Shared Waters: Making a positive impact on our local watershed

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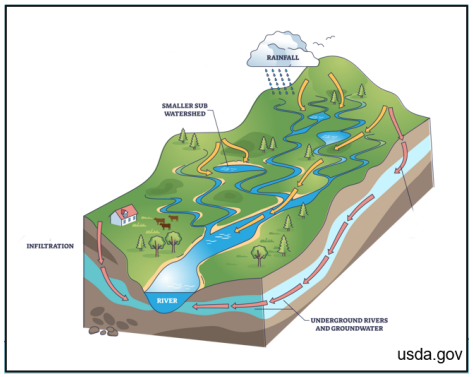
Lesson 4: Runoff Simulation
(1 day)

Overview:

This activity aims to inform students that we are part of the Chesapeake Bay Watershed and that healthy watersheds have more infiltration and less runoff.

When rain falls or snow melts, water goes somewhere. It may soak into the ground (infiltration), evaporate, or runoff the surface. The water will likely be channeled into a storm drain (runoff) in a paved or urban area. In an undeveloped area, it will likely infiltrate the ground, runoff the surface, and flow downhill into a stream.

Small streams flow downhill and join with others, eventually forming rivers. The area drained by a stream, whether it is a small creek, a large river, or an entire river system, is called a watershed or a drainage basin. The watershed includes not only the surface of the land and the water but also the land and water beneath the surface. The water flowing from the land, or runoff, carries dissolved chemicals and suspended materials with it. A small stream may have a watershed consisting of only a single small valley. A large river's watershed is comprised of the combined watersheds of all streams that feed into it and may cover thousands of square miles.



In developed areas, storm drains carry runoff from streets, yards, parking lots, rooftops, and other areas. Most storm drains flow directly into creeks, rivers, lakes, or the ocean without treatment or filtering. In other cases, water from the storm drain normally passes through a water treatment plant or sewage treatment facility before being released. Sometimes, though, storms add so much water that the treatment plant cannot handle it, and the untreated water is released into rivers, lakes, or the ocean.

Because of the runoff, creeks and rivers contain chemicals from the watersheds that feed them. Of course, whatever is in the runoff water can affect the aquatic organisms in the streams, lakes, and or other bodies of water into which the runoff flows. Runoff (and chemicals dissolve in it) can also enter the underground water system as it soaks into the soil and percolates down into the aquifer. As it passes through the soil, chemicals in the percolating water can also affect plants and animals living in the soil, including microorganisms. Thus, chemicals in the runoff can affect not only aquatic animals and plants but also organisms on the land and the water systems upon which humans depend. (If you want to learn

more about the Chesapeake Bay Watershed before teaching this lesson watch PBS- Water's Way: Thinking Like a Watershed.

Materials:

Materials provided in the lesson 4 kit:

- **Activity 1:** n/a
- **Activity 2:** n/a

Materials you will need to gather:

- Lesson 4 slide show
- **Activity 1 & 2**: Computer/tablets
- **Activity 2**: Copies of Lesson 4 handout for each student (Answer sheet for Lesson 4 handout)

Websites:

- River Runner - https://river-runner.samlearner.com/
- Run-off Simulator - https://runoff.modelmywatershed.org

Learning Objectives:

At the end of the lesson, students will be able to utilize the runoff simulation and determine the impact of runoff on our environment.

Activity 1 (5 minutes): Who are our watershed neighbors?

The purpose of this activity is to inform students that we are part of the Chesapeake Bay Watershed, but there are many smaller watersheds that make up the Chesapeake Bay watershed.

A difficult concept for students and adults to grasp is that watersheds are **nested**. What does nested mean? It means that larger watersheds are made of smaller watersheds. For example, Millersville University is in the *Lower Conestoga River Watershed.* This watershed is nested in a larger watershed called the *Conestoga River Watershed,* which is nested in the *Lower Susquehanna Watershed*, which is nested in the *Susquehanna Watershed*, which is nested in the *Chesapeake Bay Watershed*. WOW! That is a lot! What this means is what we do in our little local watershed impacts the larger watershed!

Smallest to biggest... *Lower Conestoga River Watershed -> Conestoga River Watershed -> Lower Susquehanna Watershed -> Susquehanna Watershed -> Chesapeake Bay Watershed*

Tell the students that they are going to take a virtual float down their nearest stream to see where water that falls on our schoolyard travels, and we will meet all of their watershed neighbors along the

way! For this virtual float, we will use the river runner simulation at https://river-runner.samlearner.com/.
Open the website. Students will enter the address for the school/home in the location box. Then, they will use the simulation to trace where water travels in their watershed. Ask students, when water falls on our schoolyard, where does it eventually end up? The answer is the *Chesapeake Bay*. **This is an important time to remind them that while we live in the Susquehanna River Basin Watershed, we are also part of the larger watershed – the Chesapeake Bay Watershed. What we do in our schoolyard impacts the Chesapeake Bay!**

Activity 2 (25 minutes): Runoff Simulation

Not all precipitation soaks into the ground. Some of the water runs off the surface. This activity will explore three places water can go: runoff, infiltration, and evapotranspiration. Using a computer simulation, we will also learn how land cover, soil type, and the amount of rainfall influence where water goes when it rains.

This activity can be done in small groups or individually. (We recommend small groups of 4 to facilitate communication.)

- Have students visit https://runoff.modelmywatershed.org
- Give students 3-4 minutes to explore the simulation of their own. (Do not give them directions, but encourage them to click on different land cover types, soil types, and rainfall amounts.)
- Ask the small group, "What does this simulation do? What is it trying to show us?"
- Provide students with the Lesson 4 handout.
- Explore the simulation together using the directions on the handout. Have students adjust the amount of rainfall to 3 cm (this is the amount of rainfall per 24-hour period).
- Students will be guided to make some changes to the land cover and rainfall amounts (which will enable the students to see changes in runoff, infiltration, and evapotranspiration.)
- Record the results: students will record (on the form provided) the changes in runoff and infiltration as changes were applied.
- Review the students' answers (Lesson 4 handout answers) to the questions on the handout together and highlight the concepts that the landcover type and amount of precipitation impact where the water goes when it rains and that healthy watersheds have more infiltration and less runoff.

Assessment:

The questions within the handout serve as the assessment for this lesson.

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Possible Differentiation Adaptations:

Some students may need one-on-one help. Instead of working in groups while exploring the runoff simulation, the teacher can assign an MU student to work with the student to provide one-on-one help.

Reading Connection:

Nagelhout, R. (2013). Saving the Chesapeake Bay (Exploring the Chesapeake Bay). Gareth Stevens Pub Learning library.

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