Flasks, Faucets and Fountains–Where Does your Water Come From?

Essential Questions

- What is the nearest source of municipal tap water?
- How far must the water travel from the municipal supply compared with popular brands of bottled water?
- How do tap water and bottled water compare in terms of cost and pollution?

Objectives

- Identify the local watershed and map its main reservoirs.
- Estimate and compare distances that tap water travels to its end user compared with bottled water.
- Compare aspects of bottled water with tap water including cost, use of fossil fuels and potential for pollution.

Teacher Notes

It's easy to slip into thinking that water comes from a tap or a bottle. Indeed it does. But how does it get there?

In this activity students will connect the dots. First they will identify their local watershed from the EPA website. They will then map reservoirs and estimate the distance to water treatment plants. They estimate the distance to their school or home. This will illustrate how far water must travel to reach them from the local water source.

By way of comparison, students then map the sources of brands of bottled "spring" water to identify their source. They will compare this data to their maps of local water. The activity will demonstrate that bottled water typically travels a lot further from its source than tap water.

Students then compare several aspects of bottled water with tap water including cost, use of fossil fuels and potential for pollution.

Tips

- Students will need Internet access for the activity.
- Download the infographic and print to show students or embed it in your own page (code is provided on the page link below).
- Some brands of bottled water may not list the location of the water source. Be sure to choose a brand that lists the location of its water source.

Engage

- Review some of the water Fun Facts (see Teacher Background).
- Introduce students to key concepts (see Teacher Background) to explain why we should care about where our water comes from.
- Show the students pictures of pollution caused by plastic bottles.
- Have students experiment with a new EPA mapping site: http://watersgeo.epa.gov/mwm/ They can map rivers and streams, watersheds, water quality data and so forth. Google Earth is another fun application for exploring local water features.

Explain (Sample Answers to Analysis Questions)

1. Answers will vary. In most cases, the distance from the home or school to the local reservoir will be less than the distance from the home or school to the bottled water source.
2. Calculations as follows:
    - 1000 x 5 = 5000 liters
    - 5000/20000 =0.25 liters diesel per bottle
    - 0.25 x 2.67 = 0.67 kg of carbon per bottle
    - 0.67 kg = 1.5 pounds

    Other sources of carbon emissions associated with bottled water include:
    - Production of plastic for the bottles
    - Energy used to extract, treat and cool bottled water
    - Energy associated with disposal of plastic water bottles
3. Providing drinking water by pipe from a local reservoir is more efficient than by truck from a bottled water source. Bottled water has to be transported over long distances, which uses fossil fuels and adds to the cost of the water. Also, fossil fuels are used in manufacturing plastic bottles.
4. Since bottled water is not independently checked for quality, there is a chance that it is a lower quality than tap water, which is constantly monitored for quality.
5. Bottled water causes pollution due to its transport, manufacturing of plastic bottles and waste when bottles are not recycled.

Useful Links

http://cfpub.epa.gov/surf/locate/index.cfm
http://www.onlineeducation.net/bottled_water
http://waterdata.usgs.gov/nwis
http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm203620.htm
http://www.epa.gov/ogwdw000/faq/pdfs/fs_healthseries_bottlewater.pdf
http://storyofstuff.org/bottledwater/about/
http://www.pacinst.org/topics/water_and_sustainability/bottled_water/index.htm

Plastic bottles cause serious pollution if not disposed of correctly or not recycled. Most plastic water bottles are not recycled.
http://www.bigstockphoto.com/image-3612350/stock-photo-polluted-beautiful-landscape

Flasks, Faucets and Fountains—Where Does your Water Come From?
Student Resource Page

In this lab, you will determine the source of your local water supply. You will then estimate the distance from the source to your school or home. You will compare the distance this water must travel with the distance travelled by a popular brand of bottled water. Then you will compare various aspects of tap water with bottled water.

Objectives

- Identify the local watershed and map its main reservoirs.
- Estimate and compare distances that tap water travels to its end user compared with bottled water.
- Compare aspects of bottled water with tap water including cost, use of fossil fuels and potential for pollution.

Materials

- Bottle of water (popular commercial brand)
- Computer with Internet access

Procedures

A. Identify your watershed and estimate the distance from a reservoir to your home

1. Go to the following URL online: http://cfpub.epa.gov/surf/locate/index.cfm
2. Select the option "Zip code" from the menu. (Alternatively, you can use your city name.) Enter your Zip code in the "geographic information" field.
3. Click "Submit." The new page will show your watershed name and a map.
4. Enter the name of your watershed in the table on your worksheet.
5. Visit the following URL online: http://waterdata.usgs.gov/nwis
6. Select "Data Mapper" from the pull-down menu (on the right hand side of the page). Select your state. Click Go.
7. A map will load in the page on your browser.
8. Enter your zip code in the field on the upper part of the page. The map will zoom to your area.
9. Check the box "Surface water sites" and deselect the others.
10. Identify the nearest large water body on the map. This is likely the reservoir or lake that supplies your drinking water. You can click on the triangle to get information about facilities near the reservoir.
11. Find your school or home on the map. (Hint: If you're uncertain of the location of your school or home, open another browser window and use Google Maps to find the location.)
12. Use the scale on the map to estimate the distance from the reservoir to your home or school. (Alternatively, enter the location of the reservoir and that of your home or school into Google Maps. Click Driving Directions to get the approximate distance.)
13. Enter the distance in the table.

Flasks, Faucets and Fountains–Where Does your Water Come From?
Student Resource Page (Continued)

B. Identify the source of a popular brand of bottled water and the distance it travels to the end user

1. Identify the brand of bottled water. Enter its name in the table.
2. Examine the label on the bottled water. The label will list the source of water.
3. Enter the location of the bottled water source and that of your home or school into Google Maps. Click Driving Directions to get the approximate distance.
4. Enter the distance in the table.

C. Characterize differences between bottled water and tap water

1. Study the infographic that compares bottled water with tap water.
2. Create a table that includes the following features of tap water and bottled water: Relative distance from source to end user, Cost per gallon, Testing for E. coli, Testing for water quality, Potential for pollution.

Analysis

1. Which distance was greater, the distance from your home or school to your local reservoir, or the distance from your home or school to the bottled water source?
2. Assume the following:
   - The bottled water plant is 1000 km from your school or home.
   - A truck carries 20,000 bottles of water
   - The truck has a fuel efficiency of 5 km per liter of diesel.
   - Carbon emissions of burnt diesel is 2.67 kg per liter.

   How many pounds of carbon enter the atmosphere for just one bottle of water to reach your home or school? What other sources of carbon are associated with bottled water?
3. Which method is more efficient for providing drinking water, by pipe from your local reservoir or by truck from the bottled water source? Explain.
4. Which is method is likely to have lower water quality? Explain.
5. Which method has the higher potential to cause pollution? Explain.

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Student Worksheet

Name of watershed	
Name of nearest reservoir	
Distance from reservoir to school or home*	
Name of bottled water brand	
Location of water bottling facility	
Distance from water bottling facility to school or home	

*Note: If your home or school uses well water or other private water supply, the distance from the source is likely much less than the distance to the reservoir.