England's Historic Seascapes Marine HLC Pilot Study: Southwold to Clacton

Final Project Report

oxfordarchaeology

ENGLISH HERITAGE

March 2007

Client: English Heritage

Funded by:
Aggregates Levy Sustainability Fund

Issue N^{O}: 2
OA Job N^{O}: 3182

Final Project Report

Client Name: English Heritage

Client Ref No:

Document Title: England's Historic Seascapes. Marine HLC Pilot Study: Southwold-to-Clacton. Final Project Report

Document Type: Strategic Study

Issue Number: 2

National Grid Reference: NN 0000 0000
Planning Reference: NN 0000 0000

OA Job Number: 3182
Site Code:
Invoice Code: SEASCACO
Receiving Museum:
Museum Accession No:

Prepared by: Leif Isaksen
Mark Littlewood
Kelly Powell
Position:
Date: 29th March 2007

Checked by: Ianto Wain
Position: Head of Heritage Management Services
Date: 29th March 2007

Approved by: Ianto Wain Signed…….
Position: Head of Management Services
Date: 29th March 2007

Document File Location L:\SEASCACO Historic Seascapes\002Reports
Graphics File Location L:\SEASCACO Historic Seascapes\002Reports
Illustrated by Leif Isaksen

Oxford Archaeology

Janus House
Osney Mead
Oxford OX2 0ES
t: (0044) 01865 263800 e: info@oxfordarch.co.uk
f: (0044) 01865 793496 w: www.oxfordarch.co.uk

Table of Contents

Acknowledgments 5
About This Document 7
1. Introduction 8
1.1 Introduction 8
1.2 Historic Landscape Characterisation and Maritime HLC 8
1.3 England's Historic Seascapes 9
1.4 The Present Character of the Study Area 10
1.5 The Historic Character of the Study Area 11
1.6 Aims and Objectives 13
2 Methodology Overview 15
2.1 Principles 15
2.2 Wessex Archaeology's Methodological Framework 15
2.3 Software 17
2.4 Metadata & Standards 17
3 Stage 1: Primary DataSet Preparation 19
3.1 Field survey and consultation 19
3.2 Datasets Used 19
3.3 Unincorporated Datasets 22
3.4 Licensing Issues 23
3.5 Integration Issues 24
3.6 Terrestrial Datasets 26
3.7 Maritime Datasets 26
4 Stage 2: Creating the Near-Level Layer 28
4.1 Assigning Subcharacter Type 28
4.2 Unioning the data 29
5 Stage 3: Character Areas 37
5.1 Introduction 37
5.2 Creating the Character Area Layer 37
5.3 Compiling Character Area Texts 41
5.4 Example Character Area Text 42
5.5 The Web Resource 44
6 Metadata 47
7 Post-Project Summary 48
7.1 Conclusions 48
7.2 Recommendations 49
7.3 Usage Scenarios 50
8 References 52
9 Bibliography 54
10 Glossary 58
11 Abbreviations 62
APPENDIX I: Character Type Descriptions 64
Broad Character Type 64
INDUSTRY 64
MILITARY 64
NATURAL LANDSCAPE 64
NAVIGATION 64

RECREATION 64
SETTLEMENT 64
Character Type 64
Navigation feature 64
Navigation activity 64
Navigation hazard 65
Intrusive offshore industry 65
Non-intrusive offshore industry 65
Ports, docks & harbours 65
Fisheries and Mari-culture 65
Coastal industry 65
Coastal recreation 65
Offshore recreation 66
Coastal environment 66
Prehistoric land surface 66
Coastal settlement 66
Coastal military 66
Offshore military 66
Subcharacter Type 67
Administrative region 67
Anchorage 67
Anchorage (disused) 67
Beach 67
Canal 68
Caution area 68
Channel 68
Channel (disused) 68
Channel (disused, buried) 69
Cliff 69
Coastal/estuarine settlement 69
Coastal marsh 69
Coastal Way 69
Dive site 70
Drained fields 70
Dredging (aggregates) 70
Dredging (unspecified) 71
Drying area 71
Dumping ground (military) 71
Dumping ground (industrial) 71
Energy installation (coastal) 72
Energy installation (offshore) 72
Ferry route 72
Fisheries 72
Fish farming 73
Fisheries (shellfish) 73
Historic town core (OS 1st edition) 73
Industry (coastal, unspecified) 73
Intertidal land (unspecified) 74

Leisure fishing area 74
Lost settlement 74
Marina 74
Maritime safety installation 75
Military installation 75
Military installation (disused) 75
Military practice area 75
Mineral extraction (oil/gas) 76
Mineral extraction (other, coastal) 76
Mineral extraction (other, offshore) 76
Mudflats 76
Named area 77
Natural channels 77
Naval dockyard 77
Palaeochannels 77
Palaeolandscape 78
Peat bed 78
Port-related industry 78
Protected area 78
Protected recreation area 79
Quarantine area 79
Reclaimed land 79
Restricted area (unspecified) 79
River 80
Salt industry 80
Saltmarsh 80
Sandbanks 80
Sand dunes 81
Sandwaves 81
Sailing area 81
Safety area (offshore) 81
Sea defences 81
Seaside leisure area 82
Shingle 82
Shipbreakers yard 82
Shipping lane 82
Shipyard/boatbuilders yard 83
Submarine cable/pipeline 83
Submerged forest 83
Submerged rocks 84
Watersports area 84
Water turbulence 84
Woodland 84
APPENDIX II: Summary of Primary Datasets Used 85
Study Area 85
Historic Town Cores 85
Protected Areas (Coastal) 85
Ordnance Survey (Current) 86

Suffolk Coastal Marshland HLC 86
Suffolk HLC 87
Essex HLC 87
Terrestrial Component 88
Protected Areas (Marine) 88
Offshore Cables and Pipelines 88
Offshore Fishing Industry 89
Wrecks 89
Obstructions 89
Palaeolandscape 90
Maintenance Dredging 90
Transportation 91
Licensed Activities 91
Regulatory Administrative Areas 91
Named Areas 91
APPENDIX III:Summary of Secondary Datasets Used 93

Acknowledgments

England's Historic Seascapes Pilot Project: Southwold to Clacton was commissioned by English Heritage and funded by the Aggregates Levy Sustainability fund. We would particularly like to thank Dave Hooley (English Heritage Characterisation Team), Virginia Dellino-Musgrave (English Heritage Maritime Archaeologist), and Helen Keeley (English Heritage Project Officer) for their support and guidance throughout.

Oxford Archaeology are also grateful to a number of organisations who have provided us with data and information that was pertinent to the project:

Essex County Council

Suffolk County Council

Maritime and Coastguard Agency (MCA)

The UK Hydrographic Office (UKHO)

Seazone Solutions Ltd.

Consultancy Support Ltd

Eastern Sea Fisheries Joint Committee (ESFJC)

British Sub-Aqua Club (BSAC)

Porcupine Newsletter

Marine Fisheries Agency (MFA)

Kent and Essex Sea Fisheries Committee (KESFC)

National Maritime Museum (NMM)

British Geological Survey (BGS)

Royal Yacht Association (RYA)

Centre for Environment, Fisheries & Aquaculture Science (CEFAS)

and the three other concurrent pilot project contractors based at:

Cornwall County Council

Museum of London Archaeological Services (MOLAS)

Hampshire & Wight Trust for Maritime Archaeology, Southampton University and Bournemouth University

In conjunction with these organisations or on an individual basis, a number of people have been extremely helpful in providing technical help and personal or professional advice on end-user needs, for which we are grateful: Nigel Brown, Joe Collins, Frances Dipper, Sean Douglas, Lynn Dyson-Bruce, Paul Eastwood, Sally Gale, Adrian Gascoyne, Paul Gilman, Dave Lock, Edward Martin, Mike Millichamp, Kate Moore, Bob Moss, Peter Murphy, Fred Nash, Colin Pendleton, Jane Pinn, Jude Plouviez, Alison Smith, Joan Taylor, Dave Thorne, Brian Thynne, Duncan Vaughan, Keith Wade, Joss Wiggins, Bill Wilkinson and Tom Williamson.

This project was undertaken by Leif Isaksen, Kelly Powell and Mark Littlewood and

managed by Ianto Wain. David Lock and James Vessey worked on the initial stages prior to their departure from Oxford Archaeology. Technical support was provided by Paul Backhouse, Markus Dylewski, Sarah Lucas, Julia Moxham and Lucian Pricop.

About This Document

This document is a Statement of Methodology, documenting the techniques used by Oxford Archaeology (OA) in order to undertake a Marine Historic Landscape Characterisation (Marine HLC) of a study area comprising UK Controlled Waters between Southwold and Clacton-on-Sea, extending seaward to the Median Line with Holland. The study was comissioned by English Heritage and funded by the Aggregates Levy Sustainability Fund (ALSF). The remit of the project was to evaluate and adapt a prior methodology established by Wessex Archaeology Ltd. for the original England's Historic Seascapes pilot study focused on the Liverpool Bay area (Wessex Archaeology 2006). This document is to be used, in conjunction with three other pilot studies, to inform a single, unified methodology which will eventually be applied throughout those parts of UK Controlled Waters around the English coastline, and reapplied to the original pilot study areas. The project was devised to create a process generic enough for widespread use and document the reasoning behind it, as well as identifying issues for which better solutions still need to be found.

As this document is primarily technical, and it is intended to be used by organisations with some experience in HLC and its related technologies, this report does not constitute a user manual. The specific steps taken by which our results were obtained are identified, as are the software packages used. Nonetheless, a variety of software solutions are available for such an activity and there has been no intention to advocate any specific software product. The project has focused on documenting the processes behind the methodology, rather than explaining user-interfaces, and it is assumed that future practitioners will already have the intermediate-level Geographical Information System (GIS) skills that such a large scale project inevitably demands. A glossary of the most technical terms is, however, provided.

1. Introduction

1.1 Introduction

1.1.1 The main objective of this report is to discuss the methodology formulated by Oxford Archaeology (OA) in the second stage of 'England's Historic Seascapes' pilot programme. The overall aim of the scheme, commissioned by English Heritage (EH), with funding from the Aggregates Levy Sustainability Fund (ALSF), is to apply the principles of Historic Land Characterisation (HLC) to the inter-tidal and maritime zones in order to create, among other purposes, an integrated spatial planning tool. This is particularly significant as pressure on coastal and marine areas is rapidly increasing in scale. Marine aggregate dredging, coastal development, , construction of windfarms and port development and maintenance dredging are some of the main activities which can impact on maritime archaeology including submerged palaeo-landscapes, lost settlements, harbours and shipwrecks. It is anticipated that the final outcome of the programme will assist with planning, conservation and research of this threatened maritime cultural landscape.

1.1.2 This project is one of four concurrent pilot projects which seek to develop and test the broader applicability of the methodology established in an initial stage of the programme by the Wessex Archaeology Ltd. (WA) in the Liverpool Bay area. It is anticipated that this development will aid in the process of formulating a methodology suitable to apply nationally, in the next stage of the programme. Differing areas of coastline have been targeted to ensure the final methodology is suitable for application to the whole of the England's diverse coastline and territorial waters

1.2 Historic Landscape Characterisation and Maritime HLC

1.2.1 Historic Landscape Characterisation has become a key EH programme and leading method for managing change (Aldred and Fairclough 2003). The initial concept arose from the 1990 White paper, 'This Common Inheritance', in which it was proposed that a comprehensive characterisation of the whole landscape was preferable to generating a list of landscapes of special importance. The approach to HLC is therefore very broad, characterising large tracts of land, rather than discrete features. The main concept of HLC is that the landscape is a culmination of many thousands of years of human activity and land use (Fairclough *et al* 1999, vii) – landscape as history, not geography (Clark et al 2004, 6). The methodology developed over a decade after the initial HLC was completed for Cornwall in 1994; coverage by HLC now extends over approx. 75% of England's land area.

1.2.2 A logical and timely progression is to apply HLC to the marine environment, creating a seamless characterisation of the terrestrial, inter-tidal and marine zones. This is particularly pertinent in the context of the extensive marine development outlined above, in particular aggregates extraction. Increasing demand to supply the construction industry has resulted in expansion of the marine aggregates industry, and currently marine dredging provides a significant percentage of annual supply.

1.2.3 Partly as a consequence of this development, the establishment of marine HLC fits into a wider context of increasing political awareness of maritime cultural heritage. This

approach to marine resource management moves towards fulfilling EH's responsibilities under the National Heritage Act 2002 which extended their remit to the limit of Territorial Waters and complements the Government's first Marine Stewardship Report 'Safeguarding our Seas' (DEFRA 2002a). This committed the government to consider the role of marine spatial planning, to extend the coverage and capacity of existing seabed mapping and develop an integrated assessment of the seas by 2004. The concept is particularly pertinent when considered in relation to the current proposals for a Marine Bill intended to introduce a new framework for the seas, based on marine spatial planning that balances conservation, energy and resource needs (DEFRA 2006, 3).

1.3 England's Historic Seascapes

1.3.1 In consideration of the above, the concept of applying HLC to a maritime context is being realised in the form of a programme of pilot projects intended to develop a robust methodology. The current study is one of four areas selected in order to test and further refine the methodology developed by Wessex Archaeology (2006) in the Liverpool Bay area. The four study areas have greatly differing environmental and management contexts, providing a diverse set of characteristics. The next stage of the programme will be to produce a definitive methodology which will ultimately be applicable to the whole of the national share of the coastal zone and UK Controlled Waters.

