Bronx River Citizen Science Stewards Volunteer Monitoring Program Training Manual

Section 1: Introduction and Reference
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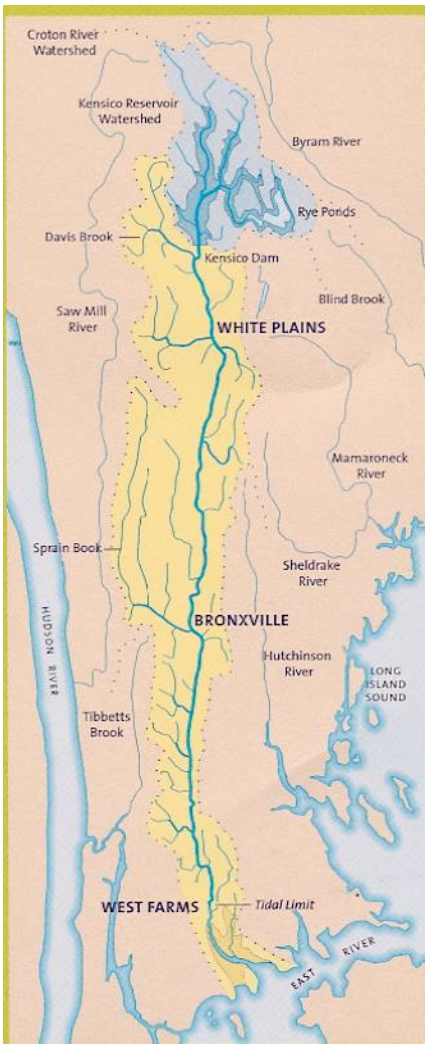
Bronx River Stewards:
Mission

- Create a historical baseline of water quality information for the Bronx River throughout the Bronx
- Connect communities with their water resources through education and hands on involvement
- Allow public access to water quality monitoring information for educational purposes
- Engage and empower local residents to become advocates for the Bronx River

History

The Bronx River Citizen Science Stewards Program was established in 2004 in order to create a baseline of water quality data on the Bronx River and make information easily accessible to the public.

One of the little known marvels of the New York City landscape, the 23-mile Bronx River winds down through southern Westchester and the Bronx to define a peaceful corridor of green for strolling, biking, boating, and nature study amid the noise and bustle of urban life. In order to better study and protect this resource, it is important to understand the river's health and how human activities impact that health. The Bronx River Citizen Science Stewards aim to create a comprehensive database of water quality for the Bronx River.

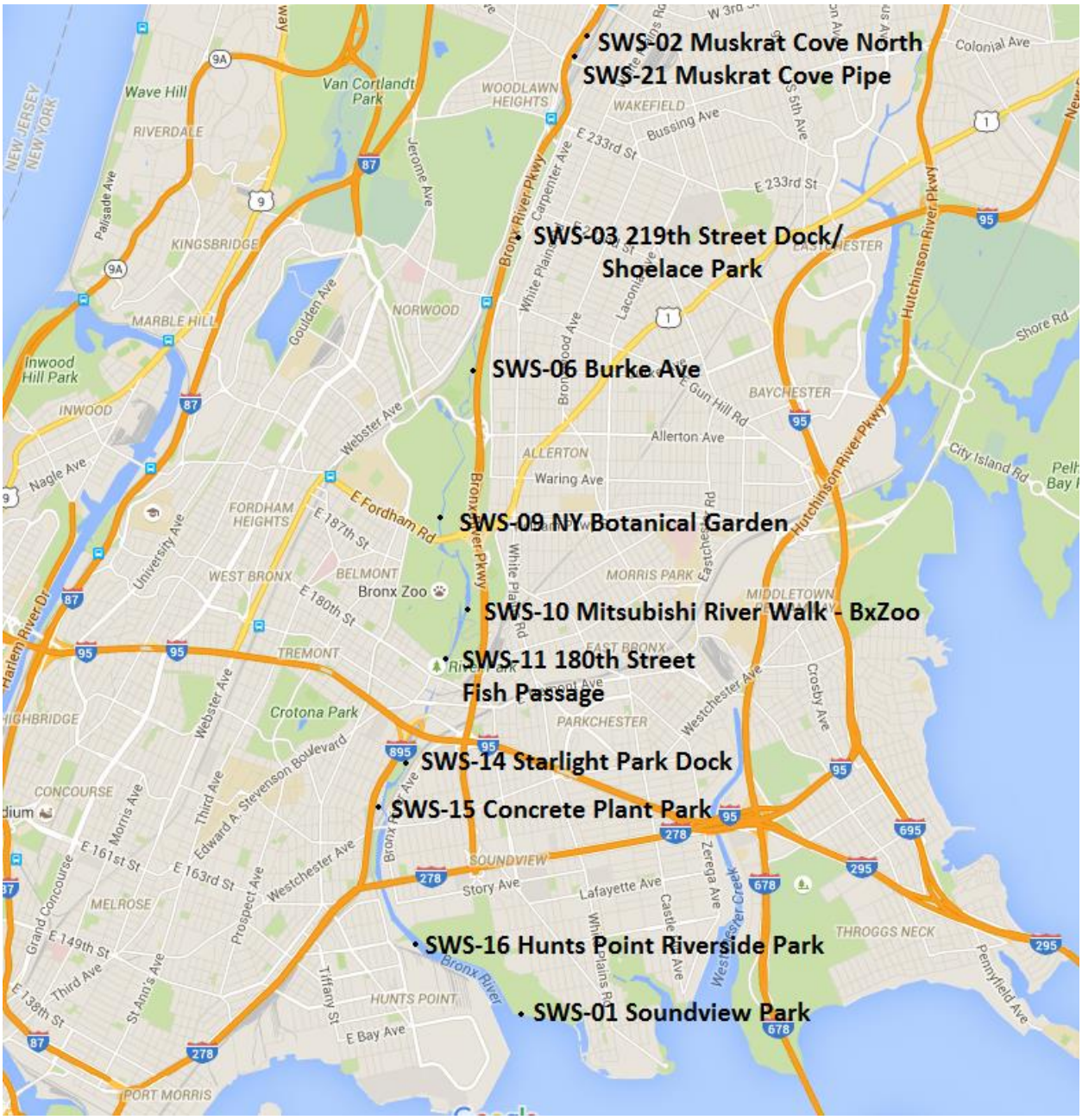


Baseline water quality information is a useful tool for decision makers to balance environmental quality and economic sustainability. At present, there is a lack of accessible standardized comprehensive data regarding water quality in the Bronx River. This is due to limited resources available to monitor the river. The Bronx River Citizen Science Stewards Program will create standardized water quality data by training volunteers and connecting with current volunteer monitoring groups.

Bronx River Watershed Facts and Figures

- The Bronx River is 23 miles long and its watershed is 56.4 square miles. It begins as a small brook in Valhalla, NY and empties into the East River portion of the Long Island Sound
- The Mohegan Indians called the river *Aquahung*, "River of High Bluffs"
- The first parkway built in America, the Bronx River Parkway, was originally built to help improve the water quality of the Bronx River by allowing the Bronx River Valley Sewer System to be built. Along with the Hudson River, factories and sewage had heavily polluted the Bronx River in the late 19th century

Monitoring Site Map



Stewards Study Design

The study design of a monitoring program is simply the why, who, what, where and where of the program. Below you will find a summary of the Bronx River Citizen Science Stewards study design.

1. Why monitor?
   The program has been established to create the first comprehensive baseline water quality data for the Bronx River.

2. Who will use these data?
   Data collected by stewards will be live uploaded to a data collection site created by the Alliance in 2015. This data website, BronxRiverWater.org, will make data available for view, along with thousands of other data points collected since 1989, by the public with a 24 hour lapse time.

3. What parameters will be monitored?
   To achieve a complete understanding of the water quality changes over time, the physical, chemical and biological characteristics of the monitoring sites will be assessed. These parameters include, but are not limited to:
   - Flow, turbidity, water appearance, salinity, pH, temperature, etc.

4. Where?
   Stream monitoring sites will be distributed along the river in the Bronx based on your base lab location. Each site is easily accessible by the public or we must have landowners permission to access site.

5. What is the monitoring frequency?
   We understand that it may be hard to tend to your site at a frequent schedule. We ask all stewards to commit to at least 4 parameters at a frequency of at least once a month at their testing site.

Stewards Team Structure

Why are teams necessary?

- To stay safe
- To support and help each other
- Divide and share work
- Promote citizen involvement
- Have more FUN!!!

Team Roles: Team structures are flexible. However, it may be helpful to assign persons of your team to the following roles.

- Scheduler/Organizer: This can be the lead educator or samplers within the group.
  - Keeps team monitoring schedule and organizes reminder calls or emails to the team members
  - Keeps community and Bronx River Alliance abreast about team activities
  - Presents information collected to interested groups and local media

- Historian/Data Collector:
    - Records all data in a consistent, legible manner and verifies that results are complete and correctly documented
    - Maintains team book with all original hard copy datasheets to be turned into the Bronx River Alliance via mail at the end of the monitoring year
    - Enters data into BronxRiverWater.org webpage
- Lab and Field Technician: Quality Assurance/Quality Control (QA/QC) Officer
    - Oversees all aspects of the lab work involved in the monitoring program
    - Keeps supplies and reagents stocked, ensure glassware and collecting containers are properly cleaned, and equipment is properly maintained and stored
    - Checks physical, chemical, and macroinvertebrate biological equipment prior to each testing
- Workers
    - Assists and supports all team roles
    - If properly supervised by a trained team member, does not have to complete training workshop

Steward Team Member Recruitment

It is important that your Bronx River Citizen Science team involve many different people from your community. Your team will benefit from inviting groups and citizens with various backgrounds and interests to join your team.

Below you will find some key points about the Bronx River Citizen Science Stewards. This should help you and others understand what your team is doing, and be more likely to help in tracking the local weather conditions of the Bronx River.

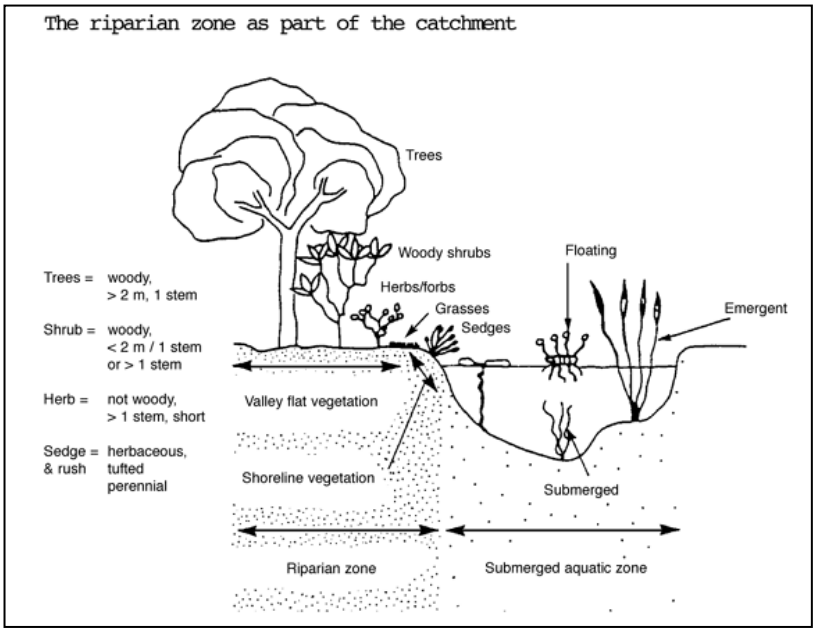
- Bronx River Alliance Citizen Science Stewards is a volunteer water quality monitoring program supported by the interest of Bronx residents interested in water resources.
- BxRCSS volunteers are equipped with the knowledge, skills, and equipment necessary to perform water monitoring
- The data your team collects will be USED! All data is submitted to the Alliance data collection site, BronxRiverWater.org, which is readily accessible to the public.

Physical Parameters of a Stream: Overview

The physical parameters consist of the basic outward appearance and condition of the stream; such as the bank vegetation and stability, sediment composition, and habitat. An understanding of the physical conditions will serve as the foundation for understanding and evaluating the chemical and biological results. For example, if there is no canopy cover shading the stream, it is expected the water temperate will be warmer than rivers and streams with canopy cover. The increased water temperature will then lower the streams that are prone to flood frequently, banks and in stream sediment are reworked and shaped more frequently than those with less variable flow. Physical parameters are constantly, although sometimes very slowly, changing. Slow changes are hard to detect from day to day, but by comparing a site drawing and physical conditions data sheets from one year to another the changes become very apparent.

Riparian Zone

The riparian zone is the area of land adjacent to a stream (see figure below). A healthy riparian zone is fully vegetated with a diverse plant community. The land slopes gently and there is little to no human disturbance, such as mowing. An unimpaired riparian zone keeps streams healthy and productive in many ways: it eases flooding by absorbing surface flow, the shade of a tree canopy keeps the water cool, the roots of plants absorb nutrients and stabilize soil, and overhanging vegetation offers shelter and food to wildlife and aquatic critters.



Streambed Sediment

The streambed sediment is the composition of particles that make up the bottom of the stream; the streambed sediment can be composed of fine particles such as silt, larger rocks such as cobbles and boulders, or a combination of both.

