



Hydraulics Research
Wallingford

REVIEW OF THE USE OF SALTINGS
IN COASTAL DEFENCE

Report No SR 170
March 1988

Registered Office: Hydraulics Research Limited,
Wallingford, Oxfordshire OX10 8BA.
Telephone: 0491 35381. Telex: 848552

ABSTRACT

This short report is intended as an update to the HR Report No SR 109 of April 1987.

It concentrates chiefly on those areas of the south and southeast where the problems of saltings recession and the consequent likelihood of land loss or inundation were found to be most acute.

The review also notes and considers the findings of a meeting held in March 1988 to look at ways and means of conducting a multi-disciplinary research programme to study the problem of recession and how best it can be tackled.

Prepared for the Ministry of Agriculture, Fisheries and Food, this report was written within the research commission project CSA 1299. The departmental project officer is Mr A J Allison, while the company's nominated project officer is Dr S W Huntington.

For further information on this report, please contact Mr J Welsby, Coastal Processes Section, Coastal Engineering Group, Maritime Engineering Department.

CONTENTS

	Page
1 INTRODUCTION	1
2 THE EAST COAST	3
2.1 The Wash	3
2.2 The Essex Coast	5
2.3 The Kent Coast	11
3 THE SOUTH COAST	13
3.1 The Sussex Coast	13
3.2 The Hampshire Coast	13
4 CONCLUSIONS	16
5 ACKNOWLEDGEMENTS	20
6 REFERENCES	21

FIGURES

1. Typical brushwood groyne construction
2. Proposed polders - Mersea Island
3. Artificial seaweed placement
4. Proposed multiple polders - Horsey Island
5. Lymington area profile plan
6. Lymington beach profile - Station 124
7. Lymington beach profile - Station 128
8. Lymington beach profile - Station 142
9. Lymington beach profile - Station 149
10. Lymington beach profile - Station 151
11. Lymington beach profile - Station 153
12. The Wash (west) reclamation between 1950's and 1970's
13. The Wash (south) reclamation between 1950's and 1970's
14. The Wash (east) reclamation between 1950's and 1970's
15. The Medway Marshes

Note: Figures 2,4,12,13 & 14 are reproduced from Ordnance Survey Maps under copyright Licence No 815780

APPENDICES

1. Appendix A - Summary of meeting held on 15 March 1988
2. Appendix B - Interest of the participants to that meeting

1 INTRODUCTION

During 1986, a review of the extent and condition of coastal saltings was undertaken by Hydraulics Research Ltd (HRL) on behalf of the Ministry of Agriculture, Fisheries and Food.

This review was an initial definition study and looked at the general condition and effectiveness of coastal saltings with special reference to those which form an integral part of the sea defence around the coast of England and Wales.

The objective then was to determine the areas of the major saltings and identify sites where there may be economic justification for saltings management. Discussions were held with the relevant authorities as to the state of those saltings, the aim being to identify any problems such as recession or vegetation die back. Areas of significant erosion were identified and attempts at regeneration by the authorities noted.

In March 1987, HRL submitted their report (SR 109, Ref 13) to the Ministry of Agriculture, Fisheries and Food. Entitled 'The effectiveness of saltings', the report pinpointed areas which were causing concern to the coastal authorities. In particular, that report found that the problems of recession were most acute in the south and southeast.

In November 1987, the Ministry of Agriculture, Fisheries and Food asked Hydraulics Research to update that report and:

- i) Review the ecological, biological and engineering work currently being carried out in terms of preventing saltings recession and

reclamation of areas that were previously vegetated and are now open mudflats.

- ii) Bring to the attention of the relevant authorities the results of other peoples experiences and research and the best ways of combatting the problem.

For (i) above the method was twofold. The relevant authorities were contacted or visited to find out the current situation in the areas of most concern. A meeting was then arranged to which a selection of engineers, biologists, ecologists and researchers, with a known interest in saltings, were invited. The object of this meeting was to determine the extent of research to date and to discuss ways and means of conducting a co-ordinated multi-disciplinary research programme to look at the problem and how best it can be tackled. The results of this meeting are presented in Appendices A and B.

As mentioned above, the coastal areas where the problems seem most acute are:

- i) Essex, especially in the Dengie Flats area between the River Blackwater and the River Crouch, and
- ii) The Keyhaven/Lymington area of Hampshire.

This report concentrates therefore on the south and southeast coast of England and reviews the progress or otherwise around the coast from the Wash south and then west to Hurst Spit on the Hampshire coast.

In the course of this review, several meetings were held with MAFF and the Nature Conservancy Council (NCC).

Chapter 2 of this report covers the east coast and includes the Wash, Essex (the Blackwater to the Crouch) and the east coast of Kent. Chapter 3 investigates the south coast as far west as Hurst Castle Spit on the Hampshire coast.

Appendix A is a resume of the meeting held at HRL and Appendix B contains a summary of the interests of some of the experts invited to that meeting.

2 THE EAST COAST

One of the largest concentrations of coastal saltings is to be found in the southeast corner of England, all of which are classified (Ref 17) as Sites of Special Scientific Interest (SSSI). That these saltings are of great importance to the coastal defences is of little doubt. Essex is protected by several hundred kilometres of seawall and where the seawalls are fronted by healthy saltings, reinforced earth banks are often the only protection. This is because the saltings fronting these embankments dissipate a large proportion of the incoming wave energy before it reaches the coast. It is therefore clear that healthy coastal saltings play an important role in protecting the coastal zone from flooding.

2.1 The Wash

On the west bank of the Wash the saltings extend seawards in front of the earth banks protecting large areas of reclaimed land. Comparing the 2.5 inch (1903-1951) Ordnance Survey maps with the latest Pathfinder series (to 1977) these saltings seem to be accreting and large scale reclamation has taken place in the Leverton area (see Fig 12). Trial monitoring of an area on this western edge of the Wash by remote sensing was carried out in 1985 and is explained more fully below.

On the southern shore of the Wash the sea defences were brought up to a common level of 7.7m ODN after the 1978 surge. Material for the heightening of these earth embankments came from the foreshore. Little is known about the state of the saltings fronting the area and it is thought that the last full survey of the Wash was carried out in the early 1970's. This included both aerial and hydrographic surveys carried out by Fairey Surveys and Hydraulics Research respectively. Anglian Water (Oundle Division) thought that most areas were accreting, especially in the estuary of the River Welland. They had no evidence of saltings recession. There has been some reclamation on this southern foreshore, in particular in the 1970's in the Breast Sands area to the west of the Great Ouse (Fig 13).

On the eastern bank of the Wash the saltings are not extensive and front large areas of reclamation from the mouth of the Great Ouse north of Wolferton Creek. Overlaying Ordnance Survey charts (see Fig 14) shows that fairly large scale reclamation has been carried out on Wooton Marsh during this period. Vegetation is shown seaward of the new embankments, although the condition and growth of the saltings is not known.

The apparent decrease in *Spartina Anglica* in the Wash has, according to a 1982 report by the NCC (Ref 1), been spectacular. In 1975, Randerson (Ref 2) completed a vegetation survey from aerial photographs taken in 1972. He estimated that from approximately 2000ha in 1958 it was down to only 200ha in 1973. This must however be taken in context as reclamation of the high level flats and other forms of saltings vegetation have taken over areas formerly colonised by *Spartina*.

A study of saltmarsh vegetation using remote sensing was undertaken in the Wash in 1985. The site chosen was Butterwick Marsh on the west bank fronting reclaimed land. Hobbs and Shennan in their paper (Ref 10) were able to identify vegetated and non-vegetated saltmarsh. This was further sub-divided and Halimione, Puccinellia, and mud and Salicornia identified. Spartina and Salicornia however were not separable from the Halimione group. Also distinguishable (although with some difficulty) based on their spectral properties, were dry sand, wet sand, mud, and water and mud.

2.2 The Essex coast

The consensus from the many papers and reports written over recent years and from personal contact is that the saltings are in a state of general erosion. Anglian Water have become increasingly concerned with the rate of saltings loss occurring along the coast of Essex, especially between the Rivers Blackwater and Crouch. In some areas where the saltings have eroded back almost to the sea wall, a number of trial installations have been constructed in an attempt to build up the foreshore and regenerate the vegetation.

This is particularly so on the Dengie Peninsula where Harmsworth and Long (Ref 18) suggest that approximately 10% of the total salt marsh area was lost between 1960 and 1981. This low lying, east facing shoreline is about 12kms long. The offshore area is very flat with intertidal mudflats stretching seawards some 3kms and backed by saltings ranging between 50 and 400m wide (Ref 3). In 1972, Kestner (Ref 12) wrote a report on a visit to the area entitled 'Report on a visit to River Crouch, Maplin Sands and Dengie Flats'. Although obviously related

toward the then proposed Maplin Sands Airport, the report does comment on the flats.

Samples taken at that time across the Dengie Flats show the seaward area of the foreshore to be coarser than to landward with a predominance in both sets of samples of a very fine sand fraction (64-128 microns). Because of the finer particle size fraction on the Dengie Flats (in relation to the Wash and Maplin) the pioneering plant is not *Salicornia* but *Enteromorpha*, a green algae also known as 'Sea hair'. The sediments being finer, the foreshore tends to be much more muddy and Kestner relates the characteristics of Dengie more with the Wash than with Maplin.

According to a report by the NCC (Ref 1) the Dengie Flats showed an expansion in the growth of *Spartina* between the early 1940's and the early 1960's. The Maplin study of 1973 however showed that erosion has reduced this to more like its original (pre 1940) area of 542ha with the dominant vegetation being *Salicornia*.

Overlaying the latest (1958-79) Ordnance Survey maps with earlier (1900-53) ones, shows a slight seaward movement of the mean high water line at the northern end of the Dengie Flats along Gunner's Creek and to the south in the area south of the Grange Outfall. The comparison also shows a landward (erosional) movement in the Bradwell and Tillingham marsh area. This could have changed significantly since then however, due to the reclamation detailed below.

There are three major coast protection sites, all on the Dengie Flats.

1) Deal Hall

Here, as mentioned in the previous report, two polders, based on the Schleswig Holstein brushwood design were installed in 1981 and 1983. Each polder was 400m square and the brushwood groynes were originally filled with conifer faggots similar to the German method. Subsequent repairs have been either with conifer or enkamat geotextile. Work was started on a third polder to the north but was abandoned because of labour problems.

In March this year, the most northerly of the two polders was in disrepair, certainly on its seaward side, and Anglian Water hope to put repairs in hand sometime this year.

The southern one has been repaired. *Spartina* is continuing to spread within the polders and some transplanting done last autumn is continuing to grow as well. The polders are said to be functioning, although not as fast as those on the north coast of Germany. This may be because the ditches are not dug out annually as they are on the German coast. The Essex Naturalist Trust are monitoring the vegetation within the polders at Deal Hall.

2) Marsh House

The sunken lighter breakwater (see Ref 13) complete with its shore-connecting groynes is functioning well although the pattern of accretion has changed. Since the groynes were placed there has been quite rapid accretion at the shoreward end of the most southerly groyne. A recent survey by Dr Pethick (Ref 3) tends to confirm this and states that although there are areas of accretion and erosion, on balance it is still accreting satisfactorily.

3) Sales Point

In their paper on coast protection in an area of salt marsh erosion, Pethick and Reed (Ref 3) quote a paper by Greensmith and Tucker (Ref 16) who noted that over 90m of horizontal erosion had taken place here between 1953 and 1960.

This area, at the northern edge of the Dengie Flats, has little left in the way of protective saltings and none around the Point. The coastline here is protected by an earth bank revetted on its seaward side by a concrete block apron. The revetment is subject to toe scour and the area around the Point has suffered foreshore erosion.

Large scale protective measures were carried out here in 1987 when eleven lighters were placed around the promontory to act as an offshore breakwater.

Designed to protect the coast in a similar fashion as the lighters at Marsh House further to the south, they were placed one lighter length apart and 250m seaward of the existing coastal revetment. Once installed the lighters were pumped full with mud and sand, the material being taken from the foreshore on their seaward side. The project was completed in April 1987 and although a little early to judge their competence a recent site inspection noted scour holes immediately landward of the lighters and soft sandy mud on the foreshore that may have been accretion.

At this northern end of the Dengie Peninsula, north of Bradwell, gravelly shell banks which are to be seen throughout Dengie, tend to be mobile. Although they provide plateaus, they cover the saltings, stifling the vegetation and when they move on they leave just mudflats.

A paper given by Pethick and Reed (Ref 3) at the 1987 Coastal Sediments Conference gives an up to date picture of the effects of the coastal protection on the Dengie Peninsula and in particular the offshore breakwater at Marsh House. Recent research has also been carried out towards the southern end of the peninsula by Reed (Ref 15). At Bridge Creek, a study of aerial photographs indicated that some 50m of saltings were lost between 1955 and 1981 out of a total width of about 550m.

In Hamford Water a further lighter-type installation is scheduled for Foulton Hall (to the north). Plans are also in hand to use barges (2.46m long, 1.84m wide and 1.23m high) as protection off the north east corner of Horsey Island. Here there is erosion of the front face of the embankment, the rills are enlarging and the saltings are becoming denuded on their top face. Anglian Water have allowed the first line of defences here to deteriorate, and a counter wall built in 1984 protects the main part of the island to the southwest. The NFU have installed timber post groynes to the west of this area to deter further scour (see also below). There were plans to use polder type groynes at the north east corner of Horsey Island as well (see Fig 4) but this may be superceded by the lighter installation.

Other smaller installations are also being carried out by Mr A Mascall on a NFU/MSD sponsored project. Usually in the form of groynes or small polders they are made up of two lines of timber posts some 0.25m apart. The distance between each line of posts is about 0.40m and the posts protrude approximately 1.0m above the foreshore as shown in Figure 1. The gaps between each line of posts are filled with either brushwood or wooden slats.

