

**Grade 2 (Grade Band K-2)**  
**Unit 3: Earth Science**  
**Disciplinary Core Idea: Earth's Systems**  
**Investigation 2**

### **Overarching Questions**

- How can we find the best solution to solve a problem?
- What forces can change the land?

### **Overarching Goals**

Students will understand that the shape of the land changes over time due to natural processes caused by wind and water; rock is first broken down and/or changes color during the weathering process, which is eventually transported by wind or water to a different area through a process called erosion. Students will also be able to compare multiple solutions to a problem associated with weathering and/or erosion using a graphic organizer and connect how each solutions slows or prevents the land from changing.

### **Objectives**

#### ***Next Generation Science Standards***

[2-ESS2-1] Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.

- After instruction and firsthand observations the student will be able to explain the overall process of weathering (breaking up) as well as its causes (action of water and air) and effects (changing shape of land), at the proficient level of a teacher made rubric.
- After instruction and firsthand observations the student will be able to will be able to explain the overall process of erosion (movement of smaller rock pieces by wind, water or ice) as well as its causes (weathering) and effects (changing shape of land) at the 'proficient' level of a teacher made rubric.
- After instruction and practice in other contexts the student will be able to compare and contrast multiple solutions using a graphic organizer that are designed to slow or prevent weathering/erosion by wind or water at the proficient level of a teacher made rubric.

### **Vocabulary**

**Weathering-** a process of the breaking up or changing the color of rocks

**Erosion-** the movement of smaller rock pieces (pebbles, sand or soil) by wind, water or ice

**Engineer-**

### **Materials**

#### **Lesson 1: Pre-Assessment- What do you know?**

- Pre-Assessment- 2-ESS2-1 written (1 per student)
- Glue and/or double sided tape
- Science notebooks

#### **Lesson 2: How Raven made the Tides**

- Pp. 7-17 & 103-107 in Keepers of the Earth by Michael Caduto and Joseph Bruchac

### Lesson 3: How does the land change? (What causes the land to change)?

#### **Day 1:**

- Science A-Z Career File: Engineer (1 copy per student)
- Career File worksheet (1 copy per student)
- Colored pencils/crayons
- Double sided tape/glue
- Science notebooks

#### **Day 2:**

- Science A-Z Nonfiction book: Earth's Surface (available in three levels: low, mid, high)
- Science A-Z Nonfiction Book Teacher's Guide
- Science A-Z Nonfiction graphic organizers: KWL, Web Wheel, Word Smart (optional)
- Science A-Z Vocabulary Cards (optional)

#### **Days 3-4:**

- 3 different rocks:
  - One that is crumbling and has a reddish color
  - One that is rounded
  - One that has been split in half (you need to have both halves)
  - Sand
  - soil
- Weathering Vocab Card
- Science A-Z Word Smart worksheet (1 copy per student- 2 worksheets total)
- Rusty Rock activity materials (pp. 90-91 in Earth Science For Every Kid by Janice VanCleave)- this needs to be set up **THREE** days in advance
- Wash Out activity materials (pp. 100-101 in Earth Science For Every Kid by Janice VanCleave)
- Crack Up activity materials (pp. 108-109 in Earth Science For Every Kid by Janice VanCleave)

#### **Days 5-6:**

- Erosion Vocab Card
- AKSCI Vanishing Coast: Erosion lesson plan and activities
  - Supplement with Wind Erosion activity (p. 8) and 1 copy per student of worksheet (p. 11)
  - Ocean Wave Erosion worksheet (1 copy per student)
  - Rain Fall Erosion worksheet (1 copy per student)

#### **Day 7:**

- One of the following books:
  - Erosion by Becky Olien
  - Wind and Water at work by Thomas Sheehan
- TeachersPayTeachers Weathering and Erosion Scoot Tasks (optional)

### Lesson 4: Does wind or water cause more erosion? (Learning to compare)

#### **Day 1**

- TeachersPayTeachers: Compare and Contrast

#### **Day 2**

- Science A-Z Experiment: Erosion Control (part 1)

