



# Lesson Plan: Water Quality, Conservation & Your Impact

HIGH SCHOOL





## Learning Goals:

- Students will analyze how surface water and groundwater are connected and interact.
- Students will understand the components of the Floridan aquifer.
- Students will be able to compare various forms of human impact on the water quality in the surface water and the Floridan aquifer.
- Students will understand how nonpoint source pollution impacts surface and groundwater.
- Students will understand the goal of best management practices.
- Students will analyze why a plan is needed for protection, preservation, and restoration of our water resources.
- Students will be able to identify how everyone can be a part of the solution to protect our water quality.

### RELATED STANDARDS:

- SC.912.E.6.1: Describe and differentiate the layers of Earth and the interactions among them.
- SC.912.E.6.2: Connect surface features to surface processes that are responsible for their formation.
- SC.912.E.6.4: Analyze how specific geologic processes and features are expressed in Florida and elsewhere.
- SC.912.L.17.16: Discuss the large-scale environmental impact resulting from human activity, including waste spills, oil spills, greenhouse gases, ozone depletion, and surface and groundwater pollution.





## 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](http://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:

- ☞ "What are some of the recreational waterways you have visited?"
- "What types of activities did you enjoy?"
- "Besides recreation, what are other ways we use water?"  
Ex: drinking water, cooking, washing, watering lawn, putting out fires, watering crops, water for animals and livestock.
- "Where do you think the water that we use comes from?"
- "Why do you think it is important to protect the Springs?"





## 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

“In Florida there is surface water and groundwater. **Surface water** - The water found above the surface of the Earth- lakes, ponds, rivers, streams. **Groundwater** - The water found below the surface of the Earth. The aquifer holds groundwater. The **aquifer** is a geographical underground formation of porous rock, sand, shell, and limestone that holds water and allows it to move through the spaces between the rocks. More than 90 percent of the people in our area use water from the aquifer. Water from the surface gets to the aquifer through groundwater recharge. **Groundwater recharge** occurs when rainwater 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 through sinkholes. These sources of water from the surface can contain **nonpoint source pollution** which is pollution that cannot be traced to one specific source. It may result from stormwater runoff over a large amount of land or a variety of different land uses. 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.

Plants and animals require certain **nutrients**, such as nitrogen and phosphorus, for their nourishment and growth. However, too much of these nutrients in the water can have adverse effects on health and the ecology of our water. Nitrogen is found in many of the fertilizers used in agriculture to grow crops and maximize the yield. The water that runs off contains nutrients like nitrogen and phosphorus. When there is too much nitrogen and phosphorus in the water it causes algae to grow. The algae may grow faster than the ecosystems can handle. Water quality is harmed when the amount of nutrients increases significantly. **Water quality** is determined by its physical, biological, and chemical properties. An overabundance of nutrients also harms food resources, habitats, and it decreases the oxygen in the water needed by fish and other aquatic life to survive. In our community, technology is



being used to conserve water and decrease pollutants from agricultural runoff, public wastewater systems, and other land uses.

We all rely on the water from our aquifer; therefore, it is important to protect the quality of the water. It is important to have plans to protect, preserve, and restore the water quality through best management practices. There are many careers related to the protection, preservation, and restoration of our water. You may want to consider if this is a career path that interests you.”

### **Vocabulary:**

- **Aquifer:** an underground layer of rock and sediment that stores and transports water
- **Best Management Practices (BMPs):** BMPs are a practice or combination of practices based on research, field testing and expert review, to be the most effective and practicable, for improving water quality in agricultural and urban discharges.
- **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.
- **Nutrient:** a substance that provides plants and animals essential nourishment needs to grow and live. Examples in nitrogen and phosphorus.
- **Surface water:** the water found above the surface of the Earth - lakes, ponds, rivers, streams
- **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

### **SHOW VIDEO WHICH WILL INCLUDE THESE TOPICS:**

- The Floridan aquifer
- How we use water
- How people impact the water, which includes nonpoint source pollution
- The importance of protecting, restoring and preserving our water quality
- Initiatives to restore, protect, and preserve the quality of our water
- How you can be part of the solution
- Jobs and technology used to protect and preserve our water

Have students take notes about important and interesting facts using the **Guided Notes sheet**. Following the video, review guided notes with students to emphasize the essential information.



## Answers to Guided Notes for Video

### **Q** What is an 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. Aquifers can be composed of different types of earthen materials, such as sand, shell and limestone. Fresh and saltwater fill the various sized holes in the rock. Freshwater generally fills the uppermost part of aquifers, while saltwater is present at greater depths.

### **Q** Where do the majority of people in north-central Florida get their ground water?

From the aquifer

### **Q** Where is the Floridan aquifer?

The Floridan aquifer is the largest aquifer in the southeastern United States. 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. 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.

