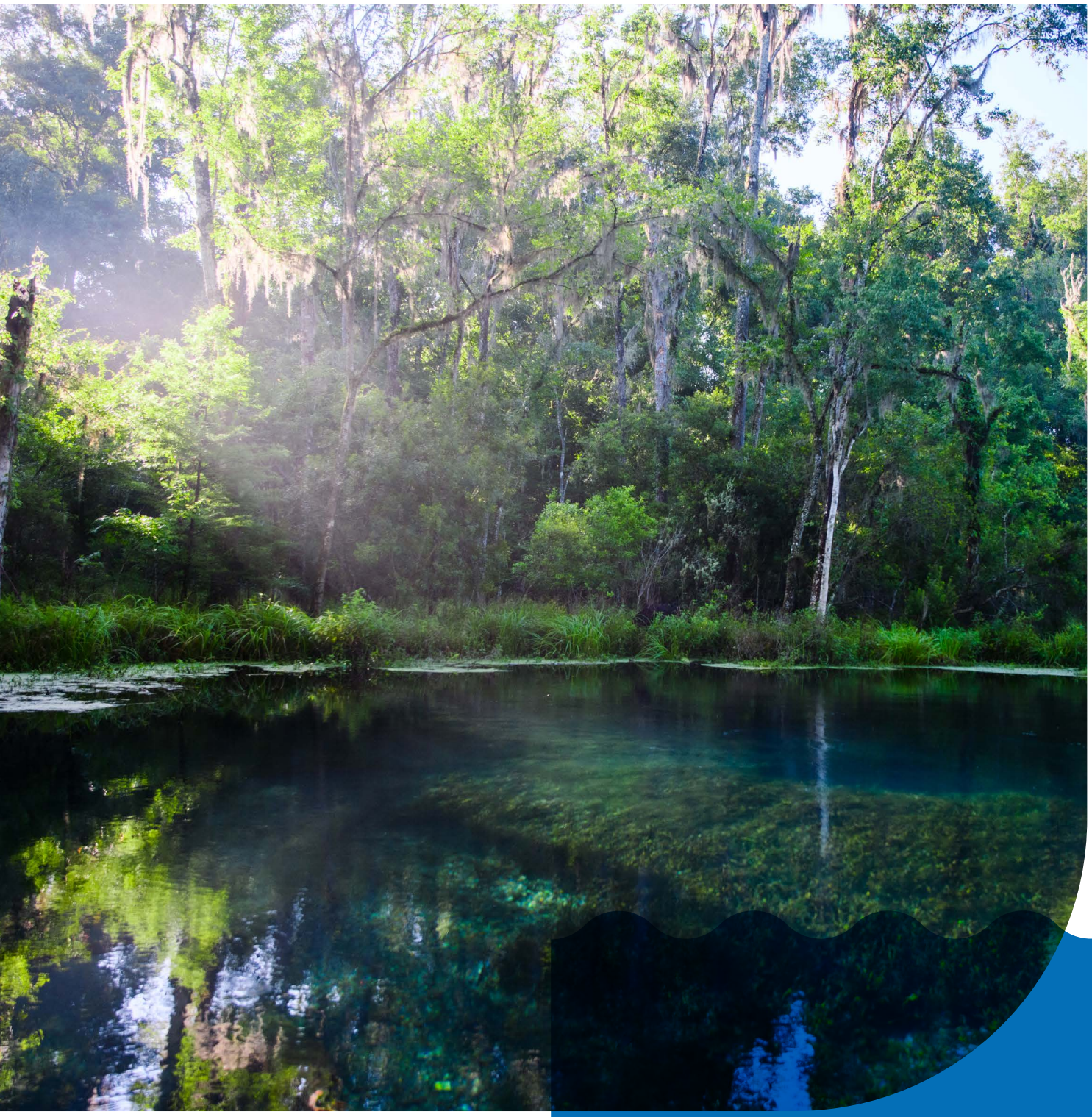
Lesson Plan: Water Quality, Conservation & Your Impact