### Lesson 5: How can we slow or stop erosion? (Learning to compare solutions)

#### **Days 1-3**

- Science A-Z Experiment: Erosion Control (Part 2)
- Various erosion control measures: egg cartons, fabrics
- Potting Soil, Dirt, Sand
- Erosion Control Data Sheet (1 copy per student)

- TeachersPayTeachers: Compare and Contrast Sheets- 1 copy per student (pp. 20-21)
- Scientific Method Posters

#### Lesson 6: Post Assessment- What did you learn?

- Post-Assessment- 2-ESS2-1 written (1 per student)
- Post-Assessment- oral component (optional)
- Glue and/or double sided tape
- Science notebooks

### **Investigation 2**

#### **Time frame**

- Two Weeks
- 8, forty-minute lessons

#### **Overall Procedure**

# Investigation 1

## **Lesson 1: Pre-Assessment- What do you know?**

**Estimated time:** 1, forty-minute lesson.

**Teacher Prep:** Make and glue 1 copy per student of the *Pre-Assessment: 2-ESS2-1 (written)* in each science notebook. Print and laminate the Earth Changes Cards (4).

### *Engagement*

- Ask students if they have ever heard family members and Elders talk or tell stories about changes they have seen in the land over time. Ask students to volunteer stories or comments in front of the class.
- Tell students they are about to start a new investigation! Explain that from this day forward they will have to wear their engineer hats to school. Explain to the class that the Yakutat Tlingit Tribe has just hired the second grade engineering team to figure out what is causing the land in Yakutat to change and present solutions that can slow this change. For a long time the community has seen the mountains slowly crumble into smaller pieces, rivers get wider, trees fall into the ocean and ripples in the sand come and go! (As you discuss these points show students the photographs of these changes).
- Ask students to volunteer ideas of what the duties of an engineer are and what could be responsible for changing the land of Yakutat. Write students' ideas on a large sheet of chart paper and save the sheet for later in the investigation.

### *Elicit*

- Explain to the class that they have a lot to learn before they can present in front of the Tribe. Students will spend the rest of the lesson filling in worksheets in their notebooks to show what they know at this point about forces that shape the land. Reiterate that this is not a graded assignment; it is an activity to let you (the teacher) know to move forward with the investigation.
- Being the assessment.

## **Lesson 2: How Raven Made the Tides**

**Estimated time:** 2-3, forty-fifty minute lessons

Note: Feel free to choose one of the two options (or both) provided in this particular lesson.

**Teacher Prep (Option 1):** Read and familiarize yourself with the Parts 1 & 2 of *Keepers of the Earth*, which provides guidance on how to successfully implement the stories and activities in the text (pp. 7-17). In addition, read over the following story and activities that will be used throughout the lesson: *How Raven Made the Tides* (pp. 103-104), Activities: *Seashore Symphony* (pp. 105) and *Seashore Solitude* (pg. 106).

**Teacher Prep (Option 2):** Invite an Elder or guest speaker from the YTT Cultural Center or community into the classroom to speak on themes related to the Overarching Question and/or Cultural Perspectives (heat/substances) stated below. It is important to note that the 'heritage cultural perspectives' were adopted from the Sealaska Heritage Institute Curriculum in order to provide an overall context as well as

connections to the science investigation and should be adapted accordingly to reflect the culture of Yakutat.

**Overarching Investigative Question:**  
**How were forces on Earth responsible for shaping the land?**

- **Heritage Cultural Perspective (on Energy)**

Native people recognized wind and air as forms of energy. The wind was used to propel their sailing canoes. Air and the sun were used to dry meats, fish, plants, and skins. Steam energy was used to create bentwood boxes and canoes.

- **Heritage Cultural Perspective (on Forces)**

When making a dug-out canoe, the log is steamed and then a spreader is used to provide the force necessary to widen the canoe. A mallet is used to force the spreader into place. Historically, daily life called for the use of force in a variety of ways. This would have included the grinding of cottonwood bark and ash, as well as seaweed. Rock scrapers were used to force the flesh from hides.

**Lesson 3: How does the land change? (What causes the land to change)?**

**Estimated time:**

Day 1

**Teacher Prep:** Print and make 1 copy per student of the *Science A-Z Career File: Engineer* as well as the *Career File* worksheet. Glue worksheets into students' science notebooks. Have available colored pencils and crayons.

