AQUIFERS AND RECHARGE AREAS

SUBJECTS:
Art, Geology

TIME:
50 minutes

MATERIALS:
3-liter soda bottle – demo
three large syringes
ruler
gravel
builder's sand
topsoil
measuring cup
water
food coloring
clear plastic cups (10 oz.)
student sheet
teacher sheets

OBJECTIVES

The student will do the following:

1. Create a model of an aquifer.
2. Describe how an aquifer works.
3. Describe how pumping affects an aquifer.
4. Prepare a model presenting to local planners the important aspects of protecting recharge areas.

BACKGROUND INFORMATION

An aquifer is a layer of underground rock or sand which stores and carries water. A recharge area is the place where water is able to seep into the ground and refill an aquifer because no confining layer is present. Recharge areas are necessary for a healthy aquifer. Few rules and regulations were made to protect these areas.

Aquifers form significant natural reservoirs of water and can form a large proportion of water used for drinking purposes. In some countries the supply of water from underground can be the only source of water available. The location and extent of aquifers is dependent upon the geological conditions of the underlying rock. There are three types of aquifers: perched, unconfined, and confined.

Perched aquifers occur in isolation as small quantities of water in suitable confining strata above the water table. Unconfined aquifers form when the permeable strata forms an outcrop on the surface. The upper part of the aquifer is represented by the water table whose levels fluctuate according to the groundwater balance. Confined aquifers have impermeable strata above and below and are not recharged by percolating rainwater.

Note that impermeable strata do not always represent a complete barrier to water movement and that recharge of the aquifer may take place many kilometers away where the strata forming the confined aquifer form a surface outcrop.

Terms

aquifer: an underground layer of unconsolidated rock or soil that is saturated with usable amounts of water (a zone of saturation).

recharge area: an area where water flows into the Earth to resupply a water body or an aquifer.

ADVANCE PREPARATION

A. Gather information from the city planning staff concerning a local recharge area that needs special protection from pollution and development.

B. Have the students visit the site and take pictures of the area.

C. After the trip have the students divide into groups of four.

PROCEDURE

I. Setting the stage

A. Tell the groups that they are going to conduct an experiment that includes creating an aquifer.

B. Explain what an aquifer is and the importance of a recharge area.

C. Brainstorm how this information will help us develop a plan to protect our recharge area.

II. Activities

A. Have each group mimic you as you:

1. Place 4 inches of gravel in a bowl. Measure correct amounts of gravel, topsoil, and sand with the ruler.

2. Put three syringes upright in the gravel. Do this before Step 3, or they will clog with sand. The syringes show an example of wells pumping from the aquifer.

3. Hold the syringes and at the same time put 3 inches of sand on top of the gravel and 2 inches of topsoil over the sand.

4. Add food coloring to 2 cups of water.

5. Slowly pour enough water over the topsoil to saturate. This is the example of rain seeping into the aquifer and becoming groundwater.

