Image Credit: Julien Millet / Unsplash

3

The Kīlauea Volcano: Be a Volcanologist

Final Project

Learning IN MOTION®

3 Final Project

In this two-day project, students apply their previous learning and data analysis about volcanic hazards. The class begins by reviewing a rubric for developing a Hazard Response Plan. Then, pairs or teams work together to each create their own plan for scientific monitoring and public response to two volcanic hazards they have selected. The class concludes with a brief summary of volcanic events that continued after the May 2018 eruption.

GUIDING QUESTION

How do scientists monitor volcanoes in order to predict hazards and keep the public safe?

Image Credit: United States Geological Survey

Lesson 3: Final Project

MATERIALS

Teacher Materials

- **Final Project** visuals
  - **Kīlauea Eruption Continues** slideshow (for Extension)

Student Materials

- **Volcanology** handout (from previous lessons) (1 per student)
- **Observation Journal** handout (from previous lessons) (1 per student)
- **Hazard Response Plan Rubric** handout (1 per student)
- Optional: **Kīlauea Eruption Images** handout (online or print) (1 per pair or team)
- Optional: Data handouts from previous lessons (1 of each per pair or team):
  - **Hawai'i Volcanoes Data** handout
  - **Monitoring Kīlauea Data** handout
- Supplies and equipment for creating final project (see Lesson Preparation)

LESSON PREPARATION

Prepare the Project Approach

1. Prior to the lesson, decide how you will structure students' final projects. Depending on the needs of your class, you may opt to have students work in pairs or in their teams of four from previous lessons. In addition, decide the level of self-direction you will offer in terms of the format of students' Hazard Response Plans. You may opt to have students select from a set of options or leave the approach completely open-ended. Some potential formats include a poster, a brochure, or an announcement to be broadcast or distributed online.

Image Credit: Jens Johnsson / Unsplash

Lesson 3: Final Project

Prepare Lesson Materials

1. Print enough copies of the **Hazard Response Plan Rubric** handout for your class.

2. Determine how students will access images to use in their project.

    - **Print version:** If the **Volcanology**, **Hawai'i Volcanoes Data**, and **Monitoring Kīlauea Data** handouts were printed but not laminated, students can select and cut out appropriate images from these handouts. Alternatively, you can print a copy of the **Kīlauea Eruption Images** handout for each team, which contains select images from the **Volcanology** handout and data handouts without accompanying text.
    - **Online version:** If students will complete their project digitally, you can provide them with access to the online **Kīlauea Eruption Images**.
    - You may instruct students to illustrate their own visuals.

3. Prepare access to the supplies and equipment students will need for the project approach(es) chosen. These may include:

    - Poster board
    - Blank paper
    - Colored pens and pencils
    - Scissors
    - Computer access
    - Text and/or visual editing programs
    - Video camera
    - Printer

Image Credit: Jens Johnsson / Unsplash

Lesson 3: Final Project

OPENING

Review the Hazards from Kīlauea's Eruption

1. Briefly review with the class the volcanic events they have analyzed in past lessons. Write a list on the board:
   - Earthquakes
   - Deformation
   - Lava flows
   - Sulfur dioxide gas
   - Explosive eruptions and tephra

   Remind students that some of the events occur before an eruption, while others happen during an eruption.

Introduce the Project

1. Tell students that their goal today as volcanologists is to create a Hazard Response Plan for the May 2018 eruption of the Kīlauea Volcano.
2. Explain that they will work in pairs (or in their teams from the previous lessons) to design and produce a response plan to inform the public living on the Island of Hawai'i about what they should do to stay safe during the Kīlauea Volcano eruption.
3. Describe the option(s) for the format of students' Hazard Response Plan and the ways that the materials could be made available to the public; examples include:
   - A brochure (to be distributed in communities at risk or available online)
   - A poster (to be posted at public locations on the island)
   - A video (to be broadcast on TV or posted on an Internet news site)

   Tell students that they will base their Hazard Response Plan on the data they explored and recorded in their **Observation Journal**.

