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## Preface

The East Solent Shoreline Management Plan is presented in four volumes. This document is Volume III. It presents background information on coastal processes, existing management operations, the natural environment, land use and the human environment that is necessary in the formulation of management plans for the large natural harbours of Chichester, Langstone and Portsmouth.

The remaining three Volumes of the East Solent Shoreline Management Plan include:

- the background management information for the open coast and Pagham Harbour (Volume I)
- the coastal defence objectives, management units, preferred management options, recommended further studies and future review programme for the open coast (Volume II)
- the coastal defence objectives, management approach, preferred management options, recommended further studies and future review programme for the harbours, including Pagham Harbour (Volume IV).

Chichester District Council, acting on behalf of the East Solent Coastal Group, commissioned HR Wallingford to undertake the Shoreline Management Plan in accordance with the Consultant's Brief and the Ministry of Agriculture, Fisheries and Food document "Shoreline Management Plans - A Guide for Coastal Defence Authorities". The Steering Committee for the East Solent Group comprised:

Mr D. Bell - Technical Services Department - Chichester District Council (Lead Authority)  
Mr A. Greenhouse and Mr P Willey - Planning and Development Department - Fareham Borough Council  
Mr M. Wheeler - Engineering Services - Gosport Borough Council  
Mr G. Lloyd - Engineering Services - Portsmouth City Council  
Mr M. Smith - Technical Services - Havant Borough Council  
Mr C. Harding - Environment Agency  
Dr R. Ekins - English Nature  
Mr D. Green - Directorate of Planning and Housing - Arun District Council (Observer)

Mr Chris Harding of the Environment Agency was the Project Manager for the Group. Mr Malcolm Smith of Havant Borough Council was Chairman of the Steering Committee.

The Plan was formulated by a project team led by HR Wallingford with support from Rendel Palmer & Tritton, the RACER Group of Portsmouth University, and Ecological Planning and Research Ltd. The Project Manager was Mr Tom Coates of HR Wallingford. Contributing authors included Mr Mark Lee (RPT), Mr Jerzy Motyka (HRW), Dr Kathryn Carpenter (HRW), Mr Andrew Bradbury (RPT) and Dr Malcolm Bray (RACER). The HR Wallingford job number was CGR 2024.

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30 June 1997

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- Appendix 1 References
- Appendix 2 Existing defences



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## ***Glossary***

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### ***Organisations***

BC	Borough Council
CC	County Council or City Council
DC	District Council
MAFF	Ministry of Agriculture, Fisheries and Food
MoD	Ministry of Defence
DoT	Department of Transport

### ***Conservation designations***

AONB	Area of Outstanding Natural Beauty
CHS	Countryside Heritage Site
GCRS	Geological Conservation Review Site
LNR	Local Nature Reserve
NNR	National Nature Reserve
Ramsar	Designated under the Ramsar Convention on Wetland of International Importance especially as Waterfowl Habitat
SAC	Special Area of Conservation
SINC	Site of Importance for Nature Conservation (Hampshire)
SNCI	Site of Nature Conservation Interest (West Sussex)
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest

### ***Tidal levels***

LAT	Lowest Astronomical Tide
MLW (S or N)	Mean Low Water (Spring or Neap)
MHW (S or N)	Mean High Water (Spring or Neap)
HAT	Highest Astronomical Tide

### ***Waves***

$H_s$ or Significant wave height	Height of 1/3 highest waves in a given event or period
Swell	Waves generated by winds outside the area
Wind sea	Waves generated by local winds including storm waves
$T_m$	Mean time interval between successive wave crests

### ***Cross-shore zones***

Beach head	The cliff, dune or seawall forming the landward limit of the active beach
Backshore	Area above normal maximum high water, but affected by coastal processes
Beach crest	The point representing the limit of high tide storm wave run-up
Intertidal or foreshore	Area between LAT and HAT
Nearshore	Area over which seabed transport can be caused by storm waves, including intertidal zone
Offshore	Area seaward of nearshore zone where sea bed transport is not normally driven by waves





### ***Beach morphology and materials***

Fines	Particle diameter less than 0.063mm (silt and clay)
Sand	Particle diameter between 0.063mm and 2mm
Shingle	Clast diameter between 2mm and 75mm, also gravel
Cobbles	Clast diameter greater than 75mm
Dune	Wind blown sand deposit, often vegetated
Shingle ridge	Upper beach feature with low lying backshore subject to flooding
Spit	A long narrow accumulation of sand or shingle, lying generally in line with the coast, with one end attached to the land the other projecting into the sea or across the mouth of an estuary
Foreland	Relict backshore area formed by long term seaward development of shoreline

### ***Coastal defence structures***

Apron	Layer of stone, concrete or other material to protect the toe of a seawall
Detached breakwater	A breakwater without a constructed connection to the shore
Embankment	Earth bank raised above low lying hinterland area to prevent flooding
Gabions	Wire mesh baskets filled with rock
Groyne	Cross-shore structure designed to reduce longshore transport by causing a reorientation of the beach
Revetment	General term for sloping, often permeable structures, providing flood or erosion protection to the backshore
Seawall	General term for vertical or near vertical impermeable structures, providing flood or erosion protection to the backshore

### ***General glossary***

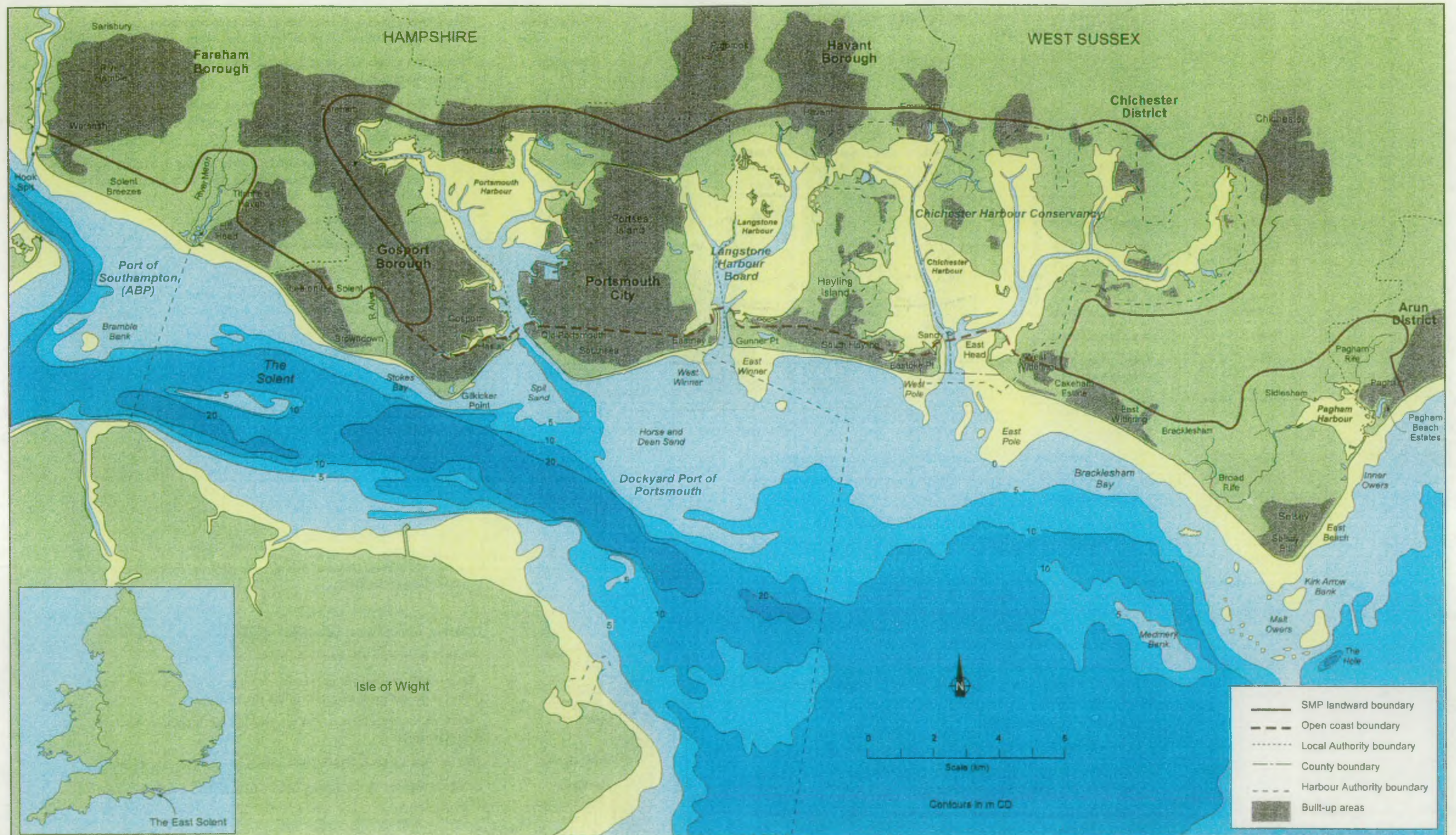
Accretion	Accumulation of (beach) sediment by natural processes
BP	Before Present
Bathymetry	Spatial variability of levels on the seabed
Beach management	Management of a beach as a coastal defence with a pre-determined standard of protection, using combinations of beach recharge, recycling, reprofiling, beach control structures and a programme of monitoring
Beach plan shape	The shape of the beach in plan: usually shown as a contour line, combination of contour lines or recognizable features such as beach crest and/or still water line
Beach profile	A cross-section taken perpendicular to a given beach contour; the profile may include the face of a dune or seawall, extend over the backshore, across the foreshore, and seaward underwater into the nearshore zone
Beach recharge	Supplementing the natural volume of sediment on a beach, using material from elsewhere - also known as beach replenishment / nourishment / feeding
Bed forms	Features on a seabed (e.g. ripples and sand waves) resulting from the movement of sediment over it
Bed load	Sediment transport mode in which individual particles either roll or slide along the seabed as a shallow, mobile layer a few particle diameters deep
Breaching	Failure of the beach head allowing flooding by tidal action

Bypassing	Moving beach material from the updrift to the downdrift side of an obstruction to longshore-drift
Chart Datum (CD)	The level to which both tidal levels and water depths are reduced - on most UK charts, this level is that of the predicted lowest astronomical tide level (LAT)
Coastal defence	General term used to encompass both coast protection against erosion and sea defence against flooding
Coastal processes	Collective term covering the action of natural forces on the shoreline and nearshore seabed
Coast protection	Protection of the land from erosion and encroachment by the sea
Cross-shore	Perpendicular to the shoreline
Depth-limited	Situation in which wave generation (or wave height) is limited by water depth
Diffraction	Process affecting wave propagation, by which wave energy is radiated normal to the direction of wave propagation in to the lee of an island or breakwater
Downdrift	In the direction of the nett longshore transport of beach material
Drift	See Longshore drift
Ebb	Period when tide level is falling; often taken to mean the ebb current which occurs during this period
Ebb tide delta	Area of sediment accretion formed where strong tidal currents decrease in velocity after leaving a restricted channel and entering a more open nearshore area
Fetch	Distance over which a wind acts to produce waves - also termed fetch length
Fetch-limited	Situation in which wave energy (or wave height) is limited by the size of the wave generation area
Freeboard	The height of the crest of a structure above the still water level
Frontager	Person or persons owning, and often living in, property immediately landward of the beach
Joint probability	The probability of two (or more) things occurring simultaneously
Kelp rafting	Transport of shingle and cobbles from the outer nearshore zone to the beach while attached to the foot of neutrally buoyant seaweed; rafted material is much more mobile than normal shingle
Littoral drift, Littoral transport	The movement of beach material in the littoral zone by waves and currents. Includes movement parallel (longshore drift) and perpendicular (cross-shore transport) to the shore
Longshore	Parallel and close to the coastline
Longshore drift	Movement of (beach) sediments approximately parallel to the coastline
Managed retreat	The deliberate setting back of the existing line of defence in order to obtain engineering and/or environmental advantages
Mud flat	An area of fine silt usually exposed at low tide but covered at high tide, occurring in sheltered estuaries or behind shingle bars or sand spits



Ordnance Datum (OD)	Standard reference level used by the Ordnance Survey for land survey in the UK, based on mean sea level at Newlyn, Cornwall
Overtopping	Water carried over the top of a coastal defence due to wave run-up exceeding the crest height
Potential drift rate	Theoretical longshore drift rate assuming no restriction on supply of material. Actual drift is often much less due to lack of supply or interruption due to cross-shore structures (e.g. groynes)
Refraction	The process by which the direction of a wave moving in shallow water at an angle to the contours is changed so that the wave crests tend to become more aligned with those contours
Return period	Average time between occurrences of a given event
Saltmarsh	Area of salt tolerant vegetation within the intertidal zone
Sea defences	Works to alleviate flooding by the sea
Sea level rise	The long term upward trend in mean sea level resulting from a combination of local or regional geological movements and global climate change
Sediment sink	Point or area at which beach material is irretrievably lost from a coastal cell, such as an estuary or a deep channel in the seabed
Sediment source	Point or area on a coast from which beach material arises, such as an eroding cliff, or river mouth
Shoreline management	The development of a strategic, long-term and sustainable coastal defence policy within a sediment cell
Standard of service	The adequacy of defence measured in terms of the return period (years) of the event which causes a critical condition (e.g. breaching, overtopping) to be reached
Surge	Changes in water level as a result of meteorological forcing (wind, high or low barometric pressure) causing a difference between the recorded water level and that predicted using harmonic analysis, may be positive or negative
Suspended load	A mode of sediment transport in which the particles are supported, and are carried along by the fluid
Tidal current	The movement of water associated with the rise and fall of the tides
Tidal range	Vertical difference between high and low water level
Tide	The periodic rise and fall in the level of the water in oceans and seas; the result of gravitational attraction of the sun and moon
Updrift	The direction opposite to that of the predominant longshore movement of beach material
Wave climate	The seasonal or annual distribution of wave height, period and direction
Wave rose	Diagram showing the long-term distribution of wave height and direction





The East Solent

Figure 1



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# **1 Introduction**

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## **1.1 Strategic background**

In 1993 the Ministry of Agriculture, Fisheries and Food (MAFF) and the Welsh Office published their "Strategy for Flood and Coastal Defence in England and Wales" (MAFF, 1993a). This publication set out the need to manage the shoreline from the perspective of coastal process cells or sub-cells rather than in accordance with the administrative boundaries of the coastal operating authorities. Since then voluntary coastal groups comprising coastal authorities, the Environment Agency and major local interest groups have formed around England and Wales with the aim of establishing integrated regional coastal defence strategies in accordance with the MAFF guidance document "Shoreline Management Plans - A Guide for Coastal Defence Authorities" (MAFF, 1995a).

The intention of the Shoreline Management Plan (SMP) for each area is to establish a coast defence strategy that is technically, economically and environmentally sustainable. The plans for adjacent coastal areas must be compatible and they must take account of natural coastal processes, existing defences and both human and other environmental influences and needs. The SMPs are non-statutory documents intended to both inform and be supported by the statutory planning processes. As such they must take account of the diverse interests in the shoreline and must be presented in a form that is accessible to a wide audience.

The SMPs are the foundation for shoreline management, but are not definitive. They are based on existing information and will need to be reviewed as future studies modify and extend the understanding of the coastal zone. An important element of each SMP is the identification of gaps in available information and recommendation of monitoring or research programmes to improve the situation.

The SMPs are not intended to set out strategies for the broader coastal issues addressed by Coastal Zone or Harbour Management Plans, such as management of tourism, natural habitats or mineral resources, although all of these matters must be considered in shoreline management. SMPs are also not intended to appraise detailed management schemes for specific frontages as that level of planning will be undertaken at the follow up stage of strategy studies and project appraisals.

## **1.2 The SMP process**

SMP production is separated into two stages. In Stage 1 the background information required for management is collected from existing sources, the broad objectives for the Plan area are established and the area is subdivided into Management Units based on natural processes, existing land use and planning objectives. The required information includes:

- coastal processes
- natural environment
- land use and the human and built environment
- existing coastal defences.

Consultation with a wide range of groups with an interest in the shoreline is an important part of Stage 1, in terms of obtaining information, providing an understanding of the management issues and identifying any further studies required.

In Stage 2 the strategic coastal defence options for each Management Unit are proposed, justified and selected to achieve the Plan objectives. Justification and selection of the options are based on all of the information obtained in Stage 1 and are subject to review and comment by the Consultees. The selected options must be sustainable in terms of engineering viability, economic justification and environmental impact. Possible management operations that will achieve the selected policy are proposed in outline and recommendations are

made for future monitoring, research and management review procedures to ensure that the Plan is carried into the future as a working document.

## 1.3 The East Solent SMP

The East Solent SMP area extends from Pagham in the east to the mouth of the River Hamble in the west, and includes the natural harbours of Chichester, Langstone, Portsmouth and Pagham (Figures 1 and 2). The landward boundary of the SMP is nominally fixed at 1km inshore or at the 5m OD contour, whichever is the greater distance from the shoreline. The seaward boundary is not defined, as all processes and factors that may influence the shoreline are considered regardless of location.

The coast varies from eroding cliffs, shingle banks and heavily defended headlands on the open coast to salt marshes, flood embankments and deepwater jetties within the large natural harbours. The open coastline extends for some 50km while the harbour coastline is over 170km. The land is generally low lying, with large areas at risk from flooding. The surface geology comprises easily erodible Tertiary and Recent deposits of sand, gravel and clay mixtures.

The wave climate and tidal regime are complex relative to other areas of the UK, due to the influence of the Isle of Wight and the constricted entrance to the harbours. The tides are particularly complex, with a rapidly changing tidal range, extended high waters and complex patterns of tidal flow including strong ebb and flood currents through the harbour entrance channels and around the major headlands.

From Pagham to Portsmouth Harbour the coast is low lying and large stretches are prone to both erosion and flooding. Selsey Bill was once one of the most rapidly eroding stretches of coast in the country prior to construction of the existing defences in 1956. West of Selsey Bill at Medmery there is much land which is low lying and would be regularly flooded were it not for the presence of a large shingle bank, artificially maintained on a regular basis. At the west end of the Selsey peninsula is the East Head spit, of great importance for coast protection, ecological habitats and amenity use.

Hayling and Portsea Islands are both low lying and liable to flooding and erosion. Much of the open coast shorelines of both islands are formed of massive shingle accumulations, influenced by a variety of coast defence structures and management operations. The nearshore zone is generally formed of wide, shallow banks divided by the deeper entrance channels to the natural harbours.

The harbours themselves are under threat of erosion and flooding with the dieback of saltmarsh causing what may be serious changes in the long term stability of the shoreline. Portsmouth Harbour is the most highly developed of the harbours. Its margins have been greatly altered by development and reclamation, although it still contains important wetland areas and long stretches of muddy shoreline little spoilt by urban development pressures.

West of Portsmouth Harbour the shoreline comprises massive shingle accumulations extending from Fort Gilkicker up to Lee-on-the-Solent. This natural frontage affords protection from the sea but this condition may change as the supply of material feeding the beaches reduces.

From Lee-on-the-Solent to Hill Head Harbour the land rises and much of the frontage is formed by seawalls protecting cliffs that were formerly subject to erosion. The construction of groyne systems and seawalls dates back to the 1950's. The condition and effectiveness of these defences varies over the frontage.

Hill Head Harbour forms a marked discontinuity in the coastline. Northwest of the harbour there are cliff exposures of easily eroded sands and gravels which provide an important supply of beach material. The cliffs are of considerable archaeological and palaeontological significance being a rich source of palaeolithic artifacts and bird fossils of the Mid-Eocene age.

These cliffs extend almost to the mouth of the River Hamble and are to a large extent unprotected. Hook Spit, formed of material eroded from these cliffs, extends northwards into the River Hamble and provides protection to low lying land behind.

Plates 1-8 illustrate the range of shoreline situations found within the harbours.

The coastal strip has varied land use. Heavily developed residential, commercial and military areas coexist with large areas of farm land and undeveloped wetlands or marshes of high environmental value. The nearshore and intertidal areas are extensively used for water sports and also have a high environmental value.

This complex area presents a particular challenge to shoreline management. Changing social, economic and military priorities have begun a process of redevelopment of the built up areas while management of the open areas must resolve conflicts between the protection or enhancement of the natural environment and pressure for further recreational, commercial or residential development. These diverse interests, plus the need for economic justification, must all be considered by shoreline managers.

For the purposes of the SMP production the East Solent area was divided into two components: the open coast and the harbours. This distinction was based on the differences in coastal processes and the general independence of shoreline management activities. The open coast is subject to relatively high energy wave conditions acting over long lengths of the shore and strong interdependencies between adjacent frontages in terms of shoreline evolution and the impact of management operations. In contrast, the harbours are subject to low wave energy conditions often acting over short frontages with little interdependency, even over short distances. Although the open coast and the harbours influence each other around the harbour entrances, it was considered that the differences between the two environments were sufficient to justify separate consideration.

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## **1.4 Report outline**

The East Solent SMP is presented in four Volumes. As the issues and processes within the harbours are largely independent to those of the open coastline, the SMP has been separated into two parts. Stages 1 and 2 of the SMP for the open coastline are presented in Volumes I and II, while Volumes III and IV present the SMP for Chichester, Langstone and Portsmouth Harbours. The SMP for Pagham Harbour has been split between the Stage 1 volume for the open coast and the Stage 2 volume for the harbours. It is included with the open coast since the coastal processes dominating its form are strongly dependant on those of the shingle spits at its entrance, and, to a lesser extent, the shingle ridge at Bracklesham Bay to the south. From the management perspective of Stage 2 it is convenient to present Pagham Harbour in the volume with the other harbours as there are distinct differences in the management approach between the harbours and the open coast.

The present document forms Volume III of the SMP and contains the background data for the natural harbours of Portsmouth, Langstone and Chichester. Chapter 2 describes the Stage 1 consultation procedures, and includes a full list of the Consultees with a summary of their interests and concerns. Data on coastal processes, existing defences, planning, land use and the natural and human environment are presented in Chapters 3 to 6. This information is set out as maps, tables and text and is intended to act as an information source. Possible future



changes affecting the SMP are discussed. It should be noted that large scale maps only present data relevant to the harbours and not the open coast.

A glossary of terms and abbreviations is presented at the front of each Volume. References are contained in the appendices, as are data on existing defences based on the MAFF and Environment Agency coast protection and sea defence databases.





Plate 1      Gosport shoreline, Portsmouth Harbour



Plate 2      Fareham Lake, Portsmouth Harbour





**Plate 3**      **Langstone Harbour**



**Plate 4**      **South shore of Eastney Lake,**  
**Langstone Harbour**





**Plate 5**

**Chichester Harbour**

(© Bryan Pinchen)



**Plate 6**

**Shore of Thorney Channel, Chichester Harbour**



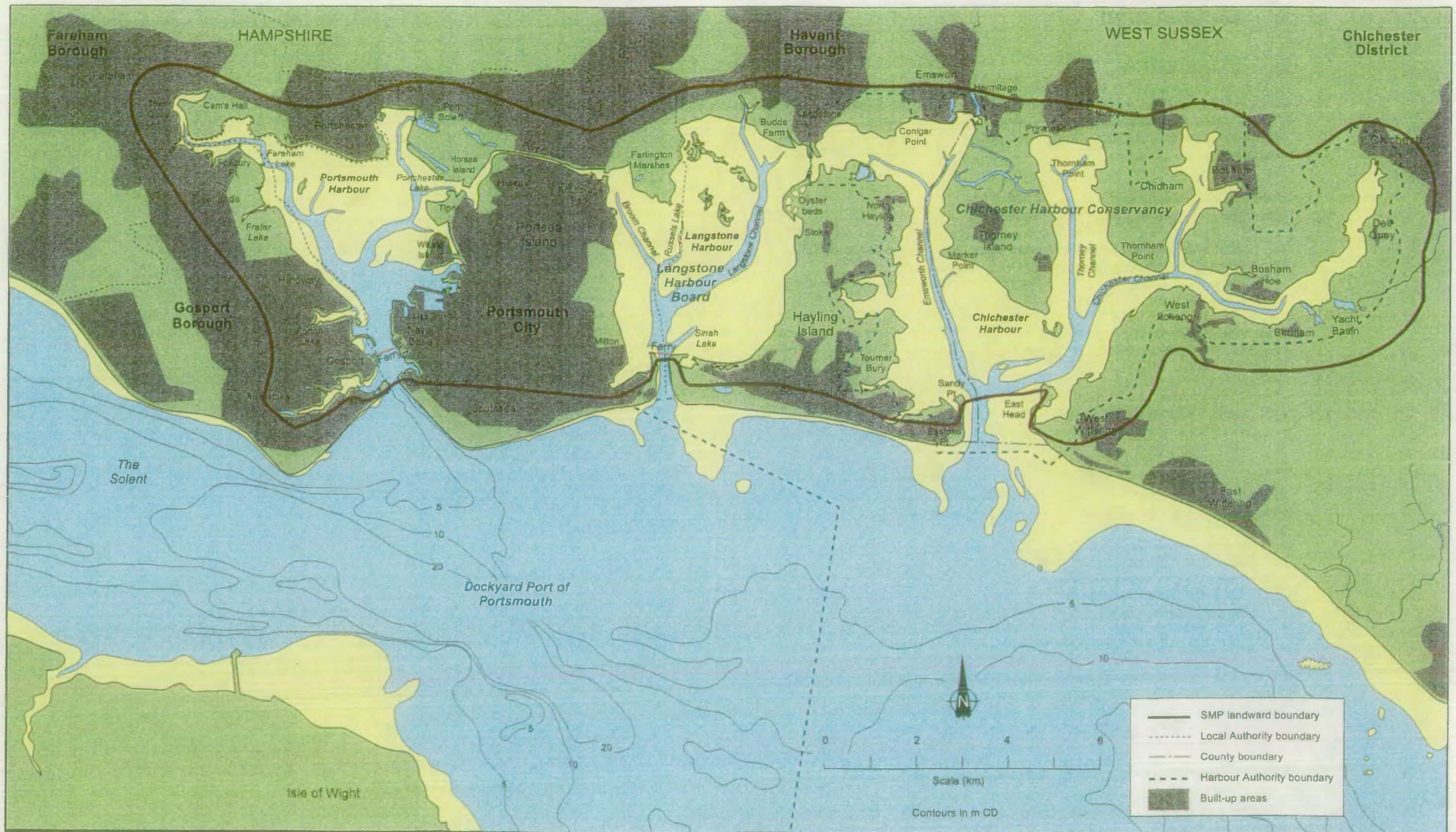


**Plate 7**      **Recent works at Prinsted, Chichester Harbour**



**Plate 8**      **Chichester Channel, Chichester Harbour**





The East Solent Harbours

Figure 2



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## 2 Consultation

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### 2.1 Consultees

The involvement in the SMP of all the groups and organizations with an interest in the Solent shoreline is seen as critical to its long term success. To achieve this involvement from the outset the project team consulted widely to obtain information and to gain an understanding of the diverse issues relevant to the SMP. Table 1 presents the Consultees contacted, the level of their involvement for Stage 1 and summarizes their interests and concerns.

### 2.2 Consultation process

A three phase approach was adopted for consultation:

- initial contact and request for information, plus a public presentation of the SMP process (Stage 1)
- meetings with major Consultees (Stage 1)
- circulation of draft Management Unit Plans for discussion and agreement, plus an open day for discussion (Stage 2).

At the outset of the study all Consultees identified by the Coastal Group were informed that the SMP was being developed, invited to the introductory presentation and asked to provide information. The information requested included:

- areas of interest
- subjects/activities of interest
- existing or future plans and aspirations relating to the shoreline
- issues of concern
- sources/locations of published data or reports.

Responses to the first phase were received from over 60% of the Consultees, as indicated in Table 1. Follow up discussions were held where particular concerns were expressed.

Meetings with the major Consultees were undertaken, including:

- members of the Steering Committee
- Chichester Harbour Conservancy
- Langstone Harbour Board
- Defence Land Services
- Hampshire and West Sussex County Council.

Each of these major Consultees provided detailed information on areas of responsibility, existing shoreline problems, existing defences, potential conflicts of interest with other groups, plans for coastal defences and plans for development. Meetings were not held with representatives for Portsmouth Harbour as they were awaiting publication of the Portsmouth Harbour Plan, which has since been released in Draft.

The final phase of consultation related to the preparation and agreement of plans for the Management Units. This is discussed in the Stage 2 volumes of the SMP (Volumes II and IV).

Coastal Groups representing adjacent shorelines are also preparing SMP's. The South Downs Group, to the east, are led by Arun District Council and have appointed Gifford Associated Consultants to act as consultants. The West Solent Group are led by New Forest District Council and have appointed Sir William Halcrow & Partners Ltd as consultant. The Plan areas overlap to some extent to ensure continuity of management. In the east the

overlap extends from Selsey Bill to Pagham. In the west the overlap is limited to the River Hamble frontage from Hook Spit to Warsash. Consultation between the Groups has ensured that the three plans are compatible.

