EXPLORE

4 | Groundwater Exploration

GRADE LEVEL

4-8

60-90 minutes

Developmental Modification: Younger students can forego the internet research and focus on a general map and an illustrated version of the water journey story.

summary

Students make a model to learn how groundwater moves. They locate wetlands on a map of the local watershed and write about the movement of water through their watershed.

objectives

- Locate local wetland(s) in relation to the school and the nearest Great Lake.
- Gain a greater understanding of the watershed concept.
- Observe groundwater flow in a model wetland.
- Describe and diagram the path of water in their local watershed.

prerequisite

Mud Painting, Wetland Alphabet, Watershed Orientation (Lake Unit)

vocabulary

Groundwater: water within the earth that supplies wells and springs
Permeable: having pores or openings that permit liquids or gases to pass through
Water table: the upper limit of the portion of the ground completely soaked with water
Aquifer: the geologic material that stores, transports and yields groundwater

setting

subjects

Geography, Geology

standards

This Great Lakes in My World activity is aligned to the Common Core State Standards and to state learning standards in:

Illinois
Indiana
Michigan
Minnesota
New York
Ohio
Pennsylvania
Wisconsin

This alignment is available on your Great Lakes in My World CD in the "Standards" folder and on-line at http://www.greatlakes.org/GLiMWstandards.

materials

- Clear, big plastic container (large plastic bin)
- Pitcher of water
- Soil
- Sand
- Rocks
- Clay
- Journals
- Pencils
- Highlighter
- Internet access
- Map(s)
- Topographic map of the area

background

A watershed is an area of land that is drained by a body of water. Wherever you are, you are in a watershed. The boundary between two watersheds occurs where water that falls on one side of the line flows toward one body of water, while water falling on the other side of the line flows toward another body of water. Watersheds do not follow political boundaries.

Two thirds of the world's freshwater is found underground and called groundwater. This water is found in aquifers and appears at the surface as springs. Very often groundwater is interconnected with the lakes and rivers. Groundwater is all the water below the water table stored in empty spaces below the surface. Water flows through permeable surfaces into the top layer of soil. From there, it either flows into a body of water, is taken up by plant roots, or flows below the water table into the saturated zone. Groundwater flows through air pockets between soil and rock particles, following the path of least resistance. Larger soil or rock particles (such as sand or gravel) have larger air pockets, while smaller particles (such as silt or clay) have smaller air pockets for groundwater.

Groundwater is important to the Great Lakes ecosystem. It may discharge directly to the lakes or indirectly as water that feeds the tributaries. It is also a source of drinking water for many communities in the Great Lakes basin. In addition, shallow groundwater can provide moisture to plants.

Surface runoff is water that flows over the surface of the land into bodies of water. When precipitation (rain, snow) exceeds the rate of infiltration into the soil, the ground is saturated and surface runoff begins. When a surface is non-permeable, e.g., parking lot, surface runoff begins as soon as precipitation becomes steady.Runoff may include pollutants such as; sediment, excess nutrients, trace metals, organic pollutants, grease, oil and salt from roads.

procedure

Part One

1. Briefly review the concept of a watershed, and have students look again at the watershed maps (from Watershed Orientation on page 17. Ask students to look at the map and find wetlands near their school. Point out any they will be visiting.

2. Look at a local map. Once you have located your wetland and watershed, outline them on a road map of your region that shows rivers and the lake. Use pencil first, then marker. If you can obtain more than one map, try this activity in small groups.

