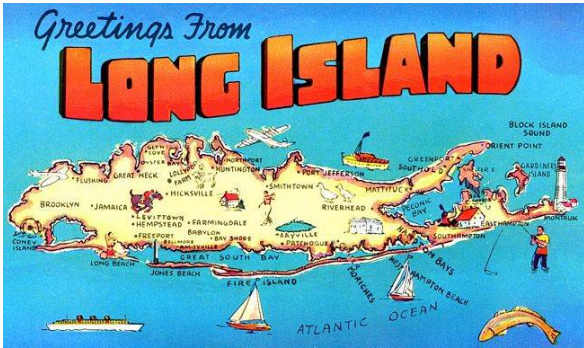


Name: \_\_\_\_\_ Period: \_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

## THE GLACIAL HISTORY OF LONG ISLAND



Our little place in the universe is known as **Long Island**, and it has an amazing history. It hasn't always been there; in fact it took glaciers thousands of years to form the land you live on. If you don't know exactly where you are, well here's a little hint — **Long Island** is located in the Southeastern part of New York State, it is separated by the rest of the state by water, more specifically the East River, and from Connecticut by the Long Island Sound.

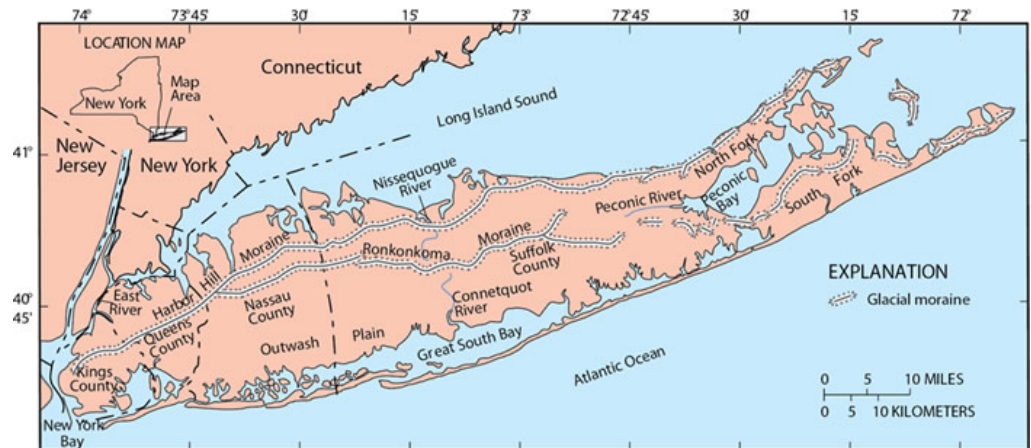
Long Island was formed by **glaciation** — process, condition or result of being covered by glaciers or ice sheets, roughly around 22,000 years ago. Long Island is part of the Outer Lands Region; it is primarily formed by four spines of glacial **moraine** — a mass of rocks and sediment carried down and deposited by a glacier, typically as ridges at its edges or extremity. The **moraines** consist of gravel and loose rock left behind by the Wisconsin glaciation some 21,000 years ago (19,000 BC). The northern moraine, which directly abuts the North Shore of Long Island at points, is known as the Harbor Hill moraine. The more southerly moraine, known as the Ronkonkoma moraine, forms the "backbone" of Long Island; it runs primarily through the very center of Long Island, roughly coinciding with the length of the Long Island Expressway.

The land to the south of this moraine to the South Shore is the **outwash plain** — a landform feature created by outwash, of the last glacier. Part of this, known as the Hempstead Plains, supported one of the few natural prairies to exist east of the Appalachian Mountains.

The glaciers melted and receded to the north, resulting in the difference between the North Shore beaches and the South Shore beaches. The North Shore beaches are rocky from the remaining glacial debris, while the South Shore's are crisp, clear, outwash sand. Running along the center of the island like a spine is the moraine left by the glaciers. (Bald Hill, Farmingville, is the highest point along the moraine.) The glaciers also formed Lake Ronkonkoma.

