LLOYD CENTER FOR THE ENVIRONMENT *Protecting nature through research and education*
430 Potomska Road | Dartmouth | Massachusetts | 02748 | tel 508-990-0505 | fax 508-993-7868 | www.lloydcenter.org

Welcome!

Enclosed is a packet of classroom activities to complement the Watershed Watch program, which has been scheduled for your class. This information will help prepare you and your students for our visit and reinforce concepts, which will be covered during the program.

The Lloyd Center is a not-for-profit membership organization located in Dartmouth, Massachusetts, which serves the region of southern New England. The Lloyd Center's mission is to help create the next generation of environmental stewards through education and research; seeking to instill in students of all ages an understanding and appreciation of our coastal environment, its unique and fragile nature and our special relationship and responsibility to it.

We are committed to providing quality, hands-on science programs for students in kindergarten through college. The focus of our efforts is in the interdisciplinary study of coastal environments and watersheds. All of our programs are linked to the current Massachusetts Curriculum Frameworks in Science and Technology/Engineering.

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Watershed Watch Program Overview

The Watershed Watch program is a two-part, hands-on classroom experience designed for elementary school students. Using both the *Enviroscape*, a model that demonstrates how a watershed works and a *Ground Water Flow Model*, that shows how water moves underground and filters through soil; students will discover how water travels through a watershed. Working alongside the Lloyd Center's professional staff, students will observe how pollutants can enter communities' drinking water through run-off and how these toxins flow underground to contaminate groundwater.

Classes are divided into two groups to enhance the hands-on science activities conducted throughout the program. Each group will be led by a staff member who will explain the models and the key concepts. In these groups, students will manipulate the models watching each concept in action. Groups will then discuss how contaminated water sources directly affect the quality of our lives and identify strategies to combat local pollution problems.

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Connections to the Massachusetts Science and Technology/Engineering Curriculum Framework
May 2001

Guiding Principal V: Investigation, experimentation, and problem solving are central to science and technology/engineering education.

Investigations introduce students to the nature of original research, increase students' understanding of scientific and technological concepts, promote skill development, and provide entry points for all learners.

Guiding Principal VI: Students learn best in an environment that conveys high academic expectations for all students.

School districts should also invite role models from business and the community (including professional engineers and scientists to visit classes, work with students, and contribute to instruction.

Guiding Principal X: Implementation of an effective science and technology/engineering program requires collaboration with experts, appropriate materials, support from parents and community, ongoing professional development and quantitative and qualitative assessment.

In addition, local members of the science and engineering community may be able to lend their own expertise to assist with the implementation of a new curriculum. Teachers and administrators should invite scientists, engineers, higher education faculty, and representatives of local businesses and museum personnel to help evaluate the planned curriculum and enrich it with community connections.

Strand 1: Earth and Space Science

In grades 3 – 5, students explore properties of earth materials and how they change. They conduct tests to classify materials by observed properties, make and record sequential observations, note patterns and variations, and look for factors that cause change. Students observe weather phenomena and describe them quantitatively using simple tools. They study the water cycle, including the forms and locations of water. The focus is on having students generate questions, investigate possible solutions, make predictions and evaluate their conclusions.

Topic	Learning Standard	Example
Soil	5. Recognize and discuss the different properties of soil, including color, texture (size of particles), the ability to retain water, and the ability to support the growth of plants.	Students will discover how different types of soil affect the rate of water flow and the ability to absorb water
The Water Cycle	10. Describe how water on earth cycles in different forms and in different locations, including underground and in the atmosphere.	Through the use of surface and groundwater models students discover how water and pollution travel on the surface of the ground as well as how they are transported underneath the ground.
	11. Give examples of how the cycling of water, both in and out of the atmosphere, has an effect on climate.	Students discover how precipitation, especially rain storms affect the local environment.

Strand 2: Life Science (Biology)

Topic	Learning Standard	Example
Adaptations of living things	10. Give examples of how organisms can cause changes in their environment to ensure survival. Explain how some of these changes may affect the ecosystem.	Students discover how wetlands are important not only as a habitat but for control of pollution. Students also discover how changes made to the environment for human use can be detrimental to the environment. Students also learn steps to take to prevent pollution from entering the environment.

