District of Columbia
Office of the State Superintendent of Education

RUNOFF IN THE WATERSHED

High School Environmental Science Instructional Sequence

This high school environmental science instructional sequence was created to support teaching the Next Generation Science Standards through the Biological Sciences Curriculum Study (BSCS) 5E instructional model. Developed by District of Columbia teachers, these lessons include real-world contexts for learning about environmental science through a lens that encourages student investigation of local issues.

The lessons also support Scope and Sequence documents used by District local education agencies:
Unit 3: Earth and Human Activity: Chesapeake Bay and Anacostia Watershed Analysis (Advisory 3-4)

Acknowledgements:
Steve Donkin, Cardozo Education Campus

This curriculum resource can be downloaded online:
https://osse.dc.gov/service/environmental-literacy-program-elp

Overview and Goal of the Lesson: In this sequence of lessons, students investigate the impact of stormwater runoff on the local watershed and develop mitigation strategies to minimize the negative impacts of runoff. After first investigating the phenomenon of erosion as an outcome of runoff, students use a watershed model to explore watershed dynamics and the various factors that influence the flow of runoff in the watershed. Negative impacts from runoff - the movement of contaminants in addition to erosion impacts - are further explored in the context of the water cycle, which is assumed here as a previously covered unit. With an understanding of the negative impacts of runoff on the watershed, students then are guided through a survey of their local school environment to gather data on how the school campus affects runoff, and are encouraged to develop and present mitigation procedures designed to minimize the negative impacts.

Essential Question: What effect does stormwater runoff have on the watershed, and how can we minimize its negative impacts?

NGSS Emphasized and Addressed in this Lesson Sequence:

PERFORMANCE EXPECTATIONS	SCIENCE AND ENGINEERING PRACTICES	DISCIPLINARY CORE IDEAS	CROSSCUTTING CONCEPTS
HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. **HS-LS2-7.** Design, evaluate and refine a solution for reducing the impacts of human activities on the environment and biodiversity.	**Analyzing and Interpreting Data.** Analyze data using computational models in order to make valid and reliable scientific claims. **Engaging in Argument from Evidence.** Evaluate competing design solution to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors.	**ESS3.C: Human Impacts on Earth Systems.** Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. **ETS1.A**: **Defining and Delimiting Engineering Problems.** Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering.	**Cause and Effect.** Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. **Systems and System Models.** When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.

Materials

ITEM	QUANTITY	PURPOSE
Erosion Demonstration Worksheet	1 per student	Erosion Demonstration (**Engage**)
Large plastic bins (~1 X 2 ft; ~8 in. high)	1 per group	Erosion Demonstration (**Engage**) Watershed Model (**Explore 1**)
Sandy soil or sand	1 bag per class	Erosion Demonstration (**Engage**)
Clay soil	1 large bag per class	Erosion Demonstration (**Engage**) Watershed Model (**Explore 1**)
Watershed Model Protocol Worksheet	1 per student	Watershed Model (**Explore 1**)
Modeling clay	1 box per class	Watershed Model (**Explore 1**)
Toothpicks	1 box per class	Erosion Demonstration (**Engage**) Watershed Model (**Explore 1**)
Spray bottle	1 per group	Watershed Model (**Explore 1**)
Food coloring	1 bottle per class	Watershed Model (**Explore 1**)
Cloth strips (~1 in. X 2 in.)	1 or 2 per group	Watershed Model (**Explore 1**)
Erosion in a Bottle Protocol Worksheet	1 per student	Erosion in a Bottle (**Explore 2**)
2-Liter plastic bottles	3 per group	Erosion in a Bottle (**Explore 2**)
Potting soil	1 bag per class	Erosion in a Bottle (**Explore 2**)
Leaf litter (or paper scraps if unavailable)	~1 small bag or box per class	Erosion in a Bottle (**Explore 2**)
Grass seed (Bermuda grass or perennial ryegrass are fast-growing)	1 bag per class	Erosion in a Bottle (**Explore 2**)
Water Cycle Review Sheet	1 per student	**(Explain)**
Contaminants in Runoff Graphic Organizer Sheet	1 per student	**(Explain)**
School Campus Runoff Survey	1 per student	(**Elaborate** and **Evaluate**)
Clipboards and tape measures (metric)	1 per group	(**Elaborate** and **Evaluate**)

