

Becoming Water Wise

Calculating Our Water Use

Pre Water Festival or Independent Lesson



Image of Eastern Georgian Bay from Fox Island (Peter Van Rhijn, 2015)

Description of Lesson

Through this lesson, students will recognize that even though there is a lot of water in the world, only a small amount of it can be used for drinking and other water needs. They will become familiar with the quantity of water Canada has in its different regions compared to other countries in the world, and the main ways water is used in Canada. They will learn the need for water conservation.

Connect with the Georgian Bay Biosphere

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GEORGIAN BAY
BIOSPHERE
MNIDOO GAMII
Spirit of the Water

Georgian Bay Biosphere: Lesson in a Backpack Program

At a Glance

Grade Level: 5

Learning Environment:
Classroom

Prep Time: 15 minutes

Length of Lesson: 1 hour

Key Vocabulary: Conservation, glaciers, ice sheets, groundwater, surface water, fresh water, aquifer, wells, water cycle, precipitation, evaporation, condensation.

Staffing: 1 educator

Materials:

Map of the world power point
Pictures of water sources
13.5 litre bucket
Measuring cup
Tablespoon
4 cups
Student worksheets
Graph paper

Kit available at the NNDSB
Resource centre.

Groupings: Whole class, and
Individual work

Teaching/Learning Strategies:
Presentation, discussion, individual
problem solving.

Lesson Outline

TIME	ACTIVITY	LOCATION	MATERIALS
10 minutes	Exploring our Watery World	Classroom	PowerPoint Projector or Smartboard
20 minutes	Water in the Bucket Demonstration	Classroom	Large Bucket Tablespoon Measuring Cup 4 cups
10 minutes	Worksheet	Classroom	Worksheets
15 minutes	Bar Graph	Classroom	Graph Paper
5 minutes	Discussion	Classroom	

Curriculum Expectations

Science and Technology

Understanding Earth and Space Systems: Conservation of Energy and Resources

Overall Expectations

1. Analyze the immediate and long-term effects of energy and resource use on society and the environment, and evaluate options for conserving energy and resources

Specific Expectations

1.1 analyze the long term impacts on society and the environment of human uses of energy and natural resources, and suggest ways to reduce these impacts.

Mathematics

Data Management and Probability

Overall Expectations

Collect and organize discrete or continuous primary data and secondary data and display the data using charts and graphs, including broken-line graphs

Specific Expectations

Collect and organize discrete or continuous primary data and secondary data and display the data in charts, tables, and graphs (including broken-line graphs) that have appropriate titles, labels (e.g., appropriate units marked on the axes), and scales that suit the range and distribution of the data.

Background

All the Water in the World

Almost three quarters of the earth's surface is covered by water. So you might think that there is lots of water to go around, and we will never be able to use it all up. The reality is that only a small amount of this water is usable for humans. Most of the water on earth, over 97%, is salt water in oceans. Of the remaining 3% of the fresh water on earth, 2% is frozen in glaciers, ice caps, and snow in the mountains, and is not accessible to us. So our daily water needs have to be satisfied by the remaining 1% of fresh water, stored in pockets in the soil (aquifers), in cracks in bedrock underneath the earth's surface (ground water) or above ground in streams, rivers and lakes (surface water).

Water is needed by all living creatures on earth. Plants need water to grow, and animals need water to drink. Fish and other aquatic animals need water to live in. We need clean drinking water to survive as well too. Did you know that the human body is made up of 60% water? In Canada, the largest amount of fresh water is consumed by agriculture, at 66%, followed by electricity generation at 12%. Roughly 10 percent of the fresh water we consume is used by manufacturing and industry; 8% by residences and businesses in cities, towns and rural areas, with the remaining 4% being used by mining and petroleum industries. Growth of cities and industry, and changes in our climate mean that there is more and more pressure on our ability to supply enough water to households. This is why having enough water is a growing concern for many communities. It is estimated that 25% of Canadians rely on groundwater as a source of drinking water.

Oh Canada - How Much Water Do We Have?

Living near the Georgian Bay, you might feel that we have more than enough water. In fact, many populated areas of the country are found near large bodies of water, including the Great Lakes, and the St. Lawrence River, the Atlantic and the Pacific Oceans. The Great Lakes and the St. Lawrence River basin contain almost one - fifth of the world's fresh surface water. We are lucky in Canada to have lots of water, but many Canadians think we have unlimited water, and they use and waste too much of it. Domestic per capita water consumption was at 326 liters per day in 2012, the second highest amount per person in the world after the USA.