*Engagement/Explore*

- Tell the team of engineers they are ready to begin their investigation! Ask the team to recall the role they have to fill, the name of the local organization they are now working for as well as the problem they will try to solve over the next few weeks. Record the engineers' ideas on the board and reiterate that they are a team of engineers who have been hired by the Yakutat Tlingit Tribe. The Tribe has stated that over the years, the community has watched the land change. Some of the changes have been very small while other changes have been so dramatic that it has effected people's lives. It is the job of the engineers to compare multiple solutions that can try and stop or at least slow some of these changes to the Earth's surface.
- Explain to the team that before they can dive fully into the investigation the engineers must learn a little more about their role. Hand out the *Career File: Engineer* reading to the team's members and explain that they will read more about the role of an engineer together before filling out worksheets glued inside notebooks individually. Ask engineers to recall ideas of what they think an engineer is and what she/he does for their profession. Write these ideas on the board.
- Read over the *Career File* reading together and ask students to summarize during class discussion what engineers do for a living. Ask members of the team to volunteer ideas of engineers in the community. Reiterate that there are different types of engineers; some work on cars while others design bridges and buildings. Tell the team that they are environmental engineers. What does an environmental engineer do? **(They figure out ways to improve the land when it's undergone changes or has to meet the needs of people or other living things.)**
- Have students fill out the *Career File* worksheet in their notebooks.

Day 2

**Teacher Prep:** Read over the *Science A-Z Nonfiction Book Teacher's Guide* to familiarize yourself with different reading tactics as well as the lesson's reading material, *Earth's Surface*. The nonfiction book is available in three levels (low, mid, high). The objective of the lesson is to familiarize students with the

surface of the Earth and the concept that it undergoes changes. Terminology such as weathering and erosion will be discussed during later. How you wish to proceed with the lesson is entirely up to you; feel free to utilize tactics and techniques described in the Guide (i.e. graphic organizers or vocabulary cards) or use your own that better address the needs of the students. Make 1 copy per student of the *Science A-Z Graphic Organizer: KWL*, glue them into students' science notebooks and finally on a large sheet of chart paper make an enlarged version of the KWL.

### *Elicit*

- Begin the lesson by telling the team of engineers that before they can think about and compare solutions that try and stop or slow processes that change the land, the engineers first need to figure out two very important concepts, which can be written as questions. Ask the team to think about what it is that they need to learn and understand about the problem before trying to solve it. Students can write down ideas or questions inside science notebooks or discuss with partners. Ask the engineers to present their ideas and record them on the board. Sum up the teams' ideas and questions with the following (which should be clearly written on the board as well):
  - What is the Earth's Surface?
  - How does the land change?
  - What causes the land to change?
- Have engineers' record their prior knowledge to both questions in their science notebooks on the *Science A-Z Graphic Organizer: KWL* worksheet under the "K" column. Discuss the team's thoughts and ideas as a class and record them under the "K" column of the enlarged version of the KWL. Ask the engineers to volunteer other questions they would like to have answered over the course of the investigation and record these under the "W" column of the chart.

### *Explore*

- Begin the reading assignment. Take time to focus and visualize concepts related to the weathering process, or the breaking down of large rocks into smaller and smaller pieces. Ask students to think about areas around the community where they've seen very large rocks, such as boulders on the beach or mountain peaks. Have students describe in as much detail as possible these rocky areas. Did engineers see any cracks or missing pieces from these large rocks or boulders? Did the shape or size of these large rocks or boulders change over time? What could have caused these changes to happen?

### *Explain*

- After the class has completed the reading discuss the three questions that were stated earlier.
  - What is the earth's surface?
  - How does the land change?
  - What causes the land to change?
- Make sure that the following information is addressed during the discussion:
  - The earth's surface is where we live and play.
  - Earth's Surface is made up of land as well as water from the ocean, lakes, rivers and glaciers.
  - Most of land is made out of rocks, which are hard materials.
  - Soil also makes up the surface of Earth. It is made out of tiny bits of rock that have broken from larger rocks.
  - The Earth's surface can be flat or pointed and have deep holes.
  - Water moves over the land.
  - Earth's surface changes. Wind and water can make rocks loose. Soil and rocks can also fall down slopes.



