Explanatory notes

The actions of the sea and the weather are the major causes of changes to the coastal landscape of the South West of England, leading to both erosion, where material is worn away, and accretion, where it is deposited at new locations.

A major cause of coastal erosion is the power of waves. When a wave hits a cliff face or similar solid object, any cracks can be gradually expanded, destabilising the structure. Waves also carry sand and pebbles and these can wear away cliffs and man-made defences. The stormier the weather, the bigger the effects. In calmer weather, the sea can deposit sediment, causing beaches to grow.

Beaches themselves are a strong defence against erosion: put simply the further a wave has to travel up a beach the weaker it becomes.

But at Seaton, near Looe in Cornwall, an extra factor came into play: data gathered by the scientists at the South West Coastal Monitoring shows how a river came to weaken a seawall, helping to lead to its collapse.

The Observatory is the data-gathering arm of the South West Regional Coastal Monitoring Programme, which was founded in 2006 to provide a standard, repeatable and cost-effective method of monitoring the coastal environment in the region.

The programme operates from Beachley Point in Gloucestershire to Portland Bay in West Dorset on behalf of the region's maritime local authorities and coastal groups, as well as the Environment Agency and Defra, and is managed by Teignbridge District Council.

A series of aerial photographs commissioned by the SWCM clearly shows how the course of the River Seaton moved rapidly eastwards across the town's beach between 2012 and 2014. Having previously been relatively stable between 2008 and 2012.

Topographic measurements taken between 2008 and 2014 also show the level of the beach fell considerably just in front of Seaton's seawall and rose at the foreshore.

Emerald Siggery, Coastal Process Scientist at the South West Coastal Monitoring, said: "Our comprehensive data has shown that the movement of the river eastwards across the beach and in front of the seawall contributed largely to erosion of the defences.

"We also operate a series of wave buoys and tide gauges around the region which recorded the ferocity of a series of storms which hit the area in late 2013 and early 2014. During one of the storms in January 2014, 100 meters of the seawall collapsed, in part due to erosion caused by the river running in front of it, and there was severe damage to nearby properties."

Since those storms, new defences have been built and beach reprofiling has taken place, returning it to its pre-storm condition, as can be seen when beach profiles taken by the SWCM at various times are compared.

The SWCM's data is freely available: southwest.coastalmonitoring.org

Coastal Processes schools case study:
Seaton, Cornwall

1 South West Coastal Monitoring has been monitoring the beach at Seaton, Cornwall, since 2007. Over this time SWCM have observed many changes to the beach shape and profile, with different areas experiencing erosion and accretion.

Look at the aerial photograph of the beach on the right (Figure 1) – What feature is present which may have had a big impact on the movement of material on the beach?

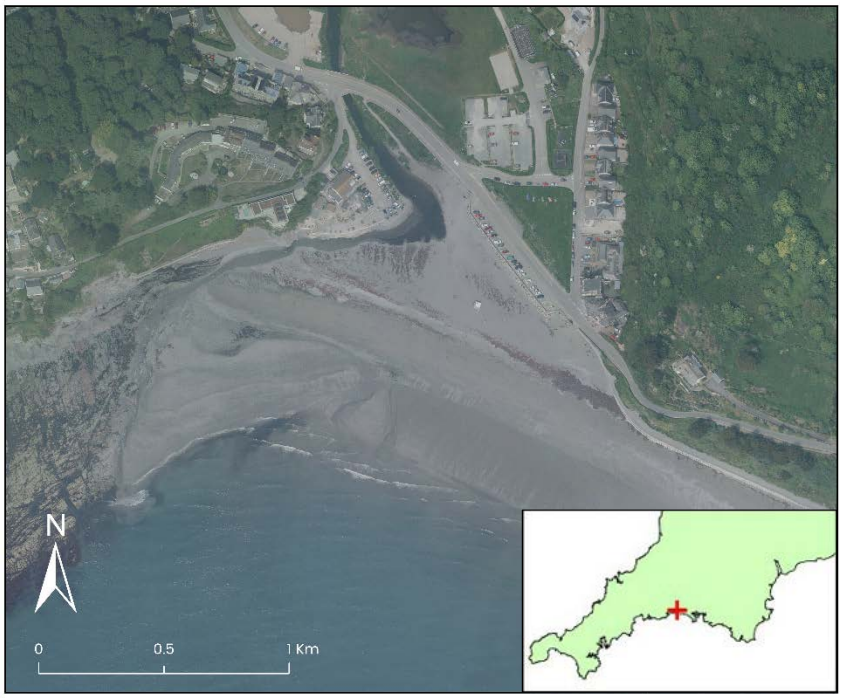

Figure 1 An aerial photo of Seaton, Cornwall (2018).

