tubing.

j. Check marine battery voltage.

k. Secure sampling station shelter.

l. Complete chain of custody forms. Make sure collection time, date, and sample ID are recorded accurately for each sample.

m. Transport samples to WSSC Consolidated Laboratory (see Appendix C for directions). Obtain photocopy of chain of custody form after being signed by laboratory representative (faxes are acceptable).

QA/QC inspection of sampling methods will be conducted by the Field Leader quarterly.

### 4.4.2 OFF-HOURS SAMPLING CONSIDERATIONS

If off-hours (*i.e.*, any time other than between 6 a.m. to 6 p.m. Monday through Friday) sample delivery to the WSSC laboratory is anticipated, notify the Laboratory Manager (see contact list in Table 2-1) so that analytical staff can be scheduled to perform short-hold time testing.

Because of safety considerations, field storm monitoring staff are exempt from performing on-site “first flush” grab sampling and water quality parameter measurements using the sonde between the hours of 12 a.m. (midnight) and 6 a.m. If an eligible storm event is

anticipated to initiate between these times, field staff may, at an appropriate time, "pre-program" the sampling equipment to initiate automated sampling at the expected time of storm event arrival.

### 4.4.3 TROUBLESHOOTING OF EQUIPMENT PROBLEMS

The following guidance is derived from actual problems encountered in over ten years of water quality monitoring.

- Something goes wrong:

  First and foremost, don't give up! Surprises are not desirable, however many problems can be solved with minor fixes onsite. Telephone somebody involved with storm sampling at home or at Versar for ideas/advice. If problem is technical in nature (pertains to ISCO equipment), contact ISCO service via mobile phone if coworkers are unreachable.

- You arrive at sampling site, ready to sample a storm, and power is off:

  Check the cable and clips for solid battery connection. Telephone Versar and have somebody bring fresh battery. In the meantime, take samples manually, in the ISCO bottles, at the same interval you would have had the equipment been operational. Measure in-pipe level.

- You arrive at the sampling site and the flowmeter reads zero or negative flow:

  Check the integrity of the bubbler line. Make sure that the line has not detached from the sensor carrier. If bubbles are not observed, then the line may have a hole or may not be secured properly to the flowmeter or metal tube. Small holes in the bubbler line can be repaired temporarily by covering the hole with scotch tape (in the backpack). If the bubbler line is dried thoroughly and the tape is placed smoothly on the hole, then the line will hold pressure. If the line has been cut or chewed completely in half, check to see if enough slack exists in the line to enable one end to be detached and be reattached with the severed end. If the line is taped or patched, it should be replaced as soon as possible after the storm event ends.

- You are attempting to monitor a storm, you hit rush-hour traffic on US 29, and a ferocious downpour hits.

  Proceed to the site and verify that the site has received rain. Sampling will likely need to be aborted as the first flush there arrives very soon after the commencement of rain.
- You discover, upon arrival for compositing, that the sampler stopped just after the peak limb and did not sample the falling limb.

This may be due to power failure or icing in the suction line causing the line to pop off the sampler during the purge cycle. Take one large GWQ grab sample from the stream – hopefully the stream is still in the falling limb of the hydrograph. If the stream has returned to baseflow, then the storm will be voided.

- You arrive onsite for compositing to find that bottles are partially full or have no sample.

  Check volume calibration of sampler. Check to see if the sampler top and bottle support bottom are aligned properly. Check sample tubing on distributor arm to be sure it is in place and will deliver water into the bottles. Check to see if the gnurled knob at the distributor arm pivot point is tight. Perform test of suction line integrity (run pump). If damage to suction line is not apparent, check to see if internal peristaltic pump tubing is split.

- You arrive onsite to find that the flowmeter is showing no display and is making constant low purging noise.

  This is a sign of motherboard or memory failure; a replacement flowmeter will have to be brought to the field.

## 4.5 ESTABLISHING MANNING COEFFICIENTS FOR FLOW CONVERSION

Manning's coefficients are used to convert water level in an artificial channel (e.g., pipe or trapezoidal channel) to flow rate using the characteristics of the pipe. The Manning's coefficients can be determined using field measurements, obtaining design plans of the channel, or a combination of both. At Breewood Road Tributary, the coefficients are applicable to a pipe configuration. The coefficients are input into the flowmeter and the flow rate corresponding to a given water level in the pipe is automatically calculated.