5E Lesson Sequence

TOTAL DURATION: 350-400 MINUTES				
5E MODEL STAGE	**DURATION**	**TEACHER AND STUDENT ACTIONS**		**NOTES**
Engage The Phenomenon of Erosion	40-50 minutes	What Teacher Does	1. Teacher introduces the phenomenon of erosion by showing a picture of a house on an eroding beach cliff and asking, "What is happening? What will happen in the future? Why?" 2. Teacher sets up the Erosion Demonstration, hands out the *Erosion Demonstration Worksheet*, and asks students to work in groups to explore how erosion changes the landscape, specifically looking at wave action on beaches, erosion in a river bed, and erosion of a mountain (with and without trees) by rain. 3. Teacher asks students "Is this a problem? Why?" and facilitates discussions in groups on what types of problems erosion might create in the environment.	Supporting Document 1: *Erosion Demonstration Worksheet*. This worksheet includes photos of severe beach erosion that may be used for the first Engage activity. The Erosion Demonstration involves using plastic bins with either sandy soil formed into a beach with a body of water (to demonstrate wave action), clay soil with a stream bed leading downhill to a body of water (to demonstrate river erosion), and clay soil formed into a mountain, with toothpicks as trees, and a spray bottle to represent rain (to demonstrate mountain erosion). The group discussions are organized around framing questions in the *Erosion Demonstration Worksheet*. At this point, students should understand that the focus is simply to compile a list of problems caused by erosion (and explain why they are problems) rather than brainstorm solutions (this will come later). Potential problems for discussion include effects on land plant and crop health, soil stability as it relates to building structures and roads, and effects of sediment on river health (i.e., turbidity and blockage of sunlight for aquatic plants, ability of fish to find food, aesthetics from a human perspective). A good video that the teacher can refer to for the Erosion Demonstration is Erosion Lab[1]. But don't show to the class - they should be doing this, not watching.
		What Students Do	1. Students follow the protocol in the *Erosion Demonstration Worksheet* and record their observations. 2. Students engage in group discussions around framing questions on problems caused by erosion and record their ideas and justifications, then share out with class.	
Explore 1 Runoff: What is It?	70-80 minutes	What Teacher Does	1. The teacher provides students with the *Watershed Model Protocol* and guides students in doing the activity, recording observations, and answering the questions. The teacher instructs students to be mindful of observing the speed and volume of water flow on impervious versus pervious surfaces (this can increase the potential for flooding) and how impervious surfaces affect the ability of water to get to plant roots in the soil. 2. **Alternatively**, the teacher may have students follow the procedure outlined in the Lesson 4 (Elaborate) from the Interactions and Stewardship of the Watershed 5E instructional sequence[3]. Use a stream table in place of the watershed model.).	Supporting Document 2: *Watershed Model Protocol.* A watershed model that demonstrates the differences between pervious and impervious surfaces can be easily constructed using a large plastic bin and some clay soil (pure sand may erode too easily) and some modeling clay. • The soil should have enough clay content to allow it to maintain its form when slightly wet, but not so much as to make it nearly impervious. The soil is formed into a gentle slope on one side of the bin, the other side to be filled with water to represent a river. • The modeling clay can be flattened and formed into various shapes to represent impervious surfaces such as roads and parking lots and placed on top of the soil at various points. • Students should be reminded not to forget roofs of buildings and houses, which can also be modeled with clay. Toothpicks can be stuck into the soil at various points, separately or in clumps, to represent trees or forests when investigating the effects of vegetation on runoff. • There are many variations using different materials that can be tried, but the point is to have a body of water surrounded by pervious and impervious surfaces. It may be preferred (if time allows) to have students create their own models.

5E MODEL STAGE	DURATION	TEACHER AND STUDENT ACTIONS		NOTES
Explore 1 Runoff: What is It?	70-80 minutes	What Students Do	1. Students follow the *Watershed Model Protocol*, working in groups to explore the effects of pervious and impervious surfaces on the watershed using a spray bottle to represent rain. 2. Students answer questions in the *Protocol* and consider examples of pervious and impervious surfaces in their neighborhood or school campus.	Phenomena addressed in the investigation include: • What happens to rain on a pervious surface versus an impervious surface? • What happens to a pollutant (colored dye) on a pervious and impervious surface when it rains? • How do trees (toothpicks) control runoff and protect the river? How does the runoff change when we cut down trees and clear vegetation? • How effective is erosion fencing (toothpicks and cloth strips) at controlling runoff at a construction site?
Explore 2 Runoff and Watershed Health	40-50 minutes	What Teacher Does	1. Teacher asks students to consider what things they saw carried into the river in the watershed model and what impacts these might have on watershed health. Consider the prompt, "Now let's think about some ways to minimize the bad effects of runoff." 2. Teacher has students work in groups to follow the *Erosion in a Bottle Protocol* to examine the effects of no vegetation, leaf litter and vegetation on soil erosion. Teacher circulates among groups and aids students in adhering to the protocol and recording observations.	Supporting Document 3: *Erosion in a Bottle Activity*. The *Erosion in a Bottle* activity should help students to understand that one important mitigation solution for the problem of runoff is to preserve and expand the presence of trees and other vegetation. A good video demonstrating how to perform the Erosion in a Bottle activity is "Erosion and Soil."[2] As with the video referred to in Engage, this video is best for teacher reference only, as students should be doing, not watching. Students should begin to view runoff as a carrier of many things, some of which may be harmful, and to realize that most contaminants in a watershed eventually end up in the river (a source of drinking water and food) or groundwater (also a source of drinking water). This is explored further in Elaborate.
		What Students Do	1. Students participate in a class discussion on the impacts of runoff on the watershed and possible ways to minimize impacts. 2. Students work in groups on the *Erosion in a Bottle Protocol*. Students make hypotheses, record their observations and form conclusions based on the gathered evidence.	
Explore 2 Runoff and Watershed Health	40-50 minutes	What Teacher Does	1. Teacher asks students to consider what things they saw carried into the river in the watershed model and what impacts these might have on watershed health. "Now let's think about some ways to minimize the bad effects of runoff." 2. Teacher has students work in groups to follow the *Erosion in a Bottle Protocol* to examine the effects of no vegetation, leaf litter and vegetation on soil erosion. Teacher circulates among groups and aids students in adhering to the protocol and recording observations.	Supporting Document 3: *Erosion in a Bottle Activity*. The *Erosion in a Bottle* activity should help students to understand that one important mitigation solution for the problem of runoff is to preserve and expand the presence of trees and other vegetation. A good video demonstrating how to perform the Erosion in a Bottle activity is "Erosion and Soil."[2] As with the video referred to in Engage, this video is best for teacher reference only, as students should be doing, not watching. Students should begin to view runoff as a carrier of many things, some of which may be harmful, and to realize that most contaminants in a watershed eventually end up in the river (a source of drinking water and food) or groundwater (also a source of drinking water). This is explored further in Elaborate.
		What Students Do	1. Students participate in a class discussion on the impacts of runoff on the watershed and possible ways to minimize impacts. 2. Students work in groups on the *Erosion in a Bottle Protocol*. Students make hypotheses, record their observations and form conclusions based on the gathered evidence.	

