Student Name:_____ Independent Site: _____

Partner's Name:_____ Partners Site: _____

Part 1: Physical Investigation

Station 1: Waves

Create a hypothesis that predicts how waves will impact erosion.

Design an experiment to test your hypothesis. Sketch the experiment below.

Did your experiment support your initial hypothesis?

Explain the results.

Station 2: Coastal Geology

Create a hypothesis that predicts how beach morphology will impact erosion.

Design an experiment to test your hypothesis. Sketch the experiment below.

Did your experiment support your initial hypothesis?

Explain the results.

Station 3: Slope and Sea Level Rise

Create a hypothesis that predicts how coastal slope and SLR will impact erosion.

Design an experiment to test your hypothesis. Sketch the experiment below.

Did your experiment support your initial hypothesis?

Explain the results.

Part 2: Field Investigation

Use the online data site to complete the table on the following page. Use the link below to the right to access the data. You should use a large screen to interact with the data site.

(https://experience.arcgis.com/experience/8a56c883113d4c15be67d10d13c70c15)

Table 1: Shoreline Evaluation Criteria						
Variable	*High Stability*	*Stable*	*Slightly at Risk*	*Vulnerable*	*High Risk*	*Notes*
Geomorphology	Rocky Beaches, High Bedrock Cliffs	Medium Cliffs	Low Cliffs or Cobble Beaches	Estuary or Protected Beaches	Barrier Beaches, Sand Beaches, Salt Marsh, or Mud Flats	Classify the site visually.
Offshore Slope	>0.04	0.03-0.04	0.02-0.03	0.01-0.02	<0.01	The slope from the waterline seaward 300 meters. Use the topographic profile to calculate this parameter.
Maximum beach Elevation (meters)	>7	5-7	3-5	1-3	<1	Use the topographic profile to measure this parameter.
Relative Sea Level Rise (mm/yr)	<2	2.0-3.0	3.0-4.0	4.0-5.0	>5.0	SLR data has been calculated by NOAA.
Significant Wave Height (m)	<0.55	0.55-0.85	0.85-1.00	1.00-1.25	>1.25	Wave height is measured by the National Data Buoy Center.

Complete the table below.

Table 2: Shoreline Data						
	Class Example: Virginia Beach		*Your Site: Cedar Island or Savage Neck Circle the location*		*Partner Site: Cedar Island or Savage Neck Circle the location*	
Variable	*Description or Value*	*Vulnerability*	*Description or Value*	*Vulnerability*	*Description or Value*	*Vulnerability*
Geomorphology						
Offshore Slope						
Maximum beach Elevation (meters)						
Relative Sea Level Rise (mm/yr)						
Significant Wave Height (m)						

Review the data you have collected and recorded in table 2. Create a hypothesis that predicts which of these locations is the most vulnerable to future shoreline erosion. Explain which of the variables cause the beach to be more vulnerable than the other sites.

Part 3: Validation

You will now return to the data to test your hypothesis. The data sets provided include orthophotos from 2002 and 2021. The change in shoreline location between the 2 photos can be measured and then the erosion rate can be calculated. The erosion rate is the distance divided by the time.

$$\text{Shoreline Change Rate} = \frac{\text{change in shoreline location (meters)}}{\text{Time (years)}}$$

The change in location should be measured in meters. The time in this example will always be 19 years (2021-2002=19 years). On the photo, the shoreline is identified as the wet/dry line, not the waterline. The wet/dry line is used rather than the waterline because the waterline will fluctuate each time a wave breaks on the shore. Erosion should be noted with a negative rate while accretion (beach growth) should be recorded as a positive rate. Calculate the rate of shoreline change and record it in the table below. For partial credit, show your work.

Table 3: Shoreline Change			
	Virginia Beach	*Cedar Island*	*Savage Neck*
Shoreline Change (m/yr)			

Review your hypothesis and the rate of shoreline change. Is the erosion rate the highest at the site you predicted to be the least stable?

Yes No

In the future sea level rise is expected to accelerate because of warming temperatures and ice melting. Which type of beach do you expect to be most impacted by accelerating sea level rise? You should discuss the impact of specific variables in your response. Is there a correlation between potential inundation caused by sea level rise and proximity to an offshore subduction zone?

Sketch a beach that is highly vulnerable to erosion and flooding and another that is more stable. Annotate both sketches to highlight the differences.

Unstable Beach

Stable Beach