LESSON 2.1: WHAT IS A WATERSHED?

** For detailed information on the Skeena Watershed, please also review Lesson 2.2: My Home, My Watershed: Exploring the Skeena Watershed. A workshop and powerpoint presentation are also available combining Lesson 2.1 and 2.2.*

GRADE LEVEL: Grades 3-8 (can be adapted for appropriate grade level)

OBJECTIVES:

Students will be able to:
- Explain what a watershed is and how the landscape dictates the watershed boundary
- Explore how watersheds work and their value to the overall ecosystem

ACTIVITIES:

1. The Earth as an Apple Demonstration
2. Two Water Cycle Experiments (for younger grades)
3. Water Infiltration Demonstration
4. Soil Erosion Demonstration
5. Basic Watershed Concept
6. Crumpled Paper Watershed Model
7. Build a Watershed Model Demonstration
8. Build a Simple Watershed Model Activity

OVERVIEW

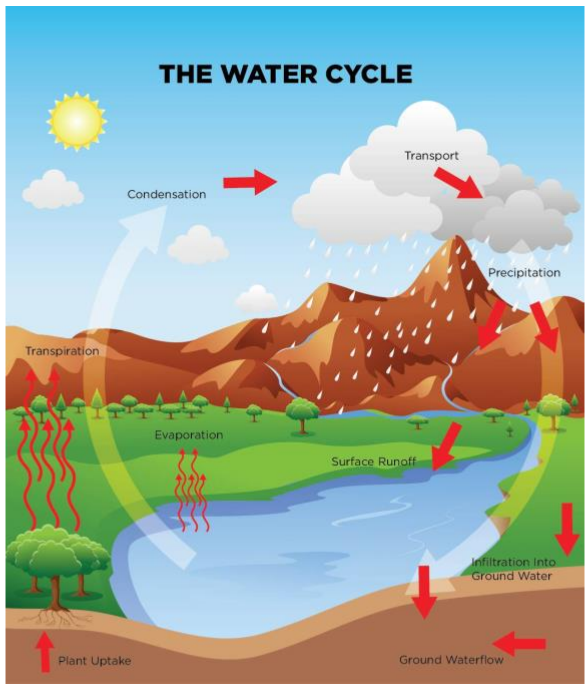
Everyone lives in a watershed. Watersheds are land areas that funnel water to a common low point – usually a stream, lake, river or out to the ocean. Each watershed is separated from the one next to it by a height of land or ridge, called a divide. When it rains, water flows down from areas of higher elevation following the natural shape of the land. Along the way, rainwater and urban runoff can collect and deposit trash, sediment, metals, fertilizers, pesticides and other pollutants into our local waterways. All of our actions affect the health of the waters than run through our watershed. Preventing pollution and contamination from entering our local waterways is everyone's responsibility.

BACKGROUND INFORMATION

Overview of the Water Cycle

About 70% of the Earth is covered by water, and most of the Earth's water is found in the ocean (97.5% of the Earth's water is salt water and not drinkable). Only 2.5% of the Earth's water is fresh water, and only 1% is easily accessible in lakes, rivers and groundwater. Most fresh water is trapped in icecaps, glaciers and snowfields. Canada is home to 20% of the world's freshwater.

Water evaporates from the ocean, lakes and rivers and condenses into clouds. When these clouds fill with water, the water will eventually fall as precipitation. Precipitation can be rain, snow, hail or sleet. Once the rain hits the ground, it will flow downward following the path of least resistance. For some of the water, this will be in the form of infiltration, which means that the water flows through the soil to the ground water. For some water, this will be in the form of surface flow in creeks and rivers. In both cases, the water will continue to flow and pick up minerals, nutrients and pollution, until it reaches a body of water that is at low elevation. For most water, this ends up being the ocean. Then evaporation continues the cycle. Check out ***Activity #2 (The Earth as an Apple)*** at the end of this lesson plan to demonstrate to the students about the distribution of salt water, fresh water, inhabitable and habitable land on the earth.

