The Water Cycle in Greater Victoria

Key Concepts

- The Greater Victoria drinking water supply system is dependent on annual precipitation, which falls mostly as rain.
- Responsibility for water is everyone's concern.

Method

Students learn about the local water cycle by building a watershed model in the school yard.

Activity Information Box:

Time Required: 120 minutes or more

Grade Level: Grades 8-11

Key Words: *water cycle, watershed, evaporation, condensation, precipitation, evapo-transpiration, infiltration, aquifer*

Materials:

- sloped area in schoolyard
- watering can or hose
- container to hold water
- plastic sheet & chairs (optional)
- a variety of rocks, sticks, model trees, garlands, foam blocks, model houses, sponges, bowls, carpet samples to add to watershed model
- Water Cycle diagrams
- food dye, juice crystals, soy sauce

Setting: indoors & outdoors

Skills: Gathering information, Hypothesizing, Interpreting, Analysing, Scientific processes

Subjects: Science 8-10
Earth Science 11

Learning Outcomes:

It is expected that the student will:

- Explain the Greater Victoria area water cycle and how it affects their water supply;
- Predict where water will flow in a watershed model.

Background

The **water cycle** is the term used to describe the movement of water – in our atmosphere, over our land, and through our soils. In the water cycle, water moves through different states such as liquid, solid and gas, all driven by the sun's energy. The water cycle has no starting point per se as water is continually changing states. The water cycle in the Greater Victoria area, as everywhere, has its own distinct pattern.

The lands around Greater Victoria lie within the Dry Coastal Belt and have a Northern Mediterranean type climate. If you look at the local water cycle from a starting point in the ocean, air masses over the Pacific Ocean pick up moisture through **evaporation** from the ocean. **Condensation** occurs when the vapour rises into the atmosphere where cooler temperatures cause it to condense into clouds. As winds push clouds towards Southern Vancouver Island, they lose much of their moisture in the Olympic Mountains to the south. How does this happen? The mountain ranges force air to rise and cool forcing moisture in the clouds to fall as **precipitation** - either rain or snow. As clouds move eastward over the island, little moisture is left in the air masses; as a result, the land on the southern tip of Vancouver Island and the east coast of the island lies in a dry coastal belt.