### Physical Features of Long Island

- Created by glaciers.
- Surrounded by salt water.
- Bedrock deeply buried.
- Porous unconsolidated material (sand, silt, clay and gravel) form layers that holds water underground.
- There are 3 **aquifers** — a body of permeable rock which can contain or transmit groundwater: The aquifers are: The Upper Glacial, The Magothy and The Lloyd.



Base from U.S. Geological Survey State base map, 1:100,000, 1979, Universal Transverse Mercator projection, NAD 27, Zone 18

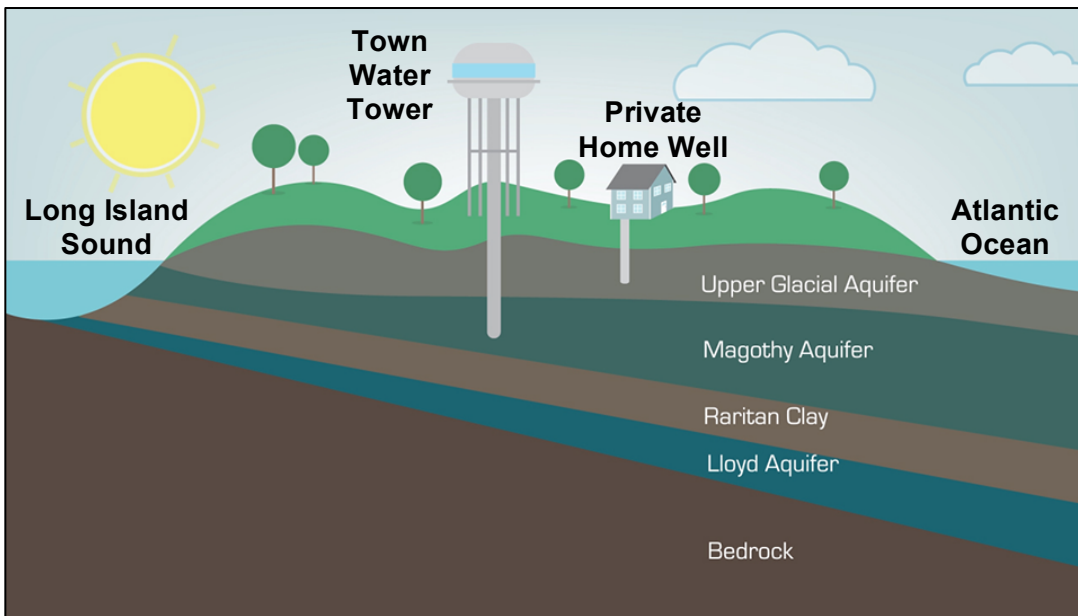
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## YOU ARE WHAT YOU DRINK!

Do you know where your drinking water comes from? How about the water you shower with? Or the water that fills your pool? Well you will be happy to find out that all the water you drink, bathe and play in comes from your backyard, well sort of! All of the water Long Island consumes comes from underground watersheds found directly beneath our feet, and in some places its not that far down to reach the **water table** — the level below which the ground is saturated with water.

As Long Island was formed, the glaciers carved out Long Island leaving behind moraines and basin. As glaciers advanced and retreated, sediments were deposited all along their path and fresh water became trapped in the sediments. The underground pockets that hold and transmit water are called **aquifers**. These aquifers found on Long Island are extremely important for our survival, and not only for people, but for all the species that we cohabitate with.

### Long Island Cross Section – Aquifer Layers



**The Upper Glacial Aquifer** is the aquifer closest to the surface of Long Island. It is the youngest and was laid down during the last Ice Age. It is made up of sands, pebbles, rocks and boulders, carried to Long Island by the glacier that carved it. Long Island's water table is found in this aquifer. ***We live on it!***

