

# “Solutions-Oriented Learning” Storyline

## 2-Coastal Hazards: Erosion

### Storyline introduction and overview:

Erosion is a natural hazard that causes major damage and can cause homes to collapse. In this storyline, students are introduced to weathering and erosion. Students will gain an understanding of coastal erosion by experimenting with different types of erosion control practices, including seawalls and riprap.

**Coastal Hazards NGSS Learning Progression:** The 2nd grade storyline is part of a larger learning progression that includes students mastering standards pre-K to 12th grade. Look at how the 2nd grade performance expectations fit in a continuum of learning for your students.

<p><b>Placemaking:</b></p> <p>Along with a 157 miles long Pacific coastline, Washington state has another 2,500 miles of Puget Sound shoreline, ranging from rocky sea cliffs to coastal bluffs and river deltas. As a result, students are likely to have visited a beach or seen one. The phenomenon of erosion occurs naturally on the shoreline, shaping coastlines and creating beaches. However, erosion is also generating problems like threatening homes, buildings, streets, highways and the cranberry industry in the state and therefore needs effective solutions.</p> <p>Connect students to the concept of erosion along waterways by asking them if they have visited a beach, a riverbank or lake/pond and what they remember about the shoreline.</p>	<p><b>Anchoring phenomena:</b></p> <p>Students will watch a video(s) and look through a series of photographs depicting the effects of erosion at Washaway Beach. Afterward, they will compile a list of questions, observations, and any pre-knowledge they may already have.</p>	<p><b>Environmental Justice:</b></p> <p>Sea Level Rise Threatens Washington’s Coastal and Puget Sound Communities</p> <p><a href="#">As the Ocean Encroaches, this Washington State Tribe Is Building Its Next Chapter</a></p>
<p><b>Indigenous and other relevant cultural connections:</b></p> <p>Since time immemorial Indigenous peoples have been connected to the ocean and the Salish Sea through harvesting food, managing marine land/resources, traveling/trade routes, and observations of ecosystem changes. The ocean and the Salish Sea have high cultural and</p>	<p><b>NGSS PEs (progress towards):</b></p> <p>2-ESS2-1 Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.</p> <p>K-2-ETS1-2 Develop a simple sketch, drawing or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.</p>	

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## 2-Coastal Hazards: Erosion

sustenance value to Coastal and Puget Sound tribes.

**Estimated time required to implement this storyline: 2-3 weeks**

### NGSS PEs:

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

K-2-ETS1-2 Develop a simple sketch, drawing or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Science & Engineering Practice (SEP)	Disciplinary Core Idea (DCI)	Cross Cutting Concept (CCC)
<p><b><u>2-ESS2-1</u></b>  <b><u>Constructing Explanations and Designing Solutions</u></b>            Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.</p> <ul style="list-style-type: none"> <li>Compare multiple solutions to a problem.</li> </ul> <p><b><u>K-2-ETS1-2</u></b>  <b><u>Developing and Using Models</u></b>            Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.</p> <ul style="list-style-type: none"> <li>Develop a simple model based on evidence to represent a proposed object or tool.</li> </ul>	<p><b><u>2-ESS2-1</u></b>  <b><u>ESS2.A: Earth Materials and Systems</u></b></p> <ul style="list-style-type: none"> <li>Wind and water can change the shape of the land.</li> </ul> <p><b><u>ETS1.C: Optimizing the Design Solution</u></b></p> <ul style="list-style-type: none"> <li>Because there is always more than one possible solution to a problem, it is useful to compare and test designs.</li> </ul> <p><b><u>K-2-ETS1-2</u></b>  <b><u>ETS1.B: Developing Possible Solutions</u></b></p> <ul style="list-style-type: none"> <li>Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem’s solutions to other people.</li> </ul>	<p><b><u>2-ESS2-1</u></b>  <b><u>Stability and Change</u></b></p> <ul style="list-style-type: none"> <li>Things may change slowly or rapidly.</li> </ul> <p style="text-align: center;"><b><i>Connections to Engineering, Technology, and Applications of Science</i></b></p> <p><b><u>Influence of Engineering, Technology, and Science on Society and the Natural World</u></b></p> <ul style="list-style-type: none"> <li>Developing and using technology has impacts on the natural world.</li> </ul> <p style="text-align: center;"><b><i>Connections to Nature of Science</i></b></p> <p><b><u>Science Addresses Questions About the Natural and Material World</u></b></p> <ul style="list-style-type: none"> <li>Scientists study the natural and material world.</li> </ul> <p><b><u>K-2-ETS1-2</u></b>  <b><u>Structure and Function</u></b></p> <ul style="list-style-type: none"> <li>The shape and stability of structures of natural and designed objects are related to their function(s).</li> </ul>