5E MODEL STAGE	DURATION	TEACHER AND STUDENT ACTIONS		NOTES
Explain Runoff on the School Campus	70-80 minutes	What Teacher Does	1. Teacher hands out the *Water Cycle Review Sheet* and reviews the water cycle with students, and checks for understanding of condensation, precipitation, collection and evaporation. 2. The teacher says, "We will go outside and survey the school campus, looking specifically for the things we learned about, to try to see how runoff from our campus affects our watershed." 3. Teacher hands out the *School Campus Runoff Survey* and clipboards and has them work in groups to survey the campus for runoff flow and answer the questions.	Supporting Documents 4 and 5: *Water Cycle Review Sheet and School Campus Runoff Survey* The *School Campus Runoff Survey* can be tailored to the specific school site. For example, some school campuses may include a stream, wetland or forested area, while others may not. For some schools, the campus may be divided up so each group may survey only one section. The main points are to have students become aware of the topology and layout of their campus, locate pervious and impervious surfaces, trace directions of runoff, identify possible contaminant sources, and conduct measurements of areas and calculate amount of water flow.
		What Students Do	1. Students complete the *Water Cycle Review Sheet* as a check for understanding. 2. Students perform survey of campus runoff and record as directed by the *School Campus Runoff Survey*.	
Elaborate	80-90 minutes	What Teacher Does	1. Teacher facilitates the creation of a *Contaminants in Runoff Graphic Organizer* or other device for compiling ways in which runoff acts as a carrier of things that may be harmful to the watershed, and asks students to consider the effects of each of these on the watershed. 2. Teacher works with groups to help them organize their presentations, each group presenting on one of the contaminants they listed in the graphic organizer. 3. A possible **extension** to this activity is described in the Water Quality and Wastewater Management 5E Instructional Sequence, specifically Lesson 2 (Eutrophication and Water Treatment), which looks at eutrophication and wastewater treatment in the context of contaminants in runoff.	Students are encouraged through the creation of a graphic organizer to consider the many ways that runoff affects the watershed, and to sort them into the categories such as solids and liquids, or things that affect the river (surface water) and things that affect the groundwater. Examples may include: • oil, gasoline, transmission fluid and other fluids from cars; • particulates washed from the air by precipitation; particulates from cars such as tire rubber and asbestos from brake linings; • various toxics that seep from landfills and smaller garbage dumps; • small plastics or other non-biodegradables that may be ingested by fish; • improperly disposed hazardous wastes; • any toxics that may seep through soil and contaminate groundwater; and • increased silt in river and lakes which clogs fish gills and blocks sunlight for plants. Supporting Document 6: *Contaminants in Runoff Graphic Organizer* sheet includes questions to guide students in putting together their presentations. Thinking of examples of contaminants in the watershed may be challenging for students. They may need guidance and prompting to lead them to considering various solid and liquid contaminant from cars, particulates from air, seepage from garbage piles or landfills, or sediment itself as a potential contaminant. Their search may benefit from access to internet resources.
		What Students Do	1. Students work in groups to brainstorm about ways that runoff is a carrier for things harmful to the watershed, first creating a list, then organizing in a graphic organizer or other device by type (solid vs. liquid; surface water vs. groundwater). Groups share out their ideas and evaluate each other.	

5E MODEL STAGE	DURATION	TEACHER AND STUDENT ACTIONS		NOTES
Evaluate Controlling Runoff	50-60 minutes	What Teacher Does	1. Teacher helps the student groups to compile their data and observations for presentation to the class. 2. Teacher has the students each make a **claim** about a mitigation strategy to control harmful effects of campus runoff and provide **evidence** from what they've learned to support their claims, and share the **reasoning** behind their conclusions.	In thinking about whether a contaminant is likely to impact surface water or groundwater, students may also need to be prompted to remember what they observed in the *Watershed Model Protocol*, specifically the behavior of liquids and solids in the watershed, and to consider things such as which is more likely to seep into soil. Student presentations may be enhanced by student- created posters or a PowerPoint if time allows. The *School Campus Runoff Survey* guides students through the process of "Claim-Evidence-Reasoning" in coming up with solutions in stormwater management. Possible solutions for students to explore include tree and shrub planting, installation of rain barrels, rain gardens, and green roofs.
		What Students Do	1. Students compile and present their findings from the survey. 2. Students use claim, evidence and reasoning to propose mitigation solutions and justify them.	

Vocabulary:

Erosion - a process that removes soil from an area, by water or wind, and wears away rock.

Stormwater runoff - water that moves on the ground during collection after a rain storm.

Pervious - describes a surface that allows water to move through it.

Impervious - describes a surface that does not allow water to move through it.

Surface water - water on the surface of the ground, such as streams, rivers, lakes and oceans.

Groundwater - water that has moved into the soil and collects deep under the ground.

Contaminant - a dangerous or unhealthy chemical or substance that is in water.

Footnotes

1 www.youtube.com/watch?v=ZNJe6hrdL3M

2 www.youtube.com/watch?v=im4HVXMGI68

3 Stewardship in the Watershed instructional sequence can be found on the OSSE website: https://osse.dc.gov/node/1113336.

SUPPORTING DOCUMENTS

Supporting Document 1.

Name _____ Period _____ Date _____

EROSION DEMONSTRATION WORKSHEET

Look at the two pictures above.

What is happening in picture **A**? _____

What is happening in picture **B**? _____

What do you think will happen in the pictures in the future? _____

_____

These are examples of **erosion**. **Erosion** is a process that removes soil from an area, by water or wind, and wears away rock.

In this experiment, we will look at three examples of erosion by water.

EROSION BY WAVES

Each group will get a bin with sand, to represent the beach, and water, to represent the ocean.

- Use a plastic bottle to gently make waves at a rate of one per second.

What is happening to the beach? _____

What will happen to any houses or buildings on the beach?