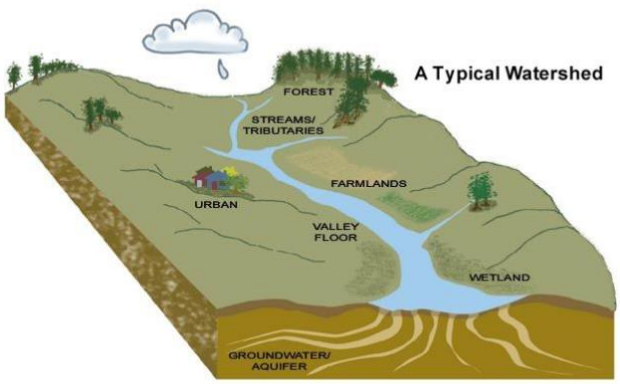


Source: Science World (www.scienceworld.com)

What is a Watershed?

A watershed is an area of land where all the surface water drains (or funnels) into a common low point, whether it's a creek, a stream, a river or an ocean. Each watershed is separated from the one next to it by a height of land or ridge, called a divide. When it rains, water flows down from areas of higher elevation following the natural shape of the land. A watershed starts at the headwaters - at mountain peaks and hilltops. The source of the Skeena River is at what is commonly referred to as the Sacred Headwaters – the start of a trio of important rivers in Northwest British Columbia: the Skeena, the Nass and the Stikine Rivers. Snowmelt and rainfall (and often glacial melt) wash over and through the high ground into rivulets which drain into fast-flowing mountain streams. As the streams flow downwards from the source, tributaries and groundwater add to their volume and they become rivers. As they leave the mountains, rivers slow and start to meander and braid, seeking the path of least resistance across widening valleys. Eventually, the river will flow into a lake or ocean.

Watersheds can vary by scale with a large watershed containing many smaller ones. The Skeena Watershed is an example of a complex watershed that can be broken down to 11 smaller watersheds (or sub-basins). Similar to the branches of a tree, a network is created as streams increase in flow and join with other streams. In the case of the Skeena Watershed, all smaller rivers and creeks (tributaries) flow into the Skeena River, which then flows into the Skeena Estuary, and the Pacific Ocean. Therefore, all the actions of people who live in our watershed affect the health of the waters that run through it. Rainfall and snowmelt wash chemicals, fertilizers, sediment, and other pollutants from the land into waterways, from the headwaters of the Skeena River high in the Spatsizi Plateau in Northwest BC to the Skeena Estuary and the Pacific Ocean near Prince Rupert.



Source: Michigan Water Stewardship Program

Features of Watersheds

Watersheds have many living (biotic) and non-living (abiotic) components, which co-exist and work together in complex ways. Watersheds provide many benefits and services to the ecosystem, including:

- Storing and releasing water and filtering many pollutants
- Trees and plants help anchor soil and absorb rain and snowmelt so that flooding, erosion and landslides are less severe
- Vegetation provides shade, keeping water temperatures cool and stable so salmon and other aquatic life can thrive

Forests and Wetlands maintain watershed health. Forests maintain water quality and regular year-round supply by preventing erosion, holding water for slow summer release, and provide shade maintaining cool temperatures that salmon need. Wetlands – whether major swamps or tiny pockets of marsh, swamp or bog – store and purify water.

Salmon Forest – Wild salmon bring marine nutrients insland and provide an important food source for a variety of animals. These nutrients also increase the productivity of nearly plans and forests. Bears, wolves, eagles and other animals feast on spawning salmon, flying off with or dragging carcasses into surrounding forests, bringing marine-derived nutrients for the forest around salmon-bearing streams. Up to 70% of the nitrogen intake for plants and trees in the Tongass Rainforest in Alaska can ne traced back to salmon.

Human Uses – In addition to the natural systems that store and purify, maintain stream flow and recharge ground water, watersheds also contain and sustain the forests, farms and fisheries from which humans draw their livelihoods. The actions of people who live within a watershed affect the health of the water that drains from it. Because watersheds are, in effect, closed systems, land managers are using them as standard units for studying sustainable land use and resource management. By understanding the water cycle and the other components of a watershed, landowners and planners can minimize the impact of development.

Watersheds can be big and complex, tiny and simple or somewhere in between. Complex Watersheds are usually large, consisting of a main river and several levels of tributaries. The Skeena River Watershed is an example of a complex watershed. The watershed served by a complex river system consists of several nested sub-basins or valleys, roughly corresponding to the order of streams in the system. Each sub-basin is a local watershed.