Here are a few other facts about Canada's water supply:

- Canada has about 7% of the world's renewable freshwater supply.
- Over half of Canada's fresh water drains north, while 85% of Canadians live within 300km of the U.S. border.
- Canada's glaciers contain more water than the Great Lakes
- Canada's rivers and lakes contain enough water to flood the country to a depth of more than 2 meters.
- Lake Huron is the second largest of the Great Lakes and ranks as the fourth largest lake in the world (by surface area).
- Georgian Bay is about 190km long by 80km wide and covers approximately 15,000 square km, making it nearly 80% as large as Lake Ontario.

Water is on the Move

Water doesn't stay in one place for a long time. It is forever traveling between the earth and sky on a cyclical journey that never ends. We call this process the water cycle, or hydrologic cycle. During this journey, water is continuously recycled and reused. Its form also changes. It falls to the earth as a liquid or solid in rain, snow, sleet, or hail, and returns to the atmosphere as water vapour as it evaporates from the earth.

The form water takes and where it will go when it arrives at the earth's surface depends on where it lands. It could soak into the ground slowly and become part of the ground water that feeds a nearby lake, river or stream. Or, once it has seeped into the earth, a plant might drink the water up through its roots to its leaves, and release the water back into the atmosphere through evaporation (transpiration). If it falls into a lake or pond, it could spend a couple of seasons changing from liquid to solid, and solid to liquid again (freezing and thawing), as temperatures change. Water that lands in rivers and streams could be carried to the ocean. The heat of the sun might cause it to evaporate into the atmosphere, where it will condense into droplets, forming clouds. The journey begins again as the water from the cloud falls back to the earth's surface.



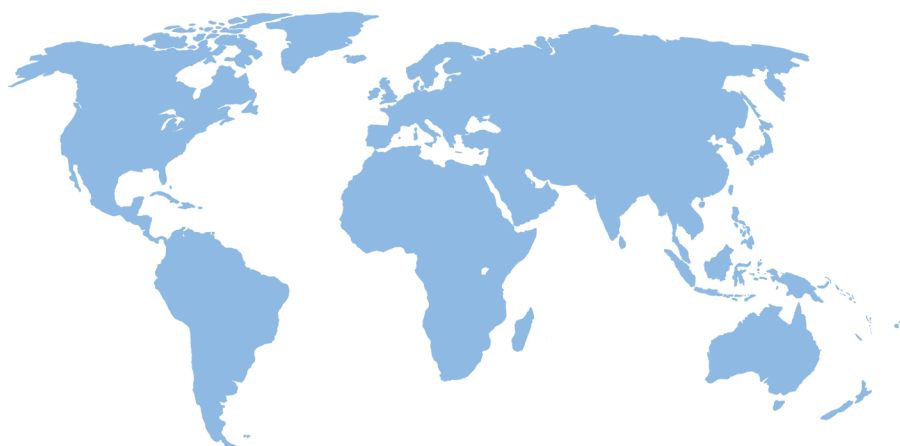
Teaching and Learning

Part A. Exploring our Watery World

1. Look at the world map with the students (PowerPoint projection). See if they can find where they live on the globe. Have them point out lakes, rivers, and oceans. Explain that these are called surface waters. Use the pictures of water bodies provided to help emphasize the definition of surface water.

2. Ask the students if they know which kinds of waterbodies are salt water and which are freshwater. Have they ever tasted salt water? Was it good?

3. Ask the students if they think there is more water or land on the globe. Is there water beneath the surface of the ground that we cannot see?



Did you know World Water Day is March 22? There are many resources online to celebrate and learn more!

Part B. Water in the Bucket Demonstration

As you do this experiment, stress that the amounts represent relative quantities of different types of water, not actual amounts. Use the pictures provided to help define different types of water.

1. Put 9.5 liters of water in an aquarium or bucket. Tell students to imagine the container represents all the water in the world.

2. Have a student helper remove 17 tablespoons of the water and put them into a cup. Tell them this amount represents all the water in the world that is not ocean. Use the picture of the ocean

3. Have a student helper remove 13 tablespoons of water from the cup containing the 17 tablespoons of water and put it in a separate cup. This amount represents the world's ice caps and glaciers. Use the picture of the glacier to reinforce the definition of a glacier

4. Have a student remove another 4 tablespoons of water from the cup containing the 17 tablespoons of water. The 4 tablespoons represent the world's fresh water (ground water and surface water). Use the picture of an aquifer to talk about groundwater.