The coefficients are as follows: roughness of the pipe material, slope of the pipe, and diameter of the pipe. Determine the coefficients as follows:

1. Pipe diameter: measure the inside diameter (in feet) of the pipe away from the end of the pipe, which is often a flared edge for connecting to other pipe sections.

2. Pipe slope: measure the distance from the end of the pipe to a point upstream of the end. Measure the greatest distance possible, but only below the most downstream connecting vault or manhole (in order to measure only a single, straight section). Measure the change in elevation by using a surveyor's level and a stadia rod. The slope is the change in elevation divided by the pipe length.

3. Roughness: consult a reference manual such as "ISCO Open Channel Flow Measurement Handbook" (ISCO 2008) to obtain appropriate roughness coefficient corresponding to the pipe construction material and condition.

## 4.6 DOWNLOADING TIPPING BUCKET RAIN GAUGES

### 4.6.1 Wheaton Branch Rain Gauge

Go to https://secure.montgomerycountymd.gov/dana-na/auth/url_default/welcome.cgi

Username: hageth01
Password: [enter current password]

Click on Wheaton link
Choose Wheaton from dropdown menu, put in dates, then click View Report
Expand the data (Data will be upside down – end date data first)
Export the data

When finished, be sure to sign out (both pages) otherwise the interface will not let you back in for awhile. Use the brown/orange door button on the top right (sign out button).

### 4.6.2 Onset Rain Gauge

Downloading Gauge:

1. Open HOBOWare Lite on the laptop
2. Attach USB cable to data logger located inside the gauge. Logger should slide into the coupler (which is the black piece attached to the pendent). (Coupler has groove – logger has ridge). Bottom right of screen should indicate "1 device attached".
3. Select READ OUT. When told "logger is currently logging", select DON'T STOP.
4. Save. Use site name with date.
5. Select PLOT. Check graph to make sure download was successful. Event line should have step increments when there was a rain event and a straight line when no rain occurred.
6. Close plot and disconnect.
7. **IMPORTANT:** The logger has a tiny red light. The light should be blinking once every 4-5 seconds when the logger is launched and every 8-9 seconds when waiting to be launched. Before you leave the site make sure the logger is launched and the cord is not in the way of the tipping bucket.

Reading the Plot:

1. To check amount of rainfall, open datafile.
2. Plot setup – uncheck temp and batt. PLOT.
3. View – Points Table. Each EVENT is a tip of the bucket equaling 0.01"
4. Find time frame for rain event you want. Subtract lowest event # from highest within that time frame and multiply by 0.01. That will be total inches for that rain event.

De-bug task bar (for instances when the gauge will not download):

In Windows Explorer, navigate to C:\program files\onsetcomp\hobolite folder
Edit by right clicking on "Hoboware properties.txt"

Choose “Open With” from drop down menu then choose notepad (uncheck box for “always use”)
Go to Hoboware Dbm off line
    Change off to on
    Save and exit
“Debug” should now be on task bar
    Select “Force offload”
(Data file may need to be sent to Onset to clean up)

# 5.0 DATA MANAGEMENT

The automated sampling equipment enables data to be downloaded directly to a field laptop PC. The data are then added to a master database on one or more desktop PCs. The master database is stored on the company mainframe, which is backed up daily. Selected data are then exported to comma-delimited text files (.CSV) which then are imported into a spreadsheet program for formatting in preparation for monthly submittal (see APPENDIX D for format). Note: since continuous flow data date and time stamps are exported as one datum, the two are separated by using the "text to columns" function of the spreadsheet program.

For quarterly data reports, data are directly transferred from field data sheets to a dBASE V compatible database file or are calculated by performing the required integrations using Flowlink 4.15 software prior to database entry.

