Hard and Soft Engineering

Learning Objective:

-**Assess** the best way to manage the coast

Learning Outcomes:

-**Compare** the coastal management options

-**Organise** the costs and benefits of management types

-**Apply** understanding to explain how the risk of flooding can be reduced

Hard engineering **reduces/absorbs the energy** of breaking waves by building **artificial structures** between the sea and the land. Soft engineering is used in environmentally sensitive areas, where the area is less built up. This **sustainable** option is often cheaper and is environmentally friendly, working with natural processes.
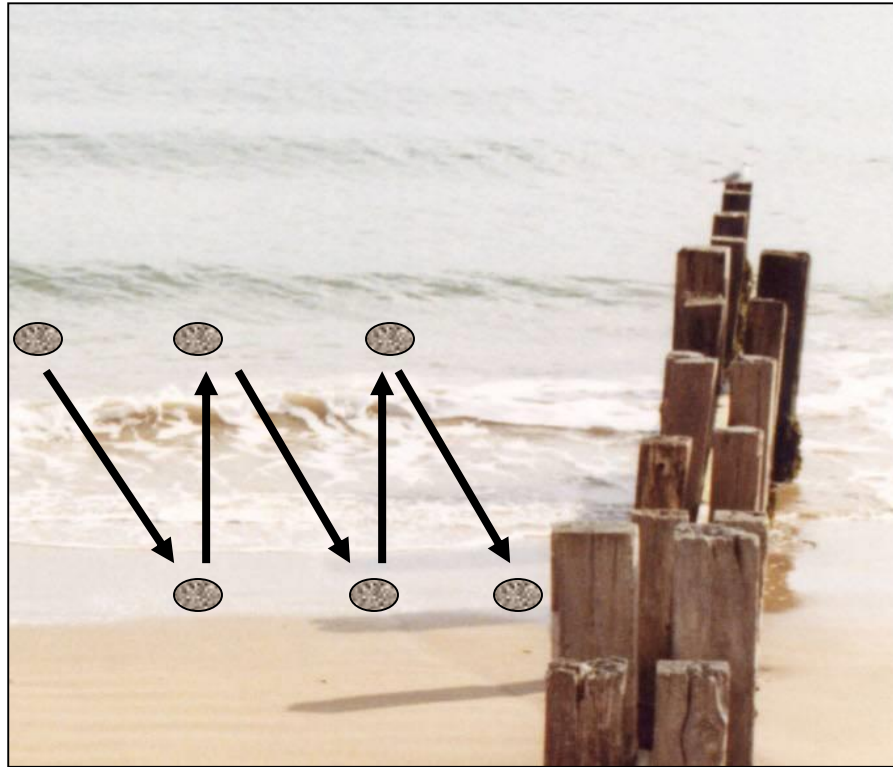
TASK:

Describe the key differences between hard and soft engineering

How do groynes work?

Timber or rock structures built at right angles to the coast. Groynes trap the sand which is carried along the coast by **longshore drift**. This enlarges the beach.

The sand acts as a natural protection against the force of the waves. The waves break onto the beach and not the cliffs.

What are the disadvantages of groynes?

Mappleton is located on the Holderness Coastline.

a Flamborough   c Hornsea
b Mappleton   d Spurn
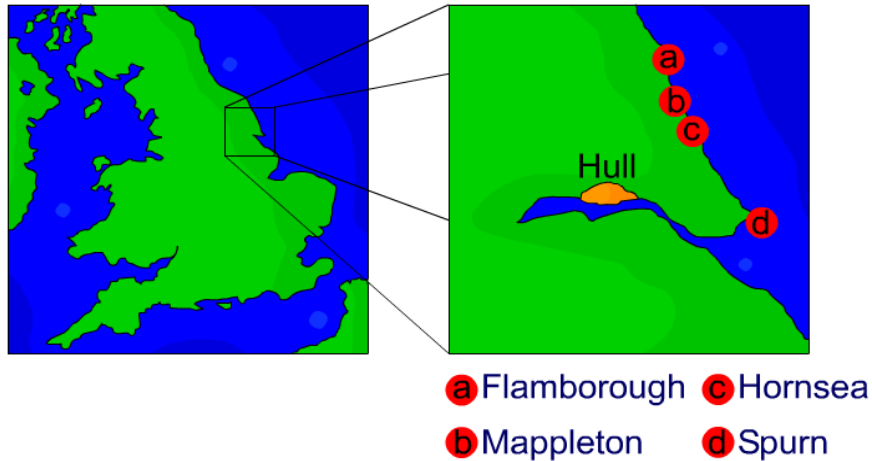
- In 1991 a rock revetment and two rock groynes were built. Sand accumulated and halted erosion.
- South of Mappleton, the rate of erosion has increased significantly.
- Material that usually moves south via longshore drift is becoming trapped within the groynes.
- Now there is no beach to protect the cliffs - the sea reaches the base of the soft cliffs and erosion occurs.