_____

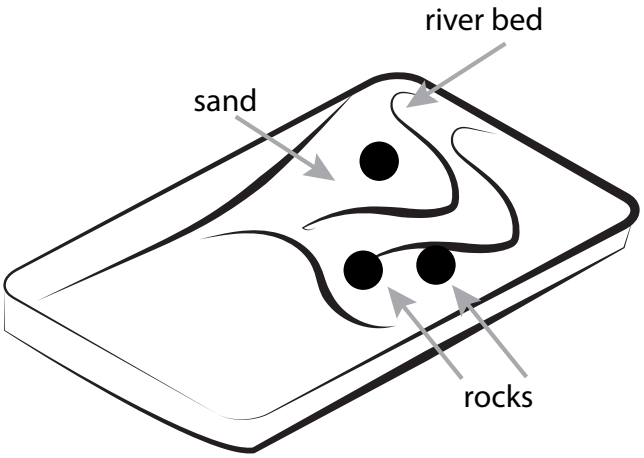
If you were an engineer, what is a solution you would propose for this problem? _____

_____

_____

_____

EROSION IN A RIVER BED



1. Push the wet sand to one side of the bin. Make a winding river bed with your finger.
2. Put some rocks along the side of the river bed.
3. Slowly pour water at the top of the river bed and observe what happens.

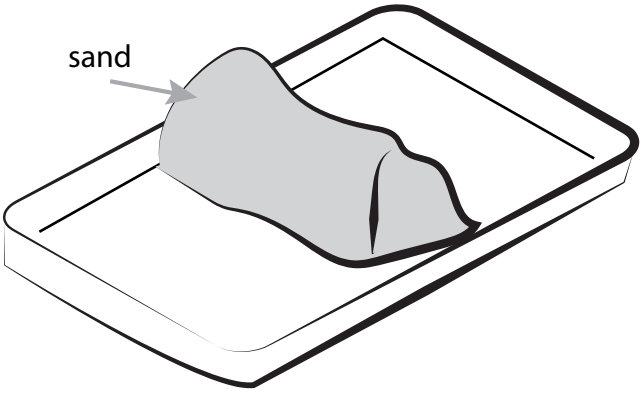
Did some sand move? Where did it go? _____

_____

What effect did the rocks have on the river bed? _____

_____

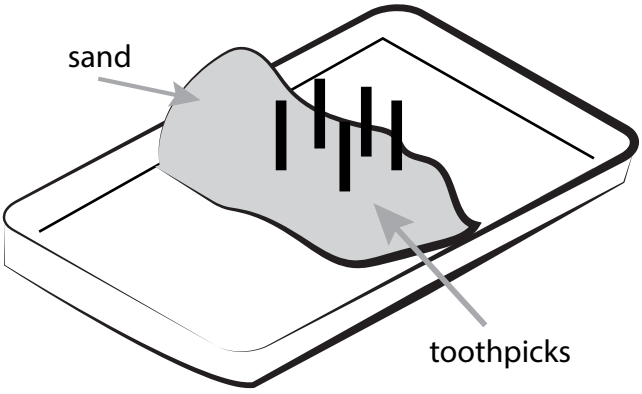
EROSION BY RAIN



1. Push the wet sand to the middle of the bin to make a mountain with steep sides.
2. Spray the entire mountain with water from a spray bottle for several minutes and observe what happens. This represents millions of years of rain.

Did the shape of the mountain change? How? _____

_____



3. Now empty the water, make the mountain again, and put some toothpicks in one end of the mountain to represent trees, and repeat the spraying. Compare what happened to the part of the mountain with trees to the part of the mountain without trees. How are they different? _____

   _____

Talk with your group about some <u>problems</u> that can be caused by erosion and write some of your ideas below. Remember to think about the effects on water in lakes and rivers in addition to effects on land:

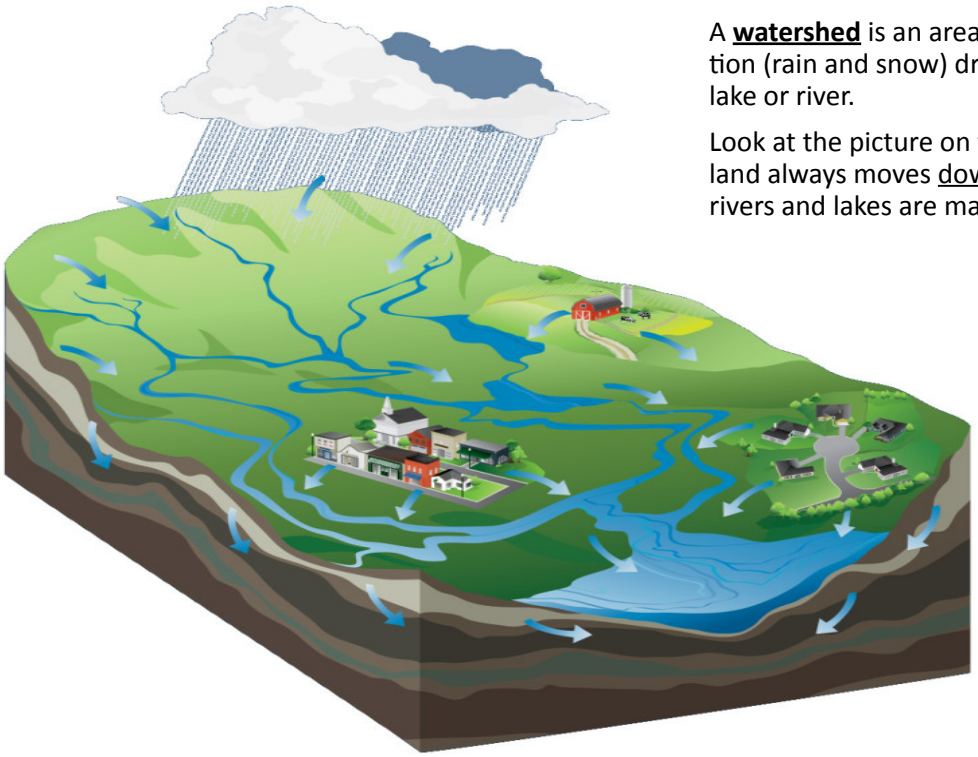
1. _____
2. _____
3. _____
4. _____

Supporting Document 2.

