

Power of Water

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UNIT DESCRIPTION

This unit includes three 50-minute classes and a follow-up activity all focusing on watersheds. For background readings on watersheds, go the **Geography: Teaching with the Stars** web site at <http://geoteach.org> and click on the Teacher Resources page.

The purpose of this unit is to help students understand watersheds, human impact on watersheds, and ways watersheds can be protected and conserved. On the first day of the unit, students complete a lab activity demonstrating how topography affects watersheds. On day two, a guest speaker uses a model of a watershed to demonstrate the impact of human activities on watersheds. On the third day, students engage in a lab activity to synthesize what they have learned about topography, watersheds, and the human impact on watershed. In a follow-up activity, students prepare Public Service Announcements (PSAs) to share what they have learned with others.

Note: You can click on links in the teacher guide to see how the teaching suggestions are operationalized in a classroom.

LEARNING OBJECTIVES

- Student will define watersheds.
- Students will explain the effect of topography on watersheds and be able to map the boundaries and flow of water within a watershed.
- Students will describe the impact of human activities on watersheds and be able to identify consequences of pollution within a watershed.
- Students will create messages sharing what they learned about watersheds.

NATIONAL STANDARDS

National Science Standards

Strand 4: Earth and Space Science

Strand 6: Science in Personal and Social Perspectives

National Environmental Education Standards

Strand 1: Questioning, Analysis and Interpretation (A, E, F, G)

Strand 2.1: The Earth as a Physical System

Strand 2.4: Environment and Society

Strand 3.1: Analyzing and Investigating Environmental Issues

National Geography Standards

Standard 1: How to Use Maps and Other Geographic Representations, Tools, and Technologies to Acquire, Process, and Report Information From a Spatial Perspective.

Standard 4: The Physical and Human Characteristics of Places.

Standard 7: The Physical Processes That Shape the Patterns of Earth's Surface.

Standard 14: How Human Actions Modify the Physical Environment.

Texas Essential Knowledge and Skills

Note: Standard 6.14.B will change to 8.9.C and 7.8.C with new TEKS.

6.6.C Science concepts. The student knows that there is a relationship between force and motion. The student is expected to: (C) identify forces that shape features of the Earth including uplifting, movement of water, and volcanic activity.

6.14.B Science concepts. The student knows the structures and functions of Earth systems. The student is expected to: (B) identify relationships between groundwater and surface water in a watershed.

8.14.C Science concepts. The student knows that natural events and human activities can alter Earth systems. The student is expected to: (C) describe how human activities have modified soil, water, and air quality.

ADVANCE PREPARATION

1. Contact your local agricultural extension agent, parks and recreation department, river authority, or environmental department to identify resources on watersheds that can be used in this unit.
2. Gather all materials for classroom demonstrations and student labs, described below. Practice the demonstrations and labs, before conducting them in class.
3. **Lesson One:** The lab included in this lesson requires a roll of butcher paper, water-based markers, a spray bottle of water for you to use, and powdered drink mix (cool-aid).
4. **Lesson Two:** This lesson calls for the use of a watershed model. Many agencies (for example, county agricultural extension offices) have these models and are willing to come to schools to demonstrate them. An alternative would be to demonstrate the model yourself. Here is the source of the model use in the classroom video.