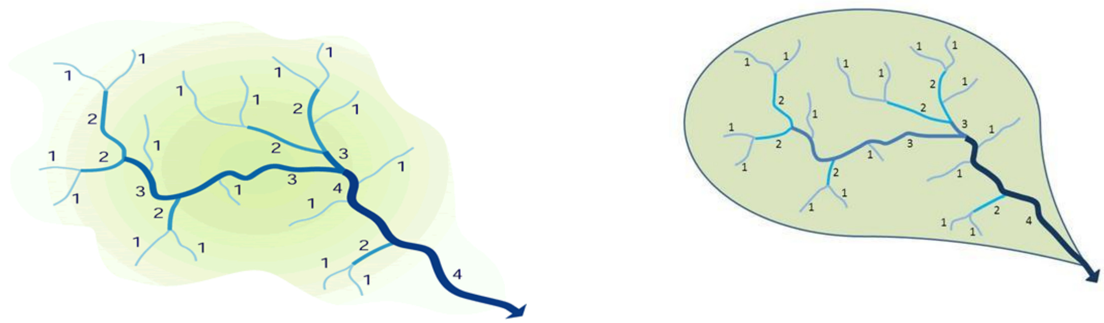
In the Skeena Watershed system, there are 11 primary sub-basins and local watersheds including:

- Lower Skeena
- Lakelse Watershed
- Kalum Watershed
- Morice Watershed
- Bulkley Watershed
- Kispiox Watershed
- Zymoetz Watershed
- Babine Watershed
- Middle Skeena
- Sustut
- Upper Skeena

Simple Watersheds are usually small and short, containing a simple stream system – a first- and perhaps a second- and third-order stream. Simple watersheds are common in coastal BC where small rivers cascade down steep coastal mountains to the sea.

Stream Order

River systems display a tree-like pattern, with many small streams feeding into fewer larger rivers, then into one very large river, and eventually, into the ocean. The smallest channels in a watershed have no tributaries and are called first-order streams. First order streams are the small headwater creeks that are the sources of the river system. These streams usually carry a small volume of fast moving water down a steep gradient. Vegetation from adjacent banks often meet over top of first order streams, leaving them in near-continuous shade. When two first-order streams join, they form a second-order stream. When two second-order streams join, a third-order stream is formed, and so on. Higher order steams (second through fourth order) gather the water in larger and larger channels. Many of these streams have slower moving sections where material gathered upstream is deposited in sand and gravel bars. Orders six or greater are larger rivers. Eventually the highest-level stream releases its freshwater into the ocean. A tributary is a river or stream which contributes its water to a main river by discharging its water into it.



Source: FISRWG 2010

The largest river in the world, the Amazon River, is a 12th order river. The Skeena River is a 6th order river. Major rivers that flow into the Skeena River, such as the Morice, Babine and Zymoetz, are also 6th order rivers. The Lakelse, Kispiox, Kitsumkalum, Kitwanga and Bear Rivers are all 5th order rivers that also flow into the Skeena River. The Gitnadoix flows directly into the Skeena River (known also as the 'main stem'), but is only a 3rd order river, and the Ecstall is a 4th order river that also flows directly into the Skeena. Many of the smaller tributaries that flow into the 4th and 5th order rivers such as the Lakelse River, including Williams Creek, Hatchery Creek and Schulbuckhand (Scully) Creek are all 1 and 2 order streams. (Gottesfeld reference).

Streamflow Types

Besides the stream order system, streams can also be classified by the period of time which flow occurs. Streams that flow nearly year-round (90% of the time or more) in a well-defined channel are called perennial. Most higher-order streams are perennial. Streams that flow only during the wet season (50% of the time or less) are called intermittent.

KEY WORDS

Aquifer – Underground water flow formed by the infiltration of precipitation from the surface. It flows through a permeable substrate and is contained by impermeable layers below it. They are often the source for springs, where the topography drops below the elevation of the water table.

Condensation – the process by which water vapour in the air is changed into liquid water; it is crucial to the water cycle because it is responsible for the formation of clouds (opposite to evaporation)

Drainage Basin (or Catchment) – the total area drained by a river and its tributaries

Drainage Divide – the division between two watersheds.

Estuary – the body of water where the river (freshwater) meets the ocean (saltwater); important habitat for juvenile salmon to prepare for their ocean life.

Evaporation – the process by which water changes from a liquid to a gas or vapour; it is the primary pathway that water moves from the liquid state back into the water cycle as atmospheric water vapour.

Groundwater – water that collects or flows beneath the Earth's surface, filling the porous spaces in soil, sediment, and rocks. Groundwater originates from rain and from melting snow and ice and is the source of water for aquifers, springs, and wells. The upper surface of groundwater is the water table.

