# Section 5

# FUTURE DEVELOPMENT

HALCROW

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# THE SHORELINE MANAGEMENT PLAN

## SUBCELL 3C

## LOWESTOFT TO HARWICH

## SECTION 5

## FUTURE DEVELOPMENT

## CONTENTS

# 1 GENERAL

This Shoreline Management Plan (SMP) contains the coastal defence policies that will be adopted at the present time. However, this SMP is a 'live document' and must be capable of change. Such change may arise through new planning requirements, a change in environmental factors, or from improved understanding of the natural processes influencing the evolution of the coast. This section largely deals with the last, identifying what needs to be considered next to facilitate more informed decision making in the future.

# 2 MONITORING

## 2.1 Introduction

Monitoring of the coastline and the natural processes influencing it is fundamental to future understanding and hence planning the management of the shoreline. Traditionally monitoring has been carried out on a ad-hoc basis in many areas without a structured monitoring strategy in place. However, in the past decade the need for monitoring programmes has been recognised and these are gradually being implemented where funding allows. The issue of funding monitoring is an important one. The relatively small costs of undertaking monitoring can be offset in the longer term, allowing better informed decisions on coastal defence to be made and enable more cost effective design of appropriate defence works. The information obtained from regular monitoring also provides for action levels to be established. With the tools available it is also possible to compare parameters and analyse trends to predict excedence thresholds, eg the beach level which presents a risk of failure to a seawall structure.

There are a number of elements to be considered in any monitoring programme, based upon what needs to be known and how it can be established. The basic needs relate to the condition of the defence itself (including beaches) and any likely change to that condition in the future. The latter will be influenced by many factors including natural forcing conditions, sediment supply and human intervention.

## 2.2 Existing Monitoring

There is already a comprehensive monitoring programme in place on this coastline, undertaken by the EA and held as part of their Shoreline Management System. This includes the following:

- bi-annual beach profile surveys at 1 kilometre spacing throughout the sub-cell (commenced in 1991);
- 5 yearly bathymetric profile surveys at 1 kilometre spacing throughout the sub-cell (commenced in 1991);
- asset and condition survey of all flood defences within the sub-cell, carried out in 1990;
- annual aerial photographs of the entire sub-cell (commenced in 1991);
- water level gauges (EA Telemetered gauges).

In addition to the above, other existing monitoring and available data includes:

- asset and condition survey of all other coastal defences within the sub-cell, carried out in 1993 for MAFF, and updated regularly;
- 3 hourly offshore wave records (hindcast from winds) purchased from the Met Office annually and used to establish inshore conditions at specific locations;

- Proudman water level data (Oceanographic Class A);
- hourly water levels recorded at Lowestoft and Harwich which can be used to estimate water levels at intermediate positions;
- additional bi-annual beach profiles at various locations;
- monitoring of inshore wave conditions at Felixstowe.

## 2.3 Future Monitoring

### 2.3.1 Introduction

Whilst the existing monitoring and data collection is excellent, it is recommended that further information is gathered to provide the level of detail required to manage the shoreline in this sub-cell effectively. A number of requirements are location specific, relating to the problems experienced locally or a need for more detailed knowledge. Examples of this include the need for groundwater monitoring on certain sections of cliff where groundwater flows are a major contributor to coastal cliff instability, or close centred and regular beach profile surveys where the strategy requires a detailed understanding of local trends at a precise location. These specific additional requirements are presented in the relevant Management Unit Statements. However, there are more general requirements which apply throughout the sub-cell and are presented below.

### 2.3.2 Beach Profile Surveys

Beaches provide the natural form of defence but are often very vulnerable. A long term comprehensive set of beach profiles is essential for developing an understanding of beach behaviour and continued effectiveness. **The present monitoring strategy, surveying profiles at 1 kilometre intervals twice a year** (ie summer and winter profiles), **is essential and should be continued. These should be supplemented with additional beach profiles where site specific conditions or concerns require.**

### 2.3.3 Storm Response Surveys

There is over most of this coastline a fairly constant annual erosion. This total volume of eroding material often results from a number of distinct storms. It is of considerable value to our knowledge if the effect of each storm is recorded as soon as possible after the event. This enables understanding of the range of movement of beaches and their immediate change of profile before calmer weather either partially reinstates the loss or moves eroded material into other areas. **It is recommended that the immediate effects of storms are closely monitored where and whenever possible.**

### 2.3.4 Bathymetric Profile Surveys

The bathymetry of the nearshore zone influences wave activity and hence the exposure of the coastline through its shape, steepness and other features such as banks. On this coastline which is largely in retreat, any change in the nearshore zone needs to be known and understood, particularly when the long term sustainability of stabilised areas is being considered. The frequency of 5

years between surveys is too long on this sensitive coastline and **it is recommended that initially these surveys should be conducted every 2 or 3 years at the present 1 kilometre intervals.** The present seaward boundary of the survey is approx 2km offshore. This is adequate for a coastline survey. However if the coastal zone was the subject of study a wider ranging survey to include the offshore banks would yield much useful information.

