GROUNDWATER

Narrative

BIG IDEAS:

Groundwater…

1. is between the grains of sand and gravel.
2. moves because gravity works underground just like it does above ground.
3. is connected to surface water.
4. is part of the water cycle.
5. We use groundwater as a part of our water supply.

MATERIALS:

Earth Material Tubes:
- One filled with sand
- One filled with gravel
- Container for wet sand

2 Groundwater Models, including:
- 2 wooden stands
- 1 hand pump with tubing
- 1 flask
- Diluted green food coloring
- 2 recharge bottles

- containers to catch water
- extra dry sand

- Paper towels
- 15 re-usable student groundwater models
- 15 100 mL graduated cylinders
- 15 1-2 L containers of water

ENGAGE — Earth Material Tubes - 5 Minutes.

1

How does water move through different earth materials? Look at these tubes full of earth materials. **What do you see inside the tubes?** Sand and gravel. **What will happen if we pour water into the tubes?** Have students predict how long it will take for water to move through each tube. Have one student pour water in each tube (gravel first) and another student act as the "boss". The boss will instruct the pourer when to begin and watch for water to come through the bottom of the tube. Have the rest of the class count out loud while the water moves through the earth materials. After you've observed both, ask: **Why does water move faster through the gravel?** Because the large spaces or pores in between grains of gravel allow water to flow more easily. The pore spaces between sand particles are smaller and slow down the flow of water.

Q AND A — Introduce Groundwater Flow Models – 3 Minutes.

2

Have students pair share: **What does it look like underground?** Sand, gravel and other rock materials. **How do we find out what it looks like under the ground?** We drill a well and note the sediments that we go through as we drill. **What is a model? This groundwater flow model represents what it might look like if you were to sink down in the ground below our feet 200 feet. It's a side view of the ground, called a cross-section. From one side to the other represents miles and miles and miles and from the surface to bottom of the model represents 100's of feet down.**

What do you notice about this groundwater model? What do you see? As students note various features, introduce them. They might see the different layers represented

here. **Can you tell me what one of them is made of?** Gravel. **What about another layer?** Sand. They might point out 2 kinds of **wells:** The 2 **pumping wells**, with rectangular boxes at the end, are used to pump water from the groundwater. There are also **observation wells** that are used to look at the water level and take samples.

EXPLORATION — Movement of Water through the Ground – 9 Minutes.

What is groundwater? Water that is beneath the earth surface. **Where does groundwater come from?** Rain. **Where does it rain most often around here?** Up in the mountains. Have a student, put the recharge bottle up on left side of model. **This is our mountain rain or recharge.** Often it snows up on the mountains, creating snow pack. Open the valve on the right side of the model.

As the water bubbles out of the bottle, point out the holes in the column on the left side of the model allowing water to enter. **When snow pack melts, it seeps into cracks or fractures inside the bedrock of a mountain.** As water comes out of the outlet hole on the right, ask: **Where is the groundwater?** The answer is: **In the spaces between the grains of sand, gravel and soil! This is a big idea!** It's *not* a big lake down there!

Have three different volunteers put green dye into three of the observation wells that end in the sand layer. Tell them to: **put the squeeze bottle in nice and snug and squeeze until a big blob comes out in the sand**. Make sure the recharge bottle is flowing and that the valve is open. The green dye should move. **Which direction does it move? Why?** Gravity! **Water flows from higher areas** (point to the recharge bottle) **to lower areas** (point to the outlet on the right side of the model)**.** If they don't get this, drop a pen and ask why that pen dropped. Groundwater flows underground through earth materials. **This is a big idea! Gravity works underground too!**

Why do we care about groundwater? Because it is on average, 40%of our water supply. **This is a big idea! How do we get groundwater out of the ground?** We pump it out! **Hydrologists, engineers, water technicians, and other professionals designed a system using a well with a pump installed and a screen to keep soil from being drawn in with the water.** Have a few volunteers come up individually to pump the pumping well that ends in the sandy layer. While they pump, ask: **what happens to the green dye?** It moves into the well.

EXPLORATION—Groundwater/Surface Water Connection – 10 Minutes.

Tell students to pair up and find a small rectangular model. **This model represents a groundwater system**. From the long side to the other is miles and miles across and from the short side to the other is miles and miles across. From top to bottom represents 100's of feet. Pick up a piece of the brown rubber. **What do you think this represents in our system?** Earth materials or gravel.

Refer to the groundwater flow model: **Remember the wells that we pumped over here? What do you think the pumping well is in the model in front of you?** The white tube with the pump in it. If they have trouble with this refer to the pump and remind

them how they pumped the well in the big model. **If the white tube represents our well, then what do you think the green plastic container represents in the natural system?** Talk about this with your partner. **What do you think?** It represents a lake or surface water.

Now, look at the side of the model. Can you find the water level? Take your finger and trace the water level. Below this line, what is between the grains? Water. **What kind of water does this represent in our model?** Groundwater.

Look up here for 1 minute so that I can give you 3 directions. 1) Together you and your partner will measure out 100 mL of water using your graduated cylinder. Show them the graduated cylinder and show them the 100 mL mark. **2) One person will be the observer; observing what happens in your model when water is added. 3) The other person will be the pourer; pouring water into the brown "soil".** Show them where to pour water on the soil, NOT into the green lake. Let them do this.

Let me get your attention up here again. What did you observe? Start your sentence with: *When I poured water on the soil…* Possible answers: 1) the water level went up in the ground and 2) the water moved up in the lake. Accept their answers for now.

Now we're going to observe what happens when we pump water out of the ground. Remember doing that in the big model? Demonstrate how to pump the well with fingers under and above the pump. **Here are your directions: 1) One team member should pump 100 mL of water from the well and then pour it into the container.** Demonstrate where to pour it. **2) The other team member should observe the lake. 3) The team will then discuss what they saw. 4) The second team member should pump out another 100 mL from the well and then pour it in to the container. 5) The other team member should watch the lake. 6) The team will discuss what they saw again.** Let them do this. Walk around and ask questions about what they observe.

Q AND A—<u>Debrief Student Models</u> - 2 Minutes.

Okay, let me get your attention up here. What did you observe? Start your sentence with: *When I pumped water out of the ground …* *the water went down in the lake*. **So wait a minute, where did the water that you pumped come from again?** The Ground. **What kind of water was it then?** Groundwater. **So how did that make the lake go down?** They are connected! **<u>Groundwater is connected to surface water.</u> THIS IS A BIG IDEA!**

So is <u>groundwater part of the water cycle</u>? Yes.

EXPLANATION — <u>Review the Big Ideas</u> – 1 Minute.

- **Is groundwater connected to surface water?**
- **Is the groundwater system part of the water cycle system?**
- **Does groundwater move through sand and gravel underneath the land surface?**

- **Why do we care about groundwater? How do we get groundwater out of the ground so that we can use it?**