Along the rivers and within the estuaries the polders are often placed as with rugby posts (see Fig 2) so that the groynes project further into the river than the shore parallel polder sections. Artificial seaweed is also used in some areas. Pinned to the foreshore (see Fig 3), the plastic fronds are designed to hold the sediment.

These projects, which are normally in the rivers, are designed to;

- a) prevent undercut of the seawalls and embankments by tidal currents;
- c) encourage the growth of incumbent saltings within embayments.

The NFU Project has three gangs working (there were once four) and the sites that are either being worked or are proposed are given below.

Schedule of sites for NFU Project

1. Brickhouse Farm, Peldon	TM 003148 006151
2. Mell Farm, Tollesbury	TL 976092 980096
3. Stamfords Farm, Althorne	TQ 885972 891973
4. Grapnells Farm, Wallasea	TQ 984939 984946
5. Wellhouse Farm, Mersea	TM 003138 010144
6. Marsh House Farm Outfall, Bradwell	TM 033046 034052
7. Grapnells Farm, Wallasea	TO 980946 984946
8. Fleet Hall Farm, Rochford	TO 887898 895899
9. Cudmore Grove, Mersea (Proposed)	TM 062141 065143 (Not LLDC)
10. Mell Farm, Tollesbury	TL 984100 987103
11. Pewet Island, Bradwell	TL 990078 992082 (Not LLDC)
12. Bohuns Farm, Tollesbury	TL 959082 964082

13. Raypits Farm, Canewdon	TQ 891961 909964
14. Horsey Island	TM 235254 245254
15. Horth Fambridge Marsh	
16. Rolls Farm, Tollesbury	TL 937083 943080
	(Proposed)

Along the rivers the general trend is towards erosion and in the River Crouch the vertical cliff edge at low water is 2m deep in places. Some accretion has been noted at Cattawade at the upstream end of the River Stour (downstream of the tidal barrier) and in isolated spots at the high water mark.

2.3 The Kent Coast

Along the southern bank of the Thames Estuary the seawalls have been upgraded where necessary to withstand 1 in 100 year tidal levels as part of the Thames Tidal Flood Protection Scheme. The ground here is very soft, so that, in many cases, heavy walls could not be built and concrete panels have had to be carefully placed on the front face of the existing earth banks. Scour too has been a problem here.

From Higham to the Isle of the Grain on the Kent coast there is a thin ribbon of saltings hugging the coast and within small bays such as Egypt and St Mary's with extensive mudflats to seaward.

Within the Medway Estuary (see Fig 15) the main areas of saltings are centred on Stokes Marsh, the Medway and Kingsferry Marshes and Burntwick Island. On the north side of the Estuary the Isle of Grain complex and the Oil Refinery have had their sea defences largely updated so there is less reliance placed on the retention of the saltings.

In between these two areas, landward of the Stoke Marshes, the saltings are thought to be on the decline. The defences here have not been updated and it is probable that some reliance is placed on the saltings as well as the railway embankment, to play their part in the protection of the hinterland. In the tidal Medway considerable lengths of earth walls are set back from the coast and here again the saltings play their part as protection against flooding. Dredging in the Medway is not great (Ref 1) and most of the material is thought to be pumped onto marsh areas on the south side of the estuary.

In the River Swale (north of Chetney Marsh) south of the Isle of Sheppey, there are considerable areas of saltings to be found along the river and within the tidal creeks. Here it is thought that the sea defences rely somewhat more on the saltings than in the Medway.

There are no more major saltings to be found on the Kent coast until the River Stour south of Ramsgate. In the estuary here the saltings are again thought to be of value to the sea defences.

Southern Water say that at this time the tidal saltings are fairly stable and not giving rise to concern. This evidence is visual as they do not profile the saltings and mudflats and the aerial overflights do not cover the estuaries. The saltings are considered as part of the sea defence system and the defences would have to be updated should the saltings disappear. Nothing is being done in terms of reclamation or regeneration apart from pumping dredged material onshore.

3 THE SOUTH COAST

3.1 The Sussex coast

Moving from east to west towards Hampshire there is little in the way of saltings along the coasts of East and West Sussex. The exceptions perhaps are within the tidal rivers such as the Rother, Ouse and Adur where saltings flank the river banks in places. Pagham Harbour, protected from the sea by a shingle ridge, is an area where saltings and tidal mudflats form a large nature reserve.

3.2 The Hampshire coast

On the Hampshire coast east of the Solent there are few saltings except in the three big harbours of Chichester, Langstone and Portsmouth. Many reports have been written on the history of the marshes within these harbours. Recent research on Langstone Harbour by Coughlan (Ref 5) in 1982 and Domjan (Ref 6) in 1983 indicate considerable die back since the saltings reached their peak between 1930 and 1960. Haynes and Coulson (Ref 7) 1982, have also investigated, fairly recently, the decline of *Spartina* in the harbour.

The Solent is an open estuary where saltings used to flourish, especially along its western bank. Due however to a variety of reasons including reclamation and the installation of a power station and oil refinery, these have dwindled substantially. At the present time this recession seems to have slowed down.

A NERC report (Ref 8) gives an assessment of conditions within the Solent in 1980. In the above report, C R Tubbs (NCC) comments on the map evidence which demonstrates the general recession of the mixed

marshes in the Solent since the eighteen century. There has also been a considerable nett loss of inter tidal sediments since that date, coupled with a progressive narrowing of the inter tidal zone. He also notes that both lateral and vertical growth of Spartina has now ceased.

West of the Solent the coastal saltings fronting the Lymington River estuary continue to be a cause for concern. This is especially so for the Lymington Harbour Commissioners as the saltings are, to a large extent, the only protection between their moorings and the open sea. The Harbour Commissioners have appointed consultants to look at the problem from the point of view of protection of their moorings from storm wave disturbance.

To the west of the river, along the Lymington - Keyhaven shoreline, the coastal saltings are backed by a reinforced earth embankment sea wall protecting marshland. This wall is old and in need of frequent maintenance and Southern Water, after consultation with other interested parties, have submitted proposals to MAFF to reconstruct this embankment. Construction, if approved, will be phased over several years.

Coastal saltings front this wall and extend east from Keyhaven into the mouth of the Lymington river. In 1987, a report by Portsmouth Polytechnic (Ref 4) identified major changes to the coastline and offshore area here since the introduction of Ordnance Survey maps in about 1870. This included a large reduction of the inter tidal zone in the Keyhaven/Pennington area. This seems to have been progressive since about 1870 and means in effect that, in places, the low water line has progressed landward by up to 500m.

A comparison of the latest Ordnance Survey maps confirms that the low water line is still moving shorewards on both sides of the Lymington River, with a local seawards movement of the low water line to the southwest, in the lee of Hurst Spit.

This landward movement of the low water line, together with vegetation die back, could adversely affect the saltings and the coastline in a variety of ways. For instance the consequent steepening of the foreshore slope will have the effect of moving the waves further inshore before they break. This, together with the deterioration of the saltings vegetation, could allow the waves and tidal currents to wash away the denuded mudflats.

Although various people have said that the saltings are in decline it is usually based only on visual evidence. Southern Water have allowed us access to data taken from aerial surveys made since 1979. From these cross sectional data, profiles (see Fig 5) have been plotted across the saltings on either side to the Lymington river. Although not complete or taken over a long period of time, Figures 6 to 11 do give an indication of the trend. This tends to support the evidence of the Ordnance Survey charts in that the overall trend on the seaward edges of the saltings is to erosion. This is especially so in Figures 8 and 9 on either side of the mouth of the Lymington river. The figures do not however take the vegetation into account and for this, remote sensing seems the only answer.

Southampton University's Geodata Unit are thought to have a large amount of untapped archived data on this coast.

4 CONCLUSIONS

From various discussions with individuals during the contract period it was obvious that much past work has been done on either an ad hoc, site specific basis or a general overview without proper scientific procedures such as levelling and profiling. Also from the meeting held on the 15th March 1988 (Appendix A and B) it was clear that a co-ordinated multi-disciplinary approach was needed to assess and come to grips with the problem.

It is recommended that if saltings are to be beneficial to flood protection then they need to be monitored and maintained, a function normally required for coast protection works. It is clear that to try to understand the mechanics of a coastal salting, regular monitoring must be a priority. This should include both a land and hydrographic survey, calculating among other things the sediment budget.

It is difficult however to survey wetlands by the normal method of land surveying, and the practice of surveying by remote sensing and aerial photography should be looked at in more detail. There are several academic establishments making a study of remote sensing where, it is claimed, individual salt plant families can be identified. These include the Universities of Durham and Southampton and Portsmouth Polytechnic.

It is also recommended that conservation needs should be assessed and if possible valued when improvements to saltings are proposed.

The following conclusions identify specific problem areas.

1) Sea level rise

The impact of sea level change on the coastal environment, the implications of tidal scour at higher levels and the effect of abnormal sea states on saltings has not been looked at in any great depth either by engineers or conservationists.

Different species of saltmarsh vegetation can tolerate different degrees of tidal inundation but, it would appear need adequate supplies of sediment in quality and quantity to survive.

Rossiter (Ref 14) in 1972, gave the average sea level rise in the Essex area to be 3mm/year. This rate of rise may have contributed to the overall loss of saltings. However the present estimate in sea level rise of up to 5 times that figure could lead to a more pronounced effect.

2) Exposure to the elements

Increased exposure to waves and tidal currents will affect the equilibrium and stability of the mudflats. Any change therefore will have an effect on the magnitude of any erosion, with wave action generally playing a more significant part.

Several authorities have said that their problems include erosion of the seaward edge of the marsh. Pethick and Reed (Ref 3) suggest that, on the Dengie Peninsula, this is caused by wave action stripping the vegetation from the seaward thirty metres or so of the marsh allowing the tides and waves to erode the material into suspension. Much of this suspended sediment is thought to be deposited landward. This in turn has to keep pace with rising sea levels but with the effect of foreshortening the marsh.

3) Man's interference

Interference with the natural process of sediment supply and demand can upset the delicate balance of coastal saltings such that they become more susceptible to erosion and to drowning. The two most obvious forms of interference are:

- a) Coastal reclamation and construction of seawalls, large groynes or breakwaters severely curtailing or cutting off the supply of sediment downdrift.
- b) Dredging sediment from estuaries and river mouths, dumping it offshore and taking the sediment out of circulation.

Reclamation and intrusion into coastal saltings requires careful planning and a knowledge of the morphological sciences. Pethick (Ref 11) suggests for instance that the surface height of saltings, before embanking can commence, is critical.

It should be pointed out to designers therefore that it should also be possible with careful planning to re-use suitable dredging spoil by spreading it over areas such as eroding mudflats, where it is needed or by dumping on offshore 'spoil heaps' for later retrieval or in areas where it can find its way naturally onto coastal foreshores where it is required.

4) Disease and pollution

Silts and muds are held to a large extent by the binding effect of the roots and leaves of the salt marsh vegetation. Disease or pollution can kill off

the vegetation leaving the bare mud to be washed away by waves and/or tidal currents. It is recommended that samples of the silts and muds be taken at regular intervals and analysed so as to note changes and see if there is any relationship between vegetation change and the vitality of the sediment.

5) Future Research and Development programming

It has become clear that although there is a great deal of related research going on, there is little in the way of national co-ordinated research.

The meeting held at Hydraulics Research was a step forward in that direction and highlighted several areas of related research.

The two most urgent steps seem to be:

- a) The creation of a saltmarsh or wetlands data base for easy access by researchers, planners, designers etc.

This would have the effect of providing:

- i) the current state of saltings
- ii) what research has been carried out and where
- iii) what is currently being done, where and by whom
- iv) the data available, including historical data presently lying on dusty shelves
- v) what research is scheduled for the future and by whom.

5 ACKNOWLEDGEMENTS

Grateful thanks are due to the following for their input to this report.

Mr A Hughes	MAFF River & Coastal Engineering Group, Southeast region
Mr W Martin	MAFF River & Coastal Engineering Group, Southeast region
Mr R Thompson	MAFF River & Coastal Engineering Group, Southeast region
Mr P Trend	New Forest District Council
Mr Woolford	Harbour Master, Lymington
Mr Shorthose	Southern Water, Hampshire Division
Dr Soulsby	Southern Water, Hampshire Division
Mr Mascall	NFU Essex
Mr Robinson	Anglian Water, Colchester Division
Mr Williams	Southern Water, Kent Division (telephone conversation)

6 REFERENCES

1. Nature Conservancy Council. 'Focus on nature conservation: 5 *Spartina Anglica* in Great Britain.' Edited by Pat Doody, Peterborough, 1984.
2. Randerson P F. 'The Saltmarshes of the Wash.' Wash feasibility study ecological report scientific study D. Natural Environment Research Council.
3. Pethick J and Reed D. 'Coastal protection in an area of saltmarsh erosion.' Paper given at Coastal Sediments '87 Conference, New Orleans, USA, May 1987.
4. Hooke J and Riley R. 'Historical changes on the Hampshire coast 1870-1965.' Prepared for the Hampshire County Council coastal review and published by Portsmouth Polytechnic, July 1987.
5. Coughlan J. 'Solent Shores - the scene today.' In Solent saltmarsh Symposium, ed Stranak F and Coughlan J, Solent Protection Society, Winchester, 1982.
6. Domjan K. 'The distribution of marshland past and present in Langstone Harbour.' BSc Dissertation, Department of Biology, Portsmouth Polytechnic. 1983.
7. Haynes E N and Coulson M G. 'The decline of *Spartina* in Langstone Harbour.' Proc Hampshire Field Club Archaeology Society 38, 1982.
8. National Economic Research Council. 'The Solent Estuarial System: An assessment of present

- knowledge.' NERC Publication Series C, No 22, 1980.
9. Budd J T C. 'An investigation into the utility of remote sensing in the study of the ecology of some south coast harbours.' Unpublished PhD thesis, Portsmouth Polytechnic, 1985.
 10. Hobbs A J and Shennan I. 'Remote sensing of salt marsh reclamation in the Wash, England.' Jnl of Coastal Research, Vol 2, No 2, Spring 1986.
 11. Pethick J. 'An introduction to coastal morphology.' Edward Arnold (Publishers) Ltd, London, 1984.
 12. Hydraulics Research (Kestner F J T). 'Report on visit to River Crouch, Maplin Sands and Dengie Flats, 1-4 August 1972.' Hydraulics Research Ltd, October 1972.
 13. Hydraulics Research (Welsby J). 'The Effectiveness of Saltings.' Hydraulics Research Ltd, Report No SR 109, April 1987.
 14. Rossiter J R. 'Sea level observations and their secular observation.' Phil Trans Royal Soc, A, 272, 1972.
 15. Reed D J. 'Suspended sediment transport in salt marsh creeks.' Unpubl PhD thesis, Univ of Cambridge, 1985.
 16. Greensmith J T and Tucker E V. 'Salt marsh erosion in Essex.' Nature 206, 207. 1965.