Headwaters – upstream region within a watershed; higher elevation source for rivers

Infiltration – The seeping of surface water into the soil and down into the aquifer through the porous spaces between rock particles.

Intermittent Flow – streams that flow only during the wet season (50% of the time or less)

Perennial Flow – streams that flow nearly year-round (90% of the time or more)

Precipitation – any form of water such as rain, snow, sleet or hail that falls to the earth's surface

Riparian Zones – are important transition areas between the land and a river or stream, and support a wide diversity of plant and animal life. Riparian zones that border streams or rivers are sometimes called stream corridors.

Soil Erosion - Displacement of the upper level of soil; can be caused by water, ice, snow, wind, animals, or human activity.

Stream Order - a measure of the relative size of streams. The smallest tributaries are referred to as first-order streams, while the largest river in the world, the Amazon, is a twelfth-order waterway. The Skeena River is a sixth-order river.

Sub-Watershed – a smaller watershed that is part of a larger watershed

Tributary – a river or stream which contributes its water to a main river by discharging it into the latter, from either side and at any point along its course.

Water (or Hydrologic) Cycle – Water leaves the atmosphere and falls to the earth as precipitation where it enters surface waters or percolates into the water table and groundwater and eventually is taken back into the atmosphere by transpiration and evaporation to begin the cycle again.

Water Table – the horizontal depth of the top of the quifer. Where the surface elevation drops below the water table elevation, surface water in the form of lake.

Watershed – a region that drains via a system of connected stream channels into a particular body or water such as a river, pond, lake or ocean; also called a drainage basin. Within large watersheds, there are many smaller ones.

Watershed Boundaries – the height of land that surrounds the watershed

Wetland – a distinct ecosystem where land is covered by water, either salt, fresh or somewhere in between (such as a pond, marsh, edge of a lake or ocean). Wetlands provide critical habitat for fish, birds and other wildlife.

ACTIVITY 1: THE EARTH'S WATER AS AN APPLE DEMONSTRATION

In the following activity, students will learn about the Earth's water supply. Using an apple as a model of the Earth's water, each slice will represent salt water and fresh water (both inaccessible and accessible).

Materials:

- Whole apple
- Knife
- Cutting board

Procedure:

1. Using the knife, slice your apple into four equal quarters. Set aside three of the quarters – these three quarters represent salt water. Carefully slice the skin off of the fourth quarter. The 'meat' of the apple will also represent salt water. The skin of this quarter will represent the fresh water available on earth.
2. Slice the remaining quarter skin piece into three sections. Two of these pieces represent inaccessible fresh water – glaciers, ice fields, snow fields.
3. The remaining section of skin represents all the accessible fresh water on earth – lakes, rivers, streams (ie., potable water)
4. This one small section of fresh water is also polluted, companies have water licenses, etc.

Adapted from: One Water (www.onewater.org)

ACTIVITY 2: TWO WATER CYCLE EXPERIMENTS (for younger grades)

(1) WATER CYCLE IN A BOWL

Materials:

- Clear Glass Bowl (clear works best so that students can see the condensation form)
- Bowling Water
- Clear plastic wrap
- Empty clear glass cup
- Couple of ice cubes
- Salt

Procedure:

1. Carefully pour bowling water into the glass bowl.
2. Mix salt into the water.
3. Place the empty clear glass cup in the centre of the bowl.
4. Cover the glass bowl completely with saran wrap.
5. Place several ice cubes on top of the saran wrap. This represents the atmosphere.
6. Within the first few minutes, the water will begin to evaporate and condensation will start to form on the sides of the bowl and on the saran wrap.
7. The condensation from the saran wrap will become precipitation and fall down into the bowl and into the empty cup.
8. After about 10 or 15 minutes, carefully remove the saran wrap (and any ice cube fragments that may remain).
9. Hold up the glass cup to show the water that will have accumulated. Ask students whether the water in the cup will have salt in it. Take a drink of the water – it will be warm but not at all salty!

(2) WATER CYCLE IN A BAG EXPERIMENT

In this simple “water cycle in a bag” experiment, we can observe the different stages of the water cycle process up close.