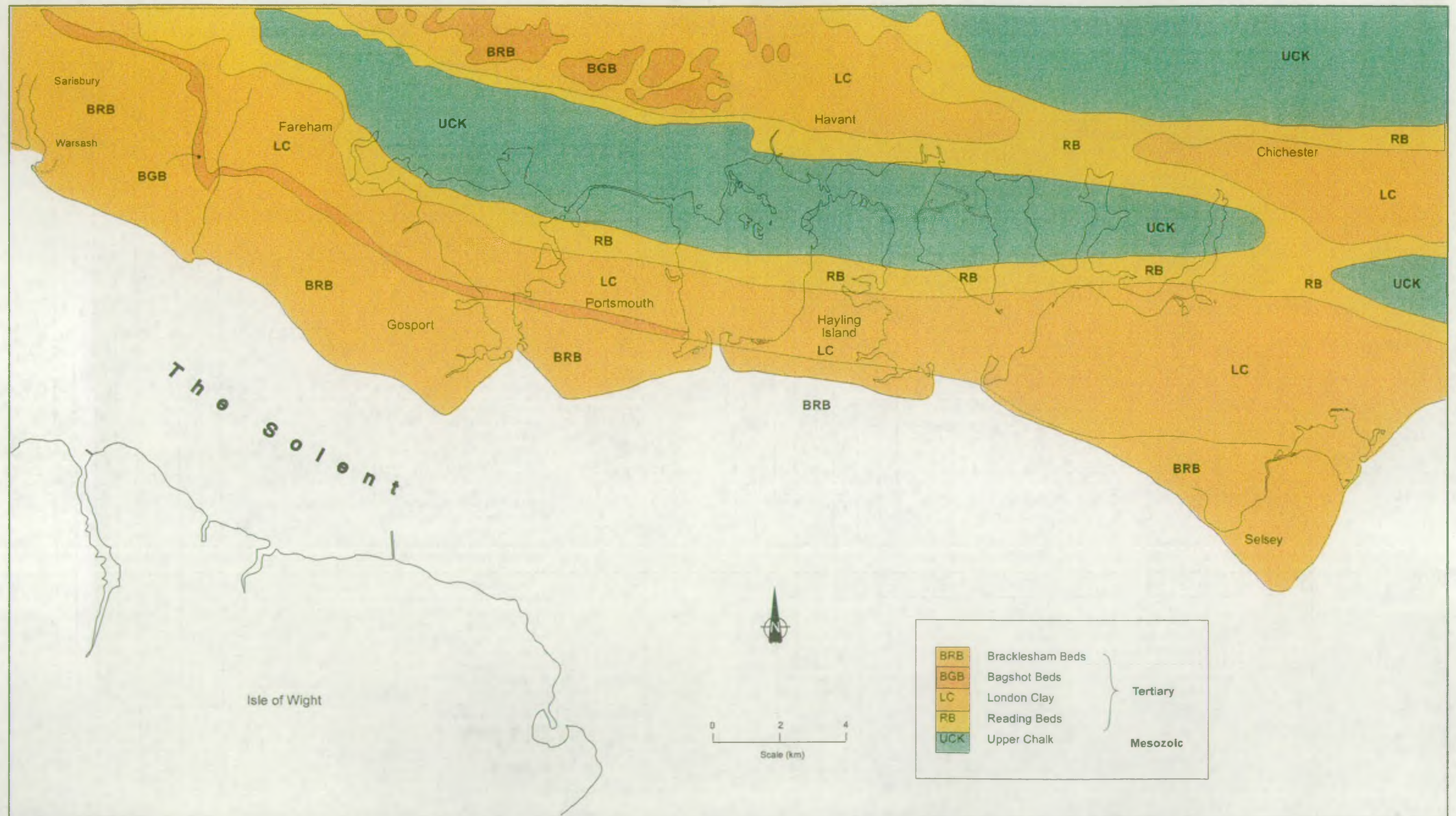


**Table 1 Consultees involvement in Stage 1 and summary of interests**

Organisation		Initial Response	Meeting	Coast Defences	Environment	Planning	Recreation	Navigation	Commerce
Steering Committee	Chichester DC	✓	✓	✓	✓	✓	✓	✓	
	Havant BC	✓	✓	✓	✓	✓	✓	✓	
	Portsmouth CC	✓	✓	✓	✓	✓	✓	✓	
	Gosport BC	✓	✓	✓	✓	✓	✓	✓	
	Fareham BC	✓	✓	✓	✓	✓	✓	✓	
	Environment Agency	✓	✓	✓	✓	✓	✓	✓	
	English Nature	✓	✓	✓	✓	✓	✓	✓	
County Councils	Hampshire CC	✓	✓	✓	✓	✓	✓	✓	
	West Sussex CC	✓	✓	✓	✓	✓	✓	✓	
Other Statutory Consultees	Arun DC		✓	✓	✓	✓	✓	✓	
	Crown Estates			✓	✓	✓	✓	✓	
	Countryside Commission			✓	✓	✓	✓	✓	
	Department of Transport								✓
Harbours	Chichester Harbour Conservancy	✓	✓	✓	✓	✓	✓	✓	
	Langstone Harbour Board	✓	✓	✓	✓	✓	✓	✓	
	Langstone Harbour Advisory Committee	✓			✓	✓	✓	✓	
	Portsmouth Commercial Port	✓					✓	✓	
	Flag Officer Portsmouth (MoD)	✓			✓		✓	✓	✓
Parish Councils	Apuldram PC	✓		✓		✓			
	Birdham PC	✓		✓		✓			
	Bosham PC	✓		✓	✓				
	Chidham PC	✓		✓	✓		✓	✓	
	East Wittering PC	✓		✓		✓			
	Earnley PC	✓							
	Fishbourne PC	✓							
	Pagham PC	✓		✓	✓				
	Selsey Town C	✓		✓		✓	✓		
	Sidlesham PC	✓		✓		✓			
	Southbourne PC								
	West Wittering PC								
Residents Associations	Emsworth	✓		✓	✓	✓	✓		
	Hardaway and Elson Residents Group	✓			✓	✓			
	Hayling Island	✓		✓	✓	✓	✓		
	Hill Head								
	Langstone (Residents Association)					✓			
	Langstone (Village Association)					✓			
	Lee-on-the-Solent	✓		✓	✓	✓	✓		
	Northney								
	NE Hayling	✓		✓		✓			
	Pagham Beach								
	Warsash								
	West Wittering	✓		✓		✓			

Organisation		Initial Response	Meeting	Coast Defences	Environment	Planning	Recreation	Navigation	Commerce
Commercial	British Maritime Industries	✓						✓	✓
	Continental Ferryport								
	Local Fisheries Committee	✓							
	Southern Marine Industries	✓	✓	✓			✓		✓
	Selsey Regeneration	✓							
Landowners	Cakeham Manor Estate	✓		✓			✓		
	Church Farm Holiday Village	✓					✓		✓
	Country Landowners								
	Defence Land Services		✓	✓					
	Hayling Island Golf Club								
	Meon Shore Chalet Owners Association	✓					✓		
	National Farmers Union	✓		✓					✓
	National Grid Company	✓		✓					✓
	Pagham Beach (Holdings)	✓		✓	✓		✓		✓
	Park World Holidays	✓		✓			✓		✓
	Solent Breezes Chalet Owners	✓		✓			✓		
	West Wittering Estate	✓		✓			✓		
	White Horse Caravan Co.	✓		✓			✓		✓
Conservation Groups	Bosmere Hundred Society	✓			✓				
	Council for the Protection of Rural England			✓	✓	✓	✓		
	English Heritage								
	Fareham Society								
	Friends of the Earth (Portsea)								
	Friends of the Earth (Gosport and Fareham)	✓			✓				
	Friends of the Earth (Manhood Peninsula)	✓			✓				
	Friends of the Earth (Havant)								
	Gosport Environmental Forum	✓			✓		✓		
	Gosport Society	✓			✓				
	Hampshire and Wight Trust for Maritime Archaeology	✓			✓				
	Hampshire Wildlife Trust	✓			✓		✓		
	National Trust								
	Portchester Society	✓			✓				
	Portsmouth Harbour Conservation Group	✓			✓				
	Portsmouth Urban Wildlife	✓			✓				
	Portsmouth Society	✓			✓				
	Portsmouth Environmental Forum	✓			✓				
	RSPB	✓			✓		✓		
	Solent Protection Society	✓			✓				
Recreation	Stokes Bay Society	✓			✓				
	Sussex Wildlife Trust	✓			✓				
	Fareham Sea Angling Club	✓							
	Hill Head Sailing Club	✓		✓			✓	✓	
	Marine Safety Agency	✓							
	Portsmouth and Langstone Sailing Association	✓					✓	✓	
	Royal Yachting Association	✓					✓	✓	
	Southern Tourist Board	✓					✓	✓	✓





Solid geology

Figure 3



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## 3 Coastal processes

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### 3.1 Introduction

The past, present and future forms of the East Solent shoreline are the result of natural forces acting on the sea bed, beach and backshore, modified by man's activities and coastal vegetation.

The natural forces include:

- swell and locally generated waves
- tidal currents
- tidal and meteorologically induced water levels
- winds
- fresh water flows.

These forces act on the mobile surface material or solid geology causing erosion, accretion and flooding. Since Roman times these natural processes have been influenced by man's activities, including:

- construction of ports
- maintenance of navigation channels
- construction of coastal defences to protect shoreline property and structures
- removal of beach and sea bed material for construction
- reclamation of land.

The physical forces are also influenced by biological processes, including:

- development and breakdown of saltmarsh communities and the formation of wetland habitats
- stabilization of backshore windblown sand by dune communities
- nearshore transport of gravel and cobbles by 'kelp rafting'
- erosion control by established vegetation
- cementation of seabed material.

These forces and processes are described in this chapter. The geological and historic evolution of the coast are presented first, followed by the present day situation. Possible future coastal developments are then considered based on potential changes to sea levels and the wind/wave climate. This volume concentrates on Chichester, Langstone and Portsmouth Harbours, while the companion Volume I covers the open coast and Pagham Harbour.

Much of the information presented is derived from the Pagham Harbour to River Hamble study undertaken for the Coastal Group by HR Wallingford (HR Wallingford, 1995a&b). This source is supplemented by referenced information from other publications and reports reviewed for the SMP.

### 3.2 Geological evolution

The underlying bedrock of the East Solent comprises chalk with overlying soft clay and sand Tertiary sediments and a mantle of Recent sediments. Figures 3 and 4 present the solid and surface geology for the area. The surface geology includes unconsolidated Recent drift deposits and exposures of underlying solid formations. Table 2 provides further details of the lithologies. This information has been derived from various maps produced by the British Geological Survey.

**Table 2 Lithological descriptions of the East Solent solid and drift formations**

Recent	
Blown sand	modern deposits
Shingle and sand beaches	modern deposits
River, marine and estuarine alluvium	relict and modern deposits of fine material
River terrace deposits	mainly gravels
Brickearth	mainly loam and clay
Raised beach	coarse flint gravels above sand at about 5m OD, Ipswichian transgression (100,000 BP?)
Tertiary	
Bracklesham Beds	clays and clayey sands
Bagshot Beds	sands and gravels, with seams of clay
London Clay	sandy clays, with occasional pebble beds
Reading Beds	clays, sand with occasional flint gravels
Mesozoic	
Upper Chalk	thickly bedded chalk with regularly spaced bands of flint nodules

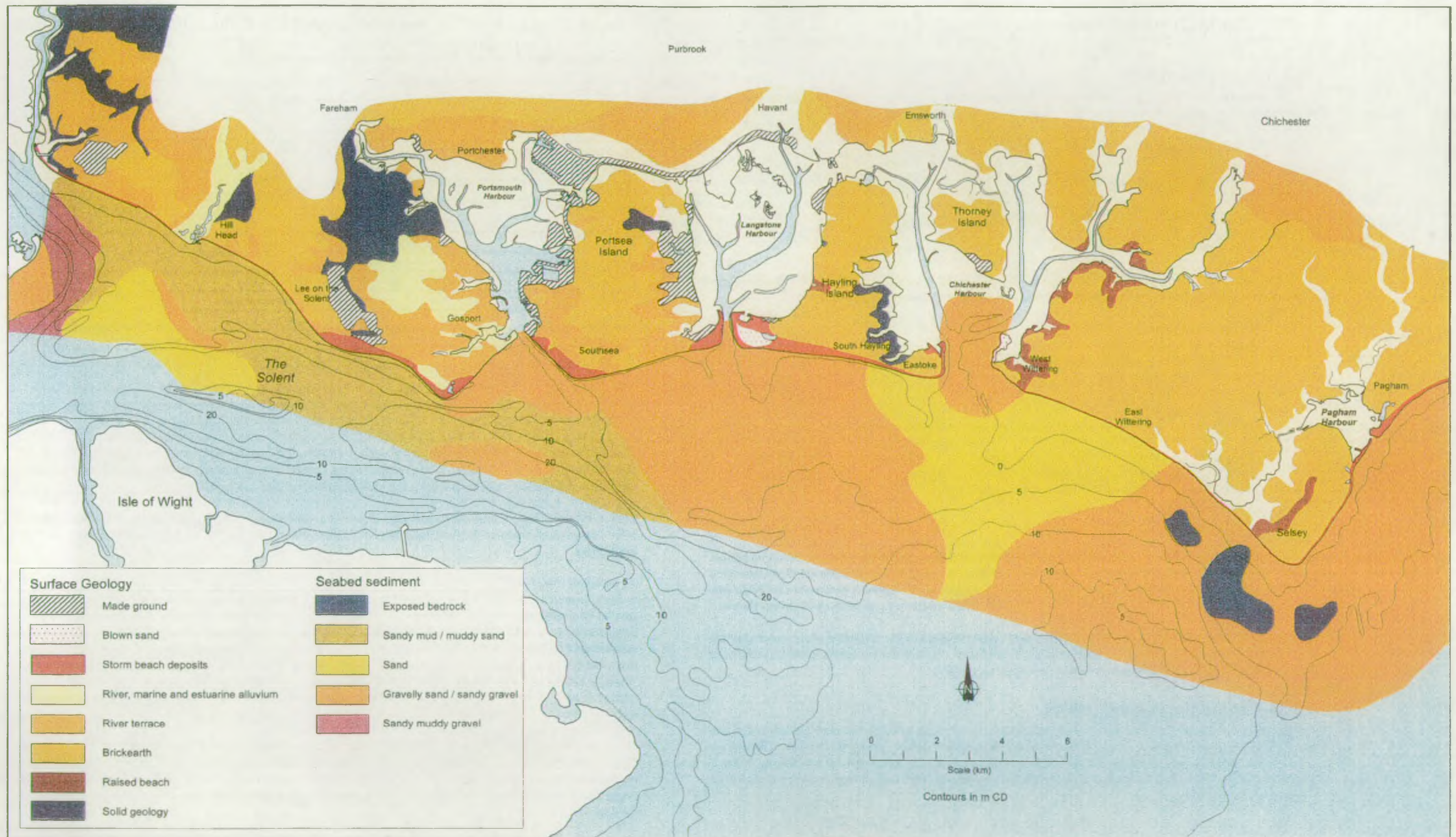
The East Solent represents the drowned channel and flood plains of the ancient Solent River that flowed across south east Dorset and southern Hampshire and into a major "English Channel" river. The Solent River developed during the late Devensian glaciation when sea levels were as much as 120m below the present level. Rising sea levels during the Holocene transgression from 15,000 years BP to 5000 years BP caused the river valley to become drowned and infilled by fluvially deposited gravels. The river deposited vast quantities of sand and gravel throughout its flood plain. These deposits are the major source of beach material throughout the region, and remaining offshore deposits are the focus of the regional dredging industry.

The rate of global sea-level rise due to post-glacial meltwater slowed some 5000 years BP, but general subsidence of the land mass of south-east England has continued. The resultant relative sea level rise has been about 250mm per century.

As sea-levels rose, large quantities of sand and shingle were combed up and driven landwards. These are thought to have formed a series of massive shingle spits, forelands, barrier beaches and major offshore shoals located several kilometres seaward of the present shoreline and protecting marshy lowlands. Relict beach bases have been identified on the sea-bed in Bracklesham and Hayling Bays. Tidal channels through the barriers facilitated inundation of the Solent and the harbours, as suggested by various dated organic deposits that have been related to ancient sea-levels. Indeed, the connection of a tidal channel through the western Solent to isolate the Isle of Wight at between 8,000 to 6,000 years BP probably marks the beginning of the present complex tidal regime within this area. Thick sequences of fine sediments have infilled the estuaries and large harbours of the region since that time.

Over the past 2,000 to 3,000 years, it is thought that the barrier beaches within Bracklesham and Hayling Bays were driven progressively landward by continuing sea-level rise and wave activity, and perhaps also by relative sediment shortages. Fresh coarse sediments are only available through erosion of the low lying soft cliffs, so with declining rates of sea level rise, transgression would have occurred in response to continuing wave activity upon the depleting barriers.





Surface geology

Figure 4



Since sea level rise slowed some 5000 years BP the harbours have received little fresh water inflow and the input of fluvial sediment has been insignificant. By contrast there has been significant input of sediment from seaward. Fine material is transported in suspension by the flood tide and accumulations of this material in the harbours appear to have kept pace with the rate of sea level rise. Deposition has given rise to saltmarsh and wetlands. There is also transport of coarser material, mainly on the margins of the harbour mouths as a result of littoral drift. Some material is transported further into the harbours forming flood tide sandbanks which shift position over time. These flood tide banks are small by comparison with the ebb tide deltas outside the harbours, which are part of the open coast transport regime.

As the geology of the harbour areas is predominantly easily erodible then any changes to the hydrodynamic conditions will affect the shoreline causing either erosion or development of the saltmarshes. The long term situation is not only affected by conditions within the harbours but by the processes active on the open coast around the harbour entrances.

With widespread coastal protection over the past 100 years, erosion no longer supplies much additional sediment, and groynes interrupt many transport pathways. Furthermore dredging for navigation (Portsmouth, Langstone and Chichester entrances) and aggregate (especially Horse and Dean Sand for Portsmouth Harbour reclamations) have removed large quantities of sediments from the system. Littoral sediments within this system are therefore both finite and depleted. The natural protection afforded by beaches will diminish unless countered by management actions.

In the absence of artificial protection, the geomorphological response would involve continued shoreline retreat. This would eventually tend to increase regional coastal stability through adoption of a flatter, more dissipative shore face profile, the release of eroded sediments and formation of a shoreline in equilibrium with the wave and tidal regime. However the complexity of this coast means that it is not easy to predict where transgression might occur first, the amount of transgression that might be needed to achieve stability and the possible consequences for neighbouring areas of permitting natural processes to operate in this manner.

This summary is compiled from the work of Allen and Gibbard (1993), Dyer (1975) and Bray et al (1991).

### 3.3 Historical evolution

Historical changes to the harbour shoreline have been dominated by two factors. The first is the long history of human intervention, such as land reclamation for farming, port development and construction of transport routes. The second is the growth and dieback of the saltmarshes. The harbours have been subject to different levels of change, with Portsmouth being most affected by reclamation work and Chichester being subject to more natural changes.

Information comes from several sources including Hooke & Riley (1987) which examines map evidence and Haynes & Coulson (1982) and Collins & Fontana (1996) which describe changes to the marshes.

The following sections summarize the available information on shoreline evolution and its relevance to the SMP. Each harbour is discussed separately. Figure 5 presents the areas of land reclamation in Portsmouth and Langstone Harbours.

#### *Portsmouth Harbour*

Much of the shoreline of Portsmouth Harbour has been reclaimed over the past 130 years for port development, naval facilities and land fill sites. Prior to that most of the low lying land around the harbour had been drained and protected by flood banks for agriculture; this former agricultural land has now been turned over to residential, industrial or recreational use, particularly over the past 40 years. Figure 4 shows the reclaimed areas, while flood area maps presented later in the report, show the low lying areas that have been developed and are now at risk



from flooding. As a result of shoreline works, the present day High Water Line has no significant areas of retreat, while the low water channels have only altered where navigation dredging has been undertaken.

Much of the reclamation for the Royal Navy occurred in the late 19th century with the development of the Dockyard, Whale Island and the torpedo test facility at Horsea Island. Smaller sites included part of Haslar Lake, the shipyard at Portchester and the upper reaches of several tidal creeks.

Civil reclamation works have included further parts of the tidal creeks and lakes, both banks of Portcreek connecting Portsmouth and Langstone Harbours to the north of Portsea Island (north bank now the M27/A27 embankment), the M275 route into Portsmouth, several small sites up the harbour arm to Fareham and, most recently, the major reclamation and land fill site at Port Solent north of Horsea Island.

In association with these reclamation works there have been major capital dredging operations to form the harbour basins and navigation channels. Maintenance dredging is ongoing, with the spoil being dumped at sea. It has been suggested that uncontaminated spoil could be used more productively, and at lower cost to the dredge operator, by dumping within the harbour to form mudflats both for habitat creation and for wave dissipation.

Much of the higher ground on the Gosport frontage has been protected against erosion by low masonry, stone and timber walls. Residential, commercial, recreational and infrastructure development has extended to the edge of these walls making their continued maintenance important.

Low lying areas, originally reclaimed for farming, were developed for the post-war housing expansion, particularly in Hilsea, Tipner and Portchester. Original earth embankments were strengthened using a variety of materials, many of which have now come to the end of their useful life. Replacement schemes have been undertaken around Portchester and along sections of Haslar and Forton Lakes.

Only two extensive areas of natural coastline remain in Portsmouth Harbour. These are the MoD area of Fleetlands north of Gosport and the east shore of the upper reaches of Fareham Lake. Fleetlands rises gradually from saltmarshes, through coastal scrub to higher ground, while the shoreline of Fareham Lake rises steeply to the higher ground of Cams Hall.

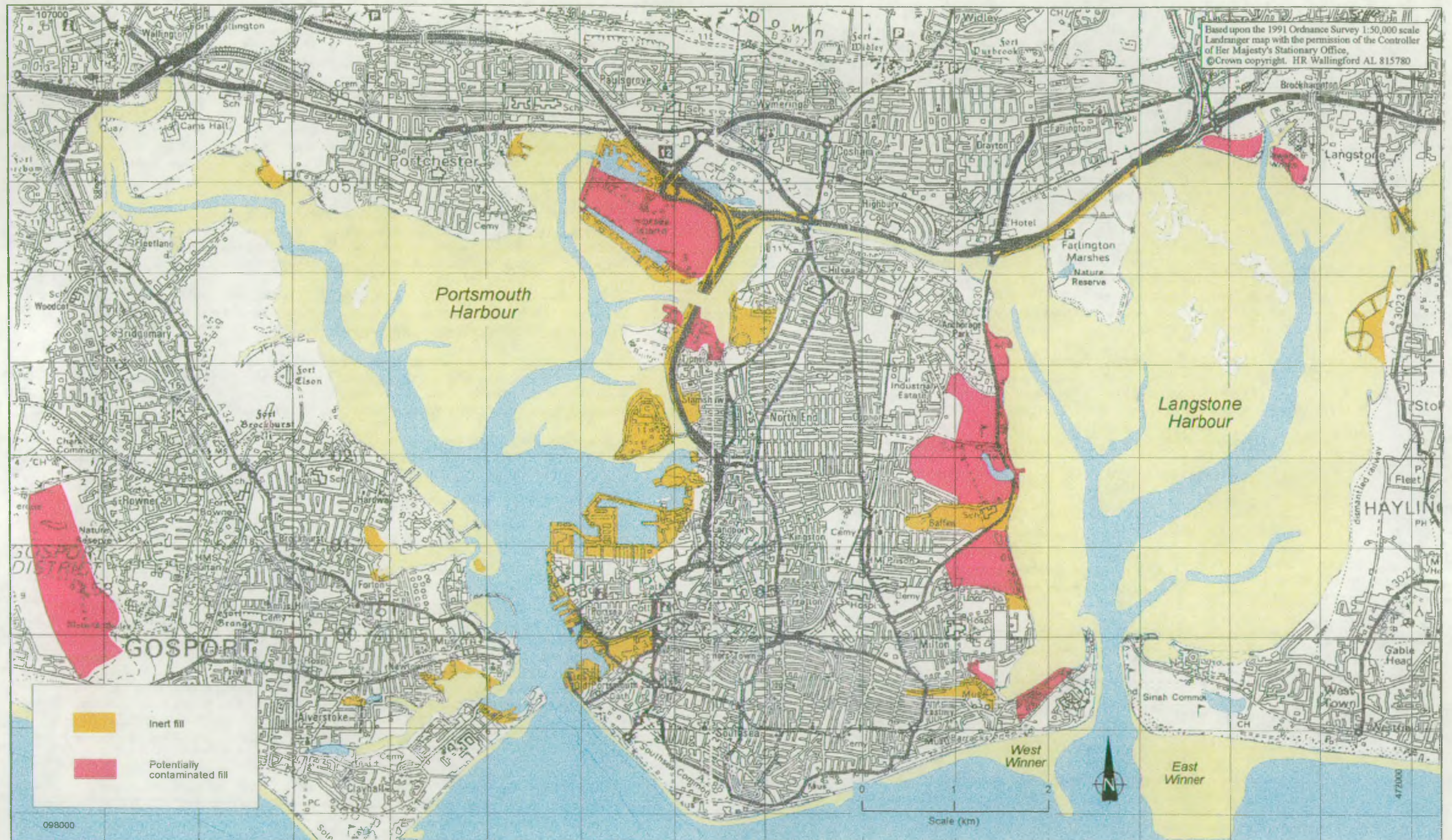
The entrance to the harbour is defined by the Haslar seawall on one side and by the various walls protecting Old Portsmouth on the other, some of which have been in place since the 15th Century.

### *Langstone Harbour*

Land reclamation sites, mainly for landfill purposes, form much of the western and northern shoreline of Langstone Harbour. A large part of the remaining shoreline is formed by transport routes, with the A27 along the north shore, the disused "Hayling Billy" rail line along the Hayling Island shore and the Eastern Road along the Portsea Island shore. The roads are protected by revetments or walls, while the shore below the rail line remains largely natural, with short sections of revetments, walls and breastwork to reduce erosion and/or flooding. There are three commercial jetties, used mainly for aggregate transfer: Great Salterns Quay and Kendalls Wharf on Portsea Island and Brockhampton Quay near Langstone. Maintenance dredging is undertaken in the channels to each jetty and to the Southsea Marina at Eastney; this work is undertaken on an ad hoc basis and quantities are not recorded by the Harbour Board. The remaining shoreline tends to be low lying, with varying levels of protection.

Eastney Spit on the west shore of the entrance channel has been reasonably stable over the past 100 years. It provides natural protection to Eastney Lake, but land reclamation and development for housing, marinas and moorings has resulted in the need for walls and revetments along most of the shore. The only remaining natural shoreline is within the Milton Locks Nature Reserve (Hampshire Wildlife Trust). North from Eastney Lake is Milton Bund, built in 1962 across a former inlet to provide a land fill site. Beyond this frontage is the Eastern





Location of landfill and reclamation sites

Figure 5



Road protected by a variety of lengths of wall, mainly rebuilt over existing walls, between the 1960s and 1980s. The only remaining older section, running up to the south side of the Great Salterns Quay, suffers severe overtopping and is structurally unsound. Anchorage Park, in the north east of Portsea Island is a further low lying area, formerly the site of Portsmouth airport but now a residential and commercial development.

Apart from the A27 road embankments, the north shore comprises the former upper saltmarsh area of Farlington Marshes, the land fill sites of Broad Marsh and Budds Farm, and the former saltmarsh of South Moor. All of these areas are protected by walls or revetments of varying standard.

The eroding remains of the disused Hayling railway embankments extend from either side of the channel separating the Island from the mainland (and joining Langstone and Chichester Harbours). On the Hayling side the rail embankment runs inland of the reclamation site formerly used as oyster beds. The original beds fell into disrepair in the early part of this century, but were redeveloped in the 1970s. The banks were rebuilt of building rubble but the ponds were never used. The outer banks suffer severe erosion and have been partially removed as part of a scheme to enhance both the landscape and the natural environment.

The rail embankment continues south along the shoreline, providing some flood protection to the west side of the island, as well as being a public access trail. The shoreline benefits from some natural protection due to the intertidal mudflats and saltmarshes in the harbour, but is still subject to minor erosion.

The south east shoreline of Langstone Harbour comprises further low lying land, partly protected by various structures and partly in a natural state. The marsh area extends up to the sand and shingle spit forming the east bank of the harbour entrance channel. The tip of the spit is now fixed by walls and jetties that protect houses, holiday facilities and the harbour office.

Apart from the maintenance dredging mentioned earlier, aggregate dredging of about 6000T/year occurred on the flood tide bank opposite the entrance channel. This operation stopped in 1994. The entrance channel has never been dredged for navigation purposes as it is swept by strong currents.

#### *Chichester Harbour*

Unlike the other two harbours, Chichester Harbour has not lost any substantial areas to reclamation schemes for ports or landfill sites, but has lost former upper saltmarsh areas to farmland over many centuries. Most of the shoreline is defined by flood embankments or erosion protection works, although there are some lengths of natural coastal transition. The harbour was important for commercial and military shipping in Roman times, with Dell Quay being a major port, but today the only commercial vessels within the harbour are small fishing boats.

Sandy Point spit forms the west shore of the entrance channel. The neck has narrowed over the past century but the head has extended north and west due to natural accretion. The spit provides natural protection to the low lying, but heavily developed, land around the Eastoke inlet. To the north walls, revetments and embankments define the shoreline along almost the full length of Hayling Island, preventing flooding of low lying reclaimed farmland, holiday developments and housing. The Northney marina has been built over a reclaimed saltmarsh area.

Across the channel to Langstone, walls and revetments protect further low lying areas and sections of slightly raised lands east to Emsworth. Enclosed marshes join the MoD land at Thorney Island to the mainland. Recently upgraded flood embankments continue past Printhead to Nutbourne and older embankments run down the Chidham peninsula. The southern tip of the peninsula is above flood levels but suffers erosion. An embankment was built across to Thorney Island from here in the 1870s to allow reclamation of marshes up to Printhead, but the embankment failed and the area returned to its natural state. The long narrow island off the point is all that now remains.



Flood embankments continue up both banks of the Bosham and Chichester Channels, with some sections of natural shoreline or erosion protection. Areas of healthy saltmarsh provide additional protection. West of Itchenor there are larger sections of natural shoreline with short lengths of embankments and walls towards West Wittering.

The shingle and sand spit of East Head forms the east side of the harbour entrance channel. The area in its lee is very sheltered and contains well developed saltmarshes.

Maintenance dredging has been undertaken within the inner channels to remove fines and within the entrance to remove coarse material. 20,000m<sup>3</sup> were removed from the channel in 1988 and a further operation is now required to maintain the published safe navigation depth.

### 3.4 Natural defences and saltmarsh changes

Changes in the condition of the natural defences have had an impact on coastal protection and flooding. Loss of saltmarsh or lowering of the mudflats increase maintenance costs of the flood embankments and coastal protection which form the boundaries of the harbour. The following sections chart the historical changes in the natural defences, particularly *Spartina anglica* saltmarsh, and outline the consequence of these changes to flood and coastal protection.