Sea walls are reinforced concrete structures that create a rigid **barrier** between the sea and the land. They are incredibly **expensive** to build - about **£5000 per metre**. Sea walls can be straight or have a curve at the top. This sends the **energy** of the waves back out to sea and is called **splashback**.

Rock armour (**rip-rap**): piles of large boulders are dumped at the **foot** of the cliff, or in front of a sea wall to reduce erosion by **absorbing the power** of the incoming waves. They also help prevent materials from being **scoured** from the beach by the backwash as the water is slowed down when it runs through the gaps between the rocks, reducing its power. Rock armour costs **£200,000 per 100m**.

Gabions: wire cages filled with rocks. They are placed in **front of cliffs**, often stacked one on top of another, to **reduce erosion** and prevent cliff falls. They **absorb the power** of the incoming waves and **prevent** the cliff from **slumping** forwards.

Gabions cost about **£50,000 per 100m**.

Cheap and flexible in the design. They can also reduce drainage of the cliffs.

Failed gabions

Why is hard engineering being used less?

- *Expensive*
- *High maintenance costs*
- *Interfere with natural processes*
- *Look unnatural*
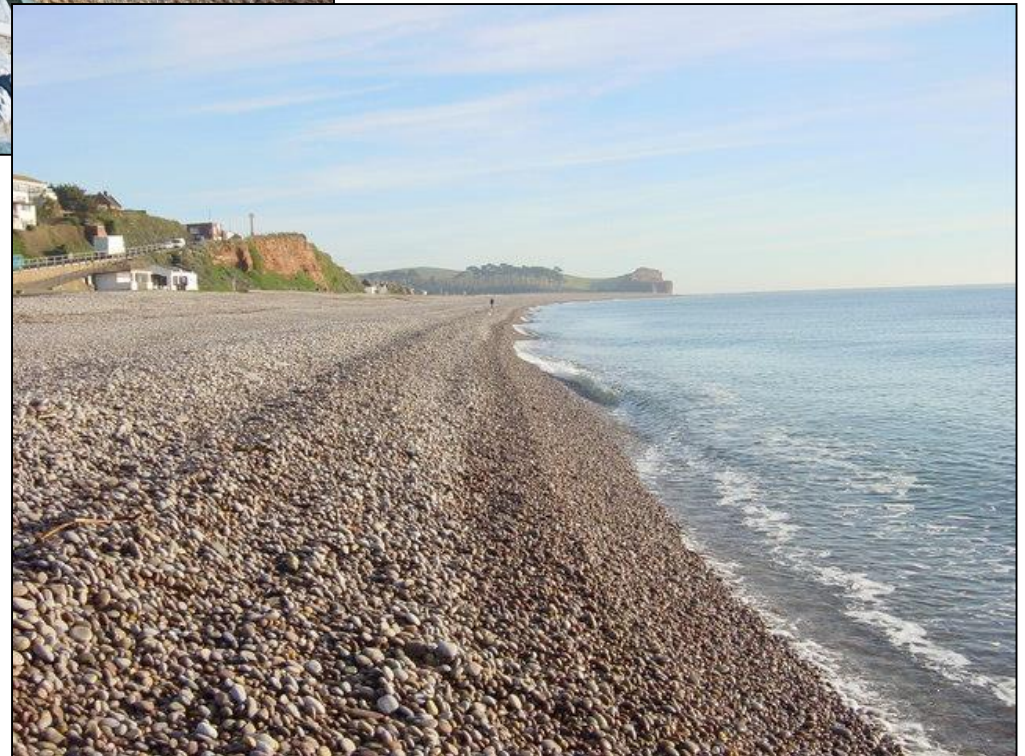- *All of the above can cause conflict*
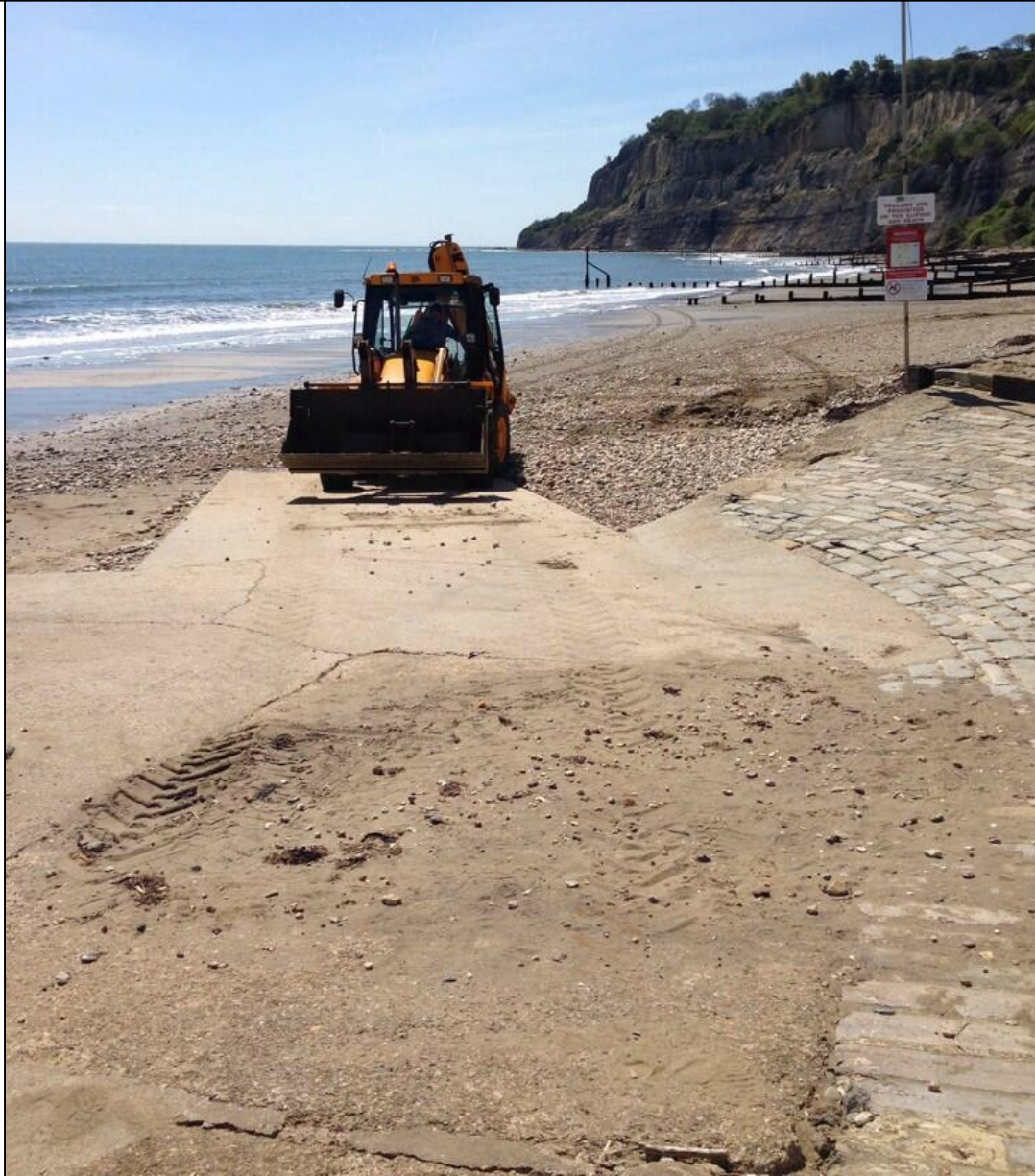
The perfect beach?