Materials:

- Ziploc plastic bags
- Colour markers
- Water
- Blue food colouring (optional)

Procedure:

1. Draw the watercycle diagram on the plastic bag using the markers.
2. Warm up the water until steam starts to rise but do not let it boil.
3. Add blue food coloring into the water to represent ocean water.
4. Pour the water into a ziplock bag and zip it up.
5. Hang the bag upright on the window (or the door like I did) using packing tape.
6. As the water evaporates, vapors rise and condense at the top of the bag. A white patch can be seen resembling clouds in the upper atmosphere.
7. After a while, water droplets appear on the inside of the bag. As they become bigger, they will eventually slide downward. The sliding down resembles the flow stage that brings water back into the sea.
8. If the water is still warm or if the bag is left on the window facing sunlight, it will keep cycling through the four different stages of the water cycle.

ACTIVITY 3: WATER INFILTRATION DEMONSTRATION

1. Using clear trays or jars, add different materials to each to represent the different soil substrates. Some suggestions include sand, gravel, potting soil, and hardened clay.

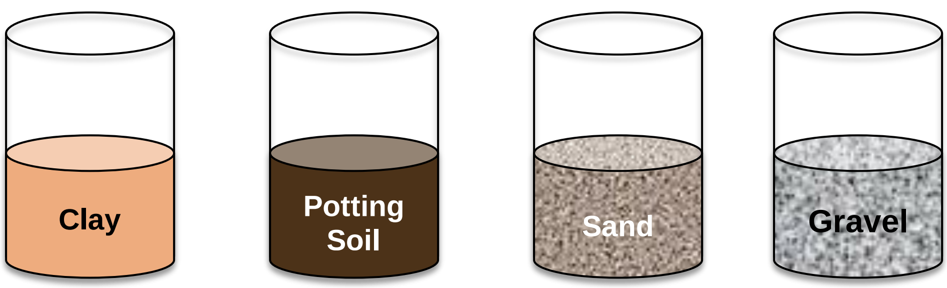
2. The best way to prepare the hardened clay in advance is to take wet mud and place it in the jar. Place the jar in an oven at 200˚F for several hours until the mud has hardened solid.

3. Next, slowly add water to the surface of each and examine how quickly water infiltrates into the soil type.

4. Students should make observations about where water stays on the surface, how long it takes to infiltrate and some hypotheses as to the reasons for the different rates.

5. Key questions for students to answer:

- What does the water look like before and after filtration?
- Which filtration system made the clearest end water? Why?
- What would happen if you filtered the water a second time?
- Does soil help filter our water?
- Is the filtered water clean enough to drink? What might still be in the water that filtration cannot remove?



Source: National Park Service (www.nps.gov/teachers/classrooms/explore-your-watershed.htm)

ACTIVITY 4: SOIL EROSION DEMONSTRATION

This experiment shows how unprotected soil can be washed away by rain, causing damage to the environment, and it also reveals how the vegetation dependent on soil to survive can help protect it.

In this experiment, water running through bare soil erodes (takes away) some of the soil – that's why the cup on the left is cloudy. A layer of mulch (fallen leaves or other dead plant material) in the middle bottle protects the soil, and the water that runs off is less cloudy. A layer of small pebbles also protects the soil. But soil with vegetation roots anchoring it in place is the best protected, and the water running out of that soil is almost clean. What does this mean for salmon in the stream?

This experiment is easy to do, but you will need to have some patience. Start setting it up at least a week in advance to give the grass time to grow in one of the bottles. When you actually run the experiment, it's best to do it outside if you can.

What you need:

- 4 x 2-Litre plastic bottles
- 4 clear plastic cups
- Wheat grass or cat grass seeds
- potting soil
- mulch (dead leaves, pine needles, moss)
- small pebbles
- pitcher of water

Setting up:

1. Draw a large rectangle on one bottle with the felt-tip pen. You need to make the hole big enough to put soil and then water into the bottle.
2. Cut along your lines and remove the rectangle shape you drew from the bottle.
3. Repeat the previous steps for the other three bottles, so you have four bottles that are just the same.
4. Put a layer of soil about 1 inch (2.5 cm) deep into one of the bottles. The level of the soil should be just below the lid of the bottle.
5. Sprinkle the grass seeds into the soil.
6. Leave the bottle is a place where it will let lots of sunlight, and where it won't get too cold. Add a little water each day to stop the soil from drying out. After a week or so, your grass should have grown.
7. Once the grass has grown, you can prepare your other three bottles. Add about the same amount of soil to them as you put in the first bottle.
8. Leave one of the bottles with soil only. In another bottle, place a layer of mulch on top of the layer of soil. In the last bottle, place a layer of small pebbles on top of the layer of soil.
9. It's time to perform the experiment! To engage the class, use student volunteers to help with this part.