3. Show the students the map and point out a nearby wetland. Have the students locate the school and the local Great Lake on the map. In what watershed are your school and the wetland? What does that mean? *A watershed is an area of land that is drained by a particular body of water. Everything is located in a watershed. If your school and the wetland are a part of the same watershed, then the rain that falls on the playground ends up in the same place as the water that seeps through the soil in the wetland. You are in the larger watershed of your Great Lake, and a smaller watershed of a river or stream.*

4. You are located in a watershed within a watershed, like a set of Russian dolls. Examine this set of "Russian dolls" to find all of your watersheds. What is the largest watershed in which your school is located? *If you are located in the Midwest, then you are in the watershed of the Atlantic Ocean. Look on the map to find the St. Lawrence River, which flows from the Great Lakes to the Atlantic Ocean.* What is the next largest watershed in which your school is located? *The Great Lakes watershed. All of the water within the Great Lakes basin (or watershed) flows into one of the Great Lakes.* What is the next largest watershed in which your school is located? *You are within the watershed of one of the Great Lakes. Look on the Great Lakes Watershed map from Watershed Orientation on page 17 to find out which one.* What is the next largest watershed in which your school is located? *This is the smaller watershed that you found on the internet. It may be the watershed of a river, stream, or wetland.*

procedure continued

Part Two

1. Now that students can map their watershed, let them discover what it means for water to flow through one. Explain the concept of groundwater and tell students is one of the ways that water makes it way back into the Great Lakes. It is an especially important source because the Great Lakes were formed by glaciers and have relatively few surface tributaries.

2. Fill 2-3 clear plastic containers with the soil, clay, sand and rocks. Allow students to decide where each material will go in the bins. Having several bins will allow students to see better and to compare different bin set-ups.

3. Pour some water into the bins, and from the side of the container, watch it move through the materials. Explain to students that they are watching what it would look like if they could see water moving underground. The bottom of the bin represents impermeable bedrock. Tilt the bin to show water moving as it would downhill. Ask students to imagine this happening on a larger scale. Ask students why the water moves differently through/around the different materials in the bin. *Water takes the path of least resistance, so it will move around objects or substrates that are more difficult to move through. Water moves through different substrates at different rates (quickly through sand, slowly through clay).*

4. Have the students take a close look at the map. Is their wetland a coastal or inland wetland? Can they tell how the water from the wetland eventually finds its way to the lake ? Do they think it moves underground or above ground? Is the wetland located near a river or tributary? Does it have direct contact with the lake, or does the water travel primarily through the soil? *It will help to look at a topographic map of the area to determine the directions of water flow.*

5. Ask a volunteer to highlight the possible path that water takes from the wetland to the Great Lake.

6. Ask students to begin thinking about why it is significant that the wetland is (or is not) connected (hydrologically) to the Great Lake.

7. Have a volunteer highlight the roads on the map that go from the school to the wetland site.

8. Ask students what would be the best way to get to the wetland: is it within walking distance; is there a bus or train that goes there?

wrap-up

1. Take students outside, or even just to the window. Pour a glass of water onto the ground. Explain that if there was a lot of rain, this water will make its way into the body of water that drains your watershed. Explain that if conditions are fairly dry, it will evaporate instead, become absorbed by the soil or be taken up by plant roots. Ask the students to imagine the path that the water might take from school on its way to the wetland, the river or stream, and eventually the lake. What might it have to go through and what are some things it could encounter on its way? *Sewer pipes, large rocks, groundhog tunnels, deep roots. It may help students to imagine that it is raining in order to visualize the water moving through the watershed.*

2. Have students spend 10 minutes writing on this in their journals. They may want to illustrate their writing with a diagram. *The water could be used by plants or animals, travel underground through the soil, evaporate and rain down again in a new place, etc.*

extension

Have students research problems related to groundwater depletion and pollution for Great Lakes communities dependent on this groundwater.

We value your thoughts and feedback on Great Lakes in My World. Please let us know about any oversights, errors or omissions you find, or if there are things you or your students particularly like.

Send your comments to: education@greatlakes.org

assessment

Rubric on page 246

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journal pages

FIRST NAME																				
LAST NAME																				

[1] Define: watershed

[2] What is groundwater?

[3] Why is groundwater important to people and to watersheds?

[4] SKetch a map of your local watershed. Include your school, a wetland, any rivers or streams, and the Great LaKe nearest you. Draw arrows from the wetland to the laKe, following the path you thinK the water might taKe.

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journal pages

FIRST NAME																			
LAST NAME																			

[5] Water Journey: Write about the path water might take from where you're sitting to the lake. What might it encounter along the way?

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