

## What should be done About Cliff Collapse in Norfolk?

In the past few years, Overstrand has been eroded, and people's lives, houses, schools, hotels, farmlands and the rest of the town is at risk. So we need to protect the coast from the waves, eroding the area. Action should be taken as soon as possible.

Overstrand is in Norfolk close to Norwich. It is situated on the coastline, where the waves are causing lots of problems. (On the right is an image of where Overstrand is located.)

Overstrand is made out of soft clay. If it was made out of hard rock or something on the lines of that, Overstrand would not have been eroded as quickly as the land has now.



Overstrand has been eroded mostly by long shore drift, because the energy from the waves rushes on to the beach in the directions the wind is blowing. The waves then hit the cliff and come back down in to the sea with bits of sand and pebbles. The reason why the waves came back down in to the sea is because of gravity. This happens along the beach when it comes to a curve. Over the years the waves wash the beach away. When the beach has been washed away, the waves then start hitting the cliffs. Later on a crack will be formed, then a notch, a cave and next an arch. After the arch has been formed, it falls down in to the sea, this is called a stack. The stack will then topple over in the sea and a stump is produced. Then the stump erodes away until you cannot see it any more, this is called a wave cut platform.

The erosion is causing lots of problems not only to the cliffs but to the local residents and people who own businesses at Overstrand. The local residents are frightened that they might lose their homes if the cliffs eroded anymore. What makes it even worse for them is

that their homes cannot be insured as the insurance companies would not have enough money to insure all the houses at Overstrand, also there is a high chance that the houses are going to get eroded with the cliffs. However the local residents can easily move homes to somewhere where it is safer for them to live, but that will not be possible as no one will want to buy a house which is going to erode with the cliffs in the next few years. But if their homes can be sold, they would not get the price they paid for their house, because of where the house is situated.

Hotel owners are in a tough position too, because tourists that come to visit Overstrand would not want to stay somewhere where they could be in danger. Also most tourists enjoy walking, getting a sun tan or just relax on the beach, but that will not be possible, as the sand on the beach would have been washed away with long-shore drift. So hotel owners would not get as much money as they did get in a few years back.

Local farmers are afraid that the cliffs are beginning to erode their farmland and if this carries on happening the crops will be gone with all the cliffs. Also if the crops go then the farmers would not have any vegetables to eat and nor will the rest of the town. As well as that they will not get any money because they cannot sell the crops and they would lose their business, or even their family trade.

The cliff collapsing is making a big impact on the local residents as they are worried sick about their homes and losing sleep over what's happening to the cliffs and now what is happening to them. They are regretting their hopes and dreams of raising a lovely family at Overstrand.

The only thing left to do is to start protecting the coast from the waves. Local farmers, hotel owners and local residents want to protect different areas of Overstrand. Local farmers want to protect the farmland. Hotel owners want to protect all the towns such as Trimingham, Cromer, Sidestrand, Horthrepps and of course Overstrand. Local residents want to protect the same places as the hotel owners as their home are there.

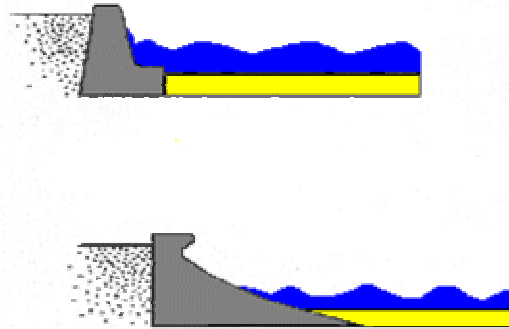
The sea defence which are going to be used should help the beach in many ways. It should leave the beach where it is, and stop the cliffs from eroding. Also the sea defences are environmentally friendly.

### Advantages and Disadvantages for Sea Wall

Sea wall is an extremely good sea defence, and it is very strong. It defends high and low tide waves. Sea walls are also very effective, it is one of the best sea defences, but is not one of the best looking sea defences.