What conditions would you therefore expect to impact this beach in particular?

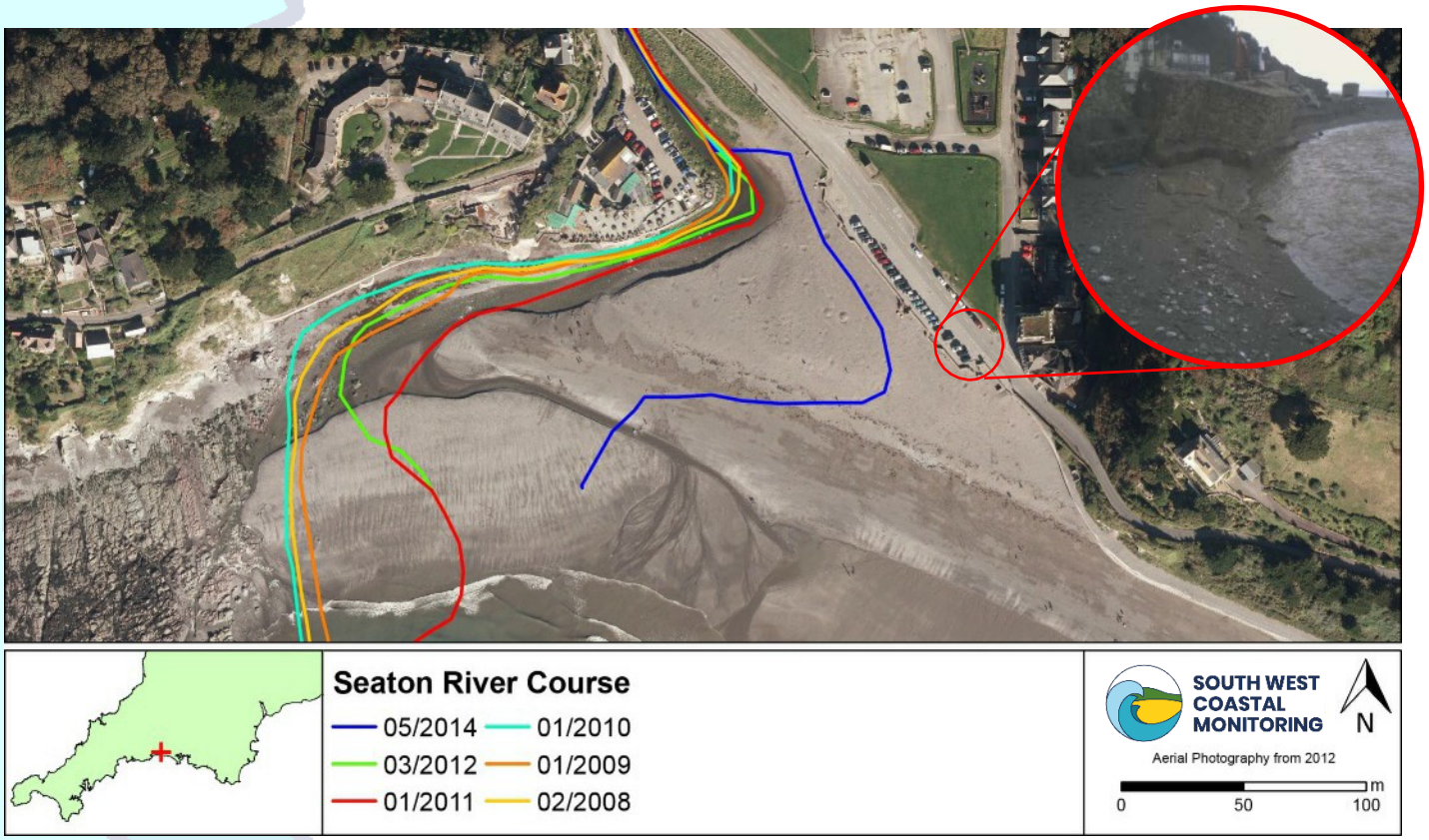

Figure 2 The different locations of Seaton River between 2008 and 2014.

2 SWCM has been tracking the course of the River Seaton: Figure 2 shows how its course has moved over time. In 2014 a sea wall in front of the car park at the beach collapsed, as can be seen in the inset photograph. Can you link the collapse of the seawall to the river in some way?