Envirosapes Watershed Model: <http://www.envirosapes.com/nonpoint-source.html>

5. **Lesson Two:** You will need to create challenge questions for use in this lesson. Work with the person offering the watershed model demonstration to make sure that the issues covered in the questions are developed in the demonstration. See the **Watershed Challenge Game: Sample Questions** master for some possible questions. You will want to create your own. Write your questions on index cards. You will also need marker boards and markers for the activity.
6. **Lesson Two:** This lesson concludes by asking students to create a word wall about watersheds. You will need to make a copy of the **Wall Wisher Activity** handout for each student. You can create a wall for them on the Internet by going to the website www.wallwisher.com. **Note:** The teacher should create a specific URL for each class period, such as `teachernamewatershedperiod1`, `teachernamewatershedperiod2`, etc. See <http://www.wallwisher.com/wall/paramourewatershed> as an example. You should enter the URL for each class period on the handout. There is also space for entering a due date for the assignment on the handout.
7. **Lesson Three:** This lesson uses the Lab-Aid Modeling and Investigating Watersheds Kit 437. It can be ordered at: www.lab-aids.com. The kit contains all materials needed for six groups of 4 or 5. *As an alternative* you can use butcher paper, as in Lesson One and have students create their own watersheds. You will also need a pipette for each group and blue food coloring and cups to make water that can be seen.

8. **Lesson Three:** You will need to make a copy of the **Modeling and Investigating Watersheds** handout for each student. **Note:** The natural features from the model that appear on the handout are labeled to represent features in the area of the school in the video. You can modify the names of features to represent places in your area. This local connection makes the activity more relevant to students. Students will need colored pencils or crayons to complete the activity.
9. **Lesson Four:** In this lesson students produce a PSA about watersheds. You will need to provide them with a variety of materials (for example, paper, markers), depending on the medium they choose to use in their PSAs. If you want to show some examples of PSAs, you can go to the following web site:

<http://libguides.chattanoogastate.edu/PSA>

MASTERS

Lesson Two: Watershed Challenge Game: Sample Questions

Lesson Two: Wall Wisher Activity

Lesson Three: Modeling and Investigating Watersheds

Lesson One:

What is a Watershed?

OPENING THE LESSON

1. Ask students to begin this lesson by completing the prompt, “I think a watershed is. . . .” in their journals or notebooks.
2. Reassure students that they don’t need to know the correct answer to this prompt, at this point, but to try to respond, based on their current knowledge. They are going to learn about watersheds in this unit.
3. Ask for volunteers to share their responses to the prompt with the class.

DEVELOPING THE LESSON

1. Divide students into working groups of four or five. Have each group assemble at a table (or at another flat surface, for example, on the floor).
2. Distribute a large piece of butcher paper to each group. Have the groups crumple their butcher paper to create two uplifted areas on the paper. (Their papers should look like three-dimensional topographic sheets.)
3. Have each group use regular water-based markers to highlight the highest elevations (peaks and ridges) on the crumpled paper.
4. Have each group distribute “sediments” (dry cool-aid) along the colored peaks and ridges.
5. Use a spray bottle of water to produce “rain” on the peaks and ridges. As you move around the room “raining” on the different watershed models, elicit student observations about water flow and the impact of topography, the formation of distinct watersheds, boundaries, the movement of sediments (cool-aid), and how the water gathers at the lowest point in the watershed, in an effort to expand students’ understanding of watersheds.

CLOSING THE LESSON

Have students share with their work groups what they have learned about watersheds in this activity. Visit each group to gauge what they have learned, to ask questions, and to answer any questions they might have.

To end the lesson, have the students reflect on the activity in their journals or notebooks, by responding to the prompt: *“I better understand what a watershed is now because: . . .”*

Lesson Two:

Watershed Model and Demonstration

OPENING THE LESSON

1. Ask students to describe, in their journals or notebooks, how humans affect their local watersheds. Give them time to write down several ideas.
2. Indicate that in this lesson, students will work with a guest speaker who uses a model of a watershed to explore the interaction between human activities and the watershed.
3. Introduce the guest speaker.
4. Assign the students to six small challenge groups. Indicate to students that at about the half way point in the watershed model demonstration, the groups will be asked to answer a challenge question about watersheds tied to what they learned from the demonstration.