Image Credit: U.S. Geological Survey

Lesson 3: Final Project

Review the Project Rubric

1. Provide students with a copy of the **Hazard Response Plan Rubric** handout. Briefly review the requirements of the project. To meet expectations, students should:
   - Identify and describe two volcanic hazards from Kīlauea.
   - Describe how scientists monitor the volcano for specific warning signs of the two identified hazards.
   - Explain which areas are most susceptible to risks from the hazards, and why.
   - Suggest actions for responding to each identified hazard, including what scientists and officials will do and/or what residents should do.
   - Include accurate images, maps, graphs, and/or data as appropriate to provide information in the plan. (Students can use images etc. from the **Volcanology**, **Hawai'i Volcanoes Data**, and **Monitoring Kīlauea Data** handouts, or the **Kīlauea Eruption Images** handout).
   - Specify where/how their response plan should be accessible to the public (on a government website, TV broadcast, etc.).


Final Project

Hazard Response Plan Rubric

Hazard Response Plan Rubric handout

ACTIVITY

Create Response Plans

1. Show the class the supplies and equipment available to them. If students will be making brochures or posters, suggest that they design a layout before attaching text or visuals to the background paper or board. If students will be making digital recordings, introduce the functionality of the devices they will be using. Discuss norms for using video cameras, and set parameters around the video content and length.
2. Tell students to bring their completed **Observation Journal** handout with them as they gather in their pairs or teams. Remind them to work together in planning and developing their Hazard Response Plan. Suggest that they use the rubric as a means of defining what needs to be done and who might do which parts.
3. Allow students to work on their project for the remainder of the class period and the following class period, allowing some time at the end for final discussion and reflection. Depending on your class and the time available, you may opt to allow students additional days to work on their project.

Lesson 3: Final Project

Discuss

1. Call on multiple students and have each share one of the volcanic hazards they identified and their plan for scientific monitoring and public response. For example, students might say:
    - ***Lava flows*** are hazards for anyone or anything in their path. To figure out where magma is, scientists use thermal imaging. Where the ground is hottest, there's more magma. We told people to evacuate the areas near fissures because the magma comes out there. Lava flows travel downhill, so people in those areas should also evacuate. We are going to keep monitoring the area and other areas in the rift zones because eruptions are more likely there. We showed the areas on a map.
    - ***Sulfur dioxide*** gas is a hazard because it can be toxic if inhaled. Scientists measure how much gas is around the volcano and its vents, and they also monitor air quality around the island. People with trouble breathing should leave areas in which sulfur dioxide levels are high. Everyone else should stay inside.
    - ***Explosive eruptions*** are hazards because they can throw large rock and lava fragments into the air. When these projectiles fall, it's a hazard to people and equipment on the ground. Scientists can predict if there will be an explosive eruption at a crater by watching the level of the lava lake and whether it's going to go below the water underground. The areas nearby should be closed and people should stay away.

Image Credit: U.S. Geological Survey

Lesson 3: Final Project

REFLECTION

Summarize

1. Let the class know that the volcano continued erupting for months after the last data set they looked at. By May 31, flowing lava had destroyed 82 structures, and half of those were homes. By mid June, over 600 homes had been lost to lava in the East Rift Zone. However, scientists and public officials were able to work together to keep people safe by issuing messages online and on the radio, mandating evacuations, and continuing to monitor the volcano closely for changes.

Self-Assess

1. Have the pairs or teams use the **Hazard Response Plan Rubric** and self-evaluate their completed project.
2. Congratulate students on their work in predicting volcanic hazards and devising a response plan to keep the public safe.

EXTENSION

Gallery Walk

1. Display students' completed Hazard Response Plans. Have the rest of the class circulate and view each other's work. Consider having students use the rubric to evaluate each other's projects.

Follow the Eruption

1. Show the **Kīlauea Eruption Continues** slideshow, and ask students to share observations with a partner as they watch. The slideshow shows the progression of lava flows, including ocean entry, the building of a new cinder cone at Fissure 8, and explosions and collapse at the summit caldera and Halema'uma'u crater. Students should look for the following as they watch:
    - Ways that the volcano interacts with Earth's air or water and/or changes the landscape
    - Hazards that scientists might predict or monitor

