

**Duration: 120 minutes**

### MATERIALS

Chart Paper  
Poster Paper  
Markers, pencil crayons  
Student access to computer with Internet access  
Variety of household items for discussion

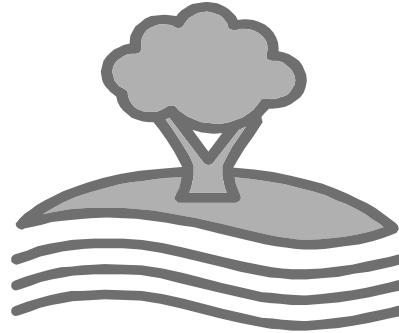
### RESOURCES

Wild Education Website:  
<http://www.wildeducation.org/programs/oceans06/od06-6.html>

[Blueprint For Life/Work Designs – The Quick Reference Guide](#)

### INSTRUCTIONAL METHODS

Brainstorming  
Direct Instruction  
Cooperative Learning  
Research



### LESSON OBJECTIVES

- ✓ Students will understand how uncertainties about the future may lead to creative or alternative choices when making life-enhancing or work-enhancing decisions (BP 8.2.9)
- ✓ Students will understand the importance of water & systems on earth to our sustainability
- ✓ Students will understand the role of a Hydro geologist in management of water resources
- ✓ Students will be able to identify human factors that are threats to watersheds (e.g. vegetation removal, timber harvesting, agricultural practices, urbanizations, impervious ground cover, land alterations, mining, invasive species, dams)

### BACKGROUND INFORMATION

Imagine spending your day exploring an underground cave. You climb along mysterious, dark tunnels and hear the trickle of water. You trace the sound to an opening where water is seeping out from a layer of limestone. You know where to drill into the surface rock to find the source of this underground water. You use computers to search for new sources of water, and to discover new ways to protect groundwater.

Hydro geologists monitor and protect groundwater by making sure it is clean and there is enough for all of us. They take samples of water, soil, and rocks and examine these samples in laboratories, to see how human activity affects this precious resource.

For example, a Hydro geologist might help design a landfill site by discovering where the ground water is, calculating which layers of rock protect the ground water, and understanding which layers of rock filter water for purity. They make recommendations and work with other scientists to plan development projects and to clean up contaminated sites.

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## MOTIVATIONAL SET

Over 70% of our Earth's surface is covered by water. 97.5% of all water on Earth is salt water, leaving only 2.5% as fresh water. Nearly 70% of that fresh water is frozen in the icecaps of Antarctica and Greenland; most of the remainder is present as soil moisture, or lies in deep underground aquifers as groundwater not accessible for human use.

Ask students what percentage of the world's fresh water they think is accessible for human use? Less than 1% of the world's fresh water (~0.007% of all water on earth) is accessible for direct human uses. This is the water found in lakes, rivers, reservoirs and those underground sources that are shallow enough to be tapped at an affordable cost. Only this amount is regularly renewed by rain and snowfall, and is therefore available on a sustainable basis.

Human activity poses a great threat to watersheds. Many human factors are involved in the depletion and deterioration of our watersheds. Ask students how they think human activity is affecting our watersheds?

## PROCEDURE / TIMELINE

### I. Brainstorm (5 minutes)

Have students brainstorm as a class the many uses of water in their daily lives? In other areas?

### II. Discussion (15 minutes)

Teacher will bring in a variety of objects and ask students: Do you think water is needed in the making of or sustaining of this object? Why or why not?

Items might include but are not limited to: an apple; a piece of paper; a juice box; a picture of a person; the gas used to run a car.

The answer is 'yes' to all of the above. In fact, there are five areas of water use:

- Agricultural – 69% of water used world-wide is for irrigation.
- Industrial – power plants use water for cooling or as a power source; oil refineries and manufacturing plants use water in chemical processes
- Household – drinking water, bathing, cooking, sanitation, and gardening account for 15% of water used world-wide
- Recreational – swimming, water skiing, angling, and reservoirs are released to enhance whitewater boating activities
- Environmental – artificial wetlands, fish ladders to allow migration, and water releases to facilitate fish spawning

### III. Cooperative Learning (100 minutes)

Students will be broken up into 11 groups and given one of the following human threats to watersheds. Within each group, they will research and become masters of their threat, give examples that may be occurring in their community and then research or simply suggest alternatives to the threat that they are working on.

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To find alternatives/solutions students may research their threat using the Internet, or create original alternatives that they believe may be the solution to the existing threat.

The group will then create a poster which will be used to elaborate on the threat and the alternatives that the group has created or discovered. The group will then give a brief presentation to the class regarding their threat as well as their ideas for alternatives.

The 11 human factors/threats are as follows with a brief description  
(Source: <http://www.wildeducation.org/programs/oceans06/od06-6.html> ):

- Land Alterations – anything we do on land within a watershed affects the water within it
- Impervious Cover – impervious cover is the sum total of all hard surfaces within a watershed (roadways, parking lots, sidewalks, driveways, etc.)
- Urbanization – replacing vegetation with impervious surfaces increases runoff and the amount of contaminants flowing directly into streams and lakes
- Land-based Water Pollution – did you know that most water pollution is caused by people? Litter, pesticides and herbicides, fertilizers and sewage are among the pollutants that find their way into water
- Vegetation Removal – removing vegetation along river banks and shorelines can destroy habitat for wildlife on the land, and increase sediments and nutrients to the detriment of aquatic life
- Altering Water Flow – water flow is modified when water is impounded or diverted by dams
- Agricultural Practices – removing streamside vegetation for pastures, applying fertilizers and pesticides that run off into water, allowing livestock to contaminate water systems and withdrawing water for irrigation
- Timber Harvesting – timber harvesting can alter stream flow, habitat for forest wildlife and the age of stands.
- Mining Operations: Mining activities basically remove soil and rock from the earth, which are then processed in plants. Tailings (residues from ore concentrations) can contain toxic chemicals and are often stored in piles or ponds close to a mine, making them accessible to water and increasing the potential for heavy metal contamination in aquatic communities.
- Invasive Species – alien invasive species (e.g. zebra mussel, spiny water flea, purple loosestrife) introduced from different parts of the world can compete with native wildlife and speed up the loss of their habitats.
- Accelerated Climate Change – the earth's climate supports life thanks to the greenhouse effect. Greenhouse gases — carbon dioxide, nitrous oxide and methane — trap solar heat in the atmosphere, maintaining temperatures well above those expected of an Earth without them. Rapid growth and industrialization over the last century has resulted in an increase in greenhouse gases released into our atmosphere, warming the planet and resulting in climatic changes. When temperatures rise, air can hold more water, and more polar ice melts than refreezes. These effects can influence the supply of water available in watersheds, which in turn affects all living things in and around them.

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## DEBRIEF

In review, this lesson was intended for the students to discover the many threats that humans pose to our watersheds. In the discovery and research of these everyday threats, students investigated and created solutions and/or alternatives to these practices. Much like the Hydro geologist, who works to maintain our groundwater resources, the student assumed this role by probing into the threats that humans pose, suggesting alternative choices/creations, and then elaborating their findings and problem-solving efforts to their classmates.

Students may be asked: How does a Hydro geologist work to maintain our watersheds? Does a Hydro geologist care about future threats to our watersheds? What can they do to prevent these future threats? What other types of careers may have been created in response to concerns about our environment and sustainability of our water resources?

Students should be able to identify the factors/threats that humans pose to watersheds and be able to think scientifically, suggesting sustainable solutions to these current and future problems that, as a future Hydro geologist, may be a large part of their career.

Students may be asked: What subjects would a Hydro geologist need to be good at in order to have success? Would a career in hydro geology interest you? Why or why not?

## ASSESSMENT / INDICATORS

Informal and formal assessment will be indicated in this lesson.

The ability to work in a cooperative learning environment may be monitored using anecdotal notes and/or checklist.

Also, the posters and presentations may be assessed using a small rubric looking for indicators that each group understood their particular threat, the ingenuity of their solution and the ability to convey their message to their classmates.

Finally, a simple peer assessment may be done for each group's presentation to ensure that all students understand and can identify the threats that humans pose to watersheds.