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COASTAL MANAGEMENT – A NEW PERSPECTIVE

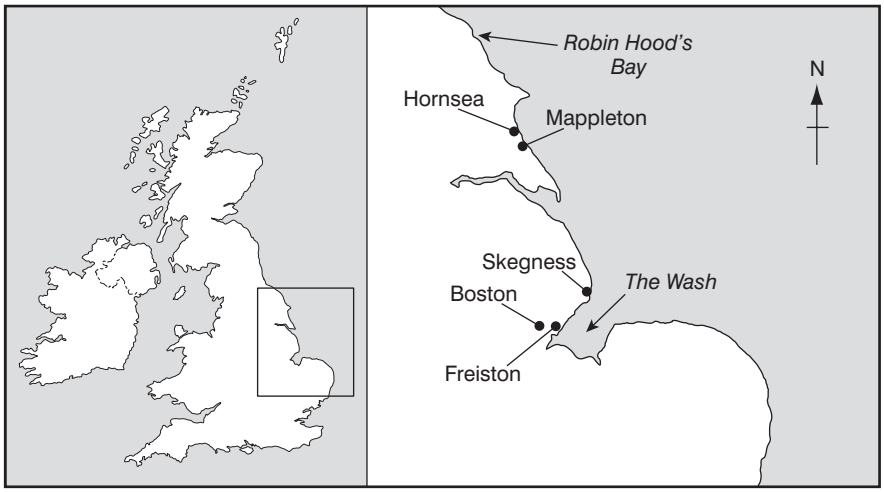
Coastal systems are dynamic – there is a constant process of change, in response to varying patterns of both erosion and deposition. Coastlines, in their natural state, maintain a state of **dynamic equilibrium** – responding and readjusting to both short- and long-term environmental changes. Human interference along the land–sea interface has long been the norm. The aim has been to manage and control, with a view to both developing and protecting land, infrastructure and property. However, such human activities – ranging from extracting sediment to reclaiming land, from disposing of waste to harnessing power – all have potentially far-reaching effects on the coastal system. Furthermore, in a world of contemporary climatic change, increasing both sea levels and the incidence of extreme weather events, deliberate intervention in the geomorphological workings of coastal systems has become ever more critical. As a consequence, the geographer's understanding of coastal geomorphology, and our potential for advisory application of this knowledge to, for example, engineering projects, is becoming ever more relevant.

Coastal management

Traditionally, the application of coastal geomorphology has taken the form of coastal management and the continuing evolution of coastal protection schemes. Unfortunately, however, such is the variety of interested parties concerned with coastal issues, that effective strategic planning is hard to implement. And yet, with such a large proportion of the world's population living, working and playing in the coastal zone, cohesive coastal management is essential.

Perhaps nowhere is this need better illustrated than along the eastern coastline of Britain. Both **isostatic sinking** and 'greenhouse' sea level rise conspire to make this coastal zone particularly vulnerable. Indeed, the Holderness coastline in Yorkshire, long recognised as Europe's fastest eroding, is now acknowledged as the world's fastest retreating coastal zone! Historically, coastal management schemes implemented by one authority have impacted neighbouring areas simply because there has been limited **strategic planning** and little understanding of natural processes. In recent years significant effort has been put into collaborative working (see *Coastal Management Today*).

Figure 1: Location map



The 1953 coastal floods

The fiftieth anniversary of the 'Great Storm' has just passed, once again raising public awareness of coastal management issues. On the night of January 31, 1953, a 'once-in-250-years' combination of events conspired to devastate vast areas of both south-eastern England and the Netherlands. Four key issues were of note:

- a particularly deep depression (low air pressure system) effectively pulled up the surface of the North Sea beneath it
- high spring tides raised the water level
- river discharges at flood levels added further volume
- 125-mph gale force winds funnelled the water southwards towards the narrow neck of the English Channel.

