

The Erosion Patrol

Educator Guidebook
2026 Revision



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The Erosion Patrol

Educator Guidebook

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Welcome to the Patrol!



Dear Educator,

Welcome to The Erosion Patrol! We are thrilled to have you join us. This comprehensive packet was thoughtfully designed using an interdisciplinary approach to enhance your fourth-grade erosion and sedimentation curriculum. Created specifically for educators, this kit directly integrates and expands upon core objectives from the North Carolina Standard Course of Study across science, language arts, mathematics, social studies, and visual arts while simultaneously introducing college and career readiness pathways in erosion and sedimentation control.

We hope these ready-to-use materials and engaging activities enrich your current lessons and inspire your students to explore the impacts of erosion within their own communities.

Program Objectives:

- Understand the harm sediment, as a pollutant, can cause and the importance of erosion and sedimentation control in our communities.
- Apply Erosion Patrol practices within educational programs.
- Create a collaborative community of erosion and sedimentation control stewards across North Carolina.

Introduction



What did you have for breakfast this morning? Was it only a cup of coffee? Maybe you had some cereal or a roll. Did you have cream in your coffee or milk on your cereal? Perhaps you skipped breakfast, got dressed, and drove your car to work.

Consider the source of all the things that helped you start your day. Broken down to their most basic elements, they all came from the soil. That's right! The beans that were ground to make your coffee grew on a tree that needed soil to thrive. The wheat used to make your cereal or roll also came from a plant that grew in rich soil. The soil grew the grass that fed the cow which produced the milk or cream that went into your coffee. The raw materials used to produce your clothing, coffee mug, and even your car ultimately came from the soil beneath our feet.

As you can see, soil is one of the most basic and important natural resources on Earth. As educators, it is important that we teach soil conservation to our students. Sediment is the largest single pollutant, by volume, in North Carolina's lakes, rivers, and streams. Students should understand how to recognize erosion and the measures that can be taken to prevent soil erosion and sedimentation. They should also recognize that soil is home to many forms of life and understand the importance of preserving the quality of our land for future generations.

Why Conserve Soil?



Soil is a basic resource that is easily taken for granted. We rarely give much thought to the soil beneath our feet or whether it will always be there for us to use. Therefore, it is important to ask the question, "Why should we conserve soil?"

Many people simply accept that soil exists and never wonder where it comes from. Soil is a natural body that results from the interaction of five soil-forming factors. These five soil-forming factors are:

- **Climate** involves the temperature and precipitation that influence the chemical reactions involved in soil formation from geologic material.
- **Topography** refers to the slope, position, and aspect of the land where soil forms.
- **Parent Material** is the geologic material from which soil develops. It determines the types of minerals found in the soil and influences the type of soil that forms.
- **Organisms** include all living things, such as earthworms, humans, microorganisms, and plants, that influence soil formation.
- **Time** is required for soil to form from parent material. Over many years, parent material is slowly weathered into the soil that surrounds us. It can take 500 to 1,000 years to form just one inch of topsoil.

We must conserve soil because it takes hundreds of years to form, yet a single rain event can wash it away.

Why Conserve Soil?



There are hundreds of reasons to conserve our soil, but most of these reasons can be grouped into four categories.

- **Humanitarian** - Soil gives life to green plants. High soil productivity has allowed the United States to become one of the world's leading producers and exporters of agricultural products. If our soil is not protected, we may not be able to grow enough food to sustain ourselves and the millions of people around the globe who depend on agricultural products for nourishment.
- **Economic** - Poor soil quality reduces crop yields, which can increase food prices for consumers and lower profits for farmers. In addition, repairing erosion damage on construction projects can be extremely expensive, and those costs are often passed on to taxpayers and consumers.
- **Environmental** - Soil helps filter our drinking water and keeps rivers, lakes, and streams clean. When soil washes away as sediment, it can harm aquatic habitats, reduce water quality, and contribute to flooding. Healthy soil is also essential for supporting wildlife habitats and sustaining forests.
- **Recreational** - We must preserve our soil to help maintain the beauty of our natural surroundings. Without proper conservation practices, we risk losing scenic landscapes, parks, trails, and other recreational areas that people enjoy for relaxation and outdoor activities.

Sources of Erosion



Soil erosion occurs in many environments, but its causes can often be traced to specific land uses and physical processes.

- **Agricultural Erosion:** North Carolina's agricultural fields become highly vulnerable to erosion after plowing. Without protective ground cover, loose soil, along with fertilizers, pesticides, and other chemicals, can wash directly into nearby rivers, lakes, and coastal sounds. Farmers are encouraged to follow state and federal conservation guidelines to protect their soil and water resources.
- **Urban Erosion:** The development of homes, commercial buildings, and highways requires significant land disturbance. Removing vegetation and exposing bare soil can create severe runoff and erosion problems. North Carolina law requires erosion and sedimentation control practices on construction sites and mandates approved erosion control plans for projects that disturb one acre or more of land.
- **Forest Erosion:** Timber harvesting can lead to significant soil loss if forests are not carefully managed. Forestry professionals follow Best Management Practices (BMPs) designed to minimize erosion, protect water quality, and maintain healthy forest soils.

Sources of Erosion



The Physical Types of Erosion

As water and wind move across the landscape, erosion can occur in several different forms:

- **Splash Erosion:** Raindrops strike bare soil with force, breaking apart soil clumps and scattering loose particles.
- **Sheet Erosion:** Rainwater flows across a broad area like a thin, uniform sheet, gradually removing layers of topsoil.
- **Rill and Gully Erosion:** Running water creates small channels called rills in the soil. If left untreated, these rills can widen and deepen into larger channels known as gullies.
- **Stream and Channel Erosion:** Fast-moving water wears away the banks and beds of streams, creeks, and rivers, causing soil loss and bank instability.
- **Wind Erosion:** Strong winds lift and carry away dry, loose soil. This type of erosion is especially common in open agricultural fields that lack protective vegetation or windbreaks.

How to Prevent Erosion



Erosion and sedimentation can be successfully managed when these common practices are properly installed and maintained:

- **Ground Cover:** Materials such as vegetation, sod, mulch, gravel, or erosion control blankets that are applied to bare soil. Ground cover stabilizes disturbed land, absorbs the impact of raindrops, and slows runoff.
- **Silt Fences:** Semi-permeable fabric barriers installed along the perimeter of a site. They slow runoff water and allow suspended soil particles to settle out, helping keep sediment on-site.
- **Riprap:** Large, crushed stones placed on steep slopes, streambanks, and around pipe outlets where vegetation may not grow well. Riprap protects vulnerable soil and slows water to a non-erosive speed.
- **Buffer Zones:** Strips of natural or planted trees, shrubs, and grasses located along waterways. They help filter runoff and trap sediment before it enters streams, lakes, and rivers.
- **Skimmer Basins:** Temporary sediment basins equipped with a floating surface skimmer. They collect sediment-laden runoff and release cleaner water from the surface while allowing sediment to settle to the bottom.
- **Curb Cuts:** Intentional openings in concrete curbs along streets and parking lots. They direct stormwater runoff away from storm drains and into nearby green infrastructure practices.
- **Rain Gardens:** Shallow landscaped depressions planted with native vegetation and designed with deep, absorbent soils. They collect runoff from areas such as curb cuts, allowing water to soak into the ground while naturally filtering pollutants.