1.3.2 It is anticipated that England's Historic Seascapes will provide an effective planning tool that can be used for a range of applications, including within Environmental Impact Assessments (EIAs) and Strategic Environmental Assessments (SEAs). These form part of the evaluation of proposals for development and aid EH in meeting obligations in terms of research, public understanding and access. It is expected that the characterisation produced by the programme will be used in conjunction with currently available data such as locations of known wrecks or submerged landscapes and artefacts. Whilst useful, such datasets can be scattered and inconsistent, and this programme seeks to assign broad character to wider areas to allow for broader contextual understanding.

Overall the project also contributes towards EH-ALSF priorities. Specifically, the project moves towards enhancing the understanding of scale and character of the historic environment in current or likely future aggregate producing areas in order to provide baseline information needed for effective future management (www.english-heritage.org.uk/alsf). The study also provides support for the development of management and conservation strategies for the historic environment in current or likely areas of future aggregate extraction (ibid). In a wider context of EH strategy and research agendas the project moves towards enabling and promoting sustainable change to England's historic environment (Embree and Stevens 2005). The project is crucial in light of the 2002 document 'Taking to the Water' which stated the aim of EH to "undertake a programme of research designed to provide a more robust basis for the understanding and management of the maritime Historic Environment" (Roberts and Trow 2002, 23). Taking to the Water also outlined the need to develop methodologies that can help seabed developers meet their obligations under Environmental Impact

Regulations, to identify underwater cultural heritage and mitigate damage incurred in the course of their activities (ibid, 24)

1.4 The Present Character of the Study Area

1.4.1 The Southwold-to-Clacton study area is located on the East Anglian coast, straddling the Suffolk and Essex border. The seaward limit of the area is the UK continental shelf, following the Median Line with Holland as defined in the UK Continental Shelf Act 1964 and as subsequently amended. The southwestern lateral extent is defined as a line extending from the Essex coast at Jaywick at 51°46'30"N, 01°07'15"E, south eastwards to the point where latitude 51°30'00"N intersects with the UK continental shelf limit. The northeastern lateral extent is defined as a line extending eastward from the Suffolk coast at Southwold at 52°20'12"N, 01°41'10"E, to the point where latitude 52°20'00"N intersects with the UK Continental Shelf Limit.

1.4.2 Mean High Water (MHW) has not been taken as an arbitrary landward line to truncate character polygons. With a view to contextualising activities that are directly related to the character of the intertidal and marine zone, OA has extended the character polygons to include landward territory. This only applies to polygons whose character is demonstrably related to the marine environment. As morphology does not play a role in marine HLC (see below), and in order to include only those areas of the terrestrial environment that directly influence use of the marine zone, the extent of the landward polygons was limited to 2 km.

1.4.3 The study area has a varied topography and environmental character comprising cliffs, low lying estuaries, mudflats, saltmarsh and shingle spits. The geology, though varied, generally comprises sand up to 10 km from the coast, grading seaward to gravelly sand in the North. The south is dominated by Eocene London Clay Formation with some Coralline Crag and Norwich Crag Formation. Muddy deposits are associated with the rivers Stour and Orwell, though generally the geology consists of less than 1m of Holocene sediments overlying brackish marine clays (Seazone Geology data)

1.4.4 The coast and estuaries in this area represent one of the most undeveloped and dynamic sections of coastline within eastern and southern England (DEFRA 2002b, 126). In recent years the area has experienced significant growth and change and has come increasingly under pressure (Suffolk District Council 2001, 1). The coastline is subject to severe erosion, particularly along the Suffolk coastline as exemplified by the settlement of Dunwich. This thriving Medieval port was lost to the sea from the 13th century onwards in the form of sudden events and gradual processes, leaving a small fishing village on the shore, still eroding at a significant rate. A major cause of erosion in this area is coastal squeeze, a term applied to the situation where the coastal margin is squeezed between the fixed landward boundary (artificial or otherwise) and the rising sea level.(www.english-nature.org.uk). A survey conducted in 2000 (Cooper) identified that 1000 hectares of salt marsh had been lost from the Essex estuaries in the previous 25 years (DEFRA 2002c, 1). Conversely, the study area is also one of extensive deposition exemplified by rapidly changing spits such as Orford Ness. In general, tidal flows flood south and return north and general sediment drift is to the south (DEFRA 2002b, 6)

1.4.5 The study area supports a range of industries and to the south is dominated by the ports

of Harwich and Felixstowe. These industrial hubs are two of the biggest multi-purpose container and passenger ports in Europe, generating an enormous volume of shipping traffic. The whole coastline supports a fleet of small fishing vehicles. In addition, leisure activities are important. The North Essex coastline, including Clacton and Walton-on-the-Naze is famous as a beach resort, known as the 'Sunshine Coast'. Tourism is also important to the north of the study area, particularly with reference to Suffolk's Designated Heritage Coast' (34 miles from Kessingland to Bawdsey Ferry) and Area of Outstanding Natural Beauty (AONB) but also leisure sailing and fishing. Offshore aggregate dredging is an important industry and increasingly the area has been targeted for the construction of wind farms. The seas off the coast of East Anglia have also long been used as Royal Navy practice areas

1.5 The Historic Character of the Study Area

1.5.1 The entire study area has been dry land at varying times before and since the end of the last glaciation and has the potential for the occurrence of submerged prehistoric remains back to at least 100,000 years BP. The study area south of 52º 30' theoretically has the potential for human and proto-human remains as old as 500,000 - 700,000 years, though some debate exists concerning the survival of such remains through glaciations (Flemming 2002, 1,6). East Anglia is unique in having extensive deposits of Lowestoft Till which acts as an accurate stratigraphic marker. As a result, Palaeolithic sites can be related to it and given relative dates (Austin 1997, 5). The area is therefore key to understanding the Palaeolithic in the UK as a whole and has produced a number of redeposited flint flakes and tools from river gravels and in situ material from sites such as Clacton in Essex and Hoxne, High Lodge and Barnham in Suffolk (*ibid*). During the Palaeolithic the River Thames is proposed to have followed a different course, entering the sea via the Suffolk coast. Remnants of the channel still survive within the area increasing the potential for Palaeolithic finds (*ibid*). In terms of specifically maritime evidence, it is difficult to surmise the extent of Palaeolithic exploitation of the ocean, although the first proven ocean crossing is the colonisation of Australia around 50,000 years BP. The type of craft likely to have been involved in this venture include simple floats, hide boats and simple logboats, though the availability of suitable trees may be a restricting factor at this time. Therefore the potential for Paleolithic archaeology in the study area is relatively high.

1.5.2 During the Mesolithic period the availability of protein was often higher close to the open water and shores, particularly in periglacial conditions, and Mesolithic sites were often adjacent to wetlands and estuaries (Flemming 2002, 7). Therefore, the potential for such archaeological sites is high around the shorelines and rivers at each date, especially where shorelines were constant for hundreds or thousands of years (*ibid*). The coastline was at its present line by around 8000 BP (Williamson 2006, 19). Although it has been subject to gradual coastal erosion, the potential for prehistoric remains as far back as the Mesolithic in this zone is high. However, a great deal of work still needs to be undertaken in this field and currently accurate maps of past shoreline locations are not available. Little or no work has been conducted on locating prehistoric sites, although artefacts have been dredged up by fishermen north of this area, particularly around Dogger Bank and Brown Bank. The latter feature is just north and east of the current study area and has produced thousands of fossil bones, dredged

up by fishermen, six of which have been identified as worked aurochs bones and dated to the early Mesolithic (Louwe Kooijmans 1970-1). Due to the nature of the discoveries through trawling, the exact findspots may not be accurate (*ibid*) and it is possible that finds may have extended into the study area. Likely areas for the survival of such archaeological material include estuaries and fossilised river valleys, wetlands, mudflats, and peat deposits. In terms of vessels, a number of Mesolithic logboats have been discovered, including a number from Denmark known to have been coastal, such as from Tybrind Vig (Andersen,1987).

1.5.3 On land, the Clacton area is particularly significant for its Neolithic to Bronze Age habitation sites which were well placed to exploit the coastal and estuarine resources. The character of the geology in this area also results in emergence of fossils and earlier prehistoric remains, associated with the Lyonesse surface. After the Bronze Age little evidence for settlement exists along the coast with the exception of saltworking in the Later Bronze Age, Iron Age and Roman periods. Roman salt working is evidenced by the presence of 'red hills', generally thought to represent salt working debris. Roman forts also existed at Walton, since lost to the sea.

1.5.4 The position of the study area on the margins of the North Sea basin has been critical to its development and East Anglia has always been a region particularly open to foreign influences and settlement (Williamson 2006, 12). The northern part of the study area is easily approached, with its estuaries and offshore spits offering welcome refuge (Williamson 2006, 25) although the southern area around Harwich has long been hazardous to shipping due to sandbanks lying parallel with the shore.

1.5.5 After the Roman period East Anglia was extensively settled from the continent (*ibid*). The independent kingdom of East Anglia was formed in the 5th century AD and the last king, Edmund, was killed by Viking invaders in AD 869/870. The Anglo-Saxon influence is evidenced in sites such as Snape and Sutton Hoo, both of which produced important boat or ship burials. The area was under Danish rule from AD 902 onwards, again indicating potential for seafaring evidence. With the invasions came large scale reclamation of coastal wetlands. In the early Medieval period this was chiefly under the auspices of wealthy monastic foundations (Wren 1976).

1.5.6 East Anglia has become an important maritime centre in periods when England's interests have focussed on the continent, such as the medieval period (Wheatley 1990, 56). During this time East Anglian ports enjoyed a degree of eminence (Malster 1969, 3). This was partly a result of the wool trade to Flanders, the manufacturing of which focussed on the Stour valley, though trade was widespread (Williamson 2006, 65). Today evidence for once prominent ports survives in the form of elaborate perpendicular churches such as Blythburgh, Southwold and Walberswick (*ibid*). In the late Medieval period many coastal settlements such as Southwold and Aldeburgh also established fishing industries, particularly with the development of Icelandic fisheries.

1.5.7 However, the coast underwent a period of decline from AD 1300 to 1600 as a result of economic and natural disasters. These included the silting up of harbours such as Dunwich, and the Black Death which particularly affected the cloth trade (Wren 1990). Increasing size of trading ships prevented use of smaller ports, focus shifted to North America, and continental wars and piracy became rife. Later, the industrial revolution largely passed East Anglia by (Williamson 2006) but the cloth trade became mechanised and the agrarian revolution enabled export of grain throughout England.

The decline of the coastal area at this time is demonstrated by the hearth tax levied between 1662 and 1689 which indicates that the proportion of people exempt from the tax in Dunwich was 73 % of the population, the highest in the country (Dymond 1999, 96). In addition, eight of the worst affected places included Aldeburgh, Woodbridge and Southwold (*ibid*).

1.5.8 As a result maritime trade became increasingly small scale and coastal. This was key to the area in the late Medieval and post medieval periods and wherries and Thames sailing barges became characteristic (Malster 1969, 6). Coastal trade remained important until the railway once more revolutionised transport. Finally, the smaller ports went into decline. Conversely the coming of the railway enabled the development of industrial centres at Felixstowe and Harwich as well as Victorian beach resorts at Clacton, Walton and Southwold.

1.5.9 Although international fishing continued it was also affected by the enterprise of the Dutch (Wren 1976) in the late Medieval period and has seen severe decline since World War II. East Anglia's other maritime industry was boat and ship building. In its heyday shipyards were common along the coast but construction became less over time. Ipswich was an important centre for naval ship building during the period of wooden warships but the advent of iron ships led to its decline. The coastline has seen a return to importance in the modern period with the influence of both war and closeness with the continent, particularly in container trade and passenger ferries preminentat Felixstowe and Harwich.

1.6 Aims and Objectives

1.6.1 The aims of the project as defined in the Project Brief are as follows:

A1: To apply, test and develop the methodology developed by Wessex Archaeology for the Liverpool Bay pilot area in a different type of coastal and marine environment.

A2: To create a GIS-based Characterisation of the historic and archaeological dimension in the present landscape of the inter-tidal and marine zones of the project area to the limit of the UK Continental Shelf.

A3: To ensure that the historic environment GIS-database for the project area can be readily integrated with analogous databases for the natural environment.

A4: To create a framework of understanding which will structure and promote well-informed decision-making relating to the sustainable management of change and conservation planning affecting the historic environment in the inter-tidal and marine zones.

A5: To enhance and contextualise the Maritime Record of the National Monuments Record and those County Historic Environment Records (HERs) impinging upon the project area, with particular regard to providing landscape-scale contextualisation of results from the Rapid Coastal Zone Assessment programme where available.

A6: To structure, inform and stimulate future research programmes and agendas relating to the project area.

A7: To improve the awareness, understanding and appreciation of the historic

dimension of the project area to professional and non-professional users of the database.

A8: To be a demonstration project in the development of a methodology for extending HLC to the breadth of environmental and management conditions in England's inter-tidal and marine zones and adjacent UK Continental Shelf.

1.6.2 The project's key objectives as specified in the brief are:

O1: To deploy, assess and, as appropriate, develop the GIS-database structure created for the Liverpool Bay pilot area to enable it effectively to accommodate the distinctive qualities of the Southwold to Clacton study area while retaining compatibility of the database with the interfacing or partly overlapping terrestrial Characterisation databases.

