Field Work

http://www.ccge.org/resources/learning_centre/classroom_activities/river_field_work.asp

Given that everyone lives in a watershed and that water is a fundamental life sustaining resource, we will investigate ways to look at surface streams for quantity and quality of this vital resource. We will construct a longitudinal profile or transect of a tributary stream to the Potomac River and test the water quality.

Materials
• Water Test kit
• Instructions from notebook
• Data sheets from notebook
• Pen or pencil

Field Site

- PLEASE BE CAREFUL AT THE FIELD SITE SO WE MINIMIZE OUR IMPACT. PLEASE DO NOT STEP IN THE WATER. PLEASE WORK WITH A PARTNER
    - Upon arrival at the stream you and your partner should select a section along the stream about 1-2 meters in length for your analysis.
    - Prepare a sketch map of your section of the stream on the paper provided. Please note your names on the sketch map as well as the names of the people working on either side of you. This is so we can put the sketch maps together in the proper sequence.
    - A sketch map does need to be drawn exactly to scale but noting measurements, direction, etc. is very helpful.
    - Prepare a second sketch of the surrounding environment of your section of the stream. We are not judging artistic talent but the reliability of the information. Please note your names on the sketch map and the orientation so we can put these together as well.
    - Take your water sample, complete the water quality tests, and record your data on the data sheets.

Data Sheet
Name:

We will not complete the coliform bacteria procedure or the Biochemical Oxygen Demand as we do not have sufficient time.

1. Water Temperature:

2. Turbidity:

3. Dissolved Oxygen:

4. Nitrate:

5. pH:

Phosphate

Phosphate is a nutrient needed for plant and animal growth and is also a fundamental element in metabolic reactions. High levels of this nutrient can lead to overgrowth of plants, increased bacteria activity, and decreased dissolved oxygen levels.

Phosphate comes from several sources including human and animal waste, industrial pollution, and agricultural runoff.

Phosphate Procedure

- Fill the test tube (0102) to the 10 mL line with the water sample.
- Add one Phosphorus TesTab (5422).
- Cap and mix by inverting until the tablet has disintegrated. Bits of material may remain in the sample.
- Wait 5 minutes for the blue color to develop.
    - Compare the Color Of the sample to the Phosphate color chart. Record the result as ppm Phosphate.

Temperature

Temperature is very important to water quality. Temperature affects the amount of dissolved oxygen in the water, the rate of photosynthesis by aquatic plants, and the sensitivity of organisms to toxic wastes, parasites and disease. Thermal pollution, the discharge of heated water from industrial operations, for example, can cause temperature changes that threaten the balance of aquatic systems.

Use of the thermometer

The two thermometers have an adhesive back. Adhere them to the kit container or another object to make grasping them easier. The temperature is indicated by a liquid crystal number on the Low Range thermometer and a green display on the High Range thermometer.

Temperature Procedure

- Wear protective gloves. At each site, place the thermometer four inches below the water surface for one minute.

- Remove the thermometer from the water, read the temperature and record the temperature as degrees Celsius.

- Repeat the test approximately 1 km upstream as soon as possible.

- The difference between the temperature upstream and the temperature at the sampling site is the change in temperature.

Turbidity

Turbidity is the measure of the relative clarity of water. Turbidity water is caused by suspended and colloidal matter such as clay, silt, organic and inorganic matter, and microscopic organisms. Turbidity should not be confused with color, since darkly colored water can still be clear and not turbid. Turbid water may be the result of soil erosion, urban runoff algal blooms, and bottom sediment disturbances which can be caused by boat traffic and abundant bottom feeders.

Turbidity Procedure

The water testing kit container is used to perform the turbidity test.

- Remove the backing from the secchi disk icon sticker.
- Adhere sticker on the inside bottom of the large white jar (kit container) Position the sticker slightly off center.
- Fill the jar to the turbidity fill line located on the outside kit label.
- Hold the Turbidity Chart on the top edge of the jar. Looking down into the jar, compare the appearance of the secchi disk icon in the jar to the chart. Record the result as Turbidity in JTU.

