Synoptic Stream Monitoring Partnerships in the Cayuga Lake Watershed

Annual Volunteer Refresher Workshop, Water Quality Review, and Event Scheduling

Introduction

The purpose of the annual winter meeting of volunteer groups monitoring Cayuga Lake tributary streams, as described by the Community Science Institute's Quality Assurance Project Plan (QAPP), is to:

- Review and discuss water quality data collected in the previous year
- Evaluate whether sampling locations need to be added, eliminated or changed
- Agree on dates to conduct monitoring events in the coming season
- Review the logistics for organizing and coordinating stormwater events
- Review procedures for maintaining the integrity of sample bottles and samples
- Review procedures for collecting grab samples that are representative of the stream
- Emphasize the paramount importance of volunteer safety when collecting samples
- Calibrate thermometers
- Update contact information for volunteers and the CSI lab staff

Group-Specific Topics

The discussion of water quality results and monitoring locations as well as the scheduling of monitoring events in the upcoming season are specific to each volunteer group.

Stormwater Events

Stormwater runoff accounts for approximately 80-90% of the nutrients, sediment and bacteria that enter Cayuga Lake. Estimating the contributions of stormwater pollution from various catchment areas within a stream's watershed is key to understanding where mitigation efforts might make a difference in reducing pollution.

Base flow monitoring events are scheduled Monday-Thursday in order to allow staff at the CSI lab, which is certified under national (NELAC) standards (NYSDOH-ELAP# 11790), not to work on weekends. However, when flows are high on a Friday, Saturday or Sunday, CSI urges our volunteer partner groups to work with our lab to coordinate stormwater sampling events on weekends.

The first step is to call the lab and check its availability to accept samples. <u>We ask our volunteer groups to target weekend stormwater sampling, to the extent possible, to a Friday morning or a Sunday afternoon</u>. Samples collected and driven to the lab by noon on Friday can be processed by lab staff on Friday afternoon plus a few hours on Saturday. Samples collected Sunday afternoon can be dropped off at the lab on Monday morning, making it possible to meet time-sensitive requirements for analyzing E. coli, phosphorus and nitrogen by Monday afternoon. When samples are collected on a Saturday, however, the lab must process them either on Saturday or Sunday. That means that two members of the CSI staff have to spend the better part of the weekend in the lab. Nevertheless, for truly exceptional stormwater sampling opportunities that happen to fall on a Saturday, we request our volunteer partners to call the lab and check for weekend availability. If staff are on call, we will accommodate Saturday stormwater events.

To coordinate for a stormwater event on weekdays, please contact the CSI staff at the lab number: **(607) 257-6606**. If you need to reach a staff member beyond normal business hours, or on weekends, to coordinate a stormwater event, please call our Stormwater Event number: **(315) 497-7478**. By calling this number, you will reach a CSI staff member who is on-call to coordinate stormwater events. Each stormwater event replaces the next regularly scheduled base flow event such that the total number of monitoring events in a year remains the same.

Integrity of Sample Bottles and Samples

The CSI lab provides each volunteer group with appropriate bottles for collecting grab samples from streams. Bottles are provided in so-called sampling kits, one kit per location. Each kit consists of a 1-gallon plastic bag containing a field data sheet/chain of custody; one sterile plastic bottle, either 60 ml or 100 ml, for collecting a sample for E. coli enumeration; and one 1-liter acid-washed plastic bottle for analysis of phosphorus and nitrogen nutrients, suspended solids, chloride and other chemical indicators of water quality. Depending on the volunteer group, a 60 ml special glass bottle for collecting a dissolved oxygen (DO) sample and two chemicals for fixing the sample in the field for later completion of the DO analysis in the lab may also be included in the sampling kit; alternatively, the volunteer group may, at its request, be provided with the dissolved oxygen measurement kit (LaMotte kit code 5860) for independent determination of DO in the field.

For each sampling kit, the location code is entered on the sample bottles and the field data sheet/chain of custody as well as on the 1-gallon bag in which they are stored. A complete set of sampling kits is provided to volunteer groups at their annual winter meeting, one kit for each location sampled by the group. Groups are organized into teams, each of which samples a subset of the locations monitored by the group. Each team designates one volunteer to take responsibility for maintaining custody of the bottles until they are used in the next sampling event.

At the time of the sampling event, volunteer teams are responsible for entering the date and time of sample collection on the bottles and on the field data sheet/chain of custody for each sampling location. Volunteer teams are urged to drive samples to the CSI lab immediately following sample collection. Samples are preserved in a cooler on ice for transport to the lab. Wet ice is preferable but blue ice is acceptable. Depending on circumstances, volunteer teams may designate one person to take responsibility for assembling samples from the whole group and driving them to the CSI lab. In this case, volunteers who relinquish their samples to the designated transport person sign the chain of custody, as does the transport person.