O2: To produce a GIS-based HLC characterising the project area's landscapes in historic and archaeological terms, by means of:

- Identifying and gaining access to the range of data sources relevant to understanding the historic and archaeological dimension of the project area, placing greatest emphasis on sources with consistent national coverage.
- Using GIS polygons to define areas sharing similar historic character.
- Defining polygons on the basis of combined shared values of dominant character attributes, with secondary attributes recorded in a consistent, structured manner.
- Identifying trends and recurrent groupings among the attributes to define historic landscape types which will, together, encompass all of the polygons and reflect the differing historical processes in their formation.

O3: To record the sources and data-sets supporting each stage of the Characterisation, to meet the needs of transparency and assist future updates against the initial benchmark Characterisation.

O4: To analyse and interpret the HLC to produce preliminary syntheses from it.

O5: To assess present uses and potential for the HLC in informing sustainable management of change and spatial planning issues surrounding marine aggregates extraction in the project area.

O6: To assess present uses and potential for the HLC in informing broader sustainable management of change, spatial planning, outreach and research programmes.

O7: To produce an archive and a report reviewing the methodological validation, development and practical application of HLC in this project area and assessing the benefits of extending such Characterisation more widely to the historic environment in the inter-tidal and marine zones to the limit of the UK Continental Shelf.

O8: To disseminate information on the progress and results of the project through professional and popular publications and other media.

2 Methodology Overview

2.1 Principles

2.1.1 The primary aim of the project was "to apply, test and develop the methodology developed by Wessex Archaeology". OA's approach, therefore, has been to continuously use the methodology designed by Wessex Archaeology Ltd. (WA) for Liverpool Bay (WA 2006) as a point of departure for further development. This is both to prevent unnecessary reinvention as well as to ensure that project results would be similar enough in structure to allow for integration with the other pilot studies being undertaken. This report gives a step-by-step description of the amended methodology, and explanations are given where it diverges from the WA approach.

2.1.2 The first task was to establish a main criterion by which the methodology could be evaluated. This process began with a substantial review of the HLC literature. This made clear that, although terrestrial HLC provides an extremely interesting starting point for looking at landscapes as a whole, both methodological and theoretical structures behind it are deeply entwined with elements of the terrestrial landscape which do not always apply in a straightforward manner to the marine environment. For example, terrestrial HLC generally identifies a mosaic of adjacent and conceptually identifiable components of a landscape which can be described based on their individual use and morphology. The marine zone is not composed of such a mosaic and hence such component parts cannot be understood in the same way . As the theoretical groundwork needed to undertake this is still in the process of being established (by projects such as this), OA needed to use more general HLC principles as guidance. In consultation with EH, a pragmatic approach has been taken, focussing on the creation of a 'marine spatial planning tool'. In other words, the primary concern, and overriding criterion, was to create a methodology, and in turn dataset, that is practical, repeatable in different areas, and provides EH and the general public with the ability to a) understand at a glance the impact of historic maritime use and activity in the present landscape, and b) contextualize smaller regions as a starting point for in-depth studies as and where appropriate. Methods traditionally employed in terrestrial HLC were adopted to the extent that they contributed to this aim

2.2 Wessex Archaeology's Methodological Framework

2.2.1 Wessex Archaeology have in their original pilot project (WA 2006) created a methodological framework which, on the whole, broadly overcomes the main difficulties of applying HLC to the sea. The initial challenge is to identify the essential elements which provide the character of the area and it is perhaps primarily here that the divergent methodologies are at their furthest apart. The principal for terrestial HLC is relatively straightforward. The land HLC can use the total coverage of Ordnance Survey mapping to break the landscape down into atomized 'chunks' which can be characterised separately based on modern usage, historical development and time-depth, and perceived morphology. Knowledge of the marine historic environment is vastly more limited however and its constitituents parts by definition much more

fluid (and few such boundaries exist It is clear then, as WA have identified, that some other means for dividing the region up into contiguous areas must be used (WA 2006). Their solution, which OA has also adopted, is a three-stage process, described below.

- Identify and prepare **Primary Datasets**
- Create **Near-Level** layer
- Create **Character Areas** Layer

2.2.2 First, a number of **Primary Datasets** are identified which are already in polygonised format or capable of being 'polygonised'. These provide the source data which will go into creating the spatial attributes of the GIS. Although it is important that such datasets provide information about the entire area concerned, they may frequently be of a binary nature, i.e. they may identify only the presence or absence of a specific type of marine character. In order to permit the structured integration of these datasets, individual polygons within them must also be given a generic character attribute from a taxonomy of possible categories. This is vital in order to allow for any kind of computational analysis. The Primary Datasets are listed in Table 1 and details of how individual sources were processed is given in Appendix II. The overall process is discussed in Section 3: Primary Dataset Preparation

2.2.3 Once the primary datasets have been prepared, they are 'unioned' in order to create a single **'Near-level'** layer -an amalgam of all of them that shows the approximate spatial distribution of marine use and activities. The process is described in Section 4: Creating the Near-Level Layer. This intermediate stage has the greatest number of theoretical issues associated with it, particularly that of inevitable data loss. The result nevertheless provides an abstract picture of sea use and perception which is vital, in conjunction with secondary datasets and literary sources, for use as a foundation for the third stage: identifying, investigating and describing **'Character Areas'**. These are much larger areas than those created at the 'Near-level' and rather than identifying generic maritime use at the small scale, they are intended to delineate regions which are cohesive yet unique local contexts. These areas are an innovation to maritime HLC, and are not ideal for thematic mapping, but come closest to identifying discrete areas of sea character, both for future research and marine planning. As separately derived spatial entities, they also avoid the licensing and copyright issues associated with distributing 'Near-level' data. The creation of Character Areas is described in Section 5: Character Areas.

2.3 Software

2.3.1 GIS is now a mature and rapidly developing technology and there are a variety of software alternatives available by which to employ it. No particular software package is, or should be, necessary to undertake a Marine HLC, although standards-based software is always preferable. Time and financial constraints often require the use of solutions with which staff are familiar or licenses have previously been purchased. The Environmental Systems Research Institute's (ESRI) commonly-used ArcGIS/ArcInfo software was adopted for this pilot study but OA have attempted to be software-agnostic throughout this methodology, so as to not to prejudice the use of Open Source or alternative options by other organisations or at later phases of the programme.

2.3.2 The ESRI Personal Geodatabase format enables spatial data to be kept in a single transferable file based on Microsoft Access 2000, leading to the further advantage that it can be manipulated using the much more sophisticated querying tools which that package provides. It is also highly integrated with the widely-known ArcGIS desktop software suite. There are issues in using such format however, particularly it's non-standards-based format which may lead to potential shelf-life problems and the lack of interoperability with other systems - an issue yet to be resolved by ESRI. Whilst these are issues which lie predominantly within the concern of the Arts and Humanities Data Service (AHDS), the methodology developed does not require features unique to ArcGIS, and future practitioners should still able to follow it using alternative software.

2.4 Metadata & Standards

2.4.1 Metadata is an extremely important aspect of any GIS archive and was recorded in accordance with the Archaeology Data Service (ADS) Guide to Good Practice for GIS (http://ads.ahds.ac.uk/project/goodguides/gis/) and in consultation with EH using the UKGEMINI Standards. The type of metadata recorded within the GIS is outlined in

the section entitled 'Metadata' below. Metadata for contributory datasets which are not in the GIS is recorded in Appendices II and III of this document.

3 Stage 1: Primary DataSet Preparation

3.1 Field survey and consultation

3.1.1 Following the initial acquisition of (primarily digital) data-sets further work was carried out to collect non-digital sources, consult relevant organisations and provide further insight into the character of the area. Data collection entailed visits to all relevant archives and museums including:

- Chelmsford Record Office
- Ipswich Record Office
- Dunwich Museum
- Ipswich Museum
- Suffolk Underwater Studies Museum

3.1.2 On-site consultation was carried out with Essex and Suffolk County Councils and the area was visited on a number of occassions with detailed walkovers/site visits being carried out in May 2006 and January 2007.

3.1.3 In order to establish communication with interested local parties, to engage their knowledge and interest, and to better ascertain end-user needs, two Stakeholder Meetings were organised and potentially interested parties were invited to attend. The first Stakeholder Meeting took place at Chelmsford Record Office on the 31st of August 2006. At this meeting, the principles of HLC were discussed, along with the proposed methodology and two trial Character Areas. The second Stakeholder meeting was held at the Swan Hotel, Southwold on the 15th of February 2007. At this meeting, the methodology was more briefly discussed and a summary of the results of the project, including the Near-level and Character Area data were presented. At both meetings there was a lively question-and-answer session as well as a period for informal discussion afterwards. These gave an opportunity for Stakeholders to provide OA with feedback and amendments were made to the methodology as necessary or appropriate. This process fitted into the wider context of increasing public awareness and encouraging public perception of cultural heritage which EH are moving towards (Embree and Stevens 2005; English Heritage 2005)

3.2 Datasets Used

3.2.1 A great variety of potential datasets were available to the project and can be broken down into three categories:

3.2.2 Primary Datasets were used in the construction of the Near-level layer. They are all digital polygonised data, although some of them are derived from point or linear data using buffering or kernel density algorithms (for details of which, see Appendix II). Secondary Datasets are further spatial datasets that were unable to be incorporated into the Near-level layer (either due to spatial uncertainty related to the data, their non-

polygonal structure, or for licensing reasons), but used to help contextualise the Near-level polygons when writing up the Character Areas. The challenges presented by individual Primary and Secondary Datasets are outlined in Appendices II & III). Literary sources, including web sites, were used as further sources of evidence in writing descriptions of the Character Areas. A full Bibliography is given at the end of this report and specific documents used are referred to the Character Area descriptions themselves.

3.2.3 The first issue was to identify Primary Datasets, namely those that could be used in creating the 'Near-level' layer. The main criteria were that they had to

a) be polygonal, or capable of being 'polygonized' in a meaningful sense,

b) give complete coverage of the region,

c) be conducive to abstract categorisation (i.e. nominal or ordinal data).

3.2.4 After consideration, data based on intermittent or itinerant maritime use was avoided, with a focus instead on permanent sea features and designated areas. To take an example, areas designated as shipping lanes were used as primary datasets, whereas information that shipping has taken/takes place in a certain location was not. This was due to the fact that there were no reliable means by which to judge the degree to which shipping in one area implies its absence elsewhere. Such information was used as secondary data during the Categorisation stage however.

3.2.5 The coastal scope of the project also meant that it was necessary to use terrestrial datasets that showed areas having direct impact on marine use and perception such coastal settlements. Here again it was important to establish what was relevant to the scope of the study. As a general guideline, data was used where it refered to areas which either

a) have or had a significant marine component (e.g. saltmarshes, reclaimed land, etc.)

b) showed human use related to maritime activity (e.g. docks, beaches etc.)

3.2.6 There were naturally various grey areas such as built up areas, where it is difficult to make any precise judgment as to how intrinsic the sea has been to their development It was in cases such as this that the 2km buffer zone became important in preventing the project from encroaching too far inland.

3.2.7 A final list of Primary and Secondary datasets is summarised below, with further details provided in Appendices II and III. Literary Sources are listed in the Bibliography.

Table 1: Primary and Secondary Datasources

Supplier	**Dataset**
Primary	
EH (Ordnance Survey)	OS Modern mapping (MasterMap)
EH	OS 1st Edition
Essex County Council	HLC
Suffolk County Council	HLC
Suffolk County Council	Coastal Marshland HLC
Seazone	Offshore Industry
Seazone	Wrecks
Seazone	Obstructions
Seazone	Installations
Seazone	Bathymetry
Seazone	Transportation
Seazone	Licenced Activities
Seazone	Administrative Regulatory Areas
Seazone	Protected Areas
Seazone	Landcover
Seazone	Seacover (Named Areas)
Secondary	
Seazone (BGS)	Geology
Seazone	Depth Areas
Royal Yachting Association	Leisure Sailing Areas
UK Hydrographic Office	Historic charts
UK Hydrographic Office	Modern charts
National Monuments Record	National Monuments Record data
Essex County Council	HER/SMR data
Suffolk County Council	HER/SMR data
Department of Trade and Industry	Tidal Range
Natural England/COAST database	Shipping information

3.3 Unincorporated Datasets

3.3.1 A number of potential primary datasets were considered that were not ultimately included in the Near-level. These comprised:

- Palaeolandscapes
- Bathymetric data
- Historic charts
- Maritime and Coastguard Agency (MCA) Traffic survey
- Anatec shipping data

3.3.2 As discussed above, the study area has some potential for the existence of palaeolandscapes and prehistoric remains buried beneath the present seabed. Whilst this aspect of the archaeological record is essential to include within the study, little if any work has been undertaken on submerged landscapes within the study area. Particular 'hotspots' can be identified such as estuaries and a number of features can indicate the likelihood of buried remains such as peat deposits and submerged forests. Peat deposits dated to 9000 and 8700 years BP have been located at Brown Bank, Dogger Bank and along the coast of Holland just outside the study area (Louwe Kooijmans 1970-1). However, such data was absent or unavailable from the area. The team considered acquiring borehole data from offshore industry, but this was beyond the scope of this project. As mentioned, coastlines are important human habitats and can be indicators of particular ranges of prehistoric activity, therefore it would be useful to reconstruct past shorelines. However, there are a number of challenges with this. In order to reconstruct shorelines, relative sea level curves are used to apply sea-level change to a landscape. Generally this is applied to present day bathymetric data to give approximate reconstructions in a programme such as Surfer (as undertaken by Wessex Archeology in the initial pilot study (WA 2006)). However, present day landscape does not always represent past landscape, particularly in a dynamic environment such as the seabed and the more accurate method would be to apply the sea level curve to the original land surface. This can more accurately be reconstructed using sub-bottom profiling. However this technique has not been universally applied due to its expense and therefore such data is also unavailable.