#### *Saltmarsh*

Before the turn of the century the area occupied by saltmarsh (depositional intertidal habitats colonised by salt-tolerant plants) in the harbours was low. Upper saltmarsh communities did exist in the highest, sheltered intertidal areas, however much of the natural marshland had been lost due to land drainage and reclamation to provide grazing and agricultural land. The introduction of *Spartina anglica* at the beginning of the century rapidly increased saltmarsh coverage in the harbours, but after peaking in the middle of the century there was a dramatic decline in the vigour and health of this hybrid.

Figures 6 and 7 show the current distribution of saltmarsh vegetation in Langstone and Chichester Harbours. Unfortunately, Portsmouth Harbour has not been mapped, but saltmarsh is found in the north central area.

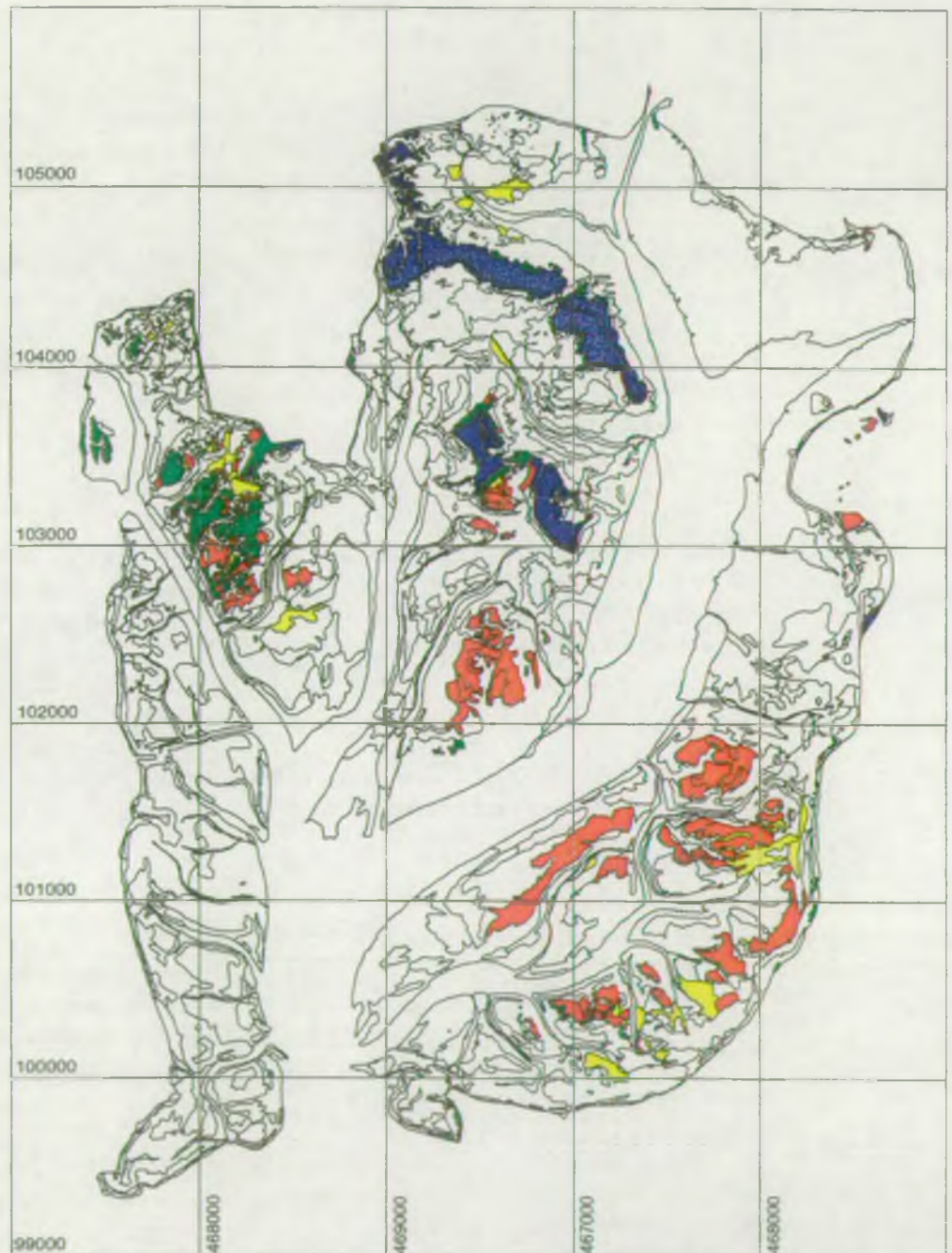
#### *The rise and fall of Spartina*

*Spartina anglica* is a vigorous hybrid of saltmarsh cordgrass which originated in Southampton Water in the latter half of the last century. Its rapid spread can be partly attributed to the fact that it was physiologically able to invade and occupy a position low in the intertidal zone (around mean high water neaps) where other pioneer saltmarsh species like *Puccinellia*, *Armeria* and *Plantago* found it difficult to survive (Gray *et al.*, 1989, 1995; Gray, 1992). The spread of the introduced *Spartina anglica* across previously uncolonised mudflats lead to the creation of substantial areas of saltmarsh in all three harbours.

Initially *Spartina anglica* was very vigorous, two or three times larger than its current height, but during the middle of this century it began to die-back, reducing the area of coverage and the height of the plants. As the plants lost vigour they became more susceptible to wave action. A vicious cycle was instigated; greater wave energy damaged the plants and this in turn reduced the degree to which the sward could dissipate wave energy and thus wave action on the weakened plants increased. The plants did not immediately die, rather they became stunted and some swards have managed to survive in a reduced state for decades.

Figure 8 shows the changes in area occupied by *Spartina* in Langstone Harbour between 1870 and 1994. The coverage was stable until the introduction of the vigorous hybrid *Spartina anglica* around 1900. After its introduction there was a rapid increase in area followed by a plateau period which lasted until the 1950s when there was a rapid drop. The loss of *Spartina* coverage between its peak and its low point are shown in Figure 9.





1994 Vegetation cover - Langstone Harbour

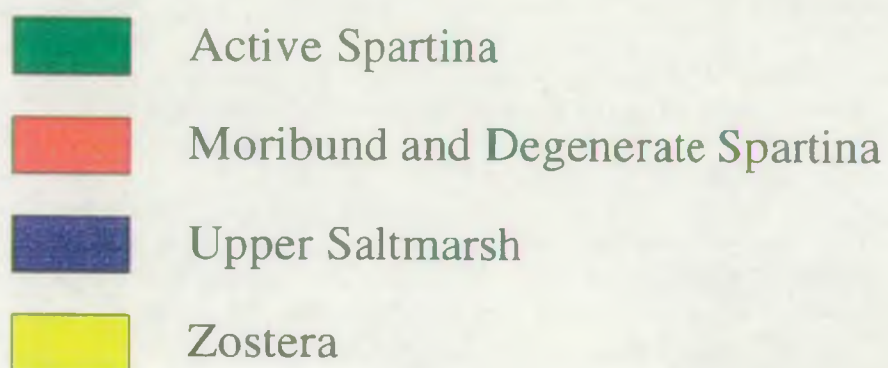
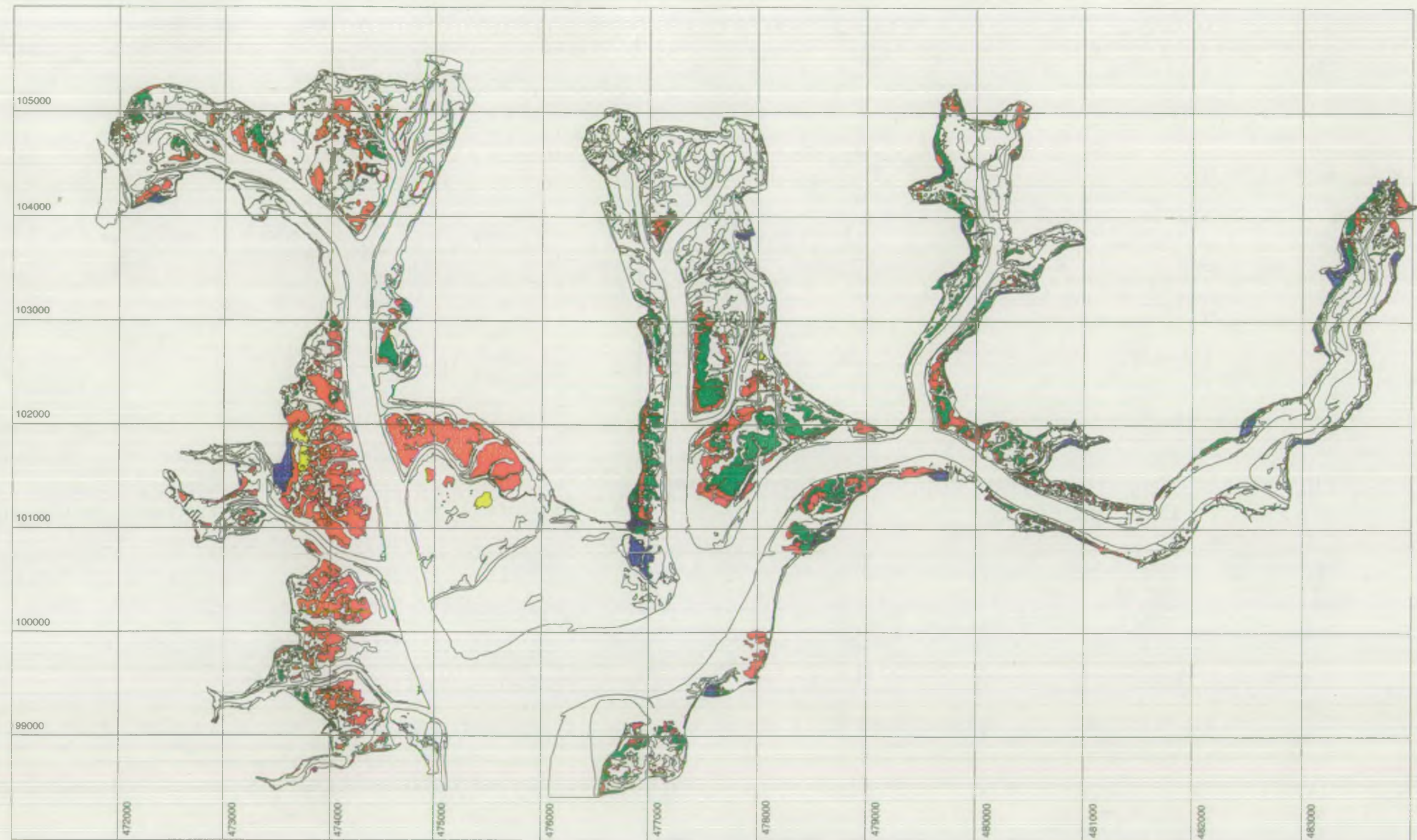


Figure 6



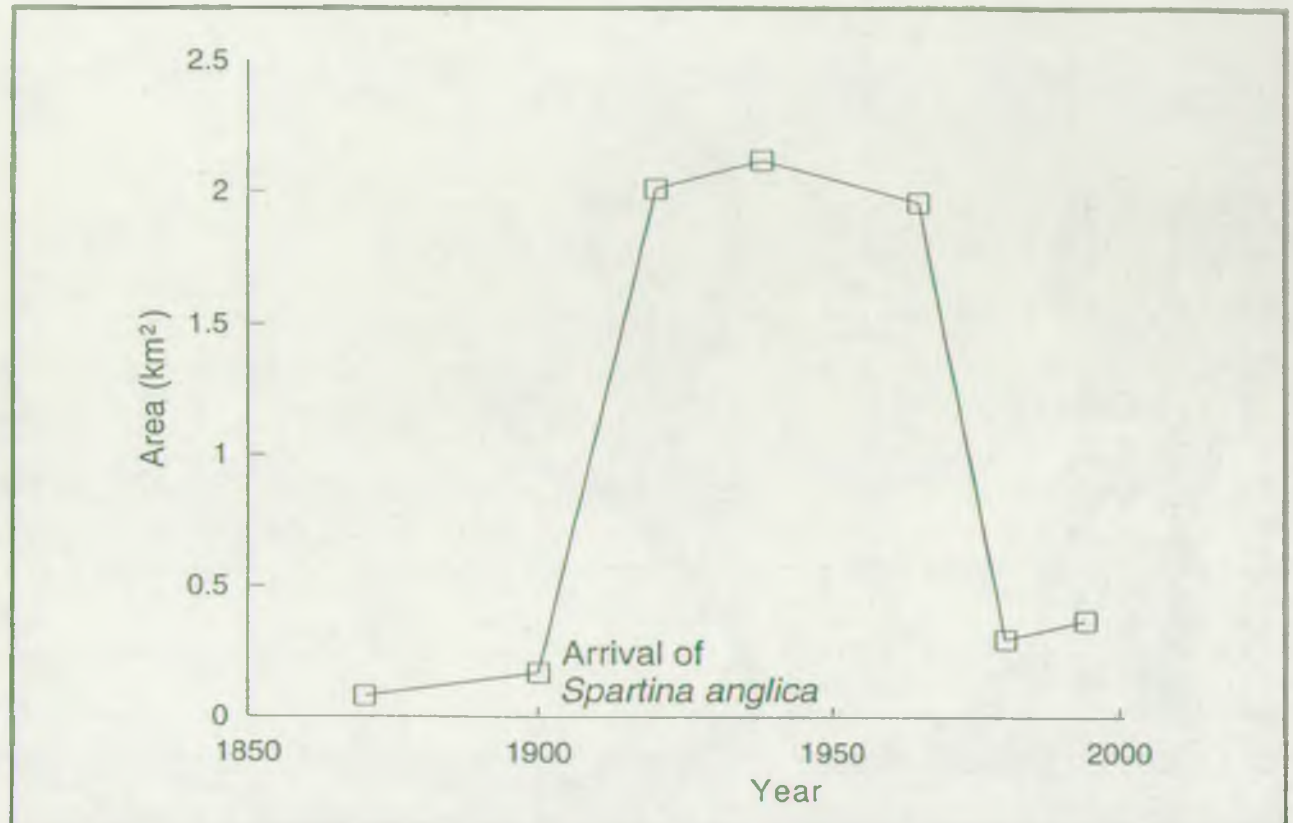


Zostera
  Moribund and Degenerate Spartina
  Active Spartina
  Upper Saltmarsh

1994 Vegetation cover - Chichester Harbour

Figure 7





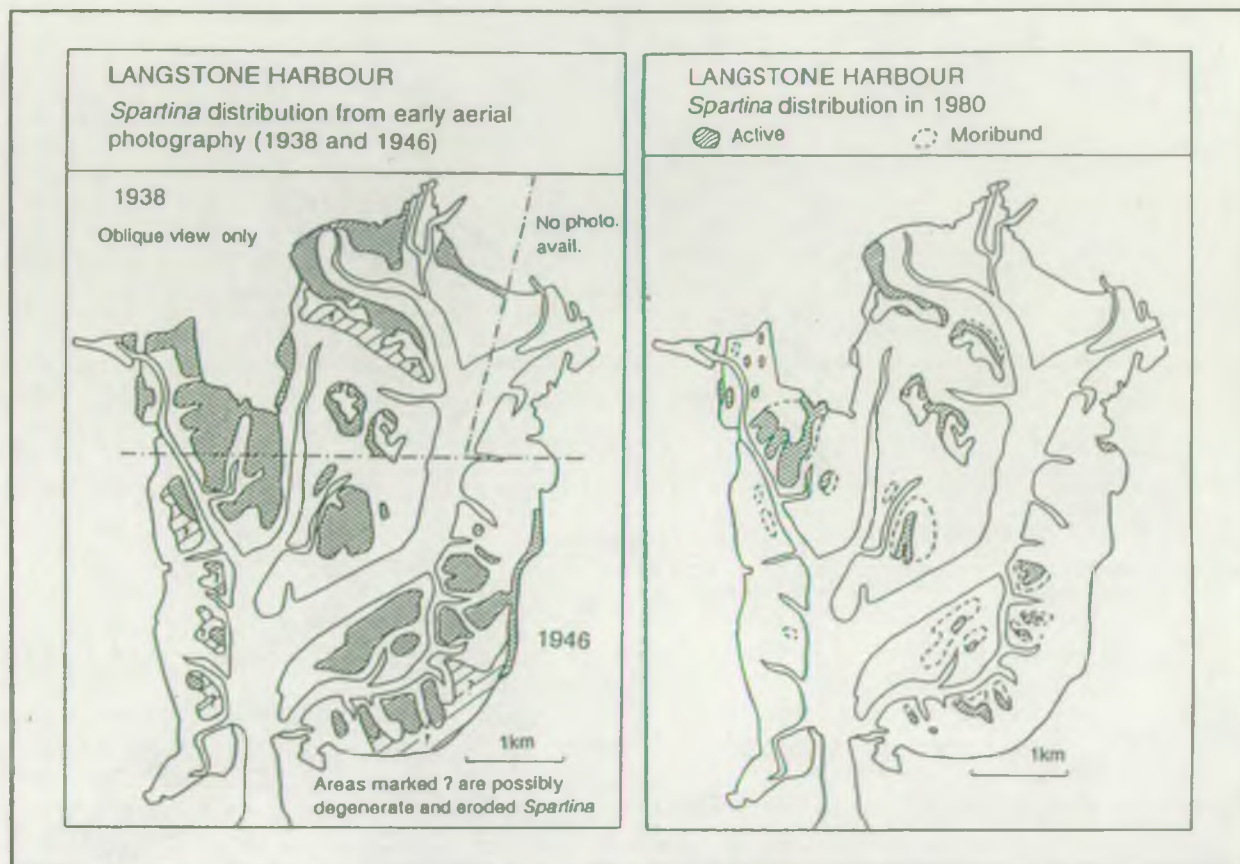
**Figure 8** Change in area occupied by *Spartina* (after Domjam, 1983)

The rise and deterioration of *Spartina* has affected hydraulic and sedimentary processes. Healthy *Spartina* was a very effective natural sea defence. The tall dense fronds exerted frictional drag which dissipated waves and tidal currents to such an extent that the water column was calm enough to deposit fine clay particles. This situation reversed as *Spartina* lost vigour. Shear stresses then became sufficient to erode the fine particles which were deposited during calmer conditions induced by the presence of healthy *Spartina*. Unfortunately, there is no existing data on mudflat levels before *Spartina* colonisation with which to compare to the present situation to see whether the mudflats have eroded to pre-*Spartina* levels.

As *Spartina* in the harbours continues to die down, the risk of coastal erosion and the frequency and volume of wave overtopping increases. The erosion of fine sediments accumulated by *Spartina* increases water depth and hence the potential wave height. The loss of the shoots reduces wave and tidal current dissipation.

Many stretches of the embankments defending reclaimed land are now showing signs of severe erosion, particularly those which had been protected by extensive *Spartina* beds (for example the stretch of Chichester Harbour between Nutbourne and Cobnor Point). Most of the houses built in the areas liable to flooding were constructed after 1945 during or just after the period when *Spartina* distribution was widespread and its growth luxuriant.

It is unlikely that the trend for *Spartina* die-back experienced over the last 50 years will reverse. Moreover, the potential for larger wave heights is likely to continue to increase in the future due to the erosion of the muds accumulated by *Spartina*. Therefore it is likely that the risk of coastal erosion and flooding will increase in the future.



**Figure 9** Change in distribution of *Spartina* (from Haynes and Coulson, 1982)

### Upper saltmarsh

Upper saltmarsh is now only found in sheltered areas of the harbours such as the lee side of spits and in areas where flood embankments have breached, allowing saltmarsh plants to recolonise (this is the situation at Prinsted Point on Thorney Island).

Historically, upper saltmarsh habitat (characterised by plants such as sea purslane, *Atriplex portulacoides*; sea lavender, *Limonium vulgare* and grasses such as *Puccinellia* and *Festuca rubra*) has been lost through reclamations. Replacement upper saltmarsh has not developed in front of the erected flood embankments due to the low sediment supply. Some of the remaining areas of upper saltmarsh, for example the islands in the RSPB reserve in Langstone Harbour, are suffering edge erosion due to wave attack (average 0.16m/y over the last 7 years - personal communication with RSPB Warden).

### Mudflats

There is visual evidence that the level of the mudflat drops after the death of *Spartina* and decay of the roots that bind the sediment. A numerical model study (HR Wallingford, 1994) for Chichester Harbour Conservancy investigated movement of the mud eroding from the area between East Head and the main shoreline, on the east side of Chichester Harbour. The model estimated that 35% - 60% of the mud in suspension was flushed from the harbour. It is thought that the closer the eroding mud is to the harbour mouth, the greater the proportion will be flushed from the estuary. The model predicted that any suspended sediment retained in the harbour moves towards the head of the estuary.



A study conducted for the RSPB by Portsmouth University (Collins and Fontana, 1996), analysing aerial photographs of Langstone Harbour from 1968 to 1992 concluded that the area of intertidal mud has not changed significantly. This suggests that the low water mark has remained constant, thus the erosion seems to be confined to the higher area formerly occupied by *Spartina anglica*. It is likely that the foreshore levels in the harbours will in time flatten and lower to what they were before colonisation of *Spartina anglica*.

Change in elevation of the mudflats will have a significant effect on wave height. For areas in which degenerate *Spartina* beds are being eroded, the increased water depth will allow larger waves to reach the shore while the wave dissipation provided by the accreting mudflats at the head of some of the harbour inlets will increase. Hence, coastal erosion and wave overtopping is likely to increase in some areas and reduce in others.

#### *Gravel spits/sand dunes*

The mouths of Langstone and Chichester harbours are framed by shingle spits formed from longshore drift. These geomorphological features provide a natural form of sea defence by:

- narrowing the harbour mouths thus restricting the propagation into the harbours of waves generated in the open sea
- protecting areas of coastline in their lee from waves and tidal currents.

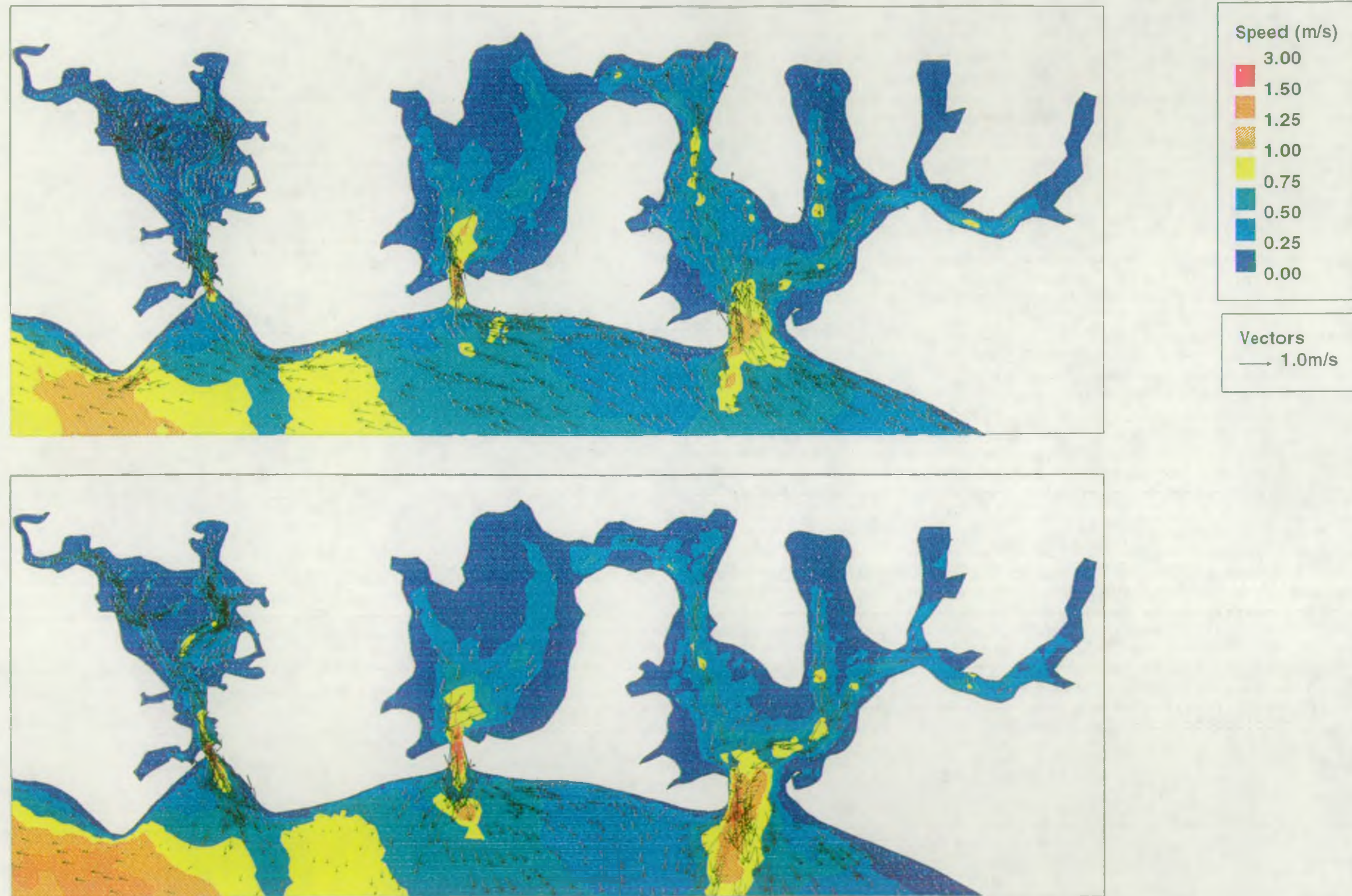
If East Head, the largest of the spits was destroyed, the residential area of West Wittering would be at risk from coastal erosion. The erosion risk would be particularly severe as the coastline in this area faces the prevailing west winds, and the harbour is wide at this point so the fetch is significant. This stretch of coastline would be among the most exposed if it was not for the protection afforded by the spit.

Like most coastal features, the shape and orientation of the spits has changed through time in response to fluctuations in forcing factors. Attempts to stabilise the spits with fixed structures have failed as their naturally dynamic form becomes out of equilibrium with the hydrodynamic climate. Obstruction of longshore drift feeding the spits leads to their deterioration and hence a reduction in the degree of coastal protection provided in their lee.

Smaller shingle spits also occur in several locations within Chichester and Langstone Harbours, for example between West Wittering and West Itchenor where they are fed by the erosion of local outcrops of shingle rich formations. The spits are curved to run roughly parallel to the shore, thus creating natural wave breaks that protect the coastline. Added coastal protection is provided by the saltmarsh which develops behind the spit.

Sand dunes have developed on top of the gravel spits on either side of the entrance to Chichester Harbour. If allowed to develop, dune vegetation traps wind-blown sand and raises the height of the spits, thus increasing the degree of flood protection. Dunes also act as a reservoir of sand which can provide extra material to the beach during winter storms. The dunes on East Head significantly enhance the protection that the spit provides to West Wittering. Dune management conducted by the National Trust has successfully built up the dunes.





Tide currents - Peak spring tide flow contours and vectors

Figure 10



## 3.5 Tidal regime

### *Tidal currents*

Tidal currents for the East Solent were investigated in detail in HR Wallingford (1995a&b). The study used the TELEMAC 2D depth averaged tidal flow model with a variable density mesh to improve resolution in areas of complex bathymetry. The model was run to simulate spring and neap tide flows, plus storm surge conditions, for the existing sea levels and for a projected 260mm sea level rise. The model was calibrated and verified against available Admiralty tidal stream data and field data collected in 1994.

Figure 10 presents the ebb and flood current vectors and speed contours for a spring tide under existing sea level conditions. The contours are for peak flow at each grid point (i.e. not at a single time) while the vectors represent flow at each point at the moment of peak flow in the entrance to Chichester Harbour. The model can also be used to predict: flows at any state of the tide; residual current velocities; the interaction between waves and current, and their combined effect on sediment transport; the impact of surges, future sea level rise and changes to the shoreline or nearshore bathymetry.

The model shows that:

- the strongest currents are found within the harbour entrance channels, with peak speeds at over 1.5m/s
- ebb currents dominate in the harbour entrance, but flood currents are stronger in upper channels
- currents are unlikely to change significantly if sea level rises, and that currents during storm surge conditions are not significantly stronger than existing spring tide currents.

It should be noted that the existing TELEMAC grid has different densities in each of the harbours. Portsmouth and parts of Chichester are represented in detail, while Langstone is represented by a much lower density grid.

### *Water levels*

The tidal regime in the Solent is extremely complex with an extended high water and spatially variable tidal ranges along the coastline (Geodata, 1991). The previous study (HR Wallingford, 1995a & b) investigated extreme water levels and the effects of sea level rise in considerable detail. Table 3 summarizes the available water level information for the locations marked on Figure 9. It is apparent that high water levels and tidal ranges generally increase from west to east. The extreme water levels are important in determining flood risk areas.

Future relative sea level rise, due to the combination of global warming and the ongoing post-glacial movements of the earth's crust, has been predicted at between 5mm/year (Houghton et al, 1990) and 13mm/year (Bray et al, 1991 & 1992). The accepted level for MAFF funded schemes is 6mm/year for the Solent area. The SMP assumes this level, except for Portsea Island where MAFF have accepted a 10mm/year rise. Given that most coastal schemes will be designed for a 50 year life, then a relative sea level increase of 300mm should be used for design except for Portsea Island where 500mm is considered to be more appropriate.