MIDDLE SCHOOL



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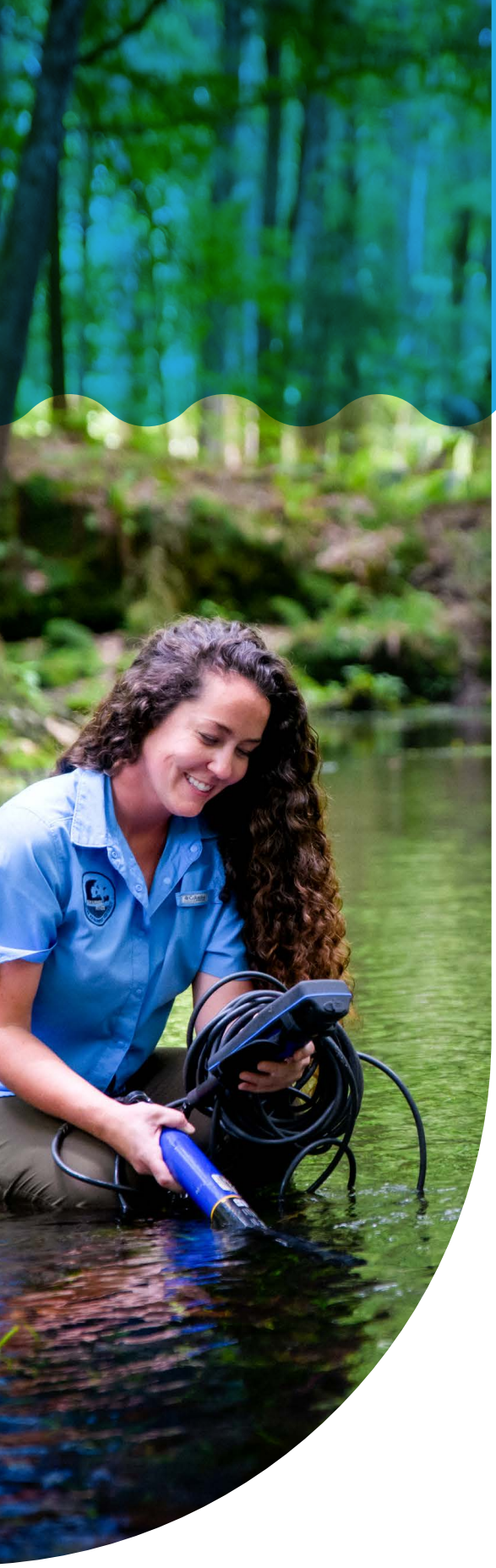


Learning Goals:

- Students will understand the importance of protecting and preserving the Floridan aquifer.
- Students will analyze how human interaction impacts water quality.
- Students will consider the importance of water conservation.

RELATED STANDARDS:

- SC.6E 6.2: Recognize that there are a variety of different landforms on Earth's surface such as coastlines, dunes, rivers, mountains, glaciers, and lakes and relate these landforms as they apply to Florida.
- SC.6.E.6: Over geologic time, internal and external sources of energy have continuously altered the features of Earth by means of both constructive and destructive forces. All life, including human civilization, is dependent on Earth's internal and external energy and material resources.
- SC 7.E 6.6: Identify the impact that humans have had on Earth, such as deforestation, urbanization, desertification, erosion, air and water quality, changing the flow of water.

DID YOU KNOW?

The largest aquifer in the southeastern United States is the Floridan. The Floridan aquifer is found beneath all of Florida and portions of Alabama, Georgia and South Carolina, and extends into the Gulf of Mexico and the Atlantic Ocean.

Engage

Directions: Display photos of local recreational waterways such as the Ichetucknee Spring, Suwannee River, Poe Springs, etc. Show the photographs on a large screen or print out an image for small groups to observe. Photos are found for download at **SuwanneeRiverPartnership.com**.

BACKGROUND INFORMATION TO LEAD DISCUSSION:

- **The Ichetucknee River and Springs** is one of the most pristine spring-run systems in north-central Florida and one of the world's most popular tubing, diving, and canoeing destinations. The natural spring water flows from the Floridan aquifer. Long ago, Native Americans lived near the banks of the river to access fresh water. In fact, Ichetucknee is an Indian word meaning "beaver pond."
- **The Suwannee River** winds 246 miles from Georgia through Florida to the Gulf of Mexico. It is a great location for canoeing, kayaking, and boating. There are many places to discover the many springs that flow into the river. You can enjoy a picnic on the riverbanks or on a sandbar. The sounds of nature will surround you.
- **Poe Springs** offers nature trails and springs that give you a glimpse into Florida's past. The springs flow into the Santa Fe River.
- **Madison Blue Spring State Park** is home to a first magnitude spring that is popular for swimming and scuba diving. The spring flows into the Withlacoochee River.