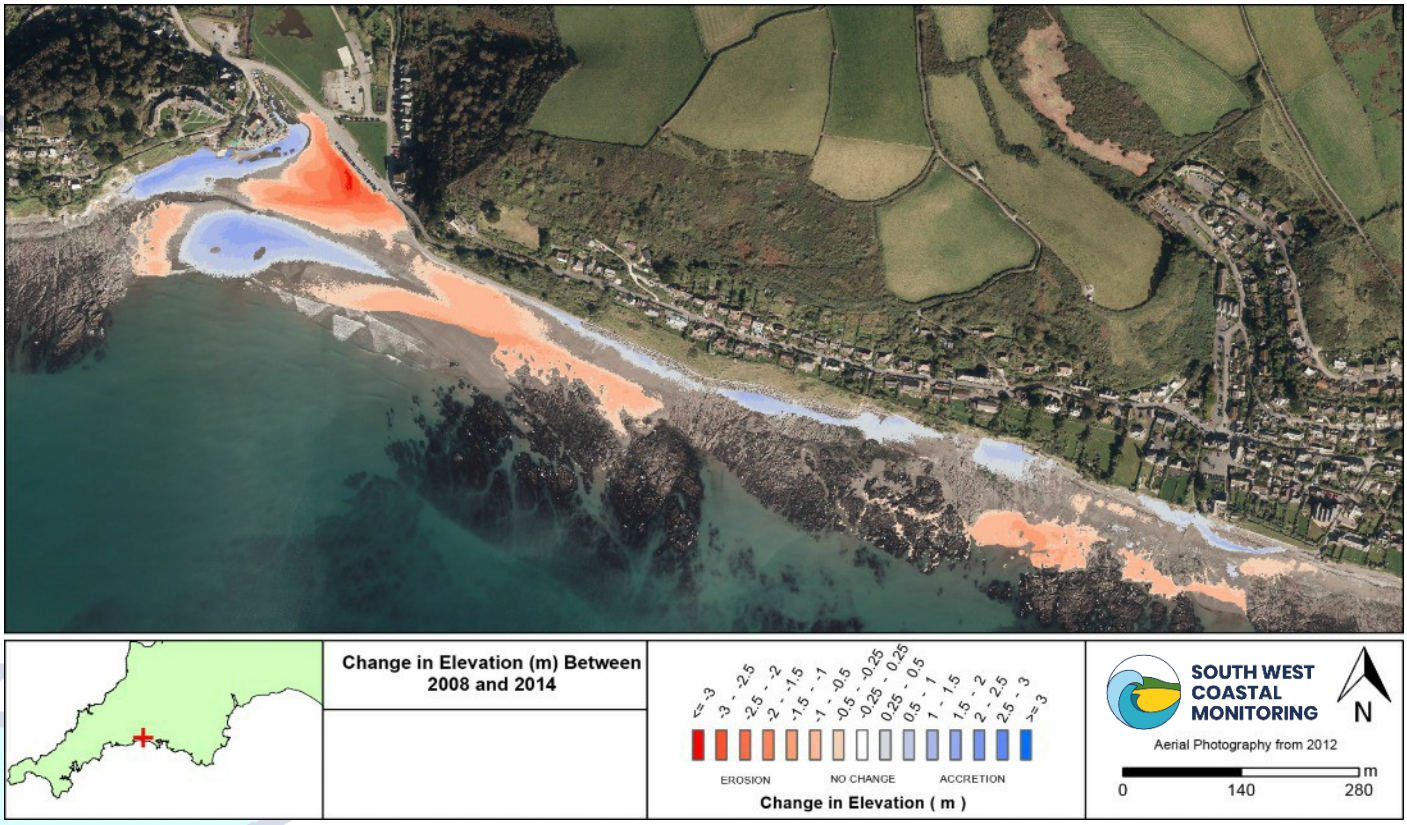

Figure 3 Difference model of Seaton, depicting the change in elevation between 2008 and 2014. Red represents erosion whilst blue represents accretion.

3 Figure 3 is a difference model of the beach – this shows the change in elevation of the sediment on the beach between 2008 and 2014. The model can be used to see how sediment has moved around the beach over time.

Describe how the beach has changed between 2008 and 2014.

There is a café behind the beach which can be seen highlighted in the photographs on the right. Do you think the shape of the beach can have an impact on how storms and storm waves affect the café?

Explain your answer.