How Can You Help?

Being an Erosion Patrol Scout



Protecting soil is not just the responsibility of scientists, engineers, and environmental professionals. Every person can play a role in preventing erosion and protecting natural resources. Small actions taken by individuals can have a positive impact on soil health, water quality, wildlife habitats, and community safety.

Students can become "Erosion Patrol Scouts" by practicing simple stewardship habits in their everyday lives. Staying on designated trails helps prevent unnecessary soil disturbance and protects plant roots that hold soil in place. Leaving natural materials such as rocks, sticks, and fallen leaves where they are found helps maintain ground cover and reduces erosion. Planting native vegetation strengthens soil stability because plant roots help anchor soil and absorb rainfall.

Students should also be encouraged to observe their surroundings and report signs of severe erosion to a trusted adult. By recognizing erosion problems and understanding how they can be addressed, students become active participants in protecting their communities and the environment.

Through these actions, students learn that protecting soil is a shared responsibility and that even small efforts can make a meaningful difference.

Meet the Erosion Patrol



There are many careers that focus on the health and safety of the Earth and its inhabitants:

- **Geologists** - Scientists who study the Earth, its history, its structure, and the processes that shape it over time. They examine rocks, minerals, soils, and landforms to understand how our planet formed and how it continues to change.
- **Hydrologists** - Scientists who study how water moves across and through the Earth. They investigate the water cycle, including rainfall, groundwater, rivers, streams, and evaporation, to help solve water supply and environmental challenges.
- **Soil Scientists** - Specialists who study, map, analyze, and manage the chemical, physical, and biological properties of soil. They help support agriculture, protect natural habitats, and ensure healthy ecosystems.
- **Field Technicians** - Specialists who collect data and conduct observations in the field. They may measure water quality, monitor erosion, collect soil samples, inspect construction sites, and assist scientists and engineers with environmental projects.
- **Engineers** - Problem solvers who use science, mathematics, and creativity to design, build, and maintain structures, tools, and systems. They use information gathered by scientists to develop practical solutions that protect people, natural resources, and the environment.

The Erosion Patrol

Lesson Plans



Field Notebook Activity

Field notebooks are used by a variety of professionals. In this initial activity, students will become familiar with the purpose of field notebooks and prepare and decorate their field notebook for use throughout the activities in this packet.



Vocabulary

Field Notebook
Hand Lens
Rock Hammer
Safety Gear
Soil Probe
Water Testing Kit

Duration: 30 minutes

Location: Indoors/classroom

Materials: (For each student)

- Student Intro Packet
- Field Notebook Printable
- Coloring utensils
- Stapler

Preparation

- Download the field notebook printable as a PDF.
- Open in Adobe Acrobat.
- Print using booklet settings.

Procedure

- 1.) **Opening Question:** What types of professionals use field notebooks? What other tools do they use?
- 2.) Introduce the **Field Notebook Activity** and guide students through the different members of the Erosion Patrol. Discuss each career, the role they play in protecting the environment, and the tools they use in their work. Who are the erosion patrol?
 - Who are the Erosion Patrol Members?
 - What do they do?
 - Why are they important?
 - What tools do they use?
- 3.) After discussing the careers, students will choose a member of the Erosion Patrol they are most interested in and draw themselves in that role, including the tools they would use.
- 4.) Explain how scientists and environmental professionals use notebooks to record observations, collect data, and organize information.
- 5.) Students will assemble their field notebooks and decorate the covers using coloring materials. Encourage students to personalize their notebooks while incorporating elements related to environmental science or the Erosion Patrol.

Field Notebook Activity



Assessment

The teacher will assess student understanding through observation, participation in class discussions, and completion of lesson activities. Students will demonstrate their understanding by:

- Participating in discussions about the members of the Erosion Patrol and the tools they use.
- Drawing themselves as a member of the Erosion Patrol and including appropriate tools or equipment related to their chosen role.
- Explaining the purpose of a field notebook and how it can be used to record observations and collect information.
- Successfully assembling and personalizing their field notebook for use throughout future activities.

Closure: Students will share one Erosion Patrol career and explain how that professional helps protect soil and water resources.

Learning Targets

- ESS.4.3.2 – Engage in argument from evidence to explain how humans can adapt their behavior to live in changing environments (e.g. recycling wastes, establishing rain gardens, planting native species to prevent flooding and erosion.)
- 4.CN.1.2 Use skills and concepts learned in other content areas and everyday life in visual arts.
- 4.CR.2.1 Combine ideas from multiple sources to create artwork
- I.1.1 Identify content required to provide an answer to compelling questions.

What are Different Types of Sediment?



In this activity students will become familiar with a variety of different types of sediments. Students will develop an understanding of different types of sediment, identify their characteristics, and recognize where they can be found within their communities.

Vocabulary

Sediment
Sand
Clay
Silt

Duration: 30 minutes

Location: outdoors/classroom

Materials: (For each student)

- Field Notebook Printable
 - Activity #1
- Writing and or coloring utensils

Procedure

- 1.) Opening Question:** What is sediment? What are different kinds of sediment?
- 2.)** Begin by asking students what they see when they visit a beach, lake, stream, or river. Guide the discussion toward different types of sediment such as sand, silt, and clay.
- 3.)** Introduce the characteristics of sand, silt, and clay using physical samples, photographs, videos, or other visual aids. Discuss how each type of sediment differs in size, texture, and appearance.
- 4.)** Students will record observations of sediment found in their schoolyard, neighborhood, or another outdoor location.
- 5.)** Once the worksheet is complete, students will participate in a group discussion about what they learned. Encourage students to share observations, ask questions, and connect the lesson to their experiences.

What are Different Types of Sediment?



Assessment

The teacher will assess student understanding through classroom discussion, student observations, and completion of the nature journal activity. Students will demonstrate their understanding by:

- Identifying the characteristics of sand, silt, and clay.
- Recording observations of sediment found in their local environment.
- Participating in group discussions and sharing observations with classmates.
- Describing where different types of sediment can be found within their community.

Learning Targets

- ESS.4.2.3 – Use models to explain changes in Earth's surface overtime (to include slow changes of erosion and weathering, and fast changes of earthquakes, landslides, and volcanic activity.)
- I.1.1 Identify content required to provide an answer to compelling questions.
- I.1.9 Make inferences from information in sources.