Discuss these questions:

"Have you ever gone to a lake, a river, or a spring?"
"What kinds of things can you do there?"
"Besides recreation, what are other ways we use water?"
Ex: drinking, washing hands, showering
"How is water used in your home?"
Ex: Wash the dishes, water the lawn, filling a swimming pool
"How is water used in our community?"
Ex: To put out fires, fill community pools, water ball fields at the park, agricultural irrigation, and manufacturing
"What would happen if we didn't have enough water?"
Ex: It would impact individuals, families, and the public.
There may not be enough water to drink, to grow food, for animals to drink, to manufacture things, to take showers, to swim in, etc.

DID YOU KNOW?

More than ninety percent of the people in north-central Florida use groundwater from the aquifer as their water supply.

Explore & Explain

INTRODUCE TOPIC AND VOCABULARY

Remind students that we all use and rely on water. It is important to conserve and protect the quality of our water. Human interaction can impact water quality. It is important to understand how everyone can be part of the solution.

"When you turn on the faucet to wash your hands have you ever wondered where that water comes from? Much of the water we use comes from the Floridan aquifer. The aquifer is a vast underground area of porous rocks that hold water and allow water to move through the holes within the rock, much like a sponge. Aquifers can be composed of different types of earthen materials, such as sand, shell and limestone. Fresh and salt water fill the various sized holes in the rock. Freshwater generally fills the uppermost part of aquifers, while salt water is present at greater depths.

More than 90 percent of people in north-central Florida use groundwater as their water supply. Our groundwater is located in an aquifer. Our largest aquifer in the southeastern United States is the Floridan aquifer, which is located beneath all of Florida and portions of Alabama, Georgia and South Carolina, and extends into the Gulf of Mexico and the Atlantic Ocean. The Floridan aquifer averages 1,000 feet thick, and freshwater can extend to a depth of 2,000 feet below land surface.

It is essential to preserve and protect our water. We need to be careful about how much water we use. We also need to be careful about keeping contamination or pollution out of the water. One risk to our water quality comes from nonpoint source pollution. There are many things that can contaminate the water: chemicals, nutrients like nitrogen and phosphorus. When water runs over the surface it can collect these contaminants. This water runoff can flow into our waterways and seep down into the ground until it reaches the aquifer.

There are many people whose jobs are to protect, preserve, and restore our water."

Vocabulary:

- **Aquifer:** an underground layer of rock and sediment that stores and transports water
- **Groundwater:** the water found below the surface of the Earth
- **Groundwater recharge:** When rain falls it seeps or percolates into the soil, moving down through the sand and rocks into the aquifer. It can also occur when surface water from rivers, lakes, and wetlands drains into the ground.
- **Nonpoint source pollution:** pollution that cannot be traced to one specific source. It may result from land runoff. When water runoff flows, it collects and carries natural and human-made forms of contamination that will eventually enter the waterways including lakes, rivers, streams, coastal waters, and the aquifer.
- **Pollution:** contamination from chemicals or waste materials
- **Saturation Zone:** The level below the water table where the ground is soaked completely with water
- **Surface water:** the water found above the surface of the Earth - lakes, ponds, rivers, streams
- **Water conservation:** to carefully manage and preserve the amount of water used
- **Water cycle:** The process of water moving from the earth into the atmosphere and back to earth again
- **Water quality:** the condition of the water based on its physical, biological, and chemical properties, with respect to use for specific purposes such as drinking, swimming, or fishing
- **Water table:** the level where the ground is saturated by water

SHOW VIDEO WHICH WILL INCLUDE THESE TOPICS:

- Where the water we use comes from
- The Floridan aquifer – what it is and why it is important
- The importance of conserving and protecting our water
- Nonpoint source pollution and the impact on water quality
- Initiatives to help protect the quality of our water

DEMONSTRATION ACTIVITY

This model of an aquifer will help students gain an understanding of how the groundwater system works. Students will observe how using water can deplete the ground water resources and that rainwater is required to replenish or recharge the aquifer. This can be completed as a whole-group demonstration by the teacher, or students could participate in small groups to create their own models. Pause throughout the demonstration to discuss observations.

Note for Teacher: ***this instructional video*** *was made to clarify instructions for the demonstration. This video is intended for teacher use, and not to be presented to the students.*

Materials Needed:

- Clear plastic container(s)
- Sand, gravel and/or aquarium rock
- Water
- Soap or lotion pump with tube
- Syringe (optional)
- Small piece of nylon cloth
- Rubber band
- Clear plastic cup
- Food Coloring
  - Blue food coloring to color water for increased visibility
  - Red food coloring to be used with optional pollution extension activity

Procedure:

Step 1: Add a layer of small gravel or coarse sand into the bottom of the container, banking it up to one side about 3 or 4 inches high. Move the sand away from the opposite corner, to form a "lake."