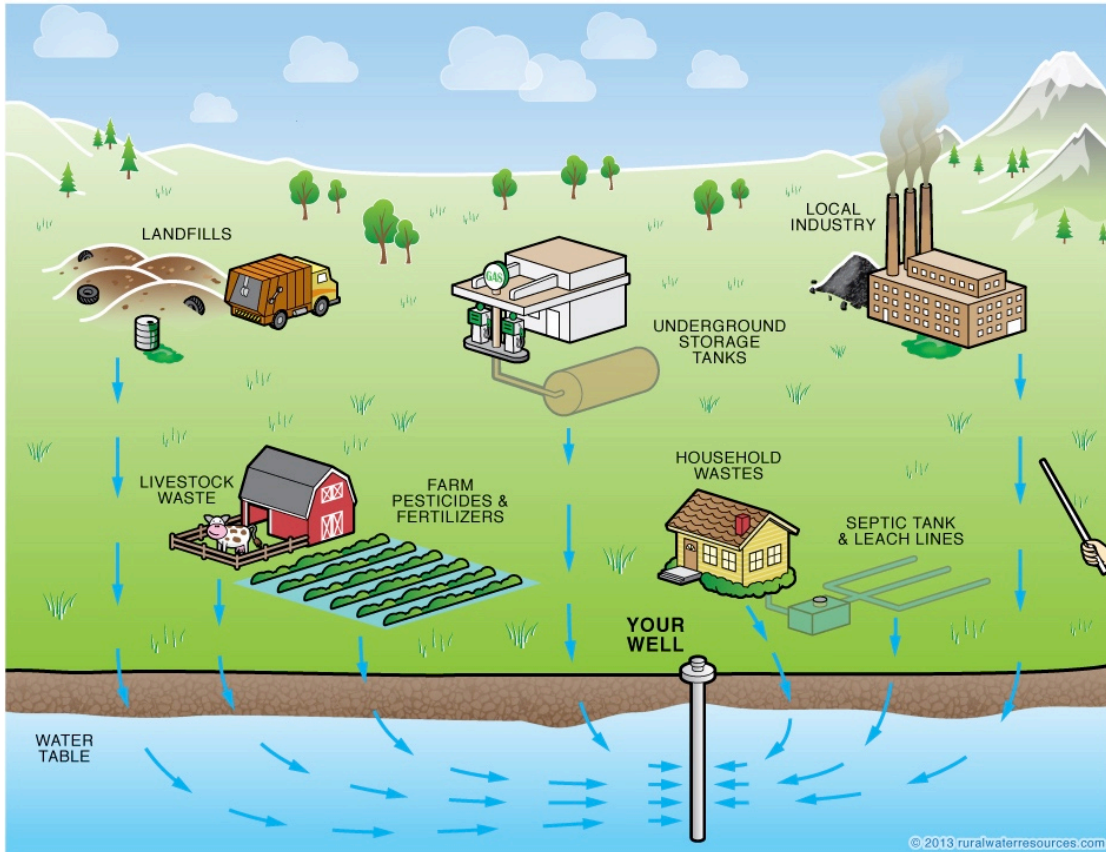
**The Magothy Aquifer** is the largest of Long Island's aquifers. Consisting of sand deposits alternating with clay, and has a maximum thickness of approximately 1,100 feet and is *the source of potable water for most of Nassau County and about half of Suffolk County*. The formation is visible within the coastal bluffs of the north shore and plunges under the land surface to the south. *The Magothy aquifer supplies more than 90% of the water used in Nassau County and about 50% of the water used in Suffolk County.*

**The Lloyd Aquifer** is the oldest and deepest of Long Island's aquifers. Composed of sand and gravel it ranges in thickness up to 500 feet thick. The Lloyd aquifer is 1,800 feet below the surface at its deepest point and its water is about six thousand years old. New York Environmental Conservation Law §15-1528 established a moratorium on the use of water from this formation. Laws strictly prohibit and regulate the pumping of water from this aquifer.