2.3.5 Defence Condition Surveys

The monitoring of defence structures is important to assess risk of failure and enable adequate measures to be implemented. **It is important that the condition of these defences is assessed annually (or bi-annually when the condition is less than fair)**. It is also important that, where possible, the cause of any damage or deterioration is recorded. A programme for regular physical surveying of any structures in addition to the beaches is recommended to assess deformations or settlements. A regular photographic record along the coastline is recommended for monitoring purposes. Inspections should also note the general condition of the beaches and an estimate of the beach material size.

2.3.6 Wave Conditions

Wave forces on this coastline generate sediment supply, through erosion of cliffs, beaches and sea bed. They move sediment through the sub-cell as they break on the beaches and they cause most damage through impacting upon structures, overtopping defences and removing materials from beaches. Consequently a knowledge and understanding of wave conditions is vital to defence management. The wave records currently obtained from the Met Office should be continued, although these are offshore and it is the conditions at the shoreline which are important. There are presently a number of wave transformation points set up on this shoreline to maintain a data record inshore. If the number of inshore points better understanding of variations in conditions would result. **An increase in the present coverage is recommended**.

2.3.7 Video Surveys

**It is recommended that in addition to the manipulation of offshore wave records to produce inshore wave climate, a qualitative assessment of wave conditions should be carried out using video records of storms.** These visual records should be linked to a time record and should include reference points within the visual record by which to gauge wave height. This will form a useful supplementary record to calculated storm wave heights.

2.3.8 Water Level Conditions

Water levels are a dominant factor in determining the risk to defences, on this coastline because of particularly due to the large surges which can, and have, occurred. A knowledge and understanding of these is therefore essential. The recording of water levels is carried out independently of the monitoring undertaken as part of the Authorities programmes. **It is recommended that the purchase of this data be continued for the primary recording stations and then interpolated for each section of the sub-cell coastline.** The tidal levels around this coastline do vary substantially.

### 2.3.9 Tidal Currents

There is no technical advantage in monitoring the general tidal currents along the open coast once the spring and neap ranges have been established. Surges will increase the current velocities particularly when they occur during a tidal cycle but the effects can be estimated from already established data. Nevertheless, there are considerable variations set up locally, especially at the mouths of the estuaries. Consequently, current velocities should be captured when opportunities arise to assist with the interpretation of other data sets that may help in the quantification of sediment movements.

### 2.3.10 Other Considerations

The implementation of a monitoring strategy also needs a suitable medium for storing and handling the volume data which will be generated. It is also important that the data can be interlinked in its digital state, to enable any relationships and impacts to be assessed. Consequently a medium which is able to accommodate all of the various data acquired through the monitoring process is advantageous. Throughout this study Halcrow have used their Shoreline and Nearshore Data System, (SANDS) to store and manipulate gathered data. It is advantageous for the future management of the coastline that Suffolk CDC and Waveney DC continue to operate this system. This will enable cost effective management of data and exchange of data between the parties.

# 3 FURTHER STUDIES AND DATA REQUIREMENTS

## 3.1 Introduction

An important aspect of the SMP development is the identification of gaps in knowledge of the coast and the investigation of research studies or data acquisition that should be carried out to enable better informed decision making in the future. Those areas that need to be considered at the present time are detailed below. It should be noted that these are requirements for the whole sub-cell and should be supplemented by the undertaking of location specific studies to appraise schemes.

## 3.2 Further Studies

The following studies should be closely interrogated.

### 3.2.1 Analysis of Sedimentology

The cliffs within the sub-cell are believed to contribute a significant source of fine sediment. An analysis of the content of the cliffs and its relationship with other littoral materials may yield information about the destination of sediment supply. The contribution of groundwater in the failure mechanism should also be investigated.

The erosion of cliffs is not generally a gradual progression. Often it is linked to individual storm events. **It is recommended that an analysis be made of the volumetric losses from cliffs following storms and correlated to areas of deposition.**

### 3.2.2 Offshore Banks

The sandbanks which lie offshore of the Norfolk and Suffolk coast are known to be significant in shoreline development. However, whilst bank development is believed to be understood, their direct implications for specific shoreline locations are not well known and the shoreline impact of changes to these banks is not sufficiently understood. **It is therefore considered essential to future shoreline management that research into the onshore-offshore interaction is carried out.** There are two interlinked topics which need to be addressed.