Required composite and total flow volumes are computed by performing the following:

For composite stream volume:

(1) Open Flowlink 4.15 as one would during storm event compositing.
(2) Select desired data file (*e.g.*, BR Instream flow rate, BR Outfall flow rate, etc.)
(3) Set beginning time of limb of interest to one time interval before first bottle collection day and time.
(4) Set summary interval to sample interval x number of discrete bottles in composite.
(5) Set statistical function to "avg".
(6) Use operation "volume conversion" (set units to cf for cubic feet or gal for gallons).

For total storm flow volume:

(2) Determine beginning time and ending time of entire storm event (*i.e.*, elevated flow) to determine total duration of event.
(3) Set beginning time to one time interval before storm beginning time.
(4) Set summary interval to sample interval.
(5) Set time span to duration of elevated flow.
(6) Set statistical function to "avg".
(7) Use operation "volume conversion" (set units to gal for gallons).
(8) Select "series sum" option.

Instantaneous baseflow discharge volumes are calculated by multiplying the flow rate (in cfs) at the moment of baseflow grab sampling to the approximate time needed to fill large miscellaneous parameter jug (ca. 15 seconds).

WSSC laboratory sample identification numbers are obtained by accessing the WSSC Consolidated Laboratory website at https://limsweb.wsscwater.com/lwwebtop/Login.aspx and performing the following steps:

(1) At the Labworks LIMS user signon page, log-in using ID: thage and password: thage. This will lead to the parameter selection page where results can be requested.
(2) Click on "Reports" then "Sample Results" buttons to obtain detailed lists of project names and parameters.
(3) Again enter user ID: thage and select appropriate date range for results requested
(4) (Optional) Set results sorting parameters as desired.
(5) Clicking on the expand node to Montgomery County displays a list of specific data for review.
(6) Data can be exported by clicking on the Export icon just above Montgomery County. Downloaded data are saved as an Excel file.

Monthly progress reports include the following:

1. Narrative summary of sampling status for the reporting month.
2. Discussion of any unusual circumstances, problems or issues which could affect the data or its analysis and interpretation.
3. Summary of expenditures for tasks carried out.
4. Spreadsheet format files (indexed in the narrative) containing continuous flow monitoring and rainfall data in the appropriate format.

All outstanding data obtained during this project will be provided to Montgomery County within 30 days of termination of a monitoring site.

# 6.0 FIELD SAFETY AT SAMPLING STATIONS

1. Bring mobile phone and first aid kit on all field visits to site.

2. Exercise caution when encountering ants, snakes, raccoons, geese, mice, and the like. Nesting animals interfere with sample collection, may contaminate sampling equipment, and therefore should be removed as soon as possible.

3. Use common sense during electrical storms and/or when severe conditions (*e.g.*, high wind, hail) develop. The safety of field staff overrides all other considerations.

4. Two persons should, whenever possible, perform equipment activation/sampling during storm events. No staff should be on-site between 12 a.m. and 6 a.m.

# 7.0 CALIBRATION OF SUITE FIELD WATER QUALITY MONITORING EQUIPMENT (SONDES)

These procedures cover basic sonde calibration, however more detailed calibration, use, and care procedures are provided in the user manuals. Calibration of water quality sondes for pH and conductivity should be performed at least every third day when in use; dissolved oxygen calibration should be performed daily.

## 7.1 CALIBRATION OF YSI SONDES

REFERENCE: YSI Instrument manual (YSI 2001, 1998a)

1. Attach hand-held display and YSI cable. Inspect dissolved oxygen membrane & change membrane if damaged, if air bubble is trapped under membrane, or membrane appears "waxy" (see user manual).

2. Remove endcap of sonde (while leaving calibration cup screwed on) and rinse electrodes with tap water.

3. Dissolved Oxygen: add 1/8" of tap water to calibration cup and screw on endcap loosely. Wait 10 to 15 minutes for the air to saturate.

4. After saturation, turn on display and note temperature (select SONDE RUN by pressing <enter> [5] button). Consult chart to determine correct DO calibration value for 760 mg/L (alternatively, consult another in-house hand-held display that has built-in barometric capability).

5. Press <escape> to get to the main menu and select SONDE MENU then CALIBRATE.

6. Select DISSOLVED OXY from the list of parameters, then press <enter>. Select DO mg/L from the subsequent menu, then press <enter>. Type the correct calibration value, the press <enter>.