Name _____ Period _____ Date _____

WATERSHED MODEL PROTOCOL

Everybody lives in a **watershed**.



A **watershed** is an area where all the water from precipitation (rain and snow) drains into one body of water, such as a lake or river.

Look at the picture on the left. Observe that the water on land always moves down (because of gravity). This is how rivers and lakes are made. This total area is a **watershed**.

Now look at the picture on the right. This shows two watersheds (A and B). Why are there two watersheds in this area? (Hint: Look at the shape of the land.)

_____

_____

_____

_____

_____

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_____

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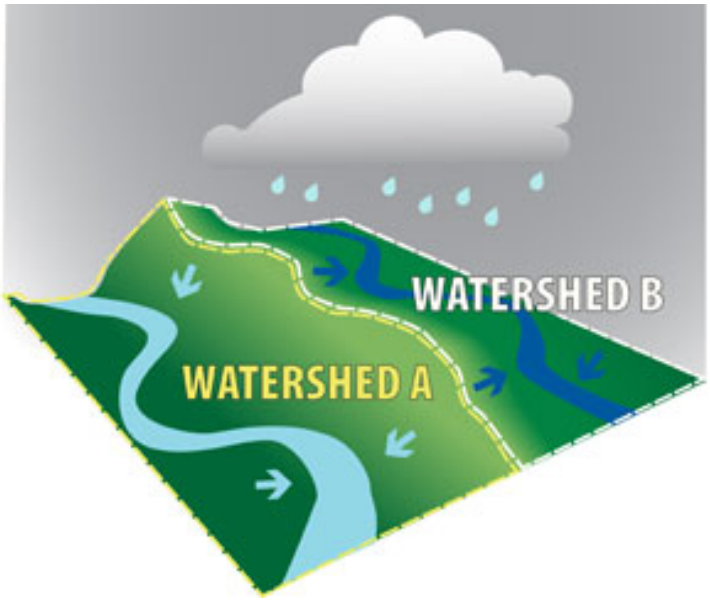
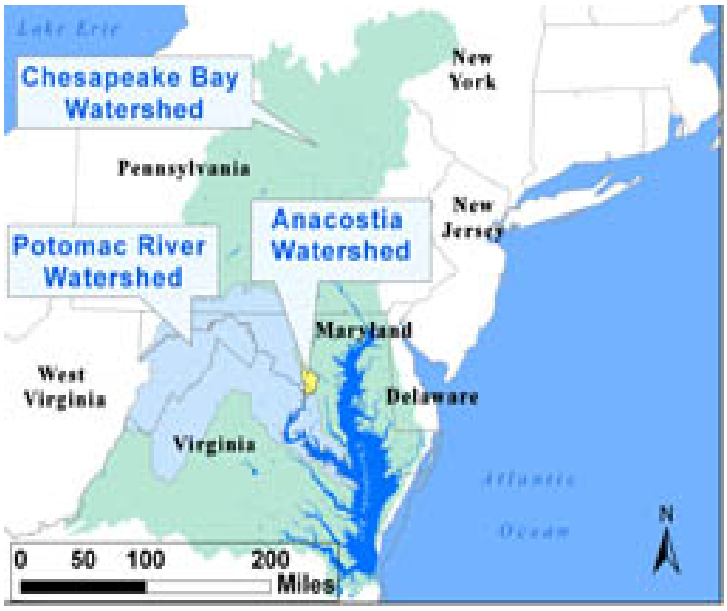
_____



In Washington, D.C., we have two watersheds:

- the **Anacostia Watershed** all the water goes into the Anacostia River.
- the **Potomac Watershed** all the water goes into the Potomac River.

These are both part of the bigger **Chesapeake Bay Watershed**, because all the water from these two rivers goes to the Chesapeake Bay.

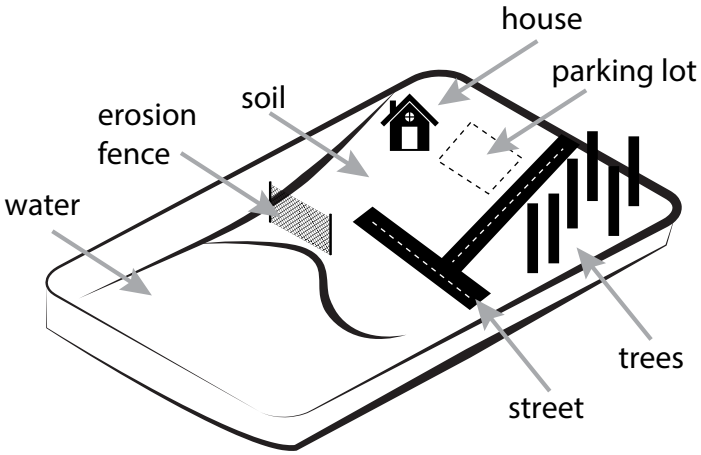


WATERSHED MODEL

In groups, you will make a model of part of one of our watersheds – the Anacostia or Potomac, and investigate some effects that the people who live here have on the watershed.