Image Credit: U.S. Geological Survey

Kīlauea Eruption Continues slideshow

Continue Monitoring

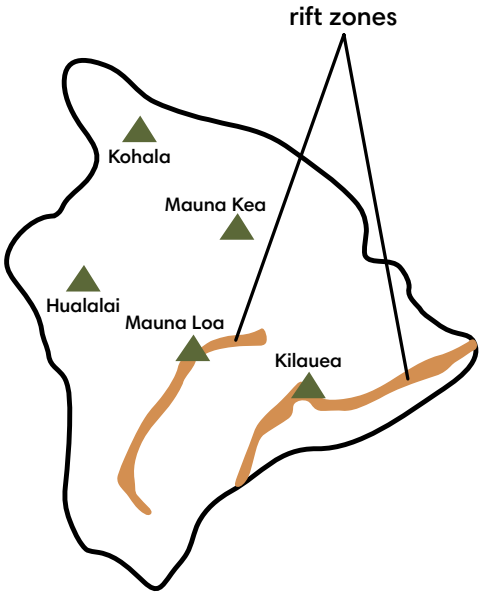
1. Have students continue to explore the updates and monitor information about the Kīlauea Volcano using the USGS website.

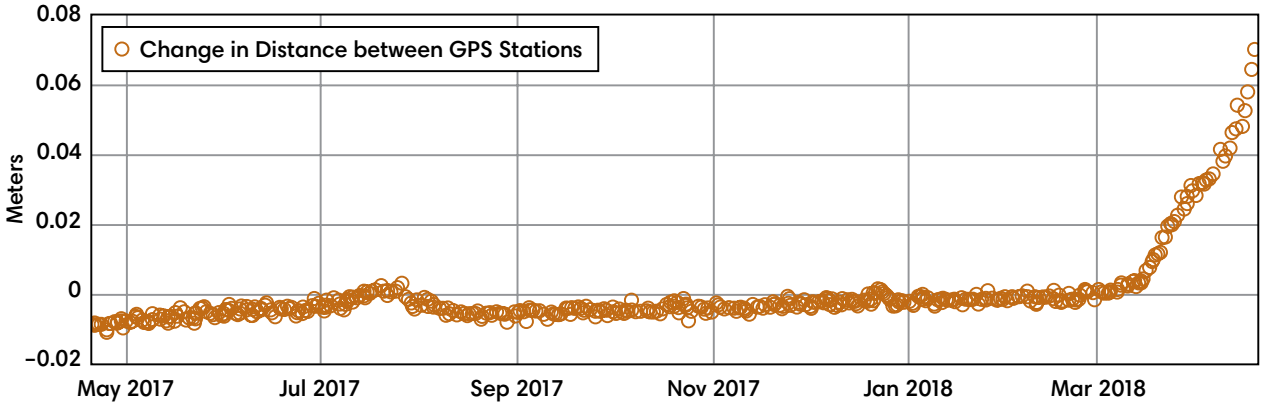
3 Final Project

Hazard Response Plan Rubric

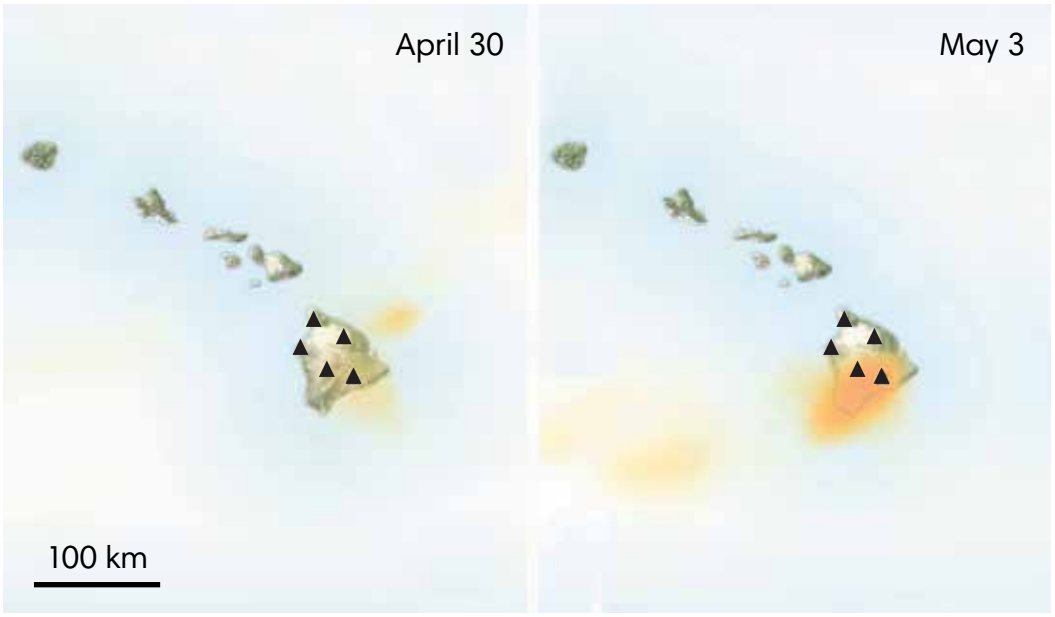
	4 Exceeds Expectations	3 Meets Expectations	2 Approaches Expectations	1 Below Expectations
Volcanic Hazards	Identifies and describes three volcanic hazards from Kīlauea.	Identifies and describes two volcanic hazards from Kīlauea.	Identifies and describes one volcanic hazard from Kīlauea.	Identifies but does not describe any volcanic hazards from Kīlauea.
Warning Signs	Describes how scientists monitor the volcano for specific warning signs of three identified hazards.	Describes how scientists monitor the volcano for specific warning signs of two identified hazards.	Describes how scientists monitor the volcano for specific warning signs of one identified hazard.	Inaccurately describes how scientists monitor the volcano for warning signs of a hazard.
Risks	Clearly explains which areas are most susceptible to risks from the hazards and why.	Explains which areas are most susceptible to risks from the hazards and why.	States which area(s) are most susceptible to risk from the hazard(s), but does not explain why.	Incompletely states which area(s) are most susceptible to risk from a volcanic hazard, and does not explain why.
Responses	Suggests actions for responding to three identified hazards, including what scientists and officials will do and what residents should do.	Suggests actions for responding to two identified hazards, including what scientists and officials will do and/or what residents should do.	Suggests an action for responding to one identified hazard, including what scientists and officials will do or what residents should do.	Suggests an action for responding to unidentified hazards, but does not specify whether scientists or residents should take the action.
Visuals	Includes a variety of accurate maps, images, graphs, and/or pieces of data that enhance the clarity of the plan.	Includes several accurate maps, images, graphs, and/or pieces of data that provide information in the plan.	Includes a few unclear or inaccurate maps, images, graphs, and/or pieces of data.	Includes no maps, images, graphs, and/or data that provide information in the plan.
Resource Type	Clearly specifies how the response plan will be accessible to the public on a national, state, or local level. The manner matches the format used (poster, video, etc.).	Clearly specifies how the response plan will be accessible to the public. The manner matches the format used (poster, video, etc.).	Specifies how the response plan will be accessible to the public, but the manner does not match the format used (poster, video, etc.).	Does not specify how the response plan will be available to the public.