7. Wait until the DO value stabilizes, note in calibration book, then press <enter>.

8. Record new DO value in calibration book. Press <escape> key twice to return to the main calibration menu.

9. Specific Conductivity: Discard water used for DO calibration. Add a small portion of conductivity solution (1.412 mS/cm), cap loosely, agitate, and discard.

10. Add enough conductivity solution to cover all probes (leave endcap off).

11. Select CONDUCTIVITY from list of parameters, then press <enter>. Select SPCOND on the subsequent menu, then press <enter>. Type correct value then press <enter>.
12. Wait until conductivity value stabilizes, note calibration in book, then press <enter>.

13. Record new conductivity value in book. Press <escape> twice to return to main calibration menu.

14. pH: Discard solution in calibration cup. Rinse with tap water, add a small portion of pH 7 buffer, cap loosely, agitate, and discard.

15. Add enough pH 7 buffer to cover all probes (leave endcap off).

16. Select ISE1 PH from the list of parameters and then select the number of points (usually 2), then press <enter>.

17. Type the correct pH value and press <enter>

18. Wait until pH value stabilizes, note in calibration book, then press <enter>.

19. Record new pH value in calibration book. Press <escape> once and repeat calibration for subsequent pH values.

20. Press <escape> to return to main menu and place a small quantity of tap water in the calibration cup and secure endcap.

21. Turn display off.

## 7.2 CALIBRATION OF IN-SITU TROLL 9500

REFERENCE: In-Situ Instrument manual (In-Situ 2007)

1. Attach hand-held display and In-situ cable. Open Pocket Situ 4 program to connect to the unit.

2. <u>Conductivity</u> -- Rinse three times with correct KCl solution and discard

3. Fill to above probe with KCl solution

4. Select Cond from the list of parameters then select the correct calibration units.

5. Press <read> and record pre-calibration value.

6. Press <calibrate> then <run>, once the reading is “stable” record K-Cell value. Low range sensor range for K-Cell should be between 0.33 and 0.39.

7. pH -- Rinse by adding a small portion of pH buffer, cap loosely, agitate, and discard. Three times.

8. Add enough pH buffer to cover all probes.

9. Select PH from the list of parameters and then select the number of points (usually 2), then press <read> for pre-calibration value.

10. Press <calibrate> then <run> and wait until there is a "stable" reading. Note in calibration book.

11. You will be automatically prompted to your next point calibration. Press <calibrate> and record in calibration book once stable.

12. Optical DO – Use bubbler cal kit (calibrate 1-2 times per year)

13. Fill bubbler container almost to the top with clean water. About 10 minutes before calibration, turn on the bubbler. Regulate bubbling with the pinch valve. Run at full flow rate to achieve saturation; after 10 minutes use the control valve to match the water turbulence conditions expected in the field.

14. Insert front end of MP TROLL into bubbler and insure RDO sensor is completely submerged.

15. Select Rugged Dissolved Oxygen from list of parameters. Press <calibrate> and <run>.

16. Select <next>, then <next> again to finalize the calibration. Note in calibration book.

# 8.0 WATER QUALITY MEASUREMENTS USING INDIVIDUAL INSTRUMENTS

## 8.1 DISSOLVED OXYGEN/CONDUCTIVITY/SALINITY/TEMPERATURE METER

REFERENCE: YSI 85 Instrument manual (YSI 1998b)

All calibrations should be noted in the Instrument Calibration Notebook. Calibrate each day of use and record in notebook. The instrument must be re-calibrated each time that it is turned on.

DISSOLVED OXYGEN

A. Remove probe from calibration chamber and check probe for air bubbles. If any are found, replace membrane according to manufacturer's instructions. Ensure that the sponge inside the instrument calibration chamber is wet prevent drying of membrane. Insert probe into the calibration chamber.

B. Turn power on; press MODE button until dissolved oxygen is displayed in mg/L or % saturation. Wait for the dissolved oxygen and temperature readings to stabilize (usually requires 15 minutes).

C. Use two fingers to press and release both the UP ARROW and DOWN ARROW buttons at the same time.

D. The LCD will prompt you to enter the local altitude in hundreds of feet. Use the arrow keys to increase or decrease the altitude. When the proper altitude appears on the LCD, press the ENTER button once.