6. Put the bowl at eye level, observe, and record changes.

7. Pull the stopper up to fill one syringe. This is an example of how water well pumping affects the aquifer.

8. Repeat Step 6 using two syringes at once. Record changes in groundwater.

9. Repeat Step 6 again using all the syringes. Record changes in groundwater.

III. Follow-Up

A. Each group must answer the following questions:

1. Is this aquifer model a recharge area?

2. How do you know?

3. Describe how an aquifer works.

4. Are the sand and topsoil permeable or impermeable? Why?

5. What do you think would happen if more syringes were used?

6. Why is it necessary that we protect recharge areas?

IV. Extensions

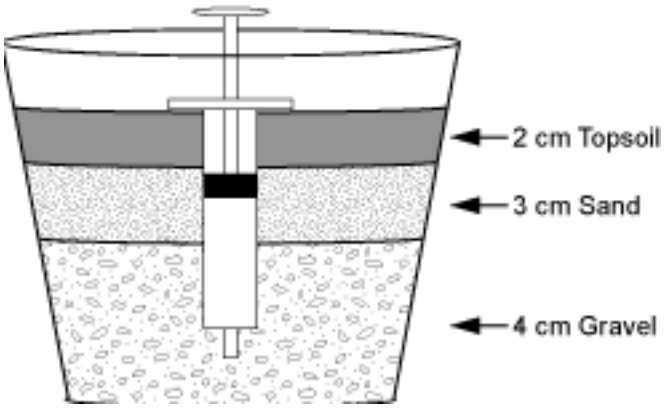
A. Each group should brainstorm ways to construct a model that they could present to the city planning committee. This model will show why this area needs protection. The model will show pictures of the site, the results of the experiments, and why a recharge area is important.

B. The winning group may present their model to the planning committee.

RESOURCES

Johnson Cynthia C., Waterways, Division of Public Information St. John's River Water Management District, Jacksonville, FL, 1991.

Groundwater: http://giswww.king.ac.uk/aquaweb/main/groundwa/gw1.html


2 cm Topsoil
3 cm Sand
4 cm Gravel

STUDENT SHEET *AQUIFERS AND RECHARGE AREAS*

Directions: Draw your investigation set-up, record your observations, and answer the questions.

1. Fill the syringe 1/3 full. Record changes in groundwater.

2. Fill the syringe 2/3 full. Record changes in groundwater.

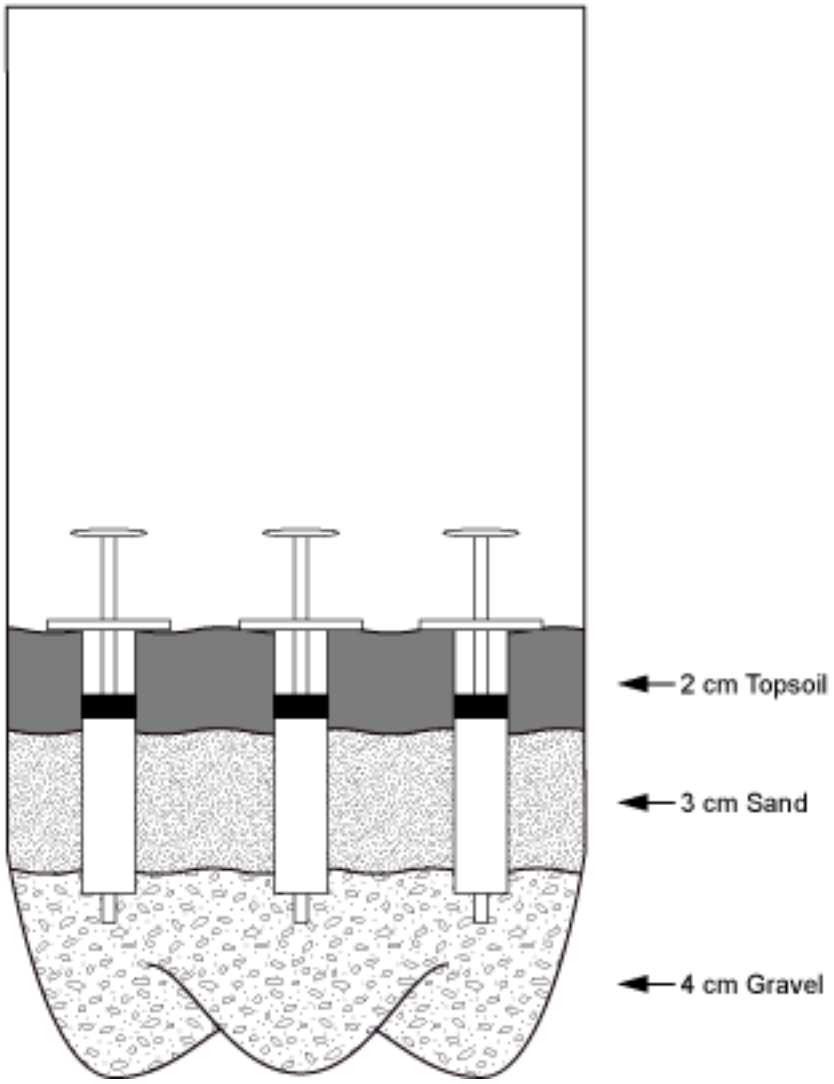
3. Fill the syringe all the way. Record changes in groundwater.