Kīlauea Eruption Images



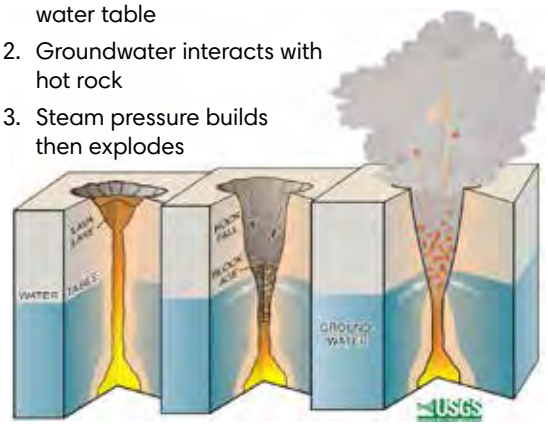


Kīlauea Eruption Images



Explosive eruptions can occur when

1. Magma column drops below water table
2. Groundwater interacts with hot rock
3. Steam pressure builds then explodes



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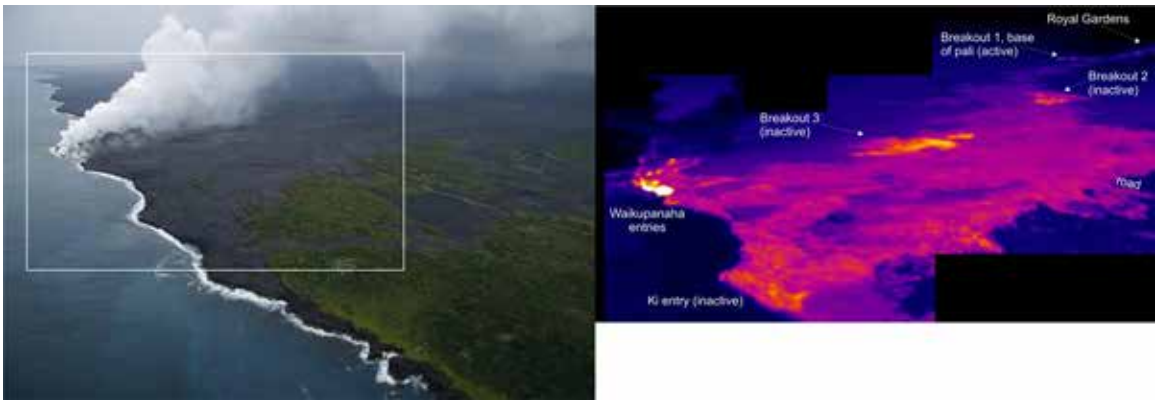

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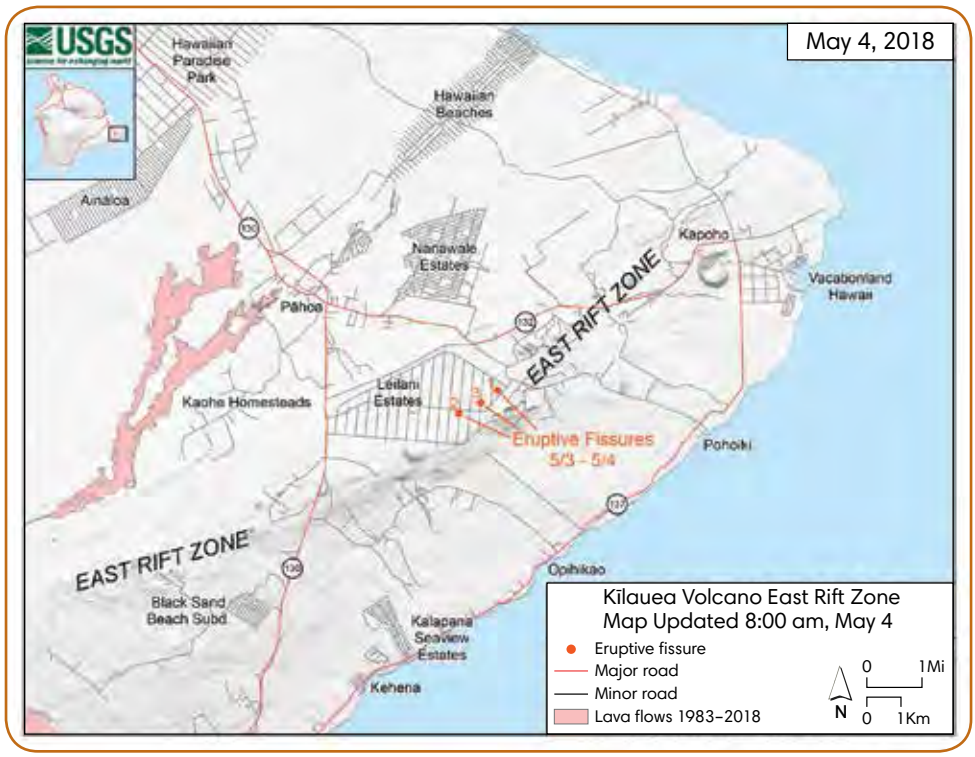

