Edible Aquifer

Activity Description
This demonstration shows students the different parts of an aquifer and how contamination can spread into groundwater.

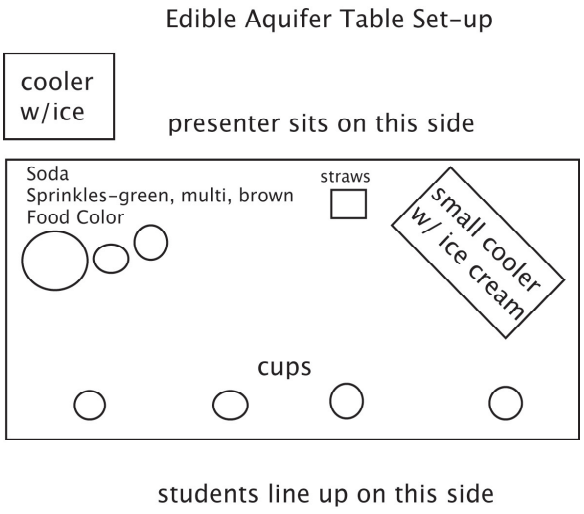
Take Home Message
An aquifer is the sand and gravel underground that is saturated with water. On Cape Cod, all of our drinking water comes from an aquifer

Massachusetts Frameworks
Earth Science
Earth Material #1 and #4

Supplies List
- Clear plastic cups
- Straws
- Crushed Ice* SEE SPECIAL NOTE
- Vanilla ice cream
- Clear or lemon lime soda
- Red hibiscus dye in dropper bottles
- Colored Sprinkles
- Green sprinkles
- Ice cream scoop
- 2 Coolers- small for ice cream, large for crushed ice
- Paper towels
- Sponges
- Chocolate sprinkles
- Green food coloring
- Anti-bacterial hand wipes
- ***This activity is done best when using two stations during bigger festivals. Helps ensure that everyone gets to participate!

Set-up
- Put most of the ice cream into a big freezer somewhere in the school and keep one at the table.
- Put the crushed ice***(SEE SPECIAL NOTE ABOUT ICE)*** in the large blue cooler. (If a full day festival you may want 1/2 ice in freezer.)
- Keep the small cooler on the edge of the table with the ice cream and some ice in it.
    a. Keep the straws on the table in a box to be given out during the activity.
    b. Also, have the sprinkles in smaller containers that you can shake over the cups and a pipette in the food coloring bottles (or use small squeeze bottles).
- Use QUEST (Stop and Shop band soda) which is yellow/green tinted soda, if this isn't available you can get any brand clear lemon lime soda and add 3-4 drops of green food coloring to give it a green tint The tint makes it easier for the students to see the water table and changes that occur.

MAKE SURE TO PUT A LARGE TARP DOWN UNDER THE TABLE AND TAPE IT DOWN WELL WITH DUCK TAPE



Script/Activity Procedure

- Start out by telling the students that they are going to be making an edible aquifer today. **Ask them if they know what edible means?**
    - Something you can eat!

- **Ask if any of the students know what an aquifer is**. Explain that an aquifer is the sand and gravel under the ground that can be saturated with water. It is the holder of our groundwater. Tell the kids that here on Cape Cod all of our drinking water comes from an aquifer.

- Explain to the kids that instead of using real sand and gravel, we are going to make an aquifer that you can eat!
    - At this point fill each plastic cup with ice about 3/4 full.
        - Explain that the ice represents the sand and gravel in our aquifer

- **Ask what else the students need to make an aquifer.** You are looking for them to say water. After they say water, **ask them ways that water can get into the aquifer** You are looking for them to say rain or precipitation. Explain that precipitation is condensed water vapor that is heavy enough to fall to the earth.
    - Begin to pour soda into each cup about halfway up the ice.
        - Explain that you are making it rain or (the precipitation of their choice)

- Have the students look at the section of their cup that is filled with soda. Tell the students that the section filled with soda is the saturated zone. Explain that saturated means all the spaces between the sand and gravel (ice) are filled with water (soda). **Ask the students what is filling the spaces between the sand and gravel above the water**. You are looking for them to say air.

- Point to the line between the saturated zone and the unsaturated zone. Explain that this is the water table line. You can use building a sand castle at the beach to explain how you can dig down and find water, the saturated zone of the sand. They should all have done this at some point in time.

- Explain now that our aquifer is full of water, **ask how do we get water out of the ground and into our houses**. You are looking for the students to say the word well, or pipe.
    - Give each student a straw
        - Explain that their straw represents a well.