First, whilst it is known that sediment exchange occurs between the shoreline and the offshore areas, it is not clear how, and importantly where, this occurs. It is essential to know if material is transported onshore within any particular unit and also exactly where material is transported offshore. This requires a detailed examination of nearshore processes and sediment movements. It is understood that the first phase of the present Southern North Sea Sediment Study is not addressing this location specific issue of shoreline-bank interaction. This should be addressed in a future stage of the study.

There are also theories on the influence of nesses upon sediment exchange. Further studies on ness development are recommended, to address this important issue.

The second topic relates to the local concern about dredging from the offshore banks and the impact on the shoreline of any change to the banks. In addition to the shoreline sediment supply which may come from offshore, it has been shown by past studies that the banks have a significant impact upon the adjacent shoreline particularly between Lowestoft and Thorpeness. They are highly influential on waves, currents and sediment supply in the area and consequently the natural development and degree of exposure of the shoreline. Consequently any changes to these banks must be considered with extreme caution. It is understood that The North Sea Sediment Study will examine the effects of these changes.

### 3.2.3 Shoreline Sediment Budget

A considerable amount of study has been conducted in the past into the processes occurring on this coast. Work was undertaken during the 1970's by the University of East Anglia to establish a sediment budget. Since that time the data available and computational ability have advanced considerably and a reappraisal of the transport processes and the sediment budget is warranted. This is extremely important to strategic development and should be undertaken prior to further review of the strategy.

The significant source of sediment is from the erosion of cliffs and the North Sea Bed (including the foreshore platforms). The quantity of material available from these would be determined from the initial proposal made in 3.1.1 above. If available, the study proposed in 3.1.2 could supplement this. As part of this SMP development the sediment transport potential has been assessed at 9 inshore locations by analysing wave energies. This provided a regional description of the shoreline sediment processes to develop an appropriate strategy.

A more comprehensive understanding of sediment transport rates would be advantageous and would also benefit future development of the schemes to implement the strategy. This would be facilitated by carrying out more local wave transformations from offshore data to points on the shoreline at close intervals, say every 1 kilometre. Then using the same computer software as already employed by most of the Authorities for handling monitoring data (SANDS), both longshore and on-offshore wave energy can be computed, and updated as new offshore data is obtained. However, this provides only the potential for sediment movement to be determined and **it is strongly recommended that this is improved upon by establishing actual sediment transport rates throughout the sub-cell.** These will be dependent upon the type and size of material and the profile of the beach.

By establishing the wave climate at 1 kilometre intervals or so, these locations can correspond with the beach and bathymetric profiles obtained from existing and future monitoring. Furthermore, **it has been recommended that future monitoring includes a general (approximate) assessment of beach sediments.** Relatively straightforward transport modelling can be applied to utilise these pieces of information to obtain longshore transport rates (both in the foreshore zone and nearshore), together with onshore and offshore transport rates. The benefit of the approach recommended here is an extremely comprehensive understanding of shoreline processes, and also the link between the analysis and the software system used for handling monitoring data. This

enables the sediment budget to be updated as and when required using the latest information.

### 3.3 Additional Data

Whilst there is a considerable amount of data for this sub-cell which is continually being supplemented by monitoring, further data could be obtained to facilitate better understanding and improve the design of schemes.

One example of this is tidal currents close to the shore. Whilst waves are understood to be one of the dominant processes in sediment transport, currents are also influential locally, particularly where beach control structures are considered. **The current field has been modelled on a regional scale, however this knowledge should be considerably improved by 28 day current measurement at a number of inshore positions along the coast.** Current measurement in the vicinity of the nesses would indicate any local variance. Repeated measurement would bring little benefit as already stated.

Mud tide sampling of beach material would eventually form a useful record of any changes over time. To undertake more extensive sampling would not be appropriate except in conjunction with specific shoreline modelling.

Also of use would be the obtaining of all records of waves, winds and water levels that can be made available, including those that can be generated historically by the Met Office and POL. This will facilitate and greatly improve the accuracy of extremes analysis which can be undertaken for any inshore locations during design studies. The cost of commissioning future studies would be reduced by this approach as data purchase costs could be reduced, particularly if the initial data purchase cost is shared by the authorities.

Finally to enhance the creditability of coastal defence planning and strategic option selection, it is recommended in future updates of the SMP that new linework is generated or purchased from existing maps/photography. This should outline the 5m AOD topographic contour to assist and enhance knowledge of low land at risk to flooding (representing the 1:200 year water level for Felixstowe : the maximum for the subcell). This information is vitally important in defining the inland limit of land at risk to flooding during the cost benefit appraisals for the SMP.

### 3.4 Other Considerations

The implications of positively encouraging erosion in particular locations may result in the loss of property. The legal implications of this are yet to be tested, however it does appear possible that compensation issues will arise. **It is recommended that both the legal and compensation issues are examined.**

Another issue that requires further examination is the benefit-cost appraisal methods that are currently applied by MAFF. The SMP guidelines refer to establishing discrete benefits relating to individual Management Units which appears contrary to the principles of an SMP to take account of the wider area. It is also necessary to consider the appraisal of schemes in non-economic terms, again in keeping with the principles of the SMP to consider the wider issues, not simply the value of land protected.