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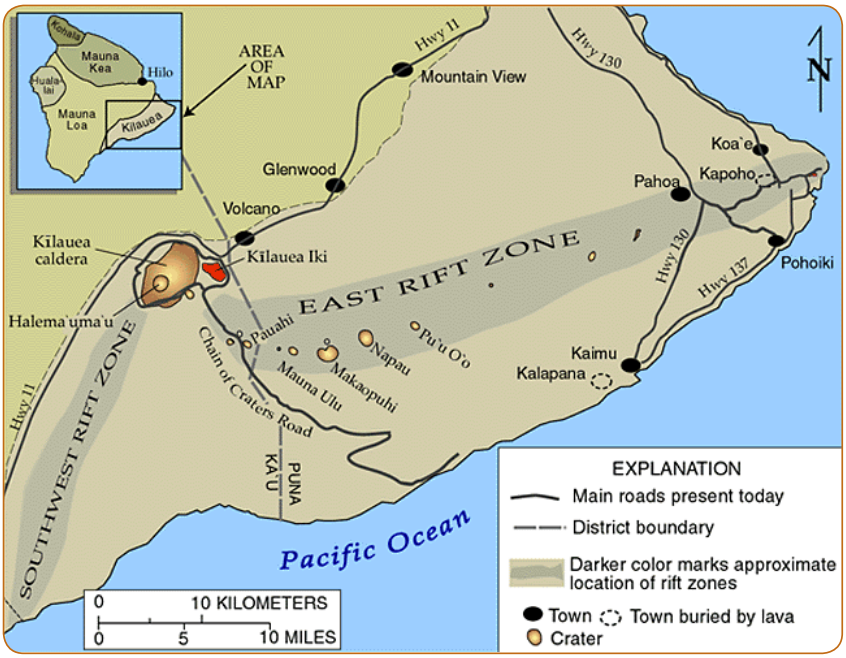

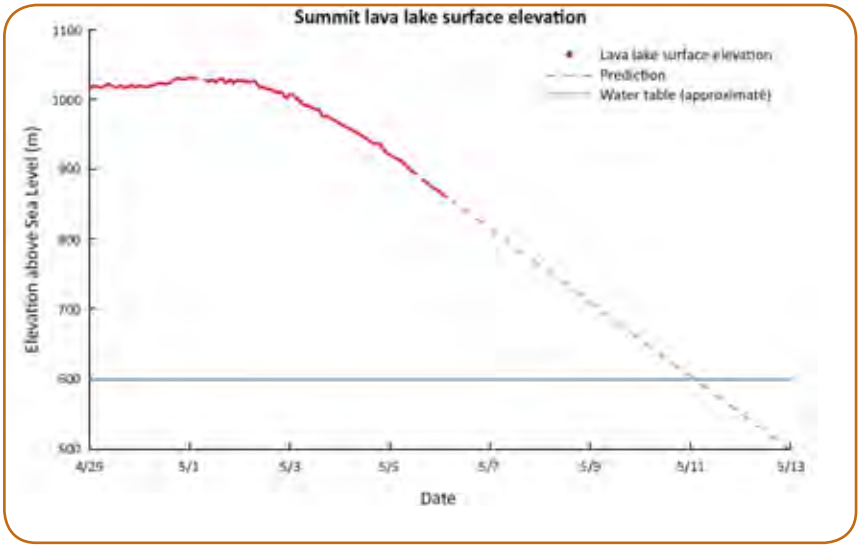

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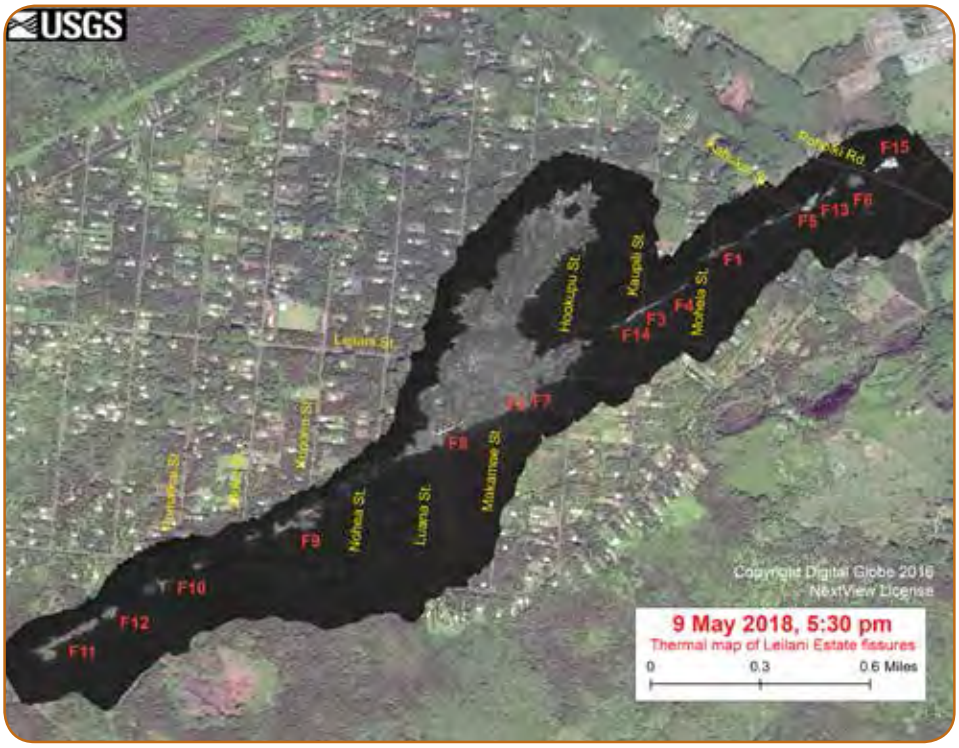

