WATER QUALITY AWARENESS IN URBAN ENVIRONMENTS

FIELD ACTIVITY:

Monitoring the Water Quality in Your Watershed

FIELD ACTIVITY:
MONITORING THE WATER QUALITY IN YOUR WATERSHED

Adapted from Earth Force/Green's Standard Water Monitoring Kit Manual in partnership with LaMotte Company

STEP 1: ESTABLISH A MONITORING LOCATION IN YOUR WATERSHED

IDENTIFY YOUR WATERSHED

Obtain a map of your watershed. Maps can be obtained from your library, local soil conservation district, county planning and zoning office, city or county courthouse, or state environmental agency. Orange County Watershed and Coastal Resources' web site (www.ocwatershed.com) is an excellent resource to help you identify and explore your watershed. Actual aerial, drainage, and land use maps are available on the web site for review.

1. Locate a potential water sampling location(s) on a map (watershed map, road map, etc...)

2. Visit the location(s) and if suitable for sampling, mark the water sampling location on the map taking note of any other useful reference points (a school, park, bridge, etc...).

3. Attempt to identify the sources of the water and any upstream sources of contamination. Note these sources and any other contributing factors you think are important to the quality of the water.

   a. Locate natural features of your watershed including hills, wetlands, etc.

   b. Locate major land-use areas contributing water to your sampling location including industrial areas, agricultural areas and residential areas. In some cases it may only be one land use or it may be many.

CREATE A LIST OF GOALS

- Educational – students will:
  - plan, implement and analyze a scientific investigation;
  - develop field and laboratory skills necessary for water quality testing;
  - compile and compare water quality data.
- Community – students will:
  - develop an awareness and responsibility to their watershed as an individual and as a community;
  - communicate findings and the results of their actions to the community.

- Environmental – students will:
    - become familiar with their watershed;
    - learn to recognize water quality problems and their sources;
    - understand relationships between land use and water quality;
    - make a responsible, action-oriented contribution toward protecting their watershed.

STEP 2: DESIGN A MONITORING PLAN

PLANNING A STUDY

- Chose a type of study.
    - Look at your watershed map.
    - Choose a study that will accomplish your goals.
        - Site Comparison Study
            - Test two sampling sites, one above and one below a specific land-use to determine if changes in water quality can be attributed to that land-use.
            - Coordinate with other groups to sample a larger watershed allowing for data to be compared between sites.
        - Water Quality Standards Study
            - Test one or more sampling sites to compare your results to local, state, or federal standards.

- Chose the tests.
  You can explore chemical and physical characteristics of the watershed. The tests you choose to perform will be based on your study.
        - Kit includes:
            - Dissolved Oxygen
            - Nitrate
            - pH
            - Phosphate
            - Temperature
            - Turbidity
            - BOD (N/A)
            - Benthic Macro invertebrate (N/A)
- Make water sampling schedule
    - Number of sites
    - Frequency of sampling
    - Number of test factors
    - Weather conditions
    - Individuals assigned to each sampling site

STEP 3: CONDUCT THE STUDY

<u>SITE ANALYSIS </u>(Conducted at the Sampling Site)

- Guidelines for Sampling:
  - Safety in Sampling
    - Wear rubber gloves and appropriate shoes (closed toe, rubber or waffle bottom such as athletic shoes or boots).
    - Wear safety goggles.
    - Avoid sampling from high traffic areas. Sites with steep banks or heavy brush should also be avoided.
  - Safety in Running Tests
    - Read the safety information on the label of each module. These labels provide very specific first aid and chemical information.
    - Understand the danger of treating reagents casually or endangering others through “horseplay”.
    - Wear safety goggles particularly when performing water quality tests that require shaking a chemical mixture.
    - Wash hands after performing water quality tests. Avoid placing hands in contact with eyes or mouth during monitoring.
    - Ensure a safe monitoring experience by using the following:
      - Safety goggles for each student
      - Clean pail or bucket for washing hands
      - Jug of clean water for washing hands
      - Soap (biodegradable if possible)
      - Towels
      - Waster container for chemical waste
        - All reacted samples can be disposed of by flushing down the drain with excess water. While in the field, reacted samples can be poured into a waste container for later disposal.
      - Plastic gloves
      - Eye wash bottle
      - First aid kit
- Guidelines for Collecting a Water Sample:
  - Collecting Samples
    - Wear protective gloves.
    - Remove the cap of the sampling container.
    - Rinse the container 2-3 times with the river water.
    - Hold the container near its base and plunge it (opening downward) below the surface of the water.
    - Turn the submerged container into the flow and away from you.