## Days 3-4

**Teacher Prep:** Read and familiarize yourself with the procedure and materials needed to implement the following activities from *Earth Science For Every Kid* by Janice VanCleave, which have been scanned and attached to this investigation: Rusty Rock (pp. 90-91), Wash Out (pp. 100-101) and Crack Up (pp. 108-109). Note that the Rusty Rock activity requires preparation three days in advance of lesson and the Crack Up activity at least three hours. Print and make 1 copy per student of the *Science A-Z Word Smart* worksheets and glue each into science notebooks. Print and laminate the *Weathering Vocab Card* (double-sided), which should have the vocabulary word on one side and the definition on the other. Fill up two separate jars with sand and soil and locate examples of the following rock types to bring into the classroom: 1 reddish/brown rock that is crumbling, 1 smooth/rounded rock (preferably white) and finally 1 rock that has been split in half (must have both halves). Set-up three stations in the classroom for each of the Earth Science activities with colored pencils/crayons:

- Station 1: Rust Rock Activity with crumbling reddish/brown rock
- Station 2: Wash Out Activity with rounded/smooth rock (near a faucet)
- Station 3: Crack Up with rock split in half

Label each station (1-3) and include a set of directions that describe what students will be doing at each station:

1. Observe the rock with teammates. What does it look like? What does it feel like? What does it smell like?
  2. Draw and label a picture of the rock.  
Under the picture
  3. Describe how the rock is changing.
  4. Write a prediction of what is causing that change.
- 

### Elicit

- Write the following questions on the board:
  - What is the Earth's surface?
  - How does the land change?
  - What causes the land to change?
- Ask the team of engineers to state the goal of today's lesson and have a brief class discussion that reviews concepts from the *Science A-Z Nonfiction Book* that was read during the previous class.

### Explore

- Tell engineers that for their first activity they will focus on learning some ways in which the land can change. Explain that three, labeled stations are set up around the room with different rock samples that engineers can observe with their senses (no tasting!). Have engineers label three separate pages in their notebooks with the following headings: Station 1, Station 2, and Station 3. Engineers will be given time to record their observations of the rock samples (under the correct heading) in their notebook with a labeled picture. Under each diagram, engineers are to describe how the rock is changing and then write a prediction of what is causing that change.
- Divide the team up between the three stations. Provide sufficient time for engineers to complete their assignments before having the groups rotate to the next station.

### Explain

- Once the engineers have spent time at each station, meet up for a brief discussion about their observations and predictions regarding the causes to the changes in each rock sample.
- Bring the team to each station one at a time and perform the demonstrations as outlined in each of VanCleave's activities: Rusty Rock, Wash Out and Crack Up.
- After completing the demonstrations have the team sit back in their seats and open their notebooks to the *Science A-Z Wordsmart* worksheet. Tell the team that they just observed one way in which the Earth's surface can change, and it is a process called weathering. Write the word on

the board and explain that weathering is a process in which rock is broken into smaller and smaller pieces. What causes the rock to break into smaller pieces? (Water in the form of rain and ice). Write the definition for weathering on the board for engineers to read to themselves: The process of water breaking rock up into smaller pieces by water.

- Ask students what is formed over time when rock is broken up into even smaller and smaller pieces.
- Bring out the cup of soil and sand. (Sand and soil, combined with pieces of vegetation and other natural materials, are formed.)
- Post the *Weathering Vocab Card* on the board. Instruct the team to fill out the first *Wordsmart* worksheet in their notebooks with their new vocabulary word.

## Days 5-6

**Teacher Prep:** Read and familiarize yourself with the AKSCI *Vanishing Coast: Erosion* lesson plan and supplemental Wind Erosion activity (p. 8) of the AKSCI *Rills and Thrills: Erosion Affects Me*. You will need to prep materials for the demonstrations outlined in these lesson plans. Make copies of the following worksheets and glue one of each into students' science notebooks: *Wind Erosion Lab* (p. 11 of *Erosion Effects Me* lesson), *Wave Erosion Lab* and *Rain Fall Erosion Lab* worksheets. Also make and laminate a double-sided copy of the *Erosion Vocab Card*. Write the following questions on the board:

- How does the land change?
  - What causes the land to change?
- 

### Elicit

- Ask the team of engineers to state the goal of today's lesson and have a brief class discussion that reviews concepts from the previous lesson's demonstrations.
  - Weathering is the breaking up of rock into smaller pieces.
  - Rock with iron can crumble when water seeps into it.
  - Falling water (like rain) can knock off tiny pieces of rock over time.
  - Water can get into small cracks in rocks. Since water gets bigger when it freezes it can make cracks wider and wider. Over time rocks can split apart.