## “Solutions-Oriented Learning” Storyline

### 2-Coastal Hazards: Erosion

#### Materials:

Learning Session	Materials	Location
1.	Storytelling videos Food Harvesting Traditions	Linked in learning session
2.	Drone Video News Story Beach erosion photographs	Linked in learning session
3.	Pre-assessment and rubric	Linked in learning session
4.	Read-aloud and video resources about sandcastles.  Materials provided by teacher or school for sandcastle.	Read-alouds linked in learning session How to Build a Sandcastle linked in learning session To be provided: <b>Sand:</b> enough to build several small-group sandcastles (6-8) <b>Water</b> <b>Straws:</b> one for each child <b>Buckets/cups/sandcastle making molds</b> <b>Container to hold sand:</b> can be a 13x9 baking dish, roasting pan, plastic bin, but needs to be waterproof
5.	Weathering and Erosion PowerPoint Book	Linked in learning session
6.	Rosie Revere Engineer video read aloud Engineering Design Graphic	Linked in learning session
7.	Video and website link about erosion control	Linked in learning session
8.	Videos of seawall. Materials provided by teacher or school for sandcastles and seawalls. Activity Tracking Sheet Salt Dough Recipe	Videos, tracking sheet, and salt dough recipe linked in session <i>*See sandcastle materials in session 4: you will also need materials for constructing the seawall: <b>LEGOs, clay, small blocks, popsicle sticks,</b> or other material that</i>

## “Solutions-Oriented Learning” Storyline

### 2-Coastal Hazards: Erosion

		could mimic a seawall that you may have.
9.	Video of what riprap is Materials provided by teacher or school for sandcastle and rip rap Activity Tracking Sheet Video Seawall vs. Rip Rap	Videos and tracking sheet are linked in the session <i>* See sandcastle materials in session 4: you will also need materials for constructing the seawall: <b>LEGOs, clay, small rocks, pebbles</b>, or other material that could mimic a seawall that you may have.</i>
10.	Materials provided by teacher or school for sandcastle and erosion control solution Activity Tracking Sheet	Activity sheet linked in session seven <i>* See sandcastle materials in session 4: you will also need materials for constructing the seawall: <b>LEGOs, clay, small rocks, pebbles, popsicle sticks</b>, or other material that could mimic a seawall that you may have.</i>
11.	Post-Assessment Rubric	Linked in the session

### Learning Sessions

<b>1.</b>	<b>Grounding Native Ways of Knowing</b>	Estimated time: 45-60 minutes
<p>To connect to native ways of knowing, consider exploring the following ideas in connection with your local tribal nation by researching stories of the past and learn about current work and actions the tribe is taking to mitigate, adapt to, and find solutions to a changing climate.</p> <ul style="list-style-type: none"> <li>• Food from the ocean</li> <li>• Management of marine lands (beaches)</li> <li>• Marine ecosystem changes</li> </ul> <p>To access information on how to reach out and build relationships with local tribes, visit the <a href="#">OSPI Office of Native Education: Partnering with Tribes</a>, and contact your district’s tribal liaison/Title VI coordinator.</p> <p>To learn more about respecting and building upon Indigenous Peoples’ Rights visit the <a href="#">Learning in Places website</a>, a project led by Dr. Megan Bang then read Practice Brief #10: <a href="#">Teaching STEM In Ways that Respect and Build Upon Indigenous Peoples’ Rights</a> and Practice Brief #11: <a href="#">Implementing Meaningful STEM Education with Indigenous Students &amp; Families</a> published on the University of Washington’s <a href="#">STEM Teaching Tools website</a></p> <p>Suggested activity for teachers and students: 3-2-1 research process</p>		