        - Allow the water to flow into the container until full.
        - Cap the container while it is still submerged.
        - Remove the full container from the water.
        - Repeat procedure for replicate water samples.
    - Evaluate land use
        - Observe the surrounding area.
        - Note characteristics of geological and physical features of your sampling site (homes, streets, vegetation, animals, etc.).
        - Note any additional contributions to sampling site (pipes, upstream runoff/irrigation, storm channels, etc.).
        - Note the direction the water is flowing.
        - Repeat for each sampling site.
    - Evaluate water odor

      Odor in water may be caused by
        - Decaying plants and algae;
        - Sewage;
        - Industrial, agricultural, domestic, or urban wastes;
        - Soil run-off.

PROCEDURE:

1. Collect the water sample in a large mouthed container.
2. Use your hand to wave the air above the water sample toward you.
3. Use the table below to describe what you smell.
4. Record the type and intensity (faint, distinct, or strong) of the water odor on the data sheet.

ODORS IN WATER	POTENTIAL POLLUTANTS AND SOURCES
Sulfur (rotten egg):	May indicate organic pollution, such as domestic or industrial wastes.
Musky:	May indicate presence of sewage discharge, livestock waste, decaying algae, or decomposition of other organic material.
Harsh:	May indicate the presence of industrial or pesticide pollution.
Chlorine:	May indicate the presence of over-chlorinated effluent from a sewage treatment facility or a chemical industry.
No unusual smell:	Not necessarily an indicator of clean water. Many pesticides and herbicides from agricultural and urban run-off are colorless and odorless, as are many chemicals discharge by industry.

- Evaluate Water Appearance
  The appearance of the water can be used as an indicator of water quality and local land-use.

PROCEDURE:

1. Collect a water sample in a clear, colorless, glass jar.
2. Look at the sample against a white background.
3. Using the table below, record the appearance of the water on the Data Sheet.

WATER APPEARANCE	POTENTIAL POLLUTANTS AND SOURCES:
Green, Green-Blue, Brown or Red:	Indicates the growth of algae, which is usually caused by high levels of nutrient pollution. Nutrient pollution can come from organic wastes, fertilizers, or untreated sewage.
Light to Dark Brown:	Indicates elevated levels of suspended sediments, giving the water a muddy or cloudy appearance. Erosion is the most common source of high levels of suspended solids in water. Land-uses which cause soil erosion include mining, farming, construction, unpaved roads and urban irrigation.
Dark Red, Purple, Blue, Black:	May indicate organic dye pollution from clothing manufacturers or textile mills.
Orange-Red or Blue:	May indicate the presence of copper, which can be both a pollutant and naturally occurring. Unnatural occurrences can result from acid mine drainage or oil well run-off. Copper is sometimes used as a pesticide, in which case a sharp odor might also be present. Copper can also cause skin irritations and death of fish.
Foam:	Excessive foam is usually the result of soap and detergent pollution. Moderate levels of foam can also result from decaying algae, which indicates nutrient pollution.
Multi-Colored (oily sheen):	Indicates the presence of oil or gasoline floating on the water surface. Ingestion of oil and gasoline can cause poisoning, internal burning of the gastrointestinal tract, and stomach ulcers. This pollution can be caused by oil drilling and mining practices, leaks in fuel lines and underground storage tanks, automotive junk yards, nearby service stations, wastes from ships, or run-off from impervious roads and parking lot surfaces.
No unusual color:	Not necessarily an indicator of clean water. Many pesticides, herbicides, chemicals, and other pollutants are colorless or produce no visible signs of contamination.