10. Have one student hold the plain soil bottle and one student hold a clear empty cup under the mouth of the bottle. Remove the lid of the bottle, and slowly pour water from the pitcher over the bottle. The water will start to trickle through the soil into the cup.
11. Follow this procedure with different students for the other three bottles.
12. Ask the students which bottle came out the cleanest. You can also ask the class ahead of conducting the experiment which one they think will come out the cleanest.

Questions for Students

- Can you explain how the stream is protected by vegetation?
- What happens when there are heavy rains and there is no vegetation planted along the stream?

How it Works

Roots are crucial to a plant's survival. The roots grow down into the soil and absorb water into tubes that extend right up into the stem and leaves of the plant, above ground. Each grass plants has roots of many different sizes – from tiny fibrous roots up to bigger ones almost as big as the stem. The fibrous roots push out in all directions in the soil, not just downward. The result is a complicated web of roots that holds the soil firmly in place. That's why the water runs out almost completely clear from the bottle with the grass growing in it.

If it is left unprotected, soil can be swept away during heavy rains, taking the nutrients that plants need to grow with it. As this image taken from space shows, soil runs off into rivers and can be harmful to salmon, and other fish and wildlife living there. Planting grass and trees along riverbanks can prevent soil erosion because they hold onto the soil, keeping rivers cleaner. Farmers can protect the soil they need for their crops with animals with a layer of mulch (dead leaves) or the roots of plants.

Source: "Smithsonian Maker Lab Outdoors: 25 Super Cool Projects" by Jack Challoner

ACTIVITY 5: BASIC WATERSHED CONCEPT DEMONSTRATION

A quick and easy activity to demonstrate how rain flows on a mountain divide into several watersheds.

Materials:

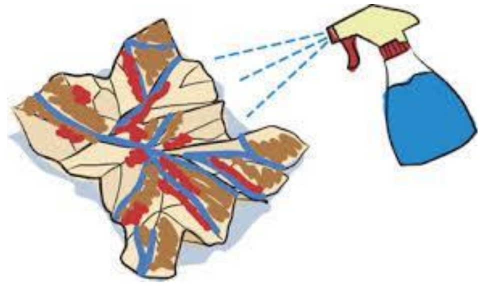
- 1 piece of wax paper (long enough to fit over block or book)
- a block or book
- spray bottle with blue coloured water

Procedure:

1. Loosely put wax paper over block of wood or book
2. Spray water at the top to demonstrate how the water will flow down to one side or another. The top is the mountain divide – the water flows into one watershed or the other.

ACTIVITY 6: CRUMPLED WATERSHED MODEL

OBJECTIVES:



- Understand how to tell where the boundaries of a watershed are; and
- Understand how runoff affects our water quality

MATERIALS NEEDED:

- Two piece of paper for each student
- Water-based markers (non-permanent) in blue, black, brown, red
- Spray bottle with water
- *Alternative*: This activity can also be done using wax paper and water with blue food colouring added to it

PROCEDURE:

Experiment #1:

1. Crumple up the first piece of paper and then smooth it back out most of the way. It should still be a bit crumpled, showing small ridges (high points) and valleys (low points)
2. Imagine that this paper is a section of land and find the ridgelines (the tops of the fold-lines)
3. Use a washable blue marker to colour along the ridgelines on your land
4. It will 'rain' on the landforms. Students are to answer the following questions to make their hypotheses before conducting the experiment:
    - What do you think will happen to your land when it 'rains'?
    - What will happen to the blue ridge lines you coloured?
    - Where will the 'rainwater' travel?
5. Use a spray bottle of water to create a 'rainstorm' over your land. You want to create gentle sprays of mist. Observe what happens after every misting. As your 'rainfall' accumulates, observe the pathways where the excess 'rainfall' travels. Answer the following questions:
    - How did the 'rainfall' travel over your land?
    - Where did the water collect? Explain why this happened.
6. Find an area on your land where water collected. This is a lake, and you get to name it! My lake is Lake ________________.
7. Look for the major stream running into your lake. Name this stream as well. My stream is called ______________________________.
8. This stream may have several tributaries (small streams which run into the larger stream). How many does your stream have? ___________

Experiment #2:

1. On a fresh sheet of paper, draw some of the ways people use the land. Include a house/community, farm, factory, and some streets/highways.
2. Using the color key below, color your areas with markers:

    - Brown Farms
    - Red Landfills and Factories
    - Black Houses and Streets

3. Crumple this paper, and smooth it in the same way you did the first one.
4. Use the blue marker to trace the ridgelines on this paper.
5. Make hypotheses about what you think will happen when you "rain" on your land this time.
6. Gently mist your new land with water from your spray bottle. Observe what happens, and how the water travels.

