LESSON: BUILD AN AQUIFER

Grade level: 4th through 5th grade

4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Activity Reference: http://www.aquariumofpacific.org/downloads/IAFTM_AquiferLesson.pdf

INTRODUCTION

Comprehension of the critical role played by water in support of all life on Earth is an essential foundational element of the Inland Empire Resource Conservation District's (IERCD's) Water Conservation classroom presentation. This activity is being provided to increase student awareness of water uses and benefits prior to program facilitation, and encourages development of this knowledge in a free form, group exercise. The suite of concepts and vocabulary covered will depend on length of activity facilitated by the participating teacher, but at any length should increase student preparation for IERCD program participation. It would also be suitable for post-program facilitation, to reinforce concepts and vocabulary covered during the program for maximum content retention.

OBJECTIVE

By engaging in this activity students will:

- Obtain, evaluate, and communicate information and experience regarding the operation of an aquifer.
- Gain Information about aquifers and the role aquifer's play in groundwater.

BACKGROUND

An aquifer is a geologic unit saturated with water that can be used as a drinking supply (potable water). The water in an aquifer can be found in sediments and rock. Some rocks are porous and can hold water in the spaces between the grains. Some rocks have a lot of cracks in them, which also allow water to travel through it. Aquifers have different zones: for collecting water, for water entering the ground, and sometimes, for confining water. Water movement in aquifers is highly dependent on the permeability of the aquifer material. Permeable material contains interconnected cracks or spaces that are both numerous enough and large enough to allow water to move freely. In some permeable materials groundwater may move several meters in a day; in other places, it moves only a few centimeters in a century. Groundwater moves very slowly through relatively impermeable materials such as clay and shale. (Source: Environment Canada: http://www.ec.gc.ca/eau-water/#piezometric)

SUMMARY

Student, as a class or in groups, will build their own aquifer and examine the way water infiltrates down into the different underground water collecting zones in an aquifer.

MATERIALS

Per Group:

- One clear plastic cup
- Blue or red food coloring
- Modeling clay or play dough *
- one cup of gravel
- 1 cup of sand

*optional

2 liter soda bottle
1 cup of water
Pin or small nail
Scissors
1 cup of soil

SKILLS DEVELOPED

- Group collaboration
- Following instructions
- Observation
- Comprehension

DIRECTIONS

1. Take pin and make holes in the cap of a soda bottle. Have 2 liter bottles pre cut in half per group. Put cap on top of cut top half of bottle. This will later be used to simulate rain.
2. Fill a cup with 8oz of water and add a few drops of food coloring.
3. Students should flatten the dough and place it at the bottom of the 2 liter bottle (Have students use the same amount of dough).
4. Next add 1 cup of sand and spread evenly.
5. Repeat with gravel.
6. Repeat with soil. (Students could add grass to their model if they choose.)
7. Have students place the rain simulator bottle top above the 2 liter bottle and pour in blue dyed water on to the aquifer bottle.
8. Students can watch the color dyed water penetrate down into the aquifer.
9. Record the results.

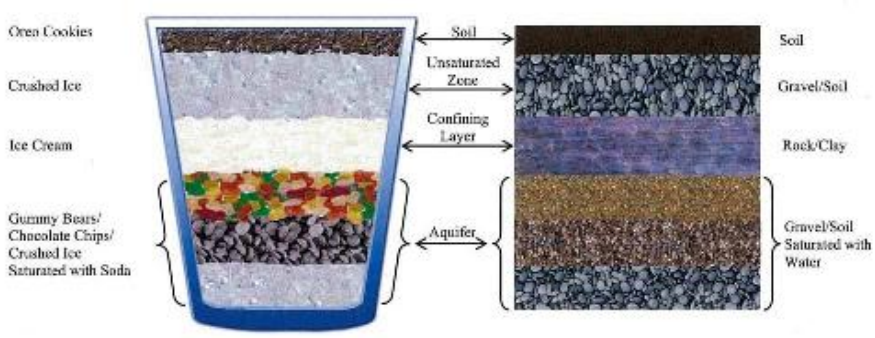
You may add additional aquifers and vary the material ratio (sand to gravel) to examine how long it will take the water to reach the bottom.