17. Ratcliffe D A (ed). 'A nature conservation review.' Publ by Cambridge University Press, 1977.
18. Harmsworth G C and Long S P. 'An assessment of salt marsh erosion in Essex, England, with reference to the Dengie Peninsula.' Biol Conservation, 35, 1986.
19. Hydraulics Research. 'The Wash Water Storage Scheme: Report on design construction and proving of a physical model.' Report No DE 14, April 1974.

FIGURES.

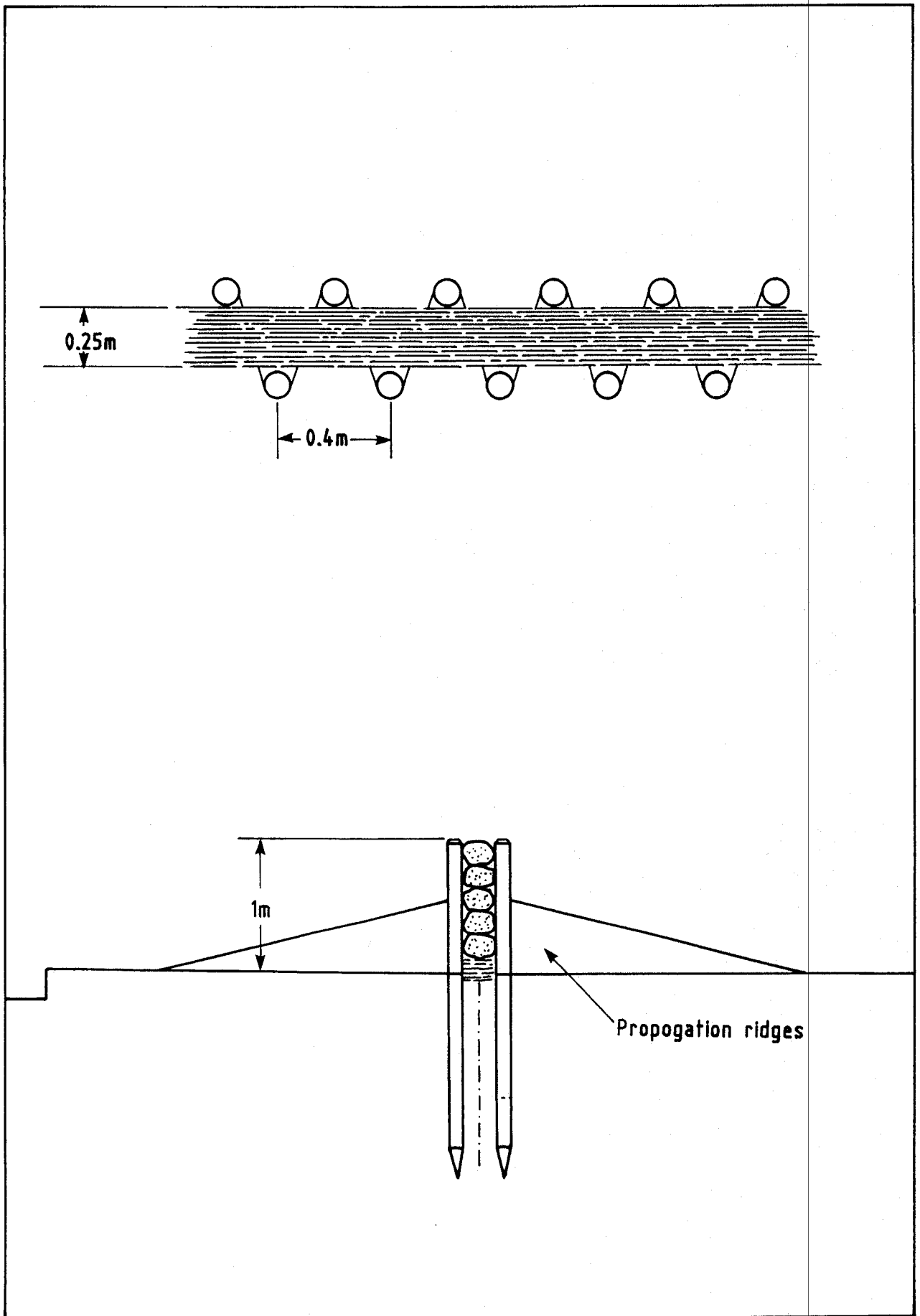


Fig 1 Typical brushwood groyne construction

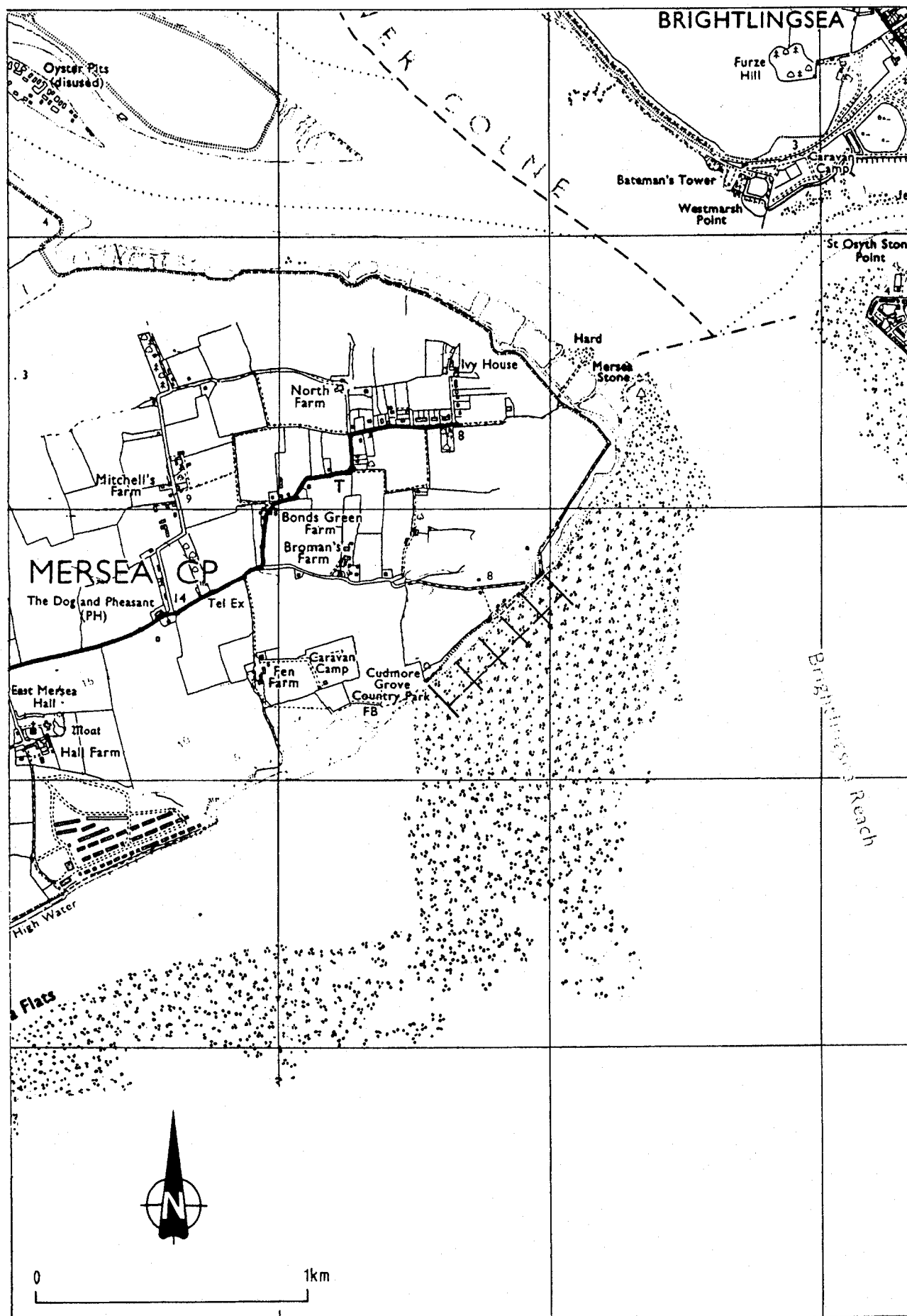


Fig 2 Proposed polders - Mersea Island

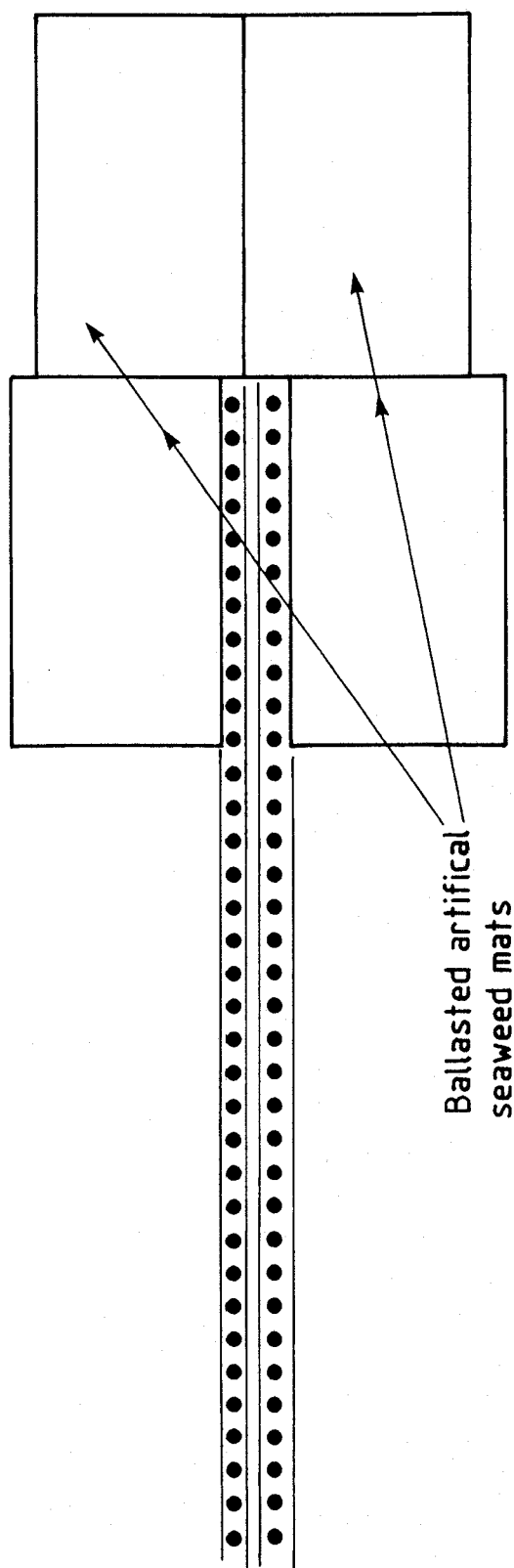


Fig 3 Artificial seaweed placement

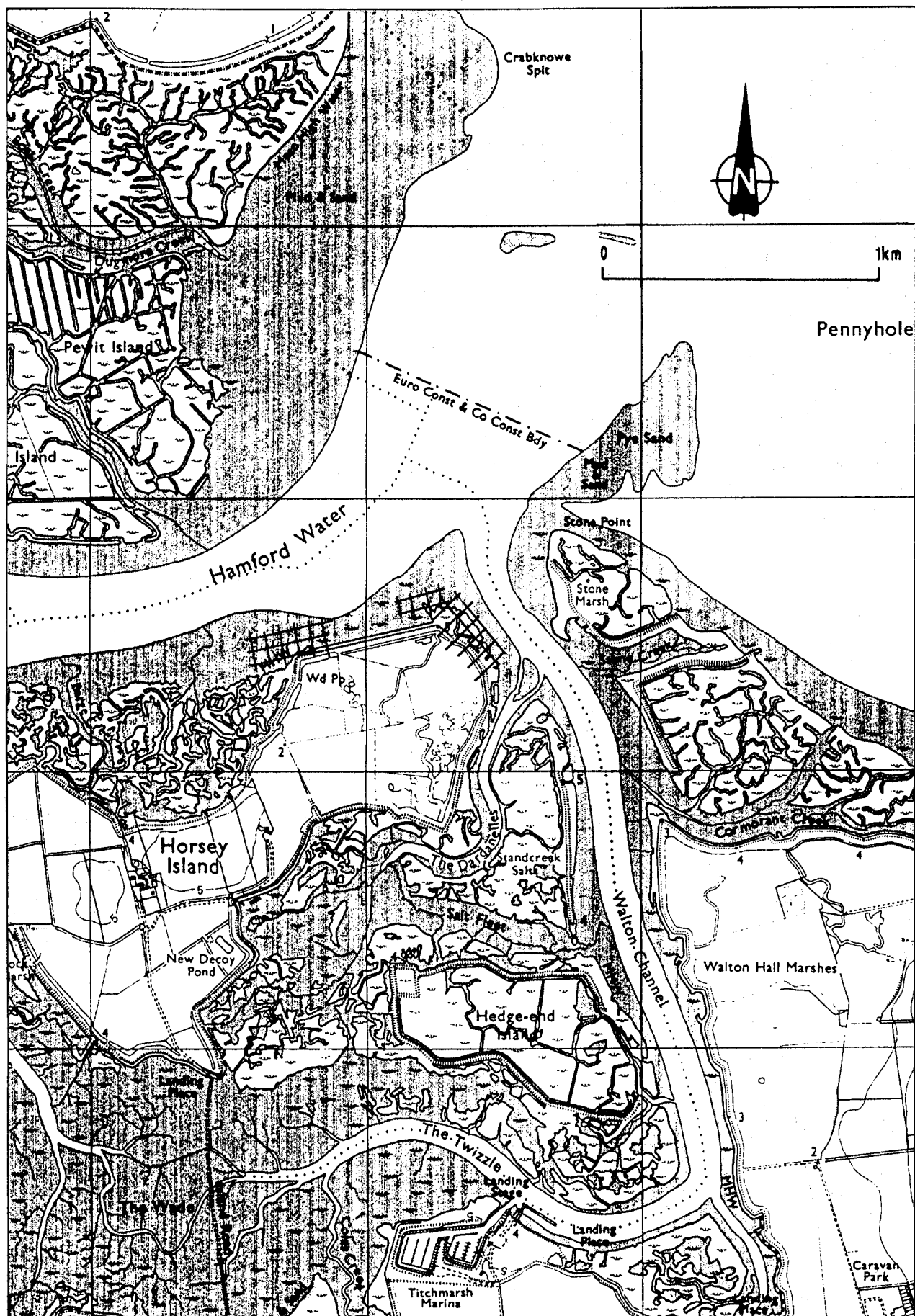


Fig 4 Proposed multiple polders - Horsea Island

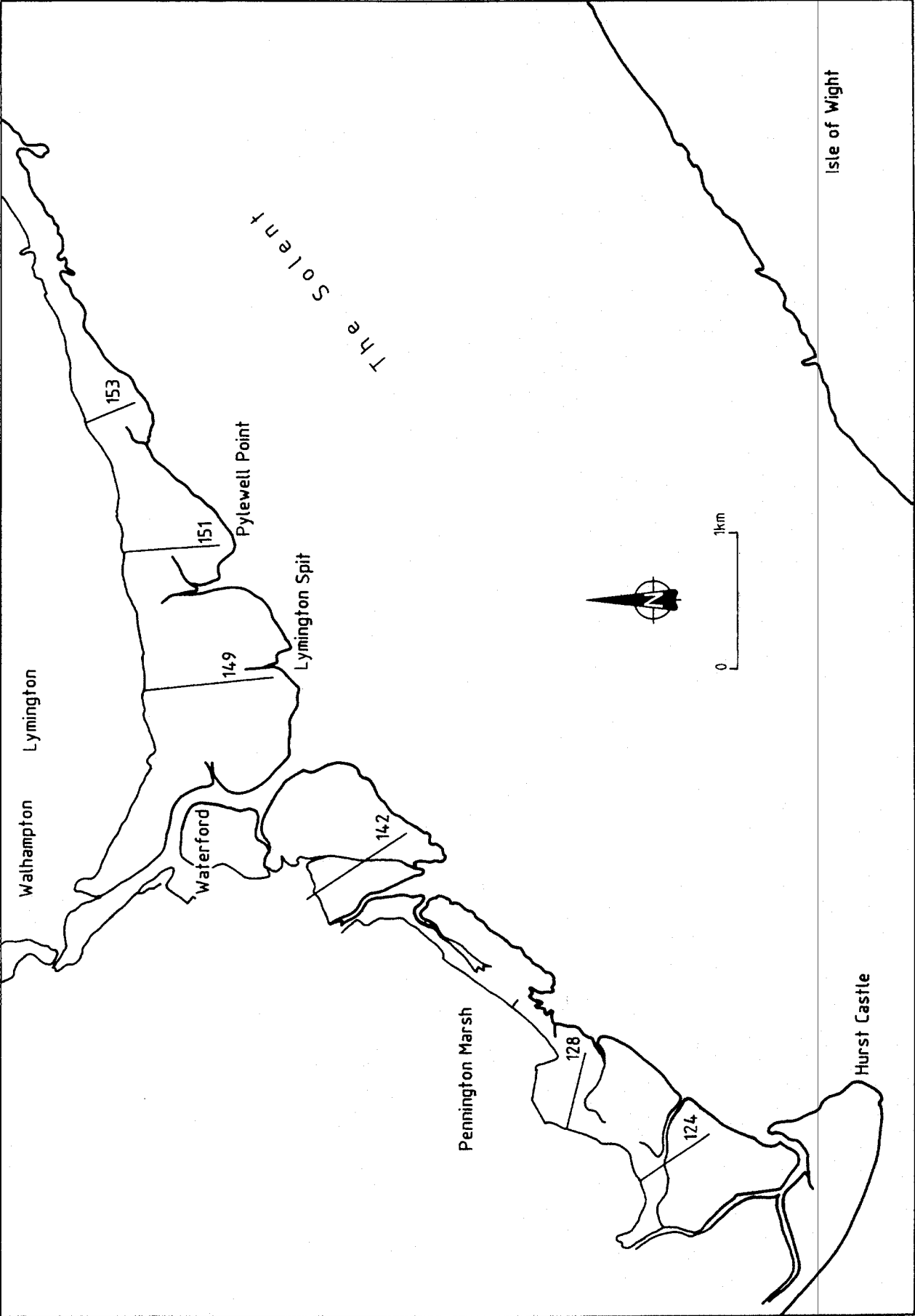


Fig 5 Lymington area profile plan