E. The meter should display CAL in the lower left of the display, the calibration value should be displayed in the lower right of the display and the current % reading (before calibration) should be on the main display. Make sure that the current % reading (large display) is stable, then press the ENTER button. The display should read SAVE then should return to the Normal Operation Mode.

CONDUCTIVITY

A. Allow probe to stabilize with regard to temperature during calibration. Perform calibrations in solutions as close to 25 C as possible.

B. Place at least 3 inches of 1.413 mS/cm solution in a clean glass beaker.

C. Use the MODE button to advance the instrument to display conductivity. Insert probe into the beaker deep enough so that the oval-shaped hole on the side of the

probe is completely covered. Suspend probe above the bottom of the beaker by at least 1/4".

D. Move the probe vigorously from side to side to dislodge any air bubbles from the electrodes.

E. Press and release the UP ARROW and DOWN ARROW buttons at the same time.

F. The CAL symbol will appear at the bottom left of the display to indicate that the instrument is now in Calibration mode.

G. Us the UP ARROW and DOWN ARROW button to adjust the reading on the display until it reads 1.413.

H. Once the display reads the exact value of the calibration solution, press the ENTER button once. The world “SAVE” will flash across the display for a second indicating that the calibration has been accepted.

When making measurements, insert probe into the beaker deep enough so that the oval-shaped hole on the side of the probe is completely covered. Suspend probe above the bottom of the beaker by at least 1/4". Stir sample vigorously (ca. 1 ft/sec.) to obtain accurate dissolved oxygen measurements.

## 8.2 PH METER

REFERENCE: Instrument manual (VWR 1994)

A. Calibrate the VWR Model 2000 pH meter (autocalibration using two buffers):

1. Place pH electrode into pH 7.00 buffer.

2. Select calibration mode by pressing the CAL key; “CALIBRATE” will be displayed in upper field.

3. The main display will be blank. The temperature display now shows pH range previously used.

4. If previous cal range is acceptable, press YES key. If range desired is otherwise, press the SCROLL key to select desired range (*e.g.*, 7-4, 7-10). Then press YES key.

5. With the electrode in first buffer (pH 7) “7" annunciator is now displayed along with “P1". When “READY” comes on, press YES key to accept

buffer. The “7" annunciator will go out and the second buffer value annunciator “4" or “10" will be displayed in the lower field.

6. Remove electrode from pH 7.00 buffer. Rinse with Deionized Water and gently blot dry.

7. Place electrode in second buffer, P2 (pH 4.01 or pH 10.01).

8. When “READY” is displayed, press YES key to accept buffer.

9. Temp display will read “SLP” and the main display will show the percent slope of the electrode for 2 seconds.

10. Both annunciators, “7" and “4" or “10" will be displayed. The meter will display “MEASURE” in the upper display.

11. The unit will hold calibration in memory as long as battery is in the meter, even *if* power is turned *off*.

B. Record buffers used to calibrate and any problems or observations in the Instrument Calibration Notebook. Replace buffers weekly.

C. After calibration, instrument is ready for sample pH measurement when the sample light comes on. Always stir while measuring and record pH only after “READY” is displayed.

# 9.0 REFERENCES

In-Situ. 2007. Multi-Parameter Troll 9500 WQP-100 Operator's Manual. April 2007. In-Situ, Inc., Fort Collins, Colorado.

ISCO. 1996a. Instruction Manual Model 4230 Flow Meter. Part No. 60-3234-051. ISCO, Inc., 531 Westgate Boulevard, Lincoln, Nebraska.

ISCO. 1996b. Instruction Manual Model 3700 Automated Portable Sampler. Part No. 60-3704-101. ISCO, Inc., 531 Westgate Boulevard, Lincoln, Nebraska.

ISCO. 2008. ISCO Open Channel Flow Measurement Handbook, Sixth Edition. Teledyne Isco., Inc. Lincoln, Nebraska.

VWR. 1994. VWRbrand pH/mV/Temperature Meter Model 2000/3000 Instruction Manual. VWRScientific Products, South Plainfield, New Jersey. Part No. 227675-001.