Thin and steep beach
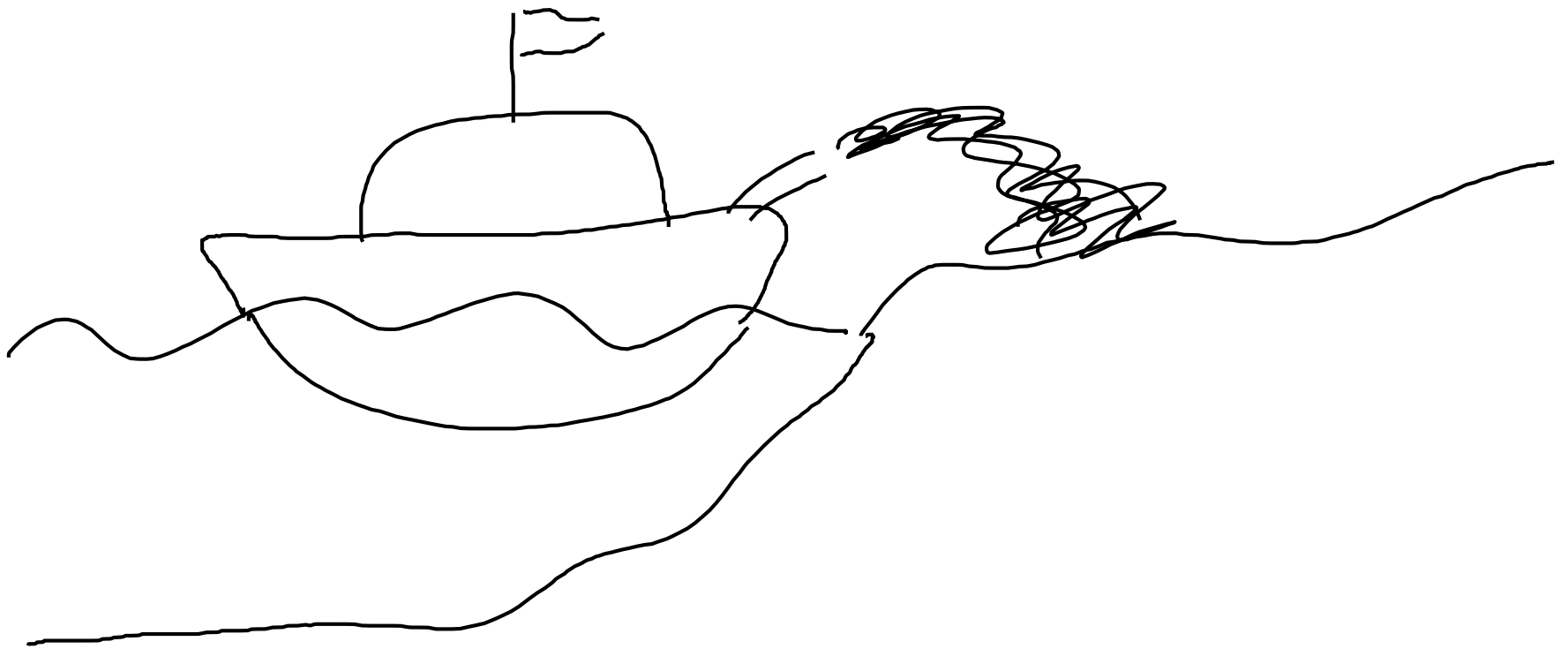
Vs

Wide and gently sloping beach

Dubai – building islands, something similar is done with beach replenishment. Where is the sand from?