## 3.5 Summary of General Studies and Recommendations for Subcell 3c

1 The essential biannual beach profile surveys at 1km intervals should be supplemented with additional beach profiles where site specific conditions or concerns require.

2. The frequency of bathymetric profile surveys should be increased to 2 or 3 year intervals.

3. The number of inshore wave transformation points along the coastline should be increased.

4. The purchase of water level data for the primary recording stations should be continued and interpolations made for each section of the sub-cell coastline.

5. Video record of storm conditions at vulnerable points on the coast should be undertaken.

6. Storm Response surveys should be undertaken to monitor the movement of eroded material after a storm.

7. Tidal currents should be measured once along the coastline and thereafter in connection with new structures, or unusual conditions, as required.

8. Research into sediment movement between the offshore banks and the coastline should be undertaken to establish dependencies.

9. Sediment budget and transport rates should be established throughout the sub-cell.

10. Future monitoring should include a general assessment of beach sediment.

11. 28 day current measurement should be undertaken at a number of locations along the sub-cell coast.

12. Digital 5m AOD contain should be purchased from Ordnance Survey to clarify existing positions of flood zones within the subcell.

13. The legal and compensation issues regarding loss of coastal property should be examined.

14. The existing team of coastal management authorities should continue to meet and liaise after completion of this study.

These represent general studies for the subcell. Site specific studies are presented elsewhere within the SMP for individual management units.

# 4 STAGE 3 DEVELOPMENT

The next stage of the shoreline management procedure is the development of strategies for the policies presented in the SMP. Outline guidance on how the preferred generic coastal defence options should be implemented are presented in each of the Management Unit statements. Stage 3 should take this guidance further, developing outline concepts for the nature of works to be undertaken, producing broad cost estimates for them and establishing a programme of works.

Whilst this stage will be conducted separately by each Authority, it will be important to liaise on the implementation programme. **It is recommended that the existing team meet on a regular basis after completion of the SMP in order to maintain the flow of information between neighbouring Authorities.** An important contribution to the work of the team would be made if the EA operations engineers attended so that capital and maintenance schemes could be coordinated. This will help to avoid operations which may be to the detriment of others in the shorter term (eg stabilising beaches could have a short term downdrift impact until an equilibrium state is reached),and increase the awareness of the operations of others. This could lead to overall benefit and result in lower cost defences in the future (eg increasing sediment supply from cliffs producing higher beaches elsewhere).

Finally, it is important to recognise the need to conduct appropriate studies when developing the outline concepts beyond Stage 3, ensuring that the local processes are fully understood as well as the broader ones. The monitoring to be undertaken will be of great significance in enabling this.

## 5 REVIEW AND UPDATING OF THE SHORELINE MANAGEMENT PLAN

As stated previously, this SMP contains the coastal defence policies that will be implemented at the present time. However, this SMP is a 'live document' and must be capable of change. This concept will ensure that new information, such as that resulting from the additional studies or future monitoring described, as well as any future changes in planning policy or environmental needs can be incorporated into the SMP. Of particular note is the production of the Suffolk Tidal Rivers Shoreline Management Plan which is to be finalised after acceptance of the adopted SMP for Subcell 3c. It is important that both non-statutory plans inter-relate and that results from one plan are disseminated into the other to ensure a holistic management approach is adopted for Suffolks open coast and estuaries.

These factors may necessitate a change in coastal defence strategy, however it would be inappropriate to have a continuous review and change to the strategy. The approach therefore must be one by which the new information can be incorporated and the implications of this upon the present strategy assessed. This would be collated and a strategy review undertaken at specified intervals. A maximum time span of 5 years between such reviews is recommended. Notwithstanding this, the format of this SMP is such that if circumstances dictate, a review to enable a strategic change in defence policy could be implemented at any time.

The proposed time frame will allow the monitoring recommendations to be implemented and the further studies to be carried out prior to updating the SMP. As such studies are completed, it is recommended that this information is appended to, or referenced within the SMP.

Ultimately the responsibility for updating and reviewing the SMP lies with the Authorities involved and close co-operation is necessary. It is important that new information is shared and that each Authority maintains an up to date SMP to avoid a number of different versions existing. This may be best achieved by nominating one Authority as a central co-ordinator with overall responsibility for maintaining the SMP, or appointing an independent party to fulfill this role. The original client group should be encouraged to meet regularly and review the updates in the SMP.

Finally, there has been public consultation throughout the development of this SMP to develop awareness and seek comment. This consultation should be continued and the SMP could be seen as the vehicle to facilitate public involvement in coastal development in the future.