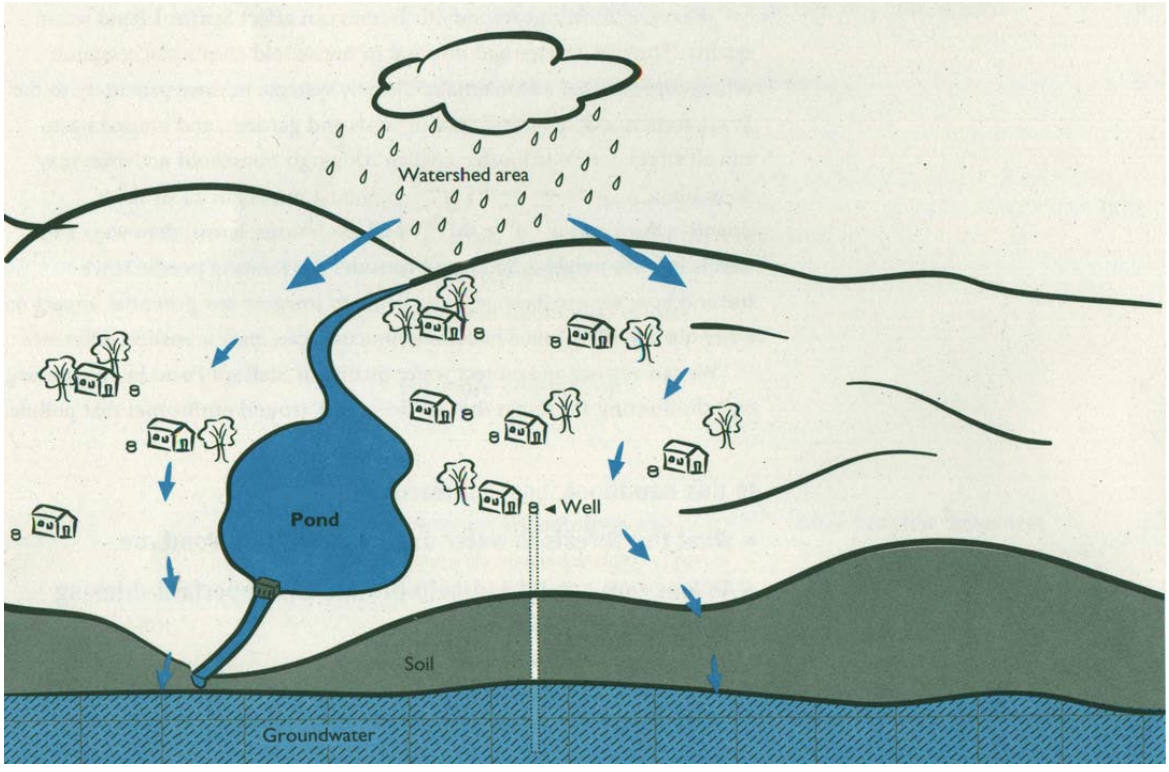
Watershed Watch

A watershed is a way of defining and thinking about where you live. We all live downstream, in a watershed. A watershed's area begins at the top of a hill or mountain ridge. It includes the region that drains into a lake or reservoir. This region can contain farmlands, rivers, streams, wetlands, roadways, forests and our back yards. The watershed also includes the clouds and the atmosphere above us, and the water that seeps and moves underground.

A healthy watershed:

- provides habitats for wildlife and natural communities
- filters pollutants
- recharges ground water
- controls flooding
- supports farm production
    - creates "greenbelts" in our residential areas

A watershed is affected by all living things within it. Whatever we do on the land will directly affect both surface and groundwater quality.