Coastal defences were swamped as seawater flooded both farmland and homes. Over 2,000 people lost their lives and, in England alone, damage totalling more than £5 billion in today's money was recorded.

Hard and soft coastal engineering

The public outcry from the loss of life and damage to both property and livelihoods in England and the Netherlands forced both governments to take action. In England, large sums of money were invested into rebuilding and strengthening existing sea defences. In effect, concrete and mortar were pitted against the relentless force of the North Sea (see Box 1). But in a conflict against nature, there can be only one winner. Many sea defences that were designed to have a life expectancy of between 30 and 50 years are now being repaired, upgraded or replaced. In other areas the sustainability of 'holding' the line of defence is being questioned, and new strategies being introduced.

More than three million people live in the 2,200 sq. km (1.5% of England's total land area) most at risk from coastal flooding. More than 25% of the region between the Humber and Thames lies below what the government describes as the 'flood risk level'. Faced with this predicament, government policy has turned towards alternative methods of coastal management and appeasement with the old enemy. Hard engineering has been replaced by soft coastal management schemes.

Coastal management today

Regardless of whether 'hard' or 'soft' engineering solutions to excessive erosion or regular flooding are adopted, controversial political

decisions have to be taken as to which stretches of coast to save, and which to abandon. In England and Wales, different organisations have responsibility for different areas. For example, Local Authorities take care of coastal protection (such as defending cliffs from erosion), and tourism amenities. The **Environment Agency** can provide flood defences for low lying coastal areas, and has a role in monitoring and ensuring the high quality of bathing waters. The one unifying organisation is **DEFRA**. This is the government department which 'sets the rules' for what defences will and will not be funded, and how they should be planned and designed. Referring back to the criticism implied earlier regarding past strategic planning, it has to be noted that defending one stretch of coast may accelerate erosion elsewhere (if the area further along is dependent for its protection on a supply of material carried by **longshore drift**). Severe erosion to the immediate south of both Hornsea and Mappleton, on the Holderness coast referred to earlier, illustrates this point dramatically. Furthermore, while **cost-benefit analysis** should be assumed to determine effectively which schemes to sanction, and which areas to leave unprotected, the criteria such analyses adopt inevitably remain subject to critical appraisal. For example, the rock armour defences of Mappleton, East Yorkshire, completed in the early 1990s using a combination of local, national and EU funding, were finally agreed following estimation of the cost of re-routing the threatened road linking Hornsea to Withernsea, rather than on the basis of domestic and agricultural vulnerability.

In recent years the different organisations outlined above, involved in managing coastal defences, have worked together and formed regional coastal groups. These meet regularly to discuss planned activities on the coast and to ensure that impacts on neighbouring beaches are taken into account and minimised where possible.

Managed realignment

In recent years one of the most significant political decisions regarding coastal protection in England and Wales has been the implementation of **managed realignment**. This has been in direct response to the accelerating costs and technical difficulty associated with

Box 1: Hard and Soft Engineering

Hard Engineering

Method	Effect	Advantages	Disadvantages
Groynes or breakwater fences	The repeated zigzag of swash and backwash piles sediment up against the windward side of each groyne.	Highly effective in a local context, such as in the maintenance of holiday beaches. (Should the beach become too uneven, this can be redistributed between the groynes, using earth-moving equipment, during the low season.)	Whilst relatively cost-effective to construct, they do require ongoing maintenance. Aesthetically questionable, although they have acquired a visual acceptance through longevity rather than design. Need for expensive hardwood timbers raises the question of sustainability.
Concrete sea walls and **revetments**. The former may also support promenades *E.g. Hornsea on the Holderness coast*	Massive barriers both absorb and reflect wave energy. Recurved wall designs turn waves back on themselves.	Effective property defence in high-risk locations. *E.g. Robin Hood's Bay, North Yorkshire.*	Very expensive to both build and maintain. By deflecting waves, rather than dissipating their energy, concrete sea walls most notably, whether recurved or flat faced, are prone to relatively rapid erosion.
Rock armour (rip-rap) *E.g. Hornsea promenade and the neighbouring village of Mappleton*	Blocks of hard resistant rock (such as granite or other igneous rock) are laid at the foot of vulnerable cliffs and used to dissipate wave energy.	Relatively cheaper than concrete constructions.	Rock armour traps flotsam and jetsam leading to both smell and rat infestation. Presents a potential public safety issue as a tripping and trapping hazard.
Gabions *E.g. 'Mattress' construction topping the beach crest at Chiswell, Dorset.*	Metal cages filled with beach cobbles and pebbles both reflect and absorb wave energy.	Cheaper again.	Unsightly and prone to cage weathering (rusting).