### Explore

- Tell the team that today they will learn other ways in which the land can change and the causes for these changes. Implement the *Vanishing Coast: Erosion* lesson plan with supplemental Wind Erosion activity. Students should complete the worksheets glued into their notebooks after each demonstration.

### Explain

- After completing the demonstrations have the team sit back in their seats and open their notebooks to the *Science A-Z Wordsmart* worksheet. Tell the team that they observed three different ways in which the Earth's surface can change through a process called erosion. Write the word on the board and explain that erosion is the movement of smaller rock pieces (pebbles, sand or soil). What causes the smaller rock pieces to move? (Wind, rain and wave action) Write the definition for weathering on the board for engineers to read to themselves: The movement of smaller rock pieces by wind, water and ice.
- Post the *Erosion Vocab Card* on the board. Instruct the team to fill out the first *Wordsmart* worksheet in their notebooks with their new vocabulary word.

## Day 7

**Teacher Prep:** Choose one of the following books to read to the class: Erosion by Becky Olien or Wind and Water at Work by Thomas Sheehan. An optional activity to implement after reading is the TeachersPayTeachers *Weathering and Scoot Task Cards*. Students may not recognize all of the

terminology or concepts presented on the scoot task cards so decide ahead of time whether to remove or keep those cards specifically in the activity. Have available the class KWL chart from an earlier lesson and write the following questions on the board:

- How does the land change?
  - What causes the land to change?
- 

#### *Elicit*

- Ask the team of engineers to state the objective of the day's lesson.
- Explain that the team will do some more research into the process of erosion, but first they must review what has been learned so far:
  - What is weathering? What causes rocks to weather?
  - How does weathering change the land?
  - What is erosion? What causes erosion?
  - How does erosion change the land?

#### *Explain*

- Introduce the book and read it to the team.
- After finishing the book have a discussion with students about what they learned.

#### *Extend*

- (Optional) Team plays the scoot activity.

#### *Evaluate*

- Have chemists fill in the "L" (learned) column of the KWL chart in their notebooks. Discuss as a class and record chemists' ideas on the team KWL chart.

### **Lesson 4: Does wind or water cause more erosion? (Learning to compare and contrast)**

**Estimated time:** 2, forty-fifty minute lessons

#### **Day 1**

**Teacher Prep:** Read through the TeachersPayTeacher's *Compare and Contrast* resource. Make 1 copy per student of the following pages from the teaching resource and glue into students' science notebooks in the same order: pp. 9, 6-8, 10, 18, 9-10, 19-21. Make enlarged versions of pp. 6-7. Write the following on the board:

- What does it mean to compare and contrast?
- 

#### *Elicit*

- Ask the team of engineers to state the topic of today's lesson. [\(Learning to compare and contrast\)](#) Tell the team they have learned so much about the processes of weathering and erosion over the last few lessons. Very soon the engineers will design an experiment to compare and contrast different solutions that slow the process of erosion. But what does it mean to compare and contrast something? Have engineers volunteer ideas of what they think it means to compare and contrast things.
- Explain that today the team will practice comparing and contrasting different objects before they are expected to compare and present different solutions to slow erosion to YTT. Practice makes us better and better each time!

#### *Explore*

- Ask the engineers to open to the graphic organizer in their notebooks (pp. 9-10). Draw a picture of the moon and the sun on the board and explain that the graphic organizer glued into the science notebooks is called a Venn Diagram. People commonly use Venn Diagrams when they want to

compare and contrast two different objects. Tell the engineers that for the next five minutes they will try their best to fill out the Venn Diagram in their notebooks on the following topics that are drawn on the board: the moon and the sun.

- Give students five minutes to try and fill out the graphic organizer on their own or by working in pairs.