Step 2: Pour 1 to 2 cups of water over the high side of the gravel/sand. Explain that this represents groundwater that can be found in the aquifer. Explain that the water table is the level below where the ground is saturated by water. The saturation zone is below the water table.

Step 3: Have students observe the surface water that formed in the lake.

Step 4: Explain that when we dig a well it draws water from the aquifer. Place the nylon cloth over the tube from the soap pump or the tube on the syringe. Secure with the rubber band. This represents a well screen and will keep the sand and rocks out of the well water.

Step 5: Insert the tube from the soap pump or syringe down into the gravel until it reaches the groundwater.

Step 6: Ask students to give examples of how water is used. For each example, extract water from the well using the syringe or soap pump. Withdraw or pump the water into a separate container or plastic cup. Have students predict what will happen if they continue to pump water out of the well. Ask students to observe what is happening to the lake as the water is pumped out – the surface water level decreases.

Step 7: Discuss the consequences of using too much water.

Step 8: Explain that groundwater recharge is when rainfall seeps or percolates into the soil, moving down through the sand and rocks into the aquifer. It can also occur when surface water from rivers, lakes, and wetlands drain into the ground. Ask students to predict what will happen to the aquifer, the lake, and the well if it rains. Pour more water over the high side of the gravel/sand to demonstrate rainfall that recharges the aquifer. Share a fun fact: Florida needs about 50 inches of rain each year to recharge the aquifer.

EXTENSION OPTION TO DEMONSTRATE NONPOINT SOURCE POLLUTION:

Mix a few drops of red food coloring into a container of water. Explain that this represents water from runoff that is contaminated with nonpoint source pollution. Have students predict what will happen when the polluted water is added. Pour the water over the sand. Have students observe what happens to the water. How does it affect the water in the aquifer, the lake, and the well? Help students understand that contaminants gathered in the water runoff can affect the quality of the water we depend upon.

DID YOU KNOW?

The Floridan aquifer averages 1,000 feet thick, and freshwater can extend to a depth of 2,000 feet below land surface. Freshwater is thickest in the central portions of the state and rapidly thins toward the coast and the south.

Elaborate

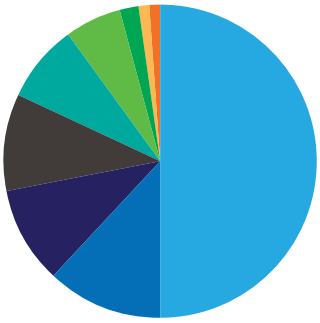
DISCUSS THE DEMONSTRATION AND MAKE CONNECTIONS

Pollution above ground can impact water below the ground.

Ask Students:

"How do we use water in homes?"

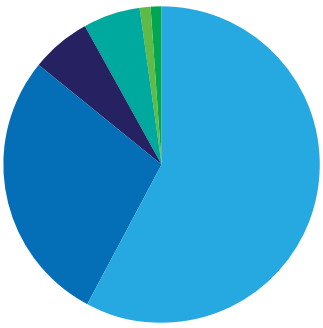
Project chart and discuss water usage.



- 50% Outdoor Use
- 12% Toilets
- 10% Faucets
- 10% Showers
- 8% Laundry
- 6% Leaks
- 2% Other Uses
- 1% Baths
- 1% Dishwashers

Explain that everyone relies on water.

Project the chart and discuss public use of water.*



- 58%: Agriculture/Irrigation/Livestock/Aquaculture
- 28%: Commercial/Industrial/Institutional and Mining/Dewatering
- 6%: Public Supply
- 6%: Domestic Self-Supply and Small Public Supply
- 1%: Landscape/Recreation/Aesthetics
- 1%: Thermoelectric Power Generation

**2018 Estimated Groundwater Use Data, Suwannee River Water Management District*

DID YOU KNOW?

People who live in areas where the Floridan aquifer is not suitable for drinking without treatment get their drinking water primarily from surface water or shallow aquifers.

DEMONSTRATION ACTIVITY: HOW MUCH WATER ARE YOU REALLY USING?

Materials Needed:

- Eight 2-ounce water bottles
- One or more 1-gallon jugs

Directions: In this demonstration, students will guess how much water it takes to do common tasks. Use the water bottles and gallon jugs to help students visualize their predictions and the actual amount used based on statistical use. The goal of this activity is to help students visualize water use in familiar quantities.

Ask students:

"How much water do you think it takes to wash your hands?"

- Have students guess the amount. **Answer: 4 gallons**
- Explain that 8 water bottles = one gallon. It takes 4 gallons to wash hands with the water running. Use water bottles and gallon jug(s) to demonstrate the amount of water used.

"How much water do you think it uses to take a bath?"

- Have students guess the amount. **Answer: about 30 gallons**
- Use the water bottles and gallon jug(s) to show how much water is used to fill a bathtub.

"Does it take more or less water to take a shower than a bath?"

- **Answer: it takes about 20 gallons of water to take a ten-minute shower.**

Use the chart below to continue the discussion about water usage.

HOW MUCH WATER DOES IT USE?	
Wash a load of laundry	20 to 30 gallons
Brush teeth with water running	5 to 7 gallons
Brush teeth without the water running	1 to 2 gallons
Flush the toilet	5 to 7 gallons
Wash dishes by hand	15 to 20 gallons
Wash dishes in the dishwasher	5 to 10 gallons
Wash a car with the water running	70 to 100 gallons
Wash a car without the water running	10 to 20 gallons
Water a small lawn	70 to 100 gallons
To make one pair of jeans	1,800 gallons
To make a pair of athletic shoes	2,250 gallons
To produce 500 sheets of paper	1,300 gallons

Have students discuss how water is used in the home and ideas of how to conserve water.

Ideas inside the home:

- Turn off the water while brushing teeth
- When washing dishes, turn off the water until time to rinse
- Run the dishwasher when it is full
- Run full loads of laundry
- Take shorter showers
- Take a shower instead of a bath
- Fix water leaks
- Rinse fruits and vegetables in a bowl and use the water to water the houseplants

Ideas outside the home:

- Water grass during cooler hours of the day to avoid evaporation
- Make sure the sprinklers are only on the grass, not on the road
- Wash your car over the grass and use a shut off nozzle

DID YOU KNOW?

In general, the water that comes from deeper aquifers is considered better than the water that comes from shallow aquifers because deeper aquifers are less susceptible to contamination.

Evaluate

WHAT DID I LEARN? WHY IS IT IMPORTANT?

Directions: Have students participate in the Watch the Water Trivia Game to review what they learned and why it is important.

WATCH THE WATER TRIVIA GAME

Directions:

- Place students into groups of 4 or 5. Have each group create a water conservation team name. Examples – The Water Watchers, The Conservation Club, #WeCareAboutWater
- Give each group a piece of paper to record their answers. Have the team write their name on the top of the paper.
- Ask a selection of the Trivia Questions. Not all questions need to be asked, however select several questions from each category.
- Each group will quietly discuss the questions to develop and record their answer.
- When the game is complete, review the questions and ask groups to share their answers.

Facts about the Aquifer:

Q What percentage of people in north-central Florida use groundwater from the aquifer as their water supply?
Answer - 90%

Q Where is the water in the aquifer stored?
Answer – In the spaces between the sand, shell, and rock particles

Q When the water escapes from the aquifer it creates a _____?
Answer – A spring

Q The water in the aquifer is replenished or recharged by _____?
Answer – Rainfall

Q Why is it important to preserve, protect, and restore the Florida aquifer?
Answers may vary but should include the idea that everyone relies on water. For example: Everyone depends on the water in the aquifer. The aquifer provides water for personal, family, and community use. Without water we could not grow crops.

Facts about Water Use:

Q Where is the most water used in your home?
Answer: Flushing the Toilet

Q About how many gallons of water are used when taking a shower?
Answer – 12 to 15 gallons

Q About how many gallons of water are used to fill a bathtub?
Answer – 25 to 30 gallons

Q How much water will you use if you run the water while brushing your teeth?
Answer – about 5 to 7 gallons per minute

Facts about Water Conservation:

Q How can you reuse water in your home?
Answers may vary. For example: Rinse fruits and vegetables in a bowl and use the water in the bowl to water your plants.

Q How can water be conserved when washing the car?
Answer: Wash the car over the grass. Use an auto shut off nozzle or turn the water off until it is needed to rinse off the car.

Q To conserve water should you wash dishes by hand or run a full load in the dishwasher?
Answer: Running a full load in the dishwasher

Q What can you do to conserve water in your home?
Answers may vary but should include ideas about how to use less water. For example: Turn the water off while brushing your teeth, take a shower instead of a bath, run the dishwasher or washer with a full load.

Extensions

School-to-Home Connection: Copy and distribute the **Be a Part of the Solution fact sheet**. Have students take home this handout and share conservation tips with their families.

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