Soft Engineering

Method	Effect	Advantages	Disadvantages
Beach nourishment *E.g. Mablethorpe to Skegness, Lincolnshire, 1990s onwards.*	Sand, shingle and coastal sediments are added to the beach from elsewhere. Pumping from the offshore zone is not uncommon.	Aesthetically pleasing. Arguably essential in supporting the tourist industry.	Any such scheme requires expensive annual replenishment to compensate for continued erosion and drifting.
Managed realignment	*Controlled* erosion of the coastline is allowed to occur. However, it does not always lead to erosion. Eg. Inundation and accretion (such as saltmarsh creation) can decrease erosion of defences.	The potential for estuary tidal reduction has been noted but not proven.	Politically sensitive, given loss of land and/or property.
Planting marram grass and osier hedges	Roots help to both stabilise and hold the soil together.	Aesthetically pleasing.	Requires protection from trampling until established fully.

both implementing and maintaining the engineering solutions described above. This is part of a wider integrated policy towards the management of our coastlines.

Managed realignment is 'identifying a new line of defence and, where appropriate, constructing new defences landwards of the original defences.' (DEFRA, 2001) It is, in effect, promoting a natural realignment of coastal zones. This can be achieved by breaching existing sea walls, or ceasing maintenance of beaches. It can also create inter-tidal habitats which both provide more natural flood defences and are valuable for coastal biodiversity.

Case study: Freiston Shore, Boston

Freiston Shore, east of Boston in Lincolnshire, one of many realignment sites, illustrates this approach particularly effectively (Figures 1, 2 and 3).

Just over 50 years on from the dramatic events of 1953, Freiston Shore has become the latest sea defence to protect this stretch of the Lincolnshire coast. It is rather ironic that the county which first experienced the fatal flooding and destructive power of the Great Storm's 125mph winds should also be one of the first to break down its coastal defences and invite the sea waters to return.

At Freiston Shore three 50 metre breaches have been cut (in summer 2002) into the outer sea bank, allowing salt water from the Wash to encroach on 78 hectares of farmland owned by the **RSPB**. Over the last decade, managed realignment has been applied to eight sites around England and Wales, but what makes Freiston Shore unique is the scale of the development – it is the largest of its kind in the UK.

The realignment, part of the 8km Wash Banks flood defence scheme, cost nearly £1.2m, including £789,877 of EU funding. The new Freiston Shore Nature Reserve created here covers 773 ha and includes:

- a 78 ha 'realignment' area
- a 12 ha lagoon (used to source material for the flood defence works)
- 683 ha of inter-tidal habitat.

Sea defences are crucial on this stretch of the Lincolnshire coastline, with much of the land lying below mean high water spring tide. Over centuries, earth embankments have been constructed to provide coastal defences and so enable salt marshes to be reclaimed from the North Sea. The consequence today is that this stretch of the Wash is 3 metres or more below surge tide levels, and ageing defences are struggling to keep the land dry. The **Wash Shoreline Management Plan** (1996) has attempted to balance the economic merits of strengthening the existing sea defences with the needs of the local population and landowners. The **Environment Agency** did this in the Flood Defence Strategy. This examined each defence option for technical and environmental merit. Subsequently an environmental assessment was undertaken for the chosen option following cost benefit analysis.