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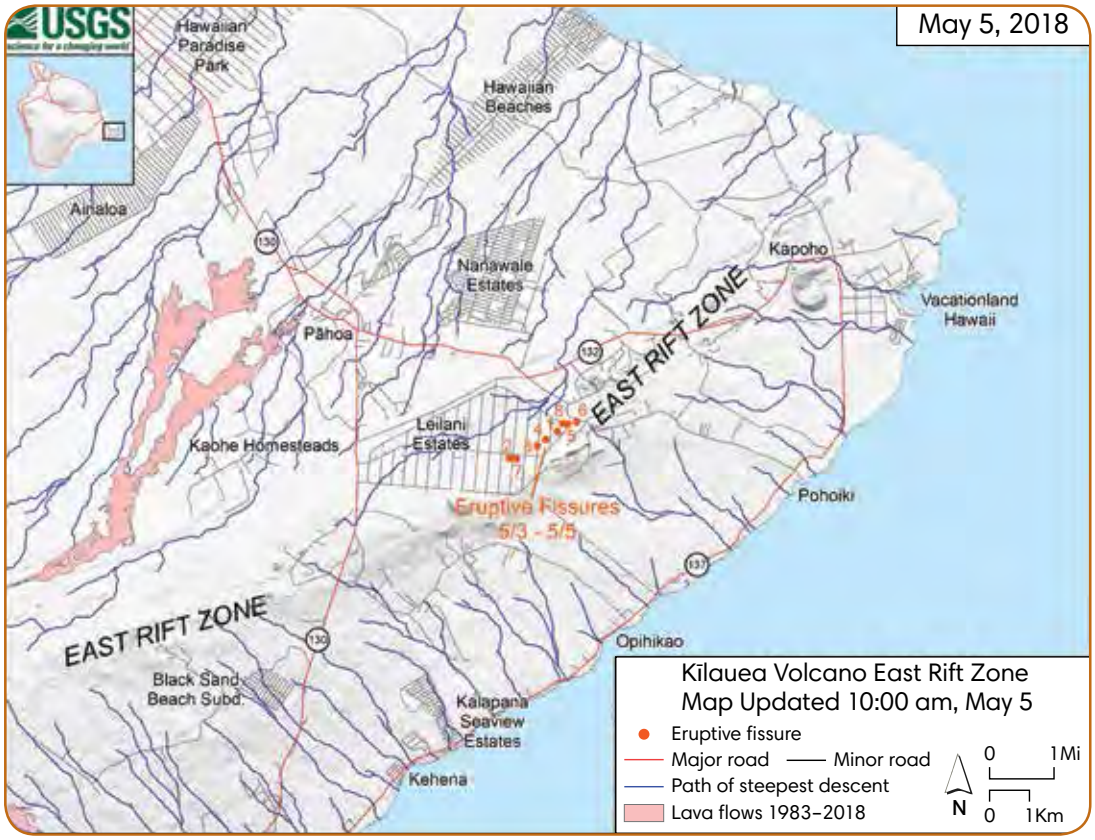

