WATER QUALITY

Watersheds and erosion

Focus questions	What is the impact of water on land surfaces? How might we prevent erosion impacts?
Learning target	Students develop an understanding of what factors impact water quality within watersheds and how to mitigate erosion on susceptible soils.
Vocabulary	Watershed, watershed boundary, runoff

MS-ESS Earth and Human Activity

Performance expectation MS-ESS3-3	**Classroom connection:** This set of lessons helps students understand the properties of water and its effects on soil, particularly erosion. (Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.)

Science and engineering practices

Constructing Explanations and Designing Solutions	**Classroom connection:** Students will apply scientific principles to determine the effect of soil type on water movement rates then build a watershed model to test various solutions to slow runoff and erosion.

Disciplinary core ideas

ESS3.C: Human Impacts on Earth Systems	**Classroom connection:** Students investigate the physical properties of water as they investigate the ability of water to transport materials. (Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.)

Cross-cutting concepts

Cause and Effect	**Classroom connection:** Students will investigate the effect of moving water across various earth materials.
Influence of Science, Engineering, and Technology on Society and the Natural World	**Classroom connection:** Students practice techniques to reduce soil erosion.

These activities focus on **constructing explanations and designing solutions** while performing two investigations to determine the effects of water on soil. The effect of water acting on the earth's surface results in runoff and erosion of soil particles that may carry additional materials into water sources. The sediments and whatever is attached to them may have multiple impacts on surface water, both on biotic and abiotic factors.

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.

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

- Student lesson page
- Paint trays or liners
- Soils of different types collected by students or provided
- Potting soil
- Gravel/rocks

Prior knowledge

Students should have some basic background and knowledge about:

- The difference between runoff and groundwater and aspects of the hydrologic cycle
- The types of erosion and how they may impact water systems (surface vs. groundwater)
- See **qld.gov.au/environment/land/management/soil/erosion/types** for information related to types of water erosion.

Teacher preparation

Time frame: 45 minutes; additional time to test strategies to reduce erosion.

1. Revisit DQB to address progress and clarify findings.
2. Once students have completed part 1 of the investigation, they will need time to research before determining which practice they want to experiment with for part 2.
3. Once they have determined which practice they want to investigate, additional time may be needed for them to grow plants or test out their hypotheses.
4. Students will create their own watershed as set forth in the activity. It will allow them to understand how erosion and runoff occurs and how they impact watersheds. It will also help them see ways in which runoff can be reduced. Instructors may choose to have students use a stream kit from a science company such as Wards or Lab Aids. The sand, silt, clay, and pea gravel can also be purchased from these same providers or a local home improvement store.

Differentiation

Other ways to connect with students with various needs:

- **Local Community:** Students may investigate local aquatic ecosystems to predict the health of the system and observe possible causes for that quality assessment.
- **Students with special needs (language/reading/auditory/visual):** Students may investigate real aquatic ecosystems. Teachers can also create copies of the phenomena slides to pass out to the students so that they can write on the slides as they identify the potential harm and possible remediation to that harm on that slide.
- **Extra support:** Volunteer Stream Monitoring, A Methods Manual: **epa.gov/sites/production/files/2015-06/documents/stream.pdf**. Nebraska Department of Environmental Quality, Stream Monitoring: **deq.ne.gov/NDEQProg.nsf/OnWeb/SBMP**
- **Extensions:** Students can observe real-time data in Nebraska through USGS: **nrtwq.usgs.gov/ne/**. Students can help to solve real water problems within their community. Take part in organizations such as Give Water a Hand: **erc.cals.wisc.edu/gwah/**.

Assessments

Rubric for assessment

Skill	Developing	Satisfactory	Exemplary
Planning and conducting investigations	Planned and conducted an investigation which produced data that did not serve as reliable measurement.	Planned and conducted an investigation which produced data that served as reliable measurement.	Planned and conducted an investigation which produced data that served as reliable measurement, considered limitations, and refined the design.

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.”			