YSI. 2001. YSI 650 MDS Multiparameter Display System Operations Manual. August, 2001. YSI, Inc., 1700/1725 Brannum Lane, Yellow Springs, Ohio. Item #655228.

YSI. 1998a. 6-Series Environmental Monitoring Systems Operations Manual. August, 1998. YSI, Inc., 1700/1725 Brannum Lane, Yellow Springs, Ohio. Item #069301.

YSI. 1998b. YSI Model 85 Handheld Oxygen, Conductivity, Salinity, and Temperature System Operations Manual. November, 1998. YSI, Inc., 1700/1725 Brannum Lane, Yellow Springs, Ohio. Item #038503.

# APPENDIX A

# EXAMPLE DATA SHEETS

BREEWOOD - MONTGOMERY COUNTY
WEEKLY INSPECTION / MAINTENANCE LOG

INSPECTOR

STATION

YEAR MONTH DAY

TIME

SITE AREA OK NO
COMMENTS:

SHELTER OK NO
COMMENTS:

ISCO SAMPLER OK NO FLOWMETER OK NO RAIN GAUGE OK NO
COMMENTS:

FT:

CFS:

CF:

STAFF GAUGE:

BATTERY VOLTAGE READING:

ACTION:

| | |
|---|---|
| CHANGE BATTERY | |
| CHANGE DESICCANT | |
| INTERROGATE | |
| COMPOSITE STORM | |
| BASEFLOW MONITORING | |

COMMENTS:

REVIEWED BY: DATE:



TPH 5/09

# MONTHLY
# BREEWOOD STREAM MONITORING FIELD DATA

CREW

OUTFALL INSTREAM

YEAR MONTH DAY

WEATHER CONDITIONS

TIME

STAFF GAUGE HEIGHT (ft)

STATION

**WATER QUALITY:**

$H_2O$ TEMP (C) DO (mg/L) pH COND (mmhos) AIR TEMP (C) RAINFALL

SONDE CALIBRATION DATE: _____ BY: _____

**SAMPLE DATA COLLECTION:**

Enterococcus

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B | R | | | | M | M | | | | | E | C |

TPH

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B | R | | | | M | M | | | | | T | P | H |

GENERAL WATER QUALITY PARAMETERS

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B | R | | | | M | M | | | | | G | W | Q |

INITIALS _____

COMMENTS:

REVIEWED BY: DATE:

TPH 5/09

STORM EVENT

# BREEWOOD STORM MONITORING FIELD DATA

CREW | STATION | OUTFALL | INSTREAM | YEAR MONTH DAY

STORM DURATION (hr) | SAMPLE INTERVAL (min) | SAMPLE BEGIN | TIME

TOTAL STORM PRECIP (in) | SAMPLE END

---

**INSTREAM WATER QUALITY:**

$H_2O$ TEMP (C) | DO (mg/L) | pH | COND (mmhos) | AIR TEMP (C)

SONDE CALIBRATION DATE: _____ BY: _____

---

HYDROGRAPH/COMPOSITE INFORMATION:

(1) RISING LIMB

| Bottle | Time | Interval discharge (cf) | Discrete vol | pH | Cond |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

(2) PEAK LIMB

| Bottle | Time | Interval discharge (cf) | Discrete vol | pH | Cond |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

(3) FALLING LIMB

| Bottle | Time | Interval discharge (cf) | Discrete vol | pH | Cond |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

PEAK FLOW LEVEL (ft)

SAMPLE COLLECTION DATA:

FIRST FLUSH SAMPLES
TIME OF COLLECTION _____

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B | R | | | | S | T | | | | | E | C | |
| B | R | | | | S | T | | | | | P | L | |
| B | R | | | | S | T | | | | | T | P | H |

INITIALS _____

GENERAL WATER QUALITY
TIME OF COMPOSITE _____

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B | R | | | | S | T | 1 | | | | G | W | Q |
| B | R | | | | S | T | 2 | | | | G | W | Q |
| B | R | | | | S | T | 3 | | | | G | W | Q |