#### *Explain*

- After a few minutes call the team's attention and ask how the engineers how they fared with the activity. Tell them not worry and that this is not a graded assignment! The idea is that they get a bit more experiment with comparing and contrasting on their own before they discuss it as a class.

### Day 2

**Teacher Prep:** Read and familiarize yourself with the *Science A-Z Experiment: Erosion Control* lesson plan; only Part 1 will be implemented this class period. Make 1 copy per student of the *Earth's Surface-Erosion Control Data Sheet* as well copies of pp. 9&10 in the TeachersPayTeachers *Compare and Contrast Resource*, and glue one of each into students' science notebooks. Write the following on the board: Does wind or water cause more erosion?

.....

#### *Elicit*

- Ask the team to state the objective of the day's lesson. Explain that they are going to practice using their compare and contrast skills with an experiment that compares the effects of erosion by wind and water on a sand tower.
- Review the concept of erosion as a team.
  - What is erosion?
  - What causes erosion?
  - How can erosion change the land we live on?

#### *Explore (Problem/Hypothesis)*

- Before implementing Part 1 of the *Science A-Z: Erosion Control* lesson plan ask the engineers to write down the question of the experiment in their notebooks (Does wind or water cause more erosion?) as well as a hypothesis to the question.
- Implement Part 1.

#### *Explain*

- Discuss the outcome of the experiment with the team. Refer to the *Discussion and Conclusion Questions* sheet of the *Erosion Control* lesson plan (p. 4) for questions to pose to the team.
  - In your experiment, which caused more erosion, wind or water? Why do you think this was so?
  - Why was it important to measure the height of your sand towers both before and after each experiment?
  - Do you think this test helped show how erosion really works on the surface of Earth? Why or why not?

#### *Extend (Results/Conclusion)*

- Refer to the *Extensions and Variations* sheet of the *Erosion Control* lesson plan (p. 5). Implement the **Writing** extension. Engineers can choose either one of the graphic organizers from the *Compare and Contrast Resource* in their science notebooks to fill out for the activity. Once the team has completed filling in their graphic organizers, each engineer is expected to write a conclusion to the experiment in their science notebooks. Write down the following questions on the board that engineers should answer in their notebooks:
  1. Was your hypothesis correct?

2. Does wind or water cause more erosion? Explain using evidence from the experiment.
3. How could the experiment be made better?
4. Write down any other questions that you have.

### **Lesson 5: How can we slow or stop erosion? (Learning to compare solutions)**

**Estimated time:** 1-3, forty-fifty minute lessons

Days 1-3

**Teacher Prep:** Read and familiarize yourself with Part 2 of the *Science A-Z Experiment: Erosion Control* lesson plan. Print and glue 1 copy per student of the graphic organizers (pp. 20-21) in the TeachersPayTeachers *Compare and Contrast* teaching resource as well as the *Erosion Control Data Sheet*. Lesson 5 is designed in two parts so that students gain an understanding of erosion control before being asked to design and test two different solutions on their own; it begins with Part 2 of the Science A-Z: *Erosion Control* and concludes with students designing and testing their own solutions (refer to the second and third **Extensions and Variations** on p. 5 of the *Erosion Control* lesson plan). Students will work in pairs so have the necessary materials available so that each pair is able to conduct his/her experiment (i.e. ruler, 2 large containers, 2 bowls, 3 disposable plastic cups, newspaper, 1 straw, 1 eyedropper, safety goggles, 2 toothpicks). In addition collect the following materials and set them up in an area of the classroom where they are visible and easily accessible: various control measures (i.e. egg cartons, cardboard, fabrics, aluminum foil, etc.) as well as different substrates (sand, dirt, soil, etc.).

Write the following question on the board:

- How can we slow or stop erosion?

-----  
*Elicit*

- Ask the team to state the objective of the day's lesson. Explain that they are going to finally put some of their engineering skills to the test! The team will first conduct an experiment using burlap sacks to get a better understanding of what erosion control means and later split off into pairs in order to design and conduct their own experiments using new materials.