5. Remove a fraction of a tablespoon ($1/20$) and place in another cup. This represents the world's fresh water lakes and rivers (including our own Georgiana Bay). Of that, all rivers amount to less than half a drop. Show the class the picture of Georgian Bay.

4. Be sure to recycle the water. Use it to water plants.

Part C. Worksheet

1. Ask students to complete the All the Water in the World worksheet, adding up the percentages of water available for drinking water. Answers: 0.419% total and 2.799% grand total.
2. Ask students if the numbers surprised them. Did they realize that such a small percentage of the water in the world is fresh?
3. Ask the students how much fresh water they think Canada has, and what are the main places it can be found. (Answer: 7% of fresh water in Canada; Main places: Great Lakes, Georgian Bay) .

Part D. Bar Graph

1. Distribute graph paper and ask students to create a bar graph that shows 97% ocean, 2% ice caps and glaciers, and 1% fresh water.

Part. E Discussion

1. Why isn't all fresh water usable? Answers: Some is not easy to get at; it may be frozen or trapped in unyielding soils or bedrock fractures. Some water is too polluted to use.
2. Why do we need to take care of the surface water/ground water? Answer: Water is very important for humans, plants/crops, and animals. If we waste water or pollute it, we may find that there is less and less of it available for us to use.
3. We are lucky to have lots of water in Canada. Are there places in the world that don't have enough? Answer: Yes, for example many African countries don't have enough water
4. Do you think we might have problems with not enough water to supply our needs (water scarcity) in the future? Why or why not? If you answered yes, what might the causes be?
5. How could water scarcity affect your family, and your community? Answer: Would need to reduce water use, might have to pay lots of money for water, might have to ration water.



Extensions

Activity #1: The AMAZING Race

You will need: water cycle diagram, 6 vials, envelopes, and printed out clues and pictures.

Students will be divided into teams of 3-4 (depending on class size) to participate in an Amazing Race Scavenger Hunt Activity, visiting different race stations within their school building and outdoor school yard to find clues and complete tasks introducing concepts around water conservation.

1. Use the Water Cycle Diagram (in PowerPoint provided) to quickly review the processes involved in the water cycle
2. Divide students into teams and have them create their own fun, water themed name (e.g. the "Soggy Bottoms" or the "Leaky Taps")
3. Teacher will provide each team with a first clue/instruction in an envelope in the classroom which will have them go to the library and find a book or magazine article on the topic of water resources of the Georgian Bay area.
4. When students complete this activity, they will show their findings to the teacher who will give them their next envelope with second task: Go to the school yard and collect water from one outside source (puddle, rain barrel) and bring back to the classroom. Answer a series of questions about the natural processes by which water arrived at the collection source.
5. Once the students have answered the questions successfully, give them the next clue to solve a riddle telling them to go to the room in the school where students use the largest amount of water (the school bathroom). Students will find the next clue on the fixture that uses the most water (the toilet). Next set of instructions asks students to return the classroom to complete a matching exercise about common water uses at home and in the community.
6. After successful completion of the questions, students get the last clue to identify 3 places in the school yard where water is used or needed (e.g. lawn, school garden, treed areas, parking lots/ walkways). Students cross the finish line when they hand in their correct answers.
7. After race lead discussion about concepts of water conservation reinforced through the game.
8. Penalty for losing team: Each member must do one push-up for every minute the team is behind the second last team.

Discuss:

1. Did you have a difficult time finding water to collect in the school yard? Why or why not?
2. Where do you think your water will go next?
3. Were you surprised by that the biggest water hog is the toilet?
4. What are some ways that we can reduce our water use at school? At home?

All of the Water in the World Worksheet

Did you know?

- Earth is called the water planet.
- Almost 3/4 of the earth's surface is covered in water.
- The Earth has many different types of water.
- Canada has 7% of the world's fresh water
- Much of that water is in the Great Lakes.
- Georgian Bay is almost as large as Lake Ontario (80%)

Oceans	97.200%
Ice caps/ Glaciers	2.380%
Ground water	0.397%
Surface water (lakes, rivers, streams, ponds)	0.022%
Atmosphere	0.001%

Add up the percentages for water available for drinking.

Ground Water: _____

Surface Water: _____

TOTAL: _____

Now add...