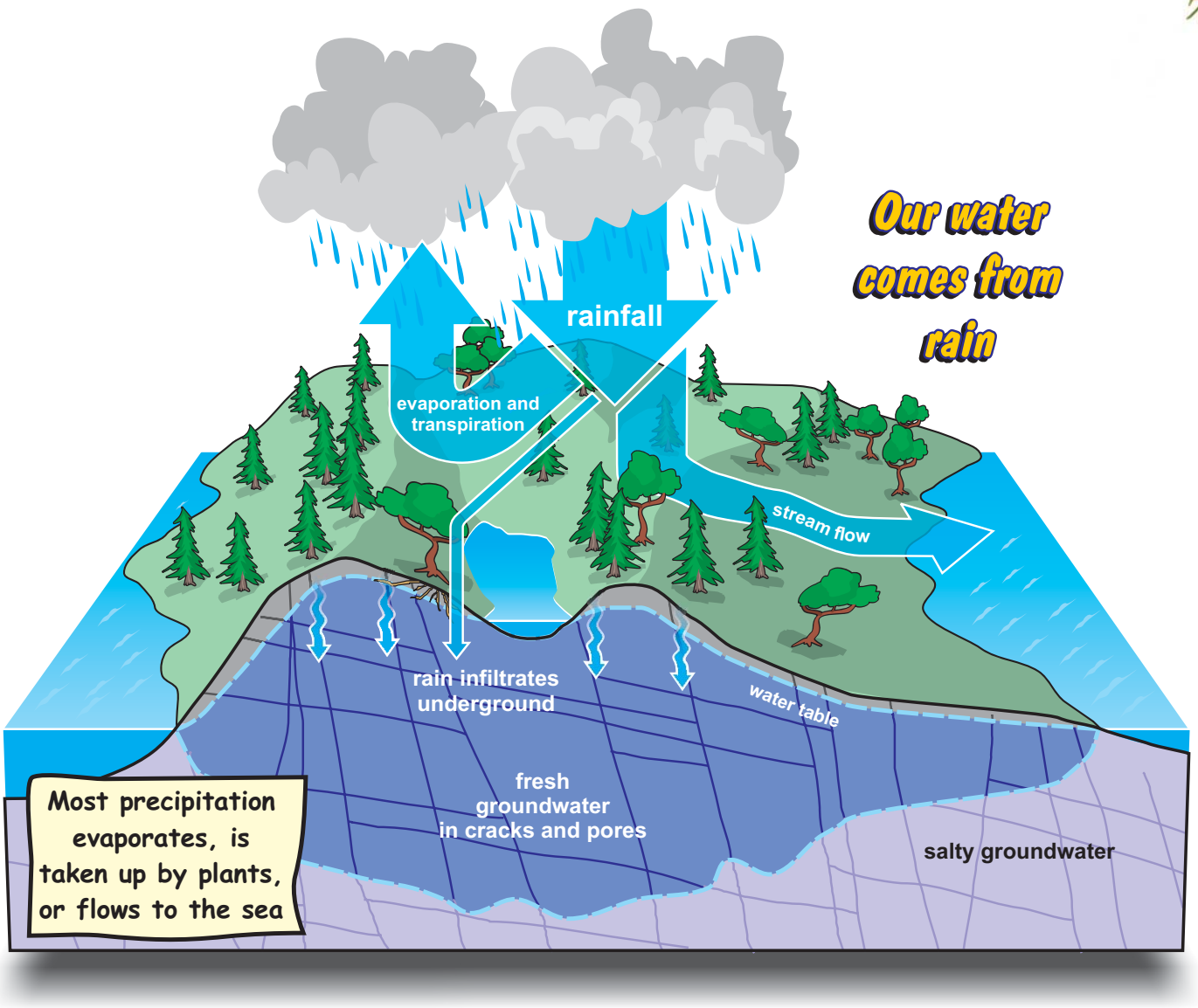
The precipitation that does fall on the Southern Vancouver Island comes from rain (or occasionally snow). Most of this precipitation evaporates off of the soil and water bodies, is taken up by plants (**evapo-transpiration**), or flows into streams and then into the ocean (**runoff or surface flow**). Rainwater flows into streams – sometimes with a pause in wetlands or lakes – or sinks into the ground (**infiltration**) to join the slow moving ground water system.