## “Solutions-Oriented Learning” Storyline

### 2-Coastal Hazards: Erosion

	<ul style="list-style-type: none"> <li>• Three new learnings about the Tribe most local to you</li> <li>• Two questions that you still have about the Tribe most local to you</li> <li>• One action you can commit to begin a partnership with the Tribe most local to you</li> </ul> <p>Below are some examples of regional tribal connections to coastal hazards.</p> <ul style="list-style-type: none"> <li>• <a href="#">Gossiping Clams by Roger Fernandes</a> (Suquamish)</li> <li>• <a href="#">Cedar Box Traditional Foods and Harvesting</a> (Salish Sea region tribes)</li> <li>• <a href="#">Run to High Ground Storytelling</a> (Hoh)</li> </ul> <p><b>For teachers:</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Challenges Facing the Quinault Tribe</a></li> <li>• <a href="#">Escaping Sea Level Rise</a></li> </ul>
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<b>2.</b>	<b>Examine phenomena: Erosion affects the landscape of Washington, including coastal communities</b>	Estimated time: 30-45 minutes
	<p>This lesson engages students in the phenomenon of beach erosion that is plaguing and changing Washington’s shores. Students will be exposed to the phenomenon of beach erosion and will come up with a list of questions, observations, and what they already know by watching 1-2 video(s) and looking at a series of pictures that show waves eroding the coast and the consequences of that erosion.</p> <ol style="list-style-type: none"> <li>1. Choose two of the three resources below: <ul style="list-style-type: none"> <li>• <a href="#">Drone Footage of Washaway Beach</a></li> <li>• <a href="#">News Story on Washaway Beach</a></li> <li>• <a href="#">Pictures of Washaway Beach</a></li> </ul> </li> <li>2. Once finished with the videos and photos, have students discuss their observations while capturing this information on the white board or chart paper. Elicit and record student questions to be answered throughout the storyline.</li> </ol>	

<b>3.</b>	<b>Pre-Assessment</b>	Estimated time: 30 minutes
	<p>Before handing out the pre-assessment:</p> <p>Tell students that they just saw a video and series of pictures of houses and buildings that had fallen onto the beach or into the ocean. They are going to answer questions, with or without the help of the included sentence stems below and draw a picture of their idea (solution) to this problem on their papers.</p> <p><a href="#">Pre-Assessment</a> (page 1 only)</p>	

## “Solutions-Oriented Learning” Storyline

### 2-Coastal Hazards: Erosion

<p><a href="#">Rubric</a></p> <p><i>Teachers note:</i> This is the initial model, but we will introduce the concept of a model later in the storyline. We use kid friendly language in the pre-assessment so children can access the idea easily.</p> <p>Optional sentence stems for scaffolding -</p> <ol style="list-style-type: none"> <li>1. The houses fell into the water because _____ I think they fell in the water because _____</li> <li>2. None needed</li> <li>3. My idea is _____ The idea I drew is a _____</li> <li>4. My idea protects the house by/because _____</li> </ol> <p><i>*If available, pre-assessment should be printed dual sided with the post-assessment on the back so students can refer to their initial model in the post-assessment. If not available, students should have access to their pre-assessment before completing the post-assessment.</i></p>
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<p><b>4. Guiding question: How does wind and water affect the land?</b></p>	<p>Estimated time: 45-60 minutes</p>
<p>Sandcastle book/video resources:  <a href="#">Video Reading of Statues in the Sand</a>  <a href="#">Video Reading of The Sandcastle that Lola Built</a></p> <p>Tell students that today they are going to see how wind and water affects land in the form of a sandcastle. Ask them these questions:</p> <ul style="list-style-type: none"> <li>• What do you need to make a sandcastle?</li> <li>• What happens if you make a mistake? How can you fix it?</li> <li>• Where on the beach do you need to build a sandcastle?</li> </ul> <p><u>Sandcastle activity:</u></p> <p>Ask students if they have ever built a sandcastle(some may have, and some might not have). What do they remember about that experience? Tell students that today we will be building small sandcastles and will see what happens when they encounter water (like you would at a beach or a riverbank) and wind (by blowing through a straw).</p> <p><u>Main activity</u>  <i>*if you have a lot of students who have not built sandcastles, or need a review, show the linked video <a href="#">How to Build a Sandcastle Video</a></i></p>	