Figure 4 The top image shows a side on image of the café, whilst the bottom photo depicts an aerial image of the café at Seaton.

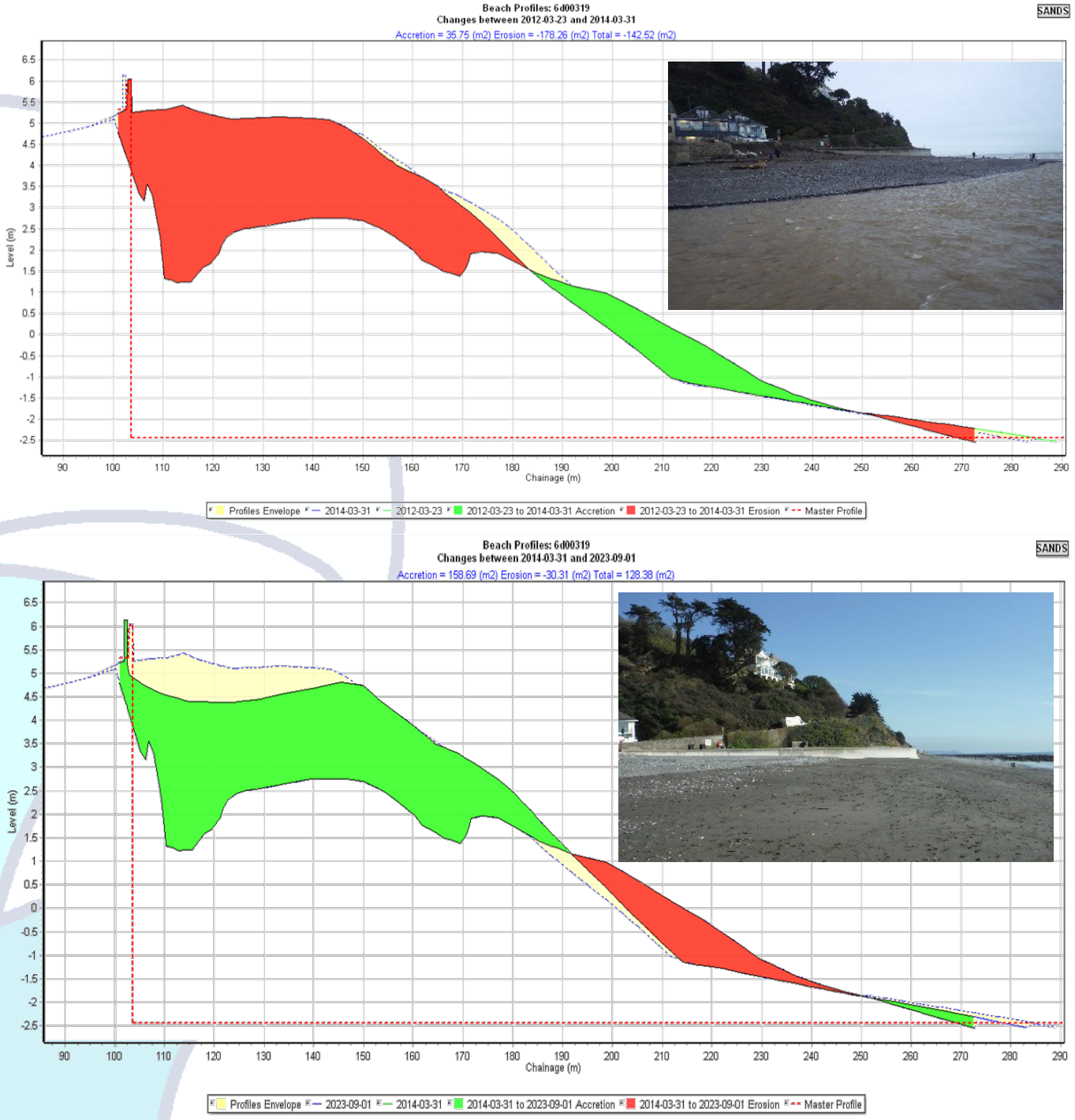

Figure 5 Profile 6d00319, top: sediment change between 2012 and 2014. Bottom: sediment change between 2014 and 2023. Green represents accretion whilst red represents erosion.

4 Take a look at these two beach profiles made by the coastal processes scientists at South West Coastal Monitoring. The top one shows changes to the beach between March 2012 and January 2014. The red area shows erosion, the green area shows accretion. The lower one shows the changes between January 2014 and September 2023. The inset photographs were taken along the profiles. There were severe winter storms in late 2013, early 2014. What was happening to the beach in the years before the storms, and what impact do you think the storms had on the beach?