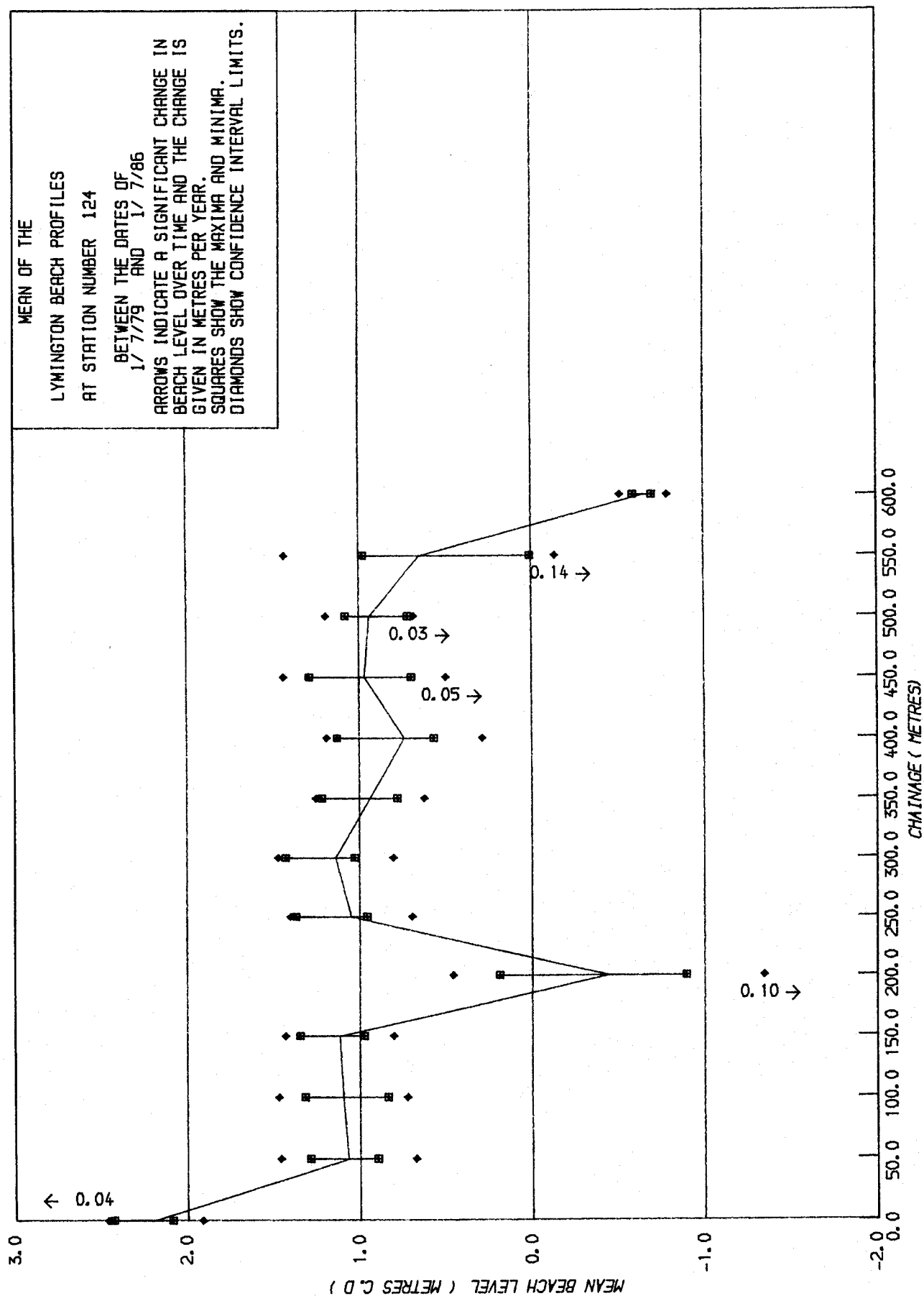


Fig 6 Lymington beach profile - Station 124

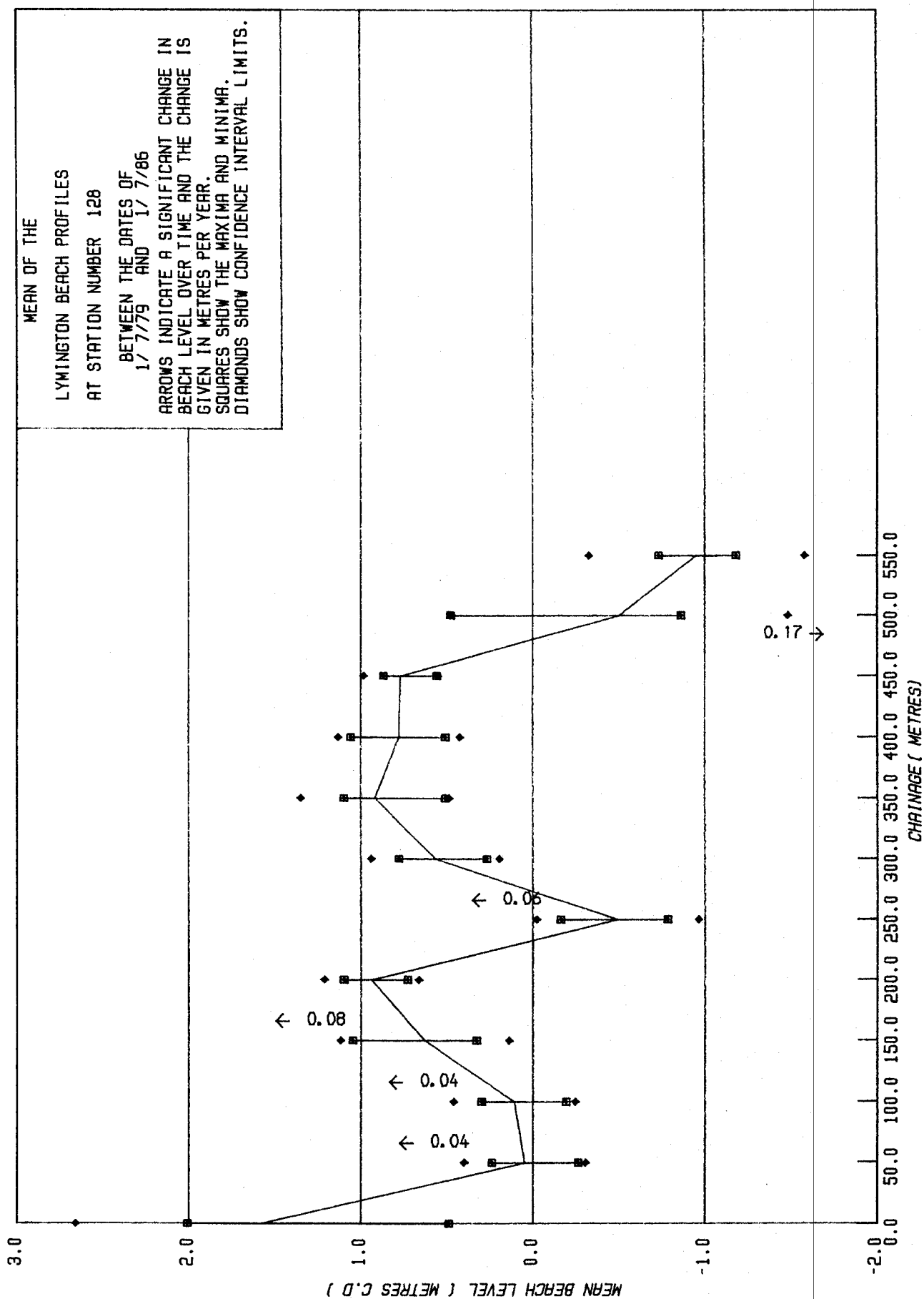


Fig 7 Lymington beach profile - Station 128

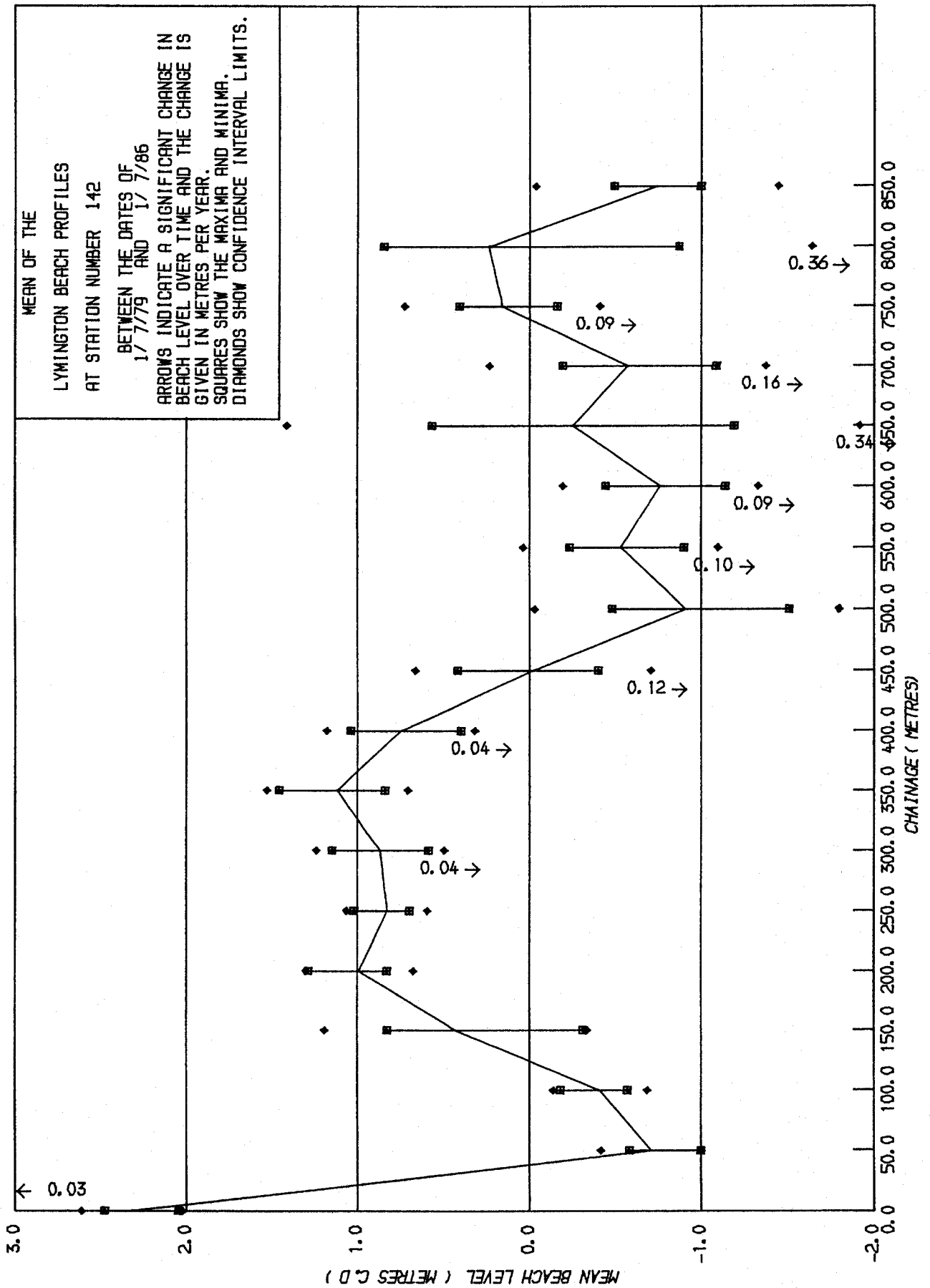


Fig 8 Lymington Beach Profile - Station.142

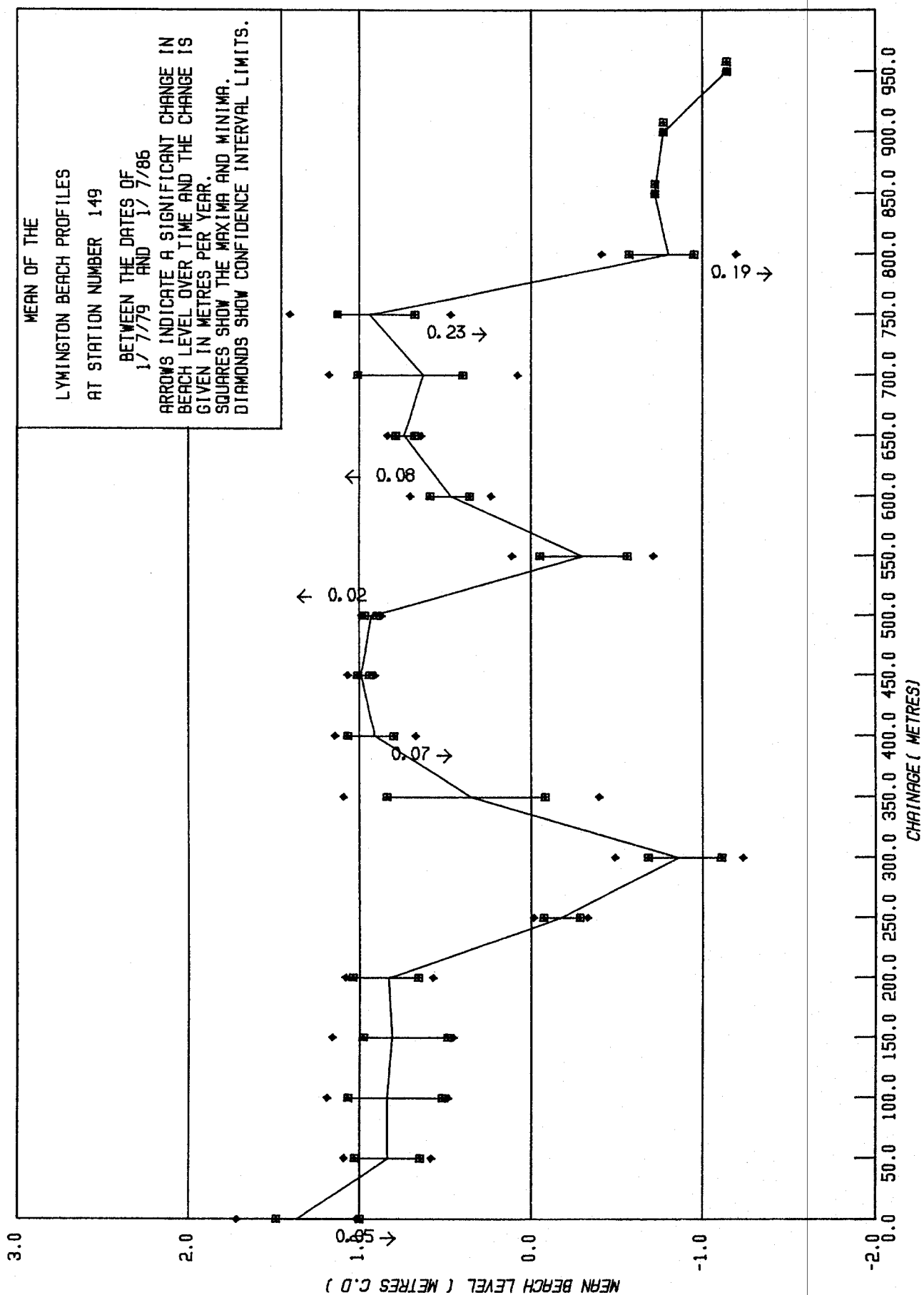


Fig 9 Lymington Beach Profile - Station 149

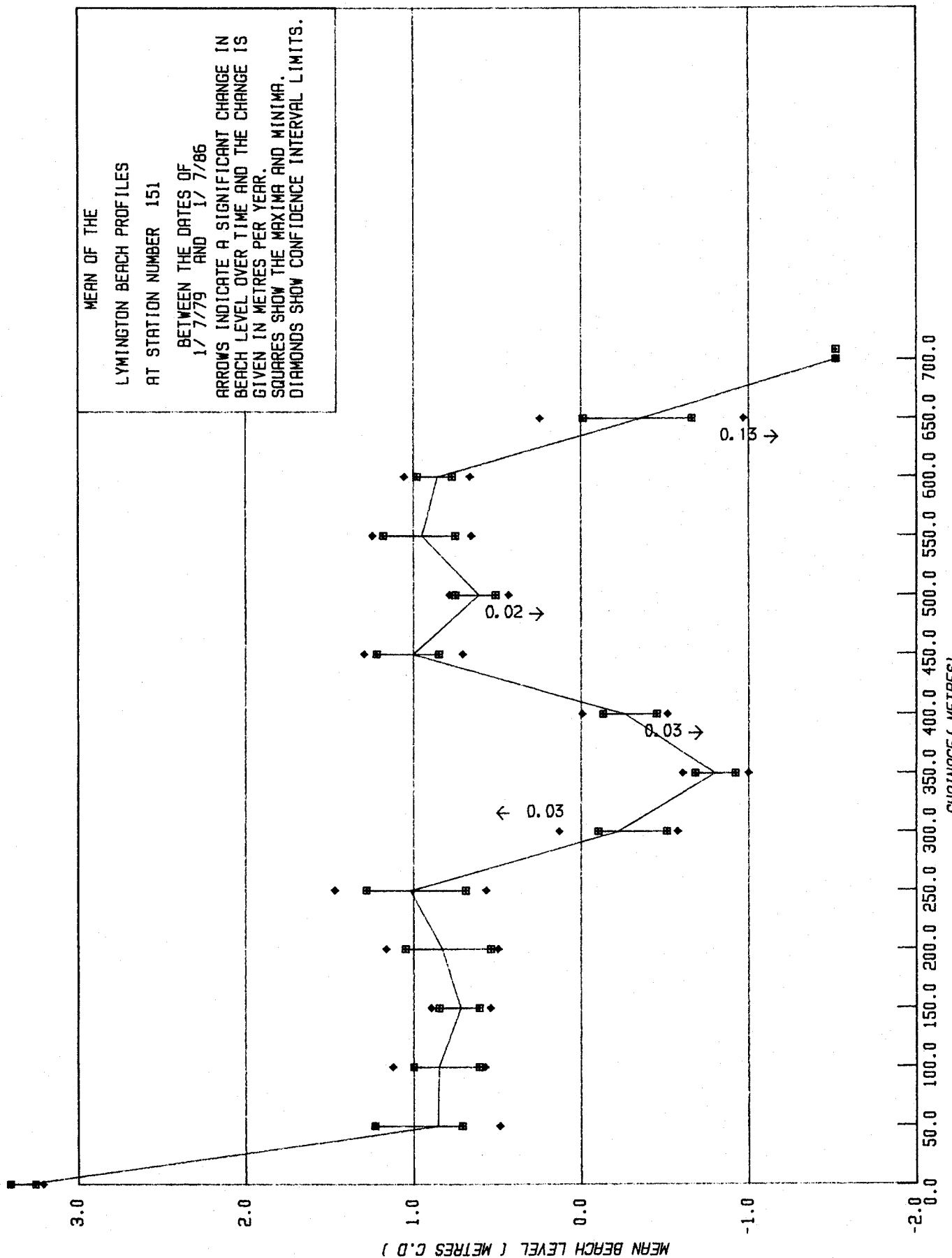


Fig 10 Lymington beach profile - Station 151

