



Combining Science with Civics

An exercise that exposes students to the ways in which stormwater pollution affects different members of our society.

For grades 6-12

Created by the Athens-Clarke County Stormwater Management Program

Lesson Summary

This exercise will expose students to the ways in which stormwater runoff and water pollution affects different stakeholders in our community. Science is integrated with government and policy through the exploration of an environmental problem.

Parts of this lesson were taken and adapted from the Colorado Department of Public Health and Environment.

Objectives

- Students will learn that water quality is a complex, multi-faceted concept.
- Students will demonstrate knowledge of common pollutants and water pollution issues through small group discussion.
- Students will be able to state at least 3 types of people stormwater pollution can affect.
- Students will learn about potential careers in stormwater management.
- Students will be able to write a professional letter expressing interest in local environmental issues.

GSE Science & Social Studies Major Concepts

Chemistry

SC6. Obtain, evaluate, and communicate information about the properties that describe solutions and the nature of acids and bases.

Environmental Science

SEV1. Obtain, evaluate, and communicate information to investigate the flow of energy and cycling of matter within an ecosystem.

SEV2. Obtain, evaluate, and communicate information to construct explanations of stability and change in Earth's ecosystems.

SEV3. Obtain, evaluate, and communicate information to evaluate types, availability, allocation, and sustainability of energy resources.

SEV4. Obtain, evaluate, and communicate information to analyze human impact on natural resources.

SEV5. Obtain, evaluate, and communicate information about the effects of human population growth on global ecosystems.

American Government/Civics

SS6CG3/SSCG1. Compare and contrast various forms of government.

SS6CG4. Explain forms of citizen participation in government.

SSCG4. Demonstrate knowledge of the organization and powers of the national government.

SSCG7. Demonstrate knowledge of civil liberties and civil rights.

Materials

- Index cards
- Poster boards
- Paper
- Pens/pencils

Background Information

Stormwater runoff

Stormwater runoff is rainwater or snowmelt that flows over the ground. In natural areas, most rainwater soaks into the ground, because the ground there is pervious, allowing water to pass through it. In developed areas, the ground is hard and impervious, which prevents stormwater from infiltrating, resulting in runoff.

As runoff moves across the landscape, it can pick up many different pollutants. In Athens-Clarke County, when runoff enters a storm drain, it carries those pollutants directly from the streets and sidewalks to the streams and rivers. Some of those pollutants include:

- **Sediment.** Sediment can cloud the water and harm aquatic plant and animal life. Sediment also presents points of nucleation for bacteria, promoting the growth of harmful bacteria.
- **Bacteria and pathogens.** Present in animal waste, bacteria and pathogens can enter the stream through septic tank leaks, pet waste and wild animal waste. Once there, the bacteria can make the water unsafe for recreation and drinking.
- **Nutrients.** Found in fertilizers and animal waste, plant nutrients such as nitrogen and phosphorus can cause problems. Once in the stream, nutrients promote algae growth, resulting in algal blooms and the disruption of aquatic ecosystems.
- **Litter.** Trash and dumped items can suffocate, choke or otherwise harm aquatic animal life.
- **Household chemicals.** Soaps, pesticides, paints and other commonly used household chemicals can enter streams and rivers and poison aquatic life.

For middle and upper grades, focus on the impact of water on topography. Consider how water can be stored as groundwater or surface water, and discuss how water can erode soil and rock to change the landscape. Also discuss how the different pollutants can disrupt ecosystems by affecting different parts of the aquatic food web, such as the plants, macroinvertebrates, and fish.

American government and civics

Briefly explain the idea of federalism and the constitutional relationship between the federal government and state governments in the United States. Stormwater programs are a great example of this: Municipal and industrial stormwater programs and permits are mandated by the Clean Water Act, which is federal legislation. The EPA takes that legislation and designates permitting authority and enforcement to individual states, who then implement the regulations to the local governments or facilities within their state. Because of this, stormwater permits and programs look slightly different from state to state.

At the local level, municipal governments typically develop ordinances (the adaptation of state laws to local conditions), provide public works services, license building projects, maintain roads and public spaces, and provide many other public services. Government employees represent the local government at all times, and often respond to citizen complaints. Stormwater programs, specifically, receive complaints of illicit dumping, water pollution, or spills.

Procedure

Start a general discussion about stormwater and common pollutants. Reference the background section above. Ask students to come up with scenarios where people or businesses could contribute to water pollution. Write down each of the scenarios on an index card and create a stack of “environmental problem” playing cards. Some example scenarios are:

- A gentleman changes the oil in his car every few months at home.
- A woman uses industrial-strength soap to wash her car every weekend.
- Your neighbor uses extra-strength fertilizer on their lawn right before a rainstorm. They tend to apply too much.
- Your neighbor walks their dog every other day and lets them go to the bathroom in your yard.
- There is a new building being built down the street from your office, and there is a creek right beside the construction area.
- The nearby industrial facility is storing hazardous materials outside in their parking lot.

Break the class into groups of 4 students each. Have one student from each group come up and draw a playing card. Whatever card they draw will be their environmental issue to focus on. Assign each member of the group one of the following jobs:

- Local Stormwater Inspector
- Responsible party (the person or business doing the action)
- Biologist/Environmental Health Scientist
- Concerned Citizen or Neighbor

Depending on time constraints, have the students do some research on their assigned position. If there is not enough time or computers aren't available, provide brief descriptions of each role.

In their small groups, have students discuss the effects that stormwater pollution could have on their respective roles. How would the citizen respond to this act? How would the Inspector handle the spill? What would the Biologist say about the environmental impacts?

Lastly, have the responsible party, biologist, and concerned citizen all write letters to the Inspector about what they have witnessed and how it's affected them. Have the Inspector write a response to each. Every letter should be formatted in a business style and should offer potential solutions to the issue.

Assessment

In a closing discussion, students will be asked the following questions:

- What are the common pollutants that get into our water via stormwater runoff?
- How would you convince someone to stop polluting?
- What stakeholders are involved in addressing environmental issues?
- How do the federal government and state governments work together to address environmental issues?
- What is federalism?