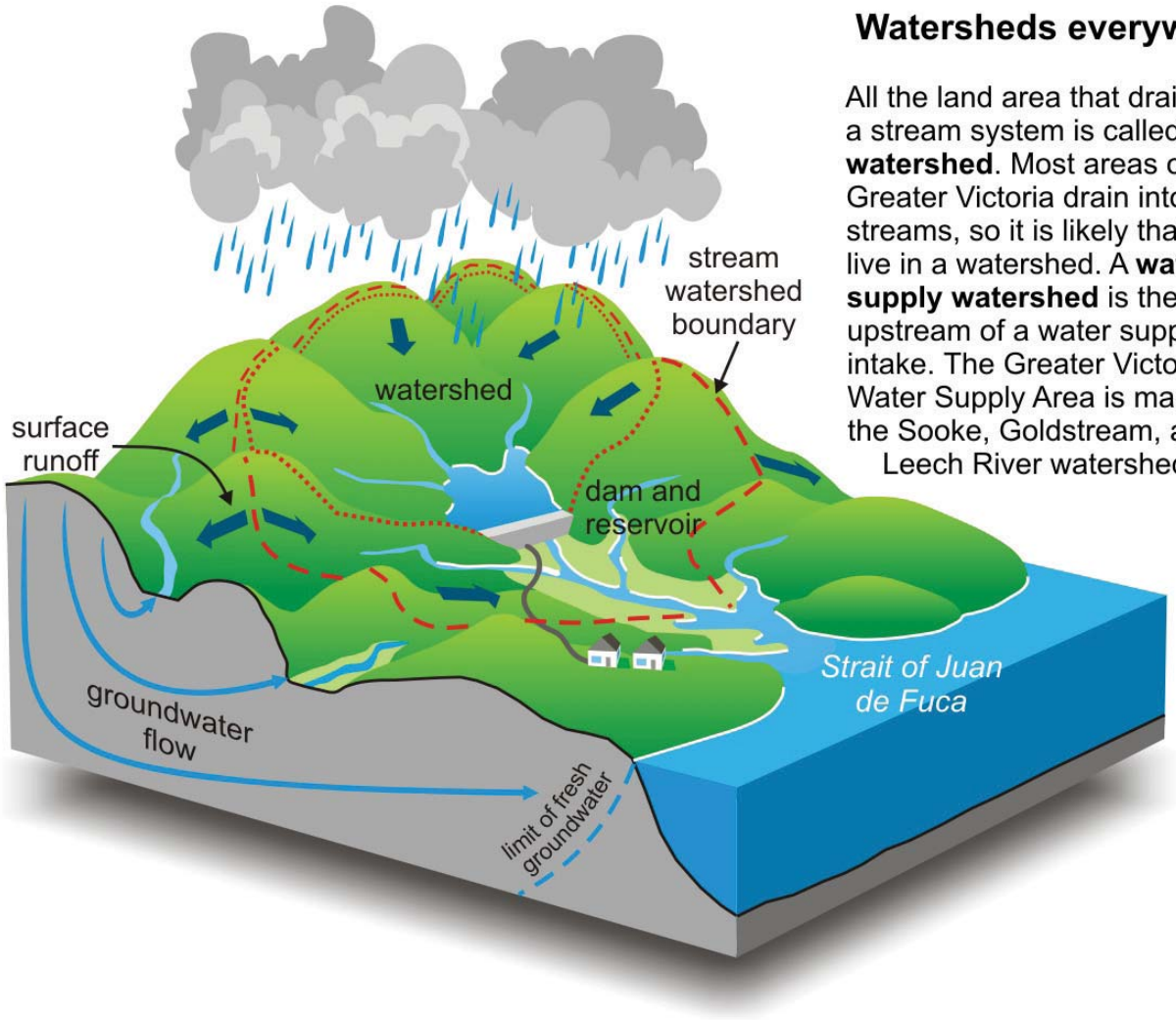
Watersheds connect us to the water cycle because the water that is collected in a watershed supplies the water we drink. In the case of Greater Victoria, the Sooke Reservoir watershed provides much of the tap water to our homes, schools, and businesses. Watersheds, also called "catchment" or drainage basins, can be defined as all the land area that drains into a stream system or other body of water such as a lake. There are many types of watersheds; drinking water supply watersheds, urban watersheds, underground catchments called aquifers, to name a few. A drinking water supply watershed is designated as such because it drains into a reservoir or other drinking water supply intake. Watersheds vary in size from that of a pond to very large areas such as the Fraser River watershed - the largest in the province of British Columbia.

One of the keys to understanding the local water cycle and how it affects our water supply is that, by far, most of our precipitation comes from winter rains; very little falls as snow; and relatively little water is stored as it moves through the water cycle.

Storage of water in watersheds can take place in the form of yearly snowpack or glaciers, and in water bodies such as lakes and wetlands, which act as "sponges" to store and slowly release water. Because much of Greater Victoria's annual rainfall comes during the winter without the benefit of snowpack or glaciers, there is limited storage in reservoirs, lakes, and wetlands. It is this limited supply that provides us with the water we use every day throughout the year.

