MONITORING THE COAST FOR FLOOD DEFENCE

NRA

National Rivers Authority
Anglian Region

The regional monitoring programme covers the entire Anglian region from the Humber estuary in the north to the Thames Estuary in the south and includes the following components:

1. Beach survey
2. Survey of the seabed
3. Aerial photography
4. Inspections of defences and beaches
5. Wind, waves and water levels

Beach survey

An initial beach survey took place in 1989. This has been followed by a continuous study which commenced in the summer of 1991. This takes place twice a year, in January/February and in July/August. A cross-section is taken every one kilometre along the coast. For some locations where engineering schemes are being undertaken more detailed information is required. In these areas, the spacing has been reduced to every 100 metres along the coast.

These cross-sections consist of a string of survey points extending seaward down the beach. Permanent ground markers have been established on the first line of defence to indicate the starting position. The cross-sections are surveyed from landward of the first line of defence to the low-water mark. This is carried out on a specified bearing to ensure that the same section of beach is surveyed on subsequent years. At each survey point, the height of the beach is recorded.

The continual record of survey data provides a record of how the beach has altered over time. Furthermore, it allows calculation of how much material has been gained or lost from the beach.

Each profile is permanently marked on the first line of defence.

Survey of the seabed

Similar to the beach survey the sea bed information is collected at the one kilometre intervals. Using the ground markers and the angle specified for the beach survey, the monitoring of the seabed continues where the beach survey terminates. This gives a continuous record of data covering the beach and extending approximately two to three kilometres offshore.

Survey vessels record the level of the sea bed.

A boat equipped with an echo sounder is utilised to ascertain the level of the seabed. As a consequence the information can only be gathered in the summer when weather conditions are more favourable. Due to the length of the survey lines, only a portion of the region is surveyed every year. The same stretch of coastline is repeated every fifth year.

Like the beach data, this information allows the changes on the seabed to be detected and identifies areas of accumulation and erosion.

Aerial survey

The aerial survey is flown annually across the whole of the region's coastline. This is performed in July/August to coincide with the beach monitoring. Additionally, at this time of year, exceptionally low tides are experienced. Flights are therefore, scheduled for these periods of low-tide since a larger area of beach is exposed from the sea. Each year, approximately 1500 photographs are taken.

Aerial survey provides a birds-eye view of the coast.

These are stereoscopic pairs which can be viewed as 3-dimensional images. The aerial photographs are, therefore, useful simply to view the coastline. A further benefit of the photography, is to map large scale features such as spits and bars. Once more, the changes that take place can be recognised.

Inspections of defences and beach

These inspections are taken simultaneously during April and again at September. Every length of defence along the region is examined. Details are recorded of the condition of the structure and the state of the beach immediately in front of the defence. For the beach inspection, the type of material along the beach is noted. Additionally, measurements are taken to determine the height of defences above the beach.

Inspections cover both natural beach ridges and man-made structures.

The inspections provide information from which to update existing details of the coastal structures. This alerts the NRA to potential problems with the defences. The measurements from the beach to the top of the defence indicate if there is any likelihood of the defence being undermined below beach level. Additionally, inspections identify those defences that are in a poor condition and need repair or replacement.

Wind, waves and water levels

The NRA has its own monitoring stations distributed throughout the region. These mainly collect water level data, but some also record wind and wave statistics. The water level information is an important factor in the design of a defence ie. the defence must be high enough to avoid overtopping. The data also illustrates how the level of the water changes through the tidal cycle. Furthermore, it indictates the nature of the tidal currents that are generated.

Supplementary information is acquired from other organisations which gather data relevant to the NRA's work. Additional water level records are obtained from Proudman Oceanographic Laboratory. From the Met. Office, wind and wave statistics are obtained. Knowledge of the wave heights, frequency, energy and direction are all significant components of engineering design.

Information on wind, waves and tidal currents is critical in identifying how these natural processes move sediment around the coastline and they enable predictions of future changes to be made.

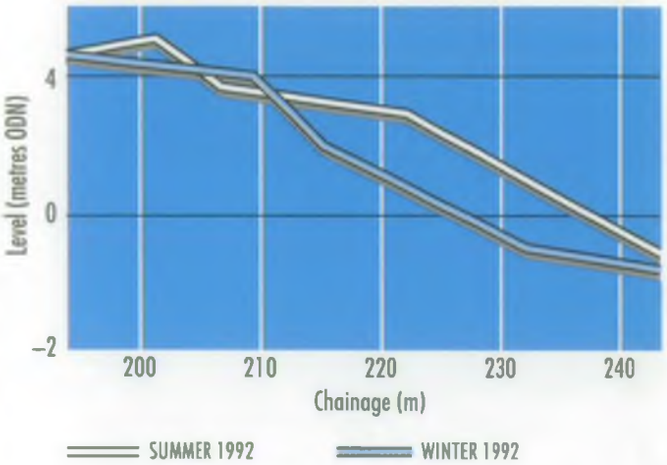
GIS

The data collected is stored on a computerised database known as a Geographical Information System (GIS). This not only stores the database information but creates computerised maps. These graphics are linked to the associated information in the database. Hence, it is possible to select a point on the map and retrieve the data tables related to it. For instance, a cross-section on the map can be chosen and its length, the marker's position and height will be displayed. Similarly, the locations of each photograph in the Aerial Survey are mapped. The GIS allows a particular location to be chosen and produces facts about that photograph, such as the date it was flown and where the hardcopy photograph is stored. This enables efficient retrieval of the relevant photograph(s) from the 1500 or so, that are taken each year.

Not only does the GIS store and retrieve the large volume of information, but it is also used to analyse the data. For instance, it has been programmed to display a graph (profile) of the beach and seabed cross-sections. It is possible to display more than one year's survey data on the same graph and allow a direct comparison of the changes that have taken place.

A more sophisticated approach is to generate a 3-dimensional surface from the cross-section data. This allows contour maps to be produced and aids in visualising the character of the beach and seabed. Furthermore, by comparing the data from two different surveys it is possible to calculate the change in volume (ie. how much material has been lost from the beach or how much has been gained). Maps are produced to show these areas of erosion and accumulation

BEACH PROFILE CHANGE AT BENACRE NESS, SUFFOLK



Shoreline Management

Overall, the monitoring programme is designed to identify the changes affecting the coastline by maintaining an on-going examination of the region. The role of the GIS is to store and retrieve the large volume of data that is gathered. Moreover, it is employed to analyse this data. This produces additional information which is utilised for shoreline management strategies. This can be achieved as the information that is generated gives an insight into the natural processes such as tides, wind and wave action, that are operating along the coast. By being aware of these processes, the outcome of constructing a proposed defence may be predicted. Also, when a coastal defence is designed, the way in which natural forces are influencing the coast can be considered. This enables "soft engineering" approaches such as beach recharge to be considered. In so doing, it is possible to build a defence which will be more effective and sympathetic with natural processes.

GIS enables rapid data retrieval and analysis.

Beach recharge in progress.

Published by the Public Relations Department of the National Rivers Authority, Anglian Region, Kingfisher House, Orton Goldhay, Peterborough PE2 5ZR. Telephone (0733) 371811.

P27/3/93