3.3.3 As a result, past shoreline reconstructions are currently considered somewhat inaccurate. Whilst this technique can provide a useful indicator of past shorelines, though not to a high degree of accuracy, it was considered by EH to be outside the scope of this study to conduct any new research and therefore reconstruction was not undertaken. Consequently a decision was made to classify the whole project area as having the potential for palaeolandscape remains on the basis of the evidence discussed above. This problem is currently being addressed by a project principally led by Professor Vincent Gaffney and Dr Kenneth Thomson at Birmingham University entitled ‘3D Seismics As A Source For Mitigation Mapping Of The Late Pleistocene And Holocene Depositional Systems And Palaeogeography Of The Southern North Sea’. Unfortunately due to the timing of the projects this data was unavailable for the current pilot study.

3.3.4 Historic charts were one of the first sources of data evaluated and preliminary scanning and georeferencing were undertaken. It soon became apparent, however, that all

notable features upon them were already available in other datasets. Although there were a handful of cases in which natural features appeared to have seen moderate change since the charted period it was never clear that such difference was not merely due to differences in mapping standards, tidal range, etc. and furthermore led to problems arising from duplication (see below). For these reasons, it was decided that historic chart data would be used as a Secondary, rather than Primary, Dataset. Information derived from the charts was therefore not incorporated into the GIS but was used to help create character area descriptions.

3.3.5 Data was obtained from the MCA in the form of the Dover Straits Traffic Survey. This surveyed the traffic in the Thames Estuary and approaches. Although this was relevant to the project, it was discounted for the GIS union as it only covered a small part of the study area. A further spatial dataset, 'Navigation routes', was supplied by the MCA. This comprised proposed navigation routes, rather than existing tracks. It was discounted on the basis that its value to the project was not clear, neither were incorporated into the GIS and value for character area descriptions was limited. The Wessex Archaeology 'England's shipping' project was considered as a source of shipping information. However, on inspection it was concluded that the information present for the study area was already present in other data sets or apparently scarce for the area. Therefore this source was also discounted from the GIS.

3.3.6 The shipping data used was taken from Natural England's document 'The Southern North Sea Marine Natural Area' and was approximate only. A more accurate dataset 'Shiproutes' showing shipping routes in the area can be obtained from Anatec UK Ltd. The decision was made not to obtain this dataset due to its cost (£2,500 ex VAT for Port data, shipping data in terms of routes with details on the numbers of vessels using each of the routes, intensity data in terms of a grid with density of shipping in each cell per annum) in view of the project budget and a preliminary assessment of the data's direct value.

3.3.7 Ideally the project would have benefited from GIS data about commercial fishing activity in the area and accurate locations of recreational diving and fishing sites. However, these datasets were not available from the relevant authorities and organisations. Fishing grounds can be particularly difficult to locate and information is often in the form of local knowledge. However, all organizations contacted were able to supply some general data, as outlined below. As a result fishing data could not be incorporated into the GIS but was used for character area descriptions.

3.4 Licensing Issues

3.4.1 **Terrestrial:** EH is a member of the Ordnance Survey Pan-Government agreement. This enables them to provide OS datasets for use in projects which they commission. OS MasterMap was used as a primary source for much maritime-related terrestrial infrastructure, whilst rasterized 1st Edition OS maps were used to digitise the extents of historic town cores in the study area. Suffolk and Essex County Councils funded, and hold usage rights over, the HLCs covering their respective counties. As stakeholders in the project, they were also able to contribute their data to it free of charge. In the case of Suffolk County Council, the project was also able to obtain the Coastal Marsh HLC created by Dr. Tom Williamson.

3.4.2 **Maritime:** As there is no officially sanctioned licensing body for UK Controlled

Waters in the manner of the OS (the remit of whom runs to Mean High Water (MHW)), issues regarding the licensing of maritime spatial datasets have proven considerably more complicated. Digital data was provided by Seazone Solutions Ltd., having been purchased by EH, but some data derived by them from other organizations, such as the British Geological Survey (BGS), could not be incorporated into the near-level layer for copyright reasons. Other potential datasets, such as the Maritime shipping data compiled by Anatec UK Ltd. could have been incorporated, but it was felt that the licensing contract would not have been cost-effective within the context of the project.

3.5 Integration Issues

3.5.1 Integration issues and the means by which to tackle them form a large focus of this report. However, even from the outset it has been clear that the datasets chosen would have a considerable impact on the level of difficulty in combining them and the quality of the end result.

3.5.2 **Reference Datum**: Land datasets for the UK are typically in an Ordnance Survey British National Grid based on the Ordnance Survey Great Britain 1936 (OSGB36) datum which uses an ellipsoid intended to provide as little distortion as possible for the UK as a whole. Unfortunately, distortion increases the further one gets away from the centre of the UK, and for this reason, maritime datasets more frequently use the World Geodetic System 1984 datum (WGS84), which gives a much better fit for the earth as a whole. Although algorithms can be used to translate from one datum to another, these can never provide a perfect meshing between datums, which are based on different presumptions of the Earths size and shape, and so a 'primary datum' must be chosen into which data from the other must be converted. As the study area was considerably distorted by the OSGB36 due to its easterly extension, and the project's focus primarily on the maritime data, WGS84 was used. The result is that the coastline looks somewhat distorted to users who are more used to seeing it in a British National Grid projection, but the sea coverage itself will be more evenly and accurately represented. The GIS can always be reconverted to OSGB36, should users wish to integrate it with a terrestrial HLC.

3.5.3 Different algorithms can be used to convert between datums but the standard ArcGIS transformation algorithm from OSGB36 to WGS84 is inaccurate by approximately 120m at the coastline within the study area making integration of marine and terrestrial datasets problematic. For this reason, a further custom algorithm was used afterwards. This effectively moved the OSGB data by 119m west and 27m south which gave a margin of difference throughout the terrestrial study area of up to 2 metres which was more than sufficient given the scale of the data. Similar custom algorithms will need to be undertaken by other projects as the degree of variation between OSGB36 and WGS84 varies considerably around the British coastline. A complete database of all UK controlled waters would have to choose however between accuracy (WGS84) or seamless integration with terrestrial HLCs (OSGB36). A detailed discussion of Reference Datums and the issues involved in integrating them is provided online by Seazone at:

http://www.seazone.com/uploads/refzone-Projection%20Reference.pdf

3.5.4 **Duplication**: The use of multiple data sources means that, in a number of cases,

similar entities, such as marshlands, might be duplicated. To make matters worse, such polygons often have differing extents, and may even be described in different ways (e.g. reclaimed land/drained fields). This was mainly a problem with terrestrial datasets, which tended to be much richer. Three techniques were used to ameliorate this problem.

- Only relevant data was extracted from each dataset, in order to reduce the number of potential conflicts (for details see Appendix II).
- A field indicating the entity's generic abstract type, or 'Subcharacter Type', was included so that overlapping, similar entities could be recognized and represented as such in the Near-level layer.
- A data ranking order was used so that datasets judged to be more accurate or comprehensive (from a maritime perspective) would supersede data that was less so during the integration.

3.5.5 The end result was to create more cohesive areas of a like kind, but often with peripheral snake-like polygons created by underlying polygons with slightly wider extents.

3.5.6 **Terrestrial Data:** The project proposal stated that terrestrial data would be incorporated where it had direct bearing on activities and perceptions related to the marine and intertidal zone. The principal difficulty to be overcome is in the inherently vague nature of that impact. For example, different parts of a large coastal settlement may have varying degrees of influence on sea use, but it is virtually impossible to distinguish between them in any concrete sense. For this reason, only evidently relevant terrestrial areas were incorporated, and even in these cases, 2km was defined as the maximum extent to which significant influence over sea-use was likely occur, although they need not have immediate adjacency to the marine zone.

3.5.7 **Median Line:** The outward boundary of British Territorial waters within the study area is defined as the Median (i.e. halfway) Line between the UK and The Netherlands. The interpretation of this line is not static (it is in fact based, by legal definition, on the datum used by the most recently issued admiralty chart). EH requested that a variant specified by them be used, which was incorporated within the Study Area shapefile provided. As the Seazone data followed (and was hence restricted by) a different variation of the Median Line, it was slightly extended at the eastern periphery so as to reach the Eastward limit of the shapefile provided by EH.

3.5.8 **Scale:** As marine mapping data has come from a variety of sources, even Seazone's attempts to create a unified mapping dataset have had to deal with wide variation in mapping scale. As a result, features located within the same layer may be mapped at widely differing scales, leading to breaks and discontinuities. Although these are not problems that can be addressed directly by the Seascapes project, it is important to note that data quality, even from the same source, may change throughout the study area. As a result, reference scales are presented as ranges, rather than single values within the source descriptions.

3.5.9 **Marine/terrestrial interface**: Perhaps the most difficult issue to resolve was that caused by the need to create a spatial dataset capable of incorporating relevant information about very different environments, with a constantly fluctuating boundary, namely the coast. Because of this, overlaps and gaps were frequently encountered at

the marine/coastal interface. In order to create a common reference it was decided to use a line derived from the Seazone 'Landcover' dataset, providing a coastal edge which would match seamlessly with the majority of our key (marine) datasets. This was used to separate the study area into two sections: a marine zone, and a coastal zone. In both cases, relevant datasets could be clipped (or occasionally expanded) so as mesh seamlessly with the littoral, and hence also adjacent datasets. Naturally, this led to the reduction in size of some polygons, such as beaches, although rarely to any significant extent.

3.6 Terrestrial Datasets

3.6.1 The terrestrial datasets, whilst in some ways more homogeneous than the maritime data, also presented the greatest challenges. This was principally due to the issues of duplication and marine integration discussed above. When unioned, large numbers of thin peripheral polygons are created that are no more than artefacts of the data integration process. The project was faced with what we fear may be a recurring issue with Marine HLC, namely the necessity of using legacy datasets which are not internally compatible with more recent HLC norms (e.g. with gaps, overlaps, or internal corruption). There is only a limited amount that can be done to prevent this without mass redigitisation, but the following measures were taken to help mitigate the consequences:

- Terrestrial data was filtered so as to only include that which was directly relevant to the project. This was both spatially (i.e. within 2km of the coastline), and in terms of attributes (which varied from dataset to dataset).
- As all the terrestrial data would ultimately be merged into a single ' Physical Surface' tier at the union stage (see 'Tiers', below), it proved practical to erase elements of individual datasets which were in any case to be superseded by those in other, more relevant datasets. This had the advantage of limiting the number of 'peripheral' polygons, as well as removing some corrupt polygons in the more problematic datasets. The order of 'dataset priority' is given below:
    1. Historic Town Cores (OS 1st Edition)
    2. Protected Areas
    3. OS MasterMap
    4. Suffolk Coastal Marshland HLC
    5. Suffolk HLC/Essex HLC

3.6.2 In order to provide a continuous surface, 'terrestial component' polygons were also created to fill residual areas of the coastal study area that were not considered not to be of maritime significance.

3.7 Maritime Datasets

3.7.1 All primary datasets for the marine zone were either provided by, or derived from data provided by Seazone Solutions Ltd. (as opposed, to secondary, contextualizing data

which came from a variety of sources). For this reason there were far fewer problems in merging the data, as common boundaries followed the same line. The main issues arising were

a) how to deal with point or linear data, and

b) how to deal with datasets which contain internal overlap.

c) how to ensure the eventual Character Area polygons do not still retain Seazone copyright restrictions or those of their data suppliers, given that their datasets have been so infuential in determining 'near level' polygons for the marine zone.

3.7.2 The former was resolved on a case-by-case basis, and specific solutions are described in Appendix II, below. The latter is still something of an outstanding issue. In many cases, it was possible to divide a dataset into two separate sub-datasets containing separate categories that don't overlap (e.g. in the case of transportation). In the case of the 'seacover' dataset, this was not possible however, as it contains regions with multiple overlapping named areas which may identify both like and unlike subcharacters. Unioning such a dataset creates identical but overlapping polygons containing different information as there is no way to computationally decide between them. The only way to resolve this difficulty is by using a topology to identify overlapping regions and then delete one of the conflicting polygons (or portion thereof). Whilst large-scale overlap can be dealt with effectively in this way, the very large number of extremely small 'slivers' created made it a practical impossibility to deal with all of them. The Topology tool in ArcGIS is also only available in the most sophisticated (and hence expensive) version of the package, ArcInfo. An automated (or semi-automated) process by which to avoid this laborious process would make the process a great deal easier.

4 Stage 2: Creating the Near-Level Layer

4.1 Assigning Subcharacter Type

4.1.1 In order to merge the data into a single Near-level layer it was first necessary to assess every polygon in the primary datasets to assign it to an abstract 'Subcharacter Type'. Subcharacter Types are simple categories of character or function that can be applied to spatial regions. This is a method inherited from terrestrial HLC and provides several benefits. Of primary importance is that polygons of an essentially similar character can be identified as such in a consistent and clearly defined manner. Because Subcharacter Types can, as their name implies, also be aggregated into 'Character Types' and 'Broad Character Types', it is thereby also possible to see where larger patterns exist, for example in military or industrial use. All Subcharacter, Character and Broad Character Types are listed in Appendix I.