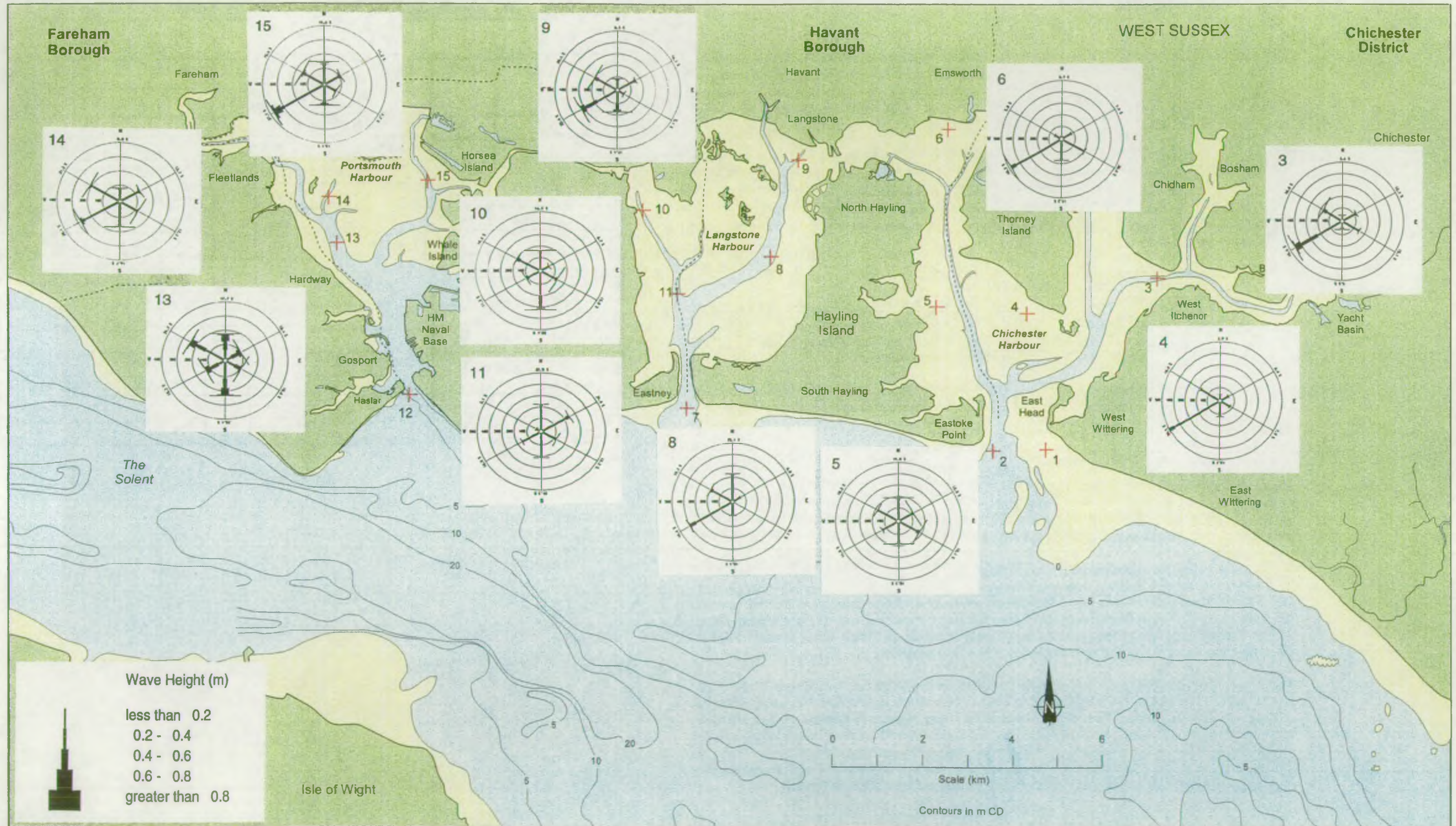
Comparison of the HR Wallingford study with other tidal data sources (Graff and Blackman, 1977 and Graff, 1981, Coles and Tawn, 1990) indicate that there are some inconsistencies in definition of extreme levels. As definition and evaluation of both mean and extreme water levels is very important to shoreline management, then a field programme should be instigated to improve the regional distribution of long term tide monitoring stations with the aim of establishing future trends in sea level rise and reappraising predicted extreme levels. This work is particularly important for Portsmouth and Gosport as there is some doubt associated with the data used in estimating a 10mm/year rise and the extent of the area over which this value should be applied.



**Table 3 Tide levels and predicted extreme water levels (m OD)**

Point	LAT	MLWS	MHWS	HAT	Return Period					Estimated 50 year rise (m)
					1	5	10	50	200	
2		-1.84	2.16	2.57	2.70	2.98	3.05	3.18	3.35	0.3
3		-	2.36		2.85	3.13	3.20	3.33	3.50	0.3
4		-1.84	2.16	2.57	2.70	2.98	3.05	3.18	3.35	0.3
5		-	2.36		2.80	3.08	3.15	3.28	3.45	0.3
6		-	2.36		2.90	3.18	3.25	3.38	3.56	0.3
7		-2.14	2.16		2.69	2.96	3.02	3.14		0.3
8		-2.14	2.16		2.69	2.96	3.02	3.14		0.3
9		-2.14	2.16		2.69	2.96	3.02	3.14		0.3
10		-2.14	2.16		2.69	2.96	3.02	3.14		0.5
11		2.14	2.16		2.69	2.96	3.02	3.14		0.5
12	-2.73	-1.93	1.97	2.37	2.46	2.78	2.78	2.90	3.05	0.5
13		-1.93	1.97	2.37	2.46	2.72	2.78	2.90	3.05	0.5
14		-1.93	1.97	2.37	2.46	2.72	2.78	2.90	3.05	0.5
15		-1.93	1.97	2.37	2.46	2.72	2.78	2.90	3.05	0.5





Wave climate

Figure 11



### 3.6 Wave climate

The processes of wave generation and transformation from offshore to inshore are particularly complex in the East Solent. Storm waves reaching the coast can be generated locally under winds from the southwest through to the east, or in the English Channel. Swell waves generated further afield will also penetrate the area, though heights will be modest.

The narrow entrances to the harbours, particularly in the case of Portsmouth and Langstone, exclude much of the externally generated wave energy. Internal generation (i.e. waves created by wind across the water surface within the harbour) is the most important method of wave creation. Chichester Harbour entrance is wider than the entrances to the other two harbours and allows some external wave energy to enter, predominantly around High Water when waves can pass over East Pole Sands. Due to the direction of the prevailing winds, the west and south facing stretches of coastline in each harbour are most exposed to wave attack.

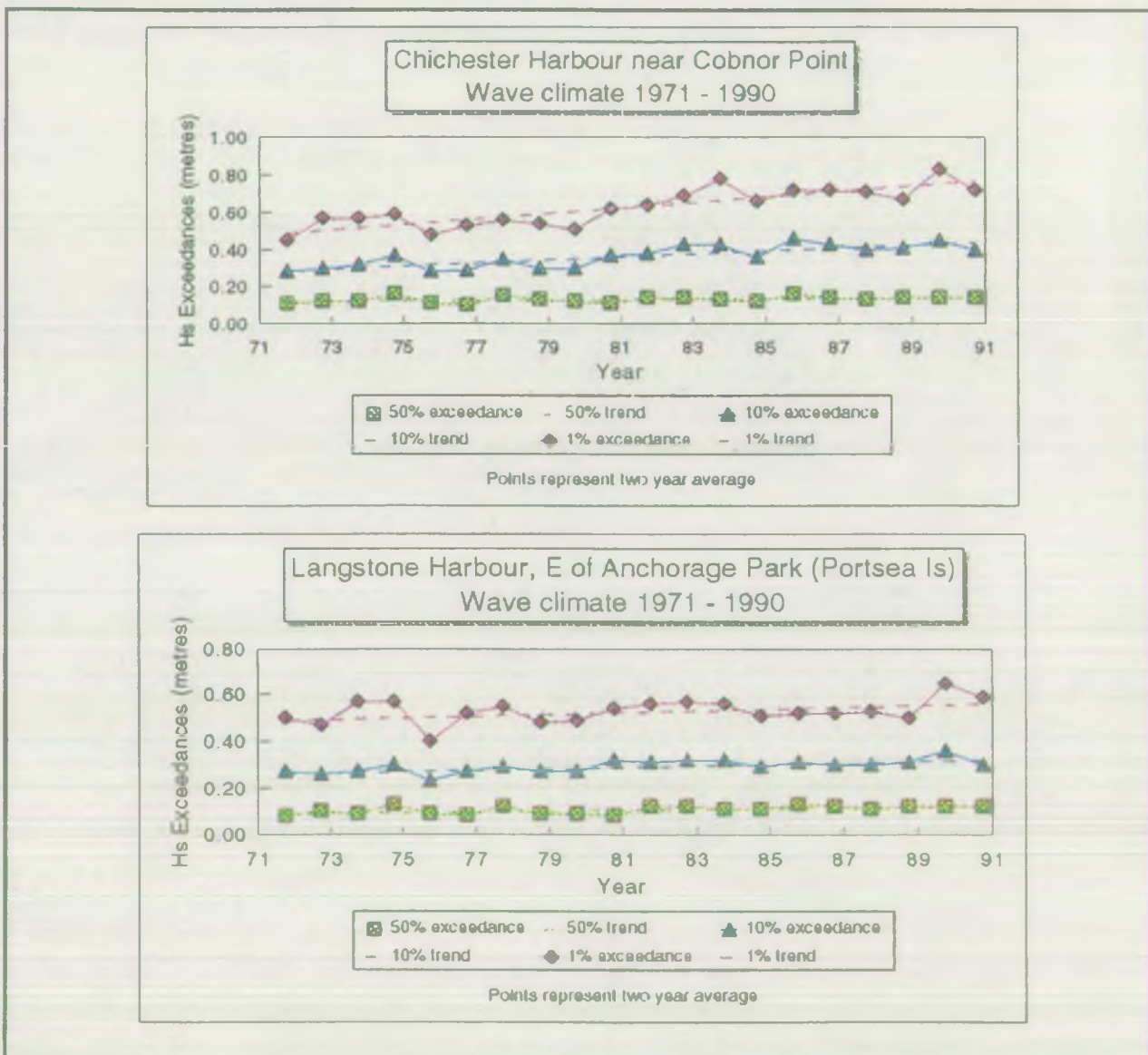
The wave climate in the harbours between 1971 and 1991 has been predicted from wind data (HR Wallingford, 1995a&b; HR Wallingford, 1996). The HINDWAVE and TELURAY models were used to predict inshore wave conditions at a number of points seaward of the normal wave breaking zone (Figure 11). These models take account of refraction, diffraction and shoaling due to the bathymetry, local wave generation and the presence of tidal currents and the tidal cycle of water levels. Table 4 presents the significant wave heights for different return periods at each point. Figure 12 presents the variation in three categories of wave height (waves exceeded 1%, 10% and 50% of the time) for two of the wave prediction points. The trend has been calculated by linear regression analysis and is represented as a dotted line on the graphs. It should be noted that the vertical scale varies on the two graphs.

**Table 4** *Extreme wave heights*

Point	Depth (mOD)	Significant wave height (m) for given return period			
		1	10	50	200
1	-0.02	1.44	1.67	1.82	-
2	-12.1	2.82	3.42	3.84	-
3	-2.7	1.06	1.26	1.40	-
4	+1.5	0.49	0.55	0.59	-
5	0.0	0.81	0.94	1.03	-
6	+0.7	0.70	0.82	0.90	-
7	-12.7	2.10	2.42	2.62	-
8	-6.2	0.78	0.90	0.98	-
9	-4.4	0.97	1.13	1.24	-
10	-3.2	0.89	1.06	1.18	-
11	-6.2	0.69	0.80	0.87	-
12	-12.3	1.20	1.34	1.43	-
13	-9.8	0.83	1.00	1.10	1.19
14	0.9	0.62	0.72	0.78	0.83
15	-0.2	0.88	1.02	1.10	1.17

Analysis of the modelled wave conditions over the 20 year period suggest a general increasing trend in wave height in all three harbours, however, there is a marked variation in the rate of increase. Future increases in wave energy and changes in dominant wave directions are likely as a result of increased storminess, shifts in North Atlantic weather patterns and rising sea levels. Erosion of mudflats and further losses of saltmarsh are probable, with consequent increased exposure of the shoreline to wave attack.

Changes in the nearshore wave climate, whether short or long term, will have significant implications for sediment transport and for the effectiveness of the existing coastal defences. Short term monitoring of the local wave climate at several nearshore and inshore locations would allow detailed verification of the existing wave models. Long term monitoring of nearshore waves and of local winds would allow trends in the wave climate to be continually re-evaluated in the management plans.



**Figure 12 Trends in wave heights from 1971 to 1991 for prediction points 3 and 10**



### 3.7 Sediment transport

Sediment transport within the harbours comprises two processes. Fine suspended material is transported by tidal currents, while both fine and coarse material are transported by waves. Previous studies (HR Wallingford, 1994 and 1995a&b) have investigated transport pathways.

Fine material, which is the predominant sediment type in all of the harbours, is derived from erosion of existing mudflats and the shoreline within the harbours, or is transported in suspension from the East Solent. Model studies indicate that fine material will not settle near the entrance channels and will tend to be drawn out of the harbours on the ebb tide. Further up the harbour channels and in the lee of the spits fine material will tend to settle, resulting in nett deposition. Field observations corroborate these predictions.

Sand can be transported in suspension under the turbulent wave and tide current conditions found in the harbour entrances, or in other parts of the harbours during storm events. Some deposition occurs as flood tide sandbanks opposite the entrance channels of each harbour, but the dominant transport pathway will be seaward out to ebb tide deltas. Small volumes of sand will also be carried further into the harbours to form narrow beach deposits in areas exposed to wave attack. Local erosion of the shoreline provides additional material for these small deposits.

Shingle is only transported when there is significant wave action or very strong tidal currents. Longshore drift along the open coast provides feed to the entrance channel spits, but negligible amounts are carried further in to the harbours. Shingle deposits along the harbour shorelines are derived from local erosion. Weak transport pathways carry material along the shore in a general north and east direction as a result of waves generated by south and westerly winds.

### 3.8 Joint probability conditions and existing defence standards

The previous HR Wallingford report (1995a&b) assessed the effectiveness of the existing defences during extreme storms. This was done using numerical models of beach response and wave overtopping.

The greatest risk to the shoreline occurs when high waves coincide with high water levels. The probabilities of the joint occurrences of extreme events are expressed in terms of their likely return period in years, and coastal defences are usually designed to resist storms up to a pre-determined return period. As a general guide defences for urban areas are normally designed to prevent significant risk to property or life under conditions with a 1 in 200 year probability of occurrence, while rural areas with predominantly low grade agricultural land might only be protected against 1 in 50 year events, beyond which some property damage would be accepted.

As a first step in assessing defence standards, the areas of risk must be defined. This is not a straightforward matter as risk combines the complex matter of the failure mechanisms for a given type of defence and the consequence of different types of failure. For example, undermining of a short section of seawall may only cause localized damage to a section of promenade, while a major breach of a flood embankment may cause extensive flooding of farmland or damage to major holiday facilities. Within the scope of a SMP it is only possible to consider relatively simple situations and therefore a conservative approach must be taken.

#### *Joint probability*

The joint probability of wave and water level extremes requires an informed assessment of the degree of correlation between the two variables, based on long term records and an understanding of the forcing conditions. The conditions set out for the SMP are for guidance only as they are based on worst case conditions for specific overtopping or beach erosion tests.. More rigorous definition is required for design of coastal structures or management operations, particularly in areas of high risk.



Most of the shoreline in the harbours is fronted by shallow water relative to the extreme wave conditions. This means that wave heights will be limited by water depth as they approach the shoreline, therefore making extreme water levels the more dominant condition. Table 5 sets out the extreme water level (SWL) and wave (significant height -  $H_s$  and mean period  $T_m$ ) conditions for return periods of 5, 50 and 200 years for the points shown in Figure 11. The table assumes present day water levels. Actual conditions at the shoreline will depend on wave transformation inshore from the prediction point.

### *Areas at risk*

The areas considered to be at risk from erosion, overtopping or flooding have been determined from published data (including HR Wallingford 1995a&b, the Environment Agency flood maps, the MAFF Coast Protection Survey and the NRA Sea Defence Survey), site observations and discussions with the responsible engineers. For the purpose of the SMP a conservative approach has been adopted which should be refined for later strategy plans.

Figures 13 and 14 present the potential flood areas and the frontages at risk from erosion. The flood areas are taken as the extent of land below the maximum 1:200 year water level, but the probability of flooding to the extent shown would be much more remote for most areas. Flooding to the extent shown would require major breaches of the defences allowing inundation over the peak of the storm event although there are some areas where the existing defences are not up to the level of the predicted 1:200 year water level. In addition it must be noted that there is no adequate land survey data to support the flood contours shown, except on Hayling and Portsea Islands. Areas of particular concern based on land use, residual life of existing defences and extent of flood area include the following:

- Old Portsmouth, Paulsgrove, Hilsea, Forton, Alverstoke and Portchester in Portsmouth Harbour
- Anchorage Park, Eastney, Farlington Marshes and Stoke in Langstone Harbour
- Eastoke, Tournerbury Farm, North Hayling and other areas along Hayling Island, Emsworth and West Wittering in Chichester Harbour.

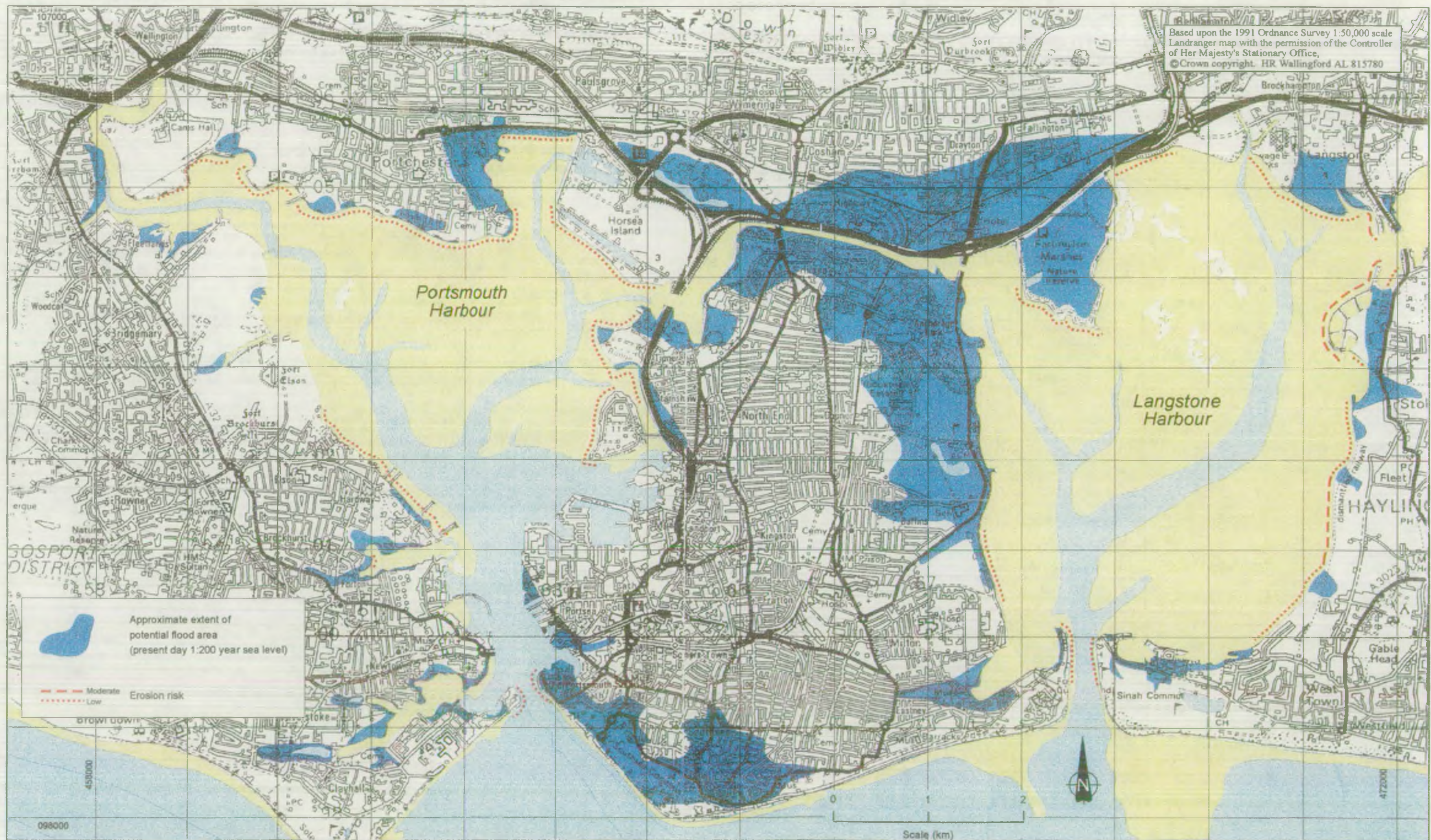
Seawall overtopping risks are not included in the figure but were calculated for the HR Wallingford study (1995a&b). Overtopping of walls can cause extensive flooding, particularly if the sea level is close to the wall crest. Unfortunately there are considerable lengths of the coastline where the defences are not even as high as the predicted 1:200 year level, so flooding will occur without the need for a breach or wave induced overtopping. Areas of particular concern with respect to overtopping include:

- Paulsgrove and Portchester in Portsmouth Harbour
- Eastern Road, Portsea Island in Langstone Harbour
- Emsworth, most of east Hayling Island and Langstone in Chichester Harbour.

The erosion risks indicated on the figure are based on a combination of existing erosion and the potential for erosion if the present day defences are not maintained. The shoreline is broken into three categories from moderate actual or potential erosion to no significant erosion. The harbour shorelines are not affected by the high energy wave conditions found on the open coast, so there are no areas of high erosion risk. Future erosion will depend on changes to the wave climate and changes to the saltmarsh distribution. Areas of particular concern include:

- the landfill sites west of Wicor in Portsmouth Harbour, due to potential environmental and landscape damage
- Milton Bund and Broadmarsh in Langstone Harbour due to potential landfill exposure, and the shoreline along the West Hayling rail line due to flood risk and loss of amenity (the oyster beds are to be improved under a 3 year contract from 1997)
- the southwest faces of Thorney Island and the Chidham peninsula in Chichester Harbour, though neither area is developed (the MoD plan to strengthen and raise the Thorney Island defences).





Flood and erosion risk - Portsmouth and Langstone Harbours

Figure 13



**Table 5 Worst case joint probability conditions**

Point	Return period (years)	SWL (mOD)	Storm waves	
			H <sub>s</sub> (m)	T <sub>m</sub> (s)
1	5	2.81	0.95	3.49
	50	3.11	1.08	3.72
	200	3.15	1.20	3.92
2	5	2.81	1.74	2.82
	50	3.11	2.00	3.02
	200	3.18	2.25	3.21
3	5	2.96	0.69	1.92
	50	3.26	0.78	2.04
	200	3.50	0.87	2.15
4	5	2.91	0.34	1.91
	50	3.21	0.38	2.01
	200	3.28	0.42	2.12
5	5	2.91	0.58	1.75
	50	3.21	0.58	1.75
	200	3.41	0.58	1.75
6	5	3.01	0.43	1.51
	50	3.35	0.43	1.51
	200	3.66	0.43	1.51
7	5	2.69	1.47	3.97
	50	2.98	1.63	4.18
	200	3.04	1.78	4.36
8	5	2.69	1.57	1.74
	50	3.02	0.64	1.85
	200	3.14	0.65	1.86
9	5	2.79	0.65	1.86
	50	3.08	0.73	1.97
	200	3.14	0.80	2.07
10	5	2.79	0.57	1.74
	50	3.08	0.65	1.86
	200	3.14	0.72	1.86
11	5	2.79	0.44	1.53
	50	3.08	0.51	1.65
	200	3.14	0.57	1.74
12	5	2.57	0.88	2.50
	50	2.83	0.97	2.63
	200	2.90	1.04	2.72
13	5	2.09	0.79	2.90
	50	2.46	0.86	3.03
	200	2.72	0.86	3.03
14	5	2.72	0.39	2.04
	50	2.90	0.46	2.22
	200	3.05	0.46	2.22
15	5	0.82	0.82	3.23
	50	0.90	0.90	3.36
	200	1.02	1.02	3.55



### 3.9 Future changes

An understanding of possible future situations is important to the development of sustainable management. As present trends cannot necessarily be taken as a guide to the future then it is important to consider a range of likely changes.

Recent research studies (Houghton et al, 1990; Bray et al, 1992; Jelliman et al, 1991; Brampton, 1993) have considered possible changes to water levels and waves. It is generally accepted that present rates of sea level rise are likely to increase. Predicted future rates vary from 5mm/year to 13mm/year. Similarly it is also accepted that the wave climate is changing. Although long term predictions are not consistent, it is likely that storm frequency and offshore wave heights will increase. No predictions have been accepted for shifts in wave directions.

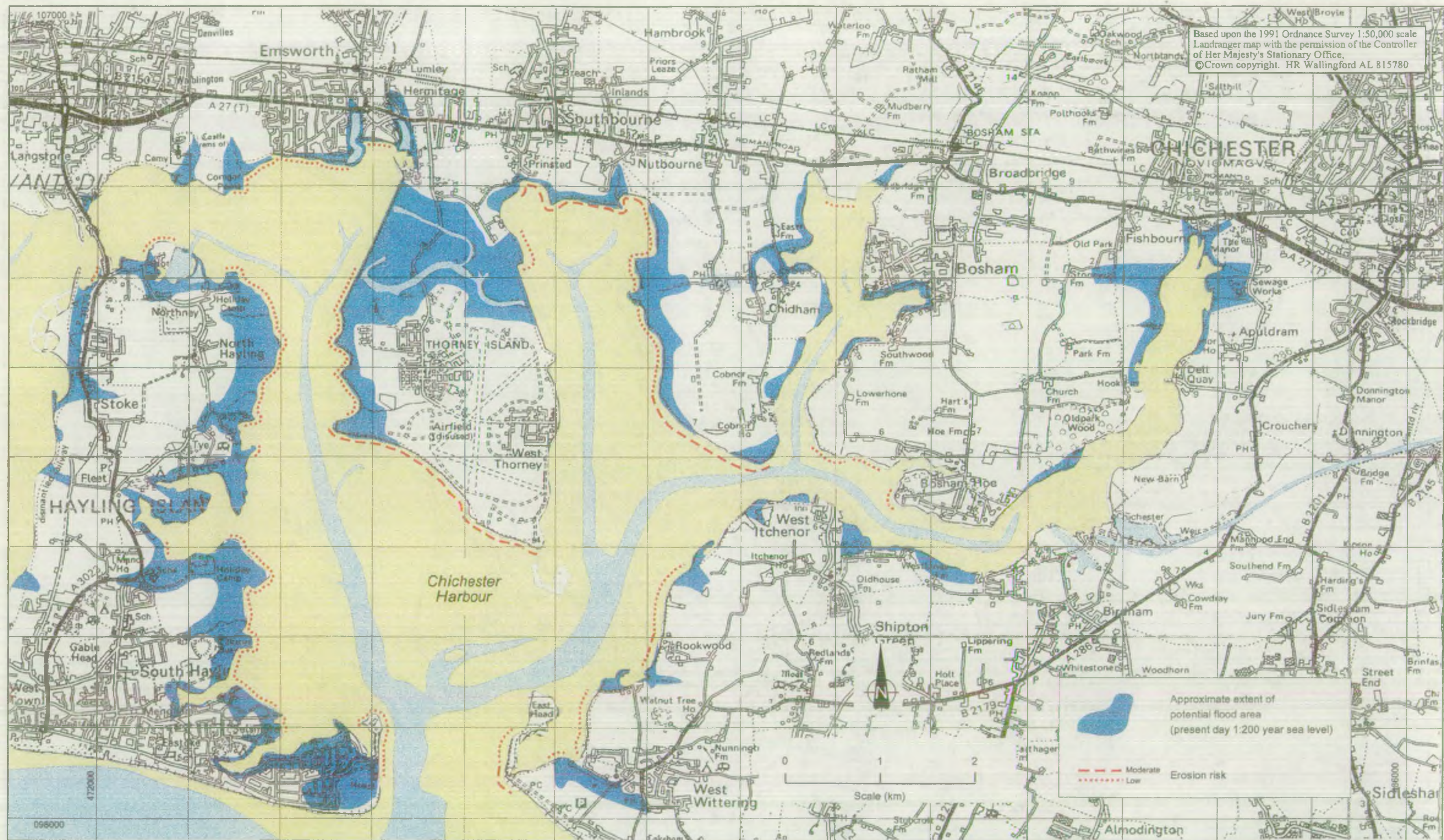
Given these potential developments then a number of shoreline changes are likely:

1. Increased water levels will increase potential overtopping rates, causing significant areas, including developed residential areas, to have an unacceptable risk of flooding. If wave energy also increases this effect will be magnified.
2. Increased wave energy and water levels will tend to increase erosion of the upper foreshore, saltmarshes and mudflats, leading to greater overtopping and greater risk of structural damage to seawalls, revetments or embankments.
3. Increased water levels will tend to increase tidal flows through the harbour channels, possibly leading to a widening of the channels, with consequent increased wave penetration into the harbour basins.

### 3.10 Existing monitoring programmes

There are no coordinated existing monitoring programmes within the harbours. Each of the authorities undertakes *ad hoc* surveys of defences. There have been several research projects on the state of the saltmarshes within the harbours and various environmental groups maintain records of bird populations. Chichester Harbour Conservancy are undertaking photogrammetric surveys of habitats in association with Portsmouth University. None of this work has been coordinated and the data is not centrally stored.