Water Quality Testing Procedures:

DISSOLVED OXYGEN • MODULE CODE 5889

Aquatic animals need dissolved oxygen to live. Fish, invertebrates, plants, and aerobic bacteria all require oxygen for respiration. Oxygen dissolves readily into water from the atmosphere until the water is saturated. Once dissolved in water, the oxygen diffuses very slowly and distribution depends on the movement of the aerated water. Oxygen is also produced by aquatic plants, algae, and phytoplankton as a by-product of photosynthesis.

The amount of oxygen required varies according to species and stage of life. Dissolved Oxygen levels below 3 ppm are stressful to most aquatic organisms. Dissolved Oxygen levels below 2 or 1 ppm will not support fish. Levels of 5 to 6 ppm are usually required for growth and activity.

Dissolved Oxygen Percent 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 percent 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.

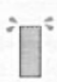
DISSOLVED OXYGEN REACTION

Dissolved Oxygen TesTabs® (3976) contain sodium citrate and 2, 4-Diaminophenol dihydrochloride. Dissolved Oxygen, in a solution buffered by sodium citrate, oxidizes a proportionate amount of 2, 4-Diaminophenol dihydrochloride to produce a colored solution.

PROCEDURE

For the most accurate results, submerge the test tube (0125) in the river. Carefully remove the test tube from the river, keeping the tube full to the top. Be sure not to mix or shake the sample, as this will add more oxygen.

Record the temperature of the water sample.

1. 
Fill a small test tube (0125) to overflowing with sample water.

2. 
Add two Dissolved Oxygen TesTabs® (3976) to the test tube.

3. 
Cap the tube. Be sure no air bubbles are in the sample.

4. 
Mix by inverting until the tablets have disintegrated (about 4 minutes).

5. 
Wait 5 minutes.

6. 
Compare the color of the sample to the Dissolved Oxygen Color Chart (6663). Record the result as ppm Dissolved Oxygen.

Determine the Percent Saturation from the chart.


actual size tube 0125

PERCENT SATURATION

DISSOLVED OXYGEN

TEMP°C	0 ppm	4 ppm	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 solubility of oxygen in water at sea level, from Standard Methods for the Examination of Water & Wastewater, 18th edition.*

Locate the temperature of the water sample on the Percent Saturation chart. Locate the Dissolved Oxygen result of the water sample at the top of the chart. The Percent 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 Percent Saturation is 41.

DISSOLVED OXYGEN (% SATURATION)	SCORE
91-110	4 (excellent)
71-90	3 (good)
51-70	2 (fair)
<50	1 (poor)

Record the score on the Data Sheet.

NITRATE • MODULE CODE 5891

Nitrogen is a nutrient that acts as a fertilizer for aquatic plants. When nutrient levels are high, excessive plant and algae growth creates water quality problems. Nitrogen enters the water from human and animal waste, decomposing organic matter, and run-off of fertilizer from lawns and crops. Nitrogen occurs in water as Nitrate (NO_3), Nitrite (NO_2), and Ammonia (NH_3).

Unpolluted waters usually have a nitrate level below 4 ppm. Nitrate levels above 40 ppm are considered unsafe for drinking water.

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. **This nitrate test is adequate for testing river water, but you should always have a professional lab, with more sensitive testing equipment, test your drinking water for the presence of nitrate .**

NITRATE REACTION

Nitrate #1 TesTabs® (2799) contain sulfamic acid which destroys any nitrite that will give a positive interference. Nitrate #2 CTA TesTabs® (NN-3703) contain zinc, which reduces the nitrate to nitrite, and chromotropic acid which reacts with the nitrite to form a pink color.

PROCEDURE

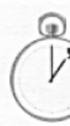
1. 
Fill the test tube (0102) to the 5 mL line.

2. 
Add one Nitrate #1 TesTab® (2799).

3. 
Cap the tube & mix until the tablet has disintegrated.

4. 
Add one Nitrate #2 CTA TesTab® (NN-3703).

5. 
Cap the tube & mix until the table has disintegrated.

6. 

Wait 5 minutes.

7. 

Compare the color of sample to the Nitrate Color Chart (5891-CC). Record the result as ppm Nitrate.

NITRATE (PPM)	SCORE
5	2 (fair)
20	1 (poor)
40	1 (poor)

Record the score on the Data Sheet.

GROUND WATER POLLUTANTS: NITRATE

What does the indicator tell us?