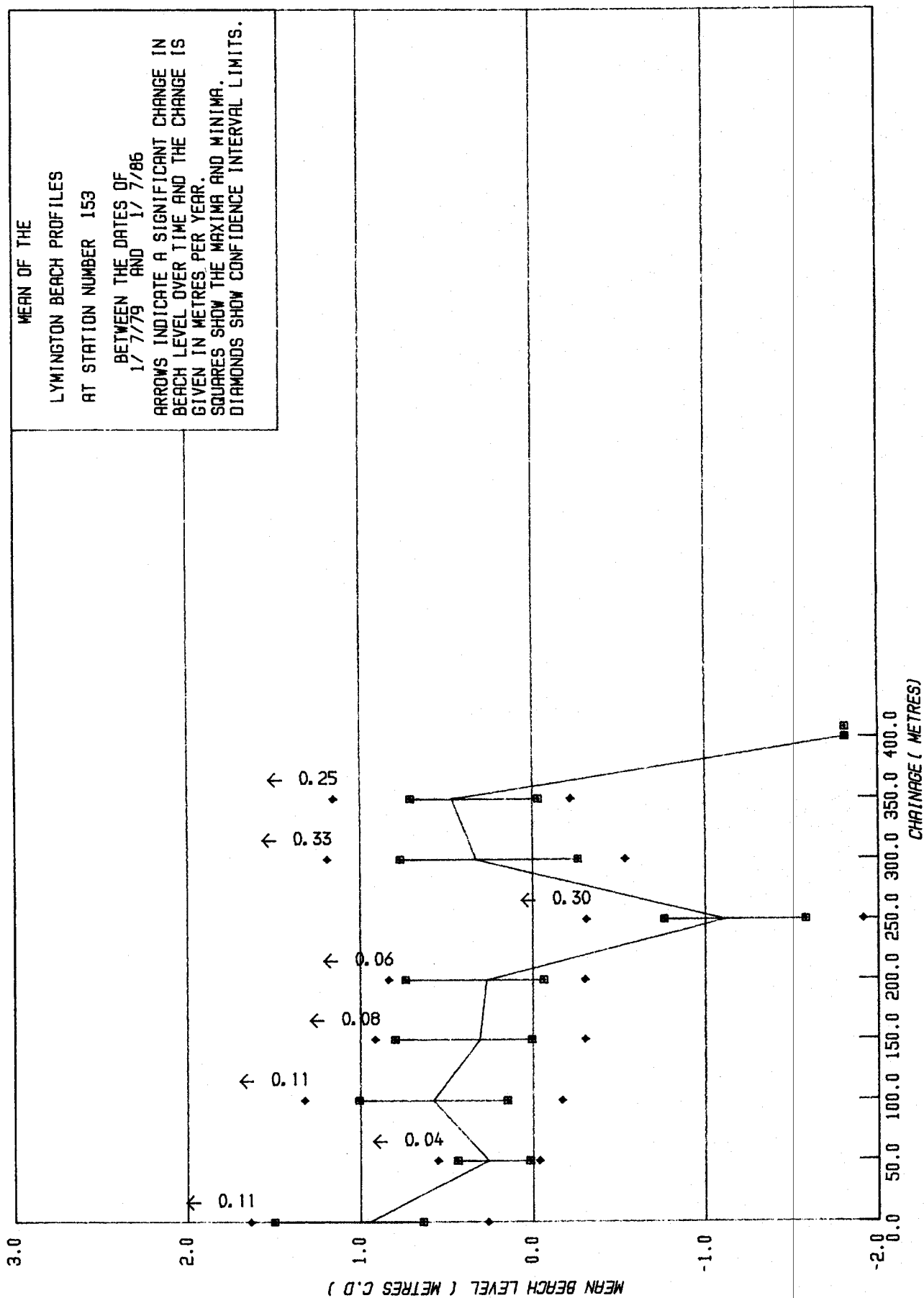


Fig 11 Lymington beach profile - Station 153



Fig 12a The Wash (West) O.S. Pathfinder Series 1970-76

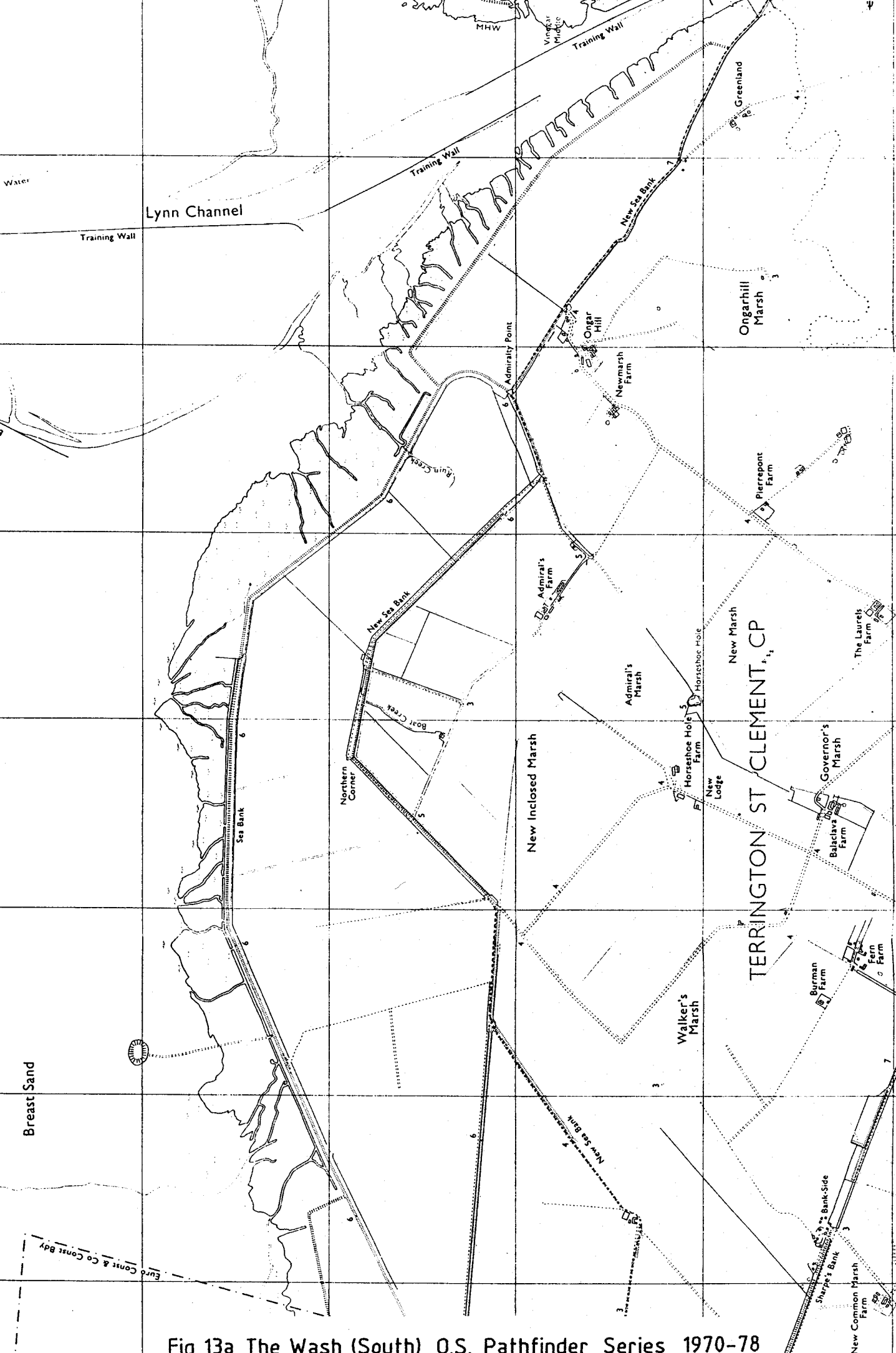


Fig 13a The Wash (South) O.S. Pathfinder Series 1970-78

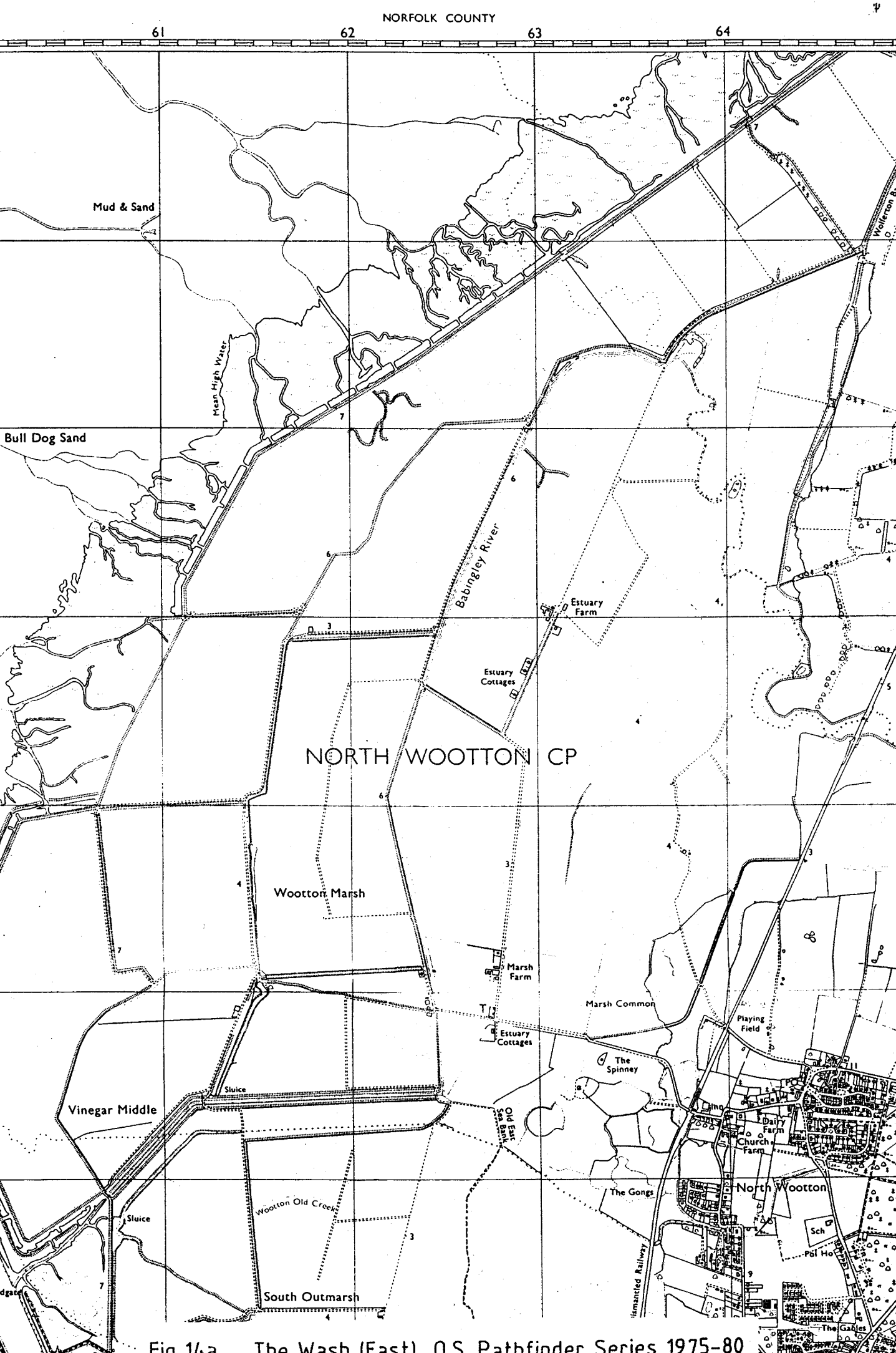


Fig 1/a The Wash (East) OS Pathfinder Series 1975-80

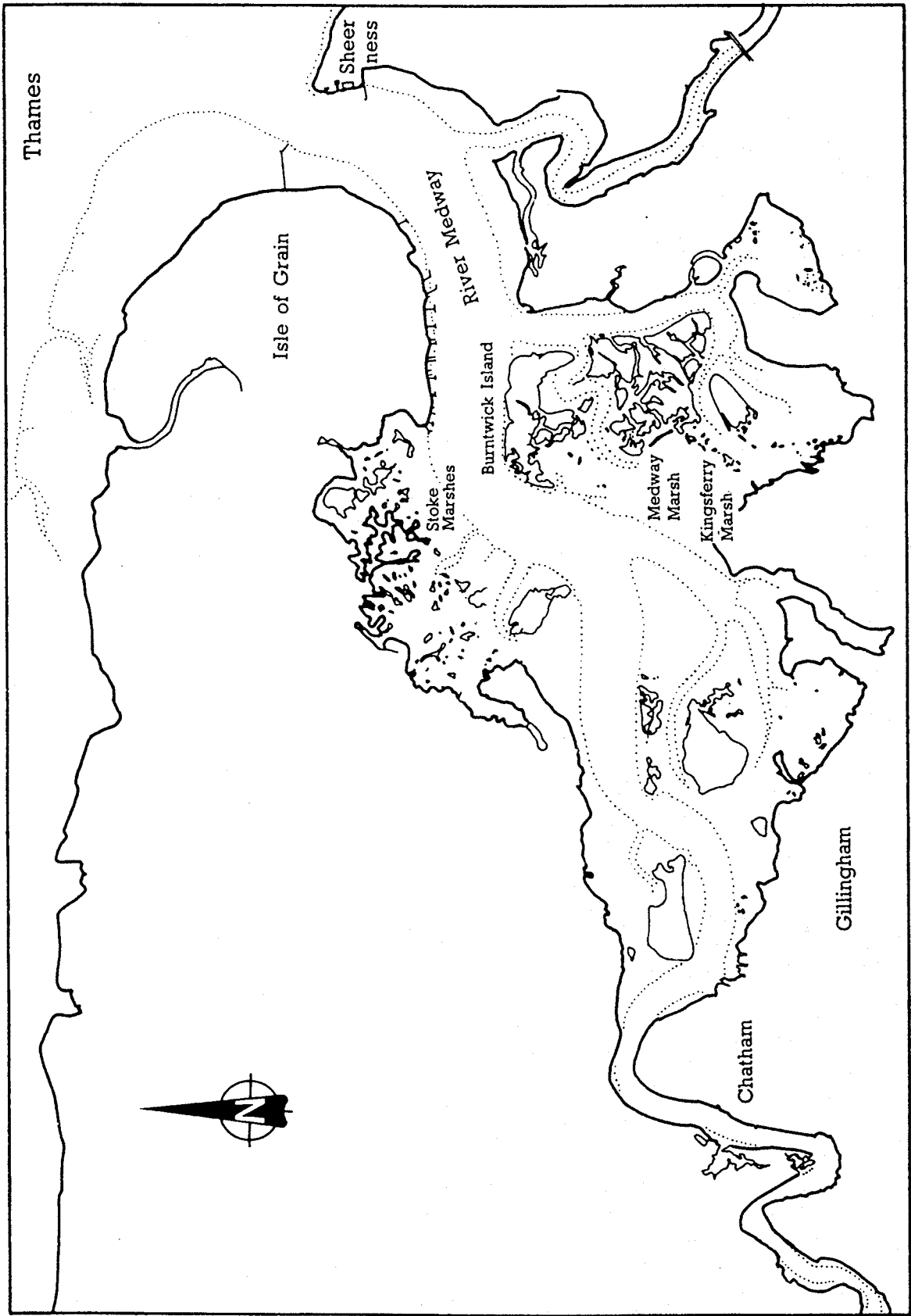


Fig 15 The Medway marshes

APPENDICES.