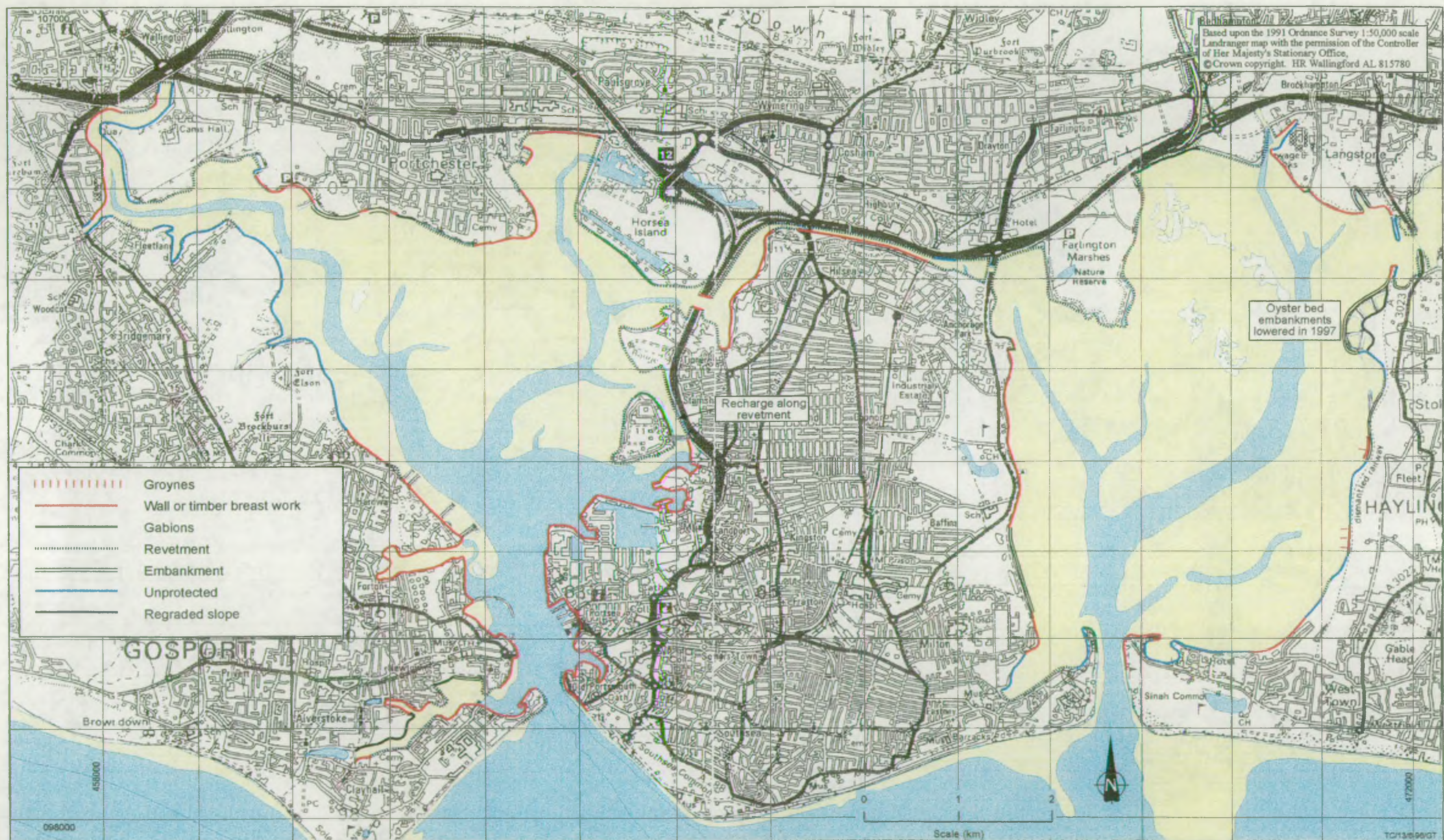




Flood and erosion risk - Chichester Harbour

Figure 14





Existing shoreline defences - Portsmouth and Langstone Harbours

Figure 15



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## 4 Existing shoreline management

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### 4.1 Introduction

A review of past shoreline management practice and existing structures provides important information for future management. Past schemes may have provided good service and may still have a considerable useful life. Alternatively they may have been unsatisfactory, either locally or due to their effect on adjacent frontages, or they may be nearing the end of their useful life and a new approach may be appropriate.

Unlike the open coast, the harbour shorelines are not dominated by high energy processes acting over long lengths of frontage. As a result, management operations are undertaken on a more piecemeal basis, normally in response to gradual deterioration of defence standards or to changing land use requirements. Although this approach does not normally have hydraulic implications for adjacent frontages, as it would on the open coast, it does mean that the landscape value of the shoreline is often compromised, and it may have a negative impact on the natural environment.

The following section outlines the existing defences and management practices. Information has been derived from site visits, consultations with the responsible authorities and a review of the MAFF Coast Protection Survey, the NRA (Environment Agency) Sea Defence Survey and various documents held by the Local Authorities.. The site visits and consultations were particularly useful in providing an updated review of the present state of the shoreline.

Appendix 2 presents information on each sea defence element, including location, length, maintaining authority, structure type, condition and residual life. This information is based on the MAFF and NRA surveys, updated during the SMP process.

Figures 15 and 16 summarize the extent of different defence types. It should be noted that for classification purposes walls and timber breastwork are vertical, while revetments include all sloping structures whether concrete, timber or rock except gabions which are classified separately. Complex structures including both vertical and sloped elements have been classified according to their dominant element. Embankments are earth banks raised above the hinterland level, with no armouring on their seaward face. Regraded slopes are formerly eroding natural or reclaimed frontages that have been artificially graded and/or vegetated to improve the landscape or reduce a possible safety hazard. Unprotected frontages have been left to respond naturally to coastal processes.

### 4.2 Review

#### *Portsmouth Harbour*

The Portsmouth Harbour shoreline comprises a mixture of erosion and flood defences, harbour walls, structures built to enclose land reclamation areas and some natural coastline. Some parts of the shoreline benefit from protection due to saltmarshes, but not to the extent found in Langstone or Chichester. Much of the natural harbour area has been reclaimed to allow development of naval and port facilities, residential areas, road construction, landfill sites and public recreation areas.

The major management operations are:

- ongoing maintenance, improvement or replacement of ageing defences
- extension of naval and port facilities
- planned raising of crest levels to achieve appropriate future standards of defence.



The following text sets out these operations in detail.

Gosport Borough Council have surveyed the full length of the built defences along their shoreline including those owned or maintained by others (Gosport, 1996). The survey identifies numerous lengths of wall in need of repair and the areas subject to flooding due to defences being below extreme water levels, notably within Haslar and Forton Lakes. Extensive lengths of the Gosport frontage have been under MoD control, but are now being released for redevelopment. Consideration is being given to the benefits of different sorts of future land use and appropriate shoreline management will be needed by the developers to ensure adequate and sustainable defences.

Work is planned for raising the seawall near the Portsmouth ferry terminal to prevent overtopping. Recent work has been completed north from Hardway where private frontagers have improved their seawalls in an ad hoc fashion, resulting in a lack of cohesion to the appearance of the shoreline. Further north the shoreline of the MoD property at Fleetlands remains largely unaltered, providing the only substantial length of natural coast around Portsmouth Harbour.

Fareham Borough Council have also completed a survey of their defences (Fareham, 1992). Since publication work has been undertaken along several priority lengths, and other works are under consideration, as follows:

- the wall fronting low lying public open space on the west shore of Fareham Lake south of the Town Quay has been repaired in places, but requires more general refurbishment to prevent undermining and collapse, particularly as the hinterland area is being redeveloped for housing and industry
- the Fareham Town Quay has been recently rebuilt to a high standard
- the north shore of the upper reaches of Fareham Lake has been recently protected by a revetment of small armour stones
- the shoreline fronting the private and public open space between Cam's Hall and Wicor is formed of building rubble in the west and collapsing walls to the east. Erosion of the lower foreshore has increased wave exposure along the shoreline. Although there is no risk to developed land, further erosion of the shoreline will result in a loss of amenity areas and possible release of contaminants from the backshore landfill, so reinstatement of the collapsing defences may be necessary
- from Wicor to Portchester the shoreline is formed by an eroded embankment. The footpath is deteriorating and flooding of the backshore is likely. Part of this length is controlled by Hampshire County council as a nature reserve, so managed retreat may be considered a practical approach
- the south frontage of Portchester suffers erosion and is low lying in parts. Recent and post-war residential and commercial areas are at risk. Part of the frontage protection has been recently upgraded by a blockwork mattress revetment to prevent erosion and flooding. Regrading and stabilizing of grass slopes along other parts has not prevented further erosion of shorefront open space and further work may be necessary. Private seawalls of varying types have been built along the east section. A lack of cohesion to the shoreline appearance has resulted
- the seawall surrounding Portchester Castle is low and subject to overtopping. Immediately to the north the privately maintained wall is in poor condition, and a breach could result in widespread flooding. A new sheet pile wall has been built further north; although this is an effective defence, it is an unsightly addition to the landscape and would benefit both hydraulically and aesthetically from a sloping face. A sloping revetment, partly topped by a raised earth embankment, extends further north.

Portsmouth City Council have published a coast defence plan covering all of their at risk areas (Portsmouth 1991). The plan includes outline design details to bring all City maintained frontages up to a high standard of service for the future, as follows:

- Southampton Road at Paulsgrove is subject to regular overtopping and the area could suffer extensive flooding under extreme conditions. A higher wall has been recommended as a priority
- the Port Solent development and the Horsea Island landfill site are protected to a high standard by a recent revetment
- Horsea Island MoD site is protected by a recent gabion revetment







- the M275 and M27/A27 revetments are generally in reasonable condition, but require maintenance. Areas with original filled textile mattress armouring will eventually need upgrading to a suitable flexible block system
- the south bank of Ports Creek is an area of some concern. The wall was built of a variety of low quality materials which are now both unstable and too low. Regular repair and maintenance is required. Outline plans for a new wall and walkway have been proposed as a matter of priority
- the Hilsea/Tipner Lake frontage comprises a vertical seawall around the public open -space and a range of revetments and unsightly building rubble slopes around the landfill site. The seawall needs maintenance and its crest level needs raising to prevent flooding. The remaining area needs a cohesive approach once the planned landfill is complete
- Tipner north shore defences include eroding slopes along the MoD ranges, stone faced walls in front of the sailing clubs and an assortment of unsightly builders waste revetments around the reclaimed land of the breakers yard. These walls need to be refurbished and raised to prevent flooding and the unprotected areas need appropriate defences once reclamation work is complete. As the reclamation areas are in a prominent position relative to the M275, then consideration should be given to the appearance of the area
- the remaining shoreline south of Tipner comprises jetties, motorway embankments or MoD frontage. Work is required to maintain the structures and crest levels need to be raised in some areas to prevent flooding.

In addition to these works, the area around the Vosper Thomeycroft Shipyard needs to be upgraded. North of the shipyard the shoreline comprises an unsightly range of revetments and dumped building rubble, all in need of raising and refurbishment to a reasonable standard to prevent widespread flooding of areas beyond the frontagers property.

#### *Langstone Harbour*

The Langstone Harbour shoreline is defined mainly by flood and erosion defences, and walls or revetments built to enclose landfill sites. However parts of the western shoreline of Hayling Island are undefended. There are also several jetties and marinas. Saltmarshes provide some protection to the north shore and to the southern part of the Hayling Island shore.

Recent, ongoing and planned operations are summarized below.

Portsmouth City Council's management plan (Portsmouth, 1991) sets out the areas at risk and the proposed schemes to bring all of the City maintained frontages up to a high standard of defence:

- Eastney Lake frontage occasionally suffers some flooding. Some work has been carried out recently and further revetments and walls have been recommended
- Milton Bund has suffered erosion since its construction and now needs to be rebuilt and armoured as a matter of priority
- Eastern Road seawall requires refurbishment along the remaining sections of old wall and raising along its full length to prevent overtopping and disruption to traffic along this major transport link
- Farlington Marshes revetment has undergone recent repair to prevent flooding of sensitive wetland habitats and destruction of the popular public coastal path.

The remaining frontage is within Havant Borough, but most of the required management relates to floodable areas of concern to the Environment Agency or to landowners:

- defences along the South Moor area to the west of Langstone are in need of refurbishment to retain public access, prevent erosion of the landfill area and prevent flooding of the low lying area
- some minor works have been undertaken along the shoreline from Langstone south along the west face of Hayling Island to prevent erosion and to protect public trails. The abutments for the disused rail bridge



are being left to collapse. Some work on the southeast shore of the harbour may be necessary to maintain public safety

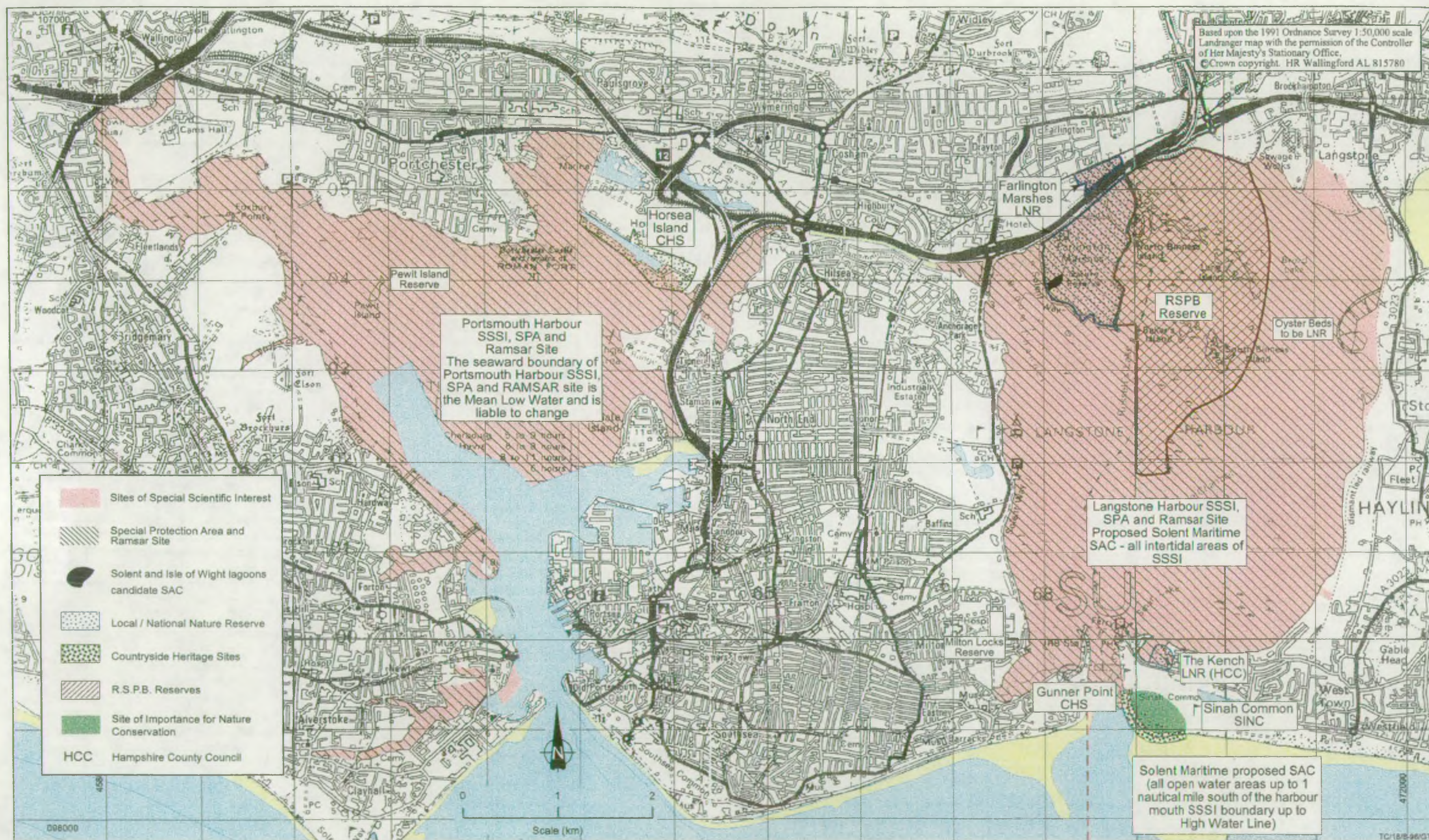
- redevelopment plans have been carried out for the oyster beds off north west Hayling Island to improve public safety and enhance the environment and the landscape.

### *Chichester Harbour*

The Chichester Harbour margins are generally less developed than the other two, but there are still substantial lengths of shoreline needing management. Although there are several eroding areas, the consequences of erosion of low cliffs are generally not serious due to the lack of development. Management of defences in front of potential flood areas and maintenance of the environment and the landscape are more pressing issues. Recent, ongoing and planned management operations are outlined below:

- all of the east shore of Hayling Island is subject to flooding, and management plans are under discussion (Atkins, 1996; HR Wallingford, 1996). Breaching of defences along several critical frontages could result in widespread flooding of agricultural land, holiday and recreation developments, some residential areas and main roads. Consideration has been given to maintenance of the existing defences, creation of new saltmarsh by managed retreat, abandonment of the existing line, and to the construction of a surge barrage across the harbour entrance channel (Lewin, 1996). Particular concerns are for the Tourner Bury and North Hayling frontages. Tourner Bury has been particularly controversial due to the conflicting interests of the landowner, English Nature and the Environment Agency. The frontage has now been protected by a bank of building rubble, extending over particularly sensitive designated nature conservation areas. The bank is not a sustainable defence and will need armouring if it is to survive for any length of time
- works have been undertaken along the Langstone - Emsworth frontage to prevent minor erosion and flooding, including protection of Conigar Point where breaching had allowed a new area of saltmarsh to develop
- Emsworth has been identified as a risk area due to overtopping and work is required to improve defences
- the Emsworth Mill Pond wall acts as a partial defence to low lying areas along the Pond, but is overtopped during high water conditions allowing some flooding of roads and properties. The long term future of the wall is uncertain
- the MoD have completed design proposals for improvements to the revetments along their frontage on Thorney Island. At Marker Point on the southwest corner the MoD have agreed to allow the existing defences to deteriorate naturally, with the intention of allowing a limited area of saltmarsh to develop on what is currently low grade farmland. Some of the proposals are being re-examined due to environmental and landscape issues
- a breach of the embankment at Thornham Point along the Thorney Channel has created a small new area of saltmarsh in an area of low grade pasture. The area is managed as a retreat scheme by the Harbour Conservancy
- the Environment Agency have undertaken major works along the Prinsted-Nutbourne frontage to prevent flooding. The existing embankment has been armoured with rock to ensure no future damage, but the works have attracted criticism for the impact on the landscape of the area
- the west shore of Chidham Peninsula is suffering erosion of flood embankments and breaches are likely if maintenance is not undertaken. Flooding may extend over adjacent farmland. Erosion of higher ground at the tip of the peninsula is not causing a significant problem
- the shoreline of the upper reaches of Bosham and Chichester channels are subject to some potential flooding due to embankments being below required levels, but no works are planned apart from footpath maintenance
- between West Itchenor and West Wittering the shoreline is subject to some flooding and erosion. Minor works have been undertaken to prevent further damage and loss of the footpath
- East Head spit is managed by the National Trust. Works have been undertaken to enhance the dunes, thereby improving the shelter offered to the lee side saltmarsh area.





Designated conservation areas - Portsmouth and Langstone Harbours

Figure 17



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## 5 The natural environment

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### 5.1 Introduction

Portsmouth, Langstone and Chichester Harbours are natural tidal basins. Although all three have their own narrow entrances that connect them with the sea, their close proximity and interconnecting channels mean that they should be viewed and managed in a coordinated and integrated way.

The harbours are shallow and the very large intertidal mudflats are attractive to wading birds. In addition to mudflats, the following types of natural habitat are found within and around the coastal margin:

- Open water
- Lagoons
- *Zostera*, eel grass beds
- *Spartina*, cord grass, dominated beds
- Upper (mature) saltmarsh communities
- *Phragmites* reed bed
- Wet grassland/grazing marsh
- Sand dunes and shingle banks
- Woodland.

Because of these special natural attributes the harbours have been assigned various conservation designations. Table 6 lists and defines the designations and states whether they have international, European, national or local recognition.

Shoreline management must take account of the environmental value and the significance of any proposed management operations on the environment must be understood. The area of potential impact is not restricted to the boundary of the operation - work in coastal areas may have a very limited impact, or may affect the environment at a considerable distance from the shoreline (e.g transport of material by road).

The present day environment is the result of many factors and processes, some relict and some on-going. Evolution of the environment occurs over a variety of timescales and existing situations must be seen as transient rather than fixed. Appreciation of the transient nature of the environment is important to the SMP for two reasons:

- change may be beneficial as well as detrimental, and should not necessarily be restricted
- assessment of environmental impact must be based on existing trends for change as well as on present day conditions.

The following sections discuss environmental issues within the harbours. Much of the information is derived from the Pagham Harbour to River Hamble study (HR Wallingford, 1995a&b), supplemented by recent citations supplied by English Nature, site visits and consultation with interested groups.

### 5.2 Designated nature conservation areas

The conservation designations contained in each of the harbours are given in the following text. The natural features which warranted the awarded conservation status have also been summarised. Detailed information can be obtained from the citations supplied by English Nature.

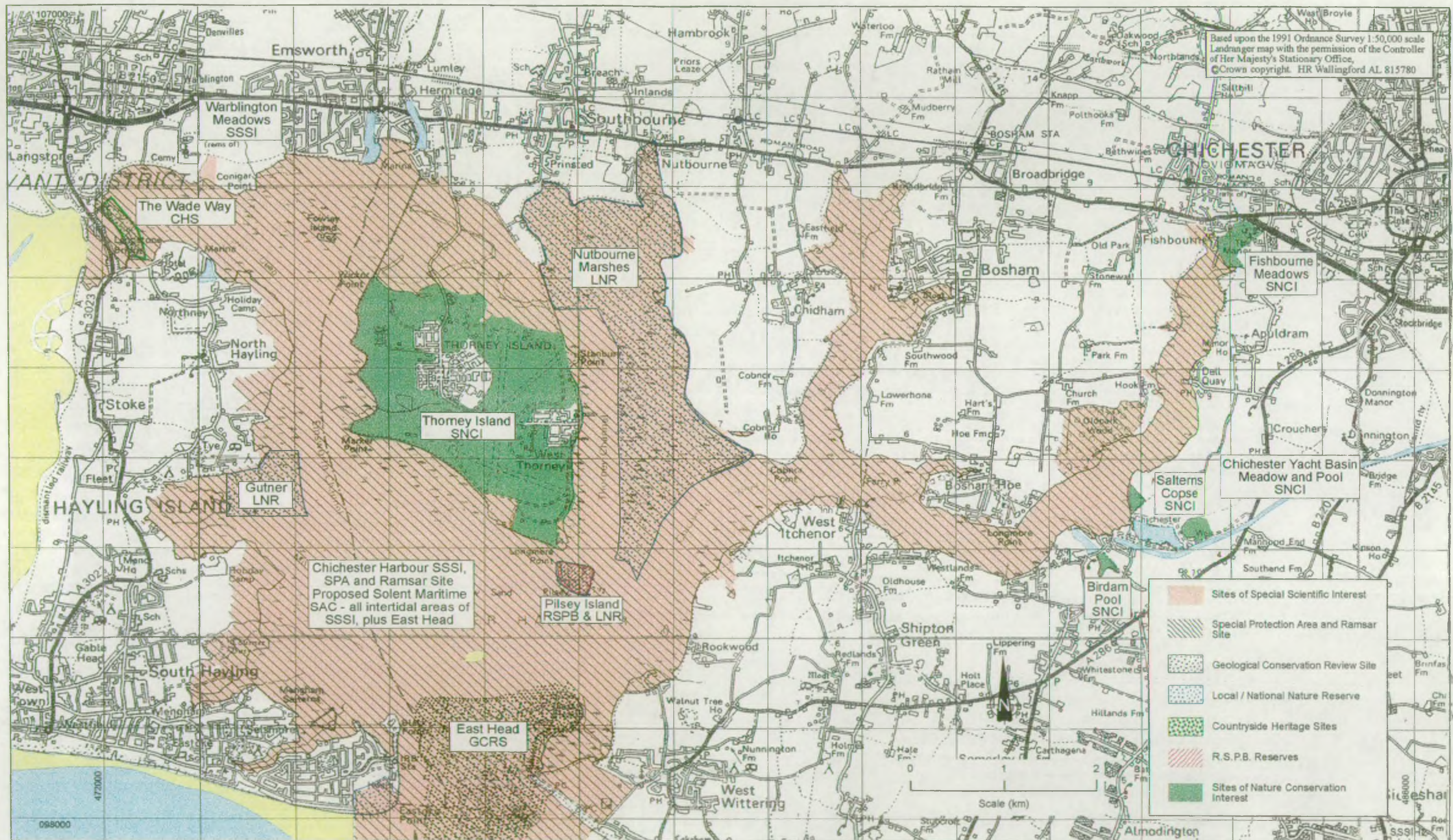
Figures 17 and 18 display the boundaries of each of the designations.



**Table 6 Definition of site designations**

Designation	Acronym	Definition	Level of Importance
Ramsar Site	none	Wetland site recognised for its international importance for nature conservation especially as Waterfowl Habitat. Designated under The Ramsar Convention on Wetlands of International Importance".	International
Special Protection Area	SPA	Internationally important area for birds. Designated under 'Council directive 79/409/EEC on the conservation of wild birds'.	European
Special Area of Conservation	SAC	Site designated under 'Council Directive 92/43/EEC', more commonly called the 'Habitats Directive'. The sites are selected to conserve natural habitats and wild flora and fauna of European importance. The aim is to sustain European biodiversity.  Potential sites are currently being considered. The final list must be agreed by the Government with the EC. by June 1998 and by June 2004 all these sites must be designated.	European
Site of Special Scientific Interest	SSSI	An area of recognised scientific value in terms of its flora, fauna, geology or physiographical features.	National
Geological Conservation Review Site	GCRS	An SSSI site of geological interest which has been identified by the Geological Conservation Review.	National
National Nature Reserve	NNR	Area of natural interest designated under the 1981 Wildlife and Countryside Act.	National
Local Nature Reserve	LNR	Area of natural interest. Designated under the Countryside Act.	County.
Countryside Heritage Site	CHS	County designation (Hampshire only) with no attached statutory protection. Includes archaeological and natural interests.	County
Site of Importance for Nature Conservation	SINC	CHS's are currently undergoing a change of name to SINC. The name change is being conducted on a District to District basis. As yet, most of the sites in the SMP study area retain their original name. Equivalent to SNCI.	County
Site of Nature Conservation Interest	SNCI	County designation, usually designated because of wildlife value. No attached statutory protection. Equivalent to SINC.	County





Designated conservation areas - Chichester Harbour

Figure 18



### *Portsmouth Harbour*

Portsmouth Harbour is designated as an SSSI, an SPA and Ramsar site. It contains a range of habitats including cord grass marsh, mudflats, eel grass beds, sea couch dominated grasslands, scrub, brackish lagoons and some surrounding terrestrial habitats. The eel grass beds are among the most extensive in Britain and support a rich associated benthos and epiphytic flora and fauna. Indeed, the biological richness of the area is reflected in the numbers of wetland birds it supports.

Portsmouth Harbour qualifies for SPA/Ramsar status under the Birds Directive by supporting internationally and nationally important wintering populations of waterfowl including the following species of waterfowl: Dark-bellied Brent Geese, Red-breasted Merganser.

Two brackish lagoons - Little Anglesey Lake and Cockle Pond - adjoining Haslar Lake in the south west of the Harbour are included in the SSSI. Both support populations of the starlet sea anemone and the lagoon sand shrimp which are specially protected by Section 9(5) and Schedule 5 of the Wildlife and Countryside Act 1981. Little Anglesey Lake supports the most diverse lagoonal species in south-east England.

A small area of terrestrial habitat extending along the southern side of Horsea Island is also included in the SSSI. Chalk spoil dumped at this site early in the 20th century now supports a rich chalk grassland flora which includes about thirty species which either have narrow habitat tolerances or are rare in Britain. Horsea Island is itself designated as a CHS. In addition to possessing the chalk grassland flora it is also of historical interest in being a man made extension of a natural island in Portsmouth Harbour. The site may also possess archaeological interest with the possibility of a midden occurring at the north west end.

### *Langstone Harbour*

Langstone Harbour is designated as a SSSI and is part of the Langstone and Chichester Harbours, SPA and Ramsar site. It contains one of the largest areas of mixed saltmarsh on the south coast, as well as extensive areas of cord grass marsh in an advanced state of degeneration. The eel grass beds are among the largest in Britain. The Harbour is of international significance as a rich intertidal system which supports large populations of migrant and overwintering wildfowl and wading birds. Indeed, the harbour ranks among the twenty most important intertidal areas in Britain as a summer and autumn assembly ground for waders during the moult and as a post moult wintering ground. Depending on fluctuating population levels Langstone Harbour has regularly supported between 5-10% of the world population of wintering Dark Bellied Brent Geese, over 3% of the European and North African wintering population of Dunlin and 1-2% of the European and North African migration flyway population of Grey Plover and Black-tailed Godwit. Part of Langstone Harbour is owned and managed by the Royal Society for the Protection of Birds and includes the site of one of Britain's largest Little Tern colonies and supports a large populations of the nationally rare little-robin.

Also located within the SSSI is the Farlington Marshes LNR which is situated in the north-west sector of the Harbour. This area of reclaimed saltmarsh, protected by a seawall contains brackish marsh, fresh marsh, a large lagoon with associated reed beds, grassland and scrub. These provide vital high water roosting grounds for the Harbour as a whole and a major feeding ground for geese. The reserve also has breeding populations of foxes, badgers and hares. Following widespread annexation for agricultural improvement few such sites remain on the south and east coasts of England where this type of habitat was once common. Shut Lake, within Farlington Marshes forms part of the Solent and Isle of Wight Lagoons candidate SAC.

The Wade Way CHS is a rare and ancient causeway linking Hayling Island and the mainland at Langstone. It was recorded in the 18th century and was in use long before then.

Langstone Harbour SSSI is part of the proposed Solent Maritime SAC.



## Chichester Harbour

Chichester Harbour is designated as an SSSI and is part of the Langstone and Chichester Harbours SPA and Ramsar site. It contains a wide range of habitats which have important plant communities as well as extensive areas of mud and sandflats. The site is of particular importance for wintering wildfowl, wading birds and breeding birds, both within the Harbour and in the surrounding permanent pasture fields and woodlands. It is deemed an internationally important site for Ringed Plover, Grey Plover, Black-tailed Godwit, Dunlin, Sanderling, Curlew, Greenshank, Shelduck, Teal and Dark Bellied Brent Goose.

The harbour contains large areas of degenerate cord grass and small areas of upper saltmarsh.

Warblington Meadow is an unimproved grazing marsh which adjoins the Harbour. It is designated as an SSSI in its own right for its gradation from freshwater base rich marsh to old reclaimed saltmarsh and for its rich associated flora. Thorney Island SNCI lies within the Harbour. It is important for migrant birds and as a roost for waders. The grassland and scrub habitats it provides support many breeding birds and butterflies.