Nitrate is the most widespread agricultural contaminant and is a human health concern since it can cause methemoglobinemia, or "blue-baby syndrome." Nitrate is also an environmental concern as a potential source of nutrient enrichment of coastal waters. High levels of nitrate in well water typically indicate that pollution is seeping in from septic tanks, animal wastes, fertilizers, municipal landfills, or other nonpoint sources. The Safe Drinking Water Act requires that EPA establish federal safety standards that limit the allowable levels of nitrate in water. This level is established at 10 milligrams per liter (mg/L).

This indicator uses information from the 1990 National Pesticides Survey to demonstrate the number of people exposed to nitrate concentrations above the EPA maximum contaminant level. The survey offers the first national look at pesticide and nitrate contamination in rural domestic wells and community drinking water systems. The survey indicates that 4.5 million people were potentially exposed to elevated levels of nitrate from drinking water wells.

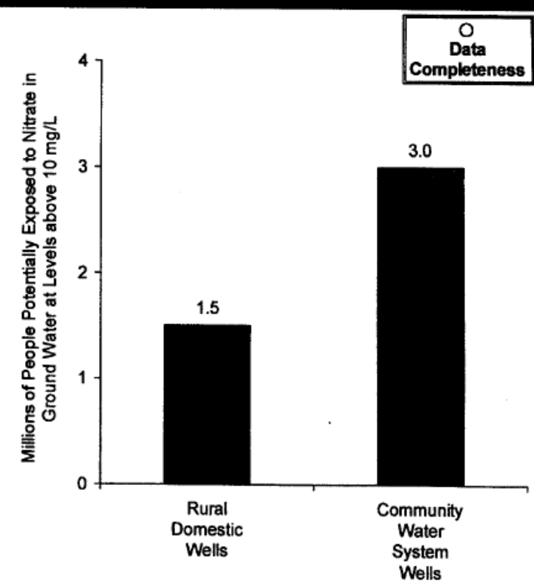
How will the indicator be used to track progress?

Most ground water studies use nitrate as an indicator because of its stability and solubility in water. Therefore, comparisons between nitrate concentrations can be made across many of these studies. It is also convenient to use nitrate concentration to track changes in ground water quality because it is a primary health-based drinking water standard. The lack of ambient ground water monitoring networks, however, hampers the tracking of any definitive trends on a national basis.

EPA will continue to review and analyze the data from public drinking water programs. It will also investigate the many studies conducted by the U.S. Geological Survey (USGS), other federal agencies, states, and local authorities that apply to existing conditions and threats to the quality of ground water. Those studies on nitrate contamination, as well as studies using other contaminants (e.g., pesticides and organic compounds) as indicators of ground water quality, will be used to update this indicator.

The modernization of the Safe Drinking Water Information System (SDWIS) and water quality monitoring data from EPA's Storage and Retrieval (STORET) systems will provide additional data to track sources of ground water contamination. SDWIS provides data on how well drinking water systems are meeting safety standards.

INDICATOR 11:
Ground Water Pollutants: Nitrate



Source: *National Survey of Pesticides in Drinking Water Wells*, 1990.

Proposed Milestone: By 2005, the number of Americans served by community and rural water wells containing high concentrations of nitrate, which can cause illness, will be reduced.

What is being done to improve the indicator?

Information on ground water quality is usually obtained from the monitoring of known or suspected contamination sites or from specific studies that monitor for various contaminants in limited areas. However, available data do not always provide an accurate representation of ambient ground water quality or an indication of the extent and severity of ground water contamination problems. In addition, there is considerable difficulty in using the results of ground water studies to project both the degree of contamination on a national level and decreases in the population served by contaminated systems. In the meantime, the best available source of ground water data is studies of drinking water supplies. Ultimately, however, this indicator should measure ground water quality directly. Achieving this will require the development and implementation of monitoring strategies and programs at the local, state, and regional levels.

EPA encourages states to conduct ground water monitoring and to build comprehensive monitoring programs through integration of existing efforts aimed at characterizing the overall quality of ground water resources. This will help develop a national picture of the needs and progress of ground water protection efforts. More research and development are also needed on the natural and human-induced factors affecting ground water quality and monitoring, as well as the selection of the best indicators. Agencies at all levels of government must address problems in their monitoring efforts, collect the most useful data for their own applications, and achieve the most economical use of their monitoring investment.