APPENDIX A

Minutes of a meeting held at Hydraulics Research

on Tuesday 15 March 1988

SALTINGS RESEARCH

Minutes of the meeting held at Hydraulics Research on Tuesday 15 March 1988

PRESENT:

Mr I R Whittle, Chairman
Ministry of Agriculture, Fisheries and Food

Mr A J Allison, Mr R G Purnell
Ministry of Agriculture, Fisheries and Food

Dr P Edwards, Dr M Clark
Geodata Unit, University of Southampton

Dr L A Boorman
Institute of Terrestrial Ecology

Dr P Doody
Nature Conservancy Council

Mr B A Tinkler
Wessex Water

Dr R M Bell, Dr M Hill
EAU University of Liverpool

Mr D A Brown
DRA Department of the Environment

Mr D N M Donoghue
University of Durham

Mr B Harbott
Anglian Water

Mr A Mascall
NFU/MSC Project

Dr J S Pethick
University of Hull

Dr A H Brampton, Mr T N Burt, Mr J Welsby
Hydraulics Research

The Chairman opened the meeting and thanked everyone for coming. He spoke briefly on the background to these discussions and how in the early days it was Mr Mascall who convinced him to revise his research plans to look at saltings fronting sea defences. He also spoke of the different policies pursued by the Water Authorities, some allow the saltings to be sacrificed, some leave them alone and some try to regenerate them.

MAFF were looking for assistance from researchers to advise on future research and this was why this meeting had been called. Questions which needed to be considered included:

- (1) Should we preserve the natural saltings or allow them to be washed away?

- (ii) What would be the effect of the 'greenhouse' atmosphere that the national papers predict is coming and the predicted sea level change?

He then asked for comments from around the table.

SALTINGS AND COASTAL PROTECTION

- a) Dr Brampton (Hydraulics Research) said that Hydraulic Research's interest started several years ago with the design of sea walls and the problem of overtopping earth banks. Research carried out in the HR laboratories found that the flat berm effect was effective in reducing wave heights, but if that berm disappeared, overtopping was much higher, with a greater risk of damage.

Attention was therefore focussed on the value of coastal saltings and it became clear that there was a financial advantage in preserving them. They not only reduce the effect of the waves on the sea defences but also reduce the tidal currents. The same benefits also apply to the retention of sand dunes.

Over the last few years HR have been gathering information on the saltings regime and in 1987 produced a report reviewing the influence and effectiveness of saltings with respect to the sea defences.

His initial thoughts were that there is no consensus of opinion as to why some saltings are in recession and civil engineering expertise could not begin to solve the problem, so a multi-disciplinary discipline is required.

- b) Mr Burt (Hydraulics Research) spoke next and said that the tidal engineering division of HR had recently conducted a study of estuarial saltings over one year in co-operation with Dr Boorman and he further emphasised concern with regard to saltings recession. A possibility exists of saltings recession leading to an increase in the tidal capacity of an estuary, hence to higher currents and more saltings recession. The whole stability of an estuary might therefore be affected.
- c) Mr Tinkler (Wessex Water) commented that they have had the problem of disappearing saltings on the Wessex coast in the Bristol Channel and this was solved by creating a pseudo salting ie creating sea defences using a 'retarded bank' some distance inland of the previous line of defences. The land between acts as a berm and is not entirely lost to agriculture. This was found to be economically justifiable. They still have problems however in protecting the edge of the new berm; this is where the money goes and Wessex Water are interested in this aspect in particular. The whole of the coast upstream from where the Severn Barrage is proposed is SSSI and this could create problems with the Nature Conservancy Council in the construction of the sea defences.
- d) Dr Edwards (University of Southampton) said that in the 1950's Joyce Lambert, their Plant Ecologist, had conducted surveys in the Christchurch-Lymington-Beaulieu areas on Spartina build up. There has been work done since then on developing this. They also have aerial photographs dating back to 1923.

The Chairman commented that there must be a lot of unpublished ecological material at the University of Southampton and this could be a useful source of information.

- e) Dr Boorman (Institute of Terrestrial Ecology) ran through the data he sent previous to the meeting (see Appendix B) and said he hoped for EEC funding for some of his research and a pollution study is proposed. He also has funding from the DOE for a long term look at the effect of climatic changes on mudflats, dunes and marshes.

The Chairman asked if we knew the present problems.

Dr Boorman agreed that we do not understand the part in research between applied and basic, but a balance has to be struck between the present and future.

The Chairman commented that we really need to understand present day problems and then project on into the future.

- f) Dr Doody (Nature Conservancy Council) stated that he was here for two reasons, namely, his inherent interest and the importance of the interaction with other disciplines. The NCC's interest in salt marshes is because of the flora and fauna and their management in terms of grazing etc. The NCC have recently completed their study of salt marshes in Great Britain and this should be available soon. In some counties 100% of the saltmarsh area is designated as SSSI and this also forms an integral part of the coasts and estuaries. The NCC must therefore co-operate in these areas with advice to coastal engineers.

The overall research and strategy is being reviewed within the NCC and up to two million pounds will be spent in four main areas:

- i) Basic survey work
- ii) Management studies
- iii) Monitoring (impact studies)
- iv) Research

A summary of this research is given in Appendix B.

Proposals (NCC, HR, ITE) have also been made for future research and the NCC also have an interest in geomorphology and coastal defence.

The Chairman asked what NCC's attitude would be if the saltings were left to fend for themselves.

Dr Doody thought that this would be a dilemma, to do nothing we would be losing something on the east coast but anything else would be interfering with the natural processes.

The NCC will be studying the marshes of Essex and North Kent this year and assessing the vegetation change since the last survey (ITE) in 1974. They are setting up a post as from the first of April. (Miss F Burd has since accepted this post.)

The Chairman asked if the NCC would allow the natural forces to pervade and would they be looking into the decaying processes?

Dr Doody said that the proposals are not as yet specific and this was one reason he was at the meeting.

The Chairman said that historical data was available and will the NCC also continue monitoring?

Dr Doody said that they would look at the available data and what factors might be important. They will also look at the data obtained from the survey carried out on the south-east coast of England in 1974 and what is happening now.

The Chairman asked why, as there are problems in several estuaries, Kent and Essex specifically?

Dr Doody said that their priority is Kent and Essex where the problems are thought to be most acute.

The Chairman asked if the NCC would be looking at other areas? Dr Doody replied that their field work would be principally in Kent.

- g) Mr Donoghue (University of Durham) said that their principal concern was in remote sensing and with understanding what is happening on various sites. They have built up a data base and are trying to reconstruct what has happened in the past and to project this into the future. For this reason they have set up a project study. This will include the gathering of field data and information on sea levels, to try to forecast what will happen.

The project, in the Wash, is monitored by Landsat and aerial work and they have two main aims:

- i) Study the impact of sea level rise
- ii) Look at cost effective ways of doing survey work ie low cost techniques.

The Chairman commented that this covered a wide range of spectra; what about Topographical and Geological work? Mr Donoghue replied that at the moment they were looking at specific problems. They are also studying how storm surges work.

The Chairman asked if they were working with the Institute of Oceanographical Sciences (ie sea level rise).

Mr Donoghue said yes, including modelling at Durham.

- h) Dr Bell (University of Liverpool) said that he was a biological scientist and worked in a research and conservation group at the University of Liverpool

They are concerned at the loss of vegetation and want to look at techniques to re-create salt marshes.

- i) Dr Hill (University of Liverpool) said that their solution was to attempt to set up trials on salt marshes and remarked that they have a good understanding of various sites including the Wash. They are interested in active steps in the study of saltmarsh and mudflats and advocate a wide perspective with an active approach.

Dr Brampton asked why, with regard to the spread of *Spartina*, is it now in decline?

Dr Hill replied that the most likely explanation is the lack of fresh sediment.

Dr Doody commented that other people would put forward a different explanation.

Dr Hill reiterated that they understand what is happening but need trials.

The Chairman asked if it was possible to get the biological procedures to work naturally in a forced sediment environment. He asked if she could force saltings in her pragmatic philosophy, adding that this would be a fundamental requirement.

Dr Hill said that they would colonise eventually and they are looking at ways to speed up the process.

The Chairman asked if this involved lots of trial and error? Dr Doody said that there had been a lot of work done on this.

- j) Mr Brown (Department of the Environment) explained that he was a NERC Biologist seconded to the DoE Directorate of Rural Affairs. They have a research programme looking at the countryside in general which includes the examination of change and its ecological consequences. DoE require an insight into climatic variability and have initiated a series of desk studies which includes Dr Boorman's examination of the impact of sea level rise on coastal habitats. DRA do not quite get into the marine environment although their interests include land reclamation in the Wash where the emphasis is on the narrowing of wading bird feeding areas and the consequences for these species and their invertebrate prey.

Dr Doody commented that the value of algae is important in the installation of salt marshes.

Dr Pethick remarked that McCave has just published a paper on this.

- k) Dr Clark (University of Southampton) said that both he and Dr Edwards were from the Geodata Unit at the University (at post graduate level). Their brief was not exclusive to the coast but they have a lot of data on the salt marshes in the Hampshire area. They are also involved in management and archiving and have a small project looking at salt marsh recession in the Solent where shingle supply is thought to be important.

They are currently researching:

- i) Coastal sensitivity,
- ii) Feedback into management, and
- iii) Oil spills

The Geodata Unit also share research into

- iv) Monitoring technologies ie remote sensing and multi spectral monitoring.
- v) Data handling for the coast ie geographical information.
- vi) Archiving of data.

The Geodata Unit have a broad interest in the Solent and was set up to interrelate with other groups.

- 1) Mr Harbott (Anglian Water, Colchester) said he was a principal scientist with Anglian Water, Colchester Division, in charge of the research and development budget. AW is involved in a lot of salt marsh projects and these are detailed in the notes received prior to the meeting (see Appendix B).

Anglian Water also have a current contract with Halcrow's to produce a Sea Defence Management Study. This will include all the relevant coastal activities.

The Chairman asked if they produced an annual report? Mr Harbott replied that their contractors have to produce reports, and R and D reports are available, including ongoing research, at Anglian Water.

The Chairman asked if a copy could be sent to MAFF. Mr Tinkler (Wessex Water) was also asked if they produce a report and could a copy be sent to MAFF.

- m) Mr Mascall (NFU Project) said that his interest started when he was with the Anglian Water because of his responsibility for the sea defences.

At present, as well as trying to retain the saltings, he is also trying to nudge them along by planting and by building groynes and poulders. He said that it was estimated in 1983 that if the saltings go the cost of updating the sea defences would be approximately two million pounds per mile.

At Deal Hall colonisation is now taking place and over the last eighteen months nine kilometres of banks within the estuaries have been protected. His conclusion was that it is possible to accrete sediment in the form of fine silts and mud. Given the right conditions it is not known why colonisation is not taking place.

The majority of the Essex salt marshes are eroding, particularly at the edges. Where the saltings are less than sixty metres wide the recession seems irreversible and is accelerating. More than fifty per cent of this recession occurs within the marsh.

He asked if seed supply was important? In some areas there seems no reason for vegetation erosion or die back, indeed these areas can be close to other growth areas.

There is cliff erosion near the low water mark and an attempt must be made to try and re-grow in smaller polders (say 60 m square). The Local Land Drainage Committee and the Hampshire County Council are most anxious and feel that more research is required.

- n) Dr Pethick (University of Hull) said that he was currently working in Essex for Anglian Water with Mr Mascall and also on the North Norfolk marshes and in the Humber.

He is looking at the fundamental coastal processes from a different approach ie at the boundry layer and trying to discover what difference vegetation makes at the bed.

He commented that Spartina was very sick in the Humber and, because it is in patches, it acts as an erosive agent. Accretion needs lots of Spartina.

He went on to say that it is possible to have a cliff edge and no erosion. This then may not necessarily be an indication of salt marsh erosion. In Essex erosion could be caused by 'surf stripping', a few microns each tide could cause dramatic erosion over a year.

The lighters placed as offshore breakwaters on the Dengie coast have the effect of cutting down the critical shear stresses and increase accretion by something like 12 cms per year. In the Humber this occurs naturally.

- o) Mr Purnell (MAFF Cambridge) felt that the situation was confused and we need to know what is going on. If we take the sea defences back in a few years we will be back to the same problem.
- p) Mr Allison (MAFF London) asked Dr Doody that if the NCC control presently 100% saltings in some counties (ie SSSI's), would all saltings become SSSI's if sea level were to rise as now being predicted.

Dr Doody replied that in certain areas the onus is on all of us to work together to find a way to help sea defence. We know there is a problem and pooling resources is vital.

He also mentioned two things have not as yet been talked about:

- i) The effect of coast protection elsewhere ie the geomorphological relationship, and
- ii) The extent to which we still allow all forms of dredging ie offshore and coastal.

The Chairman said that we have learned a lot, from harbour dredging, about what happens elsewhere.

Mr Mascall said that a lot of material is lost offshore and this is important.

Dr Brampton said that Dr Doody had a fair case although deep dredging involves no silt. If sand and gravel are part of the coastal system, dredging for aggregate is now allowed.

The Chairman then brought the morning session to a close. He summed up by commenting on how we should move forward on a middle path. There are so many people looking at different aspects.

He thought that we had aired many areas of research and should be able to structure a research programme. As far as MAFF are concerned, high priority should not be placed on changing sea levels.

The afternoon session should look at research strategy.

AFTERNOON SESSION

Before the afternoon session got underway, Dr Boorman suggested that further communication is needed in the coastal field as there is a gap in our experience between land and sea.