Fishbourne Meadows SNCI comprises several meadows lying close to the Harbour. They appear to be semi-improved and are of botanical interest. Salterns Copse SNCI adjacent to Chichester Yacht Basin is an ancient, botanically rich semi-natural woodland on the coastal plain. The Chichester Yacht Basin Meadow and Pool SNCI comprises a shallow freshwater pool, stream and adjoining pasture. It provides an important site for birds, especially wintering and passage waders and wildfowl. Birdham Pool SNCI lies close by; it is a brackish coastal lagoon which supports a population of the protected lagoon sand shrimp. Other specific areas of interest within the boundaries of the Chichester Harbour site include Nutbourne Marshes LNR, Pilsey Island RSPB Reserve, Sandy Point Country Heritage Site (CHS) (shortly to be designated a LNR as the best example of vegetated sand and shingle in Hampshire), Gutner Point LNR, The Wade Way CHS and National Trust (NT) landholdings at East Head where there is also a sizeable sand dune and shingle system of geomorphological importance. Another geomorphologically important site lies to the east of Langstone where a low cliff at high water mark exhibits a complex of Brickearth and Coombe Rock deposits.

Chichester Harbour SSSI is part of the proposed Solent Maritime SAC.

## 5.3 Future designations

EC Habitats Directive (92/43/EEC) attempts to conserve European habitat types and/or rare and threatened species by assigning special protection to Special Areas of Conservation designated by Member States. At present SACs are in the nomination stage. Chichester and Langstone Harbours are included in the proposed Solent Maritime SAC. This region has been proposed as a possible SAC because of the following habitat types: 'cordgrass swards, upper saltmarsh, estuaries. Chichester Harbour also contains a rare polychaete which is found on the steep eastern side of the entrance to Chichester Harbour.

Figures 17 and 18 show the proposed SAC coverage within the harbours. Shut Lake, within Farlington Marshes LNR, is part of the candidate Solent and Isle of Wight Lagoons SAC.

## 5.4 Responsibilities and restrictions due to conservation designations

Official conservation designations assigned to the harbours have implications for SMP. SSSIs, SPAs and SACs have statutory protection. An overview of the legislation relating to these sites and the relevant restrictions are given below.



### *SSSI, NNR and LNR*

Designation as an SSSI is accompanied by a standard list of 'potentially damaging operations', which usually include operations such as the 'erection of sea defences' and the 'undertaking of engineering works'. Owners or occupiers must not carry out potentially damaging operations (or permit them to be carried out) on an SSSI without giving written notice of the proposed operation to English Nature. Works may only legally proceed if written consent is obtained, or the operations comply with a management agreement previously drawn up with the nature conservation agency, or four months have elapsed since written notice was given. Otherwise, a criminal offence is committed if a 'potentially damaging operation' is carried out without reasonable excuse. The Wildlife and Countryside Act states that there is a reasonable excuse if the operation is an emergency one (provided that the nature conservation agency is notified as soon as practicable) or is one for which planning permission has been granted.

If English Nature seriously objects to the proposals and the objections cannot be resolved by negotiation within the four month period, English Nature may apply to the Secretary of State for the Environment for a Nature Conservation Order. Nature conservation orders are comparatively rare, and their main effect is to extend the period of delay to a maximum of 12 months, so that the nature conservation agency has more time to negotiate a management agreement or to consider compulsory purchase.

Planning authorities must consult English Nature about applications both within an SSSI or operations outside the SSSI which may have a significant impact.

### *European Sites (SPA/SAC)*

Legislation to implement EC Habitats Directive 1992 has been introduced in the United Kingdom by the Conservation (Natural Habitats, &c) Regulations 1994, SI 1994/2716. This regulation covers both SPAs and SACs, which are collectively termed 'European Sites'. Planning authorities have to follow a set procedure when considering proposals for development on European Sites. Developments include coast protection works and new flood protection works. This procedure is summarised in the flow chart in PPG9.

The regulation stipulates that any proposed scheme likely to have a significant effect on a European Site should be appropriately assessed to determine its impact on the conservation objectives. The competent authority may agree to the plan if the integrity of the site is not jeopardized. If the assessment indicates negative impacts but the competent authorities decide that scheme should go ahead due to overriding public interest, compensatory measures must be taken to ensure that the overall value of Natura 2000 (the European habitat network of SPAs and SACs) is protected. The European Commission should be informed of the compensatory measures adopted.

Where the site concerned hosts a priority natural habitat and/or priority species listed in the Annexes to the Directive, the only considerations which may be raised are those relating to human health or public safety, or to beneficial consequences of primary importance for the environment.

Permitted development rights under the Town and Country Planning (General Permitted Development) Order 1995, such as the Environment Agency for flood protection works, may not be exercised if they are likely to have a significant effect on a European Site unless they have been approved by the local Planning Authority. The Planning Authority has the power to grant permission for the works but it must consult English Nature for its opinion and consider their view when making the final decision.

At present SACs are in the nomination stage. Part of the open coastline, along the south of Hayling Island and within the Solent form part of a nominated site called Solent Maritime. The Government advises in Planning Policy Guidance PPG9, *Nature Conservation*, that proposed SAC's should be protected as a matter of policy in the same way as designated sites.



### *Environmental assessment to support planning application*

Under EC directive 85/337/EEC coastal and flood defence works must be subject to an environmental assessment if they are likely to have a significant effect on the environment. If the works require planning permission or are within a European Site (SAC or SPA) the Local Planning Authority decides whether an environmental assessment is necessary.

## **5.5 Implications for shoreline management**

1. The total coastline of Chichester and Langstone Harbours, and much of Portsmouth Harbour is designated as nationally and internationally important for nature conservation. Moreover, Chichester Harbour is also designated for its landscape value. New or significantly enlarged coastal defence structures are unlikely to be acceptable unless there is an overriding public interest that can be shown to justify the potential impact on habitats or species.
2. Compensatory measures such as replacement habitat creation elsewhere, should be conducted if coastal defence works are likely to cause significant damage to habitat or species in the sections of coastline specified as a European Site in accordance with the provisions of the Habitats Regulations 1994. The European Commission should be informed of the compensatory measures to be adopted.
3. Where new defences or improvements to existing defences are required it is important that full consideration is given to nature and geological conservation in the concept, planning, design, implementation and maintenance stages. There should be a general policy not to disrupt natural coastal processes except where life or important man-made assets are at risk.
4. Coastal defence strategies should be compatible with the relevant management plans for the designated conservation areas.
5. English Nature should be consulted at the outset of any proposal for shoreline management operations to determine whether the operations are likely to cause environmental damage and to determine whether alternative approaches may be more acceptable.



## 6 Land use and the human environment

### 6.1 Land use and recreation

The current land use within approximately 1km of the harbour shoreline has been recorded in Figures 19 and 20. Agricultural land has been further subdivided into high grade (Grades 1 and 2) and other in Figure 21. The land use survey was based on aerial photograph interpretation, field observations and information contained within various local authority development plans and the Harbour Plans (Chichester, 1994; Nicholas Pearson 1996). The following main categories were recognised, simplified from the Land Utilisation Survey Field Mapping Manual (Coleman and Shaw 1980):

- Countryside: arable and pasture land, horticulture, greenhouses, woodland, isolated buildings
- Open space: public open space, sports and recreation areas, golf courses, cemeteries, allotments
- Domestic and commercial buildings: residential, commercial, institutions
- Industry: factories, warehouses, sewerage treatment works
- Ministry of Defence holdings
- Dockyards and related industry
- Caravan sites and holiday villages
- Marinas and mooring areas
- Major transport infrastructure
- Power lines

Also noted are shoreline developments including outfalls, piers, funfairs, slipways and sailing clubs.

#### *General character*

Despite recent contraction of the dockyard, Portsmouth Harbour remains the main naval base for the United Kingdom, with berthing and maintenance, refuelling and ordnance storage, distribution and training the main activities. There has been recent intensification of naval activity on Whale Island, in response to the relocation of fleets from Plymouth and Scotland. Figure 19 indicates the extent of the Ministry of Defence holdings, including the areas which have been declared surplus to requirements. The Naval Base is a major employer, indirectly supporting numerous other industries. The Naval Heritage Area in Portsmouth is a major tourist centre, with over 500,000 visitors a year attracted to HMS Victory, HMS Warrior, the Mary Rose and the Royal Naval Museum. The Submarine Museum and Priddy's Hard Ordnance Museum, Gosport are also important attractions.

The harbour also supports an estimated 2561 marina berths and 2084 moorings, with 12 sailing clubs around the shoreline. Small boat sailing takes place throughout the harbour, with 14 slipways providing public access to the water. Boat based angling is restricted to the area north of a line from the south of Whale Island to Hardway, by order of the Queen's Harbour Master. Shore based angling takes place at Portchester, Town Quay and Birdwood Grove in Fareham, and at Powder Pier, Gosport. Canoeing and rowing are also popular water-based activities. Water skiing and windsurfing are, however, not permitted within the harbour. Personal water craft are not encouraged, being restricted by the need to observe the 10 knot speed limit which is rigidly enforced by the Ministry of Defence Police.

Portsmouth Harbour has seen recent expansion of commercial port activities, which is concentrated at Mile End (the continental ferry port), Albert Johnson and Flathouse Quays and The Camber. Over 3 million passengers a year travel through Portsmouth and provide direct employment for 1,800 and indirectly 3,800.

Although the Portsea Island shore around Milton and Eastney is largely urban, a strip of public open space or farmland remains around most of Langstone Harbour. It is an important recreation area, popular for active water sports and informal pursuits. Sailing, fishing, sub-aqua diving and boardsailing are the main water-based



activities. There are around 1,500 moorings with public slipways on either side of the harbour entrance, in Eastney Lake and at Storehouse Lake. Anglers fish from many parts of the shoreline, especially at the harbour entrance, Eastney Lake, along the Portsea Island shore and near the old Hayling railway bridge. Water skiing occurs from April to September in a designated area in the centre of the harbour. Board sailing mainly takes place near Hayling Halt near Stoke, although the Round Hayling Marathon is a national and international event. Walking is a popular shore-based activity, with the Solent Way an important long distance walk. The Hayling Billy Leisure Trail is a route for walkers, cyclists and horse riders along the Hayling shore. Langstone is one of the best areas on the south coast for birdwatching, (the Hampshire Wildlife Trust estimates 45,000 visits to the Farlington Marshes reserve each year). The Langstone and District Wildfowling and Conservation Association shoot over two intertidal areas in the harbour. At Langstone, Budds Farm Sewage Treatment works discharges biologically-treated effluent into the harbour.

Chichester Harbour is a nationally important small boat sailing centre, with the sheltered harbour waters providing a unique setting for racing and day sailing. There are 5300 moorings and 16 sailing clubs within the harbour area. The Hayling Island Sailing Club, for example, hosts national and international racing events. Other water based activities include angling, motor boating, canoeing and sightseeing from the Chichester Harbour Water Bus based at Itchenor. There is a long standing oyster dredging fleet centred on Emsworth, although boats also operate from Dell Quay, Birdham and Itchenor. Boat building, repairs and boatyards are the principal commercial activities in the harbour, based in many of the shoreline communities. Coombes Yard on the Bosham Peninsula, for example, is one of the last traditional boatyards in the Solent, specialising in the repair and maintenance of traditional wooden vessels. The RNLI have an inshore rescue base at Eastoke.

The shoreline of Chichester Harbour is frequently wooded with attractive historic settlements, including Itchenor, Bosham, Prinsted and Emsworth. Large areas are high grade agricultural land (Grades 1 and 2), supporting cereals, peas, rape, potatoes, orchards and glasshouse crops. The scenic beauty of the area attracts ramblers and horse riders, and it is a long term ambition of the Harbour Conservancy to establish a continuous footpath around the shoreline. East Head, Pilsey Island and Nutbourne Marshes are important sites for birdwatching. The Conservancy leases the shooting rights within the harbour to two wildfowling clubs. There are caravan and camping sites at a variety of locations, including Cobnor, the Sunshine Holiday Camp at Mill Rythe and around Cockle Creek, Eastoke. The main sewerage infrastructure is based at the Apuldram Waste Water Treatment Works, Dell Quay.

## 6.2 Landfill

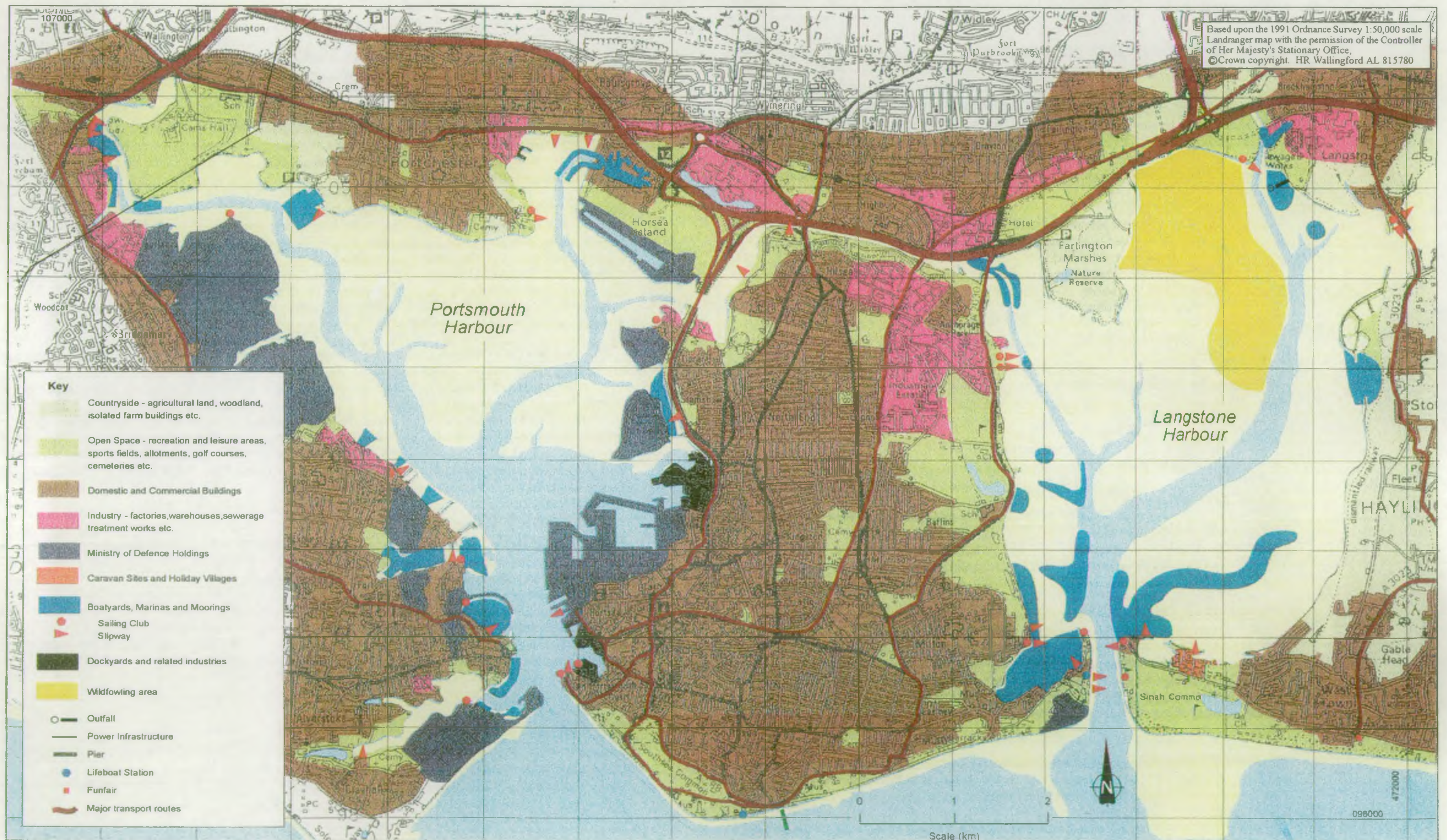
Large areas of Portsmouth Harbour and the east side of Portsea Island have been reclaimed over the last 5 centuries. Early land claim probably involved the use of dredged material from the harbours, and was associated with the development and expansion of the naval dockyards and other port facilities. However, much intertidal land has been used, this century, as landfill sites, especially at Horsea Island and in Langstone Harbour. In these areas the landfill materials will probably have been domestic waste, including methane-producing organic wastes, inert material and possibly some chemical and industrial wastes. As discussed earlier, some of these sites are subject to erosion and there could be significant pollution hazard as potentially contaminated materials may be released into the harbour waters. Figure 4 indicates areas of landfill and reclamation, sub-divided to indicate the site containing potentially hazardous materials. Figures 12 and 13 indicate areas at risk from erosion.

## 6.3 Nearshore activities

### *Fisheries*

Fishing within the harbours is controlled and managed by the Southern Sea Fisheries Committee (Portsmouth and Langstone Harbours) and the Sussex Sea Fisheries Committee (Chichester Harbour). These committees enforce byelaws relating to fishing activity and the conservation of fish and shellfish stocks within their districts.

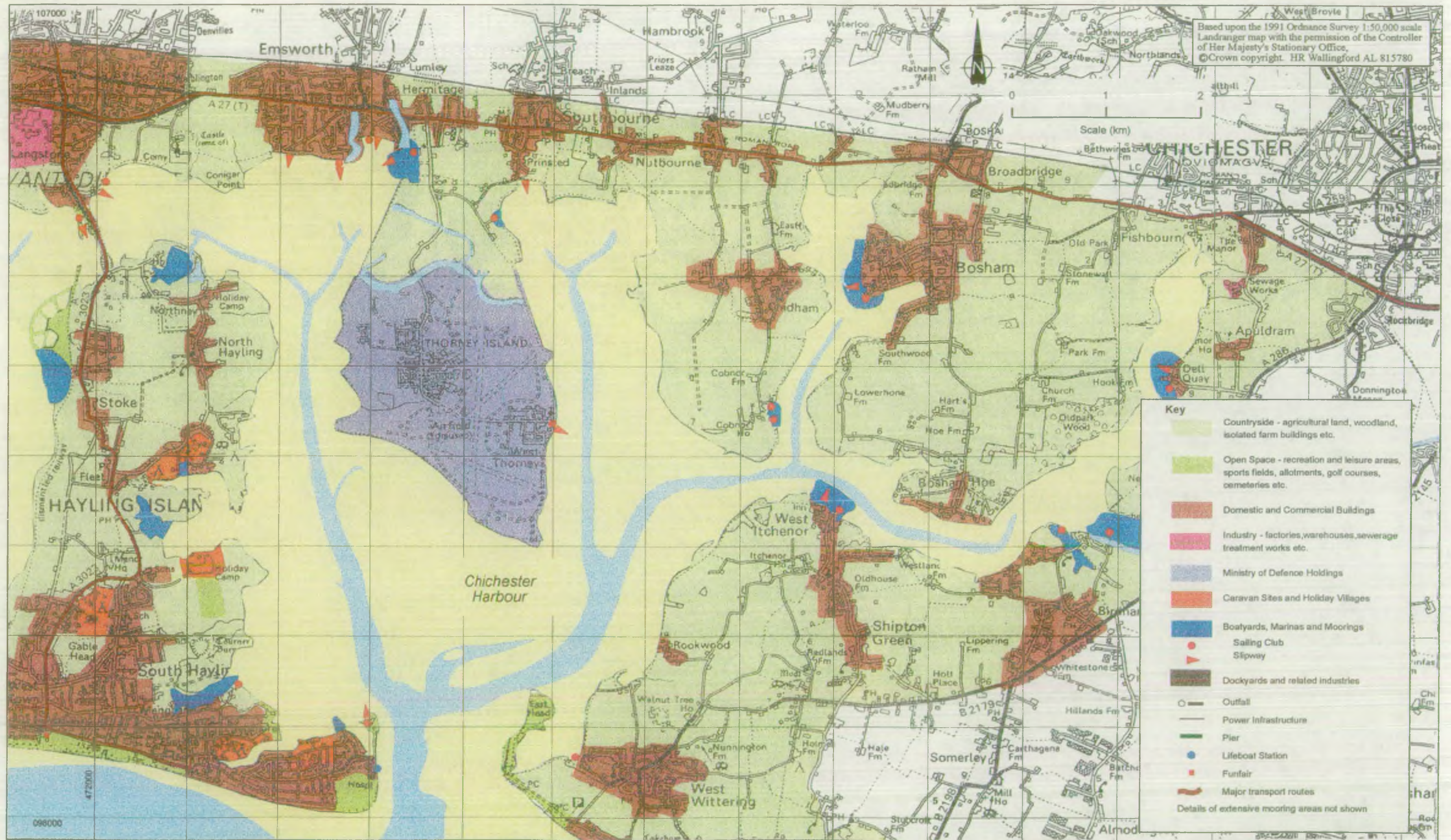




Land use - Portsmouth and Langstone Harbours

Figure 19





Land use - Chichester Harbour

Figure 20





Areas of high grade agricultural land

Figure 21



Little commercial fishing occurs within Portsmouth Harbour, although it provides the base for a sizeable inshore fishing fleet (around 60 vessels of 12m and under) and a small number of deep water fishing vessels. The inshore fleet targets a variety of species: netting for bass and potting for crabs in the summer, and dredging for oysters and crabs in the winter. The most important catches made by this fleet are sole, bass, crustaceans and bivalve molluscs. The deeper water fleet concentrates on sole, plaice and scallops.

Within Portsmouth Harbour the main areas for oyster harvesting are Fareham Lake, Portchester Lake, and numerous small channels in the northern half of the Harbour. Most beds are public, although they are regulated under the Solent Oyster Fishery Order (1980). No harvesting is permitted south of a line running from the south of Whale Island to Hardway, by order of the Queen's Harbour Master. Clam digging is an occasional activity, centred on Cams Bay. The harbour is also an important area for angling bait digging, especially around the Tipner shore.

Langstone Harbour is a designated bass nursery under the Bass (Specified Areas Prohibition of Fishing) Order 1990 which prohibits bass fishing from 1 May to 31 October. Fewer than 5 vessels trawl for fin fish (flatfish, mullet, bass, cuttlefish, mackerel and sandeels), mainly in the outer harbour. Dredging for oysters takes place in Langstone Channel, Russells Lake, Sinah Lake and Broom Channel and supports up to 85 boats in the early season (1 November to 31 March). Several small dredging boats and around 20 individuals are involved in clam digging, primarily around Budds Farm. Bait digging takes place along the northern shore off Budds Farm and also around the north west shore of Hayling Island.

Chichester Harbour supports a local fleet of oyster dredgers, centred on Emsworth, although boats also operate from Dell Quay, Birdham and Itchenor. The harbour is also a valuable area for wet fish and is a designated bass nursery. Bait digging occurs around the harbour edge.

#### *Dredging*

Dredging within the East Solent Harbours includes maintenance dredging of navigation channels, limited aggregate dredging within specific freehold sites and capital dredging for new port/marina facilities.

Within Portsmouth Harbour navigation dredging of fine sediment is undertaken by the Ministry of Defence and by the individuals or companies responsible for moorings, marinas and boatyards. Although there has been substantial capital dredging in the past, particularly for the Naval Base, there have been no recent operations.

The operators for the three commercial jetties and the Southsea Marina within Langstone Harbour undertake maintenance dredging of their navigation channels and moorings. In addition, there was a small aggregate site on the flood tide bank, known as Sinah Sands, opposite the entrance channel. About 6000T/year were taken, but operations stopped in 1994.

Chichester Harbour entrance was dredged in 1988 to re-establish the published safe navigation depths, and is in need of further dredging at the time of writing. The expected 20,000m<sup>3</sup> would be suitable for local beach recharge. Further minor maintenance dredging is undertaken to maintain moorings and navigation channels.

#### *Minerals extraction*

Oil and Gas Licences have been granted for the land and sea areas of the East Solent. A policy has been formulated for possible future developments (SCOPAC, 1986) to ensure that impacts on the environment, fisheries, the landscape and shipping are controlled. The major influences on shoreline management would be pipeline landfalls or the construction of offshore production islands. If such schemes are proposed in the future then they will need to be carefully assessed to ensure that their impacts are fully appreciated.



## 6.4 Landscape conservation and historic sites

In addition to the designated areas of nature conservation discussed in Chapter 5, the East Solent area has a number of historic conservation areas, Scheduled Ancient Monuments and a large Area of Outstanding Natural Beauty. These are all indicated in Figure 22 and listed in Table 7.

### *Landscape conservation*

The open coastline around East Head and Sandy Point lies within the Chichester Harbour Area of Outstanding Natural Beauty (AONB), designated in 1964 under the National Parks and Access to the Countryside Act 1949. The AONB is valued for the close proximity of low lying land and tidal waters. The Chichester Harbour Conservancy functions as the Joint Advisory Committee for matters affecting the "amenity area" of the AONB and, thus, has a consultative role within the land use planning system. The local authorities have specific obligations to protect and enhance the landscape through their planning and other responsibilities. The Chichester Harbour Conservancy boundaries are shown in Figure 1 and include most, but not all, of the AONB.

The Portsmouth Harbour Plan (Nicolas Pearson, 1996) identifies eight landscape character zones within the harbour and sets out guidance for future development. The guidance recognizes that some existing schemes have not been sympathetic to their surroundings.

### *Heritage and archaeology*

The history of human occupation on the stretch of coast from Pagham Harbour to the River Hamble is long and varied. It includes places of worship, defence installations, burial grounds, farms and fields and sites of manufacture. The significance of the area as a trading port is reflected in the large number of shipwreck sites and landward infrastructure associated with shipping.

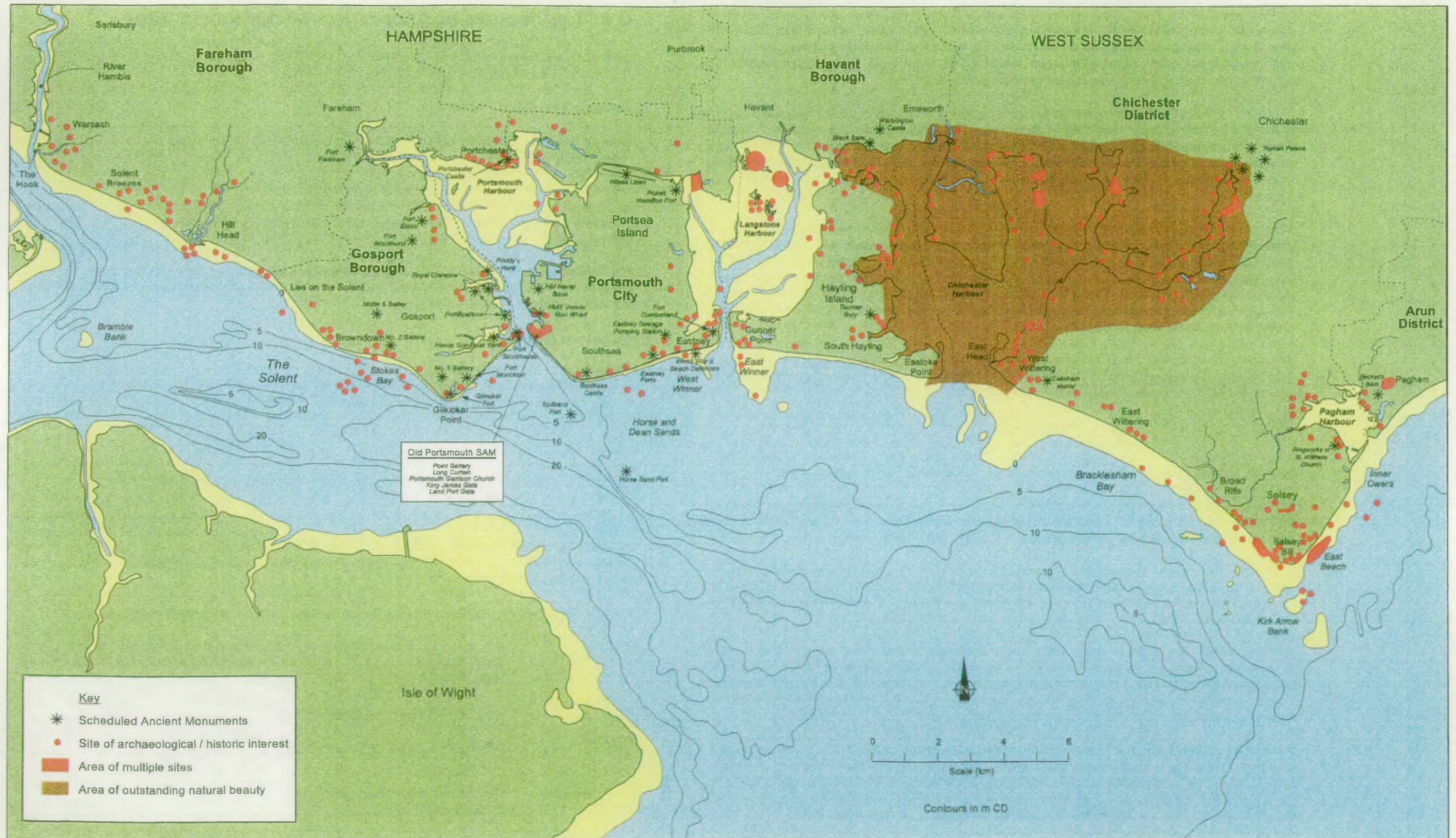
Figure 21 presents the distribution of recorded land and marine archaeological sites. This has been compiled from the Hampshire County Council's Sites and Monument Record (SMR); the West Sussex County Council's SMR; and data on maritime sites provided by Isle of Wight Council's Archaeological Unit.

The SMRs predominantly contain information on landward sites but some information on maritime sites is included on the West Sussex SMR. The SMRs contain information on in-situ remains and details of find sites. Therefore, not all the sites mapped represent existing remains, some are simply find sites. Much of the information on maritime sites is anecdotal, particularly that relating to wrecks, and therefore the exact locations of these are not necessarily known.

The varied history of the East Solent area is reflected in the nature of the archaeological finds and sites:

Prehistoric	(i.e. before the Roman invasion of AD43) ranging from the remains of palaeolithic people in the UK, dating from around half a million years ago, to the farmsteads, villages and hillforts of the late Iron Age.
Roman	(i.e. AD43 to AD410) including remains of farms, settlements and military installations.
Medieval	(i.e. fifth to sixteenth centuries AD) the period during which most modern towns originated.
Post-Medieval	(i.e. late sixteenth to early eighteenth century) remains of industrial scale manufacture, country houses etc.