ACTIVITY 7: BUILD A WATERSHED MODEL (DEMONSTRATION)

OBJECTIVE:

This experiment illustrates the basic properties of a watershed: how water flows from higher elevations to lower elevations, and how watersheds are interconnected. The students will understand how the placement of buildings, roads, and parking lots can be important to watershed runoff, and how careless use and disposal of harmful contaminants can have a serious effect on downstream watershed denizens.

MATERIALS NEEDED:

- 1 large tupperware container (about 1.5'W x 3'L x 1'H) 2 lbs. of modeling clay 3 lbs. of sand (any type of sand will do)
- 2 lbs. of aquarium gravel 1 roll of wax paper (or any other impervious, water repellent surface, tin foil, plastic wrap, etc.) 1/4 cup of cocoa mix, iced tea mix, or other flavoured drink mix (to represent chemicals) 1 spray bottle or bucket full of water

PROCEDURE:

(Note: prepare steps 1 to 4 before students are present)

1. Wash the aquarium gravel carefully to remove any powdery residue that may add cloudiness to the water. Fill the container to about 2 inches from the bottom with the gravel. Slope the gravel slightly so, that at one end (downslope), the gravel is only about ½ inch deep and, at the other end (upslope), the gravel is about 3 inches deep. This gravel layer will represent the aquifer.

2. Mix the clay and the sand. The consistency of this mix should be gritty, with slightly more clay than sand. This mixture should allow water to run freely over it, but if left standing, the water should slowly permeate the surface. Add this mixture to the container carefully, so as not to disturb the slope of the aquifer already placed. The slopes should be similar, with about 2 inches of sand/clay mix overlying the gravel already placed, and on the downhill end there should be about 3" of gravel left exposed.

3. Carve a channel in the middle of the clay/sand layer, about ½ inch deep and about 1 inch wide. This channel will represent the main river of the watershed. Near the top of the slope, split the channel into two or three separate channels to represent tributaries. You may wish to add other tributaries along the main branch of the "river" to further illustrate other watersheds.

4. With some extra clay/sand mix, build little hills between the tributaries. These hills separate the smaller watersheds, but when looked at as a whole, the entire "river" system is one watershed. You may also wish to add some small model trees or green felt to represent forests or fields. Buildings can be represented with small blocks of wood.

5. Along the main river, flatten out an area that is about 8 inches by 3 inches. Cut out a piece of wax paper to be about 4 inches by 3 inches in size. Stick this down onto the clay sand mix, sloping it slightly towards the river. If necessary, use some clay to hold the edges down. Explain to students that this wax paper represents the impervious surface of a parking lot.

6. Fill the bottom of the aquarium up to about 2 inches from the bottom with water. The water should fill all of the aquarium gravel “aquifer” area, and should just reach up to the lowest extent of the clay/sand mixture. Explain to students that the aquifer captures and transports water that seeps down through the soil.

7. Using the spray bottle, simulate rain over the flattened soil area and the parking lot. Ask the students to note that the “rain” soaks through the soil, but runs off the parking lot to the river. Ask them what the effect would be if the entire watershed was “paved”.

8. Sprinkle some cocoa mix over the sides of one of the smaller watersheds. Tell the students that the cocoa represents pollution. Over one of the unpolluted “watersheds,” cause some rain with the spray bottle (*it may be necessary to cause more rain by pouring water). Note that the runoff from the rain is clean. Now, make it rain over the polluted area. Ask the students to note how the pollution travels down through the watershed, contaminating all downstream areas. Discuss with the students why the pollution is a problem, and what can be done to fix the problem.

ACTIVITY 8: BUILD A WATERSHED MODEL (HANDS-ON ACTIVITY FOR STUDENTS)

OBJECTIVE:

This experiment illustrates the basic properties of a watershed: how water flows from higher elevations to lower elevations, and how watersheds are interconnected.