INITIALS _____

DESCRIPTION OF STORM

_____

_____

COMMENTS / PROBLEMS



REVIEWED BY _____ DATE: _____ TPH 5/09

WASHINGTON SUBURBAN SANITARY COMMISSION – LABORATORY SERVICES GROUP

# SAMPLE ANALYSIS REQUEST

**Sample Source:** **Regulatory Samples?** **Yes** ☐ **No** ☐ **Regulation?**

**Name** **WTP** ☐ **WWTP** ☐ **Other Describe:**

**Project Name or Description:**

**Additional Information / Comments:**

**Project Contact Persons:**

**Name:** **Telephone:** **Fax:**

**Name:** **Telephone:** **Fax:**

**Sampler Name:** **MD ID #:**

**LABORATORY LOGIN ID:**

| Sample No | Sample Description | Preservative | Date Collected | Time Collected | Matrix Code* | Analyses Required | Comments |
|---|---|---|---|---|---|---|---|
| -01 | | | | | | | |
| -02 | | | | | | | |
| -03 | | | | | | | |
| -04 | | | | | | | |
| -05 | | | | | | | |
| -06 | | | | | | | |
| -07 | | | | | | | |
| -08 | | | | | | | |
| -09 | | | | | | | |
| -10 | | | | | | | |
| -11 | | | | | | | |
| -12 | | | | | | | |
| -13 | | | | | | | |
| -14 | | | | | | | |

*** Matrix Code: W = Water WW = Wastewater S=Solid**

***NOTE: Incomplete information or improperly labeled samples may result in invalid data.***

| | RELINQUISHED BY | Date/Time | ACCEPTED BY | Date/Time |
|---|---|---|---|---|
| SIGNATURE | | | | |
| SIGNATURE | | | | |
| SIGNATURE | | | | |

# SONDE CALIBRATION SHEET

Sonde Make/Model _____

SN # _____

| | Pre-calibration[1] | Calibration[2] |
|---|---|---|
| Dissolved oxygen (DO) | _____ | _____ |
| Specific conductivity (SpCond) | _____ | _____ |
| pH (7) | _____ | _____ |
| pH (4/10) | _____ | _____ |
| Depth | _____ | _____ |
| ORP | _____ | _____ |

Calibrated by: _____

Date: _____

Comments:

[1] Display reading before adjustment
[2] Display reading after adjustment

# APPENDIX B

# PROJECT FIELD SUPPLIES AND EQUIPMENT LIST

**WEEKLY INSPECTIONS**

Project Field Data Notebook
Pens/pencils/ruler/duct tape
Tool Kit
Laptop PC (if necessary)
Mobile phone

**BASEFLOW MONITORING**

Project Field Data Notebook
Water quality monitoring equipment (*e.g.*, In situ or YSI sonde)
Sampling Bottles
Large cooler (1 or more)
Bags of Ice (2)
Extra sampling bottles (one of each)
Tool Kit
Hand Truck
Bug/Tick repellant
Boots/Waders
Mobile phone
Sharpie/pencils/pens/ruler/duct tape
Chain of Custody forms

**STORM EVENT MONITORING**

Project Field Data Notebook
Sampling Bottles + extras
Small cooler (1) for grab samples
Large cooler (1 or more) for composite samples
Bags of Ice (3)
ISCO sampler bottom with set of bottles (clean)
Extra sampling bottles (one of each)
Hand Truck
Tool Kit
Bug/Tick repellant
Rain gear/boots or waders
Towels
Mobile phone
Sharpie/pencils/pens/ruler/duct tape
Chain-of-custody forms

# APPENDIX C

# DIRECTIONS TO SAMPLING SITES

**DIRECTIONS TO THE BREEWOOD TRIBUTARY OUTFALL**

Take US 29 South.

Make right on University Blvd. W.

Make left on Gabel St.

Make first right on Breewood Rd

Make right on Fiesta Ct. and park. Follow trail through woods to site.

**TO THE BREEWOOD TRIBUTARY INSTREAM STATION FROM BREEWOOD OUTFALL**

Return to University Blvd. W and turn left.

Make left on Sligo Creek Pkwy.

Drive about 400 m and pull over into the playground parking area of Sligo Creek Park.