Historic sites and landscape conservation areas

Figure 22



**Industrial** (i.e. mid-eighteenth century onwards) remains of the industrialisation of the UK, not only of the buildings and processes but also the infrastructure of industry - including, of particular relevance to the area in question, artifacts from World War II.

The nature of remains in the area span the following groups:

<b>Upstanding Remains</b>	built structures ranging from buildings to field boundaries
<b>Earthworks</b>	soil covered remains of any sort which can be seen as surface undulations at ground level
<b>Buried features</b>	soil covered remains which have no visible trace at ground level but may be visible by aerial photography
<b>Artefact scatters</b>	scatter of potsherds, flint tools, metal objects, coins, animal bones, worked stone, mortar, charcoal
<b>Maritime sites</b>	sites beyond low water mark including wreck sites or former occupation sites which have been inundated (the Roman quarry at Mixon Reef off Selsey, for example).

The key protective designation is scheduling as an Ancient Monument (SAM) under the *Ancient Monument and Archaeological Areas Act 1979*. This relates to any building structure or other work above or below ground which appears to be of national importance because of its historic, architectural, traditional, artistic or archaeological interest. Once a monument is scheduled any development which may affect it requires the consent of the Secretary of State. In this context, 'affect' means work, which would have the effect of demolishing, destroying, damaging, removing, repairing, altering, adding to, flooding or covering up the monument. Further site protection is provided through the planning system, with policy for landward archaeology set out in Planning Policy Guidance Note 16: *Archaeology and Planning*. This document outlines the importance of archaeological remains and the fact that they are a finite non-renewable resource. Figure 21 indicates the location of SAM sites. Table 7 identifies the sites.

Maritime sites are protected through measures in the *Protection of Wrecks Act (1973)*; *Ancient Monuments and Archaeological Areas Act (1979)*; the *Merchant Shipping Act (1984)*; and the *Protection of Military Remains Act (1986)*. There are, however, many areas which are of interest but not designated and the potential for important maritime archaeological sites is generally high around the natural harbours.

#### *Conservation areas*

Conservation areas are designated by the local authority under the Planning (Listed Buildings and Conservation Areas) Act 1990 to provide protection for historical features or buildings. In general, the protection is provided by stricter development control procedures, taking enforcement action, undertaking urgent works to preserve unoccupied buildings and providing for purchase notices. In these areas special attention needs to be paid to the desirability of preserving or enhancing the character and appearance of the area. Conservation areas relevant to the harbours are listed in Table 7.



**Table 7 Historic environment designations**

Designation	
Conservation Areas	<p>Town Quay, Fareham  Cams Hall Estate, Fareham  Castle Street, Fareham  Haslar Peninsula, Gosport  High Street, Gosport  The Hardway, Gosport  Old Portsmouth, Portsmouth  Eastney Barracks, Southsea  Milton Locks, Southsea  HM Naval Base and St Georges Square, Portsmouth  Gunwharf, Portsmouth  Mill Lane, Havant  Langstone, Havant  Wade Court, Havant  Emsworth, Havant  Warblington, Havant  Coastguards, Hayling Island  St Peters, Hayling Island  Bosham, Chichester  Prinsted, Chichester  Earmley, Chichester  West Wittering, Chichester  West Itchenor, Chichester  Dell Quay, Chichester  Sidlesham Quay, Chichester</p>
Scheduled Ancient Monuments	<p>Fort Fareham, Fareham  Porchester Castle, Fareham  Fort Blockhouse, Gosport  Royal Clarence Victualling Yard (5 sites), Gosport  Fort Elson, Gosport  Fortifications (2 sites), Gosport  Haslar GunBoat Yard, Gosport  Priddys Hard, Gosport  Fort Brockhurst, Gosport  Hilsea Lines, Portsmouth  Dockyard (29 sites), Portsmouth  Pickett Hamilton Fort, Portsmouth  Fort Cumberland, Portsmouth  Eastney Sewerage Pumping Station, Portsmouth  Portsmouth Garrison Church, Portsmouth  King James Gate, Portsmouth  Landport Gate, Portsmouth  HMS Vernon, Portsmouth  Tourner Bury, Hayling Island  Warblington Castle, Havant  Black Barn, Havant  Fishbourne Roman Site (5 sites), Chichester</p>



## 6.5 Implications for shoreline management

1. The historical development of dockyards, quays and boatyards has been accompanied by the construction of seawalls throughout the harbours area, many of which now perform an important coastal defence function.
2. The presence of high grade agricultural land, especially around Chichester Harbour, has resulted in extensive lengths of coastal defences in rural areas.
3. Design of future shoreline structures must give consideration to the preservation or enhancement of the landscape throughout all of the harbours but particularly within the Chichester AONB.
4. The importance of water-based recreation and tourism to the local economy dictates that it is essential that easy access to the foreshore is maintained although not necessarily by car. In many areas footpaths have been located on the coastal defences which, thus, also have an important amenity function.
5. There are large lengths of the undeveloped coastline where it may be economically unacceptable to provide publicly funded coastal defences.
6. There may be a need to protect former landfill sites around Portsmouth and Langstone Harbours from erosion which could result in the release of contaminants into the harbour waters.

## 6.6 Future trends

### *Introduction*

The planning system (as defined by the Town and Country Planning Act 1990) aims to regulate the future development and use of land (including mineral extraction and waste disposal) in the public interest. Planning powers are exercised by local planning authorities whose most important functions are:

- the preparation of statutory development plans
- the control of development, through the determination of planning applications and enforcement action.

The planning system can be described as "plan led" in that all planning decisions must be made in accordance with the development plan, unless material considerations indicate otherwise. There is, in effect, a presumption in favour of development proposals that conform with the development plan which, thus, provides a strict framework for the future development of an area.

Development plans are prepared against a backdrop of national guidance in the form of Planning Policy Guidance notes (PPGs), Minerals Planning Guidance notes (MPGs); and regional planning guidance. The government therefore provides the policy framework within which the different types of development plan are prepared by planning authorities.

All statutory plans are subject to public consultation and public inquiry prior to being adopted.

The area covered by the harbours area of the East Solent SMP is administered by the following authorities:

- Fareham Borough Council
- Gosport Borough Council
- Portsmouth City Council
- Havant Borough Council
- Chichester District Council





- Hampshire County Council
- West Sussex County Council.

The administrative area of these authorities, and hence the limit of their control, includes the harbour areas as shown in Figure 1.

County Councils are responsible for the preparation of Structure Plans (in which they set out key strategic policies as a framework for local planning by the district councils), and Minerals and Waste plans. District councils prepare local plans (in which district councils set out detailed policies to guide development in their areas).

Prior to adoption, plans go through a series of revisions and consultation periods. Within this section the emerging plans have been afforded the most weight as these provide the future planning policy framework for the area.

The status of each of the plans (as of June 1996) is outlined below.

Plan	Status
Fareham Borough Local Plan	Consultation Draft
Gosport Borough Local Plan	Adopted
Portsmouth City Local Plan	Adopted
Havant Borough District Wide Local Plan	Consultation Draft
Chichester District Local Plan	Deposit Draft
Arun District Local Plan	Consultation Draft (Replaces existing Adopted Plan)
Hampshire County Structure Plan	Deposit Draft
West Sussex County Structure Plan	Deposit Draft (Inspectors Report received)
Hampshire Minerals and Waste Local Plan	Deposit Draft
West Sussex Minerals Local Plan	Consultation Draft

Unitary local government is being introduced in some areas of England under the Local Government Act 1992. Of the councils within the East Solent SMP area only Portsmouth City Council is affected. Portsmouth City Council will become a unitary authority and thus inherit some of the County Council's functions.

Table 8 and the following sections provide a summary of the constraints to and opportunities for development within the harbours of the SMP area. They have been compiled selectively and should not be read as a substitute for the relevant plans. Figures 23 and 24 set out the policy areas as they relate to the harbours.



**Table 8 A summary of relevant planning policies for the East Solent (see relevant local plans for details)**

General Description	Fareham BC	Gosport BC	Portsmouth City C	Havant BC	Chichester DC	Arun DC
Countryside Protection	Development restricted to that which would not harm the landscape and is essential to the rural economy (Proposal C1)  Development not normally permitted in <u>Local Gaps</u> between Fareham & Portchester and Strategic Gaps east of Stubbington (Proposals C2 and C3)	Development restricted in the Stubbington - Gosport Strategic Gap (Policy CY1)		Development permitted only if essential to needs of the rural economy (including agriculture, horticulture and forestry) and in other specified exceptions (Proposals C1-12; also Consult. Draft Chapt. C)  Development restricted in Strategic Gaps and in other "Countryside" areas (Proposals C13-17; also Consult. Draft Chapt. C)	Development will not normally be permitted within the rural area, except for specific uses (Proposals RE1 - RE28)  Development restricted in the Strategic Gaps between Chichester and Emsworth, West Wittering and East Wittering, Bracklesham and Selsey, Selsey and Pagham (Proposal RE6)	The countryside will be safeguarded for its own sake. Development only allowed if it is essential for agriculture, forestry, mineral extraction, waste disposal, informal recreation or appropriate diversification (Policy RE1). Development not permitted in the Pagham-Selsey Strategic Gap (Policy GEN 5)
Coastal Zone	Development will not normally be permitted in the coastal zone (Proposal C7)	Development not normally permitted in the coastal zone policy area (Policy CH9)	Development will not be permitted unless it would not significantly affect recreation, landscape or nature conservation (Proposal E9)	Development prejudicial to landscape and ecology of coastal zones not normally permitted (Proposals C19-24; also Consult Draft Chapt. C0)  Development within south and south-west Hayling not normally permissible except for appropriate recreational use not harmful to the landscape character (Proposals RL19-21)	Development which detracts from the open aspect or rural character of the Harbour will not normally be permitted (Proposal C1)	Permission will not normally be granted for new tourism development along the coast (Policy CT 5)
Control of Boatyards, Marinas and Moorings	Development will not normally be permitted for an extension of boatyard use beyond the defined curtilages. New boatyards and marinas not permitted (Proposal C9)	Development proposals will be normally permitted for additional moorings etc. within established marina and mooring areas (Policy CH7)	Additional moorings normally only permitted in established locations provided there are no impacts on navigation, nature conservation, landscape, fishing, etc. (Proposals LC11, LC12)	Limited new moorings permitted in established locations or designated new areas (Proposal RL 22). A site at Broadmarsh is proposed for improved access and sailing facilities (Proposal RL 23, Consult Draft Proposal C07)  In Chichester Harbour development which would reduce the size of mooring free areas or increase the total number of deep water berths will not normally be permitted (Proposal RL 24)	Development which would result in an increase to the total number of moorings, marina berths or launch on demand facilities in the Harbour will not normally be permitted (Proposal C5; see also C6 and C7)	
Land for Housing	Land allocated for new housing (Proposals H1, H2, H9, L4)	Land allocated for new housing and major residential development (Policies H1-H3, H13)	Land allocated for residential development (Proposal H1)	Land allocated for new residential development (one in the coastal zone; Proposals H01, H02; also Consult. Draft Chapter H)	Land allowed for new residential development (Proposals H1-H13)	Land allocated for housing (Policies HSG 2-5)
Land for Industry	Land allocated for new business and industrial areas (B1, B5, B7)	Existing industrial areas (Policy EMP 4) and land allocated for business development (Policies EMP2, EMP3)	Land allocated for comprehensive development (Proposals GS2, GS3)	Land allocated for industry (Proposal ECD1 & 2; also Consult. Draft Chapter IN)	Land allocated for business, industry and warehousing (Proposal B1)	Land allocated for industry and employment (Policy EMP 1)



**Table 8 (continued)**

General Description	Fareham BC	Gosport BC	Portsmouth City C	Havant BC	Chichester DC	Arun DC
Public Open Space	Existing and new areas of public open space (Proposals L2, L3)	Existing and allocated areas for public open space, recreation and leisure facilities (Policies RL2, RL2, RL6-RL9)	New and existing public and other open spaces (Proposals OS1, OS2, OS5, OS6)	Development will not normally be permitted which adversely affects existing public open space etc. (Proposal RL1; also Consult. Draft Chapter RLC)	Existing recreational open space will be protected from unrelated development (Proposal R3; see also R1, R2, R4-R8)	The Council will protect open spaces from development (Policy ROS 1). Land is allocated for open space and recreation/leisure uses (Policy ROS 5)
Caravans	No additional camping and caravanning development will be allowed where it would be visible from the River Hamble or the Solent Way (Proposal L11)	Residential caravans or mobile homes will not be permitted except at the Bay House site (Policy H13)		Permission will not normally be granted for the expansion of static holiday caravan sites or for the creation of new sites except at Eastoke. Touring caravan site development not normally permitted (Proposals TO7-14; also Consult. Draft Proposal TO.7)	Planning permissions subject to occupancy restrictions. In flood risk areas occupancy restricted to specified time periods (Proposal T6)  The change of use from touring holiday caravan sites to static caravan sites will not be permitted (Proposal T9)	Planning permission will not be given to new and unrelated incursions into the countryside, although proposals for expansion of existing sites will be considered (Policy TSM 6). Static holiday caravan sites will not be permitted in the Strategic Gaps (Policy TSM 7).
Coastal Paths	Footpaths and bridleways will be improved. Proposed footpaths include the Porchester Coastal Footpath, around Cams to the Delme Roundabout (Proposal L5, see also C8)	The Council will prepare a programme of footpath provision, including coastal footpaths (Statement RL9)		Permission will not normally be granted for development which is inconsistent with the objective of a complete coastal footpath around Hayling Island (Proposal RL6)  A combined footpath link and cycle track proposed between Harts Farm Way, Havant and Portsea Island (Proposal RL8; also Consult. Draft Proposal T9)	Sea and coast defence works must make provision for the coastal path, either on the seawall or within the 5m access strips (Proposal C12)	The Council supports the protection of the public rights of way network (Policy ROS 10). Proposals for development on the coast will need to establish or improve public access on foot or cycle (Policy CT 4)
Land reclamation		Development including land reclamation and/or dredging will not normally be permitted except at: • N. of Mumby Road • Ferry Gardens (Policy CH5)	In Portsmouth Harbour reclamation and/or dredging is proposed at: • Rotten Row Lake • Tipner Lake • Albert Johnson Quay and Flathouse Quay • Adjoining Gunwharf and Harbour Station (Policy E12)  In Langstone Harbour, reclamation that is inconsistent with wildlife designations will not be permitted (Policy EL14)	Development which entails significant reclamation of the Harbour or other than essential maintenance dredging of the main channels and adjoining slipways will not normally be permitted (Proposal RL20 & 23; also Consult. Draft Proposal CO6)	Proposals involving land reclamation or dredging (except essential maintenance dredging) will be refused where they would affect conservation interests (Proposal C4)	



**Table 8 (continued)**

General Description	Fareham BC	Gosport BC	Portsmouth City C	Havant BC	Chichester DC	Arun DC
Disposal of Ministry of Defence land	Policy for re-use of HMS Daedalus not yet confirmed	Development of sites surplus to requirements will need to comply with relevant plan policies and proposals (Policy MOD2)			The reuse of buildings and land for civilian use on Thorney Island will only be permitted for uses that are compatible with conservation interests. This would preclude the use of the airfield for aviation and noisy sports (Proposal C8)	
Public utilities			The following sites are allocated for Southern Water Services Ltd: • Fort Cumberland - underground treatment works • former MEME depot adjacent to Eastney Pumping Station for underground storm water storage (Proposal C34)	Land allocated at Kingscroft Farm as an extension to Portsmouth Water plc's site (Proposal PUS1; also Consult. Draft Chapt US)		
Nature conservation*	Development will not be permitted which destroys or harms:  • SPAs • Ramsar sites • SSSIs • Nature Reserves • SINC  (Proposal EN9)	Development will only be permitted which will not have an adverse effect on, or be detrimental to:  • SPAs • Ramsar sites • SSSIs • National or Local Nature Reserves • Areas of significant nature conservation value  (Policies NC1 and NC2)	Development which adversely affects nature conservation interest of:  • Nature Reserves • SSSIs • land of ecological importance  will only be permitted in exceptional circumstances (Proposal E3)	Development will only be permitted where it would not destroy or adversely affect sites of importance to nature conservation, including:  • SSSIs, SPAs and Ramsar sites • CHS • Other specified sites of importance • woodland areas of importance (Policies C19-C27; also Consult. Draft Chapt CO)	Permission for development will be refused if it would damage, destroy or adversely affect:  • Ramsar sites • SPAs (declared or potential) • Candidate SAC • SSSI • Nature Reserves • other feature important to nature or geological conservation  Where particularly sensitive ecological sites are threatened active steps will be taken to protect them (Proposals RE7 and RE8)	Development not normally permitted which would have an adverse effect either directly or indirectly on designated/statutory sites of nature conservation importance, including SSSIs, Ramsar Sites, SPA and other areas e.g. SNCIs (Policy RE5)

\* PPG9 and the Habitats Regulations published in 1994 have implications for development control in nature conservation sites that are near to designation. These implications are not included in plans adopted prior to 1994.



In 1991 Hampshire County Council produced "A Strategy for Hampshire's Coast" which sets out their approach to integrated coastal planning and management. Amongst the key issues identified in this document are pollution, the effects of dredging and marine aggregate extraction on the coastal zone, erosion and flooding risks, land recreation and access, water-based recreation, maritime archaeology, historic sites, nature and landscape conservation, and commercial activity (e.g. shipping, boatyards, fishing). Through its strategy the County Council promotes the following policies:

- (i) prevent development on the open parts of the coastline;
- (ii) guide development which requires a coastal location, including tourist facilities to existing development areas;
- (iii) safeguard waterside sites in built-up areas, which have access to the water, from changes to uses which do not require such access;
- (iv) protect important wildlife sites from development;
- (v) normally resist reclamation proposals;
- (vi) conserve buildings and sites of historic interest in an appropriate setting;
- (vii) give high priority to conserving and enhancing the coastal landscape;
- (viii) resist the development of new marinas.

The strategy for the development of the coastal area is set out in the Structure Plans prepared by Hampshire County Council and West Sussex County Council (Tables 9 and 10). These plans draw attention to the special character of the coastal zone and the complexity of development issues.



**Table 9 Hampshire County Structural Plan (Review) - Strategic policies for the coast**

C3	<p>On the built-up coast delineated in local plans permission may be granted for development which:</p> <ul style="list-style-type: none"> <li>(i) is consistent with other policies in the Plan; and</li> <li>(ii) is designed to a high standard having regard to views from land and sea taking account of retaining or opening up views of the water and has particular regard to the effects of the proposal on the townscape, landscape and seascape; and</li> <li>(iii) incorporates public pedestrian access to the water where practical and in a form suited to the site and the requirements of the proposed development; and</li> <li>(iv) has particular regard to the effect of the proposal on nature conservation;</li> </ul> <p>except that development not requiring access to the water may be refused permission if:</p> <ul style="list-style-type: none"> <li>(a) the site is specially suited by reason of location, facilities or other features to use for purposes requiring access to the water; and</li> <li>(b) there is an insufficiency of sites to meet realistically foreseen requirements in the general locality.</li> </ul> <p>Other than for exceptional social, economic or health reasons permission will not be granted for development on intertidal areas of nature conservation value.</p>
C4	<p>On the undeveloped coast and estuaries delineated in local plans development, except within areas allocated for port development and associated infrastructure, will not be permitted if it detracts from the landscape, wildlife or historic value.</p> <p>Permission for redeveloped and change of use, including existing boatyards and marinas, will normally only be granted for uses needing direct access to the water and which are:</p> <ul style="list-style-type: none"> <li>(i) designed to a high standard having regard to views from land and sea and taking account of retaining or opening up views of the water; and</li> <li>(ii) have particular regard to the effect of the proposal on the landscape and seascape and to the effect on nature conservation.</li> </ul>
C5	<p>The provision of new moorings may be permitted on the built-up coast provided that the proposed development does not have a detrimental effect on the townscape, seascape or areas of nature conservation and archaeological importance; the amenities of local residents; other recreational users; or commercial port operations; and will not:</p> <ul style="list-style-type: none"> <li>(i) cause or increase water pollution; or</li> <li>(ii) result in access and boat and car parking requirements which are detrimental to the local environment.</li> </ul> <p>Any restrictions on the growth of moorings will be based on advice from the harbour authorities on navigational safety and the ability of the local environment to accommodate development.</p>
C6	<p>Permission will not be granted for development involving the reclamation of land from the sea or the reclamation, excavation or permanent flooding of intertidal areas of conservation value unless the local authority is satisfied that the proposal:</p> <ul style="list-style-type: none"> <li>(i) has no undesirable hydrological effects locally, or on the coast as a whole;</li> <li>(ii) would not damage the landscape character or sites of historic, archaeological or nature conservation interest; and</li> <li>(iii) is well related to the existing built-up area.</li> </ul>



**Table 10 West Sussex County Structure plan (Deposit Draft) - Shoreline Policies for the Coast**

The coastal environment CO1	(a)	<p>The character and resources of the coast and coastal waters will be conserved and enhanced. Only in compelling circumstances will development be permitted:-</p> <ol style="list-style-type: none"> <li>(1) if it would harm the landscape of the Chichester Harbour AONB (policy C2).</li> <li>(2) it would harm coastal or marine habitats or species (policy C3)41</li> <li>(3) it would be damaging to geological or geomorphological features</li> <li>(4) it would damage maritime archaeological or coastal heritage features</li> <li>(5) it would have an adverse effect on the hydrological regime, water quality or coastal defences, locally or further along the coast</li> <li>(6) it would be damaging to the amenity of nearby residential areas or town centres; or</li> <li>(7) if it would be harmful to coastal commercial activities including the ports, tourism or fishing.</li> </ol>
	(b)	These criteria will be applied rigorously, especially where the proposals include land reclamation.
	(c)	The undeveloped coastline will be protected firmly from development (including recreational development) by policies C2, C3 and C5
Coastal defence CO2	(a)	<p>Built development, including the intensification of development, will not be permitted in areas expected to be at risk during the life of the building from flooding, coastal erosion, land instability, wind, waves, sea spray or wave-borne debris, whether in normal or storm surge conditions.</p>
	(b)	<p>No development (or intensification of development) will be permitted:-</p> <ol style="list-style-type: none"> <li>(1) where it would require enhanced coastal defences;</li> <li>(2) where it would inhibit the maintenance of existing coast protection or flood defence works; or</li> <li>(3) where it would prohibit or add to the expense of adopting a managed retreat solution to coastal defence, should that be an option.</li> </ol>
	(c)	The construction of essential new or replacement sea defence or coast protection works will be permitted provided that they would be working with natural processes, and would minimise detrimental visual impact, enhance natural or heritage features, and where possible accommodate recreational use of the coast.
The Built-up Coastline CO3	(a)	<p>Subject to Policies C011 and C02, appropriate development within built up areas will be encouraged under policy G5 and, at the ports, policy T14. The distinctive character of the core seafront and river estuary areas will be conserved and enhanced under policies G7 and B5, taking account of special coastal features. Sea views will be retained and new ones opened up wherever suitable opportunities allow.</p>
	(b)	Development not requiring coastal access may be refused permission if the site is particularly suited to uses for which access is essential and for which there are few other possible sites.
Coastal Recreation CO4	(a)	<p>Development for coastal recreation, including marinas and other boat launching and parking facilities, will be permitted in appropriate locations within the built up part of the coast, subject to compliance with other relevant policies (particularly policies C01 and C02) and to the avoidance of conflict with commercial shipping. Marina proposals should allow for the realisation of the full potential of the site for moorings, and should provide for visitor moorings.</p>
	(b)	<p>Access by walkers, riders and cyclists to the coast will be encouraged. Development (including redevelopment) of coastal sites for any purpose should wherever possible make provision for improved access to and along the coast for the public on foot. This will be associated with the aim of creating a coastal path and cycle track, linking into the adjoining rights of way network.</p>



The Government's policy for the development and use of the East Solent over the period 1991-2011 is addressed in "Regional Planning Guidance for the South East" (RPG, DoE, 1994) Alongside policy guidance set out in PPG's and MPG's it provides a broad framework for guiding the region's development. It identifies the special issues associated with the conservation status of much of coastal zone and the need for regeneration of many communities. At Portsmouth, for example, it is essential that provision is made for economic development to reduce unemployment caused by structural changes in the local economy, such as the run down of the defence industry. It is recognised that there is scope for redevelopment in the docks and ex-defence lands. The emphasis is placed on taking maximum advantage of those development opportunities which become available within the constraints imposed by countryside and nature conservation, for the recycling and redevelopment of under used and derelict land. Regional guidance is also given through SERPLAN's "Coastal Planning Guidelines", promoting the development of shoreline management strategies and setting out the approach to be followed in relation to the maintenance of existing defences, encouragement of soft engineering approaches and considerations of new development proposals.

### *Harbour management*

Portsmouth Harbour forms part of a dockyard port, or naval harbour, where navigation is under the control of the Queen's Harbour Master. The area of the Dockyard extends beyond the limits of the natural harbour and covers much of the eastern Solent. Figure 1 shows the extent of the controlled area for each of the harbours.

Langstone Harbour is managed by the Langstone Harbour Board who are responsible for navigation and moorings. The Board's administrative area extends to the Harbour mouth and includes the area covered by water at HWMS, thereby excluding the shoreline and islands. An advisory committee of Harbour users and interests is consulted by the Board on "all matters substantially affecting the preservation, protection, regulation, management, maintenance and improvement of the Harbour and the navigation thereof".

Chichester Harbour is managed by the Chichester Harbour Conservancy, established in 1971. The Conservancy has two main roles:

1. In the harbour it acts as harbour authority, and is responsible for the management of the water for the use of pleasure craft and other such vessels.
2. In the amenity area around the harbour shore (Figure 2), the Conservancy is responsible for leisure, recreation and nature and landscape conservation within that part of the AONB.

Since its inception the Conservancy has functioned as the Joint Advisory Committee for matters affecting the AONB and, hence, has a consultative role within the planning system. Table 11 summarises the planning guidelines prepared by the Conservancy to assist their consideration of planning applications within the AONB.

Non-statutory management plans have been prepared or are in preparation for each of the three harbours, as follows:

Portsmouth Harbour	Consultation Draft
Langstone Harbour	Draft Plan
Chichester Harbour	Adopted 1994.



**Table 11      A summary of relevant Planning Guidelines:  
Chichester Harbour Conservancy**

Land use	Guidelines
General	A presumption against development unrelated to the needs of the area
Housing	Opposed to new residential development in the AONB, although it would support new development in Settlement Policy Areas
Infrastructure	Opposed to new roads which would impact on the AONB without considerable justification
Jetties/slipways	A presumption against new jetties/slipways in areas identified as unspoilt by existing structures or where the landscape or conservation value is high
Industry	Should be confined to existing sites
Waste Disposal	It would recommend refusal of any application for dumping waste
Formal recreation	Opposed to any facility that provides new public access to water for vessels There is a moratorium on additional deepwater moorings
Caravans	It would seek to resist further expansion of caravan sites, but support small-scale tented camping sites in some locations

#### *Constraints to development*

The future development of the harbour coastal areas is constrained by:

- areas of international, national and local nature conservation importance (Figures 17 and 18)
- an Area of Outstanding Natural Beauty (AONB) around Chichester Harbour (Figure 22)
- historic buildings and archaeological sites, including marine sites and conservation areas (Table 7 and Figure 22)
- high grade agricultural land, with much of the area identified as Grade 1 or Grade 2 land (Figure 21). This land should not be built on unless there is no other site suitable for the particular purpose (DoE Circular 16/87)
- designated "strategic gaps" to preserve the balance between the rural and urban landscape. These gaps are intended to protect the individual identity and amenity of settlements by ensuring that they do not coalesce (Table 12)
- designated "coastal zones" to preserve the character and attractiveness of the undeveloped coastline (Figures 23 and 24).

#### *Opportunities for development*

In general terms, the objectives for the future development of the East Solent SMP area, insofar as they relate to coastal defence strategies, are:

- to locate new development away from the undeveloped coast and the open countryside
- to maintain or improve maintenance access to and along defences
- to permit small-scale "infill" development within existing coastal zone communities
- to restrict the development of new caravan sites, the expansion of existing sites and the extension of occupation periods into the winter season
- to conserve and enhance the natural, historical and archaeological features of the area
- to maintain and enhance the built environment
- to maintain and improve the available public open space and leisure facilities



**Table 12 Strategic and local gaps related to the margins of the harbours**

<b>Fareham Borough Strategic Gap</b>	Locks Heath /Heathfield stretching south to HMS Daedalus.
<b>Local Gaps</b>	Fareham from Portchester
<b>Gosport Borough Local Gaps</b>	Frater Lane Forton Lake and Adjoining open Spaces Haslar Lake/Warpole Park Stoke Lake/Gosport Park Rowner Lane/Rectory Copse
<b>Havant Borough Strategic Gaps</b>	Havant/Emsworth
<b>Local Gaps</b>	Hermitage Stream Langstone
<b>Chichester District Strategic Gaps</b>	East Wittering/West Wittering Chichester/Emsworth

- to control the re-use of Ministry of Defence establishments if and when they become surplus to requirements
- to restrict the development of new moorings and deep water berths
- to restrict further land reclamation and non-essential dredging operations.