MATERIALS NEEDED:

Per Group of Students:

- 1 tray
- 4-6 large and medium sized rocks
- 1 piece of plastic to cover tray and rocks
- Spray bottle with water and blue food colouring
- Small containers of cocoa powder to serve as loose soil from a clearcut) and of soy sauce to serve as some type of oily pollution

PROCEDURE:

1. Hand out materials to each group
2. Have students arrange rocks on tray, then cover rocks with plastic wrap. Make sure wrap conforms to the rocks. The rocks will serve as mountains.
3. Have students take turns spraying the blue water (rain) onto the mountains, and observe how the water flows down the mountains, where the watershed divide would be, and how lakes and rivers are forming.
4. Sprinkle some of the ‘pollution’ on top of some of the mountains or in the valleys upstream, and have students spray again, observing where the ‘pollution’ is flowing.

EXTENSION ACTIVITY:

- Using small pebbles and red water gel beads (such as *“Orbeez”*) to serve as salmon eggs in a redd, ask students where a female salmon may lay her eggs on the landscape.
- Place some of the loose soil and pollution on top of the mountains or in the valleys upstream, and have students spray again, to determine whether the salmon eggs will be impacted.
- If the salmon eggs are impacted (ie, the cocoa powder and/or soy sauce has mixed with the eggs), then ask students where on their landscape could the clearcut or development occur with no impacts to the salmon eggs.

ADDITIONAL RESOURCES

WEBSITES

- **Wildsight's "Know Your Watershed" Online Program** – This watershed education program is delivered throughout the Columbia Basin in BC by Wildsight, and is directly linked to the Grade 9 science curriculum. Lesson plans and resources are available on line on their website - https://wildsight.ca/programs/knowyourwatershed/

- **Project Wet** – Project WET's mission is to reach children, parents, teachers and community members of the world with water education that promotes awareness of water and empowers community action to solve complex water issues. They provide educational materials on water resources, hold training workshops, and organize festivals and special events. **www.projectwet.org**

- **Science World** - Educational resources for K-8 students including lesson plans and activities. **https://www.scienceworld.ca/resources/units/water-savers.**

- **Canadian Geographic -** Good educational resource for general information on watersheds, including themes such as protecting water, biodiversity, groundwater, climate change, urbanization, etc. **www.canadiangeographic.com/watersheds/map/?path=english/watersheds-list**

- **Pacific Streamkeepers** - A BC based organization that provides good training modules and videos on stream habitat surveys and restoration. **http:/pskf.ca/**

- **US Environmental Protection Agency – Watershed Academy Web Online Training** – A great online training program that offers a variety of self-paced training modules with on watershed management. **www.cfpub.epa.gov/watertrain**

BOOKS

- "**Connecting Students With Their Watersheds: A Workbook for Community Leaders"** (Will Husby and Ann Finlayson, Bowen Island Conservancy, 2001). An excellent resource for educators. **http://www.shuswapwatershed.ca/teacherguide/F-Stewardship%20Projects/connecting%20students%20to%20ws.pdf**

- '**Watershed Stewardship: A Guide for Teachers, Students, and Community Organizations"** (Dr. Milton McClaren, Kim Fulton, Chris McMahen, 1995). An excellent resource on water stewardship for BC communities. **http://stewardshipcentrebc.ca/water-stewardship-a-guide-for-teachers-students-and-community-organizations/**

- "**Skeena River: Fish and Their Habitat**" (by Allen S. Gottesfeld and Ken A. Rabnett). Not targeted at younger students, but a good resource for educators.

VIDEOS

- **What is a Watershed?** – A short animated video by the Battle River Watershed group which provides a good and brief overview of a watershed (1:17 min). https://youtu.be/QOrVotzBNto

- **Watersheds!** – A short animated video by Colorado State University (3:11 min). https://youtu.be/2pwW2rlGIa8

SKEENAWILD RESOURCES

SkeenaWild has the following **FREE** resources available for educators and students:

- **In-Class Workshop: "My Watershed, My Home" (Grades 3-6).** Students will learn about watersheds, their features and their importance, particularly in relation to the Skeena Watershed and its sub-basins. Students will also explore their personal and cultural connections to the Skeena Watershed.

- **Watershed EcoKit** – includes lesson plans, powerpoint presentation on USB, handouts, and supplies for hands-on activities and demonstrations.

- **Skeena Watershed Poster (24" x 36")**

Contact the Education Coordinator at SkeenaWild at christine@skeenawild.org or call 250-638-0998. You can also visit our website at www.skeenawild.org/education to view all of our educational resources.

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