Site is just south of parking area about 10ft off the walking path.

**TO CONSOLIDATED WSSC LABORATORY FROM BREEWOOD TRIBUTARY**

Return to University Blvd W. and turn right (going east).

Make left onto US 29 north.

Make right at light at Tech Road.

Take Tech Road around to the intersection with Broadbirch Road. Just past this intersection, the entrance to the facility is on the left at 12245 Tech Rd.

Go past front visitor parking to right side of building to loading dock. Press button to open double doors to storage area. If delivering during normal business hours, proceed through additional double doors to sample receiving area. If delivering during non-business hours, store samples and COC in refrigerator on far-right side.

# APPENDIX D

# FORMAT FOR NPDES DATA

TO BE SUBMITTED MONTHLY IN SPREADSHEET FORMAT

## CONTINUOUS FLOW MONITORING

| Field | Field Name | Field Type | Width | Description |
|---|---|---|---|---|
| 1 | STATION | Text | 30 | Name of station |
| 2 | DATE | Date/Time | 8 | Date flow measurement take |
| 3 | TIME | Date/Time | 8 | Time flow measurement taken |
| 4 | FLOW | Number | 10 | Flow rate in cubic feet per second (cfs) |
| 5 | FLOW_gal | Number | 10 | Flow rate in gallons per minute |

Rain Gauge Monitoring

| Field | Field Name | Field Type | Width | Description |
|---|---|---|---|---|
| 1 | STATION | Text | 30 | Name of station |
| 2 | DATE | Date/Time | 8 | Date |
| 3 | TIME | Date/Time | 8 | Time |
| 4 | RAIN | Number | 5 | Rainfall amount (inches) |

TO BE SUBMITTED QUARTERLY IN DBASE5 FORMAT

Baseflow and Storm Event Database

| Column Name | Data Type |
|---|---|
| Station | varchar(15) |
| Limb_Start_Time | datetime |
| Limb_End_Time | smalldatetime |
| Location | varchar(10) |
| Type | varchar(10) |
| Grab | varchar(5) |
| Baseflow_Gage_ft | float |
| Baseflow_Rate_cfs | float |
| Rainfall_in | float |
| Rainfall_inches_per_hr | float |
| Duration_Hr | float |
| Num_DryDays | smallint |
| Intensity_in_per_hr | float |
| hydrograph | varchar(10) |
| stormflow_limb_cfs | float |
| stormflow_limb_gal | decimal(20, 3) |
| total_stormflow_gal | float |
| Water_Temp_C | float |
| pH | float |
| pHMthd | varchar(25) |
| cond_umhos | float |
| condMthd | varchar(25) |
| DO_mg_per_L | float |
| DOMthd | varchar(25) |
| BOD5_mg_per_L | float |
| BOD5_DL | float |
| BOD5_Mthd | varchar(25) |
| TKN_mg_per_L | float |
| TKN_DL | float |
| TKN_Mthd | varchar(25) |
| total_phos_mg_per_L | float |
| tp_dl | float |
| tp_mthd | varchar(25) |
| [NO3_NO2 _mg_per_L] | float |
| NO3_2_DL | float |
| NO3_2_mthd | varchar(25) |
| TSS_mg_per_L | float |
| TSS_DL | float |
| TSS_mthd | varchar(25) |

| Column Name | Data Type |
|---|---|
| total_cadm_mg_per_L | float |
| CD_DL | float |
| CD_mthd | varchar(25) |
| total_CU_mg_per_L | float |
| CU_DL | float |
| CU_mthd | varchar(25) |
| total_lead_mg_per_L | float |
| pb_dl | float |
| pb_mthd | varchar(25) |
| total_zinc_mg_per_L | float |
| ZN_DL | float |
| ZN_mthd | varchar(25) |
| TPH_mg_per_L | float |
| TPH_DL | float |
| TPH_mthd | varchar(25) |
| ENTEROCOCCUS | float |
| ENTEROCOCCUS_DL | float |
| ENTEROCOCCUS_mthd_and_unit | varchar(25) |
| hardness_mg_per_L | float |
| hardness_DL | float |
| hardness_mthd | varchar(25) |
| comments | varchar(70) |