DEVELOPING THE LESSON

5. Have the students gather around the watershed model.
6. Using the watershed model, have the guest speaker demonstrate ways in which different land use and human activities affect the local watershed. The model can be used to demonstrate agricultural run-off, run-off from residential areas, roads, and hillsides, and pollution from human development and industries.
7. Periodically during the demonstration, have student form their challenge groups. Give each group a challenge question, a white board, and a marker. Give them some time to answer their question and use the white board to answer/illustrate their answers.
8. Have the groups share their answers with the class. This challenge activity, which can be done several times during the demonstration, keeps the students actively listening and participating during the activity.

CLOSING THE ACTIVITY

9. Indicate to students that in this unit, they have been learning about watersheds and how humans impact watersheds. Indicate that it is time for students to share their thoughts about watersheds. Distribute a copy of the **Watershed Wall Activity** handout to each student.
10. Ask students to go to the URL that appears on the handout and post a comment (a sticky) on the class Watershed Wall.
11. Review the questions that they can choose to answer in their posts: What did you learn about watersheds in this unit? How can you help preserve your watershed? What information about watersheds needs to be shared with others? What amazed you most about what you learned about watersheds?
12. Remind students to read and observe the Web Safety Rules that appear on the handout. Establish details of due dates for the assignment.

Possible Watershed Challenge Game Questions

Describe two sources of sediment in the watershed model.

Which area in the model uses excessive amounts of fertilizer?

List three specific pollution sources shown in the model.

Recommend three ways to improve or protect watershed quality in your area.

How could the factory in the model be tested for “point” source pollution?

Use a diagram to help you describe the difference between “point source” and “non-point source” pollution.

What is the effect of too much fertilizer in our waterways?

Give two reasons why pet owners should “pick up” after their pets.

Explain how a large rain event impacts watershed health.

Name one thing you can do to protect or improve the quality of your watershed.

Each person in your group needs to list one piece of new information learned during this activity. *You may not repeat answers.*

Class URL: _____

Wall Wisher Activity

Dear Students,

You have been learning about watersheds and how humans can impact their watersheds. It is time to share your thoughts with others. Go to your class period's URL and post a comment on our Class Watershed Wall. Select and answer one of the questions below:

- What did you learn?
- How can you help preserve your watershed?
- What information needs to be shared with others?
- What amazed you the most?

This is a homework assignment and you are required to post a “sticky” by _____.

WEB SAFETY MEASURES

- Do NOT use your full name, just your first name.
- I have to approve all “sticky” notes before they become public, so no inappropriate comments will be posted. (Although, my students are AWESOME and I don't believe this is a concern for our classes!)
- Your response can be only 160 characters in length. So think about your answer and make it *short and concise*.

The public will be able to view our class wall. Parents are encouraged to visit the wall and see what the “next generation” thinks about watersheds and their ability to *make a difference in the world*.

Remember, this is a required assignment and will be graded!

100 – Sticky posted, I can clearly tell which question was answered, answer makes sense

90 – Sticky posted, I think I can tell which question was answered, answer makes sense

80 – Sticky posted, I think I can tell which question was answered, answer “kinda” makes sense

70 – Sticky posted, I'm not sure which question was answered, answer makes sense

60 – Sticky posted, I'm not sure which question was answered, answer “kinda” makes sense

50 – Sticky posted, but the response doesn't answer a question posed nor does it make sense

0 – No sticky posted ☹

Lesson Three:

Topography and Watersheds

OPENING THE LESSON

1. Begin the lesson by reviewing the stickies that students posted on the class watershed wall in response to the assignment from Day Two. This will reinforce their efforts and give you an opportunity to review some other their thinking about watersheds.
2. Remind students that a watershed is not just water. A watershed is an area of land that water flows across or through on its way to a particular water body, such as a stream, river, wetland, or coast.

