### Scoring Criteria

<table>
<thead>
<tr>
<th>PERFORMANCE INDICATOR</th>
<th>BEGINNING</th>
<th>DEVELOPING</th>
<th>PROFICIENT</th>
<th>EXPANDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>#7 Earth and Space Sciences - Earth Systems and Human Impact: D</td>
<td>Make observations of weathering and/or erosion.</td>
<td>Make observations and/or measurements to provide evidence of a cause and effect relationship...</td>
<td>Make observations and/or measurements from multiple forms of weathering and erosion and use them to...</td>
<td>Make observations and/or measurements from multiple forms of weathering and erosion and use them to...</td>
</tr>
<tr>
<td>(4-ESS2-1)</td>
<td>Make observations of weathering and/or erosion.</td>
<td>Make observations and/or measurements to provide evidence of a cause and effect relationship...</td>
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<tr>
<td>#7 Earth and Space Sciences - Earth Systems and Human Impact: G</td>
<td>Generate a solution related to the impacts of natural earth processes on...</td>
<td>Generate solutions to reduce the impacts of natural earth processes on humans based on scientific information.</td>
<td>Generate and compare multiple solutions to reduce the impacts of natural earth processes on humans based on scientific information and the constraints and criteria of the design problem.</td>
<td>Generate, compare, and evaluate multiple solutions to reduce the impacts of natural earth processes on humans based on scientific information and the constraints and criteria of the design problem in order to make recommendations for improvement.</td>
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<tr>
<td>(4-ESS3-2)</td>
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<td>Problem Solving and Critical Thinking: 6</td>
<td>Describe the data/information gathered from plan or approach and state whether the plan or process of approach was effective.</td>
<td>Identify relationships in data/information gathered from plan or approach and describe whether the plan or process of approach was effective.</td>
<td>Analyze patterns and trends to identify relationships in data/information gathered from the plan or approach and to evaluate the effectiveness of the plan or approach.</td>
<td>Justify a data collection strategy by analyzing strengths and weaknesses and critiquing the potential effectiveness of a range of solutions with consideration of real-life constraints.</td>
</tr>
<tr>
<td>Evaluate, justify and defend the relative effectiveness of the plan or process of approach.</td>
<td>Identify relationships in data/information gathered from plan or approach and describe whether the plan or process of approach was effective.</td>
<td>Analyze patterns and trends to identify relationships in data/information gathered from the plan or approach and to evaluate the effectiveness of the plan or approach.</td>
<td>Justify a data collection strategy by analyzing strengths and weaknesses and critiquing the potential effectiveness of a range of solutions with consideration of real-life constraints.</td>
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</table>
**Save our beaches!**

1. View the following resources displaying photographs of coastal Rhode Island independently.
2. Make observations to provide evidence of the effects of weathering or rate of erosion by water, ice, wind and vegetation.

<table>
<thead>
<tr>
<th>Evidence</th>
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</table>
| A        | - Water went to pillars  
          | - Water is underneath the stand  
          | - Dip under the pillar from water and the sand  
          | - Water made soil soft |
| B        | - The hill is shaved off  
          | - Dirt is piled at the bottom  
          | - Earth is still crumbling. Grass is rotted  
          | - Waves ate away at the hill and washed away |
| C        | - Porch posts also unearthed  
          | - Sand is piled up on porch  
          | - Dip beneath the posts  
          | - The sand was washed away
D

Frontal Erosion 1939-2012
Browning Cottages, Moonstone Beach, RI

House moved to Upland

sand is soft
shoreline is big
low tide is very low
high tide is very high
the shoreline changes

First, there is distance between the shore and the house
less distance
no distance

E
Rip Rap | Breakwater

- stones, nine, off shore structure
- four in
- less in the force
- range of wave
- rocky mat
- less force = less
- erosion
- ugly
- causes more
- erosion
3. Generate an idea of another way you might be able to reduce the weathering and erosion rates at the beach. Draw and/or describe your plan clearly in the box below.

![Diagram of a small mound of sand with erosion patterns]

4. Choose two of the methods you researched or generated and construct a model of each using the materials available in the classroom.