Sea walls are also too expensive and it does not look very nice on the beach. When tourists come to the beach, the sea wall blocks the sea so all you can see is the sea wall. It also takes too long for the sea wall to be built.

Modern **sea walls** have a slope and curved top which breaks up the energy of the wave and prevents water going over the top of the wall during heavy storms. **Sea walls** are very expensive (£2000-£5000 per metre) but should last 20-30 years.



### Advantages and disadvantages for Concrete or Wooden Revetment

A cheaper alternative to sea walls is the **revetment** (about £2000 per metre).

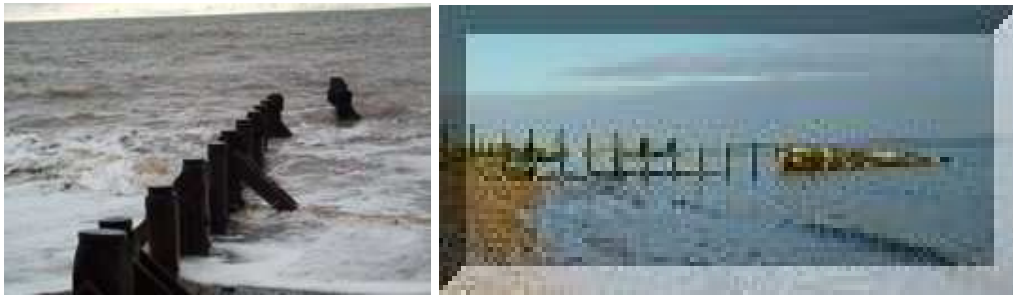


This is a sloping feature which breaks up or absorbs the energy of the waves but may let water and sediment pass through . Concrete or wooden revetment is not as good as the Sea Wall. It is not as expensive as the sea wall. It protects the beach and also it protects the cliff from eroding. If it is made out of wood then it would rot quite quickly. Also a few years later the concrete of wooden or wood revetment will need replacing because it would have got a few cracks on it. Concrete or wooden revetment is not one of the effective sea defences, and if tourists want to swim in the sea, they have to go down a couple of steps to the sea. It is not bad looking as the sea wall; however it is equally not nice to see. Concrete Revetment Systems provide benefits of ease of installation, and lower cost when compared to other options.

### Advantages and Disadvantages for Groynes

Groynes are wooden or stone 'arms' sticking out into the sea. They slow the water flow, causing it to lose energy between groynes. They are built by humans to stop sand and pebbles moving along the beach. If the sand and pebbles are left to drift, the level of the beach drops, sometimes exposing clay under the sand.

Groynes help hold the beach in place. It also stops long shore drift from happening. Groynes can be very expensive; (about £10,000 per metre) however they are very good sea defence. They are very safe to children and they look better than having a sea wall.



As the Groynes are made of wood they do tend to rot and need to be replaced regularly.

Within the groynes, sediment will be trapped and the beach levels will increase.

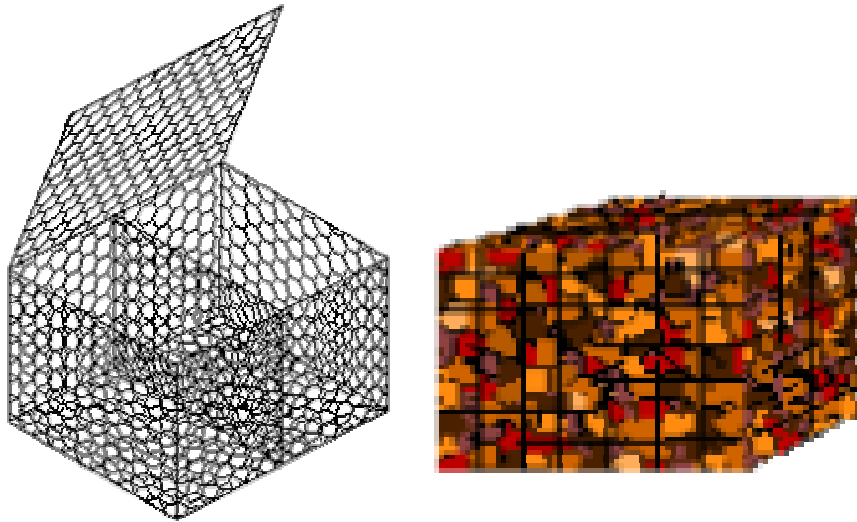
### Advantages and Disadvantages for Gabions.