## “Solutions-Oriented Learning” Storyline

### 2-Coastal Hazards: Erosion

	<p>Have students use sand to build a sandcastle in the bins. Provide them with water, so they can create a mixture to build a small structure. Two to four students can build small structures in each bin. Once students have built their mini sandcastles, have them take turns blowing through their straws to see what happens when wind blows into sand. Have them record observations. Next, take a bucket of water and pour slowly into each bin. The teacher might want to model this activity first so the students are prepared for what will happen (the sandcastle being destroyed may make some 2nd graders very sad). Pour enough water and pour slowly so that students can see the process of their sandcastle breaking apart.</p> <p><u>Wrap-up</u> Ask students, what happened to your sandcastles? Allow students the opportunity to share with a partner before sharing with the whole group. They should be able to connect what happened to their sandcastles to erosion and describe what erosion is.</p> <p>Distance Learning Option: If available, have students locate a container; cake pan, plastic bin, tin foil pan, plastic swimming pool, or other waterproof container, and sand (if sand isn't available, dirt works too). You can make a sandcastle out of wet sand/dirt and any small container, such as a soup can or cup.</p>
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<b>5.</b>	<b>Guiding question: What is erosion and weathering?</b>	Estimated time: 35 minutes
	<p>Read the book, <i>Weathering and Erosion</i> by Torrey Maloof</p> <p><a href="#">PowerPoint version of Weathering and Erosion</a></p> <p>Discuss book</p> <p><u>In school option:</u> go on a walk around your campus and look for examples of erosion</p> <p><u>At home option:</u> walk around your home/neighborhood and look for examples of erosion</p>	

<b>6.</b>	<b>Guiding question: What is engineering and how do engineers solve problems?</b>	Estimated time: 45 minutes
	<p>Play this read aloud: <a href="#">Child read aloud of Rosie Revere Engineer</a></p> <p>Discuss the engineering process and create an anchor chart for the words: <b>problem, solution, model, and erosion</b>. It is incredibly important students understand these four</p>	

## “Solutions-Oriented Learning” Storyline

### 2-Coastal Hazards: Erosion

	<p>concepts regarding the engineering process to make progress toward the engineering standard.</p> <p><a href="#">Engineering Design Process Anchor Chart example</a> and you could add the words suggested above.</p>
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<b>7.</b>	<b>Guiding question: What are solutions to erosion?</b>	Estimated time: 30-45 minutes
	<p>Teacher Resources for Background Knowledge:  <a href="#">WA Dept. of Ecology: Preventing Shoreline Erosion</a></p> <p><a href="#">Read aloud: Storm Boy</a></p> <ul style="list-style-type: none"> <li>Note: This book was not written by an Indigenous author.</li> </ul> <p><u>Introduce erosion control: <i>What is it?</i></u>  Erosion control is the practice of preventing or controlling wind or water erosion in agriculture, land development, coastal areas, riverbanks and construction. There are a lot of different ways people try to prevent erosion from happening.  <a href="#">Beach Erosion Control Options</a></p> <p>Discuss different erosion control methods from the video and explain that students will be exploring two of the options; seawalls and rip rap and get to create their own. Have them share some ideas with a partner as to what they think the best options for erosion control are and then have them share out. Try and add some of these ideas on the chart started at the beginning of this unit or start another to capture their thoughts.</p>	