EPA also strongly encourages states, through the *National Water Quality Inventory* and the Intergovernmental Task Force on Monitoring Water Quality, to assess selected aquifers or hydrogeologic settings to provide a more meaningful interpretation of ground water within the states. It is anticipated that as states develop and implement ground water monitoring plans, programs, and collection mechanisms, information will become more uniform and trends in ground water quality in states, regions, and the Nation can be evaluated more reliably.

In the future, to provide a more accurate picture of overall ground water quality, this indicator might include other contaminants as well as other uses of the ground water resource.

What is being done to improve conditions measured by the indicator?

To prevent the contamination of ground water, both the Clean Water Act and the Safe Drinking Water Act, along with other federal laws, establish requirements for states and tribes to actively protect their ground water. Unfortunately, our knowledge of the extent and severity of ground water contamination is incomplete. Other than drinking water suppliers regulated by EPA, few keep detailed monitoring records. However, with more states recognizing the need to establish ambient ground water monitoring programs, drinking water data using samples from the distribution system or blended samples from various wells will be relied on less to obtain good-quality information.

The challenge for ground water includes protecting ground water—particularly wells that supply public water systems—from pollution and helping the public better understand the ways in which it becomes polluted. Much of this effort will be supported by voluntary implementation of local or regional management strategies by cooperating agencies. Expanded ambient and site-specific monitoring can target known or suspected pollution sources, yielding valuable information on ground water quality.

For More Information:

Water Environmental Indicators
EPA Office of Water
401 M Street, SW
Mail Code 4503F
Washington, DC 20460
(202) 260-7040 phone
(202) 260-1977 fax
Internet: http://www.epa.gov/OW/indic

pH • MODULE CODE 5890

The pH test is one of the most common analyses in water testing. pH is a measurement of the activity of hydrogen ions in a water sample. The pH scale ranges from 0 to 14. Water samples with a pH below 7.0 are considered acidic, those above 7.0 are basic, with 7.0 considered neutral.

A pH range of 6.5 to 8.2 is optimal for most organisms. Rapidly growing algae and vegetation remove carbon dioxide (CO_2) from the water during photosynthesis. This can result in a significant increase in pH.

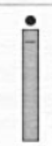
Most natural waters have pH values from 5.0 to 8.5. Acidic, freshly fallen rain water may have a pH of 5.5 to 6.0. Alkaline soils and minerals that can raise pH to 8.0 to 8.5. Sea water usually has a pH value close to 8.0.

pH REACTION

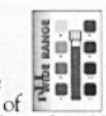
pH Wide Range TesTabs® (6459) contain mixed pH indicators which are sensitive to pH and undergo specific color changes with variation in pH.

PROCEDURE

1. 
Fill the test tube (0102) to the 10 mL line.

2. 
Add one pH Wide Range TesTab® (6459).

3. 
Cap the tube and mix until the tablet has disintegrated.

4. 
Compare the color of the sample to the pH Color Chart (5890-CC). Record the result as pH.

pH (UNITS)	SCORE
4	1 (poor)
5	1 (poor)
6	3 (good)
7	4 (excellent)
8	3 (good)
9	1 (poor)
10	1 (poor)
11	1 (poor)

Record the score on the Data Sheet.

PHOSPHATE • MODULE CODE 5892

Phosphorus is a nutrient that acts as a fertilizer for aquatic plants. When nutrient levels are high, excessive plant and algae growth creates water quality problems. Phosphorus occurs in natural waters in the form of phosphates (PO_4). Over half of the phosphates in lakes, streams and rivers come from detergents.

Phosphate levels higher than 0.03 ppm contribute to increased plant growth.

PHOSPHATE REACTION

Phosphorus TesTabs® (5422) contain ammonium molybdate which reacts with phosphorus to form a phosphomolybdate complex. This is reduced to a blue complex by ascorbic acid.