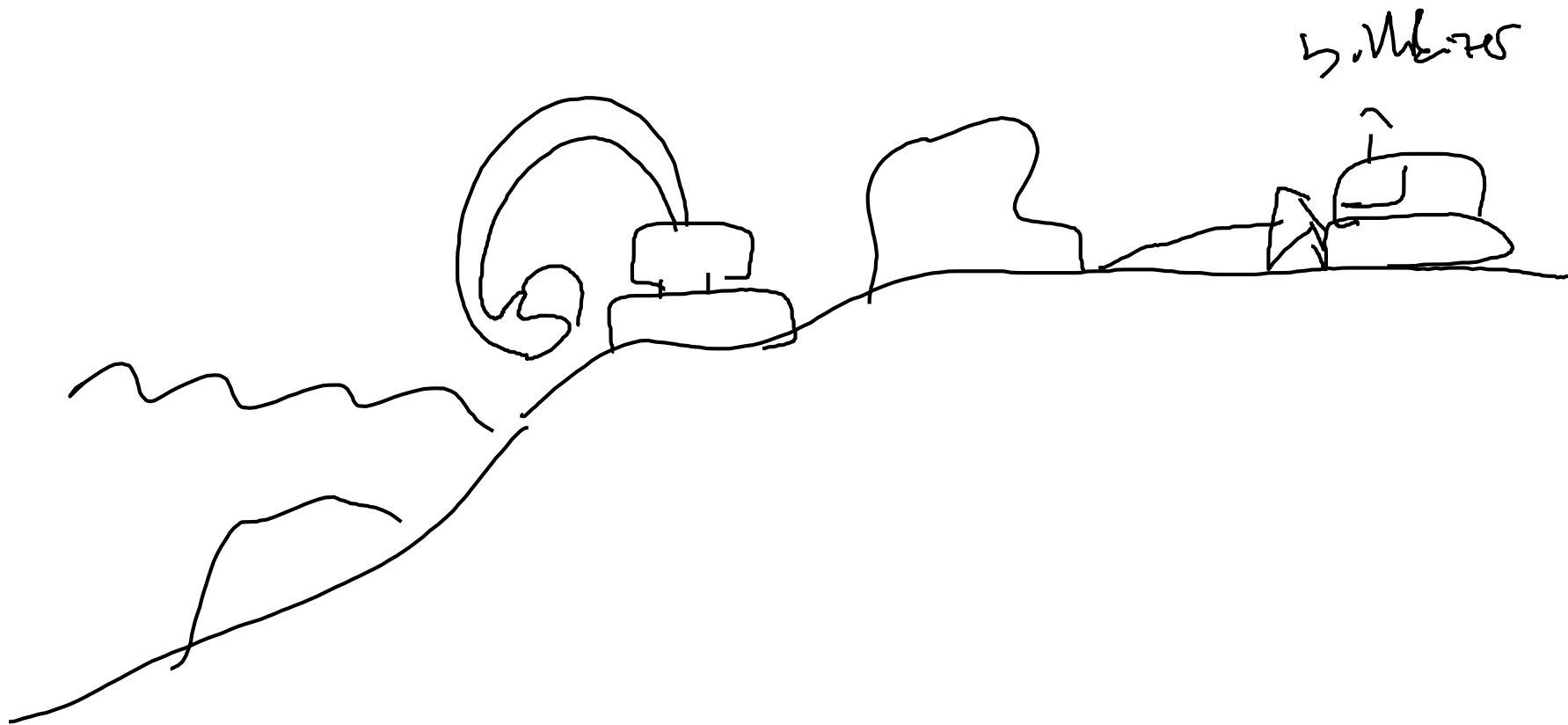
Beach reprofiling – recreate a gently sloping **beach profile**
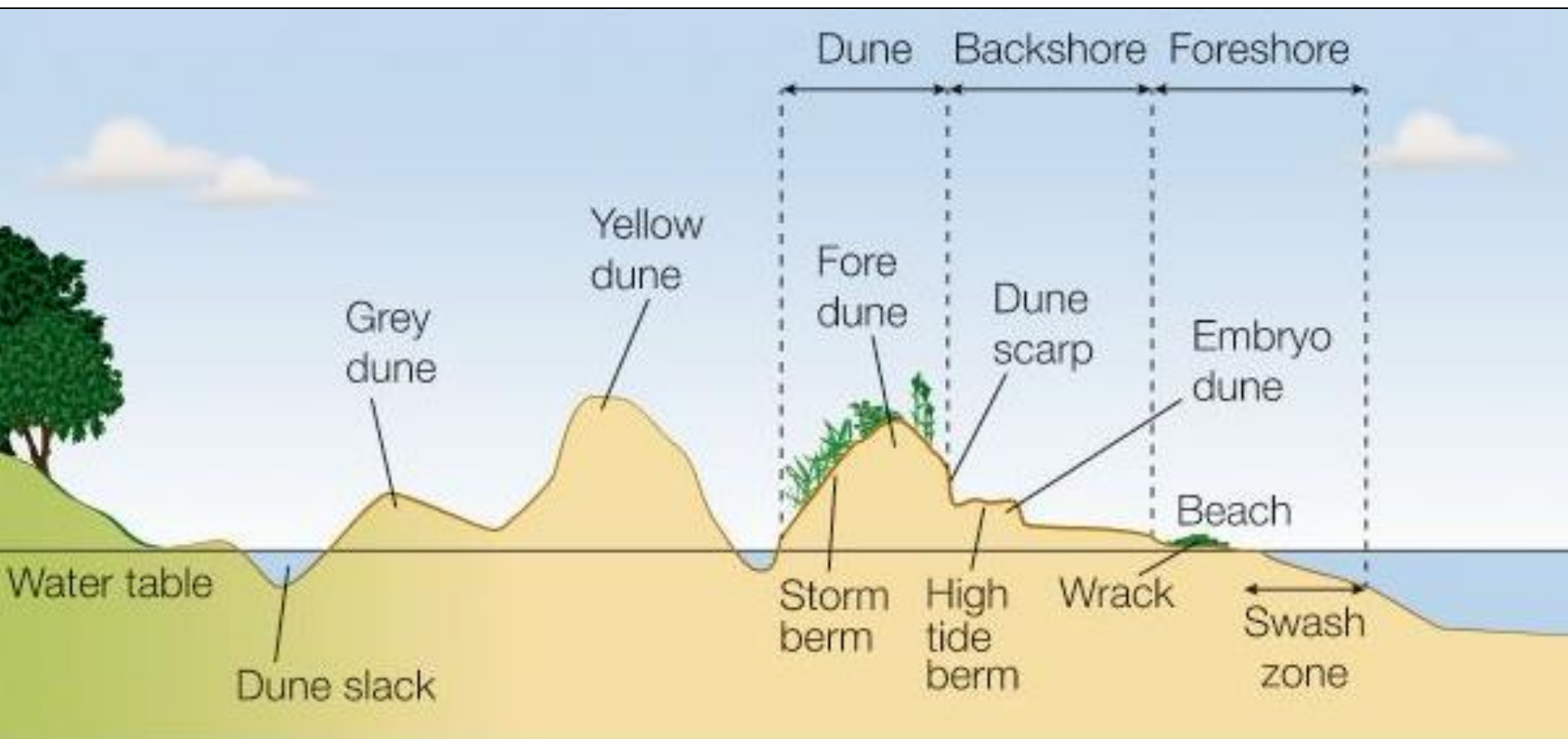
Beach replenishment