The managed realignment at Freiston Shore attempts to combine the need for improved coastal defences with a desire to work with the natural processes involved. It is an attempt to combat the problem of **coastal squeeze** whilst providing a **sustainable** method of coastal sea defence.

Sea water entering through the truncated embankments is allowed to flow much further inland. The resultant salt marsh shallows kill the energy of the waves, thereby both reducing erosive power and lessening the potential damage that may be caused in the event of future storm events.

There are many beneficiaries of the 'soft' defences at Freiston Shore. Many birds, such as dark-bellied Brent geese, feed on the salt marsh in the winter months, whilst species such as redshanks use the area for breeding. Last year 17 pairs of avocets nested at the site – this had not happened in Lincolnshire for over 100 years. Birds of prey, including short eared owls, hunt over the salt marsh throughout the year. Aside from these obvious environmental gains, there are a number of spin-off or **multiplier effects** associated with the scheme. Access to this otherwise isolated stretch of coastline has been improved, facilitating an economic gain. The construction of car parks, a cycle route and bird hide has

Figure 2: Freiston Shore

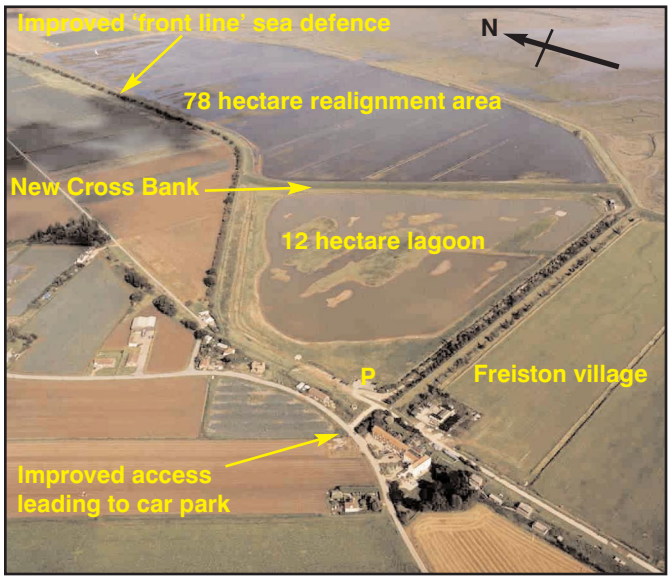


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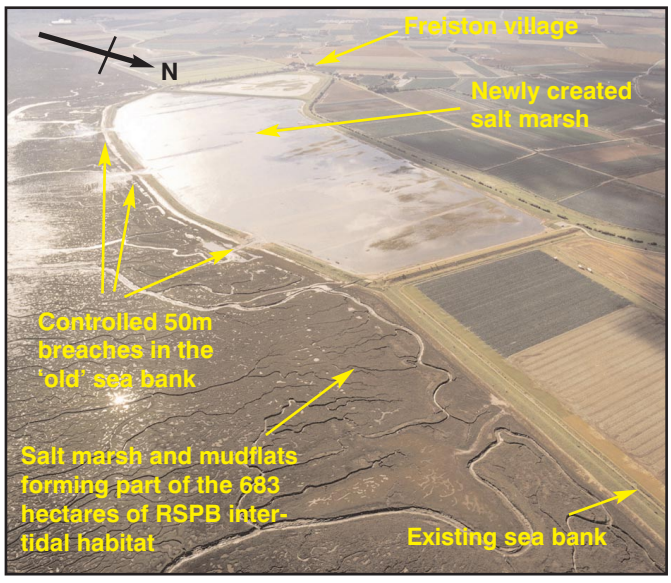
Figure 3: The southernmost breach at Freiston Shore



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encouraged a growth in tourism with numbers increased by several thousand. The educational value of this site has also been realised, with the appointment of two RSPB officers and a community art project established.

