

### Visible Elements in Photo



- Layered soil profile: Dark topsoil at the top, lighter/reddish middle layer, darker lower layer—distinct horizontal bands.
- Grass and plant roots: Small grass shoots with visible root systems extending into the upper soil layer.
- Soil texture variation: Granular, loose upper soil contrasting with more compacted lower layers.
- Small stones and debris: White and tan particles visible throughout the soil.

...

### Reasonable Inferences

- From root systems visible in topsoil !' Plants rely on stable soil structure to anchor and absorb water; loose topsoil may erode or wash away in heavy rain, threatening plant growth.
- From layered soil structure !' Different soil layers have different densities and water-holding capacities; upper layers drain faster, lower layers retain moisture longer.
- From exposed soil profile !' This soil has been disturbed (eroded, excavated, or exposed to weather), suggesting environmental stress or land management challenges.

---

### Engineering Task

#### K-2 Challenge:

"Use sand, soil, and rocks to build a cozy home for plant roots. Make it so water can get in, but the soil stays together when you sprinkle water on it. How can you mix these materials so the roots feel safe and the water doesn't wash everything away?"

#### #### 3-5: Design an Erosion-Resistant Soil Layer

"You are an engineer hired to prevent topsoil erosion on a hillside. Using only soil, sand, small pebbles, grass clippings, and water, design and test a 15 cm x 15 cm soil sample that resists water runoff. Your soil must:

- Stay intact when 200 mL of water is poured on it over 30 seconds,
- Allow at least some water to drain through (not repel it completely),
- Keep plant roots anchored (demonstrate with a small seedling or grass clump).

Test your design twice and record which material mixture works best."

#### 3-5 Challenge:

"You are an engineer hired to prevent topsoil erosion on a hillside. Using only soil, sand, small pebbles, grass clippings, and water, design and test a 15 cm x 15 cm soil sample that resists water runoff. Your soil must:

- Stay intact when 200 mL of water is poured on it over 30 seconds,
- Allow at least some water to drain through (not repel it completely),
- Keep plant roots anchored (demonstrate with a small seedling or grass clump).

Test your design twice and record which material mixture works best."

### EDP Phase Targeted

Ask / Define Problem — This phase fits best because the photo reveals a natural system under stress (exposed, layered soil with visible erosion potential). Students begin by observing and asking: "Why do soil layers look different? What happens to topsoil in rain? How do roots stay safe?" This grounds the challenge in real observation before jumping to solutions.

---

### Suggested Materials

1. Potting soil, sand, and pebbles (in separate containers for mixing)
2. Grass clippings or shredded newspaper (as binding/stabilizing agents)
3. Small cups or containers (for building and testing soil samples, ~15 cm diameter)
4. Water bottle or spray bottle (for erosion testing)
5. Small seedlings, grass plugs, or fast-growing seeds (to test root anchoring)

---

### Estimated Time

K-2: 30–40 minutes (5 min observation, 15 min building, 10 min testing & discussion)

3-5: 45–60 minutes (10 min investigation planning, 20 min building/layering, 15 min water testing, 10 min data recording & second trial)

---

### Why This Works for Teachers

This task directly supports NGSS K-ETS1-1 / 3-5-ETS1-1 (ask questions, define problems, and propose solutions based on real-world observations) by having students use a visible soil profile as evidence that soil structure matters for plant survival and erosion prevention, then design a testable solution.