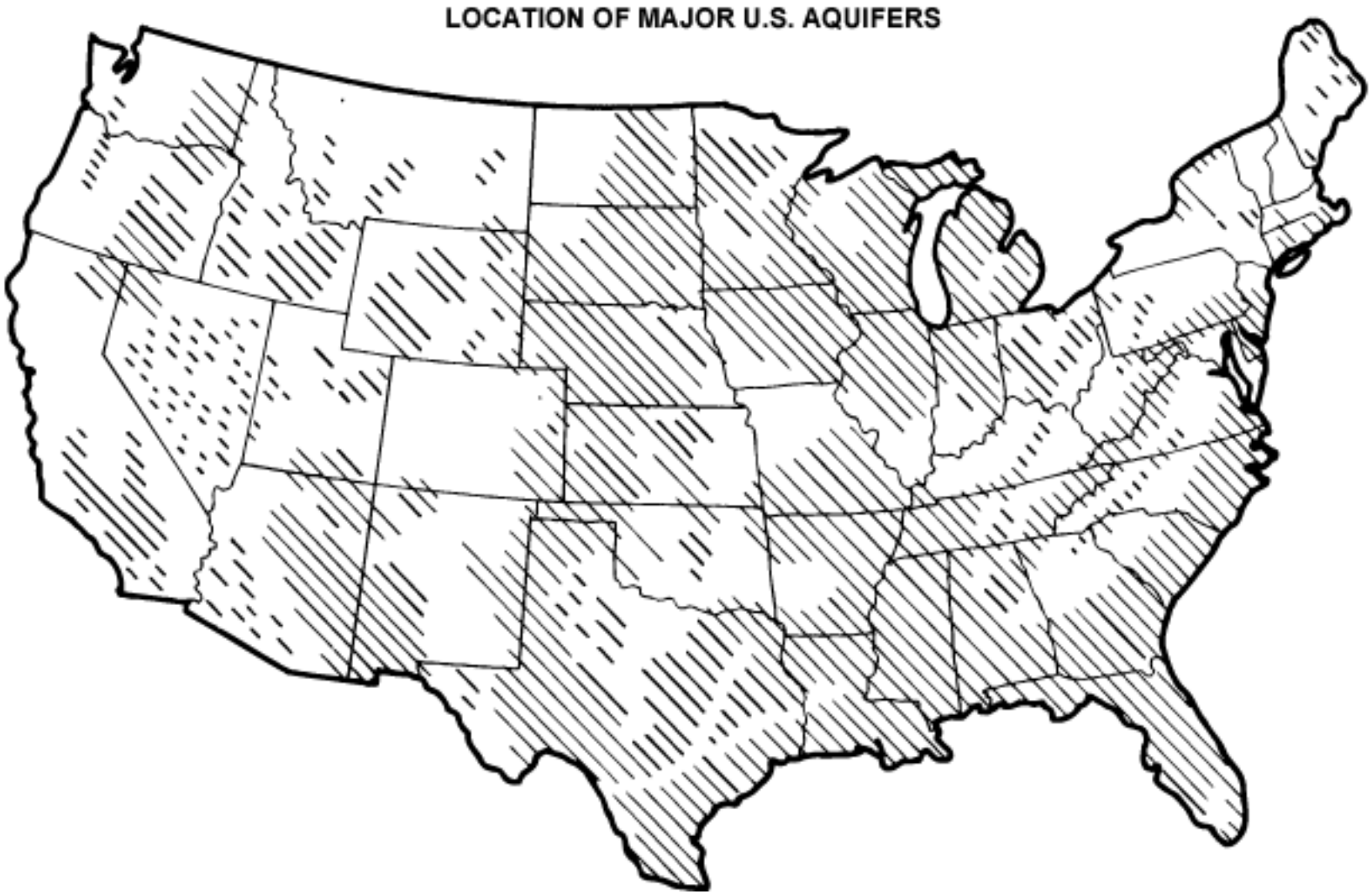
4. Is this aquifer model a recharge area? Why or why not?