Coastal Research News (a newsletter) is about to be produced and all those who receive a copy (including those at the meeting) are invited to an inaugural meeting at Peterborough on the 21 June 1988 from 1200-1600.

The Chairman suggested sending a copy to Mr Paul Lacey who is Chairman of the committee for coastal research at the ICE. He stressed the need for a central register.

The Chairman asked Dr Brampton if he would take over the chairmanship a little later as he (Mr Whittle) had to attend another meeting.

In his opening remarks at the afternoon session, Mr Whittle opened the door for HR to work to co-ordinate on MAFF's behalf, to look further into saltings and their problems.

As project managers, HR could then sublet contract to look at, for instance:

- (i) Monitoring
- (ii) Shear stresses
- (iii) Invertebrates
- (iv) Spartina - how - why?
- (v) Sediment supply
- (vi) Aspects of research to fit into the global need
- (vii) Determine if other monies were available
- (viii) Cost benefit appraisals

The managers will need a steering group, probably larger than normal, so members of this committee should also be considered.

Dr Brampton said that the aim of HR will be to manage the contracts and this umbrella cover may well bring in further research. A manager and steering group will also avoid the danger of duplication.

Dr Clark said he would be pleased to participate in such a group and the monitoring of one site could be the stepping stone to countrywide data gathering.

Mr Tinkler thought that if funding is to come from other sources as well then the group may have to be re-jigged.

The Chairman said that this would have to be explored. Relevant experience would be the Anglian Water Sea Defence Management Study and a mixture of panels containing workers and reviewers seems to work.

Dr Bell asked why HR should be the managers.

The Chairman said that HR couldn't manage the individual research but would act as overall managers on MAFF's behalf.

Dr Doody asked what is this group about, what do we want to do? He thought that it had been agreed to bring people together to put forward their views. The initial proposal was to identify what was going on and then discuss the way forward.

NCC money is now committed for this year and a small amount is left for this area.

The Chairman stated that someone has to sit down and say what is required, therefore MAFF had selected HR bearing in mind the research already done at Wallingford.

Mr Harbott commented that we had not yet identified the areas required.

The Chairman said that this was for the afternoon session. The priority is research and he would like to leave with an idea of the research needs and who was going to do it.

Dr Clark commented that there was only an apparent difference between the NCC and engineering research. There is no conflict as such.

The Chairman agreed.

Dr Bell thought that is was the problem between engineering and biological bias that has caused confusion.

The Chairman said that if there was no overlap then that is established. The new Chairman will ask for proposals.

Dr Bell said that CIRIA were looking at vegetation in the engineering sense.

The Chairman stated that all aspects were to be put on the table.

Mr Whittle and Mr Allison then left and Dr Brampton took the chair.

4. RESEARCH STRATEGY

The new Chairman said that he thought that everyone would agree that today's contacts have been useful. He saw it as encouraging that MAFF will put money into new research and it is clear that their principal aspirations are engineering related. However, every scheme has an ecological impact and engineers cannot just do what they want.

He said that it was certainly a large field and it would be difficult to put together a research package. He thought it best to go around the table to find out what each individual has in mind for research. These ideas should ideally be split into two: research ideas and research needs.

Mr Burt thought that a decision had to be made whether to preserve saltings.

Dr Doody commented that the danger here is that saltmarshes differ and you cannot make a general sweeping statement. Spartina has to be controlled, the NCC have a duty to protect the natural systems and that includes salt marshes.

Mr Burt said that there is no one policy. His expertise is on the engineering side and, in his experience, creating an artificial environment needs artificial maintenance. The DoE have funded a study of 'the fundamentals of an estuary' and this is a related study.

He was most interested in the physical processes of erosion and deposition and there is scope here for development. DoE has funded in co-operation with SERC a study entitled 'co-ordinating sediment research initiative' and HR are making their facilities available.

He was not all that sure that the difference between the engineers and the biologists was all that great.

Mr Tinkler said that a high foreshore was the best defence against the sea and salt marshes give a high foreshore. Wessex Water had found that there tends to be a gradual build, up then a big storm comes along and it is all lost. He would like a study into time related physical processes and he thought that little was known about salt marsh foreshores.

Dr Edwards said that Spartina had, over the years, colonised millions of cubic metres of mud, then came the die back which started in the 1940's. There is no concept of a natural balance and monitoring is essential.

We probably understand in part. It is fairly clear on the biological level but little has been done regarding the coastal processes and sediment transport. Any research must join together the processes of accretion and erosion together with the biological process.

The chairman asked if there were any related research.

Dr Edwards remarked that there has been a natural process of accretion, now it is erosion and it would be folly not to monitor the process fully.

Mr Harbott asked if he understood the actual processes, the causes and what to do about it.

Dr Edwards said that the biological side was understood in the Solent.

The Chairman then asked if it could be predicted.

Dr Edwards replied that it could be done, it is the interaction that is not understood.

Dr Boorman said that research is vital and in his field should be concentrated on:

- i) The lack of species in certain areas.
- ii) Pollution and how and why the clay mounds form on the Essex coast.
- iii) The mechanism of normal seeding.
- iv) The erosion/accretion balance at the surface.
- v) The effect of the substrata on the seedlings.

This has got to be applied research.

The Chairman asked whether this would be in the laboratory or in the field on trial sites.

Dr Boorman replied that both are needed.

Dr Doody said that there was a lot of information in existence and the group should review this and the priorities. The priorities are gathering expertise; everyone is too involved in their individual expertise and we should be looking at the overall problem.

The Chairman commented that the danger is that it could deteriorate into a chat shop, research money is hard to come by and it is better to press on and start research in certain areas.

Mr Donoghue thought that we must look at methods and gather information. We must think carefully on how we should look at certain areas and have an overall aim.

Mr Harbott thought that this was a golden opportunity and the meeting should ask HR to produce a list of the expertise available. People should be asked to say in one sentence what they think research should consist of.

The Chairman said that MAFF have an overall aim.

Mr Donoghue said that in some cases adjacent salt marshes were both eroding and accreting. The end project should be a map of the UK with references showing what has been or is being done in terms of salt marsh research.

The chairman agreed that there was an awful lot of information around that could be usefully brought together.

Mr Mascall said that he would continue to try and alleviate flood risk and would welcome input to understand what is going on. Salt marshes have changed over the last two hundred years. The NCC are not happy about the planting of Spartina and that he was doing this tentatively.

Mr Purnell said that he would like to define the question that MAFF are trying to ask. We either lose land or spend money to update the seawalls. If we can find out what is happening to the marshland then this will be a big step forward.

The chairman asked Mr Donoghue to put forward a scheme to be funded.

Mr Donoghue thought that there should be monitoring on a national scale and certain areas should be looked at in detail.

Dr Pethick asked if this should be a data base approach.

The Chairman also asked if this would be a salt marsh data base and would it include waves and tides.

Mr Donoghue agreed that this was so.

Dr Hill put forward her thoughts for research and they included:

- 1) Impact on creating new salt marsh on existing mudflats. This would be aimed at sea defence but would also look at the ecology of the mudflats. It would be more novel than simply planting Spartina, about which there is a lot of information.
- 11) A decision has to be made and experimental studies conducted with other vegetation and include planting with structures suitably placed.

The Chairman asked if this would be a plant ecology base. He thought that there would be a dilemma here, the results were wanted almost instantly but research takes time.

Mr Brown thought that we should look at what change is going on, why is it changing. We should also look at predicting this change and discover the gaps in research. Why are the plants dying off?

The Chairman asked if he had in mind a salt marsh data base system or would he plan on intervention and doing something.

Mr Brown thought that we should endorse experiments carried out by the University of Liverpool to create new salt marsh.

Dr Clark said he had no hangups between biology and engineering or strategy and tactics. There was a huge amount to be done on monitoring and we had to build up our historical information and our techniques. An information systems (a wetlands data base) should be put into general use.

The Chairman asked if he would concentrate on the Solent/Hampshire area and then widen out.

Dr Clark said Universities like Dr Pethick's could send students down.

Mr Harbott said he would like to see an amplification of the knowledge of vegetation loss. He would also like to see a review of current and historical remote sensing data and determine what has or has not happened to salt marshes over the years. What are the alternatives (in a civil engineering sense) to salt marshes, should we investigate rockfill etc. He also thought that there should be a register on salt marshes in the same vein as the Anglian Water Sea Defence Management Study. It would also be useful to study economic techniques.

Dr Pethick would like to see a study of the physical processes and sediment budget work in different areas and levels.

The Chairman thought also that the list should include:

- i) saltmarsh profiles,
- ii) sediment budget, and
- iii) sediment processes studies.

The Chairman wound up the proceedings and said that time was pressing and certainly there had been many ideas circulated. He suspected that MAFF would be pushing for research projects and ideas on funding. The project will probably be over three or four years, perhaps starting with a review.

Any proposals should be put in by the end of May at the latest.

Dr Doody was concerned that the original proposals at the earlier meeting were not looked at.

The Chairman promised that copies would be sent to the participants with the minutes of this meeting.

APPENDIX B

Summary of research proposals

5. SUMMARY OF THE RESEARCH PROPOSALS

The thoughts at the meeting on future research were many and varied.

They are summarised below under five headings.

Monitoring

- i) monitor changes to discover what happens, why the changes occur and if they can be predicted
- ii) time related physical processes
- iii) coastal processes
- iv) sediment transport
- v) sediment budget
- vi) profiles

Data base

- i) national register of salt marshes
- ii) historical data
- iii) review of salt marsh research
- iv) methods of gathering information
- v) list of expertise available
- vi) discover gaps in research

Remote sensing

- i) review of expertise

Geomorphology

- i) erosion/accretion balance
- ii) impact of creating new salt marshes on the existing mudflats

Ecology

- i) mechanism of normal seeding
- ii) lack of certain species
- iii) pollution
- iv) effect of substrata on seedlings
- v) studies of other salt tolerant vegetation

Summary of research projects: current or proposed

Appendix B

Research projects, either in progress or proposed, submitted by the attendees to the meetings.

Dr J Pethick, University of Hull

- a) Three year study (funded by Anglian Water) of saltmarsh recession on the Essex coast. He is looking at the processes of marsh recession including both field and laboratory studies and examining the effects of wave action and the role of vegetation on surface stresses.
- b) A long term study, begun in 1986, looking at the apparent cyclic development and erosion of saltings in the Humber and the effect of channel changes on marsh recession.
- c) Work on the North Norfolk saltmarshes, examining the surface movement of sediments on the creeks and marshes and its relationship to marsh morphology.

Dr L Boorman, Institute of Terrestrial Ecology

Current

- a) A five year study (funded by Anglian Water) to look at:
 - i) detailed changes in the saltmarshes of Hamford Water over the last thirty years. This data is needed to define
 - a) the type of marsh most likely to be affected by erosion,
 - b) whether valid predictions on future erosion trends can be made,
 - c) the use of remote sensing in the detection of salt marsh deterioration.
 - ii) the tidal regimes tolerated by the main salt marsh species. this data is needed to define the erosion processes, predict change and to plan plantings in artificially enhanced areas.
 - iii) the conservation significance of the Essex saltmarshes and how erosion and management is likely to affect this.

Proposed

- a) The effect of pollution on salt marsh processes
- b) The implications of climatic change on salt marsh processes

Under negotiation

Joint submission (France, the Netherlands, Portugal and the UK) to set up a European Coastal Marsh Research Programme to define the changing role of sediment and nutrient transport in the sequence from bare mudflats through to reclaimed marshland and to interpret the processes in relation to the needs of coastal zone management.

Mr D Brown, Department of Environment

Current

- a) A research programme looking at the impact of land use change on conservation, recreation and amenity. This includes:
 - i) the impact of further land reclamation on wading bird/invertebrate prey interactions,
 - ii) consideration of the potential effects of climatic change,
- b) About to commence is a desk study on 'The effect of sea level rise on coastal habitats'.

Dr P Doody, Nature Conservancy Council

Current

- a) Survey of saltmarshes in Great Britain (due for completion March 1988)
- b) Survey of sand dunes in England and Wales (completion date 1992)
- c) Survey of vegetated shingle structures (completion date 1990)
- d) Review of fungi on sand dunes (Wales)
- e) The investigation of grazing management on sand dunes (Handbook to be completed by 1988)
- f) Salt marsh management in NW England (review by ITE). It is intended that this will be extended to cover Great Britain over the next three and a half years and will be integrated with the proposal to review the changes in salt marshes in Essex and Kent (completion date 1991)
- g) Sea Cliff management study (Handbook to be completed by 1989).

Proposed

- a) Investigation of dune slack management (University College, Cardiff).
- b) Sand dune management strategies and sand dune vulnerability (Polytechnic of Wales).
- c) Salix repens management at Ainsdale NNR (University of Liverpool).
- d) Investigation of the relative importance of dune woodland and scrub (ITE).
- e) Investigation of grazing and its impact on invertebrates.

University of Essex (funded by Anglian Water)

Current

- a) Survey of invertebrate fauna and small mammal populations.
- b) Identification of key areas of the Essex saltings for conservation.

Royal Society for the Protection of Birds (funded by Anglian Water)

Current

- a) Status and key species of birds on the Essex saltmarsh
- b) Review habitat here and in Western Europe
- c) Overview of the importance of estuaries, assess the detrimental effects of the loss of saltings.

Dr I Shennan/Mr D Donoghue, University of Durham

Current

- a) The use of remote sensing into:
 - 1) Mapping saltings in the Wash Estuary
 - 11) Radiometric properties of salt marsh vegetation and sediments
 - 111) The impact of sea level changes on coastal environments and tidal modelling, with emphasis on the impact of storm surge events.