When samples are delivered to the lab, CSI staff inspect the samples, measure their temperature and verify the agreement between the location, date and time of sample collection on the bottle labels and on the field data sheet/chain of custody before accepting each sample and completing its chain of custody. CSI staff reserve the right to reject a sample if it cannot be identified unambiguously or if it appears to be seriously compromised, for example, if the sample bottle is cracked or melted, if the temperature of the sample is exceptionally high, or if volunteer teams report any condition or incident that could compromise the integrity of the sample. Once the sample is accepted by the CSI lab, quality assurance and quality control are conducted within the framework of CSI's Laboratory Quality Manual as approved by NYSDOH-ELAP.

Volunteers who drop off sample bottles at the lab are provided with fresh bottles for their team or group in order to ensure they are ready to conduct either the next base flow sampling event or a stormwater sampling event should a stormwater opportunity arise before the next scheduled base flow event. The volunteer who drops off samples at the lab and accepts the sampling kits for the next monitoring event also accepts responsibility for maintaining custody of the kits and conveying them to the other teams in his or her group. Thus sample bottles and samples are in the custody either of volunteers or the CSI lab at all times.

Safety of Volunteers

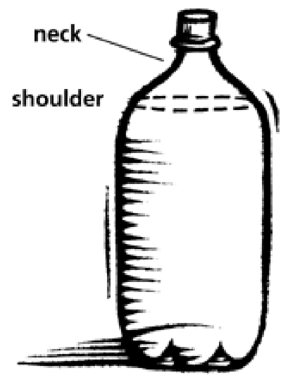
Safety is a paramount concern in stream and lake monitoring programs that depend on volunteers. CSI respectfully reminds our volunteers of the main components of safe sample collection:

Respect the power of flowing water: While flowing water is, to many, a beautiful sight to behold, it can also be very powerful. Volunteers are urged to exercise caution with all flowing waters, especially when the current appears swift. CSI strongly recommends that volunteers sample in teams of two or more in order to be able to help each other in the event of an emergency. A personal flotation device should be considered as an option, especially under high flow conditions, because it provides an added degree of safety should you accidentally fall into the stream.

Safe and Legal Access to Sampling Locations: Safe access is a prime consideration in the selection of sampling sites. Steep slopes should be avoided as should locations where access to the stream is limited by dense brush. Locations with public access, such as under bridges or on state land, are preferred. To sample on private property, volunteers must obtain the permission of the property owner in order to gain legal access. If in doubt as to whether a prospective sampling site is located on private land, volunteers should assume that it is until proven otherwise. Volunteers are encouraged to consult with CSI staff if they have questions or concerns about legal access to a prospective sampling site.

Collection of water samples

When collecting a water sample from a stream, the goal is to obtain water that is representative of the stream at the point where the sample is taken. Under this program's QAPP, volunteers collect what are known as "grab" samples: They place a sample bottle underwater in the flowing stream and allow it to fill with water. Specifically, volunteers do not use specialized equipment that integrates sample water across the width and/or depth of a stream. Controls performed by the CSI lab have shown that grab samples collected by our volunteers are, within measurement error, equivalent to width- and/or depth-integrated samples with respect to chemical and microbiological parameters. Grab samples probably underestimate total suspended solids, a physical water quality indicator, compared to depth-integrated samples, especially under stormwater conditions, because heavier solids tend to sink and not be captured by grab samples collected near the surface.



Different methods to collect a water sample

Wading into the stream: For a grab sample to be representative of the stream at the sampling site, the water in the sample should be well-mixed and free of extraneous debris. Assuming the stream is not deep and the current is not swift, a representative sample can be collected by wading into the center of the stream; facing in an **upstream** direction so that the water is flowing toward you; immersing the bottle about half-way down; and opening the bottle under water, allowing the air to bubble out as it fills to the shoulder, and capping it under water. It is important to leave about 5-10% of the bottle as head space so that the lab analyst can shake and mix the sample thoroughly before removing portions of it to perform the various water quality tests.

Sampling from shore: If the stream is too deep or the current too swift, a representative grab sample can be collected from the stream bank. To make sure the sample is representative, collect it from a point where the current is flowing and the water is well mixed. **Avoid sampling from a pool, an eddy or a back-current**. Collect the sample the same as when wading into a stream: Face the bottle upstream; immerse it; uncap it, allow it to fill to the shoulder, and recap it underwater to avoid surface debris.

Sampling from a bridge: Under stormwater conditions, the current may be so swift that it would be unsafe to attempt to sample by wading into the stream or by leaning out over the stream from the bank. If there is a bridge nearby, a sample can be collected by lowering a clean bucket into the current, then filling the sample bottles by dipping them in the bucket. **The bucket must be rinsed with stream water at least two times before collecting the sample.** Care must be taken to swirl the bucket and make sure the sample is well mixed before filling the sample bottles from the bucket.

Collection of Field Duplicate and Field Blank Samples

In addition to collecting grab samples at each location, under this program's QAPP volunteer teams will now be asked to collect one field blank and one field duplicate sample during just one monitoring event each year. Instructions for collecting the field blank and field duplicate samples are as follows:

Field Blank: Field blank samples are a quality assurance measure to ensure that no contamination of the sample occurs due to insufficient cleaning or improper storage or handling of the sampling containers. During each monitoring event, a team will be provided with a field blank kit which includes a 1-liter bottle for chemical analyses labeled "Field Blank", a sterile 60 mL or 100 mL bottle for microbiological analysis labeled "Field Blank", a tracking sheet and chain of custody form labeled "Field Blank", a 1-liter bottle filled with laboratory water labeled "Lab Water for Field Blank Kit", and a 60 mL bottle filled with sterile water labeled "Sterile Water". The field blank kit should be stored by the volunteer team along with their other sampling kits and transported with them into the field. At any time during the monitoring event, the field blank is prepared by filling the two bottles in the field blank kit with the corresponding bottles filled with water provided the lab (i.e., the 1-liter bottle filled with the 1-liter of lab water and the 60 mL microbiological bottle filled with the 60 mL of sterile water. The date and time are recorded on the field blank bottles, and the tracking sheet and chain of custody are completed for the field blank the same as for stream samples. The field blanks are transported to the lab along with the stream samples. Empty lab water bottles should be returned to the lab for reuse.

Field Duplicate: Field duplicate samples are a quality assurance measure designed to ensure that the team's sampling procedure is consistent and precise and therefore the samples being collected by the team are representative of the locations being sampled. During each monitoring event, a team will be provided with a field duplicate kit containing a 1-liter bottle for chemical analyses labeled "Field Duplicate", a 60 mL or 100 mL bottle for microbiological analysis labeled "Field Duplicate", and a tracking sheet and chain of custody form labeled "Field Duplicate". The field duplicate kit is stored by the team and transported along with their other sampling kits. The team that collects the field duplicate may be the same or different than the team that prepares the field blank sample. At the selected location, the field duplicate kit is used to collect a second sample in addition to the regular sample collected at that site for a total of two sets of samples for that location. The date, time and location code are recorded on the field duplicate bottles the same as the regular sample, and the field duplicate tracking sheet and chain of custody form are also completed the same as the regular sample. The field duplicate samples are transported to the lab on ice together with the other stream samples and the field blank.

Field measurements

In addition to collecting grab samples, volunteers collect field data and record observations at each sampling site.

Temperature: Temperature is an important component of water quality. Volunteers are provided with metal pocket thermometers to measure the temperature of stream water on-site. Immerse the thermometer directly in the stream, check every 10-15 seconds until the reading is stable, and record the result on the field data sheet/chain of custody. Do not measure the temperature of the sample in either one of the sample bottles as the thermometer could contaminate the sterile bottle with bacteria or the acid-washed bottle with phosphorus. If the sample is collected with a bucket from a bridge, measure the temperature of the water in the first or second bucketful that is used to rinse the bucket before collecting the sample.

In order to obtain accurate temperature measurements, the thermometer must be calibrated, and the calibration checked **at least once annually**. There are two simple methods for calibrating a thermometer:

Freezing/Melting Point Method: This calibration method is preferred over the boiling point method (see below) because stream temperatures are closer to 0^o C (32^o F) than to 100^o C (212^o F). Put water (any kind of water will do) in a container, for example, a glass, and add ice to create a mixture of ice and water. Place the mixture in a refrigerator and wait several minutes for the temperature to equilibrate. The temperature of water at its freezing/melting point is defined as 0^o C (32^o F). Placing the ice-water mixture in the refrigerator makes it possible to achieve this temperature faster and maintain it longer. Open the refrigerator, place the thermometer in the ice-water mixture taking care to immerse the stem, and close the door. After a few minutes, open the fridge and record the temperature reading. Repeat at least two more times until the reading is stable. This is the thermometer reading that corresponds to a temperature of 0^o C. If it is different than 0^o C, the difference can be used as a correction factor. For example, if the reading is $+2^o$ C, subtract 2^o from temperature measurements in the field. If the reading is -1^o C, add 1^o to temperature readings in the field.

