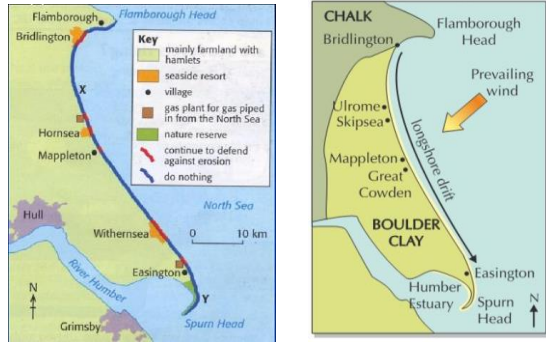


A. Holderness Coast

1 The Holderness Coast is in the North East of England, next to the North Sea. It starts at Flamborough Head and ends at Spurn Point. Along the coast are many physical and human features including cliffs, arches, towns and villages, sand dunes & coastal spits. It is Europe's most rapidly eroding coastline.

Location and Geology



2 **Processes of erosion**

Hydraulic Action: The sheer force of the waves trap air and water into cracks in the cliff. This creates pressure forcing the rock apart and breaking pieces off.

Solution: Acidic seawater dissolves some rocks that make up cliffs e.g. limestone and chalk cliffs.

Attrition: Rock fragments carried by the sea knock against each other, causing them to become smaller and more rounded.

Abrasion: Sand and stones scrape the cliffs like sandpaper and wear them away (abrasion). Fragments of rock gouge the cliff face.

3 **Processes of transporta tion**

Suspension - fine light materials, sand and silt, are carried along in the flow of the water.

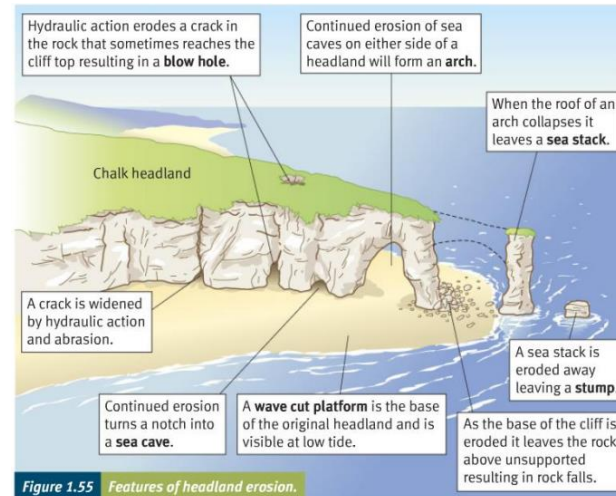
Solution - minerals are dissolved in the sea water and carried along in solution.

Saltation - small pebbles and stones are bounced along the sea bed by the waves.

Traction - large stones and boulders are rolled along by waves. Mainly when there are high energy levels, like a coastal storm.

B. Coastal Landforms

1 **Features of Erosion: Cave, arch and stack.**



2 **Features of Deposition: Sand dunes. To form they need:**

1. A large supply of sand.
2. A large flat, exposed beach.
3. Onshore wind to move sand up the beach.
4. Large inter-tidal zone. This allows sand to dry out sufficiently and enables it to be blown up the beach.
5. An obstacle such as driftwood for the dune to form against.



C. Hard Engineering

1 **Coastal Defences Include Hard and Soft Engineering**

Defence	What it is	Benefits	Costs
Sea Wall	A wall made out of a hard material like concrete that reflects waves back to sea.	It prevents erosion of the coast. It also acts as a barrier to prevent flooding.	It creates a strong backwash, which erodes under the wall. Sea walls are very expensive to build and to maintain.
Gabions	A wall of wire cages filled with rocks usually built at the foot of cliffs.	The gabions absorb wave energy and so reduce erosion. They're cheap and easy to build.	They're ugly to look at and the wire cages can corrode over time.
Rock Armour	Boulders that are piled up along the coast. (It's also sometimes called rip-rap.)	The boulders absorb wave energy and so reduce erosion and flooding. It's a fairly cheap defence.	Boulders can be moved around by strong waves, so they need to be replaced.
Groynes	Wooden or stone fences that are built at right angles to the coast. They trap material transported by longshore drift.	They create wider beaches which slow the waves. This gives greater protection from flooding and erosion. They're a fairly cheap defence.	They starve beaches further down the coast of sand, making them narrower. Narrower beaches don't protect the coast as well, leading to greater erosion and floods.

2

D: Coastal Management: Mappleton (Holderness)

1 **Parts of Holderness are Protected by Rock Armour and Groynes**

In 1991, 450 m of coastline around Mappleton had to be protected at a cost of £2 million, and using over 61,000 tonnes of rocks.

Coastal management at Mappleton involved two types of **hard engineering**:

- 1) Placing **rock armour** (granite boulders) along the **base of the cliff** to absorb the power of the waves.
- 2) Building two rock **groynes** to trap sand and create a beach to absorb the power of the waves.

There are also defences at **Hornsea** (where there is a sea wall and some groynes), and at **Withernsea** (where there is a sea wall, groynes and rock armour).

2 **The Defences Saved Mappleton... but Still Caused Conflicts**

The coastal management scheme was **successful** — the village of Mappleton and the B1242 road are **no longer at risk** from erosion.

However, the management strategy has caused **conflicts**. The rock groynes prevented sediment moving south along the coast by longshore drift. This has caused **increased** erosion south of Mappleton, and led to:

- 1) **Loss of land** to the south of Mappleton — especially around **Great Cowden's** farms and caravan park.
- 2) The operation of **coastguard** and **lifeboat** services from Spurn Head being under threat due to erosion.
- 3) A **loss of habitat** for wildlife on Spurn Head — **less material** is coming down the coast to collect at **Spurn Head**, so it is at **risk** of being washed away.
- 4) In 1999, a 1 km stretch of coast near the **gas terminal** at **Easington** having to be protected by **rock armour** — at a cost of **£6.6 million**.
- 5) **Bays** forming between the protected areas, and the protected areas becoming **headlands**. **Maintaining the defences** in the protected areas is becoming **more expensive** and may cause **conflict**.