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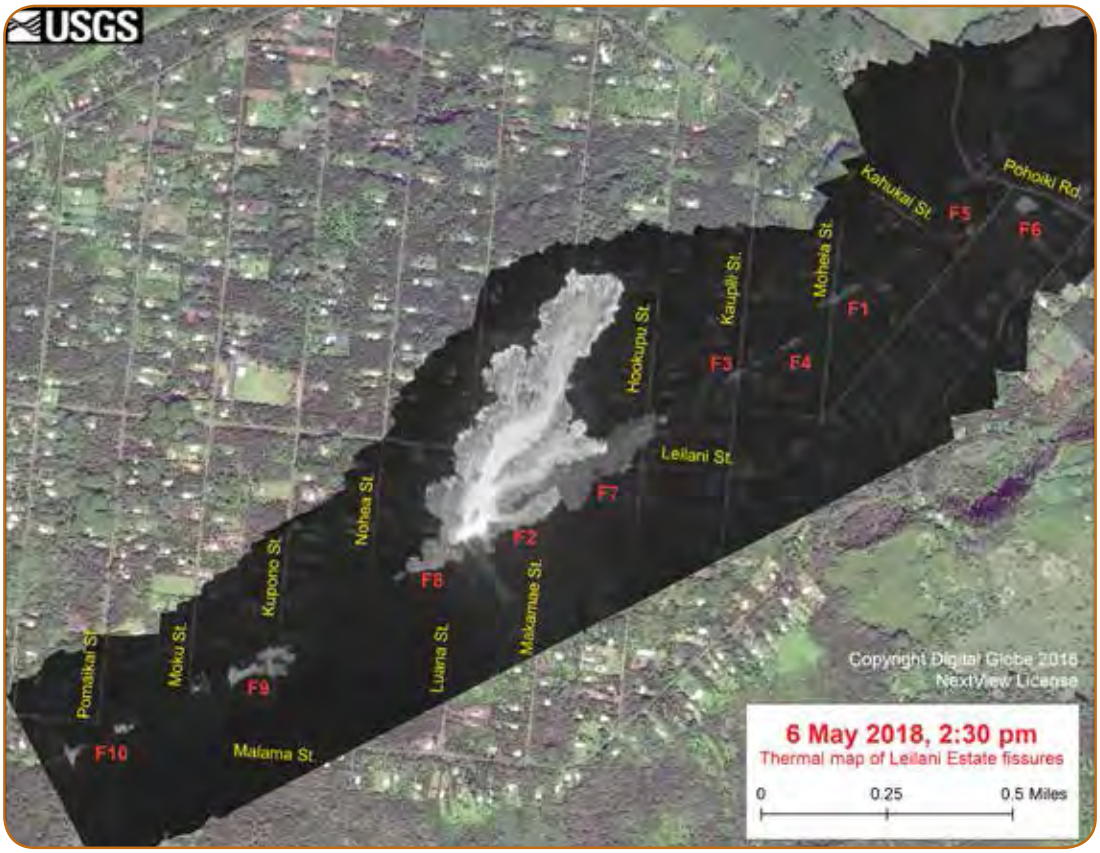

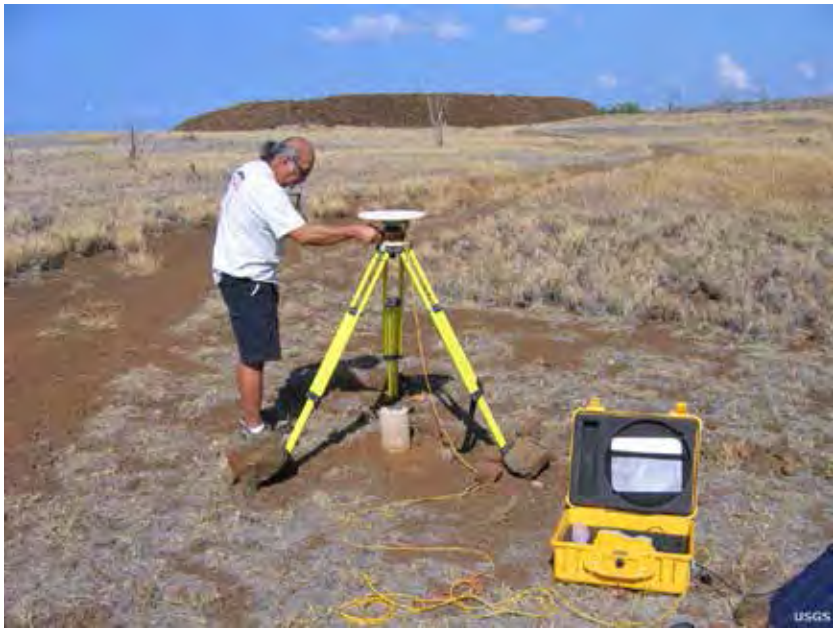

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