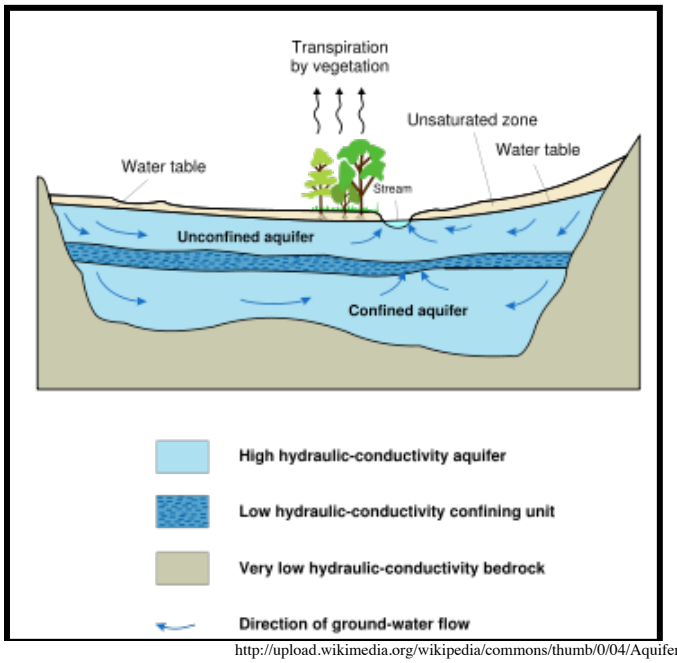
Lesson One

AQUIFERS

Adopted from the Groundwater Foundation website: http://www.groundwater.org/kc/activity2.html

The geology of each state is included in Part I. The northeastern area is based on Appalachian development, erosion, and glacial geology. The purpose of this section is to understand how water moves through soils and is sequestered as an aquifer.



http://upload.wikimedia.org/wikipedia/commons/thumb/0/04/Aquifer_en.svg/360px-Aquifer_en.svg.png

VOCABULARY

Infiltration- Flow of water from the land surface into the soil.

Water Table- The top of an unconfined aquifer; indicates the level below which soil and rock are saturated with water.

Unconfined Aquifer- An aquifer in which the water table is the upper boundary of the aquifer.

Confined Aquifer- Where the groundwater is bounded between layers of impermeable substances like clay or dense rock.

Porosity- The capacity of rock or soil to hold water.

Permeability- The rate at which water moves through rocks or soil.

Recharge- When rainwater seeps into the ground and is added to the aquifer.

Discharge- An outflow of water from a groundwater aquifer. The opposite of recharge.

Groundwater- Water found in the spaces between soil particles and cracks in rocks underground.

Hydraulic Conductivity- the ease with which water can move through pore spaces or fractures

LINK TO MORE VOCABULARY:
HTTP://WWW.GROUNDWATER.ORG/GI/GWGLOSSARY.HTML

ACTIVITIES

I. Aquifer in a Cup

Objective

Groundwater is water that is found underground in the spaces and cracks between soil, sand and gravel. Often hidden from view, in this activity you will "see" what groundwater looks like and learn some basic groundwater vocabulary.

Materials Needed

- 2 clear cups
- Sand, gravel and aquarium rock (potting soil can be substituted for sand, gravel, and aquarium rock. The soil will float, but zone of aeration, saturation, and an open aquifer can still be seen).
- Pitcher of water

Procedure

1. Fill 2 cups with layers of sand and gravel to about 3/4 from the top of each cup. Remember that in nature, aquifers consist of layers of sand, gravel and rock.
2. In one of the cups, pour water slowly into it. Watch how the water fills the spaces between the particles of sand and gravel. Does the water appear to move faster through the sand or faster through the gravel? Why?
3. Now continue to fill this cup with water to the top (above the top of the sand and gravel). Water that is located above ground, like rivers and lakes, is called surface water. Water below the ground's surface is called groundwater.
4. In the second cup, slowly pour water into the cup until the water line is about one inch below the top of the sand/gravel. Look closely at this line created by the water. This line is called the water table. Water below the water table is called the saturation zone.
5. Now pretend that your pitcher of water is a large rain cloud and pour some more water into your second aquifer until the water table is about one half an inch below the surface of the gravel. Your groundwater supply has just been recharged. This is what happens when it rains or snows and water infiltrates (or sinks) into the ground.

