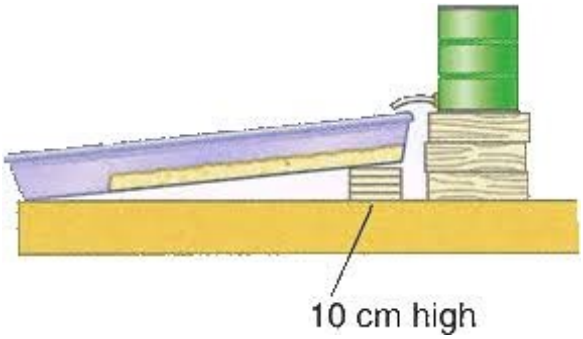
Watersheds and erosion

Focus questions	What is the impact of water on land surfaces? How might we prevent erosion impacts?
Vocabulary	Watershed, watershed boundary, runoff

This activity will help you examine and model the impacts of water on land surfaces. Build your stream bed and carry out the activity in small groups. You will record observations, draw your model and outcomes for each portion, then answer the questions in writing, using complete sentences, about the outcome of your model.

Background

The water cycle incorporates surface water, groundwater, and water in the atmosphere. Surface water is what we see in lakes, rivers, streams, and the ocean. Groundwater is stored in aquifers that provide underground water for drinking and it may feed surface water sources. Precipitation recharges aquifers. The hydrologic cycle is constantly recycling water through the processes of precipitation, evaporation, and condensation.



Example of field table setup

Many practices can help prevent erosion. Keeping the ground planted with plants, trees, or shrubs will allow roots to hold soil in place. Avoiding tillage or plowing the ground before planting or after harvest will allow the soil to retain its structure and increase percolation of water into the ground. Strip cropping and controlled grazing will also help. Students may do additional research to determine these practices and spend additional time to employ one or more of the strategies to hold their soil in place.

Materials

- Painter's tray and inside liners (You could also use aluminum paint containers but would need to poke small holes in one end of the pan to drain into a basin.)
- Soil of various types (different combinations of sand, silt, and clay from local areas or created within the classroom)
- Potting soil (extension)
- Gravel/rock
- Plant material (extension)
- Water
- Small cup
- Blocks or other source to adjust height levels of tray
- Trash bag or other plastic table covering

- Paper towels
- Timer

Procedure

1. Gather all materials for your station.
2. Set up your stream area, beginning with only one height adjustment (low slope). Make sure the catch basin area is at the bottom. (See illustration above for example.)
3. Cover the area above the basin with a layer of sand, being sure to fully cover the area. You may choose to build sand up more in some areas than others to create a more realistic watershed.
4. Sketch your setup and indicate any altered areas of sand, or you may take a photo of your setup to place in your lab. Label the watershed boundary and the watershed area.
5. Measure the height of your table and record in Table 1. Measure the distance from the top of your stream to where the basin begins and record in Table 1.
6. Take a small plastic cup and make very small holes in the bottom. (You will be simulating water from rainfall.)
7. Before you add water to the cup, make sure that you have a timer ready to record the time it takes the water to reach the basin from the time it is poured from the cup.
8. Hold the cup over the highest point of the land surface and pour in 50 mL of water while moving the cup along the top edge of the paint pan. Begin timing at the point water is added to the cup until it first reaches the water basin. Record that time in Table 1.
9. Once the water has completely entered the water basin, record your observations in Table 1 of what you see in regards to the amount of erosion. Provide a rating from 1–5, with 5 being a large amount of erosion and 1 being little erosion. Record that as well in Table 1.
10. Draw your watershed and the areas of erosion that you see in the illustration box or take a photo that shows these details.
11. Repeat this two more times using the same cup and amount of water, adding height each time to increase the slope of the land surface. Again record your data and observations in Table 1 and in the illustration box.
12. Calculate the velocity of the water for each height and place your answer in Table 1.
13. Pour the water from the basin into a provided cup or bucket and use a paper towel to attempt to extract as much water as possible from the soil that is left.

Table 1

	Length of watershed (cm)	**Height of elevation of watershed (cm)**	**Time for water to reach basin (s)**	**Velocity of Water (cm/s) V = d/t**	**Value of runoff (step 9) and observations about watershed (erosion effects, turbidity in runoff, etc.)**
Level 1					
Level 2					
Level 3					

Illustration 1 (diagram or photo of watershed)

Illustration 2 (diagram or photo of watershed)

Illustration 3 (diagram or photo of watershed)

Part 2: Experimental design

Now that you have observed the impacts of water at various slopes and with no cover, it is time for you to attempt to design a solution to prevent erosion in your watershed. Determine how you will test your solution. How does the solution lessen erosion? What areas are most vulnerable to erosion and where do you need to concentrate to prevent further erosion?

1. You will design what your watershed will look like and what you will place where. Place a drawing or photo of your proposed watershed below.

2. Write a hypothesis of how you believe your design will impact erosion and which slope you believe will benefit the most from your design.

3. Write out your materials using bullet points.

4. Write out the procedures you will carry out step by step, remembering to be specific so others can repeat precisely what you have done.

5. Carry out three trials at the various heights and record your data in a data table you create below.

6. When completed, clean up your area as before and allow the soil to remain to dry out.
7. Submit your lab report digitally, following the template below. Include all steps you have recorded above, with a detailed analysis and conclusion of your experiment.

Rubric for self-assessment

Skill	Yes	No	Unsure
I was able to plan and conduct an investigation that resulted in data that served as reliable measurement; I considered limitations and refined the design to address those limitations.			
I was able to use the experiment to design a solution to erosion in the “watershed.”			

Lab report template

Lab title

Problem
What is the overall problem you are attempting to answer with your design?

Hypothesis
What is your predicted Statement of Outcome?

Materials
Using bullet points, list all materials that will be needed for your designed experiment.

Procedures
This should be the step-by-step instructions of how to carry out the experiment and where to record the data.

Data collection
This should include your data table with the data you collected during the experiment. This should also include a graph of the data as a visual representation. This would be a good place to include photos or illustrations of the experimental outcome for each test. Analyze the data—what is the data telling the reader?

Conclusion
- Did you prove your hypothesis? Why or why not?
- What did the data specifically tell you about the problem?
  Use examples from your data to support your conclusion.
- Was your outcome what you expected?
- What would you change about your experiment if you retested?
- Were there any possible errors that could have impacted your results?
- How does erosion impact watersheds?
- What solutions might be used to reduce those impacts?