- **Ask the students if they should drill their wells in the saturated or unsaturated zone**. You want them to put it into the saturated zone in order to be able to get water. If you drilled into just the unsaturated zone what would you get?
    - You would get air not water.
    - .**NOTE* -** *if students are playing with their straws explain that wells are drilled pipes and so they don't move up and down or wiggle like their wells are doing at the moment.*

- You are now going to show the effects of pumping on the aquifer. **Tell the students to pump their wells by taking a drink from their straws.**

    - **Ask what happens to the water table.**
        - Explain that the water table gets lower when a pumping well withdraws water.

- **Ask the students what they think would happen if we kept pumping and pumping our wells.** Explain that the water level would get lower and lower. Explain that our freshwater is sitting on top of salt water. **What might happen if we pumped out too freshwater?**
    - We would get the salt water and salt water is not good for drinking.

- **Ask the students why they think we never run out of water**. Explain how it continues to precipitate in different forms.
    - Pour a little more soda over their cups again
        - Explain that this is the precipitation that comes often here on Cape Cod and that it causes the water table to rise again, so we can continue to pump water out of the ground.

- Now that you have shown them what happens underground, explain that you are going to show them what happens on top of the ground.
    - **Ask the students what is on top of the gravel on the cape?**
        - Provide them hints like what do you play in at the beach.
        - Add a scoop of ice cream to each kids cup
        - Explain that this is the fine sand layer
    - **Ask them what is on top of the fine sand?** That would be soil, or topsoil.
        - Here you can mention what your parents use when planting and gardening.
        - Sprinkle Chocolate sprinkles on the ice cream
        - Explain that is the topsoil we grow things like grass and plants in
    - **Ask the students what grows in top soil and sand?**
        - Sometimes you can say what is green and grows to help them along
        - Sprinkle the Green sprinkles
        - Explain that this is the planted grass and plants
    - **Ask the students if they can think of anything harmful that might go into the ground?**
        - Sprinkle colored sprinkles

        - Explain that some people spill and dump things into the ground. These things can contaminate the ground.
        - Have the students give some examples like motor oil, pesticides, soapy water, gasoline, toxic chemicals and fertilizers.
    - **Some people think it is okay to dump stuff on top of the ground, but let's see what happens when it rains?**
        - Pour more soda over the students' cups and ask them to pump their wells by taking a sip
        - Explain that by pumping their wells they can move the contamination in the groundwater

- **Ask if any students have contamination in their wells**.
    - Some students may have contamination. Not all students will so you can hold up an example of the contamination and ask if they would want to drink that water if they knew it was fertilizer and other chemicals possibly.
- **Once you have talked about this, now explain that you are going to have a gasoline spill.**
    - Put a drop of hibiscus food coloring into each students cup
    - Make it rain again
    - Have them take a sip to pump their wells again
    - **Show them how the contamination has spread out and contaminated their whole aquifer**

- **Now ask again if anyone has contamination in their wells**. Some will. **Ask how much water do you think one gallon of gasoline can contaminate**. Let them guess before telling them that 750,000 gallons of water, this is a question on the quiz board, hope they remember it!

- Wrap-up by **asking again what an aquifer is**. Hopefully someone can give a pretty good answer. Remind them all that an aquifer is the sand and gravel underground that is saturated with water.

- Remind them to clean-up and wash the cup out after they finish their aquifer to recycle!

Clean-Up

During the festival

- Clean-up the table and put out new cups
- Pick up the straws and anything else that fell on the ground
- Sponge down the table and replace the paper towel after a few groups.
- Use antibacterial hand wipes on your hands, and the table from time to time

After the festival

- Dump the ice outside, wipe the table and make sure the containers are dry and sealed tightly
- Make sure the leftover ice cream goes home with one of the houses.
- Wash the ice cream scoops and coolers out and dry thoroughly, complete the inventory sheets.
- If you are done quickly, help others clean up and pack, load cars, or sweep/mop the area.
- **THE TARP GETS GROSS… RINSE IT OFF OUTSIDE - AND DRY IT WELL BEFORE YOU FOLD IT UP.**

* SPECIAL NOTE:

The crushed ice that we use is actually shaved ice that comes from the produce department in the grocery store. Pick up the shaved ice early in the AM on the day of the festival. You should call ahead the night before to the store where you intend to go to ask permission from the night manager. In the morning, head for the fish or produce guy to get permission to fill your bags (hopefully they will have been notified)- lots of thank yous! Don't forget to bring the Jumbo Zip Lock Bags (or you will have to buy more) Fill bags with clean ice, using a clean scoop remember the kids will be eating it! One full jumbo bag of ice will do 20 kids. Its always better to have an extra bag of ice just in case.