Name: \_\_\_\_\_ Period: \_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

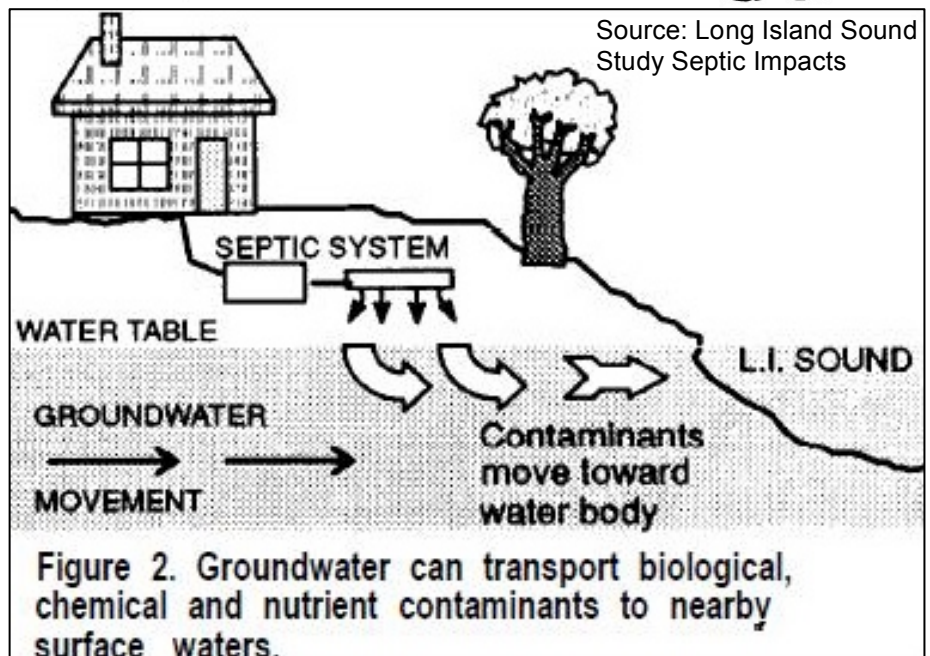
## GROUNDWATER CONTAMINATION

Aquifers can become polluted when chemicals and pollutant substances pass through the soil and into the water table. The most common sources of contamination are from — landfills, underground storage tanks (cesspools, gasoline tanks), pesticides and fertilizers. But there are many, more such as cars and boats. These are known as **Point Source Pollution** because we can identify where the pollutant comes from.



Information gathered from U.S. Environmental Protection Agency

**Fertilizers, pesticides and septic systems** are big areas of concern for Long Island because contaminated groundwater can seep into surface water bodies, like rivers and lakes. The contaminated groundwater can also contribute to offshore pollution into the ocean. Water contaminants can come from many different sources. For instance, when a car leaks fluids, oil and other hazardous chemicals travel from streets to sewers and eventually streams, ponds, rivers and even the ocean. Illegal dumping of chemicals from factory sites also greatly contribute to water contamination.



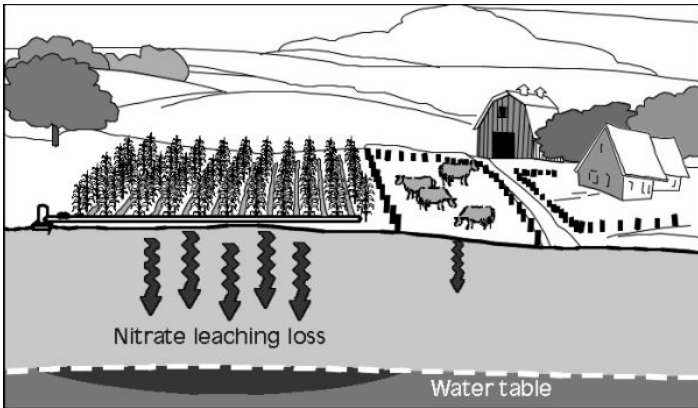
**Figure 2. Groundwater can transport biological, chemical and nutrient contaminants to nearby surface waters.**

Name: \_\_\_\_\_ Period: \_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

## SO WHY IS THIS IMPORTANT TO US?

Anything that makes its way into the water table directly affects our drinking water and surrounding environments. Fertilizers, pesticides and leakage from septic tanks can wreak havoc on aquatic ecosystems and completely disrupt the balance needed for the species living there to survive.

**Phosphates & Nitrates** — Are **nutrients**, substances that provide nourishment, found naturally in our environments (animal wastes), and are needed for plants in order to grow. We also introduce them into our environments through the use of fertilizers on lawns and farmland. They can easily move into other bodies of water like lakes, rivers and oceans. Increased levels of chemical nutrients

