TAKE CARE OF TEXAS: EDUCATOR MATERIALS

LESSON PLAN

River Geomorphology

Objectives:

Students will create a physical model of a river system to identify and explain:

- Upper, middle, and lower river courses
- Erosion, transportation, and deposition
- Tributaries and confluences
- Meanders and floodplains
- River features such as waterfalls, deltas, or estuaries

Prerequisites:

Lab Setup (Teacher Prep)

1. Fill each tin tray with sand and gently level it.
2. Slightly **raise one end** of the tray using a book to create a slope (this represents a higher elevation).
3. Provide each group with water and tools.

Duration:

45 minutes

Materials:

- Take Care of Texas Watershed Divide poster
- Take Care of Texas Estuary Systems virtual field trip

LAB MATERIALS:

- 1 shallow **tin tray**
- Fine **sand** (enough to cover the tray ~3–4 cm)
- Small cup or squeeze bottle of **water**
- Spoon or craft stick
- Small stones or gravel
- Toothpicks
- Paper towels
- River Geomorphology Student Sheet

Introduction:

Pass out the River Geomorphology Student Sheet to students and read through the scenario. Review any vocabulary with students to help with understanding. Have students decide if they want to conduct the lab in a small group (2-3 students) or independently. Have students complete the Review portion of the River Geomorphology Student Sheet prior to beginning the lab.

LP27 Created 01/26

Procedure:

LAB PART I: Provide students with the Step-by-Step Lab Instructions to follow as they go through the student sheet. Students will work on building the river system including middle course, floodplain, and lower course. Students will also review vocabulary and answer reflection questions.

EXTENSION IDEAS FOR HANDS-ON LAB:

- Add food coloring to water to track sediment movement.
- How long does it take the sediment to reach the lower course?
- Compare a straight river vs. a meandering one.

LAB PART II: Using the Watershed poster, ask students to compare the watershed to their hands-on lab. Explain that students will create a diagram like the Watershed poster and use that diagram to decide where to build and justify their reasoning. Have students follow the instructions on the River Geomorphology Student Sheet.

EXTENSION IDEAS FOR LAB PART II:

- Watch the Take Care of Texas Estuary Systems virtual field trip and reconsider the human and environmental impacts.
- Create an action plan to help mitigate any impacts.
- Go to the TCEQ's 2024 Water Quality Report, click on the 2024 Water Assessment by Basin link and locate your basin. Find the data for your area. Does this information change your build site? Why?

EXTENSION MODEL: Create a model of the channels by taking a water bottle and putting sand, silt, small rocks of varying size, broken up leaves and sticks, and water. Move the bottle around and let students see how it moves. Stand the bottle up and show what happens to it when students come in the next day.

Glossary:

- **Upper course –** begins in uplands and mountainous areas characterized by steep slopes and erosion
- **Confluence –** the point where two or more watercourses (rivers, streams) merge to form a single channel
- **Source –** where the river begins, often high in mountains from rain, snowmelt, or springs
- **Meanders –** a natural, winding bend or curve in a river, forming as water erodes the outer bank
- **Erosion –** process of wearing away and transporting soil, rock, or dissolved material from area to area
- **Lateral erosion –** the horizontal, side-to-side wearing away of a river's banks, rather than its bed
- **Tributary –** a freshwater stream or river that flows into a larger river or a lake, rather than the sea
- **Deposition –** the process where a river drops the eroded material it's carrying
- **Floodplain –** a generally flat, low-lying area of lang adjacent to a river, stream, lake, or ocean that is susceptible to being inundated by water
- **Lower course –** its final section, characterized by a wide, flat valley, slow water speed, and significant deposition of fine sediment, forming features like floodplains, meanders, and deltas/estuaries
- **Delta –** a fertile landform, often triangular, created at a river's mouth where it slows down and deposits sediment as it enters a larger, calmer body of water like an ocean, lake, or sea, forming new land
- **Estuary –** a partially enclosed coastal area where freshwater from a river mixes with salty ocean water

Applicable TEKS:

- **High School**
  - Section 112.47. c. Aquatic Science.11D
  - Section 112.50. c. Environmental Systems. 11A, B
- **Middle School**
  - **6th grade –** Section 112.6. b.1A-H
  - **7th grade –** Section 112.6. b.7.1A-H; 7.11A, B

Step-by-Step Lab Instructions

River Systems Hands-On Lab Instructions

Step 1: Create the Upper Course (Source of the River)

- Students use a spoon to make a **small channel** at the highest end of the tray.
- Slowly pour a small amount of water at the top.
- Raise and lower one side of the tray to see how the water speed and sediment erosion change

Observe & Discuss

- Water flows quickly and cuts into the sand.
- Identify **erosion** and steep sides.

Key Vocabulary: Upper course, source, erosion

Step 2: Add Tributaries and Confluences

- Students create **smaller channels by** joining the main river from the sides.
- Pour water down each smaller channel.
- Add one or two obstacles (rocks) and pour water into the river channel

Observe & Discuss

- Where streams meet = **confluence**
- Water volume increases after joining.
- River rerouting

Key Vocabulary: Tributary, confluence, transportation

Step 3: Model the Middle Course (Meanders)

- Gently reshape the main channel into **curves**.
- Pour water slowly and continuously.

Observe & Discuss

- Outside bends erode more.
- Inside bends collect sand.

Key Vocabulary: Meanders, lateral erosion, deposition

Step 4: Create a Floodplain

- Pour more water than before (simulate heavy rainfall).
- Allow water to overflow the channel.

Observe & Discuss

- Sand spreads across flatter areas.
- Identify where sediment settles.

Key Vocabulary: Floodplain, deposition

Step 5: Form the Lower Course (Delta or Estuary)

- Flatten the lowest end of the tray.
- Let the river flow into a shallow pool of water (or spread out naturally).

Optional Feature Builds

- **Delta:** Sand fans out into smaller channels.
- **Estuary:** Widen the river mouth without sediment build-up.
- **Waterfall:** Place stones at a sudden drop near the top.

Key Vocabulary: Lower course, delta, estuary, deposition

Step 6: Label features with toothpick flags