4.1.2 Another advantage of using generic Subcharacter Types is that it is possible to rapidly assign other generalised information to the polygon. Information may include which part of the historic environment the Subcharacter Type is associated with, its relative importance as defined by the project, and the degree of confidence that a predominantly desk-based assessment can assign to its location. This is extremely important for projects of this scale. Despite a number of measures that were taken to keep the Near-level layer as data-rich as possible, some degree of data loss is inevitable at this stage, based on what the compiler considers to be most relevant. By associating such information with the character types, rather than the individual polygons, it is possible for future compilers to create alternative interpretations reasonably quickly. HLC is never a 'finished product' and it is always important to be able to go back a few steps and try new approaches, quite apart from the need to develop the approach in the course of future updating.

4.1.3 One particularly important aspect of Subcharacter Type was specific zone or 'tier' in which Subcharacter Typesare found. The original methodology only used dominant and secondary Subcharacter Type fields by which to define its polygons. In order to be able to look at different aspects of sea- and maritime use, the project assigned each polygon three fields of Subcharacter Type (any of which could be populated or left empty) representing the water body, the physical geosurface, and the sub-geosurface. A water column tier was also considered but found to be virtually empty and hence integrated with the other three. In this way the Near-level layer could be interrogated for Subcharacter Types which pertained to just one of these tiers. The other advantage is that polygons are able to hold as many as three Subcharacter Type attributes, assuming that they all belong to different tiers.

4.1.4 The Wessex Subcharacter Type list (WA 2006) was used as an initial set of character types but a large number of amendments were made, partly for methodological reasons and partly due to the distinctive maritime character of the study area. The most frequent change was to remove categories deemed 'historic'. This was because it runs counter to the HLC philosophy of describing the historic landscape as it survives in its current physical and conceptual state. In other words, all HLC categories are historic - 'Landscape as history, not geography' (Clark et al 2004, 6). Hence, a shipping channel might be 'disused', or even 'disused and buried', because these are both historic aspects which can be said to persist the present day, whereas 'historical' is simply a

tautology in HLC terms. Subcharacter Types that referred to very small scale entities, such as wrecks or individual coastal businesses were also omitted. On the other hand, several new categories, such as 'Reclaimed land' and 'Military practice area' were introduced. Likewise, some Character Type categories were also amended – principally reflecting the difference between on- and off-shore maritime activities, as well as a variety of navigation-related Character Types. Broad Character Types remained the same however, despite some inclinations to make slight amendments, as it was felt that the ability to integrate this project with others at Broad Level – a practice well established in terrestrial HLC - was of greater importance. Table 4 (below) lists all the Subcharacter Types, and their corresponding Character Types and Broad Character Type.

4.1.5 Having established the final list of Subcharacter Types it was necessary to create a normalised structure for them in the database. In this case, normalisation simply means that Subcharacter Types are listed in an independent SUBCHAR table, referencing a separate CHARACTER table of Character Types, which in turn references a third BROADCHAR table of Broad Character Types. The table for each of the primary datasets is given a foreign key which identifies the ID of its SUBCHAR Subcharacter Type. The advantage gained is that changes made at any level will then cascade through to referencing tables. For example, if we were to decide that the Subcharacter Type 'Drained fields' is better designated as belonging to the Character Type of 'Coastal environment' (rather than 'Coastal settlement'), then we only have to change the SUBCHAR table and all referencing polygons will now automatically reference the new Character Type and Broad Character Type.

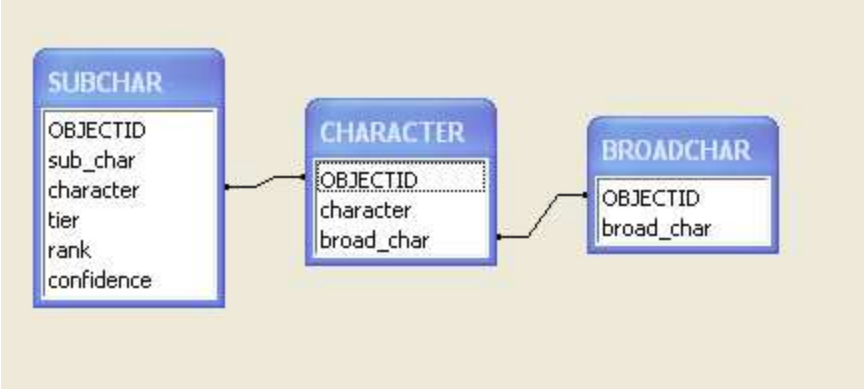


Illustration 1: Database Character Tables

4.2 Unioning the data

4.2.1 The process of creating a *spatial* union of all the data is extremely easy using ArcGIS. The 'union' tool enables the user to take an arbitrary number of datasets and merge them into a single layer. The underlying tabular information for each polygon can be either

- a field for each input dataset giving the ID of the corresponding polygon within it
- every field of each input dataset giving the semantic data of the corresponding

polygon within it

4.2.2 As in this case we are combining a large number of datasets it was deemed easier to use the former option and use Structured Query language (SQL) queries to extract the relevant information about the Subcharacter Types. The result was a spatial table with the following structure:

Table 2: Core unioned Primary Data table fields

Field	***Type***
object_id	integer
fid_datasource_1	integer
fid_datasource_2	integer
...	
fid_datasource_*n*	integer

4.2.3 Several new fields were then created in order to create a map that could be 'thematised' according to tier, Subcharacter Type, wreck & obstruction density or derived values (see Table 3, below). In order for the SQL to be able to ascertain which Type should be ascribed when several were possible, a ranking system was used. This effectively ascribed a priority value to each Subcharacter Type, which would supersede Subcharacter Types with a lower value. Because the tier system meant that polygons could effectively have up to three Subcharacter Types, there were, in effect, three ranking systems containing different sets of Subcharacter Types (one for each tier), although these were all held in one table for the sake of simplicity. These should not be seen as 'correct' in a formal sense – they merely reflect a subjective evaluation based upon presumed planning priorities as well as factors such as scale. The idea is to have a process which is repeatable so that a different set of priority values can be used if required, characterising the area in a new way.

Table 3: Near-level data table fields

Field	***Type***
object_id	integer
subcha_sur	integer
subcha_geo	integer
subcha_sub	integer
subcha_dom	integer
wreck_dens	integer
obst_dens	integer
confidence	varchar

4.2.4 Once the Subcharacter Types were ranked, an SQL query had to be executed for each primary data set and each tier. Unfortunately, because each query refers to a different table, it was not possible to simply rerun the same statement with minor variations each time, but the following SQL template can be rapidly edited for each field and tier:

```
UPDATE [primary_dataset], [union_dataset], SUBCHAR
SET [union_dataset].[tier_field] =
[primary_dataset].[subchar_field]
```

```
WHERE
[union_dataset].[primary_ds_field] =
[primary_dataset].OBJECTID AND
SUBCHAR.OBJECTID = [primary_dataset].[subchar_field]
AND
SUBCHAR.level = [tier_id] AND
(
     [union_dataset].[tier_field] = -1 OR
     (SELECT rank from SUBCHAR
      WHERE SUBCHAR.id =
[union_dataset].[tier_field]) > SUBCHAR.rank
);
```

4.2.5 This script effectively says:

for each polygon in the union dataset,

set the field corresponding to a specified tier = to the Subcharacter Type ID of the corresponding polygon in the primary data source, if

the Subcharacter Type belongs to the appropriate tier

the field does not already contain a value (i.e. = -1), or

the ranking value of the Subcharacter Type is greater than the ranking value of a previously assigned Subcharacter Type.

4.2.6 One might first run the script to update the sub-geophysical tier field using the Palaeolandscape dataset. In each case where there is a corresponding polygon in the primary data, the field will be given the Subcharacter Type ID of 'Palaeolandscape' (in this case, '70') because Palaeolandscapes are found in this tier and all the polygons have the default value of -1.

4.2.7 The script could then be run to update the same field using the Maintenance Dredging dataset. In this case, wherever there is a corresponding polygon in the primary dataset, the the field will be updated to the Subcharacter Type ID of 'Dredging (unspecified)' (=16) because Dredging affects this tier and its rank (= 91) is of a higher order than the rank of 'Palaeolandscape' (= 98).

4.2.8 The overall result is that the scripting can be run in any order as the fields will only be overwritten when they are empty or a Subcharacter Type has a greater priority than that of the previous value.

4.2.9 Wreck and Obstruction density were kept in separate fields ('wreck_dens' and 'obst_dens') and were very simple to populate as, in both cases, there was no problem of alternative datasets overwriting them. e.g.

```
UPDATE [union_dataset], [obstruction_dataset]
SET [union_dataset].obst_dens =
[obstruction_dataset].GRIDCODE
```

```
WHERE [union_dataset].FID_obstru =
[obstruction_dataset].OBJECTID;
```

4.2.10 In line with terrestrial HLC, a dominant Subcharacter Type was also assigned, this time principally by tier. This was done simply by taking the Subcharacter Type ID from the appropriate tier field.

- Sub-surface Subcharacter Type (principally dredging and palaeolandscapes) were judged as least dominant (from a heritage perspective)
- Water-body Subcharacter Types (with the exception of 'Caution Areas' which were seen as being too extensive in proportion to their importance) were ranked as secondary in importance due to their generally transient nature
- Geosurface Subcharacter Types including almost all coastal Subcharacter Types, were given most dominance .

4.2.11 The result of this process is that the Near-level layer can be colour-coded to show Subcharacter Type, Character Type or Broad Character Type of the features and activities taking place in any given tier, or an amalgamation of all three.

4.2.12 The project specification also requested that a confidence value be assigned. Applying meaningful confidence values to Near-level data is issue laden as it contains multiple attributes, to all of which can be assigned some level of confidence. As confidence is not a variable that can be ascribed in the abstract (one is always confident about something, never merely 'confident'), it is also not susceptible to meaningful combination. The original project's understandable desire to solve this problem led to epistemically dubious categories such as 'high likelihood of certainty'. OA's approach has been to assign a value of much more limited scope – namely, the degree of locational certainty of the dominant Subcharacter Type. In other words, Subcharacter Types were assigned a confidence value based on the researcher's degree of certainty that boundaries of a polygon correctly identified the spatial extent of an entity. For this reason, humanly determined areas such as military zones and protected areas tended to score highly, whereas natural entities such as sandbanks or named areas were considered more vague. Finally, the Near-level polygons were given a value commensurate with their dominant Subcharacter Type. Once again, this query could be rerun by future researchers if they wished to use a separate definition of confidence. In order to provide a confidence level that gave a more general picture, a confidence rating was also given to entities in the Character Areas Layer, details of which are given in Section 5, below.

4.2.13 After editing the semantic data of each polygon, co-extensive polygons caused due to internal overlapping in some primary datasets (see above) had to be dealt with. The technique used was to create a topology for the newly-created Near-level dataset. A topology is a set of rules which dictate the formal 'correctness' of a spatial layer. ArcGIS provides the capacity to establish such a rule set as long as the dataset is held within a 'Feature Dataset' within the geodatabase. The topology can then be created within the same Feature Dataset and rules ascribed. In this case the rule of 'no overlapping polygons' was used. The topology then allows the user both to identify areas of the layer which conflict with the ruleset, and offers a series of options with which to resolve them. Here, the general solution was to delete the overlapping section of one of the two polygons, based on the relative significances of the Subcharacter

Types assigned to them.

4.2.14 One potential feature which was not ultimately implemented was a direct reference within the Near-level data to 'relevant' primary data sources. The desire for such information is based on the intuitive assumption that each polygon created relates to only one or two of the Primary datasets. Whilst in the initial unioning process, each polygon does refer to specific entities in a subset of the Primary datasets (from which one might infer 'relevance') this is in fact misleading. Each Primary dataset is a *total* picture of the study area. Therefore presence and absence are equally important. Although datasets do not state categorically that Subcharacter Type *x* is not found at such-and-such locations, they are statements to the effect that it is not present to the best of the compiler's knowledge. Hence all Primary datasets are relevant to all areas within the region and it would be inaccurate (and potentially dangerous) to imply otherwise.

4.2.15 The final output is subjective, in that certain Subcharacter Types override other ones, but is to a large extent extensible and repeatable, as the same process can be undertaken with updated or additional Primary Data or Subcharacter Type rankings. It is important to reiterate here that no method of marine mapping enables one to perceive all elements of that environment simultaneously. The purpose of the Near-level layer is to give the analyst a broad-brushed sketch of the principal activities taking place within certain zones and tiers. Whilst it cannot provide *comprehensive* coverage it can enable them to identify natural and implied breaks and continuities. It also needs to be clear on what basis that coverage has been created so that it might be recompiled with alternative values. This goal has been achieved to a large extent, with the exception of dealing with internal overlap in primary datasets.