### **Q** How do people use water from the aquifer?

Water from the aquifer supplies drinking water to many of the millions of Florida residents and the state's visitors. The aquifer also provides many recreational opportunities. The water that escapes from the aquifer creates springs. Springs are found in many places, including the Atlantic Ocean, lakes and rivers. Many people enjoy swimming in the springs.

### **Q** How do people impact the aquifer?

- Development changes the landscape, including paved roads, parking lots, shopping centers, and housing developments. This reduces the groundwater recharge. Groundwater recharge is the primary method of how water enters the aquifer.
- Fertilizers, pesticides, and nutrients from agriculture and homes can runoff or leach into the groundwater.
- Sediment, grease, toxic chemicals are carried by rainwater runoff
- Animal waste carries viruses, bacteria, and nutrients into the water system
- Human waste contamination from failing septic tanks
- Heavy metal from roof shingles, motor vehicles, roadside metallic structures, and industry can runoff into our water system



**Q How do nutrients such as nitrogen and phosphorus affect our waterways?**

Too many nutrients, such as nitrogen and phosphorus, can reduce water quality. It can also enhance algae growth. Some algae is fine because animals can feed on it. However, too much algae is a problem because it displaces native vegetation and smothers habitats used by bugs and fish.

**Q Nonpoint source pollution enters our waterways and damages the quality of our water. What initiatives are in place to protect, preserve, and restore the quality of our water?**

The Basin Management Action Plan - BMAP is a framework for water quality restoration that contains local and state commitments to reduce pollutant loading through current and future projects and strategies.

- Create nutrient management plans to determine nutrient needs and sources to manage nutrient applications (including manure) to minimize impacts to water resources.
- Create irrigation management to address the method and scheduling of irrigation to reduce water and nutrient losses to the environment.
- Water resource protection using buffers, setbacks and swales to reduce or prevent the transport of sediments and nutrients from production areas to waterways.

**Q What types of technology are being used to protect and preserve water?**

- Soil Moisture Sensors are used to determine where water and nutrients are in the soil profile to better manage water and fertilizer use.
- Y-Drops are used to target the application of fertilizers at the base of the plant to increase yield and reduce runoff from excess nutrients.





## 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

### DEMONSTRATION ACTIVITY: WHAT IS RUNNING INTO YOUR WATER?

Remind students that nonpoint source pollution 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.

*Note for Teacher: The instruction sheet located on the Education page of [SuwanneeRiverPartnership.com](http://SuwanneeRiverPartnership.com) will help clarify the steps in this demonstration activity. This is intended as a teacher tool and not to be presented to the class.*

#### Materials Needed:

- **What is Running into Your Water? activity sheet** - one for each student or use one for a class demonstration
- Shallow pan(s)
- Water-based colored markers (not permanent markers)
- Spray bottles of water

#### Procedure:

**Step 1:** Give each student a copy of the **What is Running into Your Water? activity sheet**.

**Step 2:** Have students use the water-based markers to color each section.

- Farm - Green
- Neighborhood - Purple
- Factory - Red
- Town - Yellow
- Rivers and waterways - Blue

**Step 3:** With the picture face up, fold the paper in half, lengthwise.

**Step 4:** Fold each edge down on the outside. Forming an “M” shape.

**Step 5:** Gently crumple the paper. Smooth out slightly, keeping the general “M” shape.

**Step 6:** Place the paper in a shallow pan.

**Step 7:** The water from the spray bottle represents rain. Begin to spray the water (Rain) over the paper.

**Step 8:** Observe what happens to the different colors.



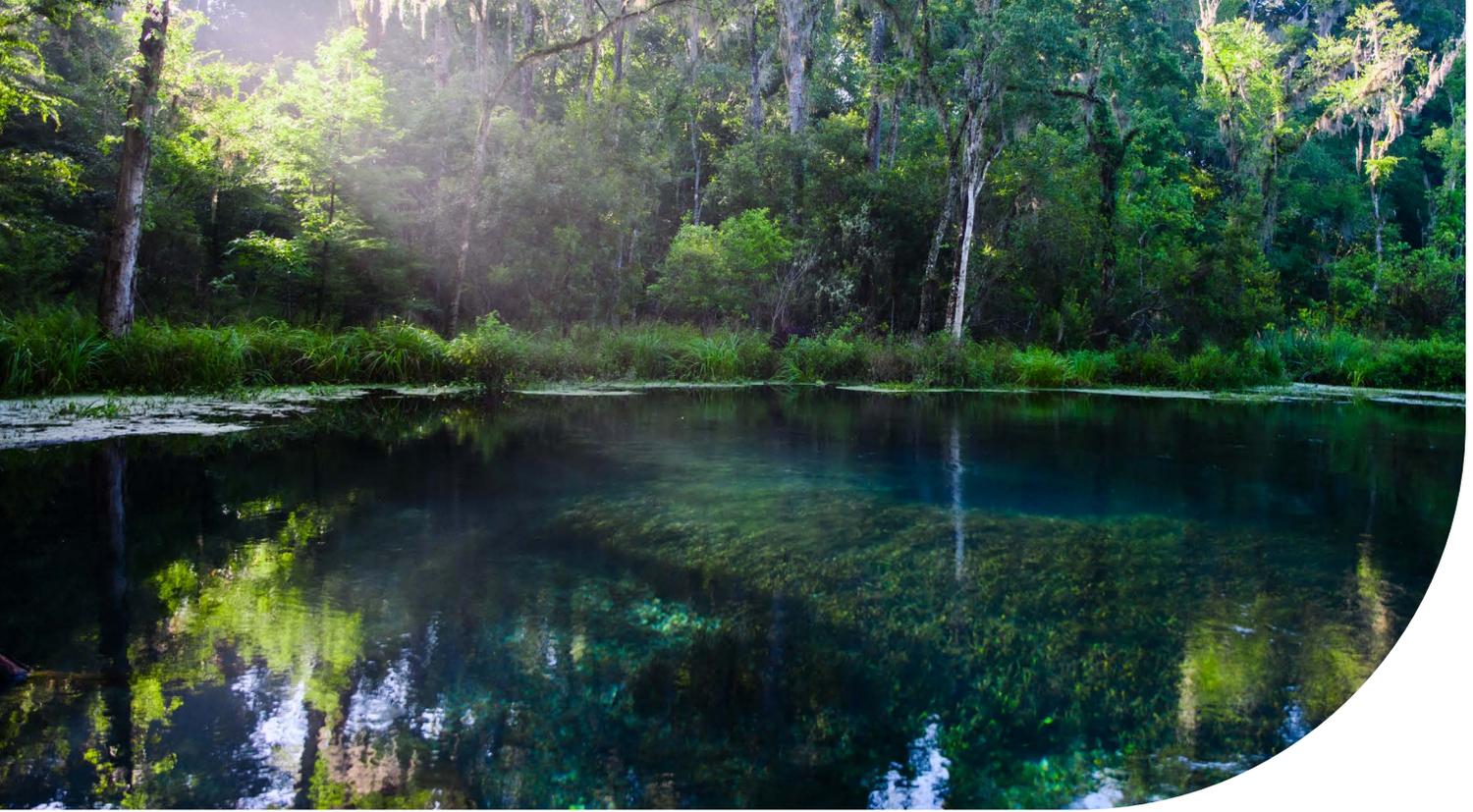
## DID YOU KNOW?

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.

## Discuss the following questions:

- ☞ “When the runoff got to the waterway, what happened?”
  - It mixed together.
- ☞ “A different color was used to represent the starting place, however, once it got to the waterway could you tell the different sources of pollution apart?”
  - The majority mixed together. You may be able to differentiate before it reaches the waterway.
- ☞ “If the piece of paper gets saturated with water, what will happen?”
  - It will leak through and soak into what is beneath the paper.
- ☞ “Imagine that we created a model of an aquifer under the paper. What would happen if the paper - representing the ground - gets saturated with the water that contains the nonpoint source pollution runoff?”
  - The contaminants or pollutants will get in the water.
- ☞ “This activity showed that many sources of pollution can get into our water. Thinking back to the video, what is being done to protect our water?”
  - Best Management Practices
    - Create nutrient management plans to determine nutrient needs and sources to manage nutrient applications (including manure) to minimize impacts to water resources.
    - Create irrigation management to address the method and scheduling of irrigation to reduce water and nutrient losses to the environment.
    - Water resource protection using buffers, setbacks and swales to reduce or prevent the transport of sediments and nutrients from production areas to waterways.
- ☞ “What can you do to protect our water?”
  - Use water wisely, avoid wasting water
  - Be careful when fertilizing your lawn
  - Implement Florida Friendly Landscaping and reduce the need for irrigation
  - Use sprinklers with automatic timers
  - Use a shutoff nozzle when washing your car
  - Wash your car over the grass
  - Use a broom instead of a hose to clean driveways, decks, and sidewalks.





## 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?

Use the **Reflection Fact Sheet** to develop a journal entry or lead a class discussion on the following:

 “Why is it important to develop Best Management Practices to protect, preserve, and restore our water quality? Why are initiatives such as the Basin Management Action Plan (BMAP) important for the restoration and preservation of our water?”

Additional Resources: [BMAP Information](#) • [Nitrogen and Water by USGS](#)

## Extensions

**Conservation PSA:** Create a short PSA about the importance of protecting, preserving, and restoring our water to be shown on the school news.

**School Conservation Slogan:** Individually or in a small group, students will develop their own conservation hashtag or slogan. Begin thinking of ways to implement school-wide conservation efforts.





[SuwanneeRiverPartnership.com](http://SuwanneeRiverPartnership.com)