Procedure:

1. In a bin, push some soil (slightly wet) to one side and shape it so that it is similar to the land in Washington, D.C. as you know it.
2. Add water to the other side. This will represent the river (Anacostia or Potomac).
3. Use the modeling clay to make streets, parking lots, and building and houses, similar to what we have in D.C. Put them in different places around the soil.
4. Add toothpicks in different places to represent trees and plants.
5. Now use a spray bottle to spray water over all of the soil for several minutes. This represents rain. Observe what happens to the rain on streets and parking lots and compare it to what happens to the rain on the soil. How are they different? _____ _____
6. Put a few drops of food coloring on a street to represent oil leaked from cars. What happens to the oil when it rains? _____ _____



7. Remove about half of the toothpicks (trees) and observe what happens to the soil when it rains. How is what happens in areas without trees different from what happens in areas with trees? _____ _____
8. Add two toothpicks with a strip of cloth taped between them to an area where the trees were removed. This represents an erosion fence that people put up in places where construction and tree removal is happening. Does the fence help to prevent erosion? How? _____

Supporting Document 3.

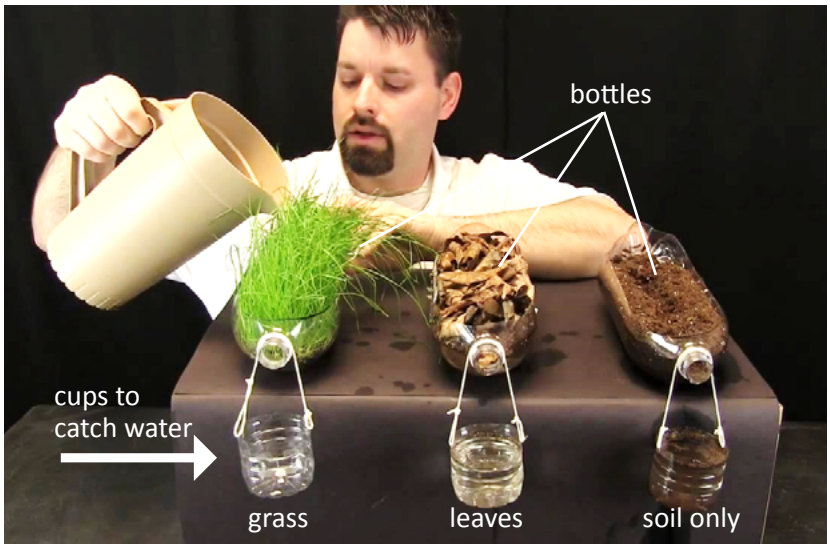
Name _____ Period _____ Date _____

EROSION IN A BOTTLE PROTOCOL

What are some ways to decrease runoff and erosion in our watershed?

In this experiment, we will investigate runoff and erosion in three different soil systems:

1. Soil with nothing else
2. Soil with dead leaves on top
3. Soil with grass growing in it



Procedure:

1. Each group will get three plastic bottles. Set up the bottles as shown in the picture.

2. Make a hypothesis: "If we pour water into each bottle, the bottle with the _____ will show the most erosion, and the bottle with the _____ will show the least erosion."

3. Explain why you think your hypothesis is correct: _____

   _____

4. Carefully pour water first into the bottle with soil only until water comes out the end and fills the cup. Then do the same for the bottle with leaves, and then the bottle with grass. Write your observations:

   _____

   _____

1. Write your conclusion. Was your hypothesis correct? Explain your observations. Why did this happen? What is the best way to decrease erosion? _____

   _____

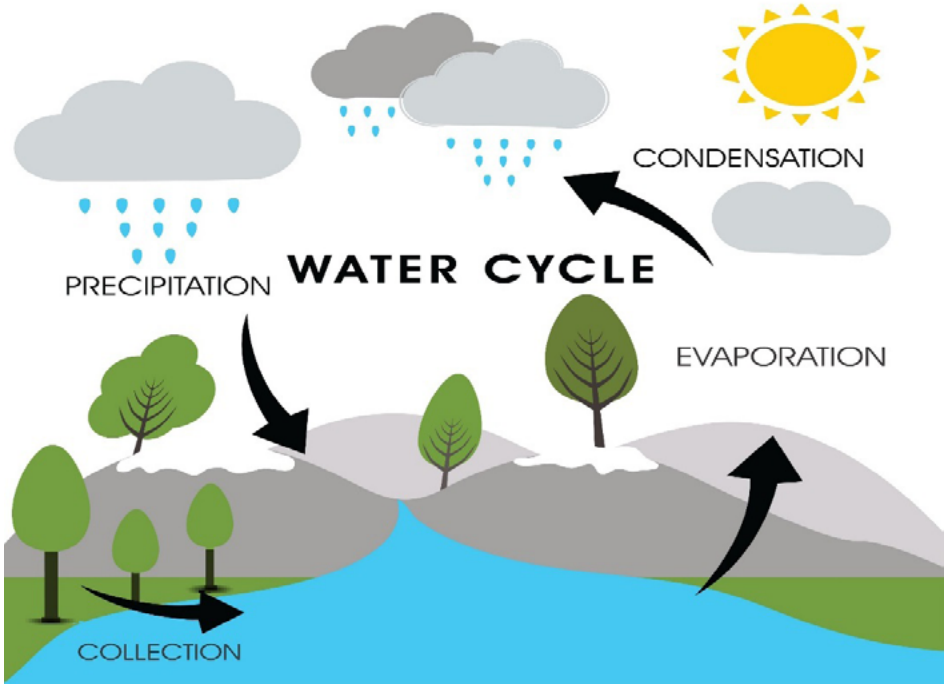
Supporting Document 4.

Name _____ Period _____ Date _____

WATER CYCLE REVIEW SHEET

The water cycle describes how water moves in the environment. It has four parts:

1. **Condensation** – water vapor in the air condenses (cools and changes to liquid), forming clouds.
2. **Precipitation** – liquid water in the clouds falls to the ground as rain (if the temperature is above freezing) or snow (if the temperature is below freezing).
3. **Collection** – water from precipitation collects at low places on the ground, forming puddles, streams, river, lakes and oceans.
4. **Evaporation** – liquid water on the ground is heated by the sun, changes to water vapor and rises into the air.