PROCEDURE

1. Fill the test tube (0102) to the 5 mL line.
2. Add one Phosphorus TesTab® (5422).
3. Cap the tube & mix until the tablet has disintegrated.
4. Wait 5 minutes.
5. Compare the color of the sample to the Phosphate Color Chart (5892-CC). Record result as ppm Phosphate.

PHOSPHATE (PPM)	SCORE
1	4 (excellent)
2	3 (good)
4	2 (fair)

Record the score on the Data Sheet.

TURBIDITY • MODULE CODE 5887

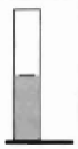
Turbidity is the measurement of the relative clarity of water. Turbid water is caused by suspended and colloidal matter such as clay, silt, organic and inorganic matter, and microscopic organisms. Turbidity should not be confused with color, since darkly colored water can still be clear and not turbid.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

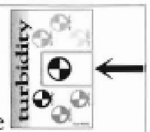
TUBIDITY METHOD

A turbidity "target" is placed below the bottom of a clear tube. The sample turbidity causes a "fuzziness" of the target. The degree of "fuzziness" is matched to target standards calibrated in Jackson Turbidity Units (JTU).

PROCEDURE

Collect a small bucketful of river water. Be careful not to disturb the sediments on the stream bottom. Shake the sample vigorously before examination.

1. 
Fill the turbidity tube (0836) to the line.

2. 

Place the base of the tube on the outline on the Turbidity Chart. (5887-CC).

3. 

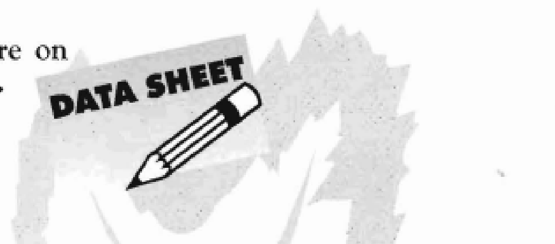
Look down through the sample water at the Secchi disk icon under the tube.

4. 

Compare the appearance of the Secchi disk icon under the tube to the gray Secchi disks on the either side of the tube to determine the turbidity in JTU.

TURBIDITY (JTU)	SCORE
0	4 (excellent)
>0 to 40	3 (good)
>40 to 100	2 (fair)
>100	1 (poor)

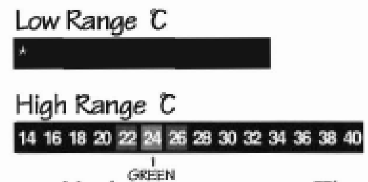
Record the score on the Data Sheet.



CHANGE IN 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 THERMOMETERS



There are two thermometers included. Each has an adhesive back. Before going to the river, adhere each one to the ruler to make holding them easier.

The Low Range thermometer will show liquid crystal numbers when it is activated by low temperatures. The High Range thermometer has liquid crystal windows. The exact temperature is indicated by a ***green*** display. The green display will usually be between a blue and a tan/red display.

PROCEDURE

Select two sites where the physical conditions, current speed, amount of sunlight reaching the water, and the depth of the stream are as similar as possible. One site should be the sampling site. The second site should be approximately 1 kilometer (approximately ½ mile) upstream.

1 4 inches

Wear protective gloves. At each site, place the thermometer 4 inches below the surface for one minute.

2 Remove the thermometer from the water. Read the temperature and record the results as degrees Celsius.

3 1 km

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

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

Record the score on the Data Sheet.

TEMPERATURE CHANGE (IN °C)	SCORE
0-2	4 (excellent)
3-5	3 (good)
6-10	2 (fair)
>10	1 (poor)

For more information on temperature, including more extensive tests that you can perform and potential causes of pollution, visit the temperature page on the Earth Force website at:
www.earthforce.org/green/temperature

CONDUCTIVITY

Conductivity is the availability of a solution to conduct an electrical current. This current is conducted by electrically charged particles called ions. Different solutions have different kinds and amounts of ions. Distilled water has very few ions, and therefore a low conductivity, while sea water has a large number of ions, and a high conductivity. In fresh water, conductivity is measured in microsiemens per centimeter. Because it is a quick, reliable, and inexpensive way of monitoring the ionic content of a solution, conductivity measurements are widely used in many areas of water testing, from environmental monitoring to municipal water supplies to many industrial applications.