Streambed sediment is an important determinant of organism diversity. A healthy streambed will have alternating patches of a rocky substrate and a fine sediment sediment. The natural presence of both increases the amount of different critters that can live in the stream. For example, many aquatic worms prefer fine sediment, such as silt, to burrow into and find food. On the other hand, critters like caddisflies require larger particles, such as cobbles and boulders, to cling or attach to so they aren't swept downstream by the current.

A streambed's original sediment composition was determined by the area's geology, but at present the sediment of many streams has been altered by human activities. Numerous streams have been influenced by excessive erosive forces, which causes fine sediment, such as silt and sand, to be deposited in the streambed. The accumulation of silt and sand buries the original rock substrate; the degree to which is quantified as the percent embeddedness.

Substrate Size Guideline:	
Boulder	> 10 inches in diameter
Cobble	> 2 and < 10 inches in diameter
Gravel	> 0.1 and < 2 inches in diameter
Sand	< 0.1 inches in diameter
Silt/Clay/Mud	water becomes cloudy when disturbed

Stream banks

The condition of a stream bank tells one a great deal about the river's history and provides insight into the quality of the stream. A bank covered in natural vegetation with a low or gradually sloping gradient will provide the most stability and habitat for aquatic critters. On the other hand, an undercut bank shows us that the stream is unstable, highly affected by erosion and probably, as a result, exhibits increased embeddedness.

Site Sketch

Drawing the site's characteristics each time you collect data will aid in identifying changes to the stream stretch over time through a comparison of recent sketches with older ones. It doesn't matter if you aren't an artist- just catch as much detail as possible and be creative; see Figure 5 for an example site sketch.

Also, feel free to take a picture upstream and downstream of the site marker to further document your site's physical characteristics. Note that neither the site sketch nor the pictures will be included in the online database, but please add them to the team folder for reference.

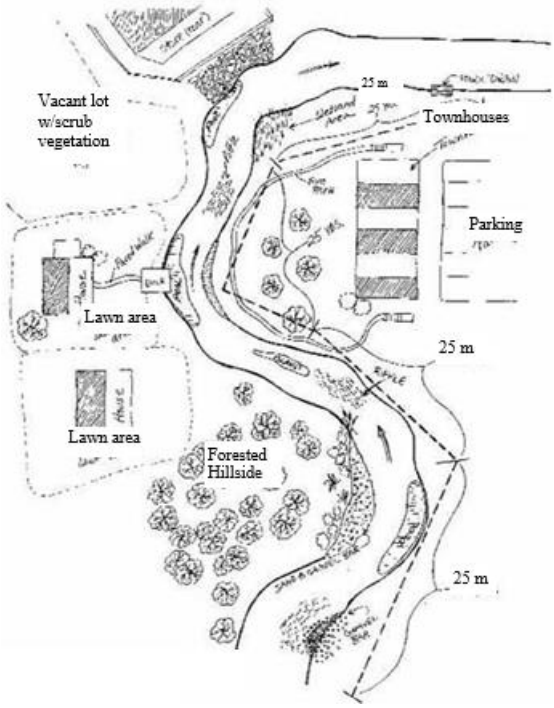


Fig. on right: Site sketch showing key features and approximate distance measurements for scale

Water Regulations

The Clean Water Act:

The first national regulation intended to protect the health of waterbodies was the 1948 Federal Water Pollution Control Act. Since 1948, the original statute has been amended extensively to authorize additional water quality programs, standards and procedures to govern allowable discharges, and funding for construction grants or general programs. As amended in 1977, this law became commonly known as the Clean Water Act. The Clean Water Act's full text is posted at http://www4.law.cornell.edu/uscode/33/ch26.html and an easy-to-follow interactive website dedicated to the Clean Water Act is found at http://www.cleanwateract.org/index.htm. Good sections to become familiar with are the water quality standards (especially designated uses), impaired waters list, discharge permits, and watershed restoration plans.

Surface Water Classifications:

Part of the Clean Water Act involves setting standards for waterbodies; each state is responsible for setting these with USEPA guidelines. The New York State Department of Environmental Conservation (NYS DEC) has assigned classification and respective water quality standards to every water body in New York. Not all streams yet meet the designated standards, but NYS DEC and USEPA are working to improve impaired waters until they do meet all standards. Here is a list of just the fresh surface water classifications for rivers, streams, lakes and ponds and their standards (there are similar lists for both ground water and saline water). The following website addresses offer more information about New York State water classifications: http://www.dec.state.ny.us/website/regs/ch10.htm - Article 2, parts 700 to 706.

NYS Department of Environmental Conservation, Fresh Surface Water Classifications and Best Uses:

- Class N: Enjoyment of water in its natural condition and, where compatible, drinking, bathing, recreation (swimming), fishing and fish propagation
- Class AA Special: Drinking, primary (swimming) and secondary (boating) recreation, fishing and fish propagation
- Class A Special: Drinking, primary (swimming) and secondary (boating) recreation, fishing and fish propagation
- Class AA: Drinking, primary (swimming) and secondary (boating) recreation, fishing and fish propagation
- Class A: Drinking, primary (swimming) and secondary (boating) recreation, fishing and fish propagation
- Class B: Primary (swimming) and secondary (boating) recreation, fishing, and fish propagation
- Class C: Fishing and Fish Propagation
- Class D: Fishing

Section 2: Monitoring Protocol
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Training Manual Instruction

Your monitoring team will collect data at your site of choosing at a minimum of once per month.

- Check the equipment list (page 13) before you go to your sampling site. Check that all chemical equipment has been thoroughly cleaned and rinsed.
- The water quality analysis collection packets that are to be filled at sampling time can be found in section 3 of this manual. Please do not detach and fill in these sheets; they are to be used as originals from which you may make copies. If possible, Rite-in-the-Rain paper is water resistant and can be used with wet hands and after accidentally falling into the river.
- After you have collected all data and recorded in an excel spreadsheet, all data should be electronically entered to our webpage BronxRiverWater.org (suggested within 24 hours of collection). All excel spreadsheets should be emailed to Bronx River Education staff at the end of year for archiving.
- Equipment care and cleaning instructions are found on page 36. It is best to clean equipment immediately after you return from the field, since reagents can become caked onto glassware.

Recording and Reporting Volunteer Hours

Record the number of student, educators, volunteers and hours each person have dedicated as a steward on the water quality analysis collection packets provided in section 1.
Include all hours spent:

- Collecting data at streams
- Travel time
- Data Entry
- Any accumulated time conducting optional watershed inventory

For example:

Team members Jane and John spent:

2 hours collecting data at site
0.5 hours traveling
1 hour entering data into the website

Therefore, the total time volunteered is 3.5 hours each – 7 total hours

(3.5 hours * 2 people = 7 hours)

Water Quality Equipment Checklist

Below is a checklist of items you will need to bring with you in the field in order to monitor your sites. Before every trip into the field, consult this list and take inventory of your equipment and supplies. It is extremely important to check that the chemical equipment has been properly cleaned and the batteries are working. Do not assume everything is there without first checking. It is better to spend extra time preparing before you go to your site than to have to return for something you forgot the first time.

Use this checklist before going into the field.

- Map, pen/pencil, clipboard
- Water quality analysis data sheets
- Tape measure or yard stick
- Stopwatch
- pH meter or strips
- pH calibration solutions (4.00, 7.00, 10.00) – Preferably handled within a lab
- Conductivity meter
- Salinity refractometer or hydrometer
- Dissolved oxygen kit
- Nitrate strips or kit
- Phosphate kit
- Turbidity tube or Secci disk
- Waste bin or bottle – Proper disposal techniques can be found on page 36
- Gloves
- First aid kit
- Cloth or rag for small spills
- Cell phone and camera (optional)
- Bin to carry all materials

Safety Instruction

Please be sure to follow the safety protocol listed below.

- Respect landowners' rights. If you are trying to test from private land, obtain the owners' permission before entering. If at any point you are asked to, leave property.
- Always monitor with one or more team member. Let someone else know where you are, when you intend to return, and what to do if you don't come back at the appointed time.
- Before you enter a stream, make sure you will be able to get out, the current is not too strong and the bottom (substrate) will safely support you. Please do not wade without an Alliance member present.
- Have a cell phone and first aid kit handy. Know any important medical conditions of the team members you are with and bring any needed medication.
- Listen to the weather report. Do not go sampling in heavy rain or if a storm is predicted.
- Keep your pets at home. Dogs can damage stream banks and hurt or destroy aquatic life and vegetation.
- Never drink the water from the river. Assume it is unsafe, and bring your own water. Also, once your hands come into contact with the stream water, avoid touching your mouth or eating until you have washed your hands with soap or disinfected with hand sanitizer.
- Do not monitor if the water appears to be badly polluted (ie. Large fish kill, strong stench, oily rainbow sheen)
- Do not walk on unsafe stream banks that might be in danger of eroding or collapsing.
- Keep equipment and chemicals away from small children.
- To dispose of water and chemicals for testing, collect in jar and dispose of appropriately, or give to Bronx River Alliance. Refer to the specific test pages in this manual for specific chemical safety and disposal information.
- Wash your hands with soap when you are finished and dispose of your trash properly when you're finished.
- Please do be cautious as to not splash any additional stewards nor yourself.

If at any time you feel uncomfortable about conditions at the site, stop monitoring and leave at once.

YOUR SAFETY IS MORE IMPORTANT THAN THE DATA!

Water Quality Analysis Data Collection Instructions

You will be conducting a partial stream analysis during the monitoring year. The data collection packets will be provided at the training workshop, and can also be found in the section 3 of this manual.

1. Gather equipment and water quality analysis data packet. Take to monitoring site with you.
2. Parameters
    - Fill in the site information in the box at the top of the page.
    - Collect water samples and conduct all physical and chemical tests listed
    - Record all values within table
    - Perform 2 replicates for each test
3. Have a recorder review water quality analysis data sheet to make sure all information has been recorded correctly and initial at the top of each page.
4. Your team is now ready to go home, clean equipment and enter data to both excel sheet and BronxRiverWater.org.

Water Sample Collection Procedure

STOP AND READ! – Before Collecting Water Samples

It is important to collect a sample in the same manner every time you monitor. Altering the sample collection procedures will also alter your results. The sample should be collected from an area in the stream with a moderate current because stagnant water will yield different results and make data incomparable.

Water Sample Collection Procedure: This is the sampling collection procedure to be used for the measurement of all parameters, except dissolved oxygen.

- There are 3 ways to conduct water sampling collection:

Preferred Wading Method	*Common* Direct Sampling Method	*Least Common* Water Collection Method
Note: This method should only be conducted with Alliance staff present. Collect water from the main current, upstream of where you have walked or are standing so that you do not collect the sediment that your feet have stirred up into the water column (the water should be flowing toward you). All testing should be done within river channel. *Note: All testing material will need to be present with you when wading out. It is recommended that all testing material be present in a bucket attached to wader belt.* Sampling should take place within 6”-12” below the surface or, if the stream is shallow, midway between the surface and the stream bottom.	Conduct all testing directly in water along edge of access point (i.e. Dock, river access point, etc.). No water is collected during this method as we are testing the direct free flowing waters at that moment in time. (i.e. pH strips will be dipped into water channel instead of from a bucket of collected water). Prior to each test, sampling should take place within 6”-12” below the surface or, if the stream is shallow, midway between the surface and the stream bottom.	If there is no or limited access to the water testing site, a bucket or sample collection bottle may be used to collect a sample. All testing will be conducted above shore. *Note: When using this method, all sample collection vessel (bucket or bottle) should be rinsed 3 times prior to sample collection to ensure no residual water that might affect results.* Bottle: - Remove cap of clean 500 mL bottle just before sample collection. Do not touch the inside of the bottle as this will contaminate your sample. - Hold bottle near base and plunge it (opening downward) below the water surface. Hold it 6”-12” below the surface or, if the stream is shallow, midway between the surface and the stream bottom. Turn the bottle, while submerged , so that the opening is towards the current (upstream and pointing away from you) and fill the bottle. Discard water behind you and

		refill sample bottle. - Once full, remove bottle from water and empty it back into the river to remove any detergent left over from washing the bottle. - Repeat collection process. - Fill the bottle completely and recap carefully. Bucket: - Hold bucket near base and plunge it (opening downward) below the water surface. Hold it 6”-12” below the surface or, if the stream is shallow, midway between the surface and the stream bottom. Turn the bucket, while submerged , so that the opening is towards the current (upstream and pointing away from you) and fill the bucket. Discard water behind you and refill sample bucket. - Once full, remove bucket from water and empty it back into the river to remove any detergent left over from washing the bottle. - Repeat collection process. - Fill the bucket to carrying capacity.

- *Please note on your data collection sheet how sampling was conducted*.
- You are now ready to conduct all (except dissolved oxygen) of your replicate one-chemical field tests with this sample water.
- Chemical waste disposal: In the field, collect all chemical wastes in a clearly labeled plastic container. Do not dispose of wastes in the stream or in the stream bank.

Sampling Parameter: Temperature

Why Collect Temperature Data?

- Water temperature is a simple but important indicator of river health. It affects the rate of many biological and chemical processes that take place in the river. For example, the warmer the water, the faster the molecules are moving. Fast moving molecules act to "push" dissolved oxygen out of the water and back into the atmosphere. Therefore, warm waters hold less oxygen then cooler waters. Every organism has a temperature range that is optimal for its health. If the temperature of the river falls below or exceeds this range, the organism will suffer. In an urban riverine system, excessive warming is often a concern. Loss of riparian vegetation shading, increased areas of impermeable surfaces and lower base flows are all results of urbanization that also contribute to higher water temperatures.

Bronx River Water Temperature Range: Depending on the season, can be from 0 ˚ C in the winter and as high as 30 ˚ C in the summer

Scientists use the metric system, Here's a handy conversion formula:

Temperature Conversions:

$^{\circ}F = (^{\circ}C * {}^{9}/_{5}) + 32$

$^{\circ}C = (^{\circ}F - 32) * {}^{5}/_{9}$

Taking Air Temperature Data using a Thermometer:

- Air temperature has a vast effect on the surface waters of the river. Thermodynamics rule that heat flows from area of high temperature to an area of low temperature ultimately trying to create equilibrium; this transfer of heat works both ways (water into atmosphere and vice versa).
- **Critical Thinking: In what ways might the temperature of the air have an effect on the river?**
- Data Collection:
    - Hold thermometer from the handle point at arm's length away (with bulb at bottom of thermostat) above area of sample collection for 30-60 seconds
    - Be aware that bulb is not within cavity of area hand is holding for this will take the body temperature of the person sampling instead of the air temperature
    - Read results in C ˚ and add data to collection sheet

Taking Water Sample Temperature Data using a Thermometer:

- **Critical Thinking: What can effect a rise in water temperature of the Bronx River?**
- Data Collection:
    - Place thermometer in water sample column for 60-120 seconds
    - Read results in C ˚ and add data to collection sheet
    - Repeat 2 consecutive times and add data to collection sheet
    - Test should be completed a total of 3 times

Taking Water Sample Temperature using an Oakton pH meter:

- Data Collection:
    - With tester on, press HOLD/CON key, then let go
    - Press CAL key

- Tester will display temperature in C˚ and add data to collection sheet
- Repeat 2 consecutive times and add data to collection sheet
- Test should be completed a total of 3 times

Review:

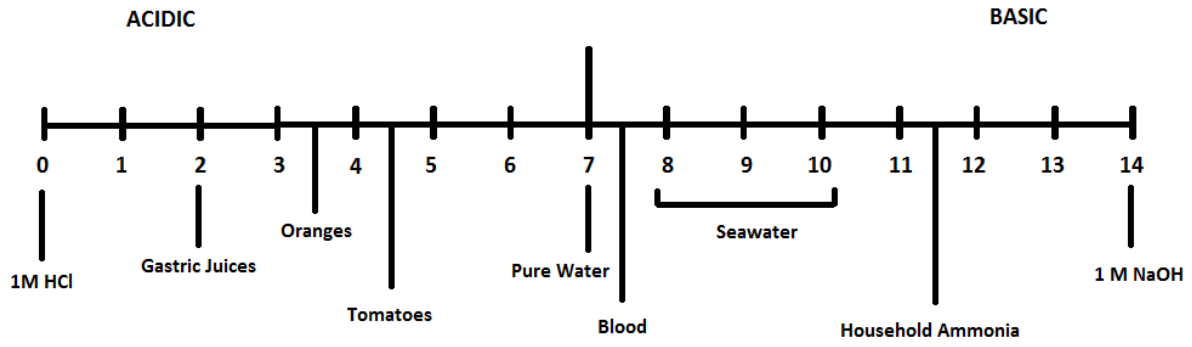
- Water temperature is naturally affected by seasonal and daily fluctuations, and typically the range remains moderate supporting diverse aquatic organisms. Aquatic animals, just like humans, need a stable temperature range to live in. If the water ever becomes too hot or cold, aquatic organisms become stressed and will eventually die if temperature remains extreme. Water temperature also influences the chemistry of the stream, for example, cooler water can hold more oxygen.

Sampling Parameter: pH

Why Collect pH Data?

- pH, which stands for power of Hydrogen, is a measure of a stream waters acidity (H^- ions) and is measured on a scale of 0-14. A value of 0-7 is considered within acidic range and a value of 7-14 is considered within basic range. A value of 7 is considered neutral. Aquatic organisms have a specific pH range in which they can live (usually around 7). Changes in pH can impact these organisms negatively if it forces them into an environment that is either too acidic or too basic for them.

Bronx River pH Range: 6.5 – 7.5 in the freshwater section and slightly more basic in the tidal section.



Taking pH Data using Dip Stick:

- Data Collection:
    - Remove dip stick from container pack being sure to only touch white portions of stick (do not touch the colored portion of the stick)
    - Dip colored portion into water sample column for approximately 20-30 seconds
    - Remove excess water on stick by shaking gently
    - Compare change in color of stick to color comparison chart on container pack
    - Read results and add to data collection sheet
    - Test should be completed a total of 3 times

Taking pH Data using Oaktron pH Tester:

- Sponge present within the tester will need to be kept moist, re-hydrate and calibrate 30 minutes before using to test
- Data Collection:
    - Remove electrode cap and rinse electrode with distilled water
    - Press on/off to switch tester on
    - Dip the electrode into water sample column and stir once
    - Allow reading to stabilize
    - Record pH reading immediately or press Hold/Con button to freeze the reading until you can record it
    - Test should be completed a total of 3 times
    - Press on/off to turn off tester; auto shut off after 8 minutes

Review:

- For water monitors, pH is the measure of acids and bases dissolved in the stream or lake water. The range of the pH scale goes from 1 to 14, with a measure of 7 being neutral (neither acidic or basic). Any substance measuring higher than 7 is a base and anything below 7 is an acid. Common forms of acids are lemon juice, soda, vinegar, and acid rain; common forms of bases are drain cleaner, ammonia, and baking soda.
- Pure water, which is neutral, has a pH of 7. Often when substances dissolve in water the pH level changes, forming either an acidic or basic solution. Waterbodies are naturally mildly acidic or basic depending on the rocks and minerals in the riverbank and watershed. A waterbody with a pH outside of the 6.5-8.6 range is unable to support a diverse amount of fish and invertebrate species. In the Northeast US, acidic waterbodies are more common and problematic due to the natural geology and influences of acid.

Chemicals Used	**Disposal**	**Safety Information -** Emergency Phone: 1-800-222-1222
pH Buffer 4.01, 7.00 or 10.00	Pour down drain and run cold water for 5 minutes to completely flush system.	**Eye Contact:** Flush eyes with water for 15 minutes. Call physician. **Skin Contact:** Wash off thoroughly with soap and water. **Ingestion:** Call physician. Wash out mouth thoroughly. Give large quantities of water.

Sampling Parameter: Turbidity

Why Collect Turbidity Data?

- Turbidity refers to how particles suspended in water scatter light and therefore affect water clarity. Turbidity only measures cloudiness, not color. It is an important indicator of suspended sediment and its effects. Since suspended particles absorb more heat than water, turbidity can cause higher water temperatures, thus decreasing dissolved oxygen. Turbid waters also allow less light to penetrate, therefore inhibiting photosynthesis, which both reduces the rate of oxygen production in the water and the availability of plant food for aquatic organisms.

The negative impacts of high turbidity include:

- Sunlight becomes blocked, reducing the amount of energy available for plants
- Suspended particles absorb heat, raising the amount of energy available for plants
- As suspended solids fall to the stream or lake bottom (sedimentation), substrate size is altered and percent embeddedness or rocks increases
- Eggs and macroinvertebrates living in the streambed become stressed and/or buried as suspended particles settle to the bottom of waterbody

Bronx River Turbidity Range: Turbidity will vary depending on reach, weather and other factors. Look for anomalies more than specific value ranges

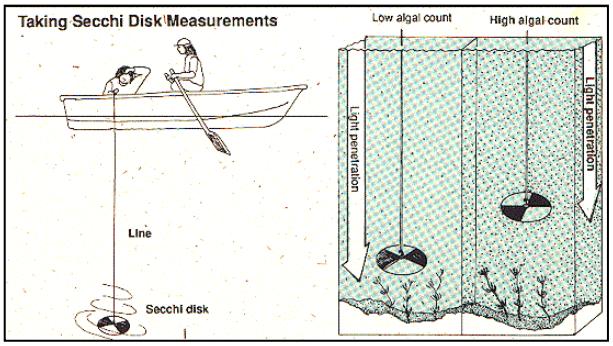
Taking Turbidity Measurement Data using Transparency Tube:

- **Critical Thinking: How would a high particulate level within the water column effect the organisms in the river?**
- Data Collection:
    - It is okay to use a bucket to fill turbidity tube within this method; be sure to have cleaned bucket prior to use; this a 2 person data collection method
    - Be sure that release valve at the bottom is closed off before next step
    - Pour sample water slowly into the tube using bucket until the tube is filled
    - Stand with your back to the sun so that the transparency tube is shaded
    - Look straight down into the tube with your eye close to the tube opening
    - An additional person should be at bottom of tube at release valve
    - While one person is looking down the tube, the secondary person at the release valve will release and allow water to flow out of tube
    - Person looking down tube will indicate to the secondary person when the secchi disk pattern present at the bottom of the tube is visible
    - At this point the secondary person will close the release valve
    - The amount of water present in the tube should be measured via ruler present on side of tube and recorded in meters
    - Test should be completed a total of 3 times.

Taking Turbidity Measurement Data using Secchi Disk:

- Data Collection:
    - Lower the Secchi disk straight down into the water until the disk just disappears from sight
    - Mark the rope at the water level with a clothespin

- Slowly raise the disk up until it reappears and mark the rope at the water level with your fingers or another clothespin
- To find the Secchi depth, grasp both clothespins in one hand and find the center of the loop of rope
- Move one clothespin to that point and remove the other
- This point is one half the distance between the point of disappearance of the disk and the point where it re-appeared
- Measure the distance from this point to the surface using a yardstick (or to the nearest depth marker if using a marked lowering line



Review:

- Turbidity is a measure of clarity or cloudiness of water in a stream or lake. Levels increase as suspended solids (tiny particles dissolved in the stream water) and plankton (microscopic plants and animals) accumulate in the water column. Factors affecting the levels of suspended solids are storms, water temperature, water flow and algal blooms.

Sampling Parameter: Salinity

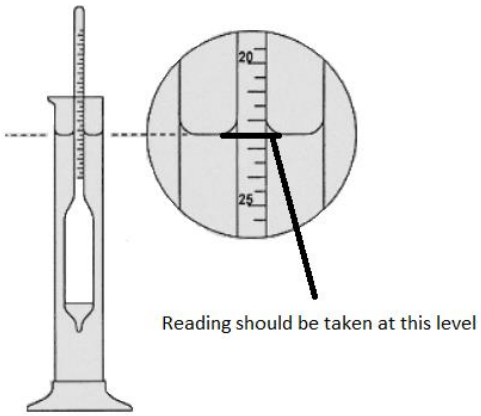
Why Collect Salinity Data?

- Salinity is a measure of salts in dissolved in water. The salinity of a body of water is one of the main factors determining what organisms will be found there. This is why many organisms that live in salt waters of oceans cannot live in freshwater and vice versa. Increased salinity levels in a freshwater system adversely affect riparian vegetation as well as aquatic plants and animals.

Bronx River Salinity Range: Depending on the reach (freshwater vs. estuarine), the season (salted roads in winter could cause freshwater reaches to become saline) and the tide, values will typically fall between 0 and 24 parts per thousand

Taking Salinity Measurement Data using a Hydrometer:

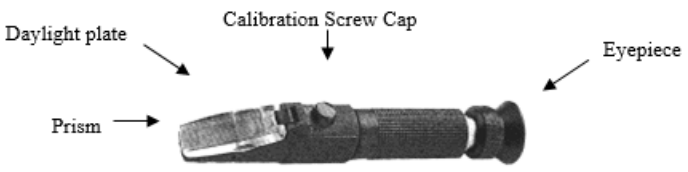
- A hydrometer will take the specific gravity of the liquid being tested. Specific gravity will tell you how much more or less dense the liquid is than fresh water. Fresh water has a density of 1.000 at about 4 ° C. Water with salt is denser causing a specific gravity reading of >1. Specific gravity is also related to buoyancy. The denser a liquid is, the greater the force of buoyancy will have on an object floating in/on it.
- **What anthropogenic sources might affect salinity?**
- Data Collection:
    - Rinse the 500 mL cylinder with sample water twice
    - Fill the cylinder with sample water to within 2 or 3 cm from the top
    - Measure and record the temperature of the water in the cylinder
    - Gently put the hydrometer into the cylinder
    - Wait for the hydrometer to stop bobbing; it should not touch the sides of the cylinder
    - Read the hydrometer at the bottom of the meniscus; read the specific gravity reading to the third decimal place and record specific gravity measurement
    - At this point the data can be converted into a salinity value of parts per thousand (ppt); it is suggested that all 3 data collections should be completed within time of each other with the repetition of all above steps



Specific Gravity Conversion Chart within the end of this parameter section.

Taking Salinity Measurement Data using a Refractometer:

- A refractometer will give you both a specific gravity reading and a parts per thousand reading. When measuring using this method, be sure to take note of which side is being used. Also, a refractometer uses the sun to work, so this method is not best used during cloudy days.



- Data Collection
    - Using a dropper, apply one or two drops of sample water to the surface of the prism, hold the prism at an angle close to parallel with the floor so the sample will not run off
    - Close the daylight plate gently; the sample water should spread like a thin film in between the daylight plate and the prism; by looking through the daylight plate, ensure that the sample solution covers the entire surface of the prism; if there are bubbles and gaps or if the sample is only on one portion of the prism, the sample water must be re-applied

    - Look through the eyepiece – looking toward a natural light source makes the image easier to read; if the scale is not focus, adjust it by gently turning the eyepiece either clockwise or counterclockwise
    - The upper field of view appears blue and the lower appears white; the reading is taken at the point where the boundary line between the blue and white fields crosses the scale. When each measurement is complete, the sample must be cleaned from the prism using tissue paper and distilled water
    - Test should be completed a total of 3 times
- Calibration
    - Refractometer should be checked for accuracy every week, and calibrated when needed
    - With continued use the calibration screw may move slightly and cause the refractometer to go just outside of zero calibration. It is good practice to periodically check the refractometer by making a reading with distilled water. If the reading is not at "0" the refractometer should be manually calibrated.
    - **DO NOT PERFORM CALIBRATION IN THE FIELD!** Calibration must take place in a controlled environment of 20° C (68° F) using distilled water of the same temperature. With distilled water on the prism, turn the calibration screw with the included screwdriver while looking through the eyepiece until the boundary line falls on "0".

Review:

- Although the Bronx River is a Freshwater river, it still has portions that are influenced by salt. Be aware of where you are taking your sample, a result in the Estuary will result in a higher number than that of a result in the Northern regions of the river.

Hydrometer Conversion Charts:

	Temperature of Water (°C)																
Observed Reading	-2	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
0.998																	
0.999																	
1																	
1.001	2	1.9	1.9	1.8	1.8	1.5	1.5	1.5	1.5	1.5	1.5	1.8	1.8	1.9	1.9	2	2.1
1.002	3.3	3.2	3.2	3.1	2.9	2.9	2.9	2.8	2.8	2.9	2.9	2.9	3.1	3.2	3.3	3.4	3.6
1.003	4.6	4.5	4.4	4.2	4.2	4.1	4.1	4.1	4.1	4.1	4.2	4.2	4.4	4.5	4.6	4.7	4.9
1.004	5.8	5.7	5.5	5.5	5.4	5.4	5.4	5.4	5.4	5.4	5.5	5.5	5.7	5.8	5.9	6.1	6.2
1.005	7.1	7	6.8	6.7	6.7	6.7	6.6	6.6	6.7	6.7	6.7	6.8	6.8	7	7.1	7.2	7.5
1.006	8.3	8.1	8.1	8	7.9	7.9	7.9	7.9	7.9	8	8	8.1	8.1	8.3	8.4	8.5	8.8
1.007	9.4	9.4	9.3	9.2	9.2	9.2	9.2	9.2	9.2	9.2	9.3	9.4	9.4	9.6	9.7	9.8	10.1
1.008	10.7	10.6	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.6	10.6	10.7	10.9	11	11.1	11.3
1.009	11.9	11.8	11.8	11.7	11.7	11.7	11.7	11.7	11.8	11.8	11.9	11.9	12	12.2	12.3	12.4	12.6
1.01	13.2	13.1	13	13	13	13	13	13	13	13.1	13.1	13.2	13.3	13.5	13.6	13.7	13.9
1.011	14.4	14.3	14.3	14.1	14.1	14.1	14.1	14.3	14.3	14.4	14.4	14.5	14.7	14.8	14.9	15	15.2
1.012	15.6	15.6	15.4	15.4	15.4	15.4	15.4	15.4	15.6	15.6	15.7	15.8	16	16.1	16.2	16.3	16.5
1.013	16.9	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.9	17	17.1	17.1	17.3	17.5	17.6	17.8
1.014	18	18	17.9	17.9	17.9	17.9	17.9	18	18	18.2	18.3	18.3	18.4	18.6	18.8	19	19.1
1.015	19.3	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.3	19.3	19.5	19.6	19.7	19.9	20.1	20.3	20.4
1.016	20.5	20.5	20.4	20.4	20.4	20.4	20.5	20.5	20.6	20.6	20.8	20.9	21	21.2	21.4	21.6	21.7
1.017	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.8	21.8	21.9	22.1	22.2	22.3	22.5	22.6	22.9	23
1.018	23	23	23	22.9	22.9	23	23	23	23.1	23.3	23.4	23.5	23.6	23.8	23.9	24.2	24.3
1.019	24.2	24.2	24.2	24.2	24.2	24.2	24.3	24.3	24.4	24.6	24.7	24.8	24.9	25.1	25.2	25.5	25.6
1.02	25.5	25.5	25.5	25.3	25.5	25.5	25.5	25.6	25.6	25.7	25.9	26	26.1	26.4	26.5	26.8	26.9
1.021	26.6	26.6	26.6	26.6	26.6	26.8	26.8	26.9	26.9	27	27.2	27.3	27.4	27.7	27.8	28.1	28.2
1.022	27.9	27.9	27.9	27.9	27.9	27.9	28.1	28.1	28.2	28.3	28.5	28.6	28.7	29	29.1	29.4	29.5
1.023	29.1	29.1	29.1	29.1	29.1	29.2	29.2	29.4	29.5	29.6	29.8	29.9	30	30.2	30.4	30.7	30.8
1.024	30.4	30.4	30.4	30.4	30.4	30.4	30.5	30.7	30.8	30.8	31.1	31.2	31.3	31.5	31.7	31.9	32.1
1.025	31.6	31.6	31.6	31.6	31.7	31.7	31.9	31.9	32	32.1	32.2	32.4	32.6	32.8	33	33.2	33.4
1.026	32.9	32.9	32.9	32.9	32.9	33	33	33.2	33.3	33.4	33.5	33.7	33.9	34.1	34.3	34.5	34.7
1.027	34.1	34.1	34.1	34.2	34.2	34.2	34.3	34.5	34.6	34.7	34.8	35	35.2	35.4	35.6	35.8	36
1.028	35.2	35.4	35.4	35.4	35.4	35.5	35.6	35.8	35.8	36	36.1	36.3	36.4	36.7	36.9	37.1	37.3
1.029	36.5	36.5	36.5	36.7	36.7	36.8	36.8	36.9	37.1	37.2	37.5	37.6	37.7	38	38.1	38.4	38.6
1.03	37.7	37.8	37.8	37.8	38	38	38.1	38.2	38.4	38.5	38.6	38.9	39	39.3	39.4	39.7	39.9
1.031	39	39	39	39.1	39.1	39.3	39.4	39.5	39.7	39.8	39.9	40.2	40.3	40.6	40.7	41	41.2

Table HY-SA-2: Salinity (parts per thousand) as a function of specific gravity and temperature (as of 9/2005)- continue

	Temperature of Water (° C)																
Observed Reading	15	16	17	18	18.5	19	19.5	20	20.5	21	21.5	22	22.5	23	23.5	24	24.5
0.998																	
0.999										1.3	1.4	1.5	1.6	1.8	1.9	2	
1		1.3	1.5	1.6	1.8	1.9	2	2.1	2.3	2.4	2.5	2.7	2.8	2.9	3.1	3.2	3.3
1.001	2.3	2.5	2.8	2.9	3.1	3.2	3.3	3.4	3.6	3.7	3.8	3.8	4	4.1	4.2	4.4	4.5
1.002	3.7	3.8	4.1	4.2	4.4	4.5	4.6	4.7	4.9	5	5.1	5.3	5.4	5.5	5.7	5.9	6.1
1.003	5	5.1	5.4	5.5	5.7	5.8	5.9	6.1	6.2	6.3	6.4	6.6	6.7	6.8	7.1	7.2	7.4
1.004	6.3	6.4	6.7	6.8	7	7.1	7.2	7.4	7.5	7.6	7.7	7.9	8	8.3	8.4	8.5	8.7
1.005	7.6	7.9	8	8.3	8.4	8.4	8.5	8.7	8.8	8.9	9	9.2	9.4	9.6	9.7	9.8	10
1.006	8.9	9.2	9.3	9.6	9.7	9.8	10	10.1	10.2	10.4	10.5	10.6	10.7	10.9	11	11.1	11.4
1.007	10.2	10.5	10.6	10.9	11	11.1	11.3	11.4	11.5	11.7	11.8	11.9	12	12.2	12.3	12.6	12.7
1.008	11.5	11.8	11.9	12.2	12.3	12.4	12.6	12.7	12.8	13	13.1	13.2	13.3	13.5	13.7	13.9	14
1.009	12.8	13.1	13.2	13.5	13.6	13.7	13.9	14	14.1	14.3	14.4	14.5	14.7	14.9	15	15.2	15.3
1.01	14.1	14.4	14.5	14.8	14.9	15	15.2	15.3	15.4	15.6	15.7	15.8	16.1	16.2	16.3	16.5	16.6
1.011	15.4	15.7	15.8	16.1	16.2	16.3	16.5	16.6	16.7	16.9	17	17.3	17.4	17.5	17.6	17.8	18
1.012	16.7	17	17.1	17.4	17.5	17.6	17.8	17.9	18	18.3	18.4	18.6	18.7	18.8	19	19.2	19.3
1.013	18	18.3	18.4	18.7	18.8	19	19.1	19.2	19.3	19.6	19.7	19.9	20	20.1	20.4	20.5	20.6
1.014	19.3	19.6	19.9	20	20.1	20.3	20.4	20.6	20.8	20.9	21	21.2	21.3	21.4	21.7	21.8	21.9
1.015	20.6	20.9	21.2	21.3	21.4	21.7	21.8	21.9	22.1	22.2	22.3	22.5	22.6	22.9	23	23.1	23.3
1.016	21.9	22.2	22.5	22.6	22.7	23	23.1	23.3	23.4	23.5	23.6	23.8	24	24.2	24.3	24.6	24.7
1.017	23.3	23.5	23.8	24	24.2	24.3	24.4	24.6	24.7	24.8	24.9	25.1	25.3	25.5	25.6	25.9	26
1.018	24.6	24.8	25.1	25.3	25.5	25.6	25.7	25.9	26	26.1	26.2	26.5	26.6	26.8	26.9	27.2	27.3
1.019	25.9	26.1	26.4	26.6	26.8	26.9	27	27.2	27.3	27.4	27.7	27.8	27.9	28.1	28.3	28.5	28.6
1.02	27.2	27.4	27.7	27.9	28.1	28.2	28.3	28.5	28.6	28.7	29	29.1	29.2	29.5	29.6	29.8	29.9
1.021	28.5	28.7	29	29.2	29.4	29.5	29.6	29.8	29.9	30.2	30.3	30.4	30.5	30.8	30.9	31.1	31.3
1.022	29.8	30	30.3	30.5	30.7	30.8	30.9	31.1	31.3	31.5	31.6	31.7	32	32.1	32.2	32.5	32.6
1.023	31.1	31.3	31.6	31.9	32	32.1	32.2	32.5	32.6	32.8	32.9	33	33.3	33.4	33.5	33.8	33.9
1.024	32.4	32.6	32.9	33.2	33.3	33.4	33.5	33.8	33.9	34.1	34.2	34.5	34.6	34.7	35	35.1	35.2
1.025	33.7	33.9	34.2	34.5	34.6	34.7	35	35.1	35.2	35.4	35.5	35.8	35.9	36	36.3	36.4	36.5
1.026	35	35.2	35.5	35.8	35.9	36	36.3	36.4	36.5	36.7	36.9	37.1	37.2	37.3	37.6	37.7	38
1.027	36.3	36.6	36.9	37.3	37.4	37.6	37.7	37.9	38.1	38.3	38.5	38.6	38.8	39	39.2	39.4	39.6
1.028	37.6	37.9	38.2	38.5	38.7	38.9	39.1	39.2	39.4	39.6	39.8	40	40.2	40.4	40.6	40.7	40.9
1.029	38.9	39.2	39.5	39.9	40	40.2	40.4	40.6	40.7	40.9	41.1	41.3	41.5	41.7	41.9	42.1	42.3
1.03	40.2	40.5	40.8	41.2	41.3	41.5	41.7	41.8	42	42.2	42.4	42.6	42.8	43	43.2	43.4	43.6
1.031	41.5	41.8	42.1	42.4	42.6	42.8	43	43.2	43.3	43.5	43.7	43.9	44.1	44.3	44.5	44.7	44.9
1.032	42.8	43.1	43.4	43.8	43.9	44.1	44.3	44.5	44.7	44.8	45	45.2	45.4	45.6	45.8	46	46.2
1.033	44.1	44.4	44.7	45.1	45.2	45.4	45.6	45.8	45.9	46.1	46.3	46.5	46.7	46.9	47.1	47.3	47.5
1.034	45.4	45.7	46	46.4	46.5	46.7	46.9	47.1	47.2	47.4	47.6	47.8	48	48.2	48.4	48.6	48.8
1.035	46.7	47	47.3	47.7	47.8	48	48.2	48.4	48.6	48.7	48.9	49.1	49.3	49.5	49.7	49.9	50.1

Table HY-SA-2: Salinity (parts per thousand) as a function of specific gravity and temperature (as of 9/2005)- continued

	Temperature of Water (° C)																
Observed Reading	25	25.5	26	26.5	27	27.5	28	28.5	29	29.5	30	30.5	31	31.5	32	32.5	33
0.998			1.4	1.5	1.6	1.9	2	2.1	2.4	2.5	2.8	2.9	3.2	3.3	3.6	3.7	
0.999	2.1	2.3	2.5	2.7	2.8	3.1	3.2	3.3	3.6	3.7	3.8	4.1	4.2	4.5	4.7	4.9	5.1
1	3.4	3.7	3.8	4	4.2	4.4	4.5	4.7	4.9	5	5.3	5.4	5.7	5.8	6.1	6.2	6.4
1.001	4.7	4.9	5.1	5.3	5.5	5.7	5.8	6.1	6.2	6.4	6.4	6.7	6.8	7.1	7.2	7.5	7.7
1.002	6.2	6.3	6.4	6.7	6.8	7	7.2	7.4	7.6	7.7	7.9	8.1	8.3	8.5	8.8	8.9	9.2
1.003	7.5	7.6	7.9	8	8.1	8.4	8.5	8.7	8.9	9	9.3	9.4	9.7	9.8	10.1	10.4	10.5
1.004	8.8	9	9.2	9.3	9.6	9.7	9.8	10.1	10.2	10.5	10.6	10.9	11	11.3	11.4	11.7	11.8
1.005	10.2	10.4	10.5	10.6	10.9	11	11.3	11.4	11.5	11.8	11.9	12.2	12.3	12.6	12.8	13	13.2
1.006	11.5	11.7	11.8	12	12.2	12.3	12.6	12.7	13	13.1	13.3	13.5	13.7	13.9	14.1	14.4	14.5
1.007	12.8	13	13.2	13.3	13.5	13.7	13.9	14.1	14.3	14.4	14.7	14.9	15	15.3	15.4	15.7	16
1.008	14.1	14.3	14.5	14.7	14.9	15	15.2	15.4	15.6	15.8	16	16.2	16.5	16.6	16.9	17	17.3
1.009	15.4	15.7	15.8	16	16.2	16.3	16.6	16.7	17	17.1	17.4	17.5	17.8	17.9	18.2	18.4	18.6
1.01	16.9	17	17.1	17.4	17.5	17.8	17.9	18	18.3	18.4	18.7	18.8	19.1	19.3	19.5	19.7	20
1.011	18.2	18.3	18.6	18.7	18.8	19.1	19.2	19.5	19.6	19.9	20	20.3	20.4	20.6	20.9	21	21.3
1.012	19.5	19.6	19.9	20	20.3	20.4	20.6	20.8	20.9	21.2	21.4	21.6	21.8	21.9	22.2	22.5	22.6
1.013	20.8	21	21.2	21.3	21.6	21.7	21.9	22.1	22.3	22.5	22.7	22.9	23.1	23.4	23.5	23.8	24
1.014	22.2	22.3	22.5	22.7	22.9	23.1	23.3	23.5	23.6	23.9	24	24.3	24.4	24.7	24.9	25.1	25.3
1.015	23.5	23.6	23.8	24	24.2	24.4	24.6	24.8	24.9	25.2	25.3	25.6	25.9	26	26.2	26.5	26.6
1.016	24.8	24.9	25.2	25.3	25.6	25.7	26	26.1	26.4	26.5	26.8	26.9	27.2	27.4	27.6	27.8	28.1
1.017	26.1	26.4	26.5	26.6	26.9	27	27.3	27.4	27.7	27.8	28.1	28.3	28.5	28.7	29	29.1	29.4
1.018	27.4	27.7	27.8	28.1	28.2	28.5	28.6	28.9	29	29.2	29.4	29.6	29.8	30	30.3	30.5	30.7
1.019	28.9	29	29.1	29.4	29.5	29.8	29.9	30.2	30.3	30.5	30.8	30.9	31.2	31.3	31.6	31.9	32.1
1.02	30.2	30.3	30.5	30.7	30.9	31.1	31.3	31.5	31.7	31.9	32.1	32.2	32.5	32.8	32.9	33.2	33.4
1.021	31.5	31.6	31.9	32	32.2	32.4	32.6	32.8	33	33.3	33.4	33.7	33.8	34.1	34.3	34.6	34.7
1.022	32.8	33	33.2	33.3	33.5	33.8	33.9	34.2	34.3	34.6	34.7	35	35.2	35.4	35.6	35.9	36.1
1.023	34.1	34.3	34.5	34.7	34.8	35.1	35.2	35.5	35.8	35.9	36.1	36.3	36.5	36.8	36.9	37.2	37.5
1.024	35.5	35.6	35.8	36	36.3	36.4	37.1	37.3	37.6	37.8	38	38.2	38.5	38.7	39	39.2	39.4
1.025	36.8	36.9	37.2	37.3	37.6	37.7	38.5	38.7	38.9	39.1	39.4	39.6	39.8	40.1	40.3	40.6	40.8
1.026	38.1	38.2	38.5	38.6	38.9	39	39.8	40	40.2	40.5	40.7	40.9	41.2	41.4	41.6	41.9	42.1
1.027	39.8	40	40.2	40.5	40.7	40.9	41.1	41.3	41.6	41.8	42	42.2	42.5	42.7	43	43.2	43.5
1.028	41.2	41.4	41.6	41.8	42	42.2	42.4	42.7	42.9	43.1	43.3	43.6	43.8	44	44.3	44.5	44.8
1.029	42.5	42.7	42.9	43.1	43.3	43.5	43.8	44	44.2	44.4	44.7	44.9	45.1	45.4	45.6	45.9	46.1
1.03	43.8	44	44.2	44.4	44.6	44.8	45.1	45.3	45.5	45.8	46	46.2	46.5	46.7	46.9	47.2	47.4
1.031	45.1	45.3	45.5	45.7	45.9	46.2	46.4	46.6	46.9	47.1	47.3	47.6	47.8	48	48.3	48.5	48.8
1.032	46.4	46.6	46.8	47	47.3	47.5	47.7	47.9	48.2	48.4	48.6	48.9	49.1	49.4	49.6	49.9	50.1
1.033	47.7	47.9	48.1	48.4	48.6	48.8	49	49.3	49.5	49.7	50	50.2	50.4	50.7	50.9	51.2	51.4
1.034	49	49.2	49.5	49.7	49.9	50.1	50.3	50.6	50.8	51	51.3	51.5	51.8	52	52.2	52.5	52.8
1.035	50.3	50.6	50.8	51	51.2	51.4	51.6	51.9	52.1	52.4	52.6	52.8	53.1	53.3	53.6	53.8	54.1

Sampling Parameter: Dissolved Oxygen

Why Collect Dissolved Oxygen Data?

- Although most fish and other sea life do not have lungs to breathe in air, these living creatures are still in need of one of the most important molecules on earth, oxygen. The test we ask you to preform here measures the amount of oxygen gas molecules O_2, dissolved in the water. In rivers, there must be a certain amount of balance between the amount of oxygen that is produced (by plant photosynthesis and diffusion from surrounding air) and the amount consumed (respiration of aquatic plants and animals and decomposition of organic matter). When the amount consumed is greater than the amount produced, DO levels decline, thus making the waters unsuitable for sensitive species.

Bronx River Dissolved Oxygen Range: 2 mg/L – 15 mg/L (or ppm)
Desired Range: DO levels greater than 4.8 mg/L year round

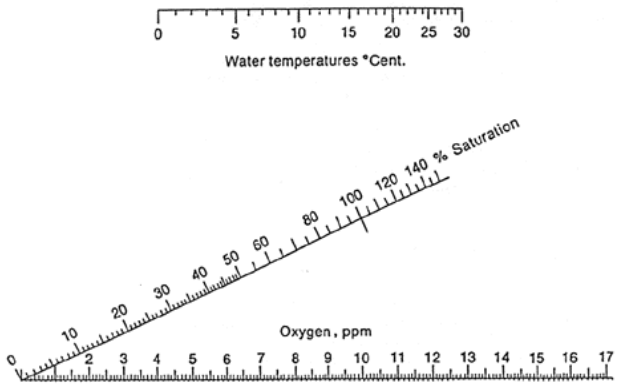
Taking Dissolved Oxygen using Winkler Titration Kit:

- To ensure quick movement in conducting this test, it may be useful to write in sharpie marker the number, in order, of which the chemicals will be added to the sample. A quick acronym to remember in terms of order of chemicals is **MASTS**!
    - M – Manganous Sulfate Solution
    - A – Alkaline Potassium Iodide Azide
    - S – Sulfuric Acid 1:1
    - T – Sodium Thiosulfate 0.025N
    - S – Starch Indicator Solution

- **Critical Thinking: How might the season effect the dissolved oxygen amounts found along the river?**
- Data Collection:
    - Remove cap of the glass bottle present within your LaMott kit and slowly lower bottle into the water so that the opening of the bottle is pointing downstream, until the lower lip of the opening is just submerged. Allow the water to fill the bottle very slowly (rushing water will add oxygen to the sample, ruining results of this test), avoiding any turbulence or bubbles. When the water level in the bottle has stabilized (it will not be full, because it is tilted), slowly turn bottle upright and fill completely. Keep the bottle under water and allow it to overflow for at least thirty seconds to ensure that no air bubbles are trapped in the sample.
    - Replace the cap while bottle is still submerged in the river. This will ensure that bubbles do not get trapped inside the bottle. Trapped bubbles in the water sample can skew dissolved oxygen results. There should be no bubbled present in your sample collection bottle, if there are, try again.
    - Immediately add eight drops of Manganous Sulfate Solution and half screw lid back on. (Note: Whenever drops are added, be sure to hold the bottle completely upright so that the drop size remains consistent)
    - Add 8 drops of Alkaline Potassium Iodide Azide Solution
    - Replace cap on glass sample collection bottle; don't worry, some liquid will spill out. Invert 8 times to mix. Note: A flocculent precipitate (cloudy looking stuff) will form. It will be orange-brown if oxygen is present or white if oxygen is absent. The floc (sediment-like stuff in bottle) settles slowly.

- Wait until the floc (sediment-like stuff in 60 mL bottle) in the solution has settled about 1 cm below shoulder of bottle. Again invert the bottle several times and wait until the floc has settled (results are not affected if some of the reagent powder does not dissolve).
- Remove cap and add eight drops of Sulfuric Acid. Cap and mix until the reagent and precipitate dissolve. Note: the floc will dissolve and leave a yellow color if oxygen is present. The oxygen is now "fixed" and can be stored for 10 hours.
- Fill titration tube (glass bottle with cap that has hole) to the 20mL line with your sample that you have added all of the chemicals to. Fill Titrator (or syringe) with Sodium Thiosulfate. When titrator is full, it will read zero. The number on the Titrator measures how much Sodium Thiosulfate has been added to the solution, <u>not</u> how much is in the tube. (Note: Make sure that no bubbles are present in your Titrator. If necessary, tap bubbles out or squirt some of the liquid out into the waste bucket, <u>not</u> back into the Sodium Thiosulfate bottle, until bubbles are gone. Then refill Titrator to the zero line.) You want to record ALL of the Sodium Thiosulfate that is added during the titration— this can be done by simply reading the titrator at the end of the procedure (and adding the volume of previous titrators if you had to re-fill)
- Titrate (add titrant in drops stirring between additions) until sample color is a pale yellow color.
- Add eight drops of Starch Indicator at this point.
- Continue titration until blue color just disappears and solution is colorless. The color can change quite suddenly, so add drops one at a time. (Note: When you think the sample is clear, note the level of titrant. Then, making sure to compare your sample to a white background, add one more drop to see if the sample becomes "more clear". If it does become more clear, you may read and record the current results. If not, the value noted previously is your result.)
- Read and record the level of the liquid left in the titrator.
- This result reflects parts per million (ppm) or milligrams per liter (mg/L) dissolved oxygen.
- Empty contents of glass bottle, titration tube and titrator into the chemical waste container. It can be washed down the drain (not in the kitchen – never have chemicals where you also store food.) After being diluted with water when you return home. Make sure to run cold water for a couple minutes to dilute and completely wash down drain.

- Calculate the percent dissolved oxygen by finding the mg/L of oxygen on the lower line and water temperature on the upper line. Use a ruler to line up the two readings and record where the ruler intersects the percent saturation line (the middle line).




Thiosulfate
0.025N

Review:

- Dissolved oxygen is just as it sounds: the amount of oxygen gas dissolved in water. While the molecular structure of water is H2O, dissolved oxygen is the amount of separate O_2 molecules that are suspended in the water. This dissolved oxygen is what enables aquatic animals, such as fish, to breathe underwater. Oxygen is dissolved in water through mixing forces, such as wind and waves; and the "breathe" of aquatic plants. Plant "breathing" is the exact opposite of human breathing; plants need carbon dioxide and give off oxygen. Aquatic plants "exhale" this oxygen into the water where fish and other aquatic animals breathe it in.
- *Percent Dissolved Oxygen* - Like a glass of water can only dissolve a certain amount of lemonade powder, water can only dissolve a maximum amount of oxygen. If water has dissolved all the oxygen it can, it is said to be 100% saturated. The amount of oxygen that water can dissolve is dependent on temperature. Cool water has the ability to hold more dissolved oxygen than warm water.
- *Biochemical Oxygen Demand* - The biochemical oxygen demand is the amount of oxygen used by bacteria and other decomposers in the breakdown of organic material. A biochemical oxygen demand test measures how much oxygen decomposers and bacteria are consuming. This data helps to determine if low oxygen measurements are caused by pollution, such as inputs of nutrients and/or organic matter.
- Unpolluted waters have a normal biochemical oxygen demand of around 5 mg/L or less, while polluted waters have a much higher biochemical oxygen demand. For example, waters with raw sewage inputs may have biochemical oxygen demand levels between 150-300 mg/L.

Chemicals Used	**Disposal**	**Safety Information:** Emergency Phone: 1-800-222-1222
Manganous Sulfate Solution	Collect in liquid waste disposal receptacle	**Eye Contact:** flush eyes with water for 15 minutes. Call physician. **Skin Contact:** wash skin. **Ingestion:** call physician. Induce vomiting.
Alkaline Potassium Iodide Azide	Collect in liquid waste disposal receptacle	**Eye Contact:** flush eyes with water for 15 minutes. Call physician. **Skin Contact:** wash skin. **Ingestion:** give 1-2 glasses water. Induce vomiting. Call physician.

Sulfamic Acid Powder or Sulfuric Acid (1:1)	Collect in liquid waste disposal receptacle	**Eye Contact:** flush eyes with water for 15 minutes. Call physician. **Skin Contact:** wash skin. **Ingestion:** call physician. Give 1-2 glasses of water.
Sodium Thiosulfate, 0.025 N	Collect in liquid waste disposal receptacle	**Eye Contact:** flush eyes with water for 15 minutes. Call physician. **Skin Contact:** wash skin. **Ingestion:** call physician. Give 1-2 glasses of water.
Starch Indicator Solution	Collect in liquid waste disposal receptacle	**Eye Contact:** flush eyes with water for 15 minutes. Call physician. **Skin Contact:** wash skin. **Ingestion:** call physician. Give 1-2 glasses of water.

Sampling Parameter: Nutrients

Why Collect Nitrate Data?

- This test measures the amount of nitrate ions are present within the water sample. Nitrate is a form of nitrogen used by plants that convert it into an organic form used by animals to make protein. Although this nutrient is essential for life, excess nitrates in an aquatic system can cause an increase in plant growth called *eutrophication*. Eutrophication lowers dissolved oxygen levels, which causes the harmful condition of hypoxia (low oxygen) in animals. Water having nitrate levels at 10 mg/L or higher is toxic to humans (for drinking) and aquatic endothermic animals. Wastewater treatment plant effluent can reach up to 30 mg/L.

Bronx River Nitrate Range: Less than 1 mg/L (typically Bronx River values fall under 1 mg/L; anything higher might indicate a problem and should be reported to stewards managers.)

Taking Nitrate and Nitrtite Data using Dip Sticks:

- Data Collection:
    - Dip one test strip into water sample for 2 seconds without motion
    - Remove and shake once, briskly, to remove excess water
    - Wait 1 minute for stick color saturation and then compare color to the Nitrate section of bottle. (Please note, you will be reading the box farthest away from the handle and comparing to the colors labeled Nitrates and Nitrite)
    - Be sure to indicate on your sheet the data collected for each parameter – Nitrate and Nitrite
    - Test should be completed a total of 3 times
    - Dispose of test strips in waste collection bottle

Review for Nutrients:

- A waterbody becomes unhealthy and overloaded with algae and other plants if too many nutrients, primarily nitrates and phosphates, accumulate. The first sign of excess nutrients is the presence of algal blooms.
- Algal blooms often indirectly stress the aquatic community, because when the algae die the dead plant material sinks to the bottom of the waterbody. This dead material is then broken down by decomposers, such as bacteria, that live in the bottom of the waterbody. Most decomposers consume oxygen. This means that as more dead plants accumulate at the bottom of a stream or lake, more decomposers accumulate to feed off of the dead plants. The addition of decomposers leads to increased oxygen consumption, often leaving little to no dissolved oxygen left for other animals such as the fish and mayflies. As a result, large animals are forced to swim to healthier, oxygenated water, while those that can't seek new water become stressed and may eventually suffocate.
- Some nutrient pollution sources include: excess fertilizer applied to agricultural fields, timbered areas, gardens and lawns; poorly maintained septic systems and sewage treatment plants; industrial effluent; pet, livestock and other animal wastes; detergents, especially car washing near storm drains; etc.
- *Forms of Phosphorous*
    - Orthophosphate is the inorganic form of phosphate and most readily available to plants. It is considered the best indicator of immediate potential problems with excessive plant and algae growth. Phosphates are often the limiting nutrient for plant growth, because

it is usually in short supply relative to nitrogen. As a result, very low levels of phosphorous can have huge adverse impacts on a waterbody.

- *Forms of Nitrogen*
    - Nitrate (NO_3) is the most common form of nitrogen tested for, as nitrate-nitrogen.
    - Nitrite (NO_2) is less stable than nitrate, and usually present in lower amounts.
    - Ammonia (NH_3) is the least stable form (or most reactive) of nitrogen, and as a result is difficult to accurately test.

The photo above shows two different algal overgrowth scenarios separated by an underwater weir present at Starlight Park. The southern end of the weir has a redish brown coloring of dinoflagellate growth also known as red tide. The northern end of the weir shows an overgrowth of plant plankton which give off a green coloring or green tide. Presence of an overgrowth of small organisms within the water due to eutrophication can be made by the indication of a rotten egg like smell within the air. Most algal bloom growth along the Bronx River become most noticeable within the summer months where other factors such as air temperature effect the water. To report an algal bloom, please refer to our Section 4: reporting protocol.

Equipment Care and Cleaning

Once back at your base station, the contents of your waste bin may be properly disposed of. It is best practice to dilute said waste and pouring into a bin of kitty litter, this will help solidify the waste and we reduce adding chemicals to waste treatment plants and our local water ways. If this is not an option for you, dilute to the best of your ability before letting drain with cool running water on.

After you have returned from monitoring, it is also important to properly clean the equipment so that it is all ready for when you need to use it next. Follow the directions below.

1. Wash all equipment, including water sample bottle with Liqui-nox laboratory detergent. This detergent is formulated specifically for lab equipment; do not use any other detergent as it may affect water quality results.
2. Gently scrub vials with cloth rags (cut up old t shirts work well) or cotton swabs (for smaller vials, if necessary).
3. Rinse all pieces with tap water and dispose of in kitty litter if possible.
4. Do two final rinses with deionized water.
5. Air-dry equipment and replace to its proper spot in the equipment kit – make sure to recap all vials to prevent them from becoming contaminated.

Every 4-6 weeks, rinse with diluted Hydrochloric Acid (HCl) solution – be careful, this is a corrosive solution. Then rinse well with tap water, and finally rinse 3-4 times with deionized water. Let dry and replace to kit.

Macroinvertebrate Study:
Leaf Pack Introduction

Note: For all leaf packing experiment, the Bronx River Alliance uses and recommends the Stroud Leaf Pack Stream Ecology Kit. All wording and protocol present here are a modification to those instructions present within the Leaf Pack Stream Ecology Kit Instructor's Manual.

Under natural conditions, trees lose their leaves with some ending on the forest floor where they will fall or be blown into the river, if not falling directly into the river. These leaves provide an essential energy source to the river and naturally accumulate as leaf packs against rocks, branches, or other structures in the stream. These packs of leaves provide food as well as habitat for a wide variety of stream organisms, including macroinvertebrates. These macroinvertebrates often go unnoticed because of their small size; however, they play a vital role in freshwater ecosystems.

In brief, this experiment entails placing an artificial leaf pack in a stream for 3-4 weeks at which point they become colonized by macroinvertebrates. Participants then identify the relative abundance and diversity of the macroinvertebrates found. By simple analysis, the information can be used as an indicator of water quality.

Please note, this portion of data collection entails working with living creatures of which a Department of Environmental Conservation (DEC) permitting is needed. Please coordinate with The Bronx River Alliance on this portion of data collection.

Leaf Packs as Habitat

The amount and variety of leaves available to the stream community are determined by the presence, health, and diversity of the surrounding streamside (riparian) vegetation. Along the Northern end of the Bronx River, invasive plants such as the Japanese Knotweed, control the edges of the river leaving little to no underlying plant diversity. Other physical features of the stream itself offer and affect many different types of habitat. Riffling characteristics bring a continuous supply of oxygen and food to the organisms; whereas, pooling characteristics support macroinvertebrates that have adapted to these specific conditions and are often different than macros found in rippling sections. Other habitat investigation possibilities include, sandy/silty bottoms, areas near vegetated banks, and areas of accumulated woody debris.

Water Quality and Leaf Packs

The ability of freshwater macroinvertebrates to flourish not only depends upon optimum physical factors, but also chemical factors of their environment. Many macroinvertebrates require a specific range of chemical parameters (pH, dissolved oxygen, temperature, etc.) to survive. Generally, unpolluted waters support greater variety of freshwater macroinvertebrates than polluted waters. The presence or absence of these organisms in a stream can be used to reveal the overall ecological quality of the water. Therefore, macroinvertebrates can be used as a bio indicator organism to estimate the water quality and the overall health of the river community.

Macroinvertebrate Equipment Check List

As for water quality monitoring, below is a checklist of items you will need to bring with you in the field in order to monitor your sites. Before every trip into the field, consult this list and take inventory of your equipment and supplies. It is extremely important to check that the equipment has been properly cleaned. Do not assume everything is there without first checking. It is better to spend extra time preparing before you go to your site than to have to return for something you forgot the first time.

Use this checklist before going into the field.

Items needed for initial leaf pack put in trip:

- Map, pen/pencil, clipboard
- GPS (if available)
- Scissors
- Plastic mesh bag
- Nylon twine
- Bag tag
- Waterproof marker
- Scale
- Waders
- Tree identification guide

Items needed for secondary trip analysis of packs:

- Map, pen/pencil, clipboard
- Scissors
- GPS (if available)
- Large zipper top bags
- Waders
- Petri dishes
- Thermometers
- Brushes
- Strainer
- White plastic trays and large dissection trays
- Macrolens
- Hand lenses
- Spoons
- Rulers
- Freshwater macroinvertebrate sorting sheets
- Freshwater aquatic macroinvertebrates: id flash cards

On site, will be the collection of leaves, depending on the season – gloves are recommended.
If you do not plan on completing the analysis of the leaf pack at the rivers' edge, please be prepared for transport of the macros in a cooler with ice packs. If using this method, be aware, organisms must be unharmed and returned to same location of which removed within 24 hours.

Sampling Parameter: Macroinvertebrates

Why Collect Macroinvertebrate Data?

- Macroinvertebrates are an indicator of water quality health. Waters that are considered pristine, will have a higher biodiversity as macroinvertebrates of all tolerance will be able to flourish. Waters that are considered tarnished will have a smaller number of organisms who are hearty and able to tolerate higher amounts of toxins and pollution.

Learning objectives surrounding a macroinvertebrate study:

- Students will conduct a scientific field investigation demonstrating the relationship between trees and the ecology of river communities
- Students will make and use artificial leaf packs to study biodiversity
- Students will use dichotomous key to identify macroinvertebrates
- Students will analyze the results of a leaf pack experiment demonstrating and using an experimental variable to draw conclusions about freshwater macroinvertebrate habitat quality and food preferences
- Students will learn the value of replication of each experimental variable to produce meaningful experimental conditions and modifications

Taking Macroinvertebrate Data using Leaf Packs:

- Preparing the leaf pack for the stream
    - Collect leaves for your experiment: gather dry leaves already fallen from trees leaves or before they become too damp and enough for experiment (approximately 30g for each pack); identify the leaf source using tree identification guide and add data to collection sheet
    - Use the waterproof marker to fill out the waterproof tags, once completed place one tag in each mesh bag – include the following information: date, bag number, school/group name (be sure to add BxRA), location and experimental variable. Record all of the same information on the data collection sheet
    - Use the scale to weigh 30g of dry leaves for each mesh bag
    - Complete one loop to tie the bag shut
    - Loop a length of twine through the mesh of the bag so that the bag can be securely attached to a large rock or tree root in the river
    - Take GPS location of leaf pack placement and add to data collection sheet
- Placing the leaf pack in the stream
    - It is best to tie the leaf packs directly to existing rocks or exposed tree roots in the river. If there are no rocks and the river flow is minimal, the leaf pack can be secured by the weight of a brick. Also, if there is little to no water flow, you may stuff the pack with less leaves
    - Use a thermometer to measure the temperature of the air and stream and record data on sheet
    - Position the leaf packs upstream from the rock or exposed tree root so that as much of the surface area of the bag is facing the current as possible
    - Make sure all of leaf pack is submerged and securely tied to substrate of choice as to minimize loss. Note, the Bronx River is a flash flood river and is effected by rain; levels on initial day of placement may be submerged after a rain event, taking GPS data may better help you find the location of your pack

    - Draw a site map next to your GPS coordinates on the data collection sheets to show position of your pack in the river
    - Complete any additional leaf pack data sheet collection items
    - Leave leaf pack in river for 3-4 weeks; without disturbance, check on packs every few days after a storm to ensure they remain submerged
- Collecting the leaf pack
    - Use a thermometer to measure air and water temperature on day of collection and add data to collection sheet
    - Collect a few inches of river water in the bottom of a zipper top bag
    - Gently hold onto the submerged leaf pack and cut the twine that is securing it to the rock or tree root; or, you can scoop up the leaf pack into the zipper top bag and then cut or untie the twine
    - Place leaf pack contents in a bucket 1/3 filled with river water and rinse remaining contents of the zipper top bag into the bucket as well
    - Prepare analysis sections by adding river water to a few petri dishes and the white plastic trays
    - Remove small handfuls of leaves from the bucket and place into large dissection trays and use brushes to gently brush anything off of the leaves and determine if there are any macroinvertebrates lodged onto the leaves
    - If any macros are present and swimming within the thin layer of water present within the large dissection trays, use the spoons to begin sorting into each of the petri dish based on general similarities; please note – no more than 10 organisms should be in any petri dish at a time
    - This portion of the project may be done at multiple stations with 2-3 persons brushing and sorting at each station
    - Any remaining water after leaves are carefully inspected, can be strained through the strainer and any remaining creatures may then be sorted by general looks
- Identification Workshop
    - Once all packs have been analyzed and brushed, petri dishes should be placed over macroinvertebrate sorting sheets and groups should be identified
    - All macroinvertebrates should be then tallied by population and data is to be added to the data collection sheet

Biotic Index and Pollution Tolerance

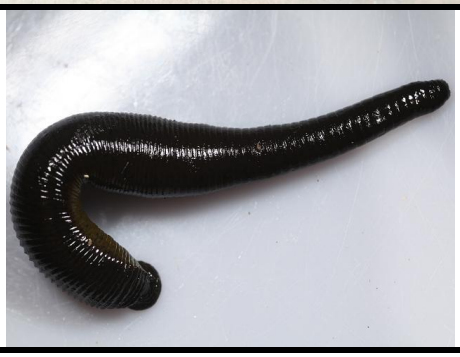
Leaf pack experiments are designed to measure water quality and this may be done by looking at quantity and diversity of the invertebrates found in your leaf pack. In controlled experiments and in field observations, scientists have learned that particular aquatic organisms are susceptible to specific types and levels of pollutants. Many freshwater invertebrates require a definitive range of physical and chemical parameters to flourish. The presence or absence of these organisms in a stream or river can be used to reveal overall ecological quality of the water. The biotic index is a widely used method of estimating organic and nutrient pollution by comparing the abundance of organisms and their tolerance to environmental stress. Each organism is assigned a tolerance value ranging from 0-10 depending on the organism's sensitivity to changes in water quality. The higher tolerance level values are for organisms that can survive and tolerate poor water quality.

Pollution Tolerance Values

Ephemeroptera	Mayflies	3.6	
Plecoptera	Stoneflies	1.0	
Trichoptera			
Hydropsychidae	Caddisflies	5.0	
Other Caddisflies	Caddisflies	2.8	
Anisoptera	Dragonflies	4.0	

Zygoptera	Damselflies	7.0	
Megaloptera			
Corydalidae	Hellgrammites	3.0	
Sialidae	Alderflies	4.0	
Coleoptera	Beetles	4.6	
Diptera	True Flies		
Athericidae	Watersnipe Flies	2.0	

Chironomidae	Midges	6.0	
Simuliidae	Black Flies	6.0	
Tipulidae	Crane Flies	3.0	
Other Diptera		6.0	
Amphipoda	Scuds	6.0	
Isopoda	Aquatic Sowbugs	8.0	

Decapoda	Crayfish	5.0	
Oligocheta	Aquatic Worms	8.0	
Hirudinea	Leeches	8.0	
Turbellaria	Planarians	8.0	
Gastropoda	Snails	7.0	

Calculating Biotic Index

Use the biotic index calculation worksheet to calculate the biotic index of a leaf pack sample:

1. For each taxon, total the number of individuals found. Enter that number in column B.
2. For each taxon, multiply the pollution tolerance value (column A) by the number of individuals found for that taxon
   Column A x Column B = Column C
3. Calculate and record the sum of B
4. Calculate and record the sum of C
5. Divide the sum of column C by the sum of column B. The value is the biotic index for the leaf pack sample

Biotic Index	**Water Quality**	**Degree of Organic Pollution**
<3.75	Excellent	Organic pollution unlikely
3.76-5.0	Good	Some organic pollution
5.1-6.5	Fair	Substantial pollution likely
6.6-10.0	Poor	Severe organic pollution likely

$$\frac{\text{Sum Column C}}{\text{Sum Column B}} = \text{Biotic Index}$$

Example: We found in our leaf pack, 25 Amphipods (Scuds) and 10 Hirudinaes (Leeches)

Type of Organism Found	Column A: Taxon Tolerance Value (depended on species)	Column B: Number of how many we found	Column C: Total tolerance value (Column A x Column B)
Amphipods	6.0	25	150
Hirudinae	8.0	10	80
	SUM	**35**	**230**

230/35 = **6.57**

So, we are assuming the organic pollution is severely likely based on a biotic index of 6.57 in this study.

Section 3: Online Data Entry

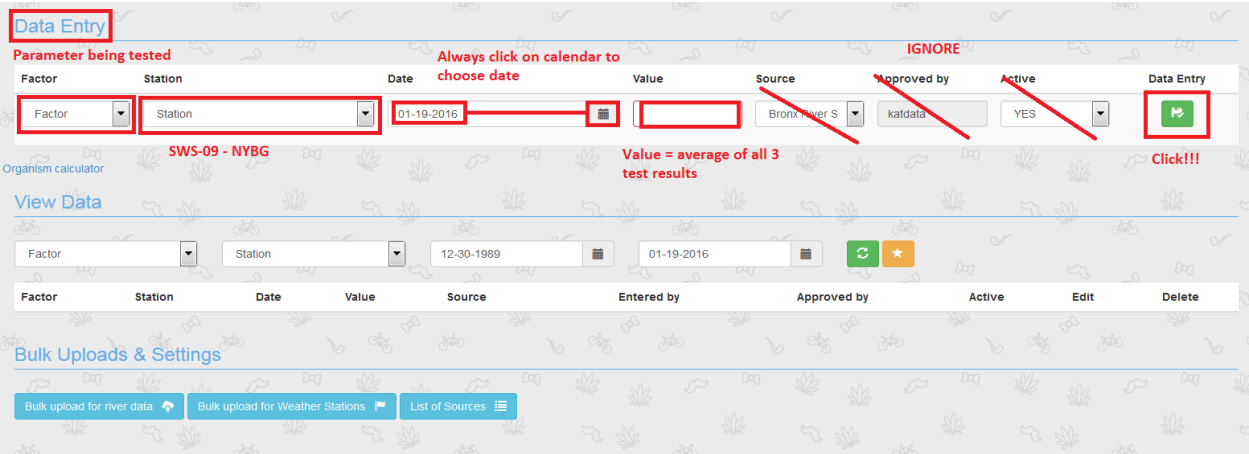
We will ask all stewards to enter their data periodically as close to the data collection date as possible. Our data collection website, BronxRiverWater.org, is a collection site of over 5,000 data points collected by stewards across the 8 miles of river that run within the Bronx since 1989. Below are instructions on how you can enter your data to this site as well.

- Go to BronxRiverWater.org via internet access; firefox and google chrome works best.
- If you already have an account login, click on the top right hand corner and click login button. Enter your username and password and when next window is prompted, click sign in on the welcome page. You are now ready to enter data.
- If you do not have an account, register by clicking register button on top right hand corner. Please note, registration approval is conducted within 24-48 hours of initial registration.

Data Entry:

- Select the correct factor: which is identified by the type of data you are uploading into the system; for example, dissolved oxygen, pH, salinity, etc.
- Select station: each station corresponds with a code available on page 5; please choose a sampling location closest to actual sampling site
- Select correct date – please enter the date of data collection and not the date of data input to site
- Enter value collected at time of sampling; if there is more than one sample for a certain date, please use the average and enter sampling event once
- Source remains as “Bronx River Steward”
- Click green “data entry” button to submit

All data must be approved by the Alliance before it is live on the website. You have approximately 24-48 hours to make edits to a data entry. You may do so by searching the data point by using the “view data” feature below the data entry section of your login and clicking the “edit” button beside the data entry. Please note, the data will appear above the data view within the data entry section once you have clicked edit, any changes you make will now be the data point entered. Once data is approved by Alliance, it cannot be edited. If you have made a mistake with entry and it has already been approved by the Alliance, contact the Alliance immediately and ask to speak to the Education staff.



Section 4: Reporting
Table of Content

Please note, photocopies of these forms are versions that should be taken out into the field with you on data collection days. Please do not record data on the sheets present within this manual.

BRONX RIVER ALLIANCE
SPILL REPORTING PROTOCOL
INTAKE FORM

If you notice a spill on the Bronx River, please follow the following protocol and reporting.

1. Collect information about spill in form below and take photo.

Spill Data Collection:

Date:_____ Time:_____

Reporter (Person witness to spill):_____

Location of spill:_____

Color of Spill:_____

Odor of Spill:_____

Sheen of Spill:_____

Source of Spill:_____

Description of Dumping:_____

Impacted Wildlife:_____

Notes:_____

---

2. Call NYS Department of Environmental Conservation, Spill Hotline at 800-457-7362 and record reporting number here: _____
   DEC Deputy Regional Water Engineer; Selvin T. Southwell 718-482-4881; Selvin.Southwell@dec.ny.gov.

3. Call 311, the operator will connect you to the NYC Department of Environmental Protection 311 operator. Be sure to get a report number from the operator and record here:_____. If you observe illegal dumping in progress or near the river, please call 911 IMMEDIATELY.

4. Email a copy of this form to the Bronx River Alliance via *info@BronxRiver.org*.

BRONX RIVER ALLIANCE CONCRETE PLANT PARK BOOM INTAKE FORM

If you see the Concrete Plant Park boom overflowing with floatables and other debris, please use the following protocol of reporting.

1. Call Department of Environmental Protection and report overflow to 212-860-8253.

2. Report what is seen by calling 311 and informing person, that the boom present at Concrete Plant Park in the Bronx is overflowing.

3. Record any notes on what is seen, below:_____

_____

_____

_____

_____

Section 5: Data Collection Packet
Table of Content

Introduction

Within this section of the manual, you will find the data collection packets that have been referenced throughout this training manual. Please note, photocopies of these forms are versions that should be taken out into the field with you on data collection days. Please do not record data on the sheets present within this manual.

These sheets are meant to cover all of the parameters the Bronx River Alliance tests the river for on a data collection date. We understand that your group will not have all possible materials to collect certain data parameters. We ask that you please omit these sections of the forms. Do not add any data points that you have not tested for at least 3 times.

No data is more important than inaccurate data.

Please be reminded, your data is being used by the Alliance staff, educators, students, policy makers and analysis groups. The more accurate your data is, the more useful it will be in the mission to protect, improve and restore the Bronx River's health. If there are any questions you may have surrounding the data, please refrain from entering it onto the data collection site and email Education@BronxRiver.org, where our Education team may best be able to assist you.

Water Quality Monitoring
Citizen Science Stewards Program

Total Number of Volunteers: Total Volunteer Hours:

Water Quality Data Collection

Site Name:	Date:	Time:	Group Name:
Cloud Cover: Clear Isolated Broken Overcast Scattered Other:			
Precipitation: None Light Rain Heavy Rain Snow Other:			Rain Now? Y N
Water State: Normal Dry Flooded Unreachable Other:			Algal Bloom: Y N

Parameter	Test 1		Test 2		Test 3		Average
Air Temp	Celsius		Celsius		Celsius		
Water Temp	Celsius		Celsius		Celsius		
pH							
Dissolved Oxygen							
Salinity	Sp. Gr.	ppt	Sp. Gr.	ppt	Sp. Gr.	ppt	
Turbidity							
Nitratrate-Nitrogen							
Phosphate							

Notes:

River Being Used By Others? ◇ Y ◇ N How so?

Water Quality Monitoring
Citizen Science Stewards Program

Visual Data Collection

What We Saw	
What We Heard	
What We Smelled	
What We Touched	
What We Said	
One Word We Would Use To Describe Our Experience	

Macroinvertebrate Monitoring
Citizen Science Stewards Program

Total Number of Volunteers: Total Volunteer Hours:

Pre-Analysis Data:

Preparation Data

Date:_____

Tree leaves used in pack:

Leaf Pack Bag Tag Information

Date of bag placement:_____ Bag Number:_____

School/Group Name:_____& BxRA

Location of Pack on River: (Generic)_____

Experimental Condition:_____

Air Temperature on Day of Pack Placement:_____

Water Temperature on Day of Pack Placement:_____

Time of Pack Placement:_____ AM PM

Notes:

Macroinvertebrate Monitoring
Citizen Science Stewards Program

Pack Removal Data Collection

Occurrences while pack in water

Date:_____

Did any storms occur during this period?

Storm Date:	Amount of Precipitation:	Did flooding occur?
_____	_____	_____
_____	_____	_____

Did any other significant events occur during this time period? (drought, etc.)

_____

Habitat Data Collection (Visual data collection at site on day of pack retrieval)

Date:_____

Stream Habitat Present (check all that apply):

	Pools		Riffles
	Logs		Woody Debris
	Wetlands		Leaves
	Fine Sediment/Sand		Other:

Water Appearance:

	Clear		Foamy
	Oily Sheen		Colored
	Turbid		Other:

Presence of Litter in Stream: (Circle All that Apply)

None Cans/Bottles Other:

Paper, Small Trash Tires, Cart, Etc.

Air Temperature on Day of Pack Removal:_____

Water Temperature on Day of Pack Removal:_____

Macroinvertebrate Monitoring
Citizen Science Stewards Program

Leaf Pack Organism Data Collection

		A	x	B	=	C
		Taxon Tol. Value		# Found		Total Tol. Value
Ephemeroptera	Mayflies	3.6				
Plecoptera	Stoneflies	1.0				
Hydropsychidae	Caddisflies	5.0				
Other Caddisflies	Caddisflies	2.8				
Anisoptera	Dragonflies	4.0				
Zygoptera	Damselflies	7.0				
Corydalidae	Hellgrammites	3.0				
Sialidae	Alderflies	4.0				
Coleoptera	Beetles	4.6				
Athericidae	Watersnipe Flies	2.0				
Chironomidae	Midges	6.0				
Simuliidae	Black Flies	6.0				
Tipulidae	Crane Flies	3.0				
Other Diptera		6.0				
Amphipoda	Scuds	6.0				
Isopoda	Aquatic Sowbugs	8.0				
Decapoda	Crayfish	5.0				
Oligocheta	Aquatic Worms	8.0				
Hirudinea	Leeches	8.0				
Turbellaria	Planarians	8.0				
Gastropoda	Snails	7.0				
		SUM		**B**		**C**

Macroinvertebrate Monitoring
Citizen Science Stewards Program

Biotic Index Calculation Worksheet

Please refer to page 45 of the training manual for more information surrounding this worksheet.

Sum Column B:_____

Sum Column C:_____

$$\frac{\text{Sum Column C}}{\text{Sum Column B}} = \text{Biotic Index}$$

Sum C:_____/Sum B:_____ = _____

Biotic Index

Use table A to complete this statement:

In assumption of our Biotic Index calculated, the water quality of the Bronx River is considered

_____ with a Degree of Organic Pollution is _____.

Table A:

Biotic Index	Water Quality	Degree of Organic Pollution
<3.75	Excellent	Organic pollution unlikely
3.76-5.0	Good	Some organic pollution
5.1-6.5	Fair	Substantial pollution likely
6.6-10.0	Poor	Severe organic pollution likely

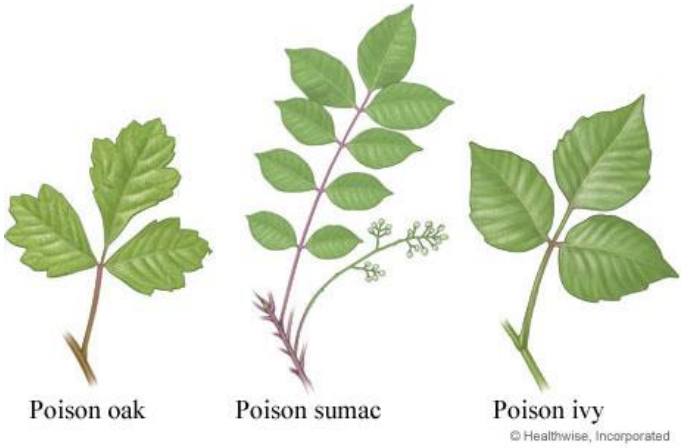
Appendices
Table of Content

Appendix A: Poisonous Vegetation

The Bronx River and its surrounding environment is a natural living being. Vegetation along the river may be beautiful to see; but, there are plenty of poisonous vegetation that you may encounter at any particular site (especially within the northern regions of the river and the forest which surrounds it). Please do a perimeter once over at every sampling event for some of the following plants and have a plan of action, such as emergency kit and emergency phone numbers handy in case of encounter.

Poison Ivy, Oak, Sumac:

The leaves of these 3 poisonous plants are compound and simple. General rule of thumb being, leaves of 3, leave them be… as they may most likely be of poisonous being. Poison ivy is most often found within the Bronx River forest growing along as vines at tree trunks and along the floor bed. Fruit is often seen of greenish/white coloring.



Stinging Nettle:

Stems are covered with stinging hairs. Contact with these hairs cause intense itching, usually of short duration. These are most often found as low laying plants and come in most contact with exposed ankles.

Appendix B: Aquatic Ecosystem

Aquatic ecosystems need a balance of all parameters that are tested by our steward groups. Dissolved oxygen is one of these important balances that effect the Bronx River the most. This section will highlight the effects of dissolved oxygen on our Bronx River ecosystem.

Why is Dissolved Oxygen (DO) important?

1. DO is important to aquatic ecosystems because a certain amount of DO is needed to support a diverse population of fish and other aquatic life. If there is not enough O_2 fish do one of 3 things. They go M.A.D. They either…..

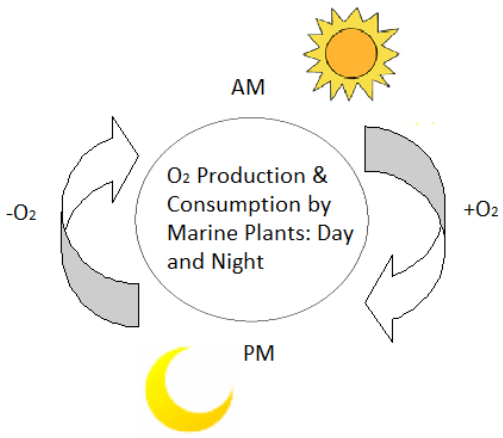
   M. Move – They either move from the habitat in which they live in search of more oxygen and a better, more comfortable environment. Could you imagine moving from place to place in search of oxygen?!

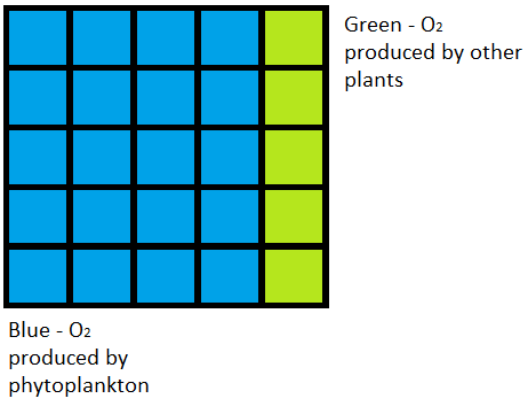
   A. Adapt – They also may just adapt to the conditions in which their ecosystem is experiencing. To adapt to certain conditions simply means to adjust to new change.

   D. Die – If an organism decides to stay and isn't able to adjust to low amounts of oxygen or food, the organism may die.

2. Another reason why DO is important is because marine plants such as algae produce ¾ of our atmospheric oxygen. A microscopic form of algae called phytoplankton live by the surface of our oceans and produce a large percentage of oxygen made in marine ecosystems overall. During the daytime hours, phytoplankton are able to produce oxygen through the process of photosynthesis. Phytoplankton are important because they serve as the base of the food chain in the ocean ecosystem. Zooplankton, which are another form of plankton, eat phytoplankton. Fish and other organisms eat the zooplankton, where bigger fish will come along and eat those smaller fish; mammals will then eat those bigger fish. Those are just 2 examples of why plankton is extremely important not just to the other organisms that live in aquatic ecosystems but to mankind itself.

Oxygen production during the day:





Appendix C: Glossary

Acidity: A measure of the number of free hydrogen ions (H^+) in a solution (i.e. stream water); an acidic substance has a pH value lower than seven

Alkalinity: A measure of the negative ions that are available to react and neutralize acids or free hydrogen ions (H^+); Common alkaline ions include hydroxide, sulfate, phosphate, bicarbonate and carbonate.

Aquatic Ecosystem: An environment based in water

Assessment: Identifying the water quality of a stream through analysis of water chemistry, biology and/or physical attributes

Benthic: Relating to the bottom or substrate, in our case the streambed

Biomonitoring: Assessing water quality by analyzing animals that live in the water, specifically benthic macroinvertebrates (critters without a backbone that can be seen with the naked eye)

Channel: A natural or artificial waterway of perceptible extent that periodically or continuously contains moving water. It has a definite bed and banks that serve to confine the water

Channelization: The straightening of a stream; this often is a result of human activity

Cobble: A rock fragment between 64 and 256 millimeters in diameter, especially one that has been naturally rounded

Community: The makeup of organisms, both plants and animals, inhabiting a given area

Culvert: A human-made construction that diverts the natural flow of water.

Deionized Water: Water that has had all ions other than hydrogen and oxygen removed.

Designated Uses: State-established desirable uses that waters should be able to support, such as fishing, swimming, and aquatic life; listed in New York State Department of Environmental Conservation water quality standards; note that not all waters meet their designated uses

Dissolved Oxygen: Oxygen that has been dissolved in water; it is available for aquatic creatures, such as fish, to breathe

Diversity: Variety

Ecosystem: The sum of all plants, animals, other living things, plus their surroundings (soil, climate). Living things within an area are dependent upon each other and the resources available

Effluent: Wastewater discharge

Embeddedness: The degree to which an object is buried in fine sediment, such as sand and silt

Emergent Plants: Aquatic plants that extend out of the water while still being rooted underwater

EPT Richness: An index used to quantify water quality based on the presence of the following pollution intolerant macroinvertebrate orders: mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddisflies (Trichoptera). A high EPT value indicates good water quality.

Eutrophication: The addition of nutrients to a waterbody, which often indirectly leads to depleted oxygen concentrations. Eutrophication is a natural process that is frequently accelerated and intensified by human activities

Fauna: The animals characteristic of a region; for example, stoneflies are part of the cobble substrate fauna

Floodplain: The flat area of land adjacent to a stream that has been formed over time by flooding

Glide: A stretch of stream with low to moderate velocities, no surface agitation and a u-shaped, smooth, wide bottom

Gradient: Slope; calculated as the amount of vertical rise over horizontal run

Habitat: The area or environment in which an organism lives, it must provide appropriate food and shelter

Headwaters: The source of a stream

Hypoxic: Areas with Low levels of dissolved oxygen; hypoxic areas are also referred to as dead zones.

Impairment: Degradation

Impervious surface: are artificial structures, such as pavements and building roofs, which replace naturally pervious soil with construction materials that do not allow for the passage of water. They are an environmental concern because, with their construction, a chain of events is initiated that modifies urban air and water resources:

Index: Indicates a value or quantity, often used to assess water quality

Intermittent stream: A stream in contact with the groundwater table that flows only certain times of the year, such as when the ground water table is high, or when it receives water from surface sources (i.e. snowmelt)

Intolerant: In reference to an animal that is harmed by and extremely sensitive to pollution. Mayflies are intolerant species because they cannot live in polluted water

Macroinvertebrate: An organism that has no backbone and is large enough to be seen by the naked eye; an example is a water strider

Marine Ecosystem: An ecosystem based in salt water

Meander: A winding section of stream with many bends that is at least 1.5 times longer (following the channel) than its straight-line distance

Meniscus: a curve in the surface of a liquid and is produced in response to the surface of the container or another object. When the meniscus is concave, as is the case of water in a glass container, one reads the volume of the water from the bottom of the meniscus.

Microscopic: Not visible with the eye only, tiny

Nitrogen: A nutrient. Plants need it, in the form of nitrate, in order to grow

Organism: Life form

pH: A measure of the concentration of acids or bases; it is used to indicate alkalinity or acidity of a substance, measured on a scale of 1 to 14; seven is neutral, values less than seven are acidic and values greater than seven are basic

Phosphorous: A nutrient; plants need it, in the form of phosphate, in order to grow

Photosynthesis: The process in which oxygen is produced by plants

Protocol: Procedure

Perennial Stream: A stream that flows continuously throughout the year

Pool: A deeper area of a stream with slow moving water

Rapid Bioassessment: A biological diagnosis of water quality using field and laboratory analysis designed to allow assessment of water quality in a short turn-around time; usually involves kick sampling

Reagent: A substance or chemical used to indicate the presence of another chemical or to induce a chemical reaction to determine the chemical characteristics of a solution

Replicate: one of several identical experiments, procedures or samples. Each replicate is done with a new water sample

Riffle: A shallow section in a stream where water is breaking over rocks, wood, or other partially submerged debris and producing surface agitation

Riparian zone: The vegetative area adjacent to a stream or any other waterbody

Riprap: A stabilizer, such as rocks, used on a stream embankment to protect against erosion

Run: A fast moving section of a stream with a defined thawed (the line followed by the majority of the streamflow) and a little surface agitation

Saturated: Completely filled; for example, water is saturated (with regard to oxygen) if no more oxygen can be dissolved in water

Species Richness: The amount of different animal or plant types found in a given area

Submerged Plants: Plants that live and grow completely underwater; roots, stems and leaves

Substrate: The mineral or organic material that forms the streambed surface

Taxonomic Key: A reference guide used to identify organisms

Tolerant: Ability to withstand particular conditions. Often in reference to an animal that is unaffected by pollution: aquatic worms are tolerant animals because they can be found in polluted water

Tributary: A body of water that drains into another, typically larger body of water

Turbidity: Murkiness or cloudiness of water caused by particles, such as fine sediment (silts, clays) and algae

Water Quality Criteria: Standards outlining the maximum concentrations of pollutants in waterbodies that will still meet water quality standards. Listed in state water quality standards

Water Quality Standards: Written goals for state waters, established by each state and approved by EPA

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