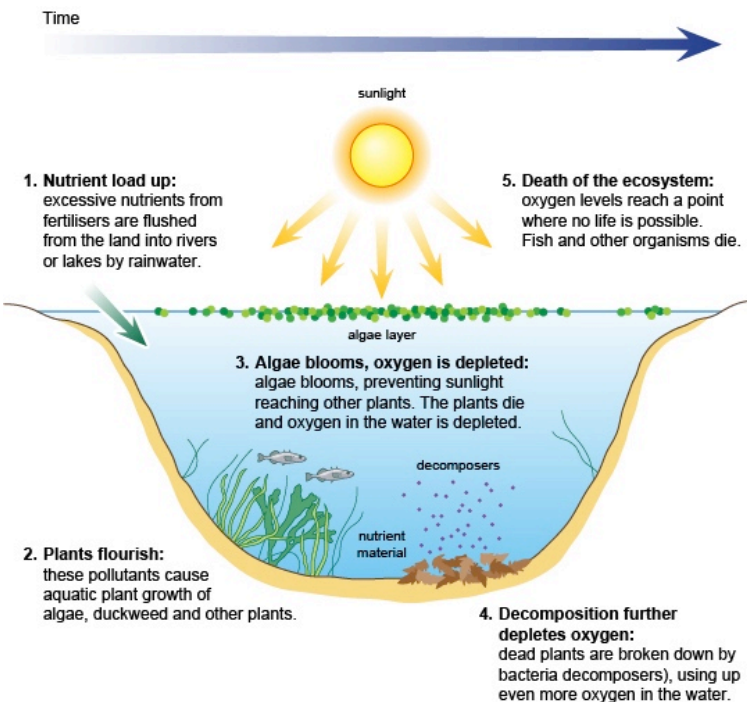


from animal waste, fertilizers and sewage often give rise to eutrophication when washed into nearby surface waters by rain or irrigation. In these environments they are harmful and considered pollutants and contribute to the **eutrophication** of surface water bodies.

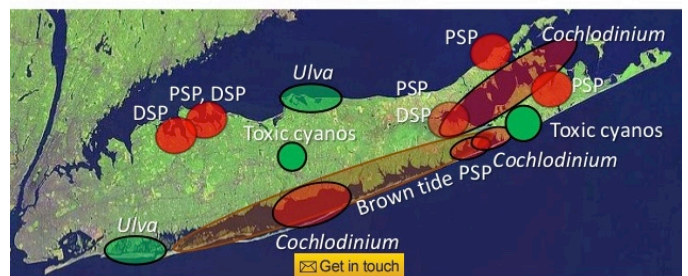
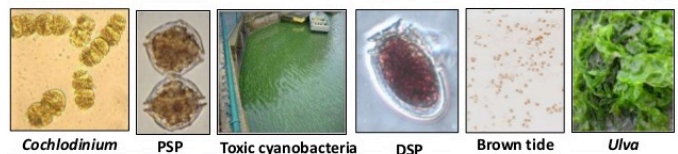
**Nitrogen & Nitrates** — Nitrates are highly soluble and are generally associated with animal waste, septic tanks & fertilizers. In porous, sandy, coarse soils, it will leach downward and contaminate

groundwater supplies. Water with greater than 10 ppm can cause Blue Baby Syndrome (methemoglobinemia), which means red blood cells lose the ability to transport oxygen efficiently.

**Eutrophication:** excessive richness of nutrients in a body of water, frequently due to runoff from the land, which causes a dense growth of plant life and death of animal life from lack of oxygen.



### Harmful algal blooms across Long Island



Name: \_\_\_\_\_ Period: \_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

### Pre-Laboratory Questions

1. How long ago was Long Island formed? \_\_\_\_\_
2. Name the bodies of saltwater that surround Long Island: \_\_\_\_\_
3. What are the aquifers found on Long Island? \_\_\_\_\_  
\_\_\_\_\_
4. Which Aquifer provides Long Island with the majority of potable water? \_\_\_\_\_
5. List three common sources for groundwater contamination and how they pose a threat to Long Island's water supply  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
6. Examples of pollutants to surface water bodies and where they originate from: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Define the following terms:

1. Glaciation: \_\_\_\_\_
2. Moraine: \_\_\_\_\_
3. Outwash Plain: \_\_\_\_\_
4. Aquifer: \_\_\_\_\_
5. Water Table: \_\_\_\_\_
6. Nutrients: \_\_\_\_\_
7. Eutrophication: \_\_\_\_\_
8. Point Source Pollution: \_\_\_\_\_

Name: \_\_\_\_\_ Period: \_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

## Laboratory Exercise: Too Many Nutrients

### Objectives

In this lab exercise you will:

- Observe algae growth caused by excess fertilizer use.
- Discuss how using too much fertilizer can be detrimental to aquatic life.

### Introduction

Farmers, foresters, homeowners, and business people can pollute water by improperly using chemical fertilizers. For example, in urban areas, homeowners often apply more than the recommended amounts of fertilizer to lawns, gardens, and flowers. Farmers applying too much manure or fertilizer at the wrong time can cause similar problems. For instance, it is not good to apply fertilizer during the rainy season. After heavy rains, fertilizer can wash into rivers and lakes and supply the aquatic plants with too many nutrients. As a result, algae can multiply faster and cause algae blooms. Algae blooms can reduce the supply of oxygen in the water because oxygen is required for algae respiration and growth. During the day, algae photosynthesize and produce more oxygen than they can use. But at night when photosynthesis ceases, algae may use more oxygen to grow than may be available. This can deplete the supply of dissolved oxygen in the water. When the algae dies, oxygen is required to break down or decompose the dead algae by bacteria. Both respiration and decomposition can make oxygen unavailable to fish and other aquatic life and may cause fish kills. When plants and animals die, they settle to the bottom. Under normal conditions this causes the water body to gradually fill with sediment and organic material. This process is called eutrophication. This process is accelerated when excess nutrients and sediment are added to a water body.

### Materials (per group)

- Two 5 gallon aquariums or similar clear containers
- 10 gallons surface water to fill aquariums (river, lake, pond)
- Index cards
- Permanent ink pen
- Tape
- Plant fertilizer (nutrient source)
- Measuring spoons
- 2 Grow lights or sun lamps



### Procedure

1. On an index card label one 5-gallon tank "With Fertilizer" and the other 5-gallon tank "Without Fertilizer".
2. Fill each 5-gallon tank approximately  $\frac{3}{4}$  with surface water brought in.
3. Add 75 grams of plant fertilizer to the tank labeled "With Fertilizer"
4. Add 6.25 grams of plant fertilizer to the tank labeled "Without Fertilizer"
5. Place sun lamp or light source near aquariums to ensure both tanks get equal amount of light. Ensure that both aquariums are not in a cold drafty area.
6. Record for your observations for the next 5 days in your science observations journal (color, smell, plant growth if any, insects alive or dead, floating and/or decaying material).



Name: \_\_\_\_\_ Period: \_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

## Laboratory Exercise: Water Pollution and Oxygen Depletion

### Objectives

In this lab exercise you will:

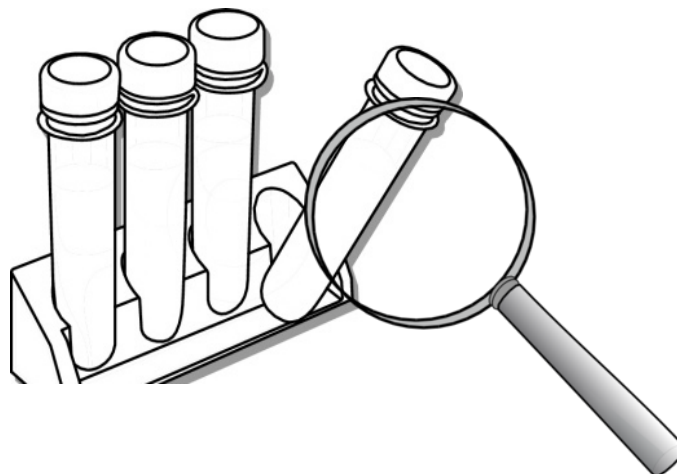
- Observe oxygen consumption caused by natural pollutants.
- Understand the use of a control when conducting experiments.

### Introduction

You have investigated how wastes such as fertilizers that are carried into a waterbody can cause rapid growth of algae. The algae flourish for a short time and then die. But then decomposers cause the dead algae to decay. The decay process uses up oxygen in the water. After a while, fish living in the water die due to lack of oxygen. The change in the water as the oxygen is used up may be detected by using a reagent called Bromothymol blue. Bromothymol blue that is added to the water will become yellow as the oxygen is depleted.