Water from precipitation collects in two places:

1. **Surface water** – water on the surface of the ground, such as streams, rivers, lakes and oceans.
2. **Groundwater** – water that has moved into the soil and collects deep under the ground.

Use your knowledge of the water cycle to answer the following questions:

1. Which statement best describes the water cycle?
   A. When water evaporates, it disappears, and the total amount of water in the world decreases.
   B. When it rains, the total amount of water in the world increases.
   C. The total amount of water in the world doesn't change, it just changes its state, or form.

2. What part of the water cycle includes **runoff**?

   A. Condensation

   B. Precipitation

   C. Collection

   D. Evaporation

3. Humans get drinking water from _____.

   A. Surface water

   B. Groundwater

   C. Surface water and groundwater.

4. Which do you think is usually cleaner, surface water or groundwater? Why?_____

   because _____

   _____

5. What happens when water vapor **condenses**? It _____

6. How can we know if **precipitation** will be rain or snow? We can know if we _____

   _____

   _____

7. What causes **collection** of water at low places, and not high places? Water collects at low places because

   _____

   _____

8. How can **evaporation** remove many contaminants from water? (Hint: think about what evaporation really is).

   Evaporation can remove contaminants because _____

   _____

   _____

Supporting Document 5.

Name _____ Period _____ Date _____

SCHOOL CAMPUS RUNOFF SURVEY

Let's look at how stormwater runoff moves on our school campus. In the box below, draw a simple map of the campus, following teacher directions. Draw the shape of the building, and include any parking lots, sidewalks, surrounding streets, gardens, streams, playing fields, and anything else that may be important.

Then use a ruler to draw vertical and horizontal lines as directed to divide the map into equal sections. Each group will survey one section. Label each section with a number.

Now we will go outside and survey our sections.

1. What is your group's section number? _____
2. What are the **pervious** surfaces in your section? _____

   _____
3. What are the **impervious** surfaces in your section? _____

   _____
4. Is your section flat, or are there hills or slopes? _____
5. Do you see evidence of erosion in your section? Describe it. Where and how much? _____

   _____
6. Draw arrows on the map to show the directions water moves in your section when it rains.
7. Use a tape measure to measure the area of your section in square meters (m^2):

   length _____ width _____ area = _____ X _____ = _____

   If it rains 1 centimeter (cm) of rain in an area of **1 m^2**, then **10 liters (L)** of water have fallen in that area (Extra credit if can you calculate how to get that number! Hint: 1 cm^3 = 1 milliliter).

8. Use that number and the area of your section that you measured to calculate how many liters of water fall in your section with a 1 cm rainfall. Show your calculations below:

Now use the information you gathered to think of one **solution** to decrease the effects of runoff in your section and help to improve our watershed:

- First make a **claim**: We should _____
- Then state your **evidence** (What did you observe? What does it mean? What is the problem, and how will your solution help?): _____

  _____
- Then state your **reasoning** (How does what we've learned support your claim that your solution will work?): _____

  _____

  _____

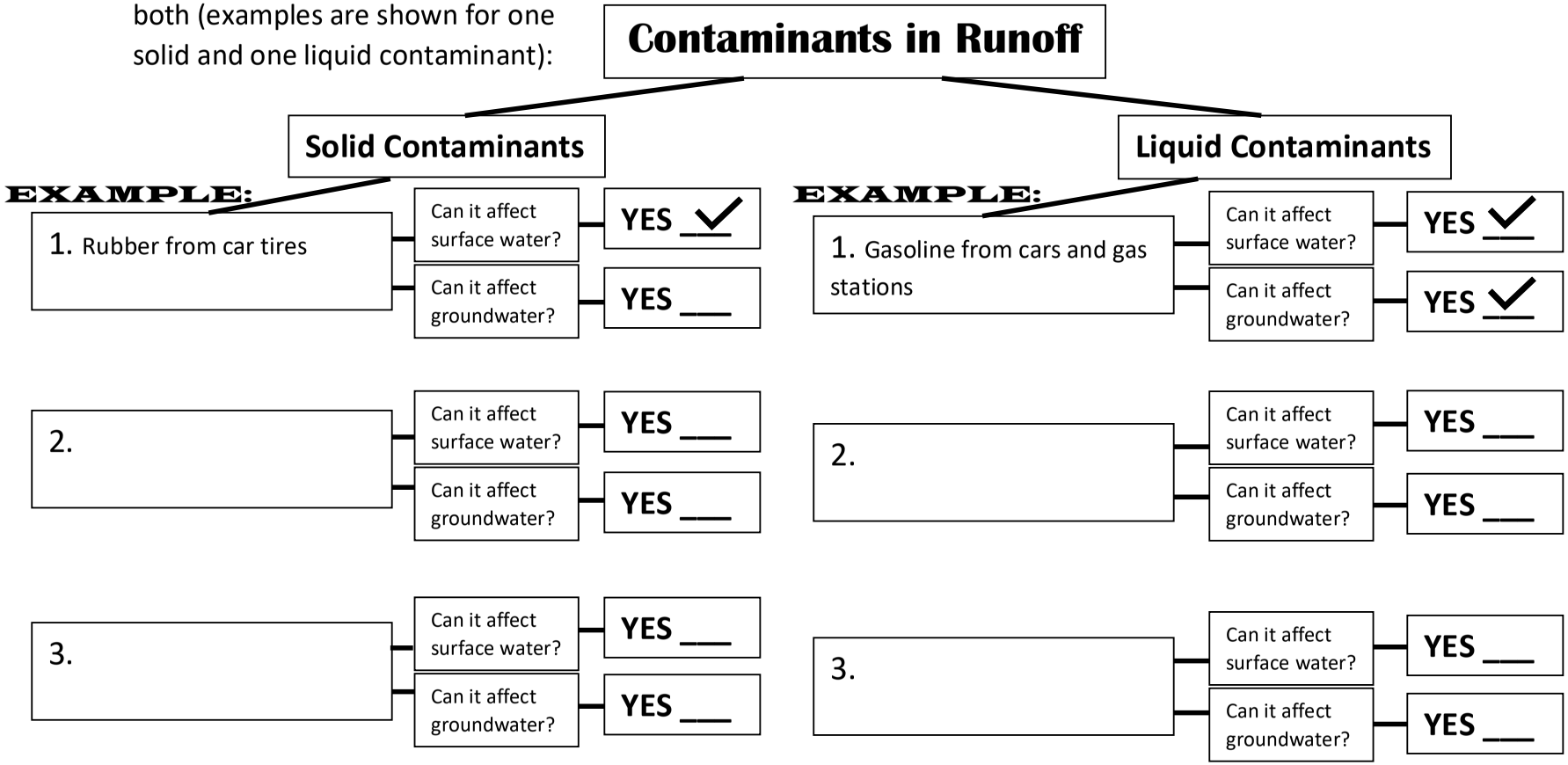
Work with your group to make a presentation about your solution!