4.2.16 The Subcharacter Types, Character Types and Broad Character Types are listed in the table below. Descriptions of each, along with their tier and confidence rating are given in Appendix II: Character Type Descriptions

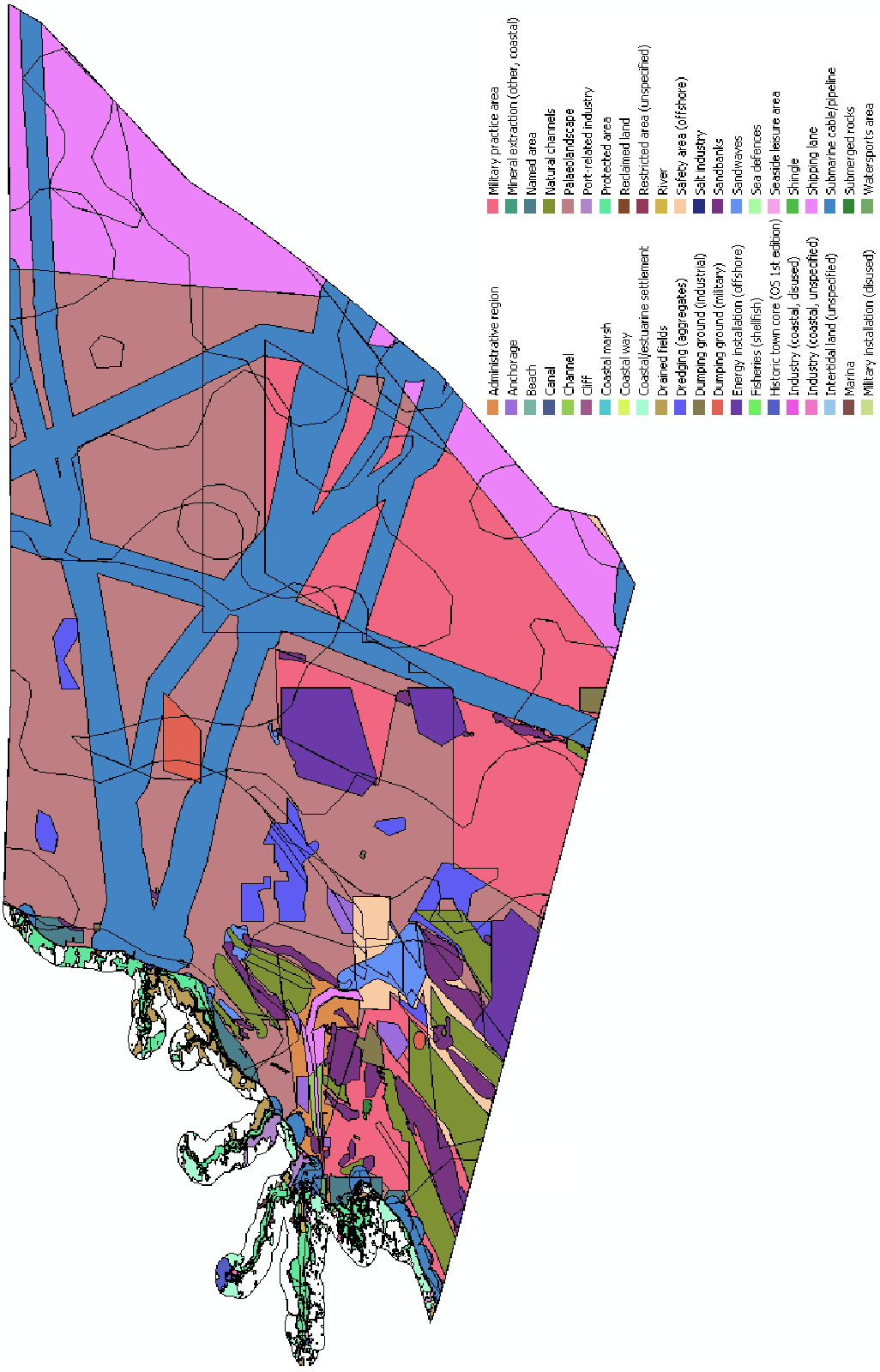
Table 4: Subcharacter Types by Character Type and Broad Character Type

Broad Character Type	***Character Type***	***Subcharacter Type***
INDUSTRY	Coastal industry	Energy installation (coastal)
INDUSTRY	Coastal industry	Industry (coastal, disused)
INDUSTRY	Coastal industry	Industry (coastal, unspecified)
INDUSTRY	Coastal industry	Mineral extraction (other, coastal)
INDUSTRY	Coastal industry	Salt industry
INDUSTRY	Fisheries and Mari-culture	Fish farming
INDUSTRY	Fisheries and Mari-culture	Fisheries
INDUSTRY	Fisheries and Mari-culture	Fisheries (shellfish)
INDUSTRY	Intrusive offshore industry	Dredging (aggregates)
INDUSTRY	Intrusive offshore industry	Dredging (unspecified)
INDUSTRY	Intrusive offshore industry	Dumping ground (industrial)
INDUSTRY	Intrusive offshore industry	Energy installation (offshore)
INDUSTRY	Intrusive offshore industry	Mineral extraction (oil/gas)
INDUSTRY	Intrusive offshore industry	Mineral extraction (other, offshore)
INDUSTRY	Non-intrusive offshore industry	Submarine cable/pipeline
INDUSTRY	Ports, docks & harbours	Administrative region
INDUSTRY	Ports, docks & harbours	Port-related industry

INDUSTRY	Ports, docks & harbours	Port-related industry (disused)
INDUSTRY	Ports, docks & harbours	Quarantine area
INDUSTRY	Ports, docks & harbours	Ship/boatbuilders yard
INDUSTRY	Ports, docks & harbours	Shipbreakers yard
MILITARY	Coastal military	Military installation
MILITARY	Coastal military	Military installation (disused)
MILITARY	Coastal military	Naval dockyard
MILITARY	Offshore military	Dumping ground (military)
MILITARY	Offshore military	Military practice area
NATURAL LANDSCAPE	Coastal environment	Cliff
NATURAL LANDSCAPE	Coastal environment	Coastal marsh
NATURAL LANDSCAPE	Coastal environment	Intertidal land (unspecified)
NATURAL LANDSCAPE	Coastal environment	Mudflats
NATURAL LANDSCAPE	Coastal environment	Named area
NATURAL LANDSCAPE	Coastal environment	Natural channels
NATURAL LANDSCAPE	Coastal environment	Protected area
NATURAL LANDSCAPE	Coastal environment	River
NATURAL LANDSCAPE	Coastal environment	Saltmarsh
NATURAL LANDSCAPE	Coastal environment	Sand dunes
NATURAL LANDSCAPE	Coastal environment	Sandbanks
NATURAL LANDSCAPE	Coastal environment	Sandwaves
NATURAL LANDSCAPE	Coastal environment	Shingle
NATURAL LANDSCAPE	Coastal environment	Terrestrial component
NATURAL LANDSCAPE	Coastal environment	Woodland
NATURAL LANDSCAPE	Prehistoric land surface	Palaeochannels
NATURAL LANDSCAPE	Prehistoric land surface	Palaeolandscape
NATURAL LANDSCAPE	Prehistoric land surface	Peat bed
NATURAL LANDSCAPE	Prehistoric land surface	Submerged forest
NAVIGATION	Navigation activity	Anchorage
NAVIGATION	Navigation activity	Anchorage (disused)
NAVIGATION	Navigation activity	Canal
NAVIGATION	Navigation activity	Ferry route
NAVIGATION	Navigation activity	Maritime safety installation
NAVIGATION	Navigation activity	Safety area (offshore)
NAVIGATION	Navigation activity	Shipping lane
NAVIGATION	Navigation feature	Channel
NAVIGATION	Navigation feature	Channel (disused)
NAVIGATION	Navigation feature	Channel (disused, buried)
NAVIGATION	Navigation hazard	Caution area
NAVIGATION	Navigation hazard	Drying area
NAVIGATION	Navigation hazard	Restricted area (unspecified)
NAVIGATION	Navigation hazard	Submerged rocks
NAVIGATION	Navigation hazard	Water Turbulence
RECREATION	Coastal recreation	Beach
RECREATION	Coastal recreation	Coastal way
RECREATION	Coastal recreation	Marina
RECREATION	Coastal recreation	Protected recreation area
RECREATION	Coastal recreation	Seaside leisure area

RECREATION	Offshore recreation	Dive site
RECREATION	Offshore recreation	Leisure fishing area
RECREATION	Offshore recreation	Sailing area
RECREATION	Offshore recreation	Watersports area
SETTLEMENT	Coastal settlement	Coastal/estuarine settlement
SETTLEMENT	Coastal settlement	Drained fields
SETTLEMENT	Coastal settlement	Historic town core (OS 1st edition)
SETTLEMENT	Coastal settlement	Lost settlement
SETTLEMENT	Coastal settlement	Reclaimed land
SETTLEMENT	Coastal settlement	Sea defences

Map 1: Dominant Subcharacter Type across the Study Area



5 Stage 3: Character Areas

5.1 Introduction

5.1.1 Once the Near-level layer has been created, the third and final stage is to create the Character Areas layer The polygons on this layer represent specific 'locales' with individual identities arising from the mix of Near-level polygons they circumscribe, unique features contained within them and perceptions held of them by coastal communities and coastal users. These identities are documented digitally via a series of webpages and associated interactive maps which allow stakeholders to explore them in much greater detail. This layer is not a static 'end product', however. Rather, the analyses presented by the research team are preliminary and not conclusive. It is a living document and hence open to future contribution by anyone with the requisite understanding to do so.

5.2 Creating the Character Area Layer

5.2.1 Two principal alternatives were considered when creating the Character Area layer. The first was to use some form of automated or semi-automated process by which to derive them from the Near-level data. The second was to use human interpretation. It was ultimately decided to adopt the latter approach for the following reasons:

- Density of sea use varies dramatically across the study region. Because of this, divisions that might be considered legitimate in remote areas, e.g. the boundary of a deep sea shipping-lane), would be considered too weak (i.e. would lead to too much fragmentation) in more complex areas.
- In a number of cases, large areas of sea need to be characterised which may have only one or two widely separated features within them. It is very difficult to automate a judgment as to where a boundary between such features should naturally lie.
- As this is the final spatial dataset generated, and further data is not derived from it, it is less important to have a dataset that can be replicated by a deterministic process.
- Occasionally there are regions which are understood conceptually by the local population (e.g. The Naze) but which cannot be recognized as specific patterns by computation alone. It would scientistic to ignore such evident candidates for Character Areas in favour of computer-generated artefacts, even if they can be shown to be more homogeneous.

5.2.2 Finally it should be remarked that both terrestrial and marine characterisation, despite their use of GIS, are ultimately processes of interpretation. Interpretation is introduced

- in the attributes assigned by data-providers to the primary datasets
- in the choice of what datasets to incorporate
- in the mapping of source attributes to Subcharacter Types
- in the choice of what constitutes the Dominant Subcharacter Type

- In the professional and technical knowledge of the characteriser

5.2.3 At the final stage, it is human interpretation which must decide what constitutes a Character Area. Such areas are no more 'real' than the significance that we choose to ascribe to them. But they do give us a useful medium by which we can start to describe the marine landscape and features of it which we consider important.

5.2.4 The process of defining Character Areas is relatively simple. An iterative approach was used in which the research team used the GIS system to view all the attributes of the Near-level data. From these, obvious candidates for Character Areas were identified. Following this, areas of increasingly less heterogeneity were able to be identified by subdividing remaining regions by the most appropriate lines of division. Despite the hi-tech options available, this proves to be most easily done using a large-scale printout of the Near-level data (colour-coded to show dominant Subcharacter Types) and a marker pen. Once a provisional set of Character Areas had been established, this was digitized using a topology to ensure that all polygons had adjacent boundaries. The digitized Character Area layer was then overlain on the Near-level data and re-evaluated, along with secondary data sources. Errors, discrepancies and 'poor-fits' were identified and the Character Areas layer amended to correct them. The end result gave a set of contiguous areas which reflects the diverse nature of the marine landscape. The GIS table underlying the Character Areas was then expanded to include a 'name' field, and appellations were given based, where possible, on established names (e.g. Kentish Knock). Where this could not be done, more descriptive titles were given (e.g. Cable Junction).