Boiling Point Method: Heat water to a steady boil, immerse the stem of the thermometer, wait about 15 seconds and record the temperature. Keep the stem immersed and record the temperature after at least two more 15-second intervals or until the reading is stable. This is the reading that corresponds to a temperature of 99^o C. The reason it is 99^o and not 100^o is that water boils at lower temperatures as its altitude above sea level increases. The Finger Lakes region is approximately 300 meters (1,000 ft) above sea level, and our altitude lowers the boiling temperature by about 1^o C. Any difference between the thermometer reading and 99^o C is used as a correction factor. For example, if the reading is 101^o C, subtract 2^o C from temperature measurements in the field. If reading is 98^o C, add 1^o C to temperature measurements in the field.

Manual adjustment of metal thermometers: The temperature reading can be adjusted manually on the metal pocket thermometers provided by CSI. However, a manual adjustment is not necessarily accurate because it can only be made after the thermometer is taken out of the ice bath or the boiling water and is no longer displaying the temperature corresponding to the freezing point or boiling point, respectively. CSI recommends that volunteers forego manual adjustment and use the correction factor provided that it is not greater than about three degrees centigrade. An effort should be made to correct larger discrepancies by manually adjusting the reading on the thermometer. After making a manual adjustment, CSI recommends that volunteers re-determine the thermometer reading at the freezing point or the boiling point in order to verify that the manual adjustment was successful, and a correction factor is no longer needed.

Temperature Readings: 1._________ 2._________ 3.__________
We encourage you to calibrate your group thermometers at your annual volunteer meeting or at home and record your temperature readings here for your reference.

Dissolved oxygen (DO): Dissolved oxygen is measured using LaMotte kit code 5860. This kit uses a miniature version of the Standard Methods protocol and is extremely accurate if done carefully. Volunteers who are trained in the use of the LaMotte kit can measure DO in the field and record the result on the field data sheet/chain of custody. Alternatively, volunteers may collect a sample and fix it in the field for later completion of the DO measurement by CSI lab staff. For this alternative protocol, collect a sample by completely filling the small glass bottle provided in the LaMotte kit. Cap and invert to check for air bubbles; if there are bubbles, discard and collect another sample. Fix the dissolved oxygen by adding eight drops of each of the first two chemicals in the DO procedure, i.e., manganous sulfate (pink solution) and potassium iodide azide (skull and crossbones on the label). Avoid skin contact with all chemicals. CSI will provide DO bottles and the first two chemicals in the DO procedure as well as latex gloves for protection when handling the chemicals.

Field observations

Record the date and time of sample collection on the sample bottle and on the field data sheet/chain of custody for each sampling location. Indicate how the sample was collected (waded, from shore, from a bridge); the use of ice for preservation and transport to the lab; and general stream conditions, e.g., appearance of the water (clear, cloudy, brown), stream flow (low, medium, high), and the – very approximate -- depth and width of the stream. Describe any unusual conditions, for example, a construction site nearby, cattle or other farm animals in the stream, or unidentified outfall pipes. Volunteers' observations can provide valuable context when interpreting results. Be sure to sign the field data sheet in order to document that you are the person who collected the sample, performed the field measurements and made the general observations. In addition to signing the field data sheet, sign the chain of custody at the bottom of the sheet when relinquishing samples to another volunteer or to the CSI lab.

It is noted that estimating the velocity of the stream current, for example, with a float and a stopwatch, is optional. Current velocity is one component of stream discharge, or flow. A complete measurement of flow is quite challenging and is beyond the capability of most volunteer monitoring programs. Fortunately, the US Geological Survey maintains a national network of flow gauges that record flows and report them on the internet. Flows in gauged streams can often be used to estimate flows in nearby streams. The product of stream flow times pollutant concentration is equal to pollutant loading. Loading is expressed as mass per unit time, for example, as pounds per second or tons per year.

Current velocity is used in biomonitoring as part of the physical survey of a stream to identify appropriate locations to sample benthic macroinvertebrates (BMI).

2022 Monitoring Events

Below are the dates selected by the group for baseflow monitoring events in 2022:

1st Monitoring Event:

2nd Monitoring Event:

3rd Monitoring Event:

Volunteers and CSI will make every effort to replace one or more of these base flow events with stormwater events.

Contact Information:

Please send updated contact information as necessary.