Our water comes from rain

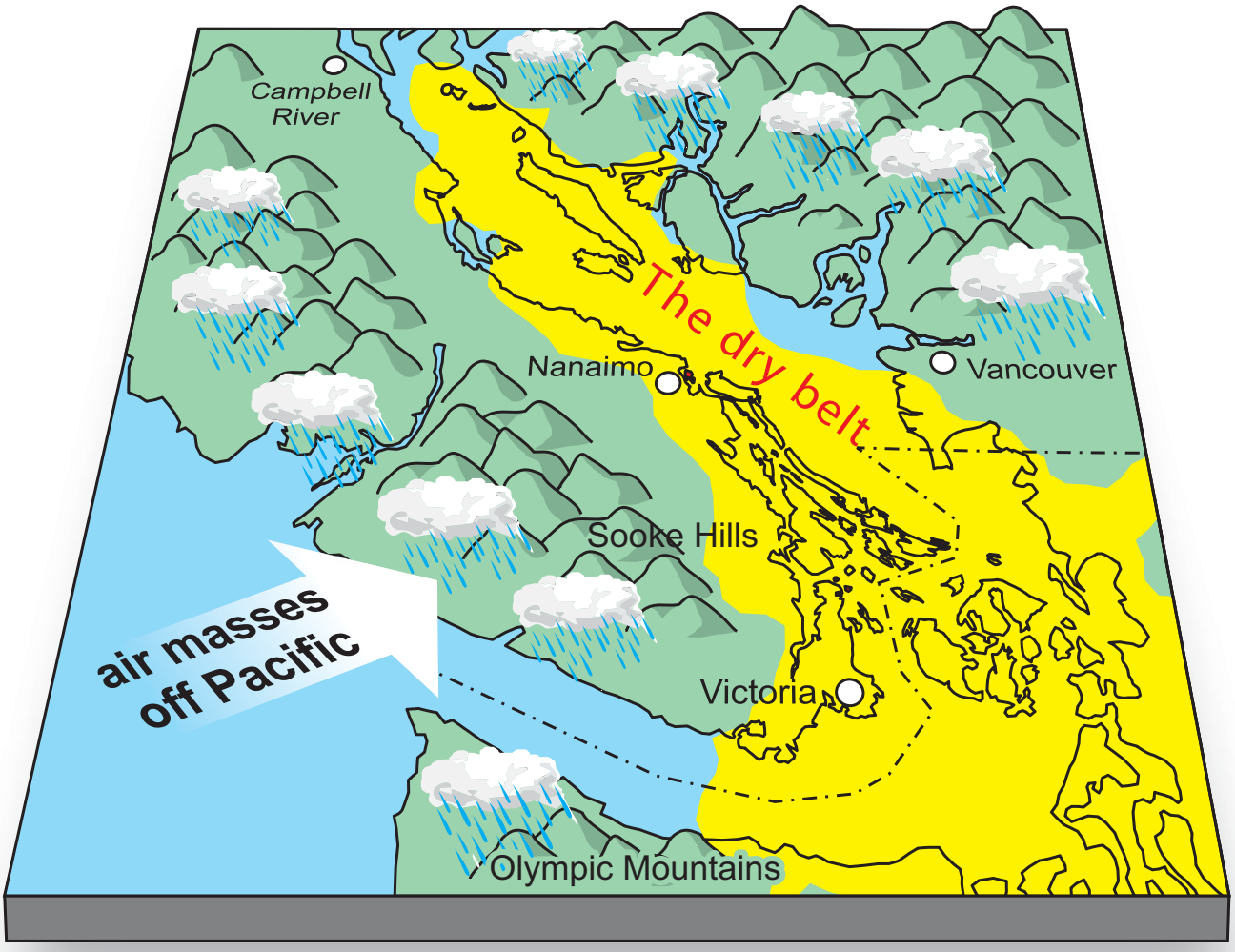




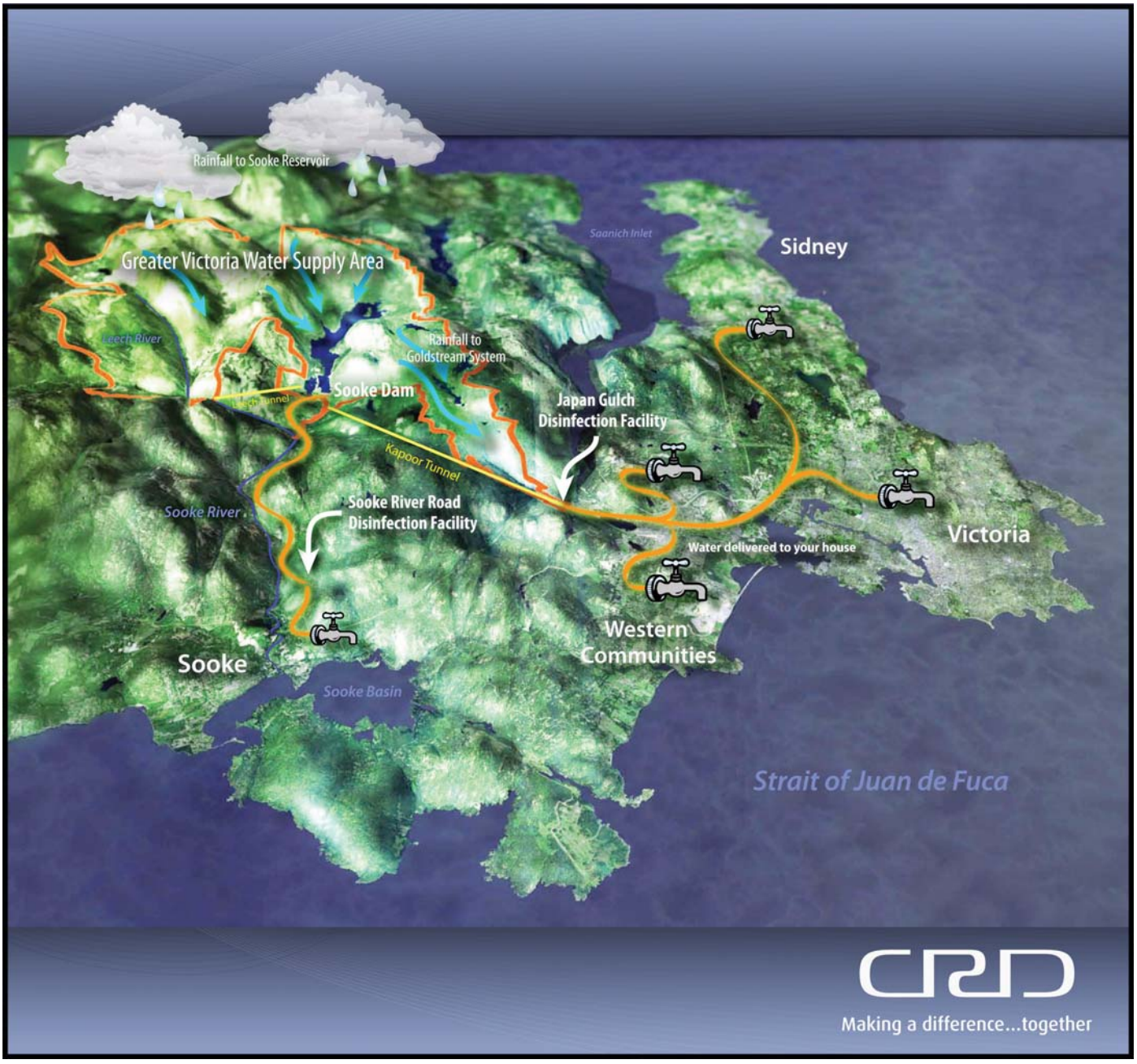
Watersheds everywhere!

All the land area that drains into a stream system is called a **watershed**. Most areas of Greater Victoria drain into streams, so it is likely that you live in a watershed. A **water supply watershed** is the land upstream of a water supply intake. The Greater Victoria Water Supply Area is made up of the Sooke, Goldstream, and Leech River watersheds.