Name _____ Period _____ Date _____

Contaminants in Runoff

Water that moves on the ground during collection after a rain storm is called **stormwater runoff**. Runoff can carry contaminants and move them through the watershed. Look at the picture on the other side to see runoff examples.

In your group, make a list of contaminants that may be carried by runoff. Try to think of all sources of contaminants (cars, trash from houses, litter, etc.). When you have completed your list, write your contaminants in the correct box in the graphic organizer below (solid or liquid), and write a check to show if it affects surface water or groundwater, or both (examples are shown for one solid and one liquid contaminant):

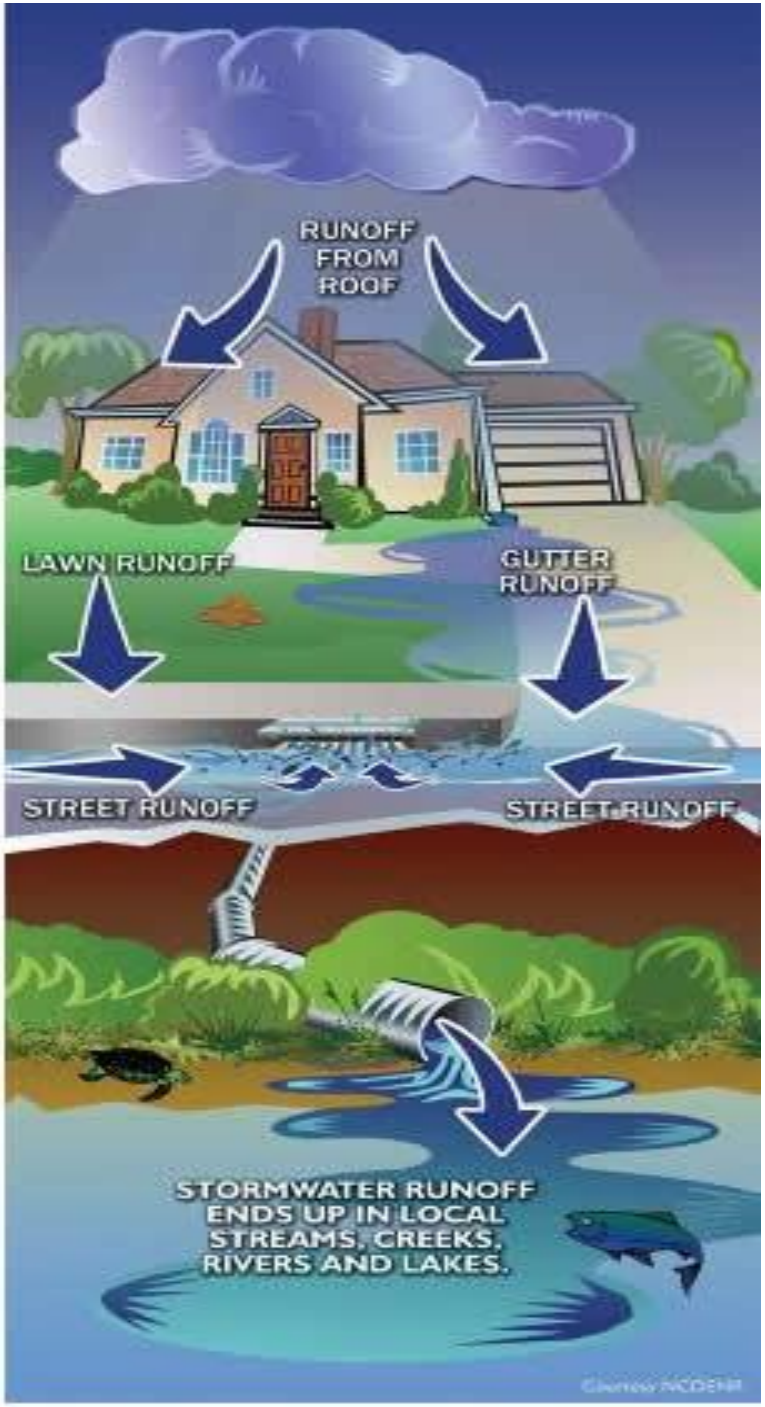


In your group, choose one contaminant from your list to present to the class. In your presentation, your group should tell the class:

- What is the contaminant?
- Is it a solid or a liquid?
- Where does it come from?
- Can it be carried by runoff into surface water?
- Can it be carried by runoff into groundwater?
- How can we stop the contaminant from getting into the watershed, or minimize the amount that gets into the watershed?

Write your answers to the questions above and make sure everyone in your group has a role in your presentation (everyone speaks!).

Practice your presentation as a group before you present.



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