WONDERING ABOUT WETLANDS

How do wetlands help our community during a heavy rainfall?

HAWAIʻI DOE STANDARD BENCHMARKS

Science 1: The Scientific Process: SCIENTIFIC INVESTIGATION

- **SC.3.1.1** Pose a question and develop a hypothesis based on observations.

Social Studies 7: Geography: WORLD IN SPATIAL TERMS

- **SS.3.7.1** Use geographic representations (e.g., maps, globes, graphs, charts, models) to organize and analyze geographic information.

Language Arts 5: Writing: RHETORIC

- **LA.3.5.3** Group related ideas into paragraphs.

KEY CONCEPTS

- Wetlands catch and filter water that flows from the mountains to the sea.
- Wetlands help prevent flooding and siltation of coral reefs.
- We can test a hypothesis using a scaled model to represent key features in our environment.

ACTIVITY AT A GLANCE

Students help to create a model to simulate the role of wetlands. They predict what will happen to the environment when "wetland areas" are removed from the model, and use the model to test their hypotheses.

ASSESSMENT

Students:

- Pose a question and develop a hypothesis about how wetlands help our community during a heavy rainfall.
- Draw a picture of a model and use a scale to identify distance.
- Write a paragraph that describes how wetlands help our community.

TIME

2 – 3 class periods

SKILLS

creativity, questioning, predicting, writing

MATERIALS

Provided:

- ✓ Learning Log cover (provided in the Unit Introduction
- ✓ Our Challenge (provided in the Unit Introduction)
- ✓ Learning Logs 1 and 2
- ✓ map of Kāneʻohe *ahupuaʻa*
- ✓ Our Kāneʻohe *Ahupuaʻa* PowerPoint (on photo CD)

Needed:

- ✓ folders (one per student for Learning Logs)
- ✓ large pan (such as 20" foil pan or plastic blanket box)
- ✓ measuring tape
- ✓ 2 large sponges
- ✓ modeling clay

- ✓ cup of soil
- ✓ pitcher of water
- ✓ blue food coloring
- ✓ old newspapers

Vocabulary

ahupuaʻa – traditional Hawaiian units of land that typically extended from mountain peaks to the outer edge of the reef

bog – a wetland type; very old lake without inlet or outlet that becomes acid and is gradually overgrown with a characteristic vegetation. Peat moss, or sphagnum, grows around the edge of the open water of a bog and out on the surface.

flooding – becoming inundated or covered with water

filter – a substance that removes particles as they pass through it

habitat – the environment where a plant or animal lives or occurs

kīkoʻo – a measure from the end of the thumb to the end of the index finger

pali – cliff or cliffs

silt – fine particles of soil

siltation – process of silt covering an area

ʻunelunelu – marsh

wetland – an area that is saturated with moisture, such as a marsh, swamp, salt flat, or bog