Managed realignment, however, is not without its critics. Cynics may argue that it is easy to make decisions on coastal management when the potential consequences of failure are debateable. In this case, the land was purchased from HM Prison North Sea Camp. Whilst the economic value of the agricultural land cannot be underestimated, an area of extended settlement is not at risk. Bricks and mortar are far more costly and difficult to maintain – and tax payers are far more difficult to appease than apolitical prison inmates!

In conclusion coastal management is becoming much more than the provision of sea defences. Global warming should act as a reminder that we live in a fragile and largely unpredictable world where nature ultimately has the final word. Schemes such as the managed retreat at Freiston Shore show that we can work with the natural processes that shape our earth, rather than fight a long, costly and often unforgiving battle.

Glossary

Coastal squeeze Valuable salt marsh and mud flat are lost as a result of the simultaneous rise in sea levels and the construction of hard coastal defences to combat the threat. Habitats cannot migrate landwards as sea levels rise, so they are 'squeezed' out.

Cost-benefit analysis An exercise to balance the economic costs of a proposal (strengthening existing sea defences in the case of Freiston Shore) with the benefits of defending the local population and land, infrastructure, industry and so on.

Dynamic equilibrium Used to describe a system that is in a state of balance. If an outside influence upsets this balance then this may result in significant knock-on effects. For example, in coastal systems the construction of sea defences, such as groynes, may increase the rate of erosion elsewhere in the system.

Environment Agency Government agency with powers to provide flood defences.

DEFRA (Department for the Environment, Food and Rural Affairs) Government department with responsibility for providing policy, guidance and funding for provision of coastal defences.

Hard engineering A series of traditional methods of coastal defence that tend to work against natural systems. Man-made structures are erected to either absorb or reflect wave energy.

IPPC Integrated Pollution Prevention and Control.

Isostatic sinking The relative sinking of the land (eg in South and East England) compared to sea level as a result of movements in the crust in response to the last Ice Age.

Longshore drift The zigzag movement of beach material along a coastline.

Managed realignment The identification of a new line of defence. Where appropriate new defences are constructed inland of the original.

Multiplier effects The acknowledgement that one (economic) activity usually triggers off further economic activities nearby. The Freiston Shore development has seen conservation and economic gains. This is a result of increased numbers of tourists visiting the site and contributing to the local economy.

RSPB Royal Society for the Protection of Birds.

Shoreline Management Plan (SMP) A high level policy document produced in partnership between the Environment Agency, local government authorities and others to coordinate coastal planning. Each SMP is based on a self-contained, geographical unit called a sediment cell, of which there are eleven around the coastline of England and Wales. They examine coastal processes and land use and produce a policy (eg. 'hold the line', 'managed realignment') for the entire coastline.

Strategic planning The second 'tier' of management plan which takes a closer look at the costs and benefits of doing works along the coast. It produces the details of how the coast will be held, or realigned.

Soft engineering A method of coastal defence that works alongside the coastal system. This may involve the planned break-up of hard engineering structures, in order to allow 'nature to take its course'.

Sustainable A widely used term that attempts to make a link between the level of resource usage today and the need to balance this with the demands of future generations. Sustainable coastal management strategies do not damage fragile coastal ecosystems, while in the long term are both practical and cost effective.

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Focus Questions

1. List the reasons why an (integrated) method of coastal management is needed in the UK today.

2. *'The effects of the 1953 Great Storm were particularly devastating because the authorities were not prepared.'*
When managing hazards such as flood events, is prediction or prevention the best course of action? Illustrate your answer by referring to the East Coast of England.

3. *'Coastal management involves the balancing of many physical, environmental, economic and social considerations. It is an example of a* ***conflict of interests****, where balancing one consideration may be in conflict or at odds with another.'*
Using Figures 1, 2 and 3, and Box 1 as a guide, outline a coastal management plan for the Wash Banks area. Identify the method/s of coastal protection used and the short- and long-term effects that this may have on the area. You should consider not only the reasons behind the approach adopted, but also the attitudes of those it may affect.