DEVELOPING THE LESSON

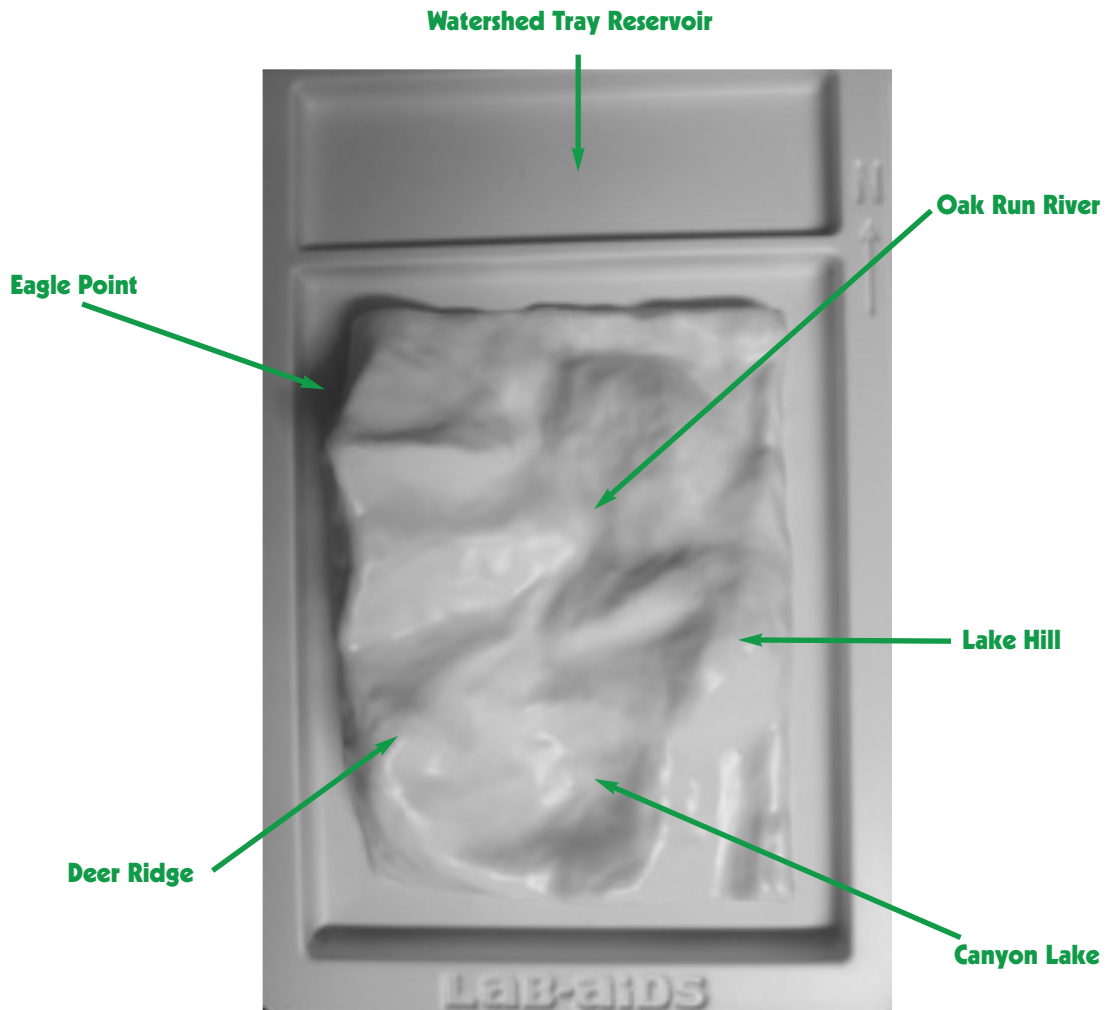
3. Distribute a copy of the **Modeling and Investigating Watershed** handout to each student. Divide students into groups of 2 or 3. Provide each group with a LabAid Watershed Model, a pipette, and some colored water.
4. Have the groups follow the directions on the handout to complete the two activities outlined.
5. The first activity (Questions 1 to 5) focuses on making predictions about water flow, based on topography. Students make and record predictions about water flow, test their predictions using the pipette and colored water, and then record what actually happened. You should circulate among the groups, offering support and asking questions, such as, “What land features influence where the water flows?”
6. The second activity (Questions 6 and 7) applies what students have learned to two environmental issues in the watershed: a gas spill and a possible coal mining operation that could have an impact on the local watershed. Again, circulate among the groups to offer support and to keep students on task.