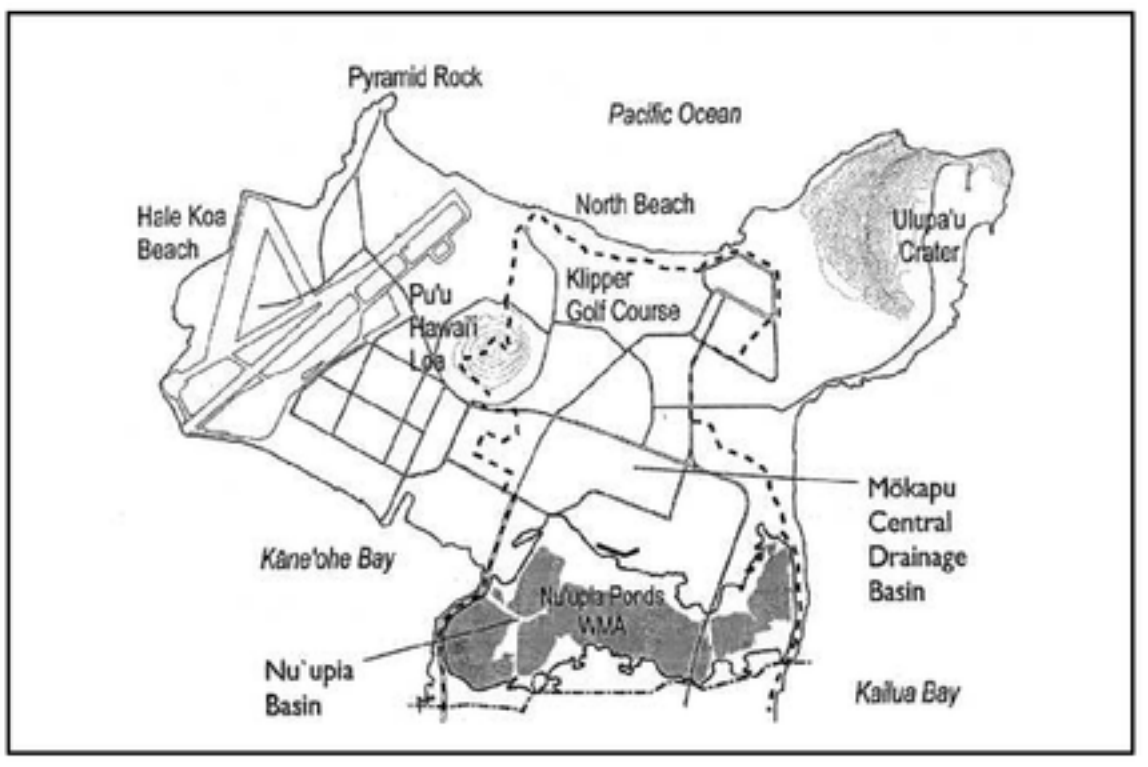
Advance Preparation

- ☐ Make a copy of the Learning Log cover and challenge sheet (provided in the Unit Introduction), and Learning Logs 1 and 2 for each student.
- ☐ Gather the materials for the model and clear a central area of the classroom where students can work with it.
- ☐ Review the PowerPoint presentation about the Kāneʻohe *Ahupuaʻa*.
- ☐ Post the essential question for the unit in large letters in a prominent place in the classroom.
- ☐ Make a transparency of the *ahupuaʻa* map provided with this lesson.

Teacher Background Information

What is a wetland?

A wetland is an area that is saturated with moisture, such as a marsh, swamp, salt flat, or bog. Plants and animals living in wetlands have special characteristics that enable them to adapt to these wet environments. Marsh communities typically have sedges and grasses at their edges and floating plants in open water; swamps have trees and shrubs.



Mōkapu Peninsula (*Reprinted from Bruce A. Wilcox et al., 1998. Mōkapu: Manual on Watershed Health and Water Quality.*)

Bogs also have trees and shrubs, which are typically stunted due to the growing conditions in bogs, which are waterlogged, highly acidic, nitrogen-poor organic peat soils. Some wetlands are created by people to grow food. Examples in Hawaiʻi are *loʻi kalo* (taro patches), *loko iʻa* (fishponds), and prawn farms.

Mōkapu Peninsula in the Kāneʻohe *ahupuaʻa* contains a 482-acre wetland / waterbird habitat that includes coastal ponds, salt flats, and remnants of five ancient fishponds -- Halehou, Muliwaiolena, Nu'upia, Pāʻōhua, and Kaluapūhi (Kikuchi, 1973). At one time, much of the lowlands at Mōkapu were coastal marsh, but much of this has been filled in. The drainage channel that passes through the area and empties into Kāneʻohe Bay was once a large estuary that extended across the neck of the Mōkapu Peninsula and well into the uplands (Wilcox et al., 1998).

Today the former fishponds are known as Nuʻupia Ponds Wetland Management Area. They are subdivided into eight interconnected ponds separated by roads and causeways. The ponds and surrounding salt flats are important habitat for wetland birds (Wilcox et al., 1998).

The gently sloping basin of Mōkapu extends below sea level so Nuʻupia Ponds, the main drainage channel that runs through the peninsula and two marine ecosystems at Mōkapu all interact through tidal action. Brackish groundwater also supplies water to the ponds. Freshwater runoff from the land drains into the ponds, into the drainage channel, and into Kāneʻohe Bay. Although recent human-made storm systems intercept and redirect some storm water runoff away from Nuʻupia Ponds into the central drainage channel (Wilcox et al., 1998). Freshwater runoff carries sediments and pollutants such as pet waste, fertilizers, oil and litter from homes, businesses and roads. While wetlands help to catch some of these sediments and pollutants and prevent them from ending up on the coral reef, the health of the wetlands depends on preventing polluted runoff from the land.

Wetlands help to catch and filter water and sediments as water flows over the land and out to sea. These natural filters are important ecosystems that help to keep our near shore waters and reefs healthy. Wetlands also catch freshwater runoff, which helps to prevent flooding during heavy rainfall. When natural wetlands are drained and filled or covered with roads and other impermeable surfaces, flooding of lowland areas can become a problem.

In this activity, students help create a simplified model of part of the southern part of the Kāneʻohe *ahupuaʻa*, from the *pali* out to the Mōkapu peninsula.

Teaching Suggestions

1. **Show the PowerPoint presentation, Our Kāneʻohe *Ahupuaʻa*, which features the area from *mauka* to *makai*.**

- Ask students to point out the different environments in the community (mountains, streams, forest, beach, fishpond, coral reef, wetlands).
- Project the Kāneʻohe *ahupuaʻa* map and discuss it with students.

2. Create a K-W-L chart about wetlands by writing a large K, W, and L on the board.

- Ask students if they have ever seen or visited a wetland.
- Find out what they know (K) about wetlands and record their statements under the K on the board.
- Ask them what they wonder (W) about wetlands, and record their thoughts under the W.
- At the end of the lesson, return to the chart and record what they have learned (L).

3. Introduce the essential question for the unit and explain that students will be investigating wetlands in your community. Distribute the materials for students to create Learning Logs.

- Instruct students to glue the Learning Log cover sheet to the outside of their folder.
- Glue the **challenge sheet** to the inside cover of the folder—this will serve as each student's Learning Log or portfolio.
- Review the challenge sheet that describes projects and assessment for the unit.

4. Pose the essential question for this activity: "How do wetlands help our community during a heavy rainfall?"

- Discuss it with students and write their initial responses on the board.
- Introduce the Hawaiian term for marsh – *ʻuneluneluʻ*.
- Review the standards that the class will be addressing.

5. Suggest using a model to simulate what happens in the community when it rains.

- Show students a sponge and explain that many people compare a wetland to a giant sponge.
- Show students the additional materials and ask for their suggestions about ways to make a model to represent the mountains, stream, forest, and coral reef in the community. (See suggestions about how to make a model on the following page.)

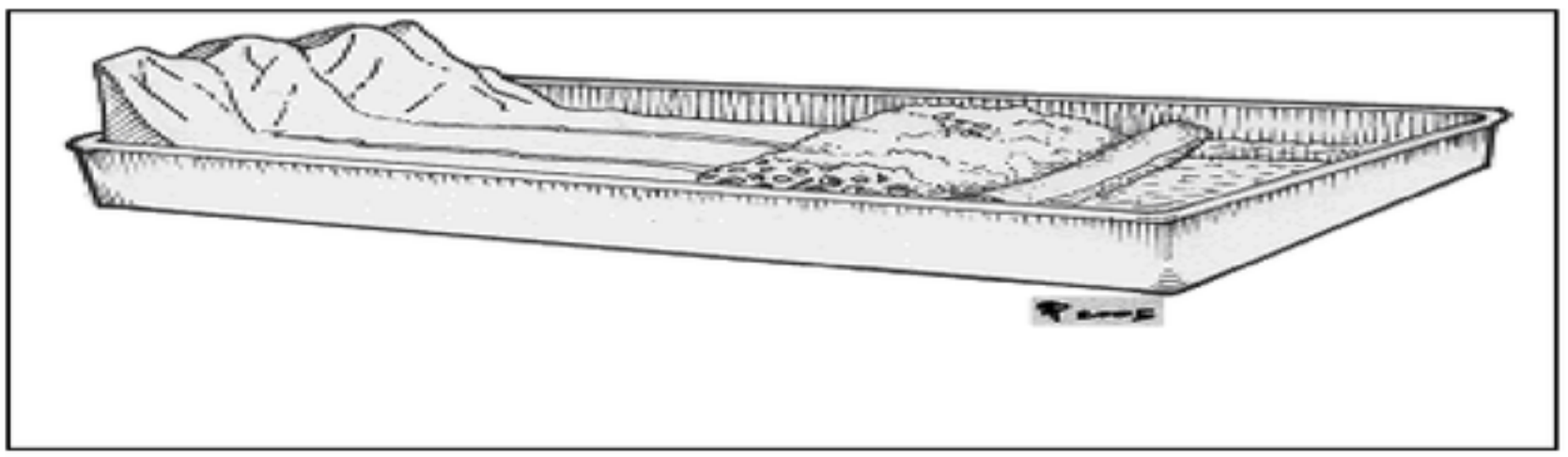
6. Discuss directions and distances for the model.

- Have students establish directions of *mauka* (toward the mountains) and *makai* (toward the sea).
- Explain that the distance from the bottom of the *pali* (cliffs) to the outer edge of Mōkapu is about eight miles.
- Measure this distance on the model and help students devise an approximate scale.
- Introduce *kīkoʻo* - the Hawaiian way of measuring from the end of the thumb to the tip of the index finger.

7. **Simulate a heavy rainfall on the model.**
   - Place a few drops of blue food coloring in a pitcher with about two cups of water.
   - Quickly pour the water at the *mauka* end of the model.

Making a Model

- Use a large 20" foil pan or plastic blanket box to represent the ocean.
- Place a block under the *mauka* (mountain) side to provide a slope to the model.
- In one end of the pan, make a mound of newspaper and tape it together with masking tape. Cover it with strips of clay to build the *pali* (cliffs).
- Use clay to form the land sloping down to the wetlands at Nuʻupia.
- Place moistened wetland sponges along the entire base of the clay.
- Make a clay strip of land to the *makai* (ocean) side of the wetland sponges to represent the rest of the Mōkapu peninsula and place it firmly across the entire edge of the sponges.
- Carve out Kawa Stream in the clay.
- Sprinkle a cup of soil onto mountains and the rest of the land.



- Ask students to describe what happened. (The wetland [sponges] will absorb the soil and catch most of the water. Clean water will filter into the bay at the *makai* end of the model.)

8. **Distribute Learning Log sheet 1 and have students pose a question and develop a hypothesis related to what will happen to the environment if the wetlands (sponges) are removed.**
   - Work with students to shape the question that they are trying to answer with the model. Write the question on the board and have students record it on Learning Log sheet 1.
   - Ask students to record their observations of what happened when the "rain" fell on the model. Discuss how those observations can help them to develop a hypothesis.

- Help students to develop a hypothesis based on their question. For example, "If we remove the wetlands (sponges) from our model, the soil from the *mauka* area will wash into the ocean."
- Ask students to each write a hypothesis in their Learning Logs.

9. **Test their hypotheses with a heavy rainfall on the model without the wetland (sponges).**
   - Pour the water out of the model and replace the soil in the uplands.
   - Refill the pitcher with two cups of blue water and pour it quickly at the *mauka* end of the model.

10. **Discuss what happened and ask students if anyone's hypotheses were supported.** (The lowland areas will flood; soil and dirty water will wash into the ocean.)
    - Discuss the role of the wetland in preventing flooding and keeping soil off of reefs.

    Discussion Questions
    - What happened to the reef when the wetland was not there?
    - How could the wetland help prevent flooding in our community?
    - What are the advantages and limitations of using a model to answer our question? (Models are only simplified versions of big events that are not easy to see directly.)
    - Are there other ways that wetlands are important? How could we find out?

11. **Have students complete the assessments - Learning Log sheets 1 and 2.**
    - Ask students to write a paragraph that summarizes how wetlands help our community. As an option for some students, conduct an oral assessment using the Learning Log sheets as a guide.
    - Revisit the K-W-L chart by having students fill in what they have learned and what they still wonder about wetlands.

ADAPTATIONS/EXTENSIONS

Science 1: Scientific Investigation Have students experiment with the model by developing and testing hypotheses that relate to removing part of the "marsh."

Language Arts 5: Writing: Range Form teams and challenge groups to develop a way to share what they have learned about why we need wetlands. For example, students could write a song or story, or develop a mock newscast that describes what happened on a hypothetical day when the wetlands in the community disappeared. Encourage students to visit Web sites created by other students about wetlands such as *Kaʻelepulu Pond: Why are Hawaiʻi's wetlands vanishing?* http://library.thinkquest.org/J0110028/splash.htm

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