EXTENSION

You can extend this activity: Have Students build an edible aquifer. This activity can be found at the link listed as well as a link to video demonstrating edible aquifers.

- Link to website: http://dnr.wi.gov/org/caer/ce/eek/cool/ameliaedibleaquifer.htm
- Link to video: https://www.youtube.com/watch?v=SVpRbtSY7gM

Another way to expand this activity is by having students research what type of aquifers are in their region as well as the layers of an aquifer.



Edible Earth Parfaits

***Attention:* Please consider your student's allergies or medical needs, prior to conducting this activity! Make substitutions if needed!**

Objective: To teach about the geologic formations in an aquifer.

Focus: Groundwater and aquifers. Students will build their own edible aquifer and learn about geologic layers, confining layers, contamination, recharge and water tables. The students will have a better understanding about the need to protect and conserve groundwater resources.

Materials needed (for a class of 25)

- Chocolate chips (4, 12 oz bags)
- Oreo cookies (2 packages)
- Crushed ice (the smaller the better)
- Vanilla ice cream (one 5-quart bucket yields 60 aquifers at one generous scoop per student)
- Clear soda pop (Sprite, lemon-lime) (4 liters)
- Colored soda Ex: strawberry, grape (1 liter)
- Small gummy bears or gummy worms (small) (2 lbs)
- Drinking straws (clear work best) (25-30)
- Clear plastic cups (12 or 16 oz) (25-30)
- Spoons (25-30)
- Ice cream scoop

Activity Steps

1. Discuss what was learned during the Groundwater Demonstration. Inquiry: What is groundwater?

2. Begin to construct your edible aquifer by filling a clear plastic cup 1/3 full with gummy bears, chocolate chips, or crushed ice.

These represent gravel & soil that make up the aquifer.

3. Add enough soda to just cover the candy or ice. *The soda represents groundwater. Notice that the soda fills all of the spaces among the gummy bears, chocolate chips and ice. The aquifer is now saturated with soda; it is a "saturated zone." In an unconfined aquifer, the top of the saturated zone is called the "water table."*

4. Add a layer of ice cream to serve as a "confining layer" over the water-filled aquifer. Discuss what a confining layer is and does. *This layer, called a "confining layer" or an "aquitard", is impermeable or significantly less permeable than the aquifer below it (it is difficult for water to soak through). It helps protect the aquifer from contamination and is usually made of rock and/or clay. An aquifer under a confining layer is called a "confined aquifer" An aquifer without a confining layer is called an "unconfined aquifer."*

5. Add crushed ice on top of the confining layer/water table. *This represents the unsaturated zone, the area where air fills most of the pores (spaces) in the soil and rock.*

6. Scatter Oreo cookies over the top. *This represents the soil, which is very porous (top soil).*

The aquifer is now complete. Your aquifers will probably be messy and not look like the picture on the front page. That's OK! Real aquifers aren't neatly layered either.

7. Sprinkle colored soda over the top. The soda represents contamination. Does anything happen to the soda right away? *(Usually nothing will happen.)*

8. Using a drinking straw, drill a well into the center of your aquifer. *Observe the aquifer and soda. What, if anything, happens when the well is drilled?*

9. *Slowly* begin to "pump" the well by sucking on the straw. *Watch the decline in the level of the clear soda and observe what happens to the contaminants. Do contaminants leak through the confining area (ice cream) and get sucked into the well? If so, do more contaminants get into wells in confined or unconfined aquifers?*

10. Pour a small amount of clear soda over the top. The soda represents precipitation. It recharges the aquifer (adds new water). Watch how the colored soda moves into the aquifer. The same thing happens when contaminants are spilled on the ground. Do you think you could get the colored soda back out of the clear soda?

11. Review what you have learned as you enjoy eating your edible aquifer.