The approved land use trends, as set out in the relevant development plans, are presented in Figures 22 and 23. There are only limited opportunities for further built development around the margins of the harbours, as follows:

1. Land for Housing; the allocated sites are:
  - Lower Quay area and the former Wicor School site (Fareham Borough)
  - Priddy's Hard and Mumby Road (Gosport Borough)
  - Port Solent, parts of Paulsgrove and the Eastney Barracks area (Portsmouth City)
  - Northney Holiday Camp, Sandy Point Hospital and various small infill sites on Hayling Island (Havant Borough).
2. Land for Industry, Business and Services, the allocated sites are:
  - Fort Cumberland underground treatment works, the former MEME Depot Site and a berth for the removal of sewage sludge by ship for disposal elsewhere (Portsmouth City). Hampshire County Council would prefer the sewage sludge to be transported to a treatment works elsewhere by pipeline
  - Priddy's Hard, around the Bus Station, Westfield Road, north of Mumby Road, Brockhurst Industrial Estate, Rowner Road, Grange Road (Gosport Borough)
  - Portsmouth Incinerator, Quatermaine Road, Copner, a potential location for an "energy from waste" incineration plant to serve southern Hampshire
  - Kingscroft Farm, an extension of Portsmouth Water plc's site (Havant Borough)



- Mill Rythe Lane and several small infill sites on Hayling Island (Havant Borough)
  - Harts Farm Way, a preferred site for an integrated waste processing plant to serve south east Hampshire (Havant Borough)
  - Broadmarsh, a site proposed for improved access and sailing facilities (Havant Borough).
3. Land for Major Development, the allocated sites are
- Tipner, including business uses, housing (200 dwellings), relocation of the Greyhound Stadium, car parking, a new public slipway and adjacent boat park, public access and landscaping to the foreshore, land reclamation (2.3 ha) and infrastructure (Portsmouth City)
  - Gunwharf, including Portsmouth Harbour Station and Hard Interchange. This would involve public access to the waterfront, tourism and leisure users, small shops, housing, business uses, public transport facilities and infrastructure (Portsmouth City).
4. The Millennium Project - "The Renaissance of Portsmouth Harbour". The main elements of this project are:
- the expansion of the Historic Dockyard
  - two harbourside promenades - one 2000 metres long on the Portsmouth side, the other 3000 metres long in Gosport, which will link existing heritage sites and new attractions and increase public access to the waterfront
  - a Harbour Tower, about 150 metres high, set in the Harbour off Gunwharf and illuminated water display features either side of the navigation channel
  - the redevelopment of the Gunwharf site to include new public spaces linked directly to the City Centre by a landscaped boulevard
  - continuing the heritage theme in Gosport with the development of the Priddy's Hard Heritage Area and the enhancement and expansion of the RN Submarine Museum
  - linking the Harbour communities with a network of waterbus services, thereby opening up fresh opportunities for tourism development.

#### *Implications for Shoreline Management*

A number of the proposed redevelopment sites listed above are in areas at risk from flooding. Consideration will have to be given to appropriate standards of flood defence by the developers and by the Planning Authority. As with most new shoreline management operations allowance must be made for future sustainability in the face of a changing physical environment.

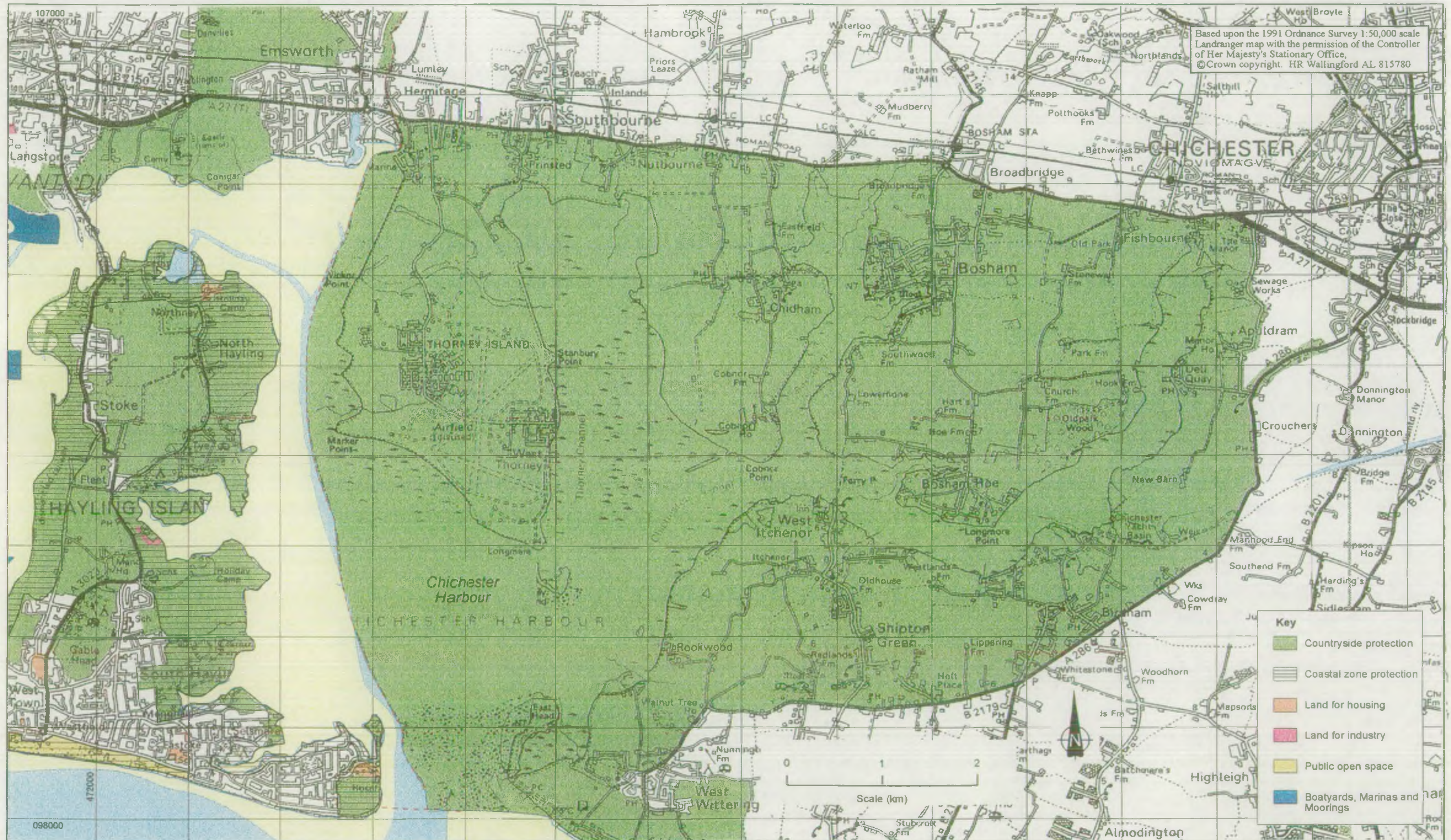




Planning policy and land allocation areas - Portsmouth and Langstone Harbours

Figure 23





Planning policy and land allocation areas - Chichester Harbour

Figure 24





## Appendix 1

## References



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## Appendix 1      *References*

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## **Appendix 2**

## **Existing defences**







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## **Appendix 2    Existing defences**

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The tables contained within this Appendix present information on the existing defences in Portsmouth, Langstone and Chichester Harbours. The information is based on the MAFF Coast Protection Survey (CPS) and the NRA (now Environment Agency) Sea Defence Survey (SDS), updated and modified following site visits and consultations.

The tables include:

- Ordnance Survey coordinates for the starting point of the defence element (working clockwise around the harbourst)
- the total length of the defence element
- the maintaining authority
- the structure type (wall, revetment, gabions, groynes, embankment, recharged beach or unprotected)
- the condition of the defence, classified as:
  - 1      as built
  - 2      some wear, needs monitoring
  - 3      moderate works required to retain effectiveness
  - 4      significant works required.
- residual life, classified as:
  - < 5 years
  - 5-10 years
  - > 10 years
- CPS or SDS code.

An asterisk (\*) indicates that the CPS or SDS information has corrected, updated or expanded.

The Harbour tables are broken by location references to assist the reader.







## Portsmouth Harbour: Existing defences (Clockwise from harbour entrance)

(\* indicates correction, update or addition to Coast Protection Survey and Sea Defence Survey)

OS Coordinates (start of element)	Element length (km)	Maintaining authority	Structure type	Condition (1-As built 4-poor)	Residual life (years)	CPS/SDS code
Gosport - Harbour entrance						
		Env. Agency				
SZ62559945	0.18	MoD	Wall	3	5 - 10	571/3134
SZ62509930	0.17	MoD	Wall	3	> 10	571/3133
SZ62479915	0.27	MoD	Wall	3	> 10	571/3132
SZ62239910	0.21	MoD	Wall	3	5 - 10	571/3131
SZ62019914	0.11	MoD	Wall	3	> 10	571/3130
SZ61939920	0.3	MoD	Bridge/ Unprotected	-	-	*
SZ61689909	1.05	MoD	Revetment	4	< 5	571/3129
SZ60799865	0.13	Private	Wall	4	5 - 10	571/3128
SZ60689858	1.0	GBC	Regraded slope	N/A	N/A	*
SZ61229916	0.29	GBC	Wall	3	> 10	571/3127
SZ60979932	0.11	HCC	Wall	3	> 10	571/3126
SZ61089933	0.48	GBC	Wall	3	5 - 10	571/3125
SZ61499924	0.35	GBC	Revetment	2	> 10	571/3124
SZ61589939	0.2	GBC	Regraded slope	N/A	N/A	*
SZ61709957	0.3	GBC	Embankment	3	> 10	*
SZ62029955	0.25	Private	Revetment*	4	< 5	571/3122
SZ62049933	0.01	HCC	Bridge	2	> 10	*
SZ62059932	0.21	Private	Revetment*	1*	> 10*	571/3121
SZ62219945	0.14	GBC	Wall	3	> 10	571/3120
Gosport Ferry						
SZ62279954	0.2	HCC	Wall	3	> 10	571/3119
SZ62339973	0.15	GBC	Wall	3	> 10	571/3118
SZ62349988	0.07	GBC	Wall	3	> 10	571/3117



SZ62239995	0.16	Private	Wall	3	> 10	571/3116
SU62230006	0.07	Private	Wall	3	> 10	571/3115
SU62180002	0.48	Private	Wall	3	> 10	571/3114
SU61810030	1.37	MoD	Wall	3	5 - 10	571/3113
SU61180073	0.13	Private	Wall	4	5 - 10	571/3112
SU61110064	0.05	HCC	Wall	3	> 10	571/3111
SU61070063	0.03	N/A	Unprotected	N/A	N/A	*
SU61020064	0.12	HCC	Wall	1	> 10	571/3110
SU60920062	0.09	HCC	Wall	3	> 10	571/3109
Forton						
SU60940069	0.5	GBC	Wall/ unprotected	4	5 - 10	*
SU61000097	1.70	GBC /Private*	Wall	4	5 - 10	571/3108
SU61370158	0.10	GBC	Wall	3*	> 10	571/3107
SU61310165	0.21	GBC	Wall	3	> 10	571/3106
SU61160179	0.13	GBC	Revetment	3	> 10	571/3105
SU61090190	0.06	GBC	Wall	3	> 10	571/3104
SU61030190	0.60	Private	Wall	4	5 - 10	571/3103
SU60530229	3.1	MoD	Unprotected	N/A	N/A	*
SU59450460	0.1	MoD	Revetment	3	> 10	*
SU59350460	1.0	MoD	Unprotected	N/A	N/A	*
SU58440456	0.40	Private	Revetment	3	> 10	571/3101
SU58110474	0.2	N/A	Unprotected	N/A	N/A	*
Fareham/Gosport boundary						
SU57960463	0.62	FBC	Wall	4	< 5	571/3019
SU58100519	0.03	FBC	Wall	2	> 10	571/3018
SU58090522	0.42	FBC	Wall	3	> 10	571/3017
SU57930554	0.18	Private	Wall	3	> 10	571/3016/2
SU57910570	0.07	FBC	Wall	1	> 10	571/3016/1
SU57870575	0.21	FBC	Wall	2	> 10	571/3015



SU58010592	0.17	Private	Wall	3	> 10	571/3014
SU58090592	0.15	FBC	Wall	2	> 10	571/3013
SU58240589	0.3	FBC	Revetment	2	> 10	New Work
SU58500590	0.13	Private	Wall	1*	> 10	571/3012
SU58550592	0.2	N/A	Unprotected	N/A	N/A	*
A27 Bridge - Fareham						
SU58600615	0.1	HCC	Revetment	3	> 10	*
SU58750620	2.2	N/A	Unprotected	N/A	N/A	*
SU58400490	1.8	Private	Revetment	3	> 10	*
SU59660511	0.45	FBC	Wall	4	< 5	571/3011
SU60040506	0.2	Private*	Wall	3	< 5	571/3010
SU60190495	0.12	Private*	Wall	3	5 - 10	571/3009
SU60250485	0.6	HCC	Embankment	4	< 5	*
SU60730470	0.1	FBC	Wall	4	< 5	571/3008
SU60820475	0.2	FBC	Embankment*	4	< 5	*
SU61030474	0.1	FBC	Wall	4	< 5	*
SU61100470	0.2	FBC	Regraded slope	N/A	N/A	*
SU61320464	0.6	FBC	Revetment*	1*	> 10*	571/3007
SU61900437	0.36	Private	Wall	1*	> 10*	571/3006
SU62260441	0.09	Private	Wall	1*	> 10*	571/3005
Portchester Castle						
SU62340441	0.45	Private	Wall	3	5 - 10	571/3004
SU62590463	0.05	Private	Wall	4	< 5	*
SU62600468	0.11*	Env. Agency	Wall	4	< 5	571/3003
SU62540476	0.41*	Env. Agency	Wall	1	> 10	571/3002
SU62280498	0.20*	HCC	Revetment	3	5 - 10	571/3001
Fareham - Portsmouth boundary						
SU62250520	0.1	HCC	Revetment	2	> 10	New Work
SU62300530	0.2	Private	Revetment	2	> 10	*
SU62400053	0.4	Private	Wall	2	> 10	571/3269



SU62480545	0.3	Private	Revetment	3	5 - 10	*
SU62480561	0.84	PCC	Wall	2	> 10*	571/3268
SU63260552	0.6	PCC	Revetment	1	> 10	New Work
SU63110505	0.48	PCC	Revetment	2	> 10	571/3267
SU63040482	0.50	MoD	Revetment	4	< 5	571/3266/3
SU63200450	0.94	MoD	Revetment	2	> 10	571/3266/2
SU63890392	0.46	MoD	Revetment	4	< 5	571/3266/3
SU64290395	1.95	HCC	Revetment	2	> 10	571/3265
SU65280457	1.51	HCC	Revetment	2	> 10	571/3204
Ports Creek rail bridge						
SU66770415	1.35	PCC	Wall	4*	< 5	571/3205
SU65490421	0.2	PCC/HCC	Revetment	3	> 10	*
SU65280454	0.3	PCC	Revetment	3	> 10	571/3264
SU65000448	1.45	PCC	Revetment/Wall	3	> 10	571/3263
SU64510319	0.07	Private/PCC	Revetment/Wall	2	5 - 10	571/3262/3
SU64460332	0.06	Private	Wall	4	5 - 10	571/3262/2
SU64450328	0.72	Private/DoT	Revetment	4/3	< 5/ > 10	571/3262/1
SU63920352	0.16	PCC	Revetment	3	> 10	571/3261
SU63790345	1.10	MoD	Revetment	4	5 - 10	571/3260
SU63910300	0.75	HCC	Revetment	3	> 10	571/3259
Whale Island						
SU63950250	0.6	MoD	Gabions	2	5 - 10	New Work
SU63604027	2.0*	MoD	Revetment	2	> 10	571/3258
SU64130220	0.05	PCC	Wall	2	> 10	571/3257
SU64160217	0.26	Private	Wall	3	> 10	571/3256/2
SU64230200	0.15	Private	Wall	3	> 10	571/3256/1
SU64210189	0.85	Private	Wall	3	> 10	571/3255
SU63180153	0.52	PCC	Wall	3	5 - 10	571/3254
Naval dockyards						
SU63950138	4.05	MoD	Wall	2	> 10	571/3253











## (\* indicates correction, update or addition to Coast Protection Survey or Sea Defence Survey)

[illegible]



SU66720422	0.2	N/A	Unprotected	N/A	N/A	*
SU66920420	0.69	HCC	Revetment	2	> 10	571/3203
SU67410406	0.7	HCC	Revetment	2	> 10	571/3202
SU67970442	2.60	Env. Agency	Revetment	2*	> 10*	571/3201
SU68840417	0.9	Env. Agency	Revetment	3	5 - 10	*
SU68980502	0.32	DoT	Gabions	4	5 - 10	571/3369
SU69110531	0.44	DoT	Regraded slope	N/A	N/A	571/3368
SU69520545	0.33	HBC	Revetment	3	> 10	571/3367
SU69840541	0.39	HBC	Revetment	2	> 10	571/3366
SU70210528	0.12	HBC	Revetment	1	> 10	571/3365
SU70310532	0.86	HBC	Revetment	2	> 10	571/3364
<b>Brockhampton Quay</b>						
SU70390566	0.28	Private	Wall	2	> 10	571/3363
SU70530556	0.4	N/A	Unprotected	N/A	N/A	*
SU70550554	0.35	Env. Agency	Wall	4	5 - 10*	571/3362
SU70500532	0.29	Env. Agency	Wall	3	5 - 10*	571/3361
SU70650509	0.26	HBC	Wall	4	< 5	571/3360
SU70830493	0.04	HBC	Gabions	2	> 10	New Work
SU70850494	0.64	Env. Agency	Wall	4	< 5	*
SU71470474	0.19	Private	Embankment	3	> 10	571/3359
SU71390491	0.20	Private	Embankment	3	> 10	*
SU71490485	0.22	Private	Wall	3	> 10	571/3358
SU71680479	0.39	HCC	Breastwork/ Embankment	4	< 5	571/3357
SU71750470	0.25	HBC	Embankment/ Breastwork	4	< 5	*
<b>Hayling Island - former rail bridge</b>						
SU7182014	0.12	HCC	Wall	3	5-10*	571/3353/3
SU71770403	0.09	HCC	Revetment	3	5 - 10*	571/3353/2
SU71750394	1.2	HBC	Regraded slope	N/A	N/A	New Work
SU71550320	0.4	HBC	Regraded slope	N/A	N/A	*
SU71710294	0.2	Env. Agency	Revetment	2	> 10	New Work
SU71690275	0.8	Private	Embankment & Breastwork	3	5 - 10*	571/3351











## Chichester Harbour: Existing defences (clockwise from harbour entrance)

(\* indicates correction, update or addition to Coast Protection Survey and Sea Defence Survey)

OS coordinates (start of element)	Element length (km)	Maintaining authority	Structure type	Condition (1 - as built 4 - poor)	Residual life (years)	CPS/SDS code
Sandy Point - Harbour entrance						
SZ75039840	0.36	Private	Embankment	3	5-10	571/3329
SZ74959863	0.32	Private	Wall/Unprotected	3	5-10*	571/3328
SZ74799889	0.20	Env. Agency	Wall/Unprotected	3	5-10	*
SZ74599887	0.16	Private	Wall	3	> 10	571/3327
SZ74449883	0.33	Env. Agency	Wall/Unprotected	3	5-10	*
SZ74119869	1.09	Private	Wall/Unprotected	3*	5-10*	571/3326
SZ73459856	0.4	N/A	Unprotected	N/A	N/A	*
SZ73719891	1.03	Private	Embankment/Gabions	3	> 10	571/3325
SZ74029911	0.8	Env. Agency	Revetment	3	5-10	*
SZ73359935	0.9	Private	Wall	3	> 10	571/3324
SZ72849946	0.1	Private	Embankment	4	5-10	*
SZ73319948	0.3	Private	Embankment	4	5-10	571/3323
SZ73459964	0.5	Env. Agency	Embankment	3	5-10	*
SU73600000	1.5	Private/Env. Agency	Embankment	3	5-10	*
SU73450110	0.8	Env. Agency	Revetment	3	> 10	*
SU72750085	0.27	Private	Embankment	4	< 5	571/3322
Mill Rythe Boatyard						
SU72670110	0.34	Private	Wall	3	5-10	571/3321
SU72420132	3.0	Private	Embankment	3	> 10	571/3320
SU72890182	0.51	Private	Wall	3*	5-10*	571/3319
SU73380177	1.8	Private	Embankment*	3*	5-10*	571/3318
SU73680245	1.8	Env. Agency	Wall	3	5-10	*



	0.4	Private/ Env. Agency	Revetment	3	5 - 10	*
	0.4	Private/Env. Agency	Embankment	4	< 5	*
	0.3	Private/Env. Agency	Embankment	3	5 - 10	*
	0.3	N/A	Unprotected	N/A	N/A	*
SU72500418	0.38	N/A	Unprotected*	N/A	N/A	571/3317
SU72120411	0.36	DoT	Revetment	2	>10	571/3355
SU72050404	0.39	Private	Embankment	3	>10	571/3354
SU71780395	0.12*	HCC	Embankment/ Regraded slope	3	5-10*	571/3353/1
Langstone - former rail bridge						
SU71820445	0.01	N/A	Unprotected	N/A	N/A	*
SU71840465	0.23	Private	Revetment	2	>10	571/3356
SU71970448	0.33	DoT	Revetment	2	> 10	571/3316
SU71900464	0.36	HBC	Wall	2	> 10	571/3315
SU71770491	0.3	HBC	Wall	3	5 - 10	571/3314
SU72120512	0.32	Private	Wall	3	< 5	571/3313
SU72430525	0.38	HBC	Revetment	3	5 - 10	571/3312
SU72780516	0.75	HBC	Wall	3	5 - 10	571/3311
SU73400492	0.40	HBC	Revetment/ Gabions/Wall*	4	< 5	571/3310
SU73630514	0.32	HBC	Revetment/ Unprotected	3*	5 - 10*	571/3309
SU73900529	0.12	HBC	Embankment	3	5 - 10	571/3308
SU73970534	0.08	HBC	Wall	3	5 - 10	571/3307
SU74020535	0.61	Private	Revetment	2*	5 - 10	571/3306
SU74630529	0.21	HBC/Private	Wall	3	> 10	571/3305
SU74770528	0.25	HBC	Wall	3	5- 10*	571/3304
SU74880550	0.36	HBC/Private	Wall	3	> 10	571/3303
SU75240546	0.06	HBC/Private	Wal	3	> 10	571/3302
SU75300548	0.26	HBC/Private	Wall	3	> 10	571/3301



Havant - Chichester Boundary

SU75300548	0.07	Private*	Wall	3	> 10	574/3495/2
SU75360547	0.03	Private	Wall	2	> 10	574/3495/1
SU75360544	0.16	Private	Wall	2	> 10	574/3494/4
SU75220537	0.22	Private	Wall	3	> 10	574/3494/3
SU75320517	0.05	Private	Revetment	2	> 10	574/3494/2
SU75330512	0.29	Env. Agency	Revetment	2	> 10	*
SU75200483*	0.95	Env. Agency*	Revetment	2/3	> 10	574/3493
SU74830397*	0.14	MoD	Wall	3	5 - 10	574/3492
SU74760387*	0.23	MoD	Breastwork	4	< 5	574/3491
SU74710368*	2.57	MoD	Revetment	4	< 5	574/3490
SU75320212	0.7	MoD	Revetment	4	< 5	*
SU75880170	1.10	MoD	Wall	4	< 5	574/3488
SU76650107	0.7	MoD	Unprotected	N/A	N/A	*
SU76870141	0.9	MoD	Wall	3	> 10	574/3487
SU76890228	0.27	MoD	Wall	3	> 10	574/3486

Thorney Island Sailing Club

SU77020255	1.78	MoD	Revetment	3	5 - 10*	574/3485
SU76550415	0.5	Private	Embankment	4	< 5	574/3484
SU76510449	0.28	Private*	Wall	4	< 5	574/3483
SU76380470	0.38	Env. Agency	Revetment	3	5 - 10	574/3482
SU76500500	0.25	Env. Agency	Revetment	3	5 - 10	*
SU76650506	0.25	Env. Agency	Revetment	1	> 10	New Work
	0.17	Env. Agency	Wall	2	> 10	*
	0.75	Env. Agency	Revetment	1	> 10	New Work
SU77700494	0.23	Env. Agency*	Revetment	3	5 - 10	574/3479
SU77800495	0.22	Env. Agency*	Revetment	2	> 10	574/3478
SU78000487	0.4	Private*	Revetment	4	< 5	574/3477
SU78080449	0.26	Private*	Wall	4	< 5	574/3476/2
SU78060426	0.42	Private*	Revetment	4	< 5	574/3476/1





SU77900400	1.66	Private	Embankment	4	< 5	574/3475
SU78270248	0.8	N/A	Unprotected	N/A	N/A	*
Cobnor Point						
SU79020203	0.19	Private*	Revetment	3	> 10	574/3474/5
SU79190193	0.08	Private*	Embankment	4	< 5	574/3474/2
SU79270196	0.45	Private*	Revetment	3	> 10	574/3474/4
SU79390237	0.23	Private*	Revetment*	1	> 10	574/3473
SU79350259	1.75*	Private	Embankment	3	> 10	574/3472
SU79850403	0.21	Private	Wall	2	> 10	574/3471
SU79680414	0.29	Private	Embankment	3	> 10	574/3470
SU79430417	0.13	Private*	Wall*	2	> 10	574/3469
SU79380429	1.18	Private	Embankment	3	> 10	574/3468
SU79790520*	1.05	Env. Agency	Embankment	3	> 10	574/3467
SU80520504	0.48	N/A	Unprotected	N/A	N/A	*
SU80430475	0.21	Private	Wall	2	> 10	574/3466
SU80400456	0.06	N/A	Unprotected	N/A	N/A	*
Bosham						
SU80350453	0.15	Private	Wall	3	> 10	574/3465
SU80320439	0.12	Private	Gabions	3	> 10	574/3464/3
SU80330423	0.05	Private	Revetment	3	> 10	574/3464/2
SU80320418	0.10	Private	Revetment	3	> 10	574/3464/1
SU80300408	0.3	Private	Wall	3	> 10	574/3463
SU80340380	0.19	Private	Wall	3	> 10	574/3462
SU80430377	0.53	Private	Wall	3	> 10	574/3461
SU80900392	0.13	Private	Gabions	3	> 10	574/3460/2
SU81000384	0.12	Private	Revetment	3	> 10	574/3460/1
SU81000372	0.36	Private	Wall	3	> 10	574/3459
SU80630359	0.25	Private	Embankment/ Revetment	2	> 10	574/3458/4 & 5
SU80580337	0.10	Private*	Embankment	2	> 10	574/3458/3



SU80530328	0.32	Private	Embankment	2	> 10	574/3458/2
SU80200325	0.12	Private	Wall	2	> 10	574/3458/1
SU80140316	0.09	Private	Revetment	3	> 10	574/3457
SU80050304	2.15	N/A	Unprotected	N/A	N/A	*
Bosham Hoe						
	1.1	N/A	Unprotected	N/A	N/A	*
SU80680163	0.04	Private	Wall	2	> 10	574/3456/2
SU80660160	0.16	Private	Gabions	3	> 10	574/3456/1
SU80680146	3.8	N/A	Unprotected	N/A	N/A	*
	0.9	Private	Embankment	3	> 10	*
	0.4	N/A	Unprotected	N/A	N/A	*
SU83360389	0.42	Private	Revetment	3	> 10	574/3454/3&2
SU83640427	0.20	Private	Embankment	3	> 10	574/3454/1
SU83640437	0.5	Private	Embankment	3	> 10	*
SU83990412	0.78	Env. Agency	Wall	4	5 - 10	574/3453
SU83880360	0.18	Private	Embankment	4	5 - 10	574/3452
SU83860342	0.2	Private	Embankment	4	5 - 10	*
SU83790323	0.09	Private	Embankment	4	5 - 10	574/3451
SU83730316	0.10	Private	Embankment	4	5 - 10	*
Dell Quay						
SU83620306	0.21	Private	Wall	4	5 - 10	574/3450
SU83530288	0.11	Private	Wall	3	> 10	574/3449/3
SU83430287	0.03	Private	Wall	4	5 - 10	574/3449/2
SU83440284	0.10	Private	Wall	3	> 10	574/3449/1
SU83440284	0.04	Private	Wall	3	> 10	574/3448
SU83580280	0.12	Private	Wall	3	> 10	574/3447
SU83600268	0.06	Private	Wall	3	> 10	574/3446
SU83610262	2.0	N/A	Unprotected	N/A	N/A	*
SU82880139	0.03	Private	Wall	3	> 10	574/3445
SU82890136	0.16	Private	Wall	3	> 10	574/3444



SU82870120	0.08	N/A	Unprotected	N/A	N/A	*
SU82790121	0.07	Private	Revetment	4	> 10	574/3443
SU82730119	0.12	Private	Revetment	1	> 10	574/3442
SU82660116	0.19	Private	Wall	3	> 10	574/3441
SU82550107	0.07	Private	Wall	3	> 10	574/3440
SU82500112	0.30	Private	Wall	4	< 5	574/3439
SU82250123	0.50	N/A	Unprotected	N/A	N/A	*
SU81920084	0.42	Private	Wall	3	> 10	574/3438
SU81550065	0.7	N/A	Unprotected	N/A	N/A	*
SU81850096	0.49	Private	Wall	3	> 10	574/3437
SU80390100	0.46	Env. Agency	Wall	3	> 10	574/3436
West Itchenor						
SU80090130	0.16	Private	Wall	3	> 10	574/3435
SU79990142	0.06	Private	Revetment	3	> 10	574/3434
SU79950147	0.20	Private	Revetment	3	> 10	574/3433
SU79760155	2.0	N/A	Unprotected	N/A	N/A	*
SU78490080	0.05	Private	Wall	3	> 10	574/3432/2
SU78460075	0.05	N/A	Unprotected	N/A	N/A	*
SU78330070*	0.04	Private	Wall	3	> 10	574/3432/1
SU78340067	0.04	N/A	Unprotected	N/A	N/A	*
SU78300063	0.04	Private	Wall	3	> 10	574/3431
SU78270060	0.13*	Private	Wall	4	5 - 10	574/3430
SU78220048	0.5	N/A	Unprotected	N/A	N/A	*
Rockwood						
SU78160003*	0.2	Private	Wall	3	> 10	574/3429
SZ78139983	0.3	N/A	Unprotected	N/A	N/A	*
SZ78029955	0.04	Private	Revetment	3	> 10	574/3428
SZ77999953	0.11	N/A	Unprotected	N/A	N/A	*
SZ77889948	0.04	Private	Wall	3*	5 - 10*	574/3427
SZ77849946	0.6	N/A	Unprotected	N/A	N/A	*