<b>8.</b>	<b>Guiding question: What are solutions to erosion? (Seawalls)</b>	Estimated time: 45-60 minutes
	<p><a href="#">Explanation and Examples of Seawalls</a>  <a href="#">Quick video of waves crashing into a seawall</a></p> <p><b><u>Seawall Activity</u></b>  5-10 minutes: Short class discussion on characteristics of seawalls and do a think, pair, share of ideas for creating your own seawall</p> <p>10-15 minutes: Teacher models sketching, and students sketch the model of their seawall and where it is located on the beach</p> <p><i>This could possibly be done on small white boards in order to allow students to alter their original ideas while</i></p>	



## “Solutions-Oriented Learning” Storyline

### 2-Coastal Hazards: Erosion

	<p><i>working</i></p> <p>30 minutes: Teacher models set up of activity and students complete the activity in small groups</p> <ul style="list-style-type: none"> <li>• Using the materials from the sandcastle activity follow the directions to build your sandcastles with the sandcastle at the top of the slope.</li> <li>• Pick one of the provided materials to create your seawall (LEGOs, popsicle sticks, small blocks, or clay)</li> <li>• Place your seawall on the slope based on your sketch</li> <li>• Pour a little pond of water at the bottom of the slope and create waves that crash into your seawall.</li> <li>• Observe what happens to the sand around your seawall. Was there evidence of erosion? Mark yes or no on the tracking sheet.</li> </ul> <p><a href="#">Half Sheet Tracking Sheet</a></p> <p>Distance Learning Option: Materials for seawall could be: LEGOs, sticks, Play-Doh, putty, salt dough, small blocks, clay You can also make your own dough using flour, salt, and water or follow the recipe in the link below. <a href="#">Easy 3 Ingredient Salt Dough Recipe</a></p>
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<b>9.</b>	<b>Guiding question: What are solutions to erosion? (Riprap)</b>	Estimated time: 45-60 minutes
	<p><b>Teacher Resources:</b> <a href="#">What is Rip Rap and Why it Rocks</a></p> <p><u>What is Riprap?</u> Rip rap describes a range of rocky material placed along shorelines, bridge foundations, steep slopes, and other shoreline structures to protect from weathering and erosion. Rocks used range from 4 inches to over 2 feet. The size of the rock needed on a project depends on the steepness of the slope and how fast water is moving. Rip rap is a very durable, natural-looking treatment. One drawback is the potential for the rocky material to not be easily traversable by animals; filling the open spaces between the rocks with soil or smaller rocks helps to address this issue. <a href="#">30 second What is Rip Rap video</a></p> <p><u>Where is it used?</u> Rip rap is used where a structure or shoreline is continuously exposed to rushing water:</p> <ul style="list-style-type: none"> <li>• Along a lake shoreline to limit erosion associated with wave action.</li> <li>• Along the outer bank of a river bend, dissipating the force of the water against the bank.</li> <li>• Near bridges along embankments and adjacent to supports in waterways.</li> </ul> <p>Erosion can compromise bridges, wash out adjacent roadways, or cause loss of property.</p>	