Greater Victoria: in the Dry Coastal Belt

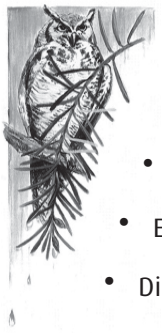


Watersheds and Water Supply



PROCEDURE

1. Review the water cycle with students and discuss how condensation, precipitation, evaporation, and evapo-transpiration work using the diagrams provided. For further information, see background information and graphics.
2. Introduce the concept of watersheds. Ask students – where do they think water comes from? Where do they think it goes? Record their answers.
3. Tell students that watersheds connect us to the water cycle because the water that is collected in a watershed may supply the water we drink. In the case of the Greater Victoria, the Sooke watershed provides most of the water to our homes, schools, and businesses. Refer to the graphic Watersheds and Water Supply.
4. Take the class outside to a sloped area in your school yard. Tell students they are going to make a model watershed to see how water moves through the water cycle. At the top of the slope is the top of the watershed or height of land while at the bottom is the ocean. Place a filled water container (garbage can) at the top of the slope, along with the filled watering can. You can also use a "Dig This" water adapter mister instead of a watering can.
5. With class gathered around the watershed area, review how the sun's energy drives the water cycle beginning with, for example, evaporation off the Pacific Ocean. Tell students that most of our weather systems come from the Pacific Ocean, moving east towards Vancouver Island. Ask students what happens to these weather systems when they hit the mountains north of Victoria and the Olympic range to the south? Have students demonstrate precipitation from the top of the watershed using a watering can or mister.
6. Now build the rest of the watershed – using sticks, rocks, etc. Place items on the slope, digging out streams, rivers, and lakes, carefully setting aside any vegetation to replace after you are done modelling. (Note: if you don't want to dig into the soil, you can build a watershed by placing chairs and other items on the slope, then placing a plastic sheet or tarp over them to represent the watershed area.) If desired, ask students to record their observations of the watershed model incorporating key terminology.
7. Ask students to predict what will happen to the watershed when it "rains."
8. Using the watering can, water the height of land to demonstrate precipitation and the movement of water into streams, rivers, lakes and ultimately the ocean.
9. Ask students whether all the precipitation flows into a stream or lake. Note that some of the water goes into groundwater via infiltration.
10. Introduce evapo-transpiration into the model by adding forests (model trees, cut up "Christmas garland", or sticks on samples of carpet), and increasing the water-holding capacity of the watershed by adding wetlands (sponges) and lakes (bowls). Let it "rain" again and have students explain the importance of forests, wetlands, and lakes.
11. Watersheds are homes to both wildlife and people. Ask students to add model houses, towns, or cities. What are the impacts of cities and towns on watersheds? How would logging or land development impact the watershed?
12. If pollution were to enter the watershed – what impact would it have? Add drops of food dye, juice crystals, or soy sauce to water flowing through the watershed to represent pollution.
13. If a watershed was a water supply watershed – how could human activities in the watershed affect water supply? Should we allow activities such as logging or development in our water supply watersheds? Why or why not?
14. Repeat the exercise as many times as you have time for, changing the features of the watershed. **When done, carefully replace any vegetation you have removed.**



Evaluation

Have students:

- Describe the water cycle in the Greater Victoria area by using at least five key words;
- Explain why Greater Victoria is in the Dry Coastal Belt;
- Discuss reasons why a water supply watershed must be protected.

Extensions

1. Do the activity The Incredible Journey from Project WET (page 161) for an active simulation of the water cycle and the many paths as water changes from state to state. Or, alternatively, complete Catching Clouds in a Bottle from BC Science 8 (page 363) to model cloud formation.
2. Compare two sites: one grassy sloped area and one with a bare slope (no plants)using two basins on a table. Ask students to predict any differences in the quality of water flowing through each system. Demonstrate how erosion on the bare slope increases when it "rains."

Community Connections

Go to **http://www.crd.bc.ca/water/** to find information on watershed protection and local precipitation data.

Borrow a watershed model from the Stream Team Society. Phone **250-479-7041**

Informaton on local watersheds may be found at **http://www.crd.bc.ca/watersheds/**

Additional Resources

BC Science 8. 2006. See section on the Water Cycle (pages 360-367)

Bill Nye the Science Guy: the water cycle, DVD. Available from: **http://dep.disney.go.com/educational/billnye**

Teaching Green - The Middle Years: Hands-on Learning in Grades 6-8; and
Teaching Green - The High School Years: Hands-on Learning in Grades 9-12;
available from: **http://www.greenteacher.com**

Rivers Day: Celebrate BC rivers - **http://www.riversday.bcit.ca/**

References

What is the Water Cycle? US Geological Survey. **http://ga.water.usgs.gov/**

Waterscapes Posters from Natural Resources Canada. **http://geoscape.nrcan.gc.ca**