5. Conduct a fair test of the two models to investigate how well each helps reduce weathering and erosion of the beach. Collect and record observational data of the performance of each of your models. Stream tables are available to help you conduct your fair tests.

This is my solution. There are two jetties parallel to each other, the length of the beach. That is 1 ft below the sea level. The idea is that the waves come in strong and the soft sand slows it them force down.
Model 1 drawing/photo

Model 1 performance

The ladder worked well too. It let the water in but not out.

Model 2 drawing/photo

Model 2 performance

The wall worked well. The water came through but did not bring any sand out.
Coastal Erosion Observation
12/3/18

2:13 pm

I observed that the first model worked very well. It let the water in but not out. The wall had some gaps, but the rocks helped with that. The water was very clear when we drained it out.

Another model we tested (mine) also worked phenomenally well. The water glided over the wall, but the waves were less powerful because they had already crashed against the wall. This caused less erosion.

In conclusion, these models both worked well. I think that these contraptions would work well on a beach. These waves will be bigger and stronger.
**Claim:** Restate and answer the question

**Evidence:** State data to support claim from investigation or text.
- For example
- I observed...
- My data showed...
- In the investigation...
- As stated in the text...
- According to...

**Reasoning:** Explain your answer (select 2 or more sentence starters)
- You can start a sentence with...
  - The evidence links to the claim because...
  - My data show that...
  - This happened because...
  - This means that...
  - I believe...
  - This is because...

**Ending:** Restate your answer in different words
- Reread your first sentence
- Write it again in new words

Based on this text evidence...
- In conclusion...
- As you can see...
- Therefore...
- To summarize...
- In summary...

**Conclusion:** What can be done to reduce coastal erosion?

Coastal erosion can be reduced by planting grass and making structures.

I observed in picture B that when the waves took away part of the hill, there were grass roots holding the rest of the hill in place. My data also showed that the stream table without a structure got eroded more than the...
Dear Gina Raimondo,

Did you know that in 50 years Rhode Island beaches have lost over 250 feet of sand?! As a beach loving Rhode Islander, I think something needs to be done about it. I have brainstormed many solutions to keep these beaches here for many years more.

Some solutions I have thought of are that we can plant grass along the shoreline because studies have shown that grass roots hold the sand in place. The water will not be able to pull away the sand if the grass is planted. We would need to plant about 2 feet of grass each year. Grass seeds are cheap and you can get a lot of them. This would be very helpful and it would be energy efficient because grass is a plant and it does not use any energy.

There is another solution to coastal erosion and it building structures such as rip raps and breakwaters. These structures are made of rock and concrete. A breakwater encloses a beach swimming area with a wall that stops big waves from coming through and taking sand out. A rip rap is rocks that are lined up against the shoreline. It doesn’t let any sand come close to the water. If we built more of these structures it would slow down coastal erosion.

So now you know that there are lots of solutions to coastal erosion. There is know reason we should not put these plans into action. This could save our beaches from losing lots more sand. Let’s get together and “Save Our Beaches!”

Sincerely,

#7 Earth and Space Sciences - Earth Systems and Human Impact: D - Expanding - Student observations provide evidence of a cause and effect relationship in multiple situations from both real-world examples and classroom models. The scoring team considered this enough to reach the Expanding category, but they did question what multiple forms of weathering and erosion meant in the Scoring Criteria. This question prompted the modification noted in the Annotated Teacher and Student Tasks.

#7 Earth and Space Sciences - Earth Systems and Human Impact: G - Proficient - The student met the constraints of the design criteria when generating multiple solutions to the design challenge.

Problem Solving and Critical Thinking: 6 - Expanding - The student critiques the potential effectiveness of their solutions acknowledging “that these contraptions would not work as well on a beach. Those waves will be bigger and stronger.”
Save our beaches!

1. View the following resources displaying photographs of coastal Rhode Island independently.
2. Make observations to provide evidence of the effects of weathering or rate of erosion by water, ice, wind, and vegetation.

<table>
<thead>
<tr>
<th>Evidence</th>
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<tbody>
<tr>
<td>A</td>
<td>The fence is broken (probably by water from the near by beach)</td>
</tr>
<tr>
<td>B</td>
<td>Wind and waves most likely pulled away pieces of this hill,</td>
</tr>
<tr>
<td>C</td>
<td>During low tide, sand is pulled back into the water.</td>
</tr>
</tbody>
</table>
The house moved up by water.