Beach reprofiling

5 Metres

Dune — Backshore — Foreshore

Yellow dune

Grey dune

Fore dune

Dune scarp

Embryo dune

Beach

Water table

Dune slack

Storm berm

High tide berm

Wrack

Swash zone

Dune regeneration: marram grass is planted to stabilise these easily damaged areas. They cost up to **£2000 per 100m**.

Explain how hard engineering is used to protect areas from the effects of storm waves.

(8 marks)

L1 (1-4) = **description** of what hard engineering is with types mentioned. Some idea of the defence creating a barrier with the sea.

L2 (5-6) = as above, but **clear explanation** of how **energy is reduced / absorbed**, such as how *'rock armour can absorb the energy of the sea'*. *Some link is made to how the defence **reduces the effects** of storm waves and / or reduces erosion.*

*L3 (7-8) = as above, but **detailed explanation**, such as how groynes stop longshore drift in order to protect the cliffs behind through building up the beach. Links are made to **reducing the effects** of storm waves.*

Explain how hard engineering is used to protect areas from the effects of storm waves.

(8 marks)

Hard engineering is the process of building man-made often concrete structures to create a barrier between the sea and land. Figure 4 is an example of a sea wall being constructed. The sea wall protects inland where there is a high tide and sea levels rise. In stormy conditions storm waves can be very powerful and big so

the sea walls prevents coastal areas from being flooded by storm waves. Other examples of hard engineering are: tetrapods, gabions, rock armour and more. These all can protect the coast from effects of storm waves as they can absorb and break the powerful waves and not let them damage and flood the coast. In Ventnor, Isle of Wight a sea wall and tetrapods are used to protect the coast from rising sea levels and

Extra space storm waves as the structures act as man-made barriers.

Suggest why some coastlines are not protected from the sea.