*Explore (Problem/Hypothesis)*

- Before implementing Part 2 of the *Science A-Z: Erosion Control* lesson plan ask the engineers to write down the question of the experiment in their notebooks (How can we slow or stop erosion?) as well as a hypothesis to the question.
- Implement Part 2 of the lesson plan.

*Explain (Results/Conclusion)*

- Discuss the outcome of the experiment with the team. Refer to the *Discussion and Conclusion Questions* sheet of the *Erosion Control* lesson plan (p. 4) for questions to pose to the team.
  - Did the burlap help control erosion? If so, did it better protect the tower from wind or water? Why do you think this was so?
  - Which type of burlap design worked best to control erosion? Why do you think this was so?
  - Why do people try to control erosion?
  - What are some jobs that would require knowledge about how to control erosion?

*Explore (Problem/Hypothesis)*

- Tell the team they are ready to design their experiment with a partner. Explain that the procedure and materials that were used in the last experiment will stay the same. The overall problem of this experiment also stays the same: How can we slow or stop erosion? Assign pairs or allow engineers to choose a partner they would like to work with then write the following parameters on the

board (you may want to color code the following phrases to help students later on when they are constructing their questions):

- Choose 1 **substrate**: soil, sand or dirt
- Choose 1 **factor that causes erosion**: wind or water
- Choose 2 different **erosion control measures**: egg cartons, cardboard, fabrics, aluminum foil (and whatever other materials you chose to include)
- Have the team write down the three parameters for the experiment in their notebooks. Tell the engineers that each pair will have to decide together what type of substrate, factor, and erosion control measure to use in the experiment. Allow time for the pairs to observe the different materials before deciding which they prefer to use for their experiment. Engineers can circle their choices directly in their notebooks.
- Explain that engineers have to write out the question for the experiment to include the parameters they have chosen with their partners. Model an example on the board:
  - Parameters: **Egg Cartons** and **Cardboard**, **Soil**, **Wind**
  - Do **egg cartons or cardboard** slow the erosion of **soil** by **wind**?
- Allow sufficient time for the pairs to write out their questions in their science notebooks. Once the engineers are finished writing out the question to their experiment they must write a hypothesis.
- Pass out materials to each pair including the following: 2 large containers, 2 bowls, 2 disposable plastic cups, newspaper, 1 straw, 1 eyedropper, safety goggles, 2 toothpicks.
- Go over the data sheet with students. Before conducting the experiment they must fill in the data sheet with the names of the materials they intend to use. Explain that each pair must do three different trials, which means they repeat the procedure three times. Why is it important to do more than 1 trial during an experiment?
- The team conducts their experiments.

#### *Explain (Results/Conclusion)*

- Discuss the outcome of the experiment with the team. Refer to the *Discussion and Conclusion Questions* sheet of the *Erosion Control* lesson plan (p. 4) for questions to pose to the team.
  - Which material helped control erosion better? Why do you think this was so?
- Refer to the *Extensions and Variations* sheet of the *Erosion Control* lesson plan (p. 5). Implement the **Writing** extension. Engineers can choose either one of the graphic organizers from the *Compare and Contrast Resource* in their science notebooks to fill out for the activity. Once the team has completed filling in their graphic organizers, each engineer is expected to write a conclusion to the experiment in their science notebooks. The conclusion can be written in the format of a letter since the Yakutat Tlingit Tribe will read it. Go over the format of a letter with students.
- Write down the following questions on the board that engineers will include in their letter to the Tribe. The letters will be written in students' science notebooks.
  5. Was your hypothesis correct?
  6. Which erosion control method (material) worked the best? Explain using evidence from the experiment.
  7. Can erosion by wind or water be slowed? Explain your answer.
  8. How could the experiment be made better?
  9. Write down any other questions that you have.

#### **Lesson 6: Post Assessment- What did you learn?**

**Estimated Time:** 1, forty-minute lesson

**Teacher Prep:** Print 1 copy per student of the Post-Assessment (written component) and glue each into students' science notebooks. An optional oral assessment is provided that can supplement or substitute the written component.

*Evaluate*

- Tell the team of engineers they have done great work. All of the information they have collected is very valuable and useful to the people of Yakutat. Explain that the last step of the investigation is to take an assessment that demonstrates just how much they learned.
- Administer the assessment to the team of engineers.