5. How does an aquifer work?

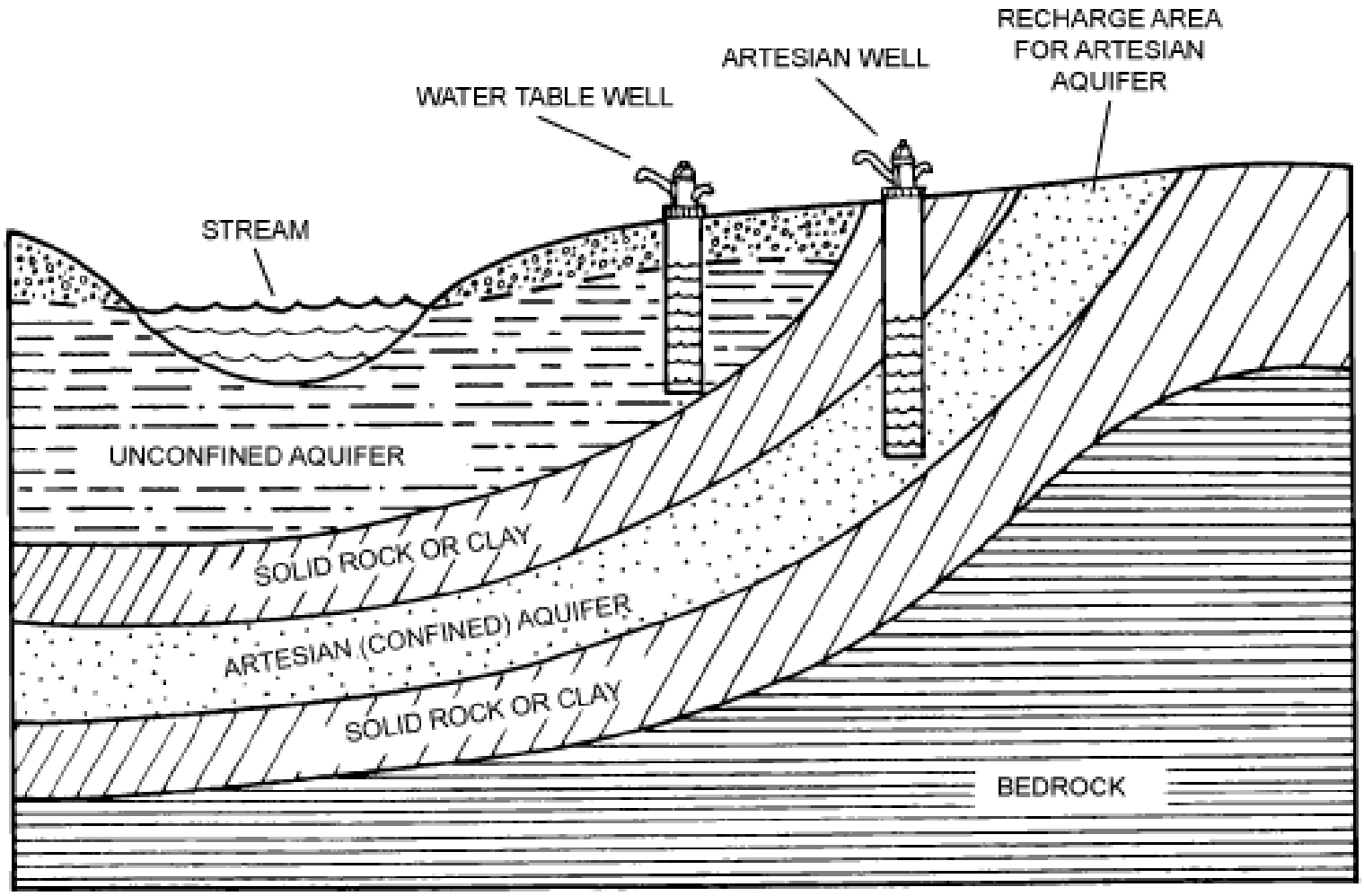
6. How are the syringes similar to wells in an aquifer?