Optional Extensions

1. Use liquid food coloring or powdered drink mix to represent a source of groundwater contamination. Sprinkle or pour the contamination on the surface of the gravel. Sprinkle water (to represent rain) on top of the gravel and contaminant. Observe and discuss what happens.

TO BE USED TO EXPLAIN ROAD SALT IN LESSON FOUR

2. Conclusion

   We have learned that groundwater is water that is found underground in the cracks and spaces in soil, sand and gravel. We have learned that groundwater is stored in--and moves through--the layers of sand and gravel. This geologic

formation of sand and gravel which stores groundwater is called an aquifer. Aquifers get more water when they are recharged by rain and snow.

Activity Source: *The Groundwater Gazette*, published by The Groundwater Foundation. http://www.groundwater.org/kc/activity2.html

II. Awesome Aquifers

Objective

To create a working model aquifer, learn about groundwater, increasing one's understanding of groundwater and related concepts.

Materials

The following is a list of suggested materials that can be used to build the aquifer. Teams may find other materials they wish to use or other ways to use materials than what is suggested.

- A transparent container (one per team): to build the aquifer in. This could be a jar, 2-liter soda bottle, small aquarium, display box, plastic storage container, etc.
- Sand, gravel, soil, modeling clay/plumbers putty, sponges: represent geological strata
- Plastic syringe or lotion pump: used as a well (pumping or injection)
- Aquarium airline tubing: can be used as part of a well
- Nylon netting, hosiery, coffee filter, or window screen: works as a well screen
- Rubber bands, plumber's putty, or electrical tape: used in various ways to hold parts together (e.g. well screen) Spray bottle: used to demonstrate rain
- Liquid food coloring and/or powered drink mix: represents contamination
- Film canister: can be used as an underground storage tank

Procedure

Students will need some initial groundwater knowledge prior to this activity. This activity is best when students have already been introduced to groundwater and related concepts. Discuss the concepts included in list provided and discuss related topics such as possible sources of groundwater contamination and possible prevention or reduction methods. Divide the students into teams of 2 or 3. Distribute copies of the Awesome Aquifer Concept list to the students as a guide for their construction and presentation.

Activity Steps

1. Design and build a working model aquifer (allow 30-45 minutes)
2. Allow the students time to discuss in their team how they will construct their model. Give the students ample time to construct a working aquifer with materials such as those listed above and maker sure they have had time to prepare a short presentation with their model.
3. Each team of students will present their model to the other teams, demonstrating and explaining concepts included in their model (10 minutes per team, use a timer.)

4. After each team of students has completed its demonstration have students discuss what they learned.
5. Discuss real world situations (drought, contamination…) that may affect groundwater supplies and discuss how communities and individuals might deal with these situations.

Activity Source: Created by The Groundwater Foundation; modified from the Science Olympiad approved event, Awesome Aquifers.

HOMEWORK

Go to: http://www.youtube.com/watch?v=uQRvN6MUajE

This EXCELLENT video will give you an overview of what groundwater is and how it relates to human interactions!

Answer these questions after viewing the video:

1. How does an aquifer (groundwater) get filled (recharged)?

2. How does water get cleaned before it goes to the aquifer?

3. Where do homes with well's get there drinking water?

4. How does tar and cement keep groundwater from being recharged?

5. List three pollutants that are seeping into the groundwater in the video.

6. List two ways to prevent groundwater/aquifer contamination.

7. What are some ways to conserve water?

8. What can you do to help keep ground water recharged and clean?