Wind, water, tornados, or other storms broke this house and changed it.
3. Generate an idea of another way you might be able to reduce the weathering and erosion rates at the beach. Draw and/or describe your plan clearly in the box below.

4. Choose two of the methods you researched or generated and construct a model of each using the materials available in the classroom.

5. Conduct a **fair test** of the two models to investigate how well each helps reduce weathering and erosion of the beach. Collect and record observational data of the performance of each of your models. Stream tables are available to help you conduct your fair tests.
1 Liter of water tested.

Model 1 drawing/photo
Before 23 cm
Sand
Ocean

Model 1 performance
After 24 cm
Sand

Model 2 drawing/photo
Before 22 cm
Sand
Ocean

Model 2 performance
After 30 cm
Sand

Slightly dirty
Very dirty water
Coastal Erosion Observations

I observed:

- Before we tested Rip rap, it had 22 cm of sand. After it had 35 cm.
- With our ideas, the wave came out cleaner than the rip rap.
- Arrival, on our idea, the sand, made the sand as much as the rip rap.
- Lastly, our idea stopped coastal erosion, more the sand moved 1 cm, while the rip rap moved 8 cm.
**QUESTION:** What can be done to reduce coastal erosion?

**CLAIM:** Restate and answer the question

**EVIDENCE:** State data to support claim from investigation or text.
For example I observed...
My data showed...
In the investigation...
As stated in the text...
According to...

**REASONING:** Explain your answer (select 2 or more sentence starters)
You can start a sentence with...
- The evidence links to the claim because...
- My data show that...
- This happened because...
- This means that...
- I believe...
- This is because...

**ENDING:** Restate your answer in different words
-REREAD your first sentence
-Write it again in new words

Based on this text evidence...
In conclusion...
As you can see...
Therefore...
To summarize...
In summary...

---

**We can reduce coastal erosion by...**

As an example, we can use Rip Rap. Rip Rap is a series of rocks lining a beaches water. Another way, we can stop coastal erosion, is by trying to stop this with new ideas, or different ways.

I believe Rip Rap could work because we did an experiment. When we tested Rip Rap not all of the sand got covered by water. My reasoning for new ideas came from the experiment. I did with coastal erosion, less of the water got covered with our idea, than Rip Rap. Play the sand moved from with Rip Rap and only 2cm with our experiment.

Based on my evidence, I can say that there are ways to reduce coastal erosion. We can use methods like Rip Rap, or try to use different things!
Coastal Erosion Solution
By: 

Coastal erosion is a big problem, which keeps getting worse only having a few ways to stop it. There are enough ways to help with this problem, but if we could help it, I think humans should try different ways. I came up with two ways while doing an experiment. I’ve researched the problem. I’ve thought about this a lot. I would love to see all of the worn down beaches fixed. But how? I happen to have some ideas.

We already have some ways to stop coastal erosion, like Rip Rap, but how, or what could be another way to save our beaches? I think a system where rocks, grass, clay and other earth materials could be a solution. Picture a beach with rocks aligning its sand, and rocks also surrounding some of its water. With my idea, the rocks would be stuck together with clay, or cement, but leaving areas where water can be brought in, or pushed away from the beach. Grass, and other leafy materials will cover the top of the rocks. I have tested both my idea, and Rip Rap. The results, my beach had less coastal erosion. I think the idea I came up with might help a lot, because the sand lever barely moved at all.

Thus, I think my idea might be a great solution to coastal erosion. It might take years to solve this problem. I don’t really think there is a way to stop coastal erosion but what’s the harm in trying?

#7 Earth and Space Sciences - Earth Systems and Human Impact: D - Proficient - The student makes observations/measurements to provide evidence of a cause and effect relationship.
#7 Earth and Space Sciences - Earth Systems and Human Impact: G - Expanding - The student evaluates the effectiveness of their solution and the Rip Rap. (“With our idea the water came out cleaner . . . our idea stopped coastal erosion, more than the rip rap because its sand moved only 1 cm, while that rip rap moved 8 cm.”)
Problem Solving and Critical Thinking: 6 - Proficient
Save our beaches!