Ranking Test Results
Rank the results of each water quality test on a 1-4 scale:

Test factor:	Result:	Rank:
dissolvedoxygen	91 110% Sat 71 90 % Sat 51 70 % Sat <50 % Sat	4 (excellent) 3 (good) 2 (fair) 1 (poor)
BOD	0 ppm 4 ppm 8 ppm	4 (excellent) 3 (good) 2 (fair)
Coliform Bacteria	negative positive	3 (good) 1 (poor)
PH	4 5 6 7 8 9 10	I (poor) I (poor) 3 (good) 4 (excellent) 3 (good) I (poor) I (poor)
temperature change	0 - 2*C 3 - 50*C 6 -10*C	4 (excellent) 3 (good) 2 (fair)

	>10*C	1 (poor)
nitrate	5 pprn 20 ppm 40 pprn	2 (fair) 1 (poor) 1(poor)
phosphate	1 ppm 2 ppm 4 ppm	4(excellent) 3 (good) 2 (fair)
turbidity	0 - 4 >0 to 40 >40 to 100 >100	(excellent) 3 (good) 2 (fair) 1 (poor)

Use the ranked results to track water quality trends over long periods of time, to compare the water quality at different sites along the river, and to investigate how land use affects water quality.

Dissolved oxygen

Dissolved Oxygen (DO) is important to the health of aquatic ecosystems. All aquatic animals need oxygen to survive. Natural waters with consistently high dissolved oxygen levels are most likely healthy and stable environments, and are capable of supporting a diversity of aquatic organisms. Natural and human induced changes to the aquatic environment can affect the availability of dissolved oxygen.

Dissolved Oxygen % Saturation is an important measurement of water quality. Cold water can hold more dissolved oxygen than warm water. For example, water at 28*C will be 100% saturated with 8 ppm dissolved oxygen. However, water at 8*C can hold up to 12 ppm of oxygen before it is 100% saturated. High levels of bacteria from sewage pollution or large amounts of rotting plants can cause the % saturation to decrease. This can cause large fluctuations in dissolved oxygen levels throughout the day, which can affect the ability of plants and animals to thrive.

Dissolved oxygen procedure

- Record the temperature of the water sample (see page 30).
- Submerge the small tube (0125) into the water sample. Carefully remove the tube from the water sample, keeping the tube full to the top.
- Drop two Dissolved Oxygen TesTabs' (3976) into the tube. Water will overflow when tablets are added.
- Screw the cap on the tube. More water will overflow as the cap is tightened. Make sure no air bubbles are present in the sample.
- Mix by inverting the tube over and over until the tablets have disintegrated. This will take about 4 minutes.
- Wait 5 more minutes for the color to develop.
- Compare the color of the sample to the Dissolved Oxygen color chart. Record the result as ppm Dissolved Oxygen.

Locate the temperature of the water sample on the % Saturation chart. Locate the Dissolved Oxygen result of the water sample at the top of the chart. The % Saturation of the water sample is where the temperature row and the Dissolved Oxygen column intersect. For example: if the water sample temperature is 16*C and the Dissolved Oxygen result is 4 ppm, then the % Saturation is 41.

% Saturation

	0 ppm	4 Pom	8 ppm
2	0	29	58
4	0	31	61
6	0	32	64
8	0	34	68
10	0	35	71
12	0	37	74
14	0	39	78
16	0	41	81
18	0	42	84
20	0	44	88
22	0	46	92
24	0	48	95
26	0	49	99
28	0	51	102
30	0	53	106

* Calculations based on the solubility of oxygen in waterat sea level from Standard Methods for the Examination of Water & Wastewater, 18th Edition.

Nitrate

Nitrate is a nutrient needed by all aquatic Plants and animals, to build protein. The decomposition of dead plants and animals and the excretions of living animals release nitrate into the aquatic system. Excess nutrients like nitrate increase Plant growth and decay, promote bacterial decomposition, and therefore, decrease the amount of oxygen available in the water.

Sewage is the main source of excess nitrate added to natural waters, while fertilizer and an agricultural runoff also contribute to high of nitrate.

Drinking water containing high nitrate levels can affect the ability of our blood to carry oxygen. This is especially true for infants who drink formula made with water containing high levels of nitrate. You should always have a professional lab test your drinking water for the presence of nitrate.

Nitrate Procedure

- Fill the test tube (0102) to the 5ml line with the water sample.
- Add one Nitrate Wide Range CTA TesTab (3703).
- Cap and mix by inverting until the tablet has disintegrated. Bits of material may remain in the sample.
- Wait 5 minutes for the red color to develop.
- Compare the color of the sample to the Nitrate color chart. Record the result as ppm Nitrate.

pH

pH is a measurement of the acidic or basic quality of water. The pH scale ranges from a value of 0 (very acidic) to 14 (very basic), with 7 being neutral. The pH of natural water is usually between 6.5 and 8.2. Most aquatic organisms are adapted to a specific pH level and may die if the pH of the water changes even slightly.

pH can be affected by industrial waste, agricultural runoff, or drainage from improperly run mining operations.

PH Procedure

- Fill the test tube (0102) to the 10ml line with the water sample.
- Add one pH Wide Range TesT2b (6459).
- Cap and mix by inverting until the tablet has disintegrated. Bits of material may remain in the sample.
- Compare the color of the sample to the pH color chart. Record the result as pH.

Coliform bacteria

Fecal coliform bacteria are naturally present in the human digestive tract but are rare or absent in unpolluted waters. Coliform bacteria should not be found in well water or other sources of drinking water. Their presence in water serves as a reliable indication of sewage or fecal contamination. Although coliform. bacteria themselves are not pathogenic, they occur with intestinal pathogens that are dangerous to human health. This presence/absence total coliform test detects all coliform bacteria strains and may indicate fecal contamination.

The coliform test in this kit will indicate if you have above or below 200 coliform colonies per
100ml of well or river water. Even if the result of the coliform test for your well water is negative, this is not proof that your water is safe to drink. You should always have a professional lab test your drinking water for the presence of coliform bacteria.

See chart for significant levels.

Collection procedure river site testing.

- Remove the cap of the sampling container.
- Wear protective gloves. Rinse the bottle 2 3 times with the stream water.
- Hold the container near the bottom and plunge it (opening downward) below the water surface.
- Turn the submerged container into the current and away from you.
- Allow the water to flow into the container for 30 seconds.
- Cap the full container while it is still submerged. Remove it from the river immediately.

Significant levels of coliform bacteria

Fecal coliform bacteria per 100 ml water

Desirable	Permissible	Water Use
0	0	Potable and well water (for drinking)
<200	< 1,000	Primary contact (for swimming)
< 1MO	<5000	Secondary contact (for boating, & fishing)

*For specific requirements consult your province, or local health department.

Coliform bacteria procedure

- Pour the water sample into the large test tube containing a tablet (3599) until it is filled to the 10 ml line. Don't worry if you overfill or underfill a little.

- Replace the cap on the test tube.

- Stand the tube upright, with the tablet flat on the bottom of the tube.

- Incubate by storing the tube upright, at room temperature, out of direct sunlight, for 30.to 36 hours. Store the tubes where the temperature will be fairly constant and between 21' to 27' C. Do not disturb, handle, or shake tubes during the incubation period.

- Compare the appearance of the tube to the picture on the Coliform color chart. Record the result as negative or positive

Reactions

negative:
-Liquid above get is clear.
-Gel remains at bottom of tube.
-Indicator remains red or turns yellow with no gas bubbles.
-Indicates less than 200 total coliform colonies per 100 ml of water.

positive:
-Many gas bubbles present.
-Gel rises to surface.
-Liquid below get is cloudy.
-Indicator turns yellow.
-Indicates more than 200 total coliform colonies per 100 ml of water.

Coliform test disposal

- One tube at a time, remove the cap and add approximately I mL M teaspoon or 20 drops) of household chlorine bleach and immediately recap.

- Let the tubes stand upright for about 4 hours.

- Dispose of the closed tubes in the a ash. Do not open tubes.

NEVER re-use tubes after coliform bacteria testing.

BOD Biochemical Oxygen Demand

Biochemical Oxygen Demand (BOD) is a measure of the quantity of dissolved oxygen used by bacteria as they break down organic wastes. In slow moving and polluted rivers, much of the available dissolved oxygen is consumed by bacteria, robbing other aquatic organisms of the dissolved oxygen needed to live.

- Submerge the small tube (0125) into the water sample. Carefully remove the tube, keeping the tube full to the top. Cap the tube.

- Wrap the rube with aluminum foil and store it in a dark place at room temperature for 5 days.

- Unwrap the tube. Add two Dissolved Oxygen TesTaO 0976) to the test tube.

- Cap the tube. Make sure there are no air bubbles. Invert until tablets have disintegrated. Wait 5 min

- Compare the color of the sample to the Dissolved Oxygen color chart..

The difference in the Dissolved Oxygen level between the uncovered tube and the covered tube is the Biochemical Oxygen Demand (BOD) of the water sample.