CLOSING THE LESSON

7. Focus on the coal mining issue considered in the second lab activity. Have students consider what they determined about the impact of the mine on local water bodies and decide whether they would support the development of the mine in their area. Have them vote yes or no. Ask for volunteers to explain why they voted the way they did.
8. Conclude by pointing out that, as citizens of their community, they will be called on to make important decisions that have an impact on the environment. Their knowledge of watersheds will help them make well-reasoned decisions.

Modeling and Investigating Watersheds

A watershed is the basin of land that water drains into. The surface features of the land or the topography of the land defines a watershed. A ridgeline or other regions of higher elevation called a divide often define watershed boundaries. Watersheds can cover large areas that can be sub-divided into smaller watersheds. In this activity you will examine the factors that determine where water bodies form, observe how topography determines the boundaries of a watershed, and how humans can impact watershed quality.



NOTE: Follow the directions on the next two pages carefully and record your observations accurately.

Eagle Point



Box A—*Predicted* water flow path

Deer Ridge



Box A—*Predicted* water flow path

Lake Hill



Box A—*Predicted* water flow path

Eagle Point



Box A—*Actual* water flow path

Deer Ridge



Box A—*Actual* water flow path

Lake Hill



Box A—*Actual* water flow path

1. Use the **black** pencil to draw your predicted path of water flow on the figure in Box A, if you were to gently empty a pipette of water over Eagle Point.
2. Fill the pipette with water from the reservoir in your watershed tray. Position the pipette about 2 cm above Eagle Point and gently release all the water from the pipette.
3. Use the **blue** pencil to draw the path of water flow that you observed in Box B.
4. Use the **red** pencil to mark the topographic features in Box B that caused the water to take the path it did.
5. Repeat steps 1–4 for Deer Ridge and Lake Hill. *Be sure to mark your predictions before you fill the pipette.*

6. Which one of the three points (Eagle Point, Lake Hill, or Deer Ridge) provided the run-off to fill Oak Run River? (If you are not sure, use the pipette to confirm your answer.)

7. Which one of the three points (Eagle Point, Lake Hill, or Deer Ridge) provided the run-off to fill Canyon Lake? (If you are not sure, use the pipette to confirm your answer.)

HUMAN IMPACT

8. A gasoline tanker truck wrecked on Deer Ridge during a heavy rain storm. Make a dot with the water-based marker to represent the gasoline. Gently release 2 pipettes of water over the gas spill and observe the water flow path. What part of the watershed was impacted the most from the gasoline spill? Support your answer!

9. A mining company has discovered a coal bed (a large layer of coal) at the top of Lake Hill. Your town wants to determine the impact of a mining operation on the water quality of Oak Run River and Canyon Lake. Use your water-based marker to represent the sediment that would be created and the coal that would be exposed during the mining operation to determine the impact on both Oak Run River and Canyon Lake.

Lesson Four:

Follow-Up Activity

Tell students that as a follow-up to the unit on watershed, they will be asked to create a public service announcement (PSA). They can work individually or in small groups (2-4). Indicate that a PSA is an advertisement broadcast on radio or television, and is intended to raise awareness about specific issues. A typical PSA is part of a public awareness campaign to inform or educate the public about an issue such as smoking, dangers of drug use, heart health, or watershed protection.

Indicate that their assignment is to decide what information about watersheds they want to share in their PSA. Then they should decide how they want to share the information: a poster, a rap, a 30 second video clip, a skit, etc. Finally, they should create their PSA and be ready to share it with the class.