## “Solutions-Oriented Learning” Storyline

### 2-Coastal Hazards: Erosion

	<p><b><u>Rip Rap Activity</u></b></p> <p>5-10 minutes: Short class discussion on characteristics of rip rap and do a think, pair, share of ideas for creating their own rip rap solution</p> <p>10-15 minutes: Teacher models sketching, and students sketch the model of their rip rap and where it is located on the beach</p> <p><i>This could possibly be done on small white boards in order to allow students to alter their original ideas while working</i></p> <p>30 minutes: Teacher models set up of activity and students complete the activity in small groups</p> <ul style="list-style-type: none"> <li>● Using the materials from the sandcastle activity follow the directions to build your sandcastles with the sandcastle at the top of the slope.</li> <li>● Pick one of the provided materials to create your rip rap (LEGOs, pebbles, small rocks, or clay boulders)</li> <li>● Place your rip rap on the slope based on your sketch</li> <li>● Pour a little pond of water at the bottom of the slope and create waves that crash into your rip rap.</li> <li>● Observe what happens to the sand around your rip rap. Was there evidence of erosion? Mark yes or no on the tracking sheet.             <ul style="list-style-type: none"> <li>○ Tracking sheet linked in previous session</li> </ul> </li> </ul> <p>Show the following video at the end of this lesson. <a href="#">Seawall vs. Riprap; a student's experiment</a></p>
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<b>10.</b>	<p><b>Guiding question: What are solutions to erosion?</b> <b><i>Create Your Own Solution</i></b></p>	<p>Estimated time: 45-60 minutes</p>
	<p>In this learning session students will get to explore and create their own erosion control solutions. They can use any of the previous materials, or any others you want to add. The goal is for them to create a solution that will prevent erosion from happening on their beaches.</p> <p>Start this lesson by either showing the video from session seven again or doing a verbal review of what they have learned thus far. Have them use the tracking sheet used in the previous lessons to capture their thinking and learning.</p> <ul style="list-style-type: none"> <li>● Using the materials from the sandcastle activity follow the directions to build your sandcastles with the sandcastle at the top of the slope.</li> <li>● Pick one of the provided materials to create your erosion solution</li> <li>● Place your material/solution on the slope based on your sketch</li> <li>● Pour a little pond of water at the bottom of the slope and create waves that crash into your solution.</li> </ul>	

## “Solutions-Oriented Learning” Storyline

### 2-Coastal Hazards: Erosion

	<ul style="list-style-type: none"> <li>● Observe what happens to the sand. Was there evidence of erosion? Mark yes or no on the tracking sheet.             <ul style="list-style-type: none"> <li>○ Tracking sheet linked in previous session</li> </ul> </li> </ul>
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<b>11.</b>	<b>Post -Assessment</b>	Estimated time: 30 minutes
<p><a href="#">Post-Assessment</a> (page 2) <a href="#">Rubric</a></p> <p>Review the previous lessons and tell students that they are going to use that knowledge to complete the post-assessment. They are going to answer questions, with or without the help of the included sentence stems below and draw a picture of their idea (solution) to this problem on their papers.</p> <p>Optional sentence stems for scaffolding -</p> <ol style="list-style-type: none"> <li>1. The houses fell into the water because My thinking has changed from _____ to _____</li> <li>2. None needed</li> <li>3. None needed, but reading assistance of word bank may be required</li> <li>4. My shape of my idea protects the house by/because</li> </ol> <p><i>*If available, pre-assessment should be printed dual sided with the post-assessment on the back so students can refer back to their initial model in the post. If not available, students should have access to their pre-assessment before completing the post-assessment.</i></p>		

<b>12.</b>	<b>Possible next steps/off-ramps/career connections:</b>	
<ul style="list-style-type: none"> <li>● <a href="#">Inland River Erosion: Enchanted Valley Chalet</a></li> <li>● Career Connections-             <ul style="list-style-type: none"> <li>○ <a href="#">Park Ranger</a></li> <li>○ <a href="#">Geologist</a></li> <li>○ <a href="#">Ocean Engineer</a></li> <li>○ <a href="#">Statistician</a></li> <li>○ <a href="#">Landscape Architect</a></li> </ul> </li> </ul>		

## “Solutions-Oriented Learning” Storyline

### 2-Coastal Hazards: Erosion

#### [2-Coastal Hazards: Earth Changes OER Tracker](#)

Pacific Education Institute would like to acknowledge and thank the writing team for their work. The team included Aide Villalobos, Molly Griffiths, Sapna Sethi, Emily Hople and Shelley Stromholt. In you have comments or questions please contact [info@pacificeducationinstitute.org](mailto:info@pacificeducationinstitute.org)

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