What are Different Types of Erosion?



In this activity students will become familiar with a variety of different types of erosion and sedimentation and their causes. Students will develop an understanding of different types of erosion and sedimentation, identify their causes, and recognize examples within their communities.

Vocabulary

Erosion	Sheet Erosion
Sedimentation	Splash Erosion
Agricultural Erosion	Stream and Channel Erosion
Forest Erosion	Urban Erosion
Rill and Gully Erosion	Wind Erosion

Duration: 30 minutes

Location: Indoors/classroom

Materials: (For each student)

- Field Notebook Printable
 - Activity #2
- Writing and or coloring utensils

Procedure

- 1.) Opening Question:** What is erosion? What is sedimentation? What are the different types?
- 2.)** Begin by asking students what they already know about erosion and sedimentation. Encourage students to share their ideas and experiences. Introduce the topic and discuss how erosion and sedimentation can affect communities, waterways, and the environment.
- 3.)** Present information about the different types of erosion and sedimentation using visuals, demonstrations, photographs, or physical examples. Discuss the causes and characteristics of each type.
- 4.)** Students will complete the fill-in-the-blank worksheet as information is presented. Pause periodically to check for understanding and answer questions.
- 5.)** Once the worksheet is complete, students will participate in a group discussion about what they learned. Encourage students to share observations, ask questions, and connect the lesson to their experiences.

What are Different Types of Erosion?



Assessment

The teacher will assess student understanding through classroom discussion, participation, and completion of the fill-in-the-blank worksheet. Students will demonstrate their understanding by:

- Identifying different types of erosion and sedimentation.
- Describing the causes of various erosion processes.
- Participating in class discussions and responding to questions.
- Completing the worksheet with accurate information from the lesson.

Learning Targets

- ESS.4.2.3 – Use models to explain changes in Earth's surface overtime (to include slow changes of erosion and weathering, and fast changes of earthquakes, landslides, and volcanic activity.)
- I.1.1 Identify content required to provide an answer to compelling questions.

What are Different Types of Erosion?

Answer Key



Read the different definitions and see if you can figure out what kind of erosion it is!

AGRICULTURAL EROSION is the loss of healthy dirt caused by poor farming choices, like letting animals overeat the grass, planting the same crops over and over, and failing to protect the land.

Stream and channel erosion Serious rill and gully erosion, commonly found on steep slopes with heavy erosion damage.

Forest Erosion is The loss of soil from not using good erosion control in the forest when cutting down trees

Sheet erosion is when a thin, even layer of dirt gets swept up and carried away by flowing water.

Splash Erosion is Erosion caused by raindrops hitting bare ground and knocking soil particles apart.

Rill and Gully erosion is when fast-moving water cuts deep grooves and trenches into steep hills, causing massive amounts of dirt to wash away.

Urban Erosion is when people build highways, houses, malls, and office buildings that block the ground and increases runoff.

Wind Erosion is when strong winds blow across dry or bare ground, lifting up the loose dirt and carrying it away.

Good vs. Bad

Students will identify factors that positively and negatively affect soil health and erosion and sedimentation control. Students will explain how human actions and natural processes can impact soil, erosion, and sedimentation.



Vocabulary

Soil	Nutrients
Sediment	Turbidity
Environment	Pollutants

Duration: 30 minutes

Location: Indoors/classroom

Materials: (For each student)

- Field Notebook Printable
 - Activity #3
- Pencils

Procedure

- 1.) **Opening Question:** Why is soil important?
- 2.) Start by asking students what plants need to grow. Guide the discussion towards other reasons of soil importance. Explain that soil is a living resource that provides nutrients, water, and support for all things on Earth.
- 3.) Walk students through several examples of practices that are beneficial to soil health and several examples that may be harmful to soil health.
- 4.) Encourage students to think of additional examples and add their own ideas to the worksheet.
- 5.) Allow students time to reflect on their responses and explain why they put them in each category.
- 6.) Review responses as a class and discuss why each example belongs in each category.

Good vs. Bad



Assessment

The teacher will assess student understanding through classroom discussion, worksheet completion, and student explanations.

Students will demonstrate their understanding by:

- Correctly identifying factors that are beneficial or harmful to soil health.
- Categorizing examples based on their effects on erosion and sedimentation.
- Contributing original examples to the activity.
- Explaining the reasoning behind their classifications using evidence from the lesson.

Learning Targets

- ESS.4.3.1 Ask questions to infer whether changes in an organism's environment are beneficial or harmful.
- ESS.4.3.2 Engage in argument from evidence to explain how humans can adapt their behavior to live in changing environments (e.g. recycling wastes, establishing rain gardens, planting native species to prevent flooding and erosion).
- ESS.4.3.3 Obtain, evaluate and communicate information to compare solutions to environmental problems impacting plants and animals.
- I.1.1 Identify content required to provide an answer to compelling questions.

Good vs. Bad

Answer Key



Good

Trees

Vegetation

Rocks

Fertilizer

Bad

Heavy Rain

Roads

Strong winds

Dog Poop

Farms*

Trash

Cars

Contstruction zones*

Examples:

trees - heavy rain - roads - vegetation - strong winds - rocks - dog poop
fertilizer - Farms - trash - cars - construction zones

*Farming and construction zones can be good for soil as long as good best management practices are being used.

Turbid Tantrum!

Students will learn how sedimentation and turbidity impact the environment through discussion and hands-on exploration. By the end of the activity, students will be able to identify sources of sedimentation and turbidity and explain their effects on local waterways and communities.



Vocabulary

Sediment
Sedimentation
Environment
Turbidity
Pollutants

Duration: 30 minutes

Location: Indoors/classroom

Materials: (For each group)

- Field Notebook Printable
 - Activity #4
- 3 clear waterbottles
- Some samples of clay, silt, and sand
- Water to fill each bottle
- Timer
- Pencils

Procedure

- 1.) Opening Question:** What happens during a rainstorm? What happens to soil, sand, and other materials when it rains?
- 2.)** Start with a mindfulness activity. Play a rainstorm audio and instruct students to close their eyes and visualize what happens during a rainstorm.
- 3.)** Once the audio is over, have students discuss what they visualized. Encourage students to share their thoughts and ideas. Guide the discussion toward muddy puddles, streams, lakes, and rivers.
- 4.)** Give students the definition of sedimentation and turbidity, have them write it in their field notebooks.
- 5.) The Experiment**
 - Separate students into groups of 3, and give each group:
 - 3 clear water bottles
 - Some samples of clay, silt, and sand
 - Water to fill each bottle
 - Timer
 - Instruct students to fill each bottle with one type of sample and then fill with water and securely cap each bottle.
 - Ask students to describe what the bottles look like before shaking and record their observations in their field notebooks.
 - Set a timer for 30 seconds and have students shake the bottles. Once the timer is up, place bottles onto a flat stable surface to allow sedimentation.
 - Ask students to predict which sediment will settle the fastest and record their predictions in their field notebooks.