1. View the following resources displaying photographs of coastal Rhode Island independently.
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<td><img src="image1.png" alt="Image A" /></td>
<td>The food cart is almost covered in water. Because its on the coast.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Image B" /></td>
<td>The waves are pushing sand to make a sand dune, so they broke the piers.</td>
</tr>
<tr>
<td><img src="image3.png" alt="Image C" /></td>
<td></td>
</tr>
</tbody>
</table>


In this image the waves eroded the sand so the house had to move.

The wind made the waves bigger so they traveled to the house. Because the wind moved it.
Breakwater
off shore structures lessen the force of waves. They cause less erosion.

Coastal Erosion Observations

- I observed that the water got really muddy.
- I observed that the waves pushed the sand up shore.
- I observed that the water moved the sea weed.
Rip Rap
They're rocks that help the stream stay in place.
3. Generate an idea of another way you might be able to reduce the weathering and erosion rates at the beach. Draw and/or describe your plan clearly in the box below.
**Question:** What can be done to reduce coastal erosion?

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<td>Explain your answer (select 2 or more sentence starters)</td>
</tr>
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<td>You can start a sentence with...</td>
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<td></td>
</tr>
<tr>
<td><strong>Ending:</strong></td>
<td>Reread your answer in different words</td>
</tr>
<tr>
<td>- Reread your first sentence</td>
<td>- Write it again in new words</td>
</tr>
<tr>
<td>Based on this text evidence...</td>
<td>In conclusion...</td>
</tr>
<tr>
<td>As you can see...</td>
<td>Therefore...</td>
</tr>
<tr>
<td>To summarize...</td>
<td></td>
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</table>

My evidence is we experimented with a riprap and it showed us how to reduce coastal erosion.

In my experiment, it showed that when we tested our riprap model, the rocks stopped the water from getting upshore. The breakwater model worked even better.

As you can see, there are ways to prevent coastal erosion...
Dear Gina Raimondo,

Did you know that over the last 50 years, 250 feet of coastline has disappeared? This is a problem that we need to stop!

To reduce coastal erosion you can use many things. In school, we tested different models and solutions. My evidence is we made a model of rip raps and it showed us how to reduce coastal erosion. In my experiment it showed that when we tested our rip rap model, the rocks stops the water from getting upshore. The breakwater model worked even better.

As you can see there are ways to prevent coastal erosion. If we save our beaches children can go for years to come!

Sincerely,

12/18/18

#7 Earth and Space Sciences - Earth Systems and Human Impact: D - Developing - Observations made to provide evidence of erosion.
#7 Earth and Space Sciences - Earth Systems and Human Impact: G - Developing - Used observations/scientific information to generate a solution to reduce the impact of beach erosion.
Problem Solving and Critical Thinking: 6 - Beginning
Save our beaches!

1. View the following resources displaying photographs of coastal Rhode Island independently.
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<tbody>
<tr>
<td><img src="image1" alt="Evidence A" /></td>
<td><em>the erosion line is under this house</em></td>
</tr>
<tr>
<td><img src="image2" alt="Evidence B" /></td>
<td><em>the waves crash into a hill and it</em></td>
</tr>
<tr>
<td><img src="image3" alt="Evidence C" /></td>
<td><em>-----------</em></td>
</tr>
</tbody>
</table>
Groins are man made
Strackers that
3. Generate an idea of another way you might be able to reduce the weathering and erosion rates at the beach. Draw and/or describe your plan clearly in the box below.

```
this wall is making the water eroding
share this sand is int blocked from moving upward from rocks
```
1 liter water

Before

After

Model 1 drawing/photo

Sement Wall
Doubling

Model 1 performance

Model 2 drawing/photo

Model 2 performance

B 16

A  []
Dear Gina Raimondo,

We need to protect our beaches. The Rhode Island coastline lost more than 250 feet in the last 50 years.

One solution that can be done is add more groins in the water. A groin is a rigid structure perpendicular to the shoreline. This structure interrupts water flow and stops movement of sand and sediment.

If we can do this, then the shoreline can’t move toward the roads. So save our beaches!

From,