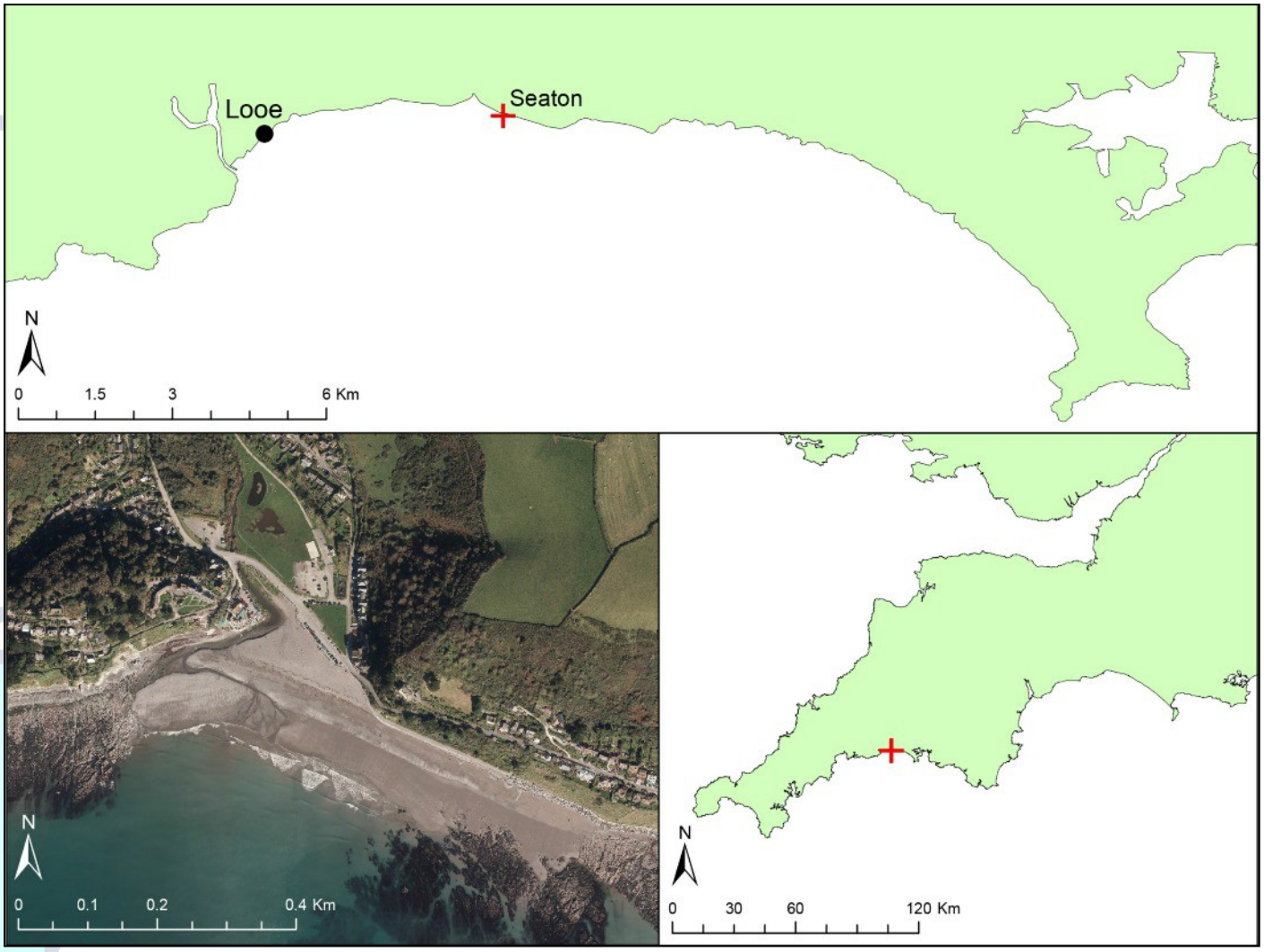

Figure 6 The location of Seaton in relation to the southwest of England.

5 Have a look at the video filmed from the café during the storms of 2014: either click on the photo to the right, scan the QR code or click here. Do you think the person filming the storm and the people outside the café in the earlier part of the video are safe?

a) Yes, they aren't on the beach

b) Yes, as long as they keep an eye on the waves and try not to get wet

c) No

d) Maybe, it depends whether they can swim.