Turbid Tantrum!



Procedure - continued

- 6.) Have students observe the bottles after the sediments have begun to settle. Ask students to compare the clarity of the water in each bottle and record their observations in their field notebooks.
- 7.) Facilitate a discussion about which sediment settled the fastest and which remained suspended in the water the longest. Have students use their observations to explain differences in turbidity.
- 8.) Encourage students to share their reflections/thoughts. Ask students how increased turbidity may affect plants, animals, and people who rely on clean water. How does this relate to erosion?

Assessment

The teacher will assess student understanding through participation in the experiment, field notebook observations, and class discussion. Students will demonstrate their understanding by:

- Recording observations of sediment and water before and after settling.
- Comparing how different sediment types affect water clarity and turbidity.
- Explaining how sediment can impact rivers, lakes, streams, and other aquatic environments.
- Participating in group discussions and using evidence from the experiment to support their ideas.

Learning Targets

- ESS.4.2.3 – Use models to explain changes in Earth's surface overtime (to include slow changes of erosion and weathering, and fast changes of earthquakes, landslides, and volcanic activity.)
- ESS.4.3.2 Engage in argument from evidence to explain how humans can adapt their behavior to live in changing environments (e.g. recycling wastes, establishing rain gardens, planting native species to prevent flooding and erosion).
- ESS.4.3.3 Obtain, evaluate and communicate information to compare solutions to environmental problems impacting plants and animals.
- NC.4.MD.4 Represent and interpret data using whole numbers.
 - Collect data by asking a question that yields numerical data.

The Process of Erosion and Sedimentation



Students will model the processes of erosion and sedimentation through a hands-on investigation. By the end of the activity, students will be able to explain how water moves soil and sediment across the landscape.

Vocabulary

Erosion
Sedimentation
Hypothesis

Duration: 30 minutes

Location: Indoors/classroom

Materials: (For each group)

- Field Notebook Printable
- Activity #5
- 2 Aluminum pans
- A marker to label your pans
- Scissors
- Soil
- Water
- Clear Cup
- Spray bottle
- Ruler

Procedure

- 1.) **Opening Question:** How do you think erosion and sedimentation occur?
- 2.) Begin instruction by asking students to visualize a rain storm. What happens when rain mixes with dirt?
- 3.) Separate students into groups and provide each group with 2 aluminum pans, a marker, soil, water, a clear cup, a spray bottle full of water, and a ruler.
- 4.) Instruct students to cut drainage holes along one side of one aluminum pan. and label it pan 1, fill that pan with a layer of soil so that the soil comes up to the bottom of the cut holes.
- 5.) Place Pan 1 inside Pan 2 and elevate the side opposite the drainage holes to create a slope.
- 6.) Have each group record their hypothesis in their field notebooks before beginning the experiment.
- 7.) Instruct students to begin spraying water to simulate rain toward the top of their slope. Encourage students to observe how the soil changes as water moves across the slope.
- 8.) Perform the experiment. Pause occasionally to check for understanding. Allow students time to record observations of both the soil slope and the runoff water in their field notebooks.
- 9.) Once students have finished simulating rain, instruct students to remove pan 1 from pan 2. Have them pour pan 2's contents into their cup. Allow time for the sediment in the cup to settle, then measure the collected sediment. Have students measure and record the amount of sediment collected in the cup using metric units.

The Process of Erosion and Sedimentation



Procedure - continued

- 10.) After experiment is completed, ask students to reflect on their original group's hypothesis. Was anything different? Did anything change? Was there anything they were surprised about.
- 11.) Give students time to reflect on what they saw and answer the question in Part 3 of the Good vs. Bad activity.

Assessment

The teacher will assess student understanding through participation in the investigation, fieldnotebook observations, recorded measurements, and class discussion. Students will demonstrate their understanding by:

- Developing and recording a hypothesis before the investigation.
- Observing and describing the processes of erosion and sedimentation.
- Measuring and recording the amount of sediment collected during the investigation.
- Comparing the results of the investigation to their original hypothesis.

Learning Targets

- ESS.4.2.3 - Use models to explain changes in Earth's surface overtime (to include slow changes of erosion and weathering, and fast changes of earthquakes, landslides, and volcanic activity.)
- ESS.4.3.2 Engage in argument from evidence to explain how humans can adapt their behavior to live in changing environments (e.g. recycling wastes, establishing rain gardens, planting native species to prevent flooding and erosion).
- ESS.4.3.3 Obtain, evaluate and communicate information to compare solutions to environmental problems impacting plants and animals.
- NC.4.MD.1 Know relative sizes of measurement units. Solve problems involving metric measurement.
 - Measure to solve problems involving metric units: centimeter, meter, gram, kilogram, Liter, milliliter.
- NC.4.MD.4 Represent and interpret data using whole numbers.
 - Collect data by asking a question that yields numerical data.

If We Lose the Soil, They Lose Their Home



Soil is a finite living resource that supports life on Earth. Students will identify the importance of soil to a variety of organisms and human activities. By the end of the activity, students will understand why protecting soil is important for healthy ecosystems and communities.

Vocabulary

Conservation Organisms
Habitat Nutrients
Ecosystem Pollutants

Duration: 30 minutes

Materials: (For each student)

Location: Indoors/classroom

- Field Notebook Printable
 - Activity #6
- Writing and or coloring utensils

Procedure

- 1.) **Opening Question:** Why is soil important? Who depends on soil?
- 2.) Ask students why they think soil is important and encourage them to identify plants, animals, and human activities that depend on soil.
- 3.) Using Activity #6, discuss how each image depends on soil. As students share ideas, allow them to color the images and record observations in their field notebooks.
- 4.) After discussing the importance of soil, allow students time to reflect on two of the items discussed and how they depend on soil.

Assessment

The teacher will assess student understanding through classroom discussion, student reflections, and completion of Activity #6. Students will demonstrate their understanding by:

- Identifying plants, animals, or human activities that depend on soil.
- Explaining how soil supports life within an ecosystem.
- Participating in class discussions and sharing observations.
- Reflecting on at least two examples of how organisms or communities depend on healthy soil

Learning Targets

- ESS.4.3.1 Ask questions to infer whether changes in an organism's environment are beneficial or harmful.
- ESS.4.3.2 Engage in argument from evidence to explain how humans can adapt their behavior to live in changing environments (e.g. recycling wastes, establishing rain gardens, planting native species to prevent flooding and erosion).
- ESS.4.3.3 Obtain, evaluate and communicate information to compare solutions to environmental problems impacting plants and animals.
- I.1.1 Identify content required to provide an answer to compelling questions.

3 Reasons We Need to Stop Soil Erosion



Students will explore the importance of soil conservation by identifying reasons why soil erosion should be prevented. Through discussion and creative expression, students will illustrate the impacts of soil erosion and explain why protecting soil is important for healthy ecosystems and communities.

Vocabulary

Conservation Organisms
Habitat Nutrients
Ecosystem Pollutants

Duration: 30 minutes

Location: Indoors/classroom

Materials: (For each student)

- Field Notebook Printable
 - Activity #7
- Writing and or coloring utensils

Procedure

- 1.) **Opening Question:** Why do we need to stop soil erosion?
- 2.) Ask students what they remember from Activity #6.
- 3.) After discussing some reasons on the importance of soil, students will create an illustration showing three reasons why it is important to prevent soil erosion.
- 4.) Have students share their artwork with their fellow peers and share the reasoning behind their artwork.
- 5.) Give students the time to reflect on any other thoughts on why it may be important to protect our environment and soil resources..

Assessment

The teacher will assess student understanding through classroom discussion, student artwork, and reflection. Students will demonstrate their understanding by:

- Identifying reasons why soil erosion should be prevented.
- Creating artwork that communicates the importance of soil conservation.
- Sharing their artwork and explaining their reasoning.
- Reflecting on how protecting soil benefits plants, animals, and communities.

Learning Targets

- ESS.4.3.1 Ask questions to infer whether changes in an organism's environment are beneficial or harmful.
- ESS.4.3.2 Engage in argument from evidence to explain how humans can adapt their behavior to live in changing environments (e.g. recycling wastes, establishing rain gardens, planting native species to prevent flooding and erosion).
- I.1.1 Identify content required to provide an answer to compelling questions.
- 4.CN.1.2 Use skills and concepts learned in other content areas and everyday life in visual arts.

Permeable vs. Impermeable

Students will identify the differences between permeable and impermeable surfaces, how they affect our landscapes, and explain the positive impacts permeable surfaces have within our communities.



Vocabulary

Soil
Organisms
Pollutants
Turbidity
Permeable
Impermeable
Ground Cover

Duration: 30 minutes

Location: Indoors/classroom

Materials:

 (For each group)

- Field Notebook Printable
 - Activity #8
- Pencils
- A spray bottle to simulate rain
- A piece of cardboard in a plastic bag to simulate an Impermeable surface
- A piece of felt to simulate a permeable surface
- 2 aluminum pans
- Some soil

Procedure

- 1.) **Opening Question:** What are some reasons our soil erodes away?
- 2.) Guide the discussion toward puddles on roads and sidewalks, water flowing along streets during rainstorms, and flooding after heavy rainfall.
- 3.) Ask students to think about what permeable and impermeable surfaces are and allow them to share their ideas and guesses.
- 4.) Divide students into groups and provide each group with two aluminum pans, a spray bottle filled with water, a piece of cardboard covered in a plastic bag, a piece of felt, and soil.
- 5.) Place the felt in one pan to represent a permeable surface and the cardboard-covered plastic in the other pan to represent an impermeable surface. Cover both surfaces with a thin layer of soil.
- 6.) After setting up the experiment, ask students to think about what will happen to each surface when it is sprayed with water. Which one will erode faster? Which pan will produce more runoff? Which pan's water will be more turbid?
- 7.) Perform the experiment. Pause occasionally to check for understanding.
- 8.) After the experiment ask students to reflect on what they thought would happen before the experiment. What changed? Was there anything they were surprised about.
- 9.) Give students time to reflect on what they saw and answer the question in part three of Activity #8.

Permeable vs. Impermeable



Assessment

The teacher will assess student understanding through participation in the investigation, student observations, and class discussion. Students will demonstrate their understanding by:

- Identifying the differences between permeable and impermeable surfaces.
- Developing and recording predictions before the investigation.
- Comparing the amount of runoff and turbidity produced by each surface.
- Explaining how permeable surfaces can help reduce erosion, runoff, and flooding within communities.
- Using evidence from the investigation to support their conclusions.

Learning Targets

- ESS.4.2.3 - Use models to explain changes in Earth's surface overtime (to include slow changes of erosion and weathering, and fast changes of earthquakes, landslides, and volcanic activity.)
- ESS.4.3.2 Engage in argument from evidence to explain how humans can adapt their behavior to live in changing environments (e.g. recycling wastes, establishing rain gardens, planting native species to prevent flooding and erosion).
- ESS.4.3.3 Obtain, evaluate and communicate information to compare solutions to environmental problems impacting plants and animals.
- I.1.1 Identify content required to provide an answer to compelling questions.

What are Best Management Practices?



Students will learn the meaning, purpose, and importance of best management practices. By the end of the activity, students will understand how different erosion and sediment control practices are used and be able to identify examples of these practices within their communities.

Vocabulary

Best Management Practices

- Silt Fences
- Buffer Zones
- Skimmer Basins
- Curb Cuts
- Rip Rap
- Rain Gardens
- Ground Cover

Duration: 60 minutes

Location: Indoors/classroom
and outdoors

Materials: (For each student)

- Field Notebook Printable
 - Activity #9
- Writing and or coloring utensils

Procedure

- 1.) Opening Question:** How do we control erosion?
- 2.)** Begin instruction by asking students to think about what best management practices may be. Encourage students to share their thoughts and ideas.
- 3.)** After explaining the meaning of best management practices, use the images in Activity #9 to introduce different forms of erosion and sediment control. Ask students if they have seen any of these practices in their community.
- 4.)** Using the matching activity in part 2 of Activity #9. Allow students time to independently match each best management practice with its description or image.
- 5.)** After some time has passed, encourage students to share their answers and correct any mistakes.
- 6.)** Now that students have an understanding of what best management practices are, take students outside on school grounds and guide them in identifying areas that may be vulnerable to erosion. Have students record observations in their field notebooks.
- 7.)** After they have mapped out areas of erosion, have students propose a best management practice for each area they identified and explain why they selected that solution.

What are Best Management Practices?



Assessment

The teacher will assess student understanding through classroom discussion, matching activity completion, fieldnotebook observations, and participation in the outdoor investigation. Students will demonstrate their understanding by:

- Identifying common best management practices used to control erosion and sedimentation.
- Correctly matching best management practices with their descriptions or images.
- Selecting and justifying an appropriate best management practice for a specific erosion problem.
- Participating in discussion and supporting their ideas with evidence from the lesson.

Learning Targets

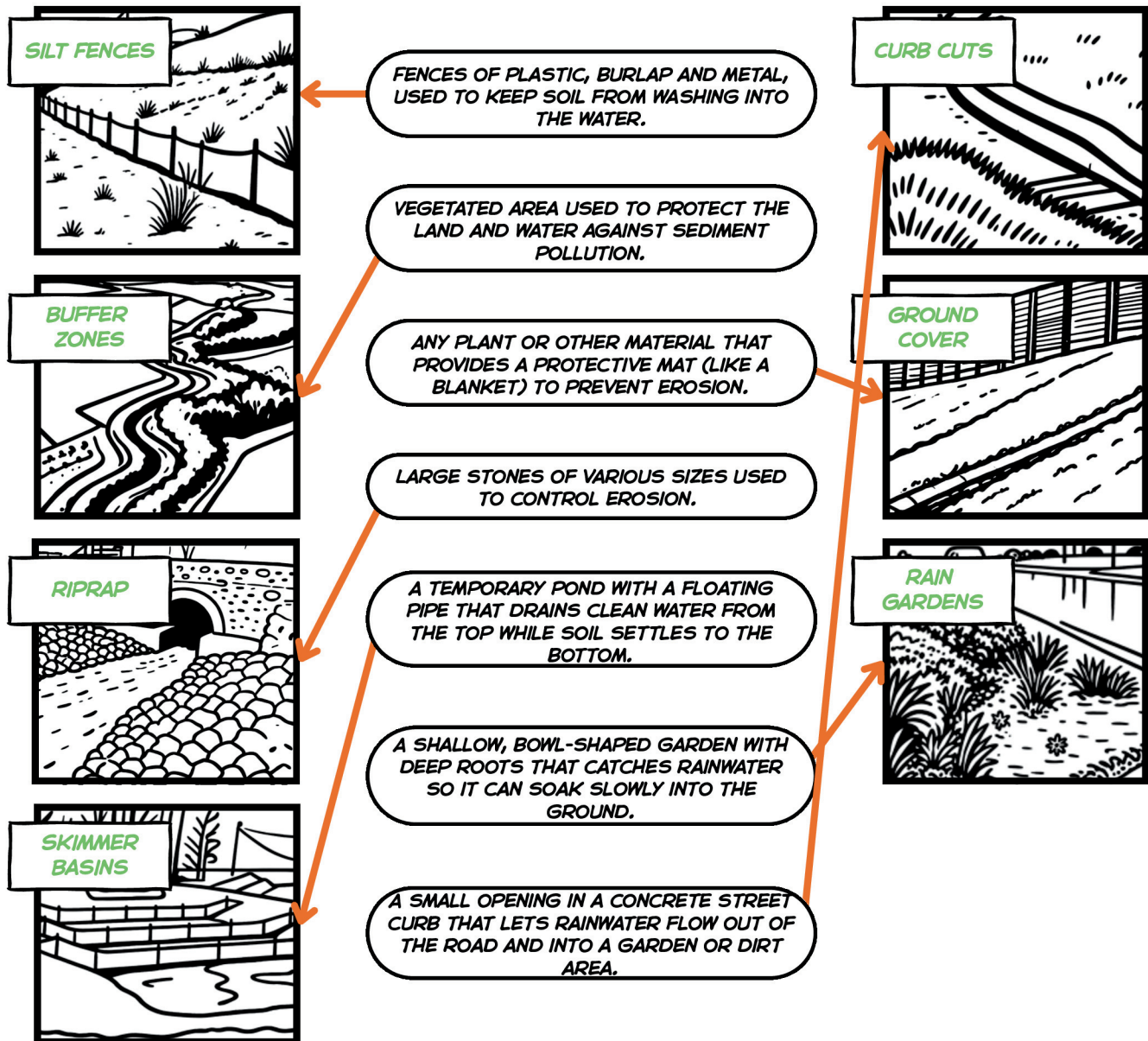
- ESS.4.3.1 Ask questions to infer whether changes in an organism's environment are beneficial or harmful.
- ESS.4.3.2 Engage in argument from evidence to explain how humans can adapt their behavior to live in changing environments (e.g. recycling wastes, establishing rain gardens, planting native species to prevent flooding and erosion).
- ESS.4.3.3 Obtain, evaluate, and communicate information to compare solutions to environmental problems impacting plants and animals.
- I.1.1 Identify content required to provide an answer to compelling questions.

What are Best Management Practices?

Answer Key



NOW THAT WE KNOW WHAT **BEST MANAGEMENT PRACTICES** ARE, **MATCH THEM TO WHAT EACH ONE DOES!**



Stop That Sediment!

Students will apply their knowledge of erosion and sedimentation control while using area and measurement skills to solve real-world problems. By the end of the activity, students will design an appropriate skimmer basin solution and explain how it helps control sediment.



Vocabulary

Sediment
Skimmer Basin
Runoff

Duration: 30 minutes

Location: Indoors/classroom

Materials: (For each student)

- Field Notebook Printable
 - Activity #10
- Writing and or coloring utensils

Procedure

- 1.) **Opening Question:** What have we learned about erosion, sedimentation, and erosion control?
- 2.) Lead a group discussion reviewing key concepts from previous lessons.
 - What is erosion and sedimentation
 - How do we control it?
 - What are best management practices? What are the different types?
- 3.) Have students complete the calculations in Activity #10. Pause periodically to check for understanding and provide support as needed.
- 4.) After calculations have been confirmed, have students design and place a skimmer basin on the provided map. Encourage students to justify why they selected that location.

Assessment

The teacher will assess student understanding through classroom discussion, completion of Activity #10 calculations, and the skimmer basin design activity. Students will demonstrate their understanding by:

- Accurately completing area and measurement calculations.
- Applying erosion and sedimentation control concepts to a real-world scenario.
- Designing an appropriate skimmer basin location on the provided map.
- Explaining how their skimmer basin design helps reduce sediment pollution.
- Participating in review discussions and demonstrating understanding of key unit concepts.

Learning Targets

- ESS.4.2.3 – Use models to explain changes in Earth's surface overtime (to include slow changes of erosion and weathering, and fast changes of earthquakes, landslides, and volcanic activity.)
- NC.4.MD.1 Know relative sizes of measurement units. Solve problems involving metric measurement.
 - Measure to solve problems involving metric units: centimeter, meter, gram, kilogram, Liter, milliliter.
- NC.4.MD.3 Solve problems with area and perimeter

The Erosion Patrol and the Mystery Sediment Plume!



This comic introduces students to the essential professionals who manage erosion and sediment control in our communities. Through this narrative, students will learn about various career roles, the tools these experts use, the importance of environmental protection, and the best management practices used to protect soil, water resources, and communities.

Vocabulary

Geologist	Sediment	Hand Lens	Best Management
Engineer	Erosion	Particle	Practices
Soil Scientist	Ecosystem	Urban Erosion	Rip Rap
Field Technician	Organism	Pollutants	Sheet Erosion
Hydrologist	Habitat	Silt Fence	Aggregate
Sediment Plume	Turbidity	Gully	

Duration: 30 minutes

Location: Indoors/classroom

Materials: (For each student)

- The Erosion Patrol and the Mystery Sediment Plume comic book

Procedure

- 1.) Have students **read as a class or on their own**. Provide the following comprehension questions to answer as a group or individually:
- 2.) Review the highlighted vocabulary words and discuss their meanings.
- 3.) Facilitate a class discussion using the following comprehension questions:
 - What kind of environmental problems occur during storms?
 - Where do you think the sediment plume could have come from?
 - What should the Erosion Patrol do to stop the sediment plume?
 - Would you have handled the situation differently? Why or why not?
 - What do the different highlighted words mean?
- 4.) Encourage students to support their answers using evidence from the comic.

The Erosion Patrol and the Mystery Sediment Plume!



Assessment

The teacher will assess student understanding through participation in class discussions, responses to comprehension questions, and vocabulary application. Students will demonstrate their understanding by:

- Identifying environmental problems related to erosion and sedimentation.
- Explaining how members of the Erosion Patrol work together to solve environmental challenges.
- Using key vocabulary correctly in discussions and responses.
- Supporting their answers with information from the comic.
- Describing best management practices that can be used to reduce erosion and sediment pollution.

Learning Targets

- ESS.4.3.2 Engage in argument from evidence to explain how humans can adapt their behavior to live in changing environments (e.g. recycling wastes, establishing rain gardens, planting native species to prevent flooding and erosion).
- ESS.4.3.3 Obtain, evaluate and communicate information to compare solutions to environmental problems impacting plants and animals.
- 4.CD.1.2 Explain how relationships between characters or individuals, settings, or a series of ideas, events, or steps contribute to the development of themes or main ideas in a text.
- 4.CD.4.1 Determine or clarify the meaning of grade-appropriate general academic and domain-specific words and phrases in texts.

Erosion Patrol Showdown!



This interactive review game challenges students to test their knowledge of erosion, soil, water quality, Best Management Practices, and the Erosion Patrol. Working in teams, students will select questions of increasing difficulty and earn points for correct answers. The activity reinforces key concepts and vocabulary while encouraging teamwork, communication, and problem-solving.

Link to game:

<https://canva.link/4ulrl8qclaus1y1>

Duration:

60 minutes

Location:

Indoors/classroom

Materials:

(For each student)

- Erosion Patrol Showdown game
- Erosion Patrol Showdown answer key
- Computer and projector or interactive whiteboard
- Whiteboard or paper for keeping score

Procedure

- 1.) Divide students into teams and explain that they will work together to complete the Erosion Patrol Showdown!
- 2.) Display the game board and introduce the five categories. Explain that each category contains questions worth 100, 200, 300, 400, or 500 points. Questions increase in difficulty as the point values increase.
- 3.) Have the first team select a category and point value. Read or display the corresponding question and allow the team time to discuss their answer.
- 4.) Ask the team to provide one final answer. Use the Erosion Patrol Showdown Answer Key to check their response. Award the listed points for a correct answer.
- 5.) Continue rotating between teams as they select questions from the remaining categories. Remove or mark questions that have already been answered and keep a running score for each team.
- 6.) Encourage students to work together and explain their reasoning. When appropriate, discuss the correct answer with the entire class to reinforce important concepts about erosion, soil conservation, water quality, and Best Management Practices.
- 7.) Continue until all questions have been answered or the allotted game time has ended. The team with the most points wins the Erosion Patrol Showdown!

Erosion Patrol Showdown!



Assessment

The teacher will assess student understanding through participation in the Erosion Patrol Showdown, team discussions, responses to game questions, and application of key concepts. Students will demonstrate their understanding by:

- Identifying causes and types of erosion and explaining how erosion affects the environment.
- Describing the relationship between erosion, sedimentation, runoff, and water quality.
- Identifying Best Management Practices and explaining how they help prevent erosion and sediment pollution.
- Using key vocabulary correctly and applying their knowledge to explain ways people can help prevent erosion and protect soil, water, and wildlife.
- Collaborating with team members to discuss questions and develop answers.

Learning Targets

- ESS.4.3.2 Engage in argument from evidence to explain how humans can adapt their behavior to live in changing environments (e.g. recycling wastes, establishing rain gardens, planting native species to prevent flooding and erosion).
- ESS.4.3.3 Obtain, evaluate and communicate information to compare solutions to environmental problems impacting plants and animals.

Erosion Patrol Showdown!



Answer Key

Soil Superstars

- 100 Points — Name one of the three types of soil texture.
 - Answer: Sand, silt, or clay.
- 200 Points — What is soil made of?
 - Answer: A naturally occurring mixture of minerals, organic matter, water, and air.
- 300 Points — How many years does it take to naturally form one inch of topsoil?
 - Answer: About 500 years.
- 400 Points — True or False: Soil is a threatened natural resource.
 - Answer: True.
- 500 Points — Why is our soil so important?
 - Answer: Soil helps grow the food we eat, supports plants and ecosystems, stores and filters water, and provides many materials and resources we use.

Erosion in Motion

- 100 Points — What is erosion?
 - Answer: The process in which wind, water, ice, or other natural forces loosen and move soil or sediment from one place to another.
- 200 Points — Name two natural causes of erosion.
 - Answer: Wind, water (rain, rivers, waves, etc.), or ice (glaciers).
- 300 Points — What is splash erosion?
 - Answer: The loosening or movement of soil particles caused by raindrops hitting bare soil.
- 400 Points — Which erodes more: grass-covered or bare soil?
 - Answer: Bare soil
- 500 Points — Why should bare soil be covered as soon as possible?
 - Answer: Bare soil can easily wash or blow away. Ground cover protects the soil from rain and wind, reduces erosion, and helps prevent sediment from entering nearby waterways.

Erosion Patrol Showdown!



Answer Key

Water Watch

- 100 Points — What is runoff?
 - Answer: Water that flows over the land into streams, rivers, lakes, storm drains, and other waterways.
- 200 Points — What does sedimentation mean?
 - Answer: The process by which sediment settles out of water, wind, or ice and is deposited in a new location.
- 300 Points — What is nonpoint source pollution?
 - Answer: Pollution that comes from many different or widespread sources and cannot easily be traced back to one specific location.
- 400 Points — What is one reason turbidity is a bad thing?
 - Answer: Turbidity makes water murky and can block sunlight, make it difficult for aquatic organisms to survive, increase water treatment costs, or lead to sediment covering bottom-dwelling organisms and habitats.
- 500 Points — How are erosion and water quality connected?
 - Answer: Erosion can carry sediment and pollutants into waterways. This can make the water murky, reduce water quality, and harm aquatic ecosystems.

BMPs to the Rescue!

- 100 Points — What is ground cover?
 - Answer: Vegetation or other natural or synthetic materials used to cover and protect bare soil. Examples include grass, mulch, straw, sod, gravel, or erosion control matting.
- 200 Points — How can you prevent splash erosion?
 - Answer: Cover bare soil with vegetation or another type of ground cover, such as leaves, straw, mulch, hay, gravel, or an erosion control mat.
- 300 Points — Name three types of Best Management Practices.
 - Answer: Examples include silt fences, skimmer basins, rain gardens, buffer zones, riprap, curb cuts, ground cover, riparian buffers, inlet protection, and outlet protection.
- 400 Points — What is the difference between permeable and impermeable surfaces?
 - Answer: A permeable surface allows water to soak into it, while an impermeable surface does not, causing more water to run off the surface.
- 500 Points — What are Best Management Practices, and why are they important?
 - Answer: Best Management Practices (BMPs) are tools, methods, or practices used to reduce erosion, control sediment, and protect water quality. They help keep sediment and pollution out of waterways and protect the environment.

Erosion Patrol Showdown!



Answer Key

Erosion Patrol HQ

- 100 Points — Name one profession you can have as a member of the Erosion Patrol.
 - Answer: Geologist, hydrologist, soil scientist, field technician, or engineer.
- 200 Points — Name some tools the Erosion Patrol uses.
 - Answer: Examples include surveying tools, maps and plans, water testing kits, soil probes, hand lenses, field notebooks, rock hammers, and safety gear.
- 300 Points — What is a geologist?
 - Answer: A scientist who studies the Earth, including rocks, minerals, soils, landforms, and the processes that shape the planet.
- 400 Points — What information could an Erosion Patrol member record in a field notebook?
 - Answer: Observations, measurements, locations, weather conditions, sketches, or information about soil and water.
- 500 Points — As an Erosion Patrol Scout, what can you do to help prevent erosion?
 - Answer: Stick to trails, avoid disturbing plants and rocks, protect vegetation, plant native plants, cover bare soil, and help keep soil and pollution out of waterways.

The Erosion Patrol

Glossary



Glossary



Aggregate – A mixture of materials such as sand, gravel, crushed stone, or recycled concrete that are combined and used in construction and erosion control.

Agricultural Erosion – The loss of soil from farmland due to rainfall, wind, irrigation, or farming activities.

Best Management Practices (BMPs) – Methods and structures used to prevent erosion, reduce sediment pollution, and protect water quality.

Buffer Zone – An area of vegetation, such as trees, shrubs, or grasses, that helps filter runoff and trap sediment before it reaches a waterway.

Clay – The smallest type of sediment particle. Clay particles hold water well and are often sticky when wet.

Conservation – The careful use and protection of natural resources to ensure they remain available for future generations.

Curb Cut – An intentional opening in a curb that allows stormwater runoff to flow into green infrastructure areas instead of directly into storm drains.

Ecosystem – A community of living organisms and the nonliving parts of their environment that interact with one another.

Engineer – A professional who uses science, mathematics, and creativity to design solutions to problems and improve structures, systems, and technologies.

Environment – Everything that surrounds an organism, including living things, land, water, air, and other natural features.

Erosion – The movement of soil, rock, or sediment from one place to another by water, wind, ice, or gravity.

Glossary



Field Notebook – A notebook used by scientists and environmental professionals to record observations, measurements, and data.

Field Technician – A professional who collects data, conducts observations, and assists with environmental investigations in the field.

Forest Erosion – Soil loss that occurs in forested areas, often due to disturbances such as logging, construction, or severe storms.

Geologist – A scientist who studies the Earth, including rocks, minerals, soils, landforms, and the processes that shape the planet.

Ground Cover – Vegetation or materials placed on the soil surface to protect it from erosion and reduce runoff.

Gully – A large channel formed when running water removes soil over time.

Habitat – The natural home or environment where an organism lives and obtains the resources it needs to survive.

Hand Lens – A small magnifying tool used to closely examine rocks, soil, plants, and other natural materials.

Hydrologist – A scientist who studies water and how it moves through the environment.

Hypothesis – A prediction or educated guess that can be tested through observation or experimentation.

Impermeable Surface – A surface that does not allow water to pass through it, such as concrete, asphalt, or rooftops.

Nutrients – Substances that living things need to grow and survive. Soil nutrients help plants develop healthy roots, stems, and leaves.

Organism – Any living thing, including plants, animals, fungi, and microorganisms.

Glossary



Particle – A very small piece of matter, such as a grain of sand, a speck of soil, or a droplet of water.

Permeable Surface – A surface that allows water to soak through it and enter the ground.

Pollutants – Harmful substances that contaminate air, water, or soil and negatively affect living things and the environment.

Rain Garden – A shallow planted area designed to collect and absorb stormwater runoff while filtering pollutants.

Riprap – Large rocks or stones placed along slopes, streambanks, or shorelines to reduce erosion and slow moving water.

Rill and Gully Erosion – Erosion caused by running water that creates small channels called rills, which can grow into larger channels called gullies.

Rock Hammer – A tool used by geologists to break and examine rocks.

Safety Gear – Equipment worn to protect people from injury while working or conducting investigations.

Sand – A type of sediment particle larger than silt and clay. Sand feels gritty and allows water to drain easily.

Sediment – Small pieces of soil, rock, and organic material that are moved and deposited by water, wind, ice, or gravity.

Sedimentation – The process by which sediment settles out of water, wind, or ice and is deposited in a new location.

Sediment Plume – A visible cloud of suspended sediment in water that causes the water to appear muddy or discolored.

Sheet Erosion – The uniform removal of thin layers of soil across a broad area by flowing water.

Glossary



Silt – A sediment particle that is smaller than sand but larger than clay. Silt feels smooth and powdery when dry.

Silt Fence – A temporary fabric barrier used on construction sites to trap sediment and prevent it from leaving the site.

Skimmer Basin – A temporary basin that captures sediment-laden runoff and releases cleaner water from the surface.

Soil – A natural mixture of minerals, organic matter, water, air, and living organisms that supports plant growth.

Soil Probe – A tool used to collect and examine soil samples below the ground surface.

Soil Scientist – A specialist who studies soil properties, formation, classification, and management.

Splash Erosion – The movement of soil particles caused by the impact of raindrops hitting bare soil.

Stream and Channel Erosion – The wearing away of streambanks and channels by moving water.

Turbidity – A measure of how cloudy or muddy water is due to suspended particles.

Urban Erosion – Soil erosion that occurs in developed areas, often caused by construction activities and increased stormwater runoff.

Water Testing Kit – A collection of tools used to measure and analyze water quality characteristics.

Wind Erosion – The removal and transport of soil particles by wind.