New Bedford's Water Supply
Background Information

- Your drinking water comes almost entirely from surface sources.
- There are very few public (3) and private (2) wells.
- The watershed extends over **50 square miles**.
- The principle storage areas are the Little Quittacas, Great Quittacas, Pocksha, Assawompset, and Long Ponds.
- The streams and five ponds are located in the towns of Lakeville, Rochester, Middleborough, and Freetown. **(See map)**
- The water is treated at the Quittacas Water Treatment Plant. **(#1 on map)**
- It is pumped through a series of conduits to the High Hill Reservoir in Dartmouth**. (#2 on map)**
- From High Hill water is pumped into houses and businesses in New Bedford.
- The reservoir serves approximately **105,000** people.
- New Bedford sells water to the neighboring towns of Acushnet, Fairhaven, Dartmouth, and Freetown.
- The pumping station pumps **15,000,000 gal/day** but can increase this to **45,000,000 gal/day**.

Sources of drinking water include rivers, lakes, streams, ponds, reservoirs, springs, and wells. As water travels over the surface of the land or through the ground, it dissolves naturally occurring minerals and radioactive material. It can pick up substances resulting from the presence of animals or from human activity. Contaminants that may be present in a water source include:

A. **Microbial contaminants**, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife.
B. **Inorganic contaminants**, such as salts and metals, which can be naturally occurring or result from runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming.
C. **Pesticides and Herbicides**, which may come from a variety of sources such as agriculture, stormwater runoff, and residential uses.
D. **Organic chemical contaminants**, which are the by-products of industrial processes and petroleum, and can come from gas stations, urban stormwater runoff and septic systems.

Information provided by the City of New Bedford – Water Quality Report

Dartmouth's Water Supply
Background Information

The town of Dartmouth has a population of 30,666 residents. The land area of proximately 60.91 miles is within the Buzzards Bay watershed.

Where your drinking water comes from:

- There are 3 different Aquifer zones in Dartmouth. Within the zones there are several wells which pump water into holding tanks. There are 11 gravel-packed wells in total. Wells A, B, C, F-1 and F-2 are within the ABC zone.
- Wells D, E-1, and E-2 are within the DUL zone. Wells V-1, V-2, V-3 are within the VOL zone.

- Water from New Bedford is used to supplement the Dartmouth supply. The Faunce Corner pumping station pumps water from the High Hill Reservoir into the Dartmouth system.

- Most residents of Dartmouth (approximately 65%) purchase water from the water department; the remaining residents (approximately 35%) will draw their water from private wells on their property.

Contaminants that may be present in a water source include:

A. Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife.
B. Inorganic contaminants, such as salts and metals, which can be naturally occurring or result from runoff, industrial or domestic wastewater discharges, oil and gas production, mining or farming.
C. Pesticides and Herbicides, which may come from a variety of sources such as agriculture, stormwater runoff, and residential uses.
D. Organic chemical contaminants, which are the by-products of industrial processes and petroleum, and can come from gas stations, urban stormwater runoff and septic systems.
E. Sediment, which come from construction, digging, farming/gardening, and bare earth runoff

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Pre-activities Descriptions

Were You Aware? **Water Precious Water, 1988. AIMS Education Foundation.**

This activity has students predicting the percentages of salt and fresh water found on the earth and comparing their predictions to the actual percentages. Students will practice estimating and graphing skills as well as recoding data. In addition, students gain an understanding of the limited fresh water resources available for human use.

Included in this activity are data sheets, useful background information, discussion questions and activity extensions.

Soil Soakers**. Water Precious Water, 1988. AIMS Education Foundation.**

Students will discover the rate at which water will soak into different soil types. This activity incorporates graphing, measuring and computation skills as well as hypothesizing, data collection/interpretation and drawing conclusions. *Soil Soakers* will prepare students for the *Groundwater Flow Model*, which demonstrates how water moves below the surface.

Included in this activity are data sheets, useful background information, discussion questions and activity extensions.

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Post-activity Description

Something's Fishy Here! **Aquatic Project Wild, 1987. Western Regional Environmental Education Council.**

After completion of the *Watershed Watch* program, students can draw on the lessons presented to them to complete this activity. This activity allows students to identify the cause and effect of water pollution in a given scenario. They will have the opportunity to examine their own opinions and try to cooperatively solve a pollution problem.

Included in this activity are background information, activity extensions and evaluations.