Why have you chosen this answer?

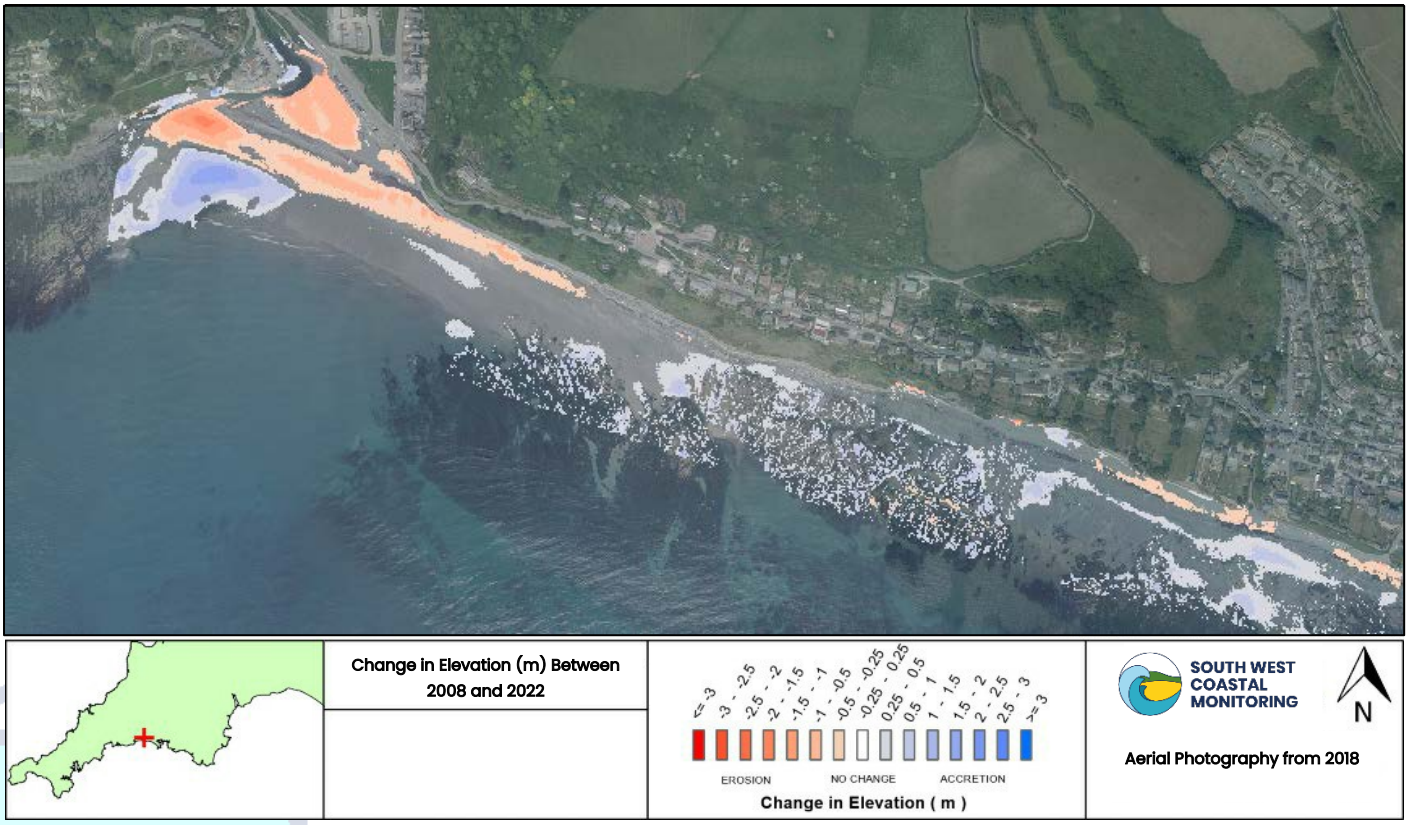

Figure 7 Difference model of Seaton, depicting the change in elevation between 2008 and 2022. Red represents erosion whilst blue represents accretion.

6 Looking at the latest difference model at Seaton (Figure 7), between 2008 and 2022, how do you think the beach will evolve in the future?

7 Looking at the eastern end of the beach, why do you think there is minimal change in beach elevation?

a) The rock platform in front of the beach reduces wave energy

b) The river is further away from the beach

c) The top of the beach consists of sea defences across the length of the unit, preventing sediment to feed the beach

d) All the above