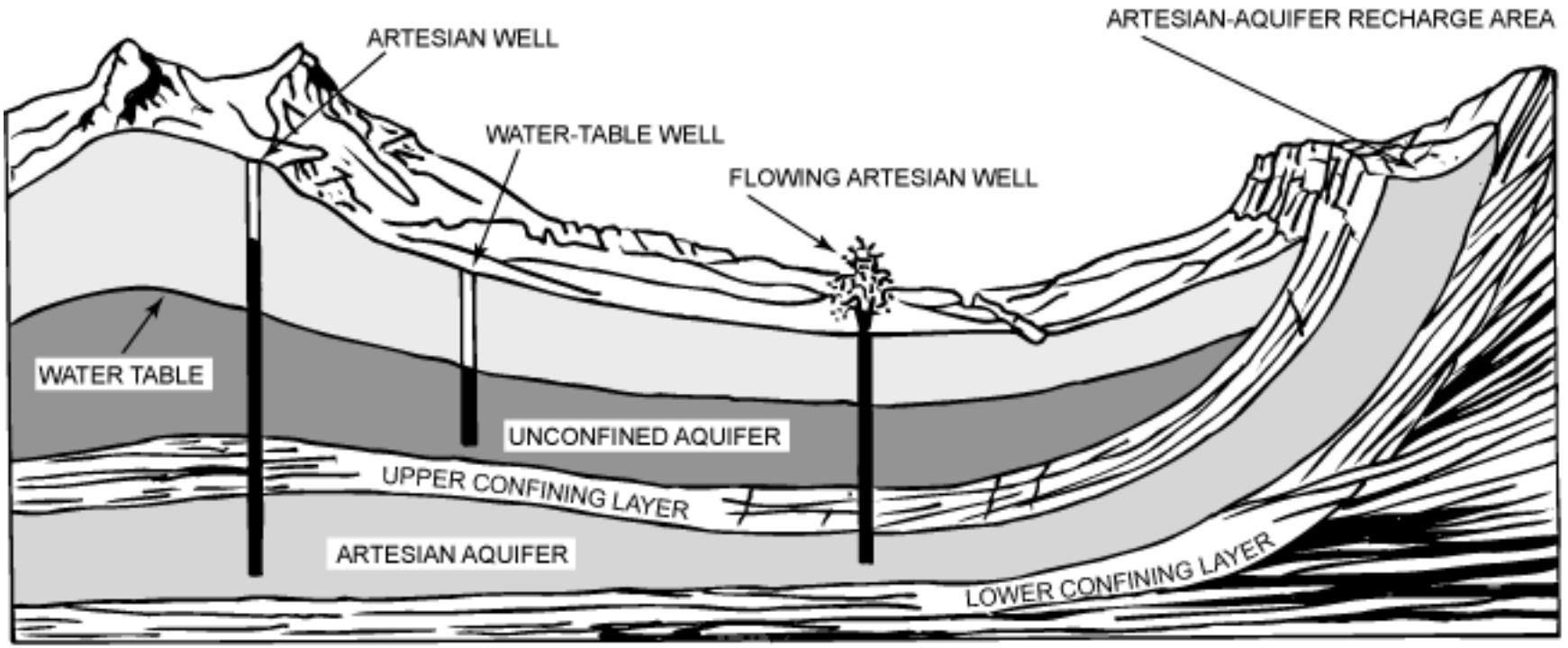
7. Why is it necessary to protect recharge areas?


2 cm Topsoil
3 cm Sand
4 cm Gravel


LOCATION OF MAJOR U.S. AQUIFERS

AQUIFER DIAGRAM





The Ground-Water Resource