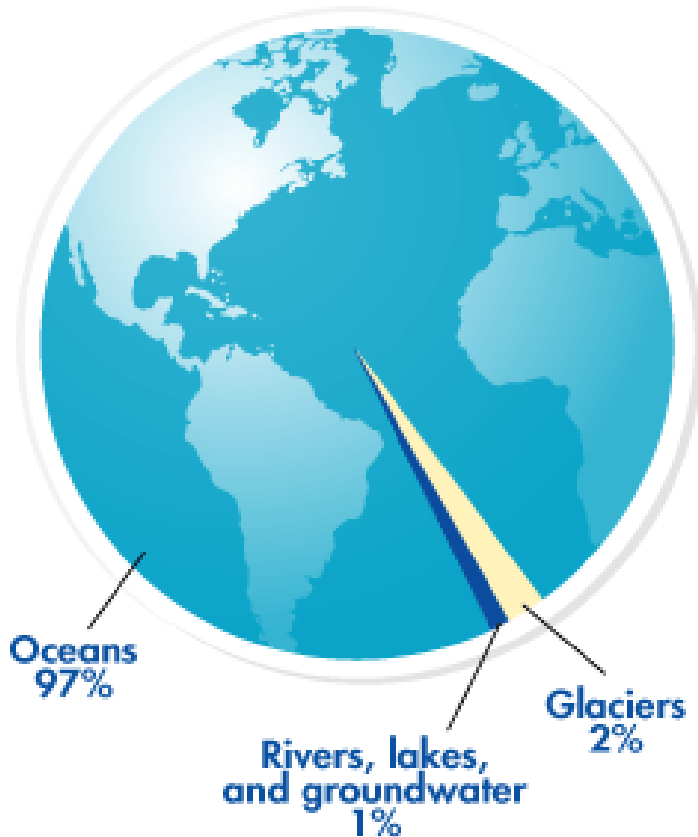
Ice caps/glaciers: _____

GRAND TOTAL: _____

Remember: Only a small percentage of water is suitable for humans to drink. Not all of the water in the ground and in lakes and rivers is easy to reach or clean enough to drink. Ice caps and glaciers are certainly hard to use for humans, plants, and animals. Some work is being done to take the salt out of ocean water (desalinate the water), but that is an expensive process.

Graphing All of the Water in the World

Usable water in the world



Let's Graph it!

On the graph paper provided, create a bar graph showing the distribution of water in the world between 1) saltwater, 2) rivers, lakes and groundwater, and 3) glaciers.

Be sure to label your x and y axis and include appropriate units in your graph.

Make sure your graph has a descriptive title.

Let's Talk About it....

1. Why isn't all fresh water usable?
2. Why do we need to take care of the surface water/ground water?
3. Do you think we might have problems with not enough water to supply our needs in the future? Why or why not? If you answered yes, what might the causes be?
4. How could water scarcity affect your family, and your community?

The AMAZING Race!

Clue #1

Go the library and find a book or magazine that talks about water in the Georgian Bay area. Once you find your article or book, show it to the teacher and receive your next clue.

Clue #2

Take a collection jar from the front of the classroom. Go outside and collect a small amount of water from the schoolyard. (Hint: water may collect in depressions on the ground, or on other surfaces. Your school might have special containers for collecting water). Bring your water back to the classroom and give your sample to the teacher.

TIDAL WAVE!!!

To get your next clue, complete the following questions, and hand your answers to the teacher:

1. Where did you collect your water from?
2. How do you think your water got there?
3. Name three other places your water may have been before it arrived at your location (Hint: think about the water cycle we discussed earlier)

Clue #4

Return to the classroom and give the teacher this clue to get a word matching exercise. Complete this to get your next clue.

Clue #5

List three places that water is used, or where water is needed outside on the school property, and inside the school. (You can go back outside if you need to, to get ideas). **Hand in your answers to the teacher to cross the finish line!!**

- | | |
|----------|----------|
| 1. _____ | 1. _____ |
| 2. _____ | 2. _____ |
| 3. _____ | 3. _____ |

The AMAZING Race!

Cut out each square individually. Flip them all over. Work to match the squares!

A

The room in our house
where we use the most
water.

Agriculture

B.

The part of our economy
that uses the most water

Georgian Bay

C

One Easy way to save
water at home.

Close taps tightly so that they
do not drip

D

The nearest large body of
Water (to Parry Sound,
Ontario)

The bathroom

E

One easy way to save
water at school.