### Materials (per group)

- 4 Corks
- Dead grass cuttings
- 4–16 x 150 test tubes
- Test tube rack
- Disposable pipette
- Glass-marking pencil
- Water
- Dead leaves
- Mud from a puddle
- Bromothymol-blue solution



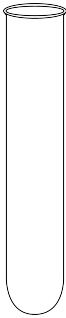
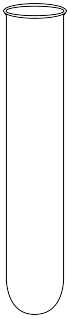
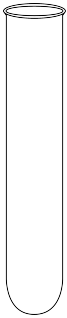
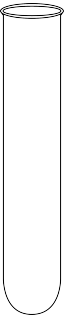
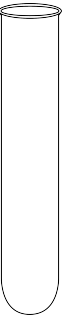
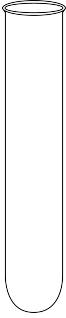
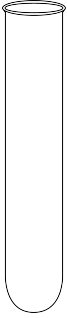
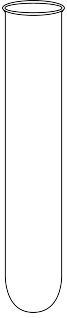
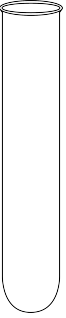

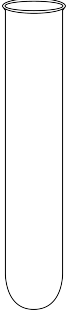
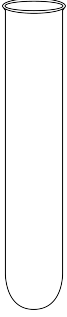
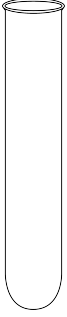
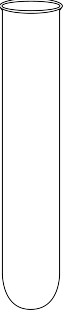

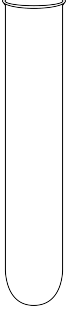
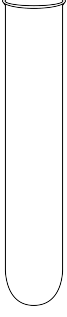
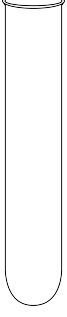
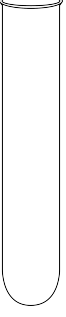

### Procedure

1. Place the four test tubes in the test tube rack.
2. Fill four test tubes about half full of water.
3. Add four drops of bromothymol-blue solution to the water in each test tube.
4. Fill each tube with the designated pollutant:
  - Test Tube 1 – Dead Grass
  - Test Tube 2 – Broken up dead leaves
  - Test Tube 3 – Mud
  - Test Tube 4 – No Materials
5. Use the glass-marking pencil to label each test tube, describing the substance added.
6. Fill all 4 test tubes with water leaving just enough room to cork the top.
7. Put a cork in each test tube.
8. Record your observations for the next 5 days in the chart.



Name: \_\_\_\_\_ Period: \_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

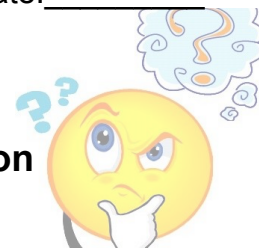
### Laboratory Exercise: Water Pollution and Oxygen Depletion Observation Chart

Test Tube	Pollutant	Observations Day 1 (write/draw)	Observations Day 2 (write/draw)	Observations Day 3 (write/draw)	Observations Day 4 (write/draw)	Observations Day 5 (write/draw)
<b>1</b>	<b>Dead Grass</b>					
<b>2</b>	<b>Broken up dead leaves</b>					
<b>3</b>	<b>Mud</b>					
<b>4</b>	<b>No Materials</b>					

Name: \_\_\_\_\_ Period: \_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

### Post-Laboratory Questions

#### **Laboratory Exercise: Water Pollution & Oxygen Depletion**



1. Which test tube had the biggest color change? \_\_\_\_\_
2. Which test tube has the least color change? \_\_\_\_\_
3. Which was the control test tube and why did we need it? \_\_\_\_\_

\_\_\_\_\_

4. Explain what may have caused the difference between the tube with the most color change and the tube with the least amount of color change:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5. Mud, dried leaves and grass are not always thought to be water pollutants, but when they are excessive they may cause changes to the environment. What other pollutant substances can make their way into surface water bodies? Name the substance and where it originates.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

6. Pick two of your answers from the previous question; can you think of at least 2 ways that we could help reduce this pollutant? Give a brief description of each idea.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_