PROCEDURES:

To measure conductivity once a water sample has been collected, use the EC 11 Tester probe as per the manufacturer's directions provided.

Record the score on the Data Sheet.

CONDUCTIVITY	SCORE
0 - <500	4 (excellent)
>500 - <1500	3 (good)
>1500 - <2500	2 (fair)
>2500	1 (poor)

STEP 4: ANALYZE DATA

<u>SUMMARIZE DATA</u>

Copy the individual results from each field data sheet into a single summary table.

<u>DRAW CONCLUSIONS</u>

Using the summary table and the site evaluation notes answer the following questions:

1. Was there any pattern to the differences in the test results? Explain.
2. Did the test results seem to correspond to land use? Explain.
3. Do the results indicate important water quality issues facing your community and the entire watershed? Explain.
4. What new questions are raised by your water quality study? Consider which of these questions you might want to investigate further.

STEP 5: TAKE ACTION

<u>IDENTIFY THE PROBLEM</u>

- From the data collected, create a list of water quality problems that have been identified. Choose the problem that you would like to help resolve.

  > **Example:** Elevated nitrate levels were detected at two water sampling sites in your neighborhood. This can indicate improper fertilizer use.

<u>DEFINE THE PROBLEM</u>

- Define the problem in terms of who or what it affects. This will direct your and should be developed carefully. Large problems can be complicated and you may have to concentrate on resolving only one part of the problem.

  > **Example:** Improper fertilizer use affects the water quality and health of the watershed, and availability of clean water for recreation and other uses.

<u>CREATE A PLAN TO HELP SOLVE THE PROBLEM</u>

- List Actions you can take.
  Actions can take multiple forms, so it is important to consider many possibilities.
  For each example consider a community partner.

Examples include:

- Education
    - Send letters to a local or regional newspaper.
    - Educate others – give presentations on the problem.
    - Make school announcements.
- Direct Action
    - Clean debris around storm drains or watershed.
    - Make personal changes in lifestyle
      (Learn about responsible garden chemical use and disposal.)
- Political Action
    - Speak at a public meeting (city council, Homeowners Association, etc.)
    - Write letters to public officials (or visit in person)
    - Invite public officials to speak at your school or in your neighborhood.

CREATE AN ACTION PLAN

Narrow the list of actions down to one or two that can help you solve the problem.

The actions should be:

- Practical
- Simple
- Inclusive of community
- Completed within a designated time frame
- Achievable with available information

IMPLEMENT THE ACTION PLAN

Keep an ongoing log to monitor progress.

STEP 6: EVALUATE THE WATER SAMPLING STUDY

The evaluation of the study will help identify your successes, improve future studies, and share your accomplishments with your community. Refer to the goals in Step 1 to assist you with the evaluation process.

Answer the following questions:

1. What were the goals of your water quality study?

2. Did your study design enable you to meet all the goals of your study? Explain.

3. Was your action plan successful? How?

4. What did you accomplish that was not a goal?

VOCABULARY

Dissolved oxygen (D.O.)	-	The amount of oxygen dissolved in water.
Eutrophication	-	The enrichment of water with nutrients, usually phosphorous and nitrogen, which stimulates the growth of algal blloms and rooted aquatic vegetation.
Impounded	-	A body of water that is confined, as if in a reservoir.
Nitrate	-	One form of nitrogen that plants can take up through their roots and use for growth.
Nonpoint source Pollution	-	Pollution whose sources cannot be traced to a single point and reach water bodies in runoff.
Organic	-	A living plant or animal containing carbon compounds.
pH	-	A measure of the acidity or alkalinity of a solution.
Phosphate	-	An important nutrient for plants to grow and for the metabolic reactions of plants and animals.
Photosynthesis	-	A process by which chlorophyll-containing cells in green plants converts light to chemical energy and synthesize organic compounds from inorganic compounds.
Phytoplankton	-	Microscopic, photosynthetic floating aquatic plants.
Point Source Pollution	-	Pollution that has discrete discharges, usually from a pipe or outfall.
Turbidity	-	A measure of the clarity of water.
Watershed	-	The catchment basin or drainage area (both below and above ground) of an entire water system.

References: