Fishable and Swimmable in 7 Years

Lesson 2 - Explore

Overview
On two maps (one showing the waterways before the Ala Wai Canal was built, and one after), students trace the paths that water can follow from the mountain to the sea. Class discussion leads to the building of watersheds in groups, with a canal at the bottom. On their watershed models, students draw where they think the wild animals, homes, and businesses are, and then add the respective pollution. To simulate rain, water is sprayed at the highest points of their watershed, which flows in streams, and accumulates at the bottom where their canal is.

Goal
Students understand how pollutants accumulate in a watershed.

Essential Question
How can we encourage others to care?

Enduring Understanding
It can be difficult to pinpoint the sole cause of a problem.

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<table>
<tr><th colspan="2">Materials</th></tr>
<tr><th>Overall</th><th>Per student</th></tr>
<tr><td>

- Printable Map - Before Canal
- Printable Map - After Canal
- Highlighters

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- Printable Map - Before Canal
- Printable Map - After Canal
- Highlighter (if necessary)

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<tr><td></td><td>Per group (3 to 4 students)</td></tr>
<tr><td>

- Foil pans, 9”x13”
- Aluminum foil, roll
- Newspaper
- Masking tape
- Markers, in sets
- Cocoa powder
- Glitter
- Vegetable oil, bottle
- Spray bottles filled with water

- Empty soda bottle, 1
- Funnel to fit into soda bottle, 1
- Soda bottle cap, 1

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- 1 foil pan
- Enough foil to cover the pan.
- 10 sheets of newspaper
- 1 roll of masking tape
- Pack of markers
- Cocoa powder (shared)
- Glitter (shared)
- Vegetable oil (shared)
- Spray bottle filled with water

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<tr><th colspan="2">Online Resources</th></tr>
<tr><td colspan="2">Ala Wai Maps (before/after): https://www.alawaicentennial.org/ESSAY</td></tr>
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Lesson Time = 40 minutes

The Ala Wai Watershed (10 minutes)

1. Distribute the map that shows the area before the canal was built.
2. Ask students to take out a highlighter if they have one. If they don't, please provide one for them.
3. Using their highlighters, ask the students to trace the paths (the white lines on the map) that water can take, flowing from the mountains to the sea.

Insight: You can use this time to discuss what the students notice about the different water paths. You can ask:

- "What do the white lines represent?"
  - Streams
- "What could the larger white patches be?"
  - Perhaps taro patches or fish ponds.

3. Distribute the map that shows the area after the canal was built.
4. Using their highlighters, ask the students to trace the white paths again.
5. Ask students what they notice about this map.

Insight: The larger, thick line on the map is the Ala Wai Canal. Construction started in 1921, and it was completed in 1928. Students may ask why the canal doesn't have an exit on the right side - one reason was for the hotels near the beach - people did not want canal water flowing in front of the hotels due to ocean currents.

6. Guide the discussion to the observation that there is only one path for the water to flow, in contrast to about 6 before the canal was built.

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Activity - Building a Watershed (25 minutes)

1. You can lead into this activity by going over the purpose of building the watershed - to see what happens when water flows into a canal.
2. Assign students to groups of 3 to 4.
3. For each group, distribute:
    a. A foil pan.
    b. A sheet of foil.
    c. 10 sheets of newspaper
    d. 1 roll of masking tape
    e. 1 box of markers
4. Instruct students to:
    a. Crumple the newspaper sheets individually to make newspaper balls of different sizes. Large balls can represent mountains, while smaller ones can represent hills.
    b. Place the newspaper balls into the pan, making a gradual slope - mountains on one side of the pan, hills in the middle, and nothing on the other end of the pan.
    c. Use masking tape to secure the newspaper balls to the pan.
    d. Once all of the newspaper balls have been taped in, cover the entire pan with foil.
    e. Gently press down the foil on newspaper balls. The crumples on the foil represent streams and other waterways.
    f. Use masking tape to secure the foil.
        i. Tape the foil on the newspaper ball side of the pan.
        ii. Tape the other end of the foil inside of the pan.

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Insight: If you want, students can test their watersheds. Using the spray bottles, groups spray water at the top of their mountains, to make sure that the water flows from the top into the canal. At the end of testing, pour out the water and dry the watershed.

5. Using markers, have students draw on the foil where they think wild animals, residential homes, and commercial businesses would be in the watershed. (Typically animals are at the top, homes in the middle, and businesses at the bottom, but allow the students to place them wherever they think is correct).
6. Distribute cocoa powder to represent animal dropping. Students sprinkle the powder wherever the animals were drawn. They can put as much as they want.
7. Distribute glitter to represent litter (if you do not have glitter, use something light that can move with water, like small crumpled pieces of paper). Students sprinkle the glitter where the homes were drawn.
8. Distribute the vegetable oil to represent car pollution. Pour oil where the businesses were drawn. Oil can also be poured where the homes were.

9. Distribute the spray bottles. Students spray the tops of their watersheds and observe what happens to the water and the pollution.

Insight: The water should collect at the bottom at the canal, bringing along the various forms of pollution on the watershed. If the water ends up collecting some place else, you can ask the students what that represents (a lake or pond). You can also ask the students what can be done to fix their watershed. Usually students will use their hands and create a new path. This can be compared to real life - when water doesn't flow the way we want it to, we sometimes manually create new waterways.

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10. If the water and pollution does collect at the bottom of their watershed, you can ask the groups what that area represents (the Ala Wai Canal).
11. Have students look at other groups' watersheds.

12. CLEAN UP - If oil was used, do not pour the mixture of liquid (that contains water, cocoa, glitter, and oil) down the sink. Instead pour as much of it as you can into the soda bottle with the funnel on it.
    a. Once the bottle is almost full, remove the funnel and place your hand on top of the bottle opening.
    b. Turn the bottle upside down, and wait a few seconds.
    c. Due to density, the oil should rise up, with the water and cocoa powder being near your hand that's covering the opening.
    d. Move the bottle over a sink, and partially remove your hand from the opening, so that the liquid can pour down the drain.
    e. Once you get near the oil layer, stop pouring out the liquid and turn the bottle right-side up.
    f. Cap the soda bottle and throw the soda bottle away with the oil.

Class Discussion (10 minutes)

1. Ask the class to share what they observed from their watersheds.
2. If it was not discussed, mention the previous "insight," about humans creating artificial waterways for their needs.
3. Compare the waterways of the previous ahupua`a with the canal.
4. Discuss the structure of the canal. Students can evaluate the decision to build the canal the way it is - if they support it or not.