Gabions are like large, wire baskets that are filled with a local stone and linked together to form terracing, retain river banks and support earth banks. The gabions can be 'stacked' to form a wall about 10m high.

Even though Gabions are cheap, (about £100 per metre) they are easy to construct with limited amount of equipment and are for short term only. They are strong and flexible and can withstand forces from water and other earth masses. However it does not mean they are a good sea defence. Gabions can trap litter in the wire basket and can be very dangerous for children, as they can get their hands stuck in the baskets. Also they are not environmentally friendly, gets litter stuck in it.

Gabions have the advantage of ease of use and are relatively cheap but their life span is short as they can rust easily.

Where longshore drift is a serious problem and the supply of beach material is poor, it may be necessary to add lorry loads of sand and shingle to the beach.



### Advantages and Disadvantages for Beach Nourishment

Beach nourishment is a process of reloading the beach with the sand from the sea to create a new sandy shoreline.

Beach nourishment requires large volumes of beach-quality sand which restores the beach to how it was originally.

The initial nourishment typically requires thousands of cubic meters of sand per kilometre of shoreline, and the disadvantage is most beaches need regular renourishment. The other disadvantage is with beach re-nourishment has been the lack of an adequate sand resource off shore of the beach and the cost can be £3 per cubic metre.

BEFORE



AFTER



### Advantages and Disadvantages for Rock Armour (Rip-Rap)

Rock Armour is the use of hard, durable rock to protect cliffs and shores from erosion.

The rock armouring is ideal for cliff protection since the rock absorbs the wave energy.

The advantages are rock armour reinforces the embankment s

The armour layer of a breakwater is expensive as it either consists of large size and erosion takes place over a number of years. The costs can be £3500 per metre.



## SUMMARY

DEFENCE	COST	ADVANTAGES and DISADVANTAGES
Sea wall	£6000 per m	Very strong, but may reflect waves, causing turbulence and undercutting. Very expensive
Concrete/Wood Revetment	£3500 per m	Absorbs the energy of the waves. Over time the concrete or wood breaks up. Unsightly
Groynes	£10,000 each	Trap sand if there is any to trap. Steal sand 100m apart from beaches down drift increasing erosion
Beach nourishment	£3 per cubic m	Absorbs wave action. May need replacing
Rock Armour	£3500 per m	Absorbs wave action, expensive, May need replacing.
Gabion	£100 per m	Cheap. Strong and flexible, but rust easily, and not environmentally friendly.

## Conclusion

### FACTORS TO CONSIDER

1. Cost of the scheme and up keep costs
2. Benefits of the scheme e.g. homes, farmland, roads and lives
3. How effective is the scheme?
4. What effect will it have on other areas?
5. What will it look like?

As I am looking for a long term solution, In order to protect Overstrand I am going to use the following sea defenses , groynes and concrete revetment. Even though the concrete revetment may need replacing; it is still a pretty good sea defense. Also I chose groynes because tourists do not need to go down any stairs to the sea. These are more able to resist storm waves .

The sea defenses are going to be placed in different areas. Between Overstrand and Trimingham , which is all farmland groynes and concrete revetment is going to be placed there. Also between Overstrand and Cromer, concrete revetment and groynes is going to be placed. This is going to protect Overstrand and the farmland. Overall, the coast line is going to be protected with groynes and concrete revetment. The total cost for the two sea defenses will be £9,735,000.

I am using groynes and concrete revetment instead of the other sea defenses because , if I used concrete revetment and gabions they will not be good at protecting the cliffs as they are poor sea defenses, even though they are so cheap. So overall I have chosen two pretty good sea defenses.

As I am protecting the whole coastline, there will not be any knock on effects happening in other places.