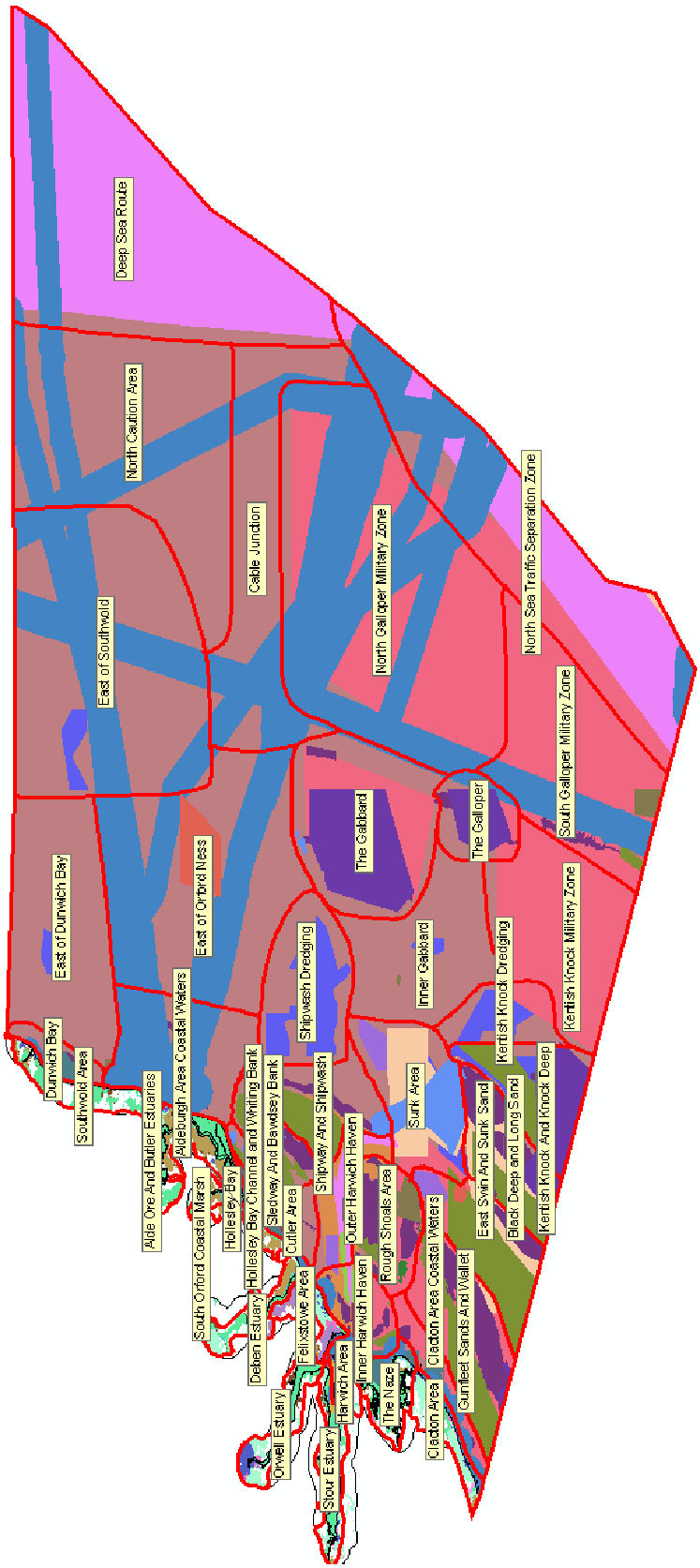
5.2.5 As many end-users will not have access to the Near-level data for copyright reasons it was decided to give an indication of the most important Subcharacter Type for the area. This was decided upon by the marine archaeologist based on a consideration of Near-level, Secondary and Literary sources. The Character Area Attribute table was extended to include a field for the Subcharacter Type ID, which thereby allowed for Character Areas to be themed by Subcharacter Type, Character Type and Broad Character Type. A further field indicating a confidence level, based on a survey of the quantity and quality of sources available was also included.

5.2.6 In total, 41 character areas were created (see list below). These comprise a variety of areas of different size and character. Overall, ten of the areas were coastal, the remainder were offshore; four of the coastal areas were estuarine. Perhaps unsurprisingly a large number of the character areas clustered around the southwest corner of the study area, in the locales of the Harwich and Felixstowe ports and on the main approach to the Thames Estuary. These areas were generally smaller than many of the other offshore areas due to highly concentrated maritime activity and were often associated with navigation. Further north and east of this area, the character areas became larger and less complicated in terms of maritime use.

Table 5: Character Areas

Character Areas
Alde Ore And Butley Estuaries
Aldeburgh Area Coastal Waters
Black Deep and Long Sand
Cable Junction
Clacton Area
Clacton Area Coastal Waters
Cutler Area
Deben Estuary
Deep Sea Route
Dunwich Bay
East of Dunwich Bay
East of Orford Ness
East of Southwold
East Swin And Sunk Sand
Felixstowe Area
Gunfleet Sands And Wallet
Harwich Area
Hollesley Bay
Hollesley Bay Channel and Whiting Bank
Inner Gabbard East
Inner Harwich Haven
Kentish Knock And Knock Deep
Kentish Knock Dredging
Kentish Knock Military Zone
North Caution Area
North Galloper Military Zone
North Sea Traffic Separation Zone
Orwell Estuary
Outer Harwich Haven
Rough Shoals Area
Shipwash Dredging
Shipway And Shipwash
Sledway And Bawdsey Bank
South Galloper Military Zone
South Orford Coastal Marsh
Southwold Area
Stour Estuary
The Gabbard
The Galloper
The Naze
The Sunk

Map 2: Character Areas



5.3 Compiling Character Area Texts

5.3.1 With the Character Areas now fixed, analysis and description could begin. The data for this came from all three source types: primary, secondary and literary. Primary sources were analysed both as the derived Near-level data and the original datasets. Near-level data was useful in understanding the predominant characteristics of an area, as well as their proportional impact in comparison to other factors. From this could be ascertained, for example, which tiers were important to an understanding of the locale, the relative density of wrecks and obstructions, and which of the Broad Character Types was most applicable. The original sources were used in order to find out individual details, such as the names of important sandbanks, the nature of protected sites and so on. Secondary sources were used to provide important semantic and contextual information as well as identify relationships between adjacent Character Areas. This included data such as current environment (Tidal range, geology, bathymetry), shipping and sailing information and monument data from the NMR and SMR.

5.3.2 Literary sources could clearly not be integrated into the GIS but provided a rich factual source which was vital in understanding both the study area as a whole as well as giving local colour and a better understanding of regional perceptions. The internet was a particularly useful source of data, especially with regard to visual media. Literary searches were made of the Oxford Bodleian library database using key words relevant to the project. In addition, bibliography from known literature was searched. The type of sources located included general works about maritime East Anglia and the ports and more specific sources relating to individual areas. The literary sources used are summarised in the Bibliography as well as in the Character Area descriptions themselves. In general, a number of literary sources were found to be useful, in particular Tom Williamson's Landscape history of East Anglia (2006), Russell Edwards 'The Suffolk Coast' (1991) and Ports of the Eastern Counties (Wren 1976). Additionally, documents published by Natural England were found to give a good overview of the character of the coastal area. Fortunately, coastal surveys have been conducted for both the Essex and Suffolk coastlines (Wilkinson and Murphy 1995, Suffolk County Council 2006), both of which provided an invaluable source of data to inform the character descriptions.

5.3.3 Lastly, a number of sources came from individuals or organisations. For example, the British Sub-Aqua club supplied general locations in which diving may take place within the study area. This information was very general but gave a potential for each area. The Eastern Sea Fisheries Committee (ESFJC) and Kent and Essex Sea Fisheries Committee (KESFC) supplied data concerning fishing vessels, the numbers involved and from which ports they launched. Recreational fishing data was taken from a local sea fishing website (http://www.leader-lines.com).

5.3.4 A final consideration was that, although the project and future EH-commissioned researchers would be able to use the Near-level data to gain a quick visual representation of the nature of each Character Area, this data would not be freely available to the general public. For this reason it was felt important to list the main dominant Subcharacter Types found in each area within its description. This means that users are able to understand the principle trends without having to read each description in turn. This is naturally only a heuristic device – for even a basic

understanding of each area users will still need to refer to the text.

5.3.5 It should be noted that some of the character areas are in a state of flux as a result of increased offshore development and their characterisations will need updating within the next few years. For example, the Gabbard and Galloper areas are currently characterised by their navigational role but planning consent has been given for huge windfarm developments, to be constructed by 2010.

5.3.6 The character areas are available to view in the form of web pages (discussed below). An example Character Area description for the Naze area is given below. The characterisation descriptions were subdivided into Main character / current form and use, historic character and archaeological potential and character perceptions The web pages will contain links to a bibliography, glossary and visual media. The words to be contained in the glossary are, for demonstration, highlighted in the example below in bold.

5.4 Example Character Area Text

THE NAZE

Main Character / current form and use

The Naze is located in the south of the study area, on the Essex side of the Suffolk/Essex border. The majority of the character area comprises the low-lying areas known as Hamford Water and Walton Backwaters. This is a large, shallow, estuarine basin comprising over 2000 hectares of tidal creeks and islands, saline lagoons, intertidal mudflats, sandflats and saltmarsh, backed to the south by Early Pleistocene Red Crag cliffs, up to 15 m high. The area also includes the Naze foreshore and public open space, containing the John Weston nature reserve. It is characterised today by its status as an internationally recognised area for wildlife and fossils. Walton Backwaters is a **RAMSAR** site, Hamford Water is a Special Protection Area **(SPA)** and the cliffs and foreshore are included within a Site of Special Scientific Interest (**SSSI)** as a result of the land and sea fossils exposed within the cliff face. Offshore the area also incorporates Pennyhole Bay, a shallow sea area and secluded beach.

The basin is located within the larger estuarine system of the Stour/Orwell and environment and character is dominated by these estuaries (DEFRA 2002b, 45). Localised **longshore drift** along the open coast moves sediment north from the Naze to form a spit of land with Stone Point at its northern tip, extending to Pye Sands. This system restricts the width of the channel and is overtopped at high tide allowing extensive salt marshes to develop on either side (*ibid*). As a result the area supports unusual assemblages of invertebrates and plants, different to those of the adjacent estuaries or open sea. The area is probably most significant as a refuge for birds, and is accordingly designated an SPA. Horsey Island is the largest of the islands and supports a colony of over 70 harbour seals and grey seals; Skippers Island is a protected bird sanctuary.

The underlying geology has had an important influence on the character of the area. This comprises Eocene rocks, overlain by a London Clay, a sequence of Quaternary sands and gravels, Holocene sands and muds. Much of the sand today is created

through erosion of the Red Crag cliffs which is also threatening the area.

Historic Character and archaeological potential

The Naze once formed the northern side of the major river valley which contained the Thames, Medway, Crouch, Colne and Blackwater and their minor tributaries before rising sea levels drowned them c. 8000 years ago (D'Olier 2002, 16). This setting, close to the coastline and major estuaries high in marine resources, suggests the Naze was a prime location for early human settlement.

The majority of archaeological material from this area was found at Stone Point, possibly representing a palaeo land surface broken up by the sea (Wilkinson and Murphy 1995). The assemblage included a tanged point which may place settlement in the area as early as the Upper Palaeolithic (Jacobi 1980a). The **Mesolithic** was represented at Stone Point by a significant assemblage of **microliths** which may indicate that some of the Mesolithic activity in the area took place when the main part of the major Mesolithic sea level rise had taken place and the coast had reached its present outline (with the exception of coastal erosion). The discovery of Neolithic pottery and axeheads may indicate that settlement was continuous.

Notably the character area lies within a section of the coastline in which a buried land surface outcrops, termed the 'Lyonesse surface,' by S. Hazzledine Warren in the early 20th century. Today the surface is depleted due to coastal erosion and development, though patches are present at the Walton end of the Naze Evidence suggests the surface was inundated in the Neolithic period, shortly after 3800-3700 BP (Wilkinson and Murphy 1995, 101). Warren located Beaker sites, pits and flint scatters indicating continuity of settlement from early to late Neolithic. It is probable that Prehistoric settlers exploited the landscape using craft such as logboats, an example of which was seen at Walton strand in 1936. Settlement appears to be discontinued in this area of the coast after the Prehistoric period, though **Red Hills** were also found at Stone Point/ Walton.

The headland is characterised by The Naze Tower, constructed by Trinity House on the Naze cliffs in 1721 (see link). The headland surrounding the Naze Tower was originally privately owned land and became a golf course in 1928. In 1963 the land was bought by local authorities and remains a public open area.

In the 19th century the western area of the Naze, inland from Walton, was a centre for busy coastal trade. This is represented by Beaumont Quay (see link). Victorian sea defences were constructed in order to try and save the area from further erosion, including the 'Tamarisk Wall.' During World War II the area was mined and access restricted and the sea defences fell into disrepair and were almost completely destroyed by the 1953 storm surge (see link).

In total, 26 wrecks are recorded within the character area, though most of these were deliberately scuppered by the National Rivers Authority to protect Horsey Island. The coastal strip also contains 19 listed buildings and a number of pill boxes and 20th century defences. Three scheduled monuments include two WWII bombing decoys at Kirby-le-Soken and a post-medieval duck decoy pond situated at the western end of Horsey Island.

Character perceptions

The character area is important to the region in terms of its natural significance and as a visitor attraction. Its importance is illustrated by formation of The Naze Protection Society, a local group which works towards finding a solution to the ongoing erosion problems with local and central authorities. The site is also internationally renowned for its wildlife.

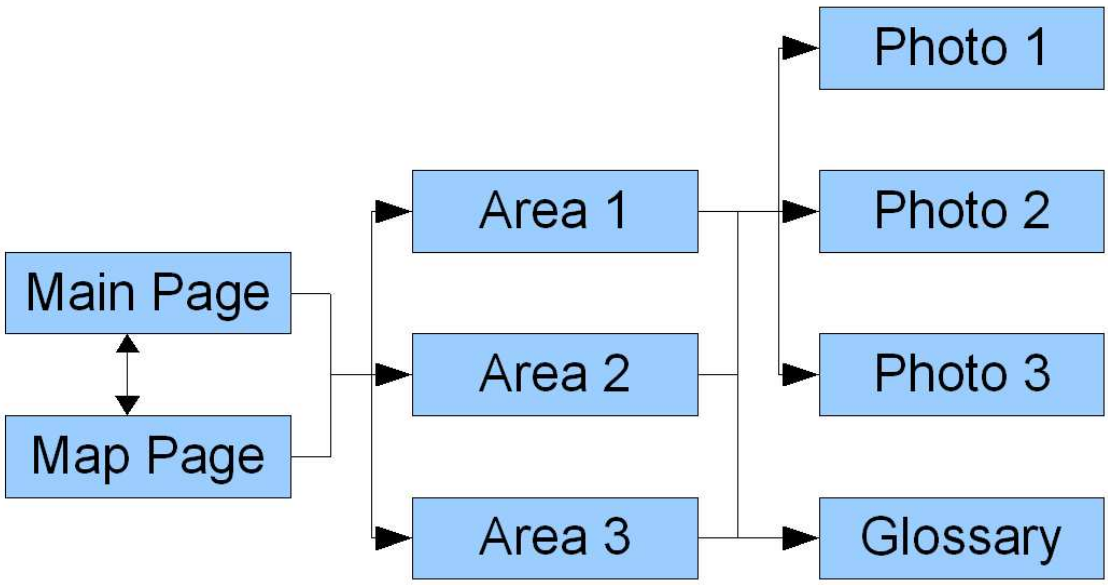
The Hamford Water / Walton Backwaters area is well known as the setting for Arthur Ransome's novel 'Secret Water', the eighth book of the Swallows and Amazons children's series, published in 1939. In addition the area was once home to William Witney Gull who became Queen Victoria's personal physician and is rumoured to have been Jack the Ripper. His house still remains standing at Landermere quay.

In combination with its function as a natural attraction, the Naze is very popular for recreational sailing and a number of marinas have been constructed within Walton Backwaters. The sandbank areas around Pye sand and Crabknowe spit can be very shallow at low water and act as a hazard to small boats and two dangerous wrecks are also recorded.

5.5 The Web Resource

5.5.1 In order to create a resource that is easily and readily disseminable to the general public as per EH's strategy and research agendas (Embree and Stevens 2005; English Heritage 2005), the medium of web pages were specified by EH. The principal features requested were separate pages for each Character Area. These needed to accessible either by hyperlink or via a map with hotlinks. Photographs and other images also needed to have their own pages so that relevant metadata could be included without impeding the flow of the descriptive text. We decided to use a simple structure, following in part from Wessex's approach although with a different approach to mapping and abandoning the tables of 'sensitivity' which we feel to be the role of planning authorities rather than HLC *per se*, although HLCs are designed to inform such assessments. The structure of the webpages is given in the diagram below.

Illustration 2: Schematic diagram of webpages



5.5.2 In order to give a standardized look-and-feel, a single Cascading Style Sheet (CSS) was used and the textual information was written in eXtensible Markup Language (XML). This effectively means that there is an abstraction layer between information and representation so that the website can be revamped and/or rebranded by EH if and when it should become necessary. Using CSS also allowed pages to have a variable menu bar which displayed not only standard links to the home, mapping and glossary pages, but also context-specific links to images. Although no multimedia files were included, the webpages can easily be extended to incorporate them. Wessex also used CSS, but in addition to the external stylesheets many representational elements were included in each webpage which was unnecessary as it made maintenance much more difficult. Exceptions to the default look-and-feel can be introduced more easily by simply writing a new CSS specifically for the required page.

5.5.3 XSL (eXtensible Stylesheet Language) was used to give the data stored in XML files a web look. It basically transforms XML files into webpages according to the type of information stored and also adds links to the CSS files and embeds Javascript code. In order to separate the menu from the data, the display name and the link to the specific webpage is stored in a .js file where menu items are recorded in JSON (JavaScript Object Notation) format, so they can easily be modified, deleted and new items can be added easily. Javascript was used to update the links to stylesheets depending on the position of the current webpage in the structure and to take the menu items from the 'menu.js' file and create the menu on each page. This approach was chosen in order to create a clear distinction between the information and presentation layers. The only other way to do this and make the entire site work from a CD was to use an AJAX (Asynchronous Javascript And XML) object to retrieve information outside the current webpage, which doesn't work offline with the Internet Explorer browser.

5.5.4 An entirely different approach was used for the webmapping. Wessex used an attractive but very heavy duty method which involved splitting an image of the GIS into a large number of separate segments, each of which was several megabytes in

size. As a result, the storage requirements of the website were almost doubled, to the extent that it had to be recorded on DVD rather than CD-ROM. This project used a useful tool in the MapInfo GIS package called 'HTML Image Map' which enables the user to export a spatial dataset into a HyperText Markep Language (HTML) page containing a series of 'hotlinks' with a JPEG image as a backdrop. The underlying webpage source can then be updated to link to the relevant Character Area description pages. The Character Area Layer was colour-coded to show different Character Types and labelled by name before exporting in this manner. The end result was a simple but very effective spatial breakdown of the study area that enables web-users to easily explore the maritime aspects of the region.

6 Metadata

6.1.1 In order to ensure that future users of the GIS Database are fully informed as to the origins and other qualities of the data, a full set of metadata was incorporated within it and an accompanying README file was created. In consultation with English Heritage, the UKGEMINI metadata standards were used and the following information was provided for each layer (optional attributes which were not directly relevant or to be decided by EH were left out):

- A.1 Title
- A.3 Dataset language
- A.4 Abstract
- A.5 Topic category
- A.6 Subject
- A.7 Date
- A.8 Dataset reference date
- A.9 Originator
- A.10 Lineage
- A.11 West bounding coordinate
- A.12 East bounding coordinate
- A.13 North bounding coordinate
- A.14 South bounding coordinate
- A.15 Extent
- A.17 Spatial reference system
- A.19 Spatial representation type
- A.21 Data format
- A.23 Distributor
- A.24 Frequency of update
- A.27 Additional information source
- A.30 Date of update of Metadata
- A.31 Metadata standard name
- A.32 Metadata standard version

6.1.2 The README file contains information about the purpose of the database, its contents (for those who may not already have access to ArcGIS), and how to use it in conjunction with the accompanying ArcGIS MXD file.

7 Post-Project Summary

7.1 Conclusions

7.1.1 The following list is a summary of the most significant conclusions arising the project, with specific regard to the evaluation and adaptation of the Liverpool Bay methodology:

7.1.2 Terrestrial HLC is a useful point of departure in attempting a 'total' approach to mapping of the marine environment. However, many of its theoretical underpinnings rely heavily on aspects of the terrestrial zone and the process requires some modification to ensure that it works effectively within the maritime sphere. In order to maintain methodological clarity it may prove useful to refer to the processes currently in development as a Historic Seascape Characterisation (HSC) or Marine Spatial Planning Tool.

7.1.3 The general framework developed by Wessex for Liverpool Bay, namely the generation of a Near-level layer from primary datasets, and thereafter a Character Areas layer, appears to be robust enough to be meaningfully applied to other regions.

7.1.4 A philosophy of software-agnosticism is advocated for what is likely to be a long-term programme of characterisation undertaken by a number of different organisations. Hence, only processes, rather than the use of individual software packages, should be considered a part of the methodology (although software used should be recorded as metadata).

7.1.5 The use of bathymetric data was not considered to be a good basis for differentiation of palaeolandscapes within the area under consideration. Given the paucity of relevant data, a general acknowledgment that the entire area potentially contained significant archaeological data appeared to be the best strategy in this case.It is anticipated that the 3D seismic modelling project outlined above should move towards addressing this issue.

7.1.6 Dividing the study area into coastal and marine zones with a clearly defined border greatly facilitated integration.

7.1.7 A number of changes were made to the Subcharacter Type and Character typologies. As with terrestrial HLC, a degree of variation is considered to be acceptable between projects at this level (rather than at Broad Character Type level which should remain identical). However, the use of Character Types described as 'modern' or 'historic' is discouraged as it runs counter to the basic principles of HLC

7.1.8 The use of kernel-density algorithms was found to be a useful way of incorporating point datasets. An ordinal metric based on a logarithmic scale proved in this case to be a useful way to separate the generated raster into zones indicating 'probability of encounter'.

7.1.9 Internally overlapping datasets, whether due to poor primary data or inevitable nesting of named areas proved to be a major issue at the union stage. Although this only affects the Near-level dataset, which will not be disseminated publicly, it still runs counter to the ADS guidelines on good GIS practice. The only solution found to this problem was correction by hand which does not seem to be cost-effective. Further research should be done here in order to find a more suitable solution.

7.1.10 The use of a 'tiered' approach to Subcharacter Types allows researchers to gain a clearer picture of where and how certain types of activity affect the marine zone.

7.1.11 Good database normalisation makes the thematisation of the Near-level data far simpler and enables it to be updated much more quickly and easily.

7.1.12 Although a clearly defined 'confidence' field was used for the Near-level data, the research team were less confident that it would find practical application. The specific purpose of such a field should be re-evaluated. It was, however, more meaningfully applied to the Character Areas.

7.1.13 A number of crucial datasets are currently unavailable for seascapes projects such as spatial data for fishing grounds and other recreational activities. In addition the available dataset also has inherent weaknesses. For example, shipwreck data in any location is biased towards losses in the last 250 years and certain types of vessel such as military or large ships, and location data may not be 100% accurate (WA2005, 27). The identification and discussion of such limitations can be seen as an integral part of the process.

7.2 Recommendations

7.2.1 It is recommended that the palaeolandscape dataset should be updated as information becomes more readily available and consideration should perhaps be given to incorporating costs for industrial data into future project budgets. In addition, though shoreline reconstruction can have its drawbacks, it is recommended that a simple exercise be undertaken using a programme such as Surfer in future projects in order to highlight possible areas of archaeological significance where the shoreline remained constant for a long period of time.

7.2.2 The database will require regular updating in all aspects of its character. As discussed earlier change is inevitable considering the increased pressure on the marine and intertidal environment.

7.2.3 There is scope for further work within the seascapes project. In particular two lines of research may be crucial to final characterisation but were not deemed to be within the scope of the current project. Firstly, lines of vision from land to sea and vice versa are considered crucial to inform about man’s complex and changing relationship with the sea (see Parker 2001). As such, field survey using established pro formas and research cruises to establish these viewsheds should be undertaken within the area. Secondly, as the sea can be a source of livelihood as well as myth and legend, local perceptions should be obtained by way of interviews or surveys within local populations and workers.

7.2.4 Finally, it would be beneficial to continue researching and collating information about character areas for which very little data has been found or currently exists.

7.3 Usage Scenarios

7.3.1 A range of usage scenarios are envisaged, encompassing governance, commerce, academic research and tourism. Potential stakeholders include:

- Planning Authorities
- Industry planners
- Government departments
- Coastal communities and coastal users
- Agencies promoting local development
- Conservation organisations
- Special interest groups (e.g. divers)

7.3.2 Three possible examples are provided below:

7.3.3 Scenario 1: Aggregates Dredging

7.3.4 The planner for a commercial aggregates dredging firm, *X*, is seeking to locate new potential areas for extraction. The Character Areas map in the GIS provides an at-a-glance view of areas where such extraction has been done in the past, as well as major areas of shipping. This enables *X*'s planning department to rapidly isolate the regions of the marine zone which are almost certainly unsuitable for aggregates dredging (thereby saving time and money from unnecessary research into those areas), as well as providing a shortlist of candidates in which there are likely to be fewer complicating factors. By accessing the on-line Character Area descriptions, they are provided with much greater detail about the region, including an outline of what those factors may be and a list of sources from which they can gather further information. The confidence level assigned to each Character Area also helps to give an indication as to whether 'as-yet-unknown' variables are likely to become involved. Having narrowed down their set of areas still further, *X* adds the Character Area layer into their own GIS so as to compare it with privately purchased geological and bathymetric data in order to ascertain which is most suitable for extraction, resulting in just two remaining areas. These provide the basis for a greatly more focussed, and hence cost-effective, research program from which three alternative proposals are outlined and presented to government.

7.3.5 Scenario 2: Academic Research

7.3.6 A lecturer at the University of East Anglia, *Y*, wants to undertake a research project on patterns in traditional sea use around the East Anglian coastline. The Character Areas map enables her to immediately ascertain that the region to the east of Harwich and Felixstowe is immensely important to shipping, whereas the modern use of other coastal areas appear to be mainly associated with leisure sailing, partly due to the natural beauty of much of the coastline. *Y*'s request to EH to access the Near-level data is accepted and she is able to further comprehend the way in which the natural sand formations near the mouth of the Stour Estuary, as well as features further out such as the Gabbard and Galloper, have led to very sophisticated navigation patterning. By comparing wreck density with more modern shipping data, such as that provided by the Royal Yachting Association and Maritime and Coastguard Agency, she is also able

to determine that there has historically been much more coastal trade than there is today. By accessing the on-line webpages, she is presented with descriptions of areas in which shipping has been extremely important and an extensive bibliography with which to continue her research. Once her project has been completed she provides a copy to EH who are able to incorporate the results back into the Character Area descriptions.

7.3.7 Scenario 3: Tourism

7.3.8 A Scottish holiday-maker from Aberdeen, *Z*, wants to sail down the East Coast of England with his family, visiting scenic and historic coastal sites en route. The on-line Character Areas map immediately enables *Z* to see that much of the Suffolk and Essex Coastline has protected status and hence may be of interest. By clicking on the map he is taken directly to a webpage giving much more detail about the regions concerned. From this he and his wife are not only able to plan an itinerary which takes them to a number of local beauty spots, but also to entertain their children with tales of the lost city of Dunwich as they sail by...

8 References

Andersen, S. H., 1987, Mesolithic Dug-Outs and Paddles from Tybrind Vig, Denmark, *Acta Archaeologica,* 57: 87-106

Austin, L., 1997, Palaeolithic and Mesolithic. In Glazebrook, J., ed., 1997, Research and Archaeology: A Framework for the Eastern Counties, 1. Resource 5-11 Assessment. EAA occ. paper 3 Sole Archaeological Committee: Norwich

Cooper, N., 2002, Erosion of the salt marshes of Essex between 1988 and 1998. Report to Environment Agency

Clark, J., Darlington, J. & