

*From the Mountains to the Estuary:
From the Schoolyard to the Bay*

Meaningful Watershed Experiences for High School Students



With grant support from the
NOAA Bay Watershed Education Training (B-WET) Program



In partnership with:



Investigating Human Impact

Design Your Own Water Filter

Overview

In the engagement activity (adapted from *WOW: The Wonders of Wetlands*¹), students discover that fresh water is a renewable natural resource but that it is locally available in limited amounts at any given moment. So conservation of this resource is important. Students will problem solve to create their own water filter and collect data to test their results.

Background

- 71% of the planet Earth is covered with water.
- Only 3% of the water is fresh; only 0.6% is non-frozen.
- Only 0.00003% is not polluted, or trapped in soil or groundwater too far underground.
- On a global scale only a small percentage of water is available for use.
- Geography, climate, and weather effect water distribution.
- Land and water use for agriculture, industry, and homes affect the quantity and quality of available fresh water. This in turn affects our watersheds and wetlands.

Materials

- Water
- 1000 mL beaker
- 100 mL graduated cylinder
- Petri dish
- Salt
- Globe
- Large sheet of white paper
- Bucket
- 2 L pop clear pop bottle per group cut as shown



- Sand
- Gravel
- Activated carbon (charcoal)
- Cotton balls
- Cheese cloth

¹ To obtain, please see http://www.wetland.org/education_wow.htm or any national book retailer.

- Paper towels
- Sponges
- Soil
- Lemon juice
- Motor oil
- Fertilizer
- Pieces of paper
- Chocolate sprinkles
- Spices
- Labquests with pH probe, turbidity probe or water quality test kits
- Nitrogen test kit

Engage:

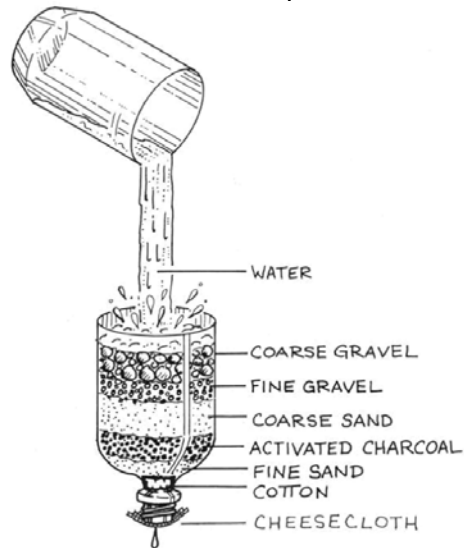
1. Show the class 1000 mL of water. This represents all of the water on earth. Question: Where is most of the water on earth located? (*About 97% of all water is in the ocean.*) Use the globe to demonstrate.
2. Pour 30 mL of water into the 100mL cylinder. Add salt to the 1000 mL beaker to show that this is unsuitable for human consumption. Question: Where is most of the fresh water on the planet? (*About 80 % of freshwater is frozen in ice caps or glaciers.*)
3. Pour 6 ml of water into a dish. This is the only non-frozen fresh water.
4. Remove a single drop of water from the dish using an eye dropper. This water, about 1.5 mL is surface water- the rest is groundwater.
5. Drop that drop of water into bucket- represents 0.00003% of total!
6. Ask students what are the consequences of having such a small amount of water available for human consumption? *Conservation, don't pollute, use wisely*

Learning Experiences:

A. Explore

1. Show students gallon container of clean water. Hand out the student data sheets.
2. As a class, collect the following data about the tap water: odor, turbidity, appearance, pH, nitrogen. You can either use the water quality test kits or demonstrate how to use the Vernier probeware (see appendix for instructions)
3. After you have collected the results from the tap water ask the students what are some ways that the small amount of fresh water we have on earth can become polluted? (Guide students for answers) As they answer- add pollutants to the fresh water as follows:
 - a. Oil spills- add motor oil
 - b. Sediment- add soil
 - c. Nutrients- add fertilizer
 - d. Trash- add paper pieces
 - e. Acid rain- add lemon juice
 - f. Industrial waste- add spices
 - g. Agricultural waste- add chocolate sprinkles
4. Mix the water in the container and pour it into a clear beaker. Does this look like water you would like to drink?

5. Tell students that their challenge is to work in a team to create a water filter that will remove as many of the pollutants as possible.
6. Go over the materials that they can use to create their filter.
7. They will make their filter in the top half of the soda bottle and filter the water into the lower half. See example filter below:



Note: The diagram to the left is just an example of one type of filter. Encourage the students to be creative to design their own filter with the materials they predict will work best.

8. Before they filter their water they should collect data using the water quality test kits or Vernier probeware.
9. Have them record their data on their data sheet.
10. When they have completed their tests, have each group share their results with the class and discuss what type of filter worked the best and why.

Water Filter Challenge

Date: _____ Names of Team Members: _____

Record Your Water Quality Data on the Table Below:

| Properties | Clean Water | Gray Water | After First Filtering | After Second Filtering |
|------------|-------------|------------|-----------------------|------------------------|
| Appearance | | | | |
| Odor | | | | |
| Turbidity | | | | |
| pH | | | | |
| Nitrogen | | | | |

Draw and Label a diagram of your filter in the space below:

Conclusion:

1. Did your filter help to clean the water? _____ How do you know?

2. What would you change if you could create a different filter?

B. Elaborate:

1. To further investigate human impact on our watershed, have the students visit:
<http://www.cacaponinstitute.org/high.htm>
2. Have the students click on the “Decision Matrix” listed under activities.
3. Students should read the background about how each decision will impact the watershed and then complete the activity.
4. In teams, have them share the results of their decisions