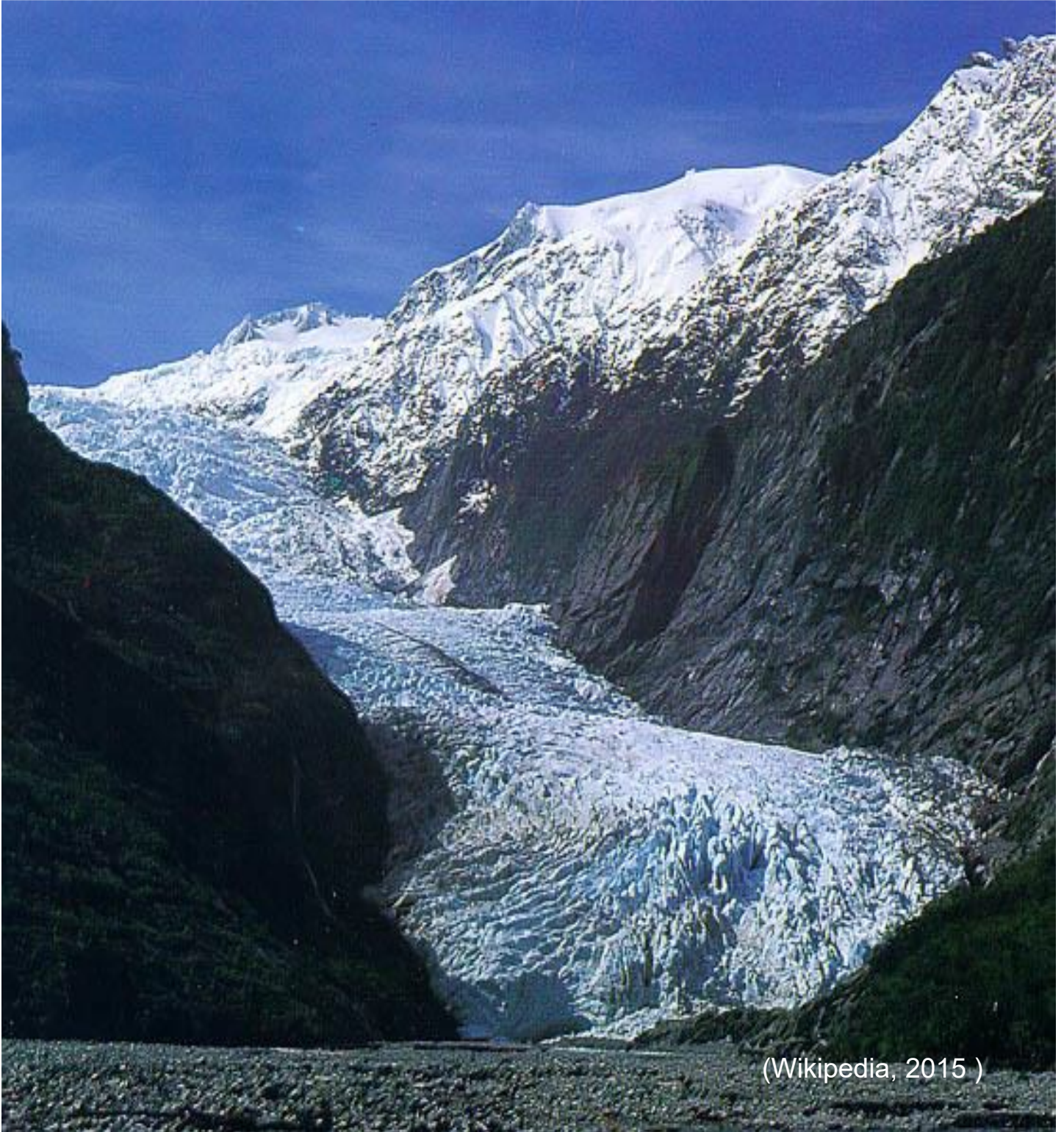
Turn off the tap when brushing
your teeth

Water Definition Photos: Ocean



(Wallcoo.net, 2015)

Water Definition Photos: Glacier (Franz Josef Glacier)



(Wikipedia, 2015)

Water Definition Photos: River (French River)



(Photo Travel Pages, 2015)

Water Definition Photos: Lake (Georgian Bay)



Township of Georgian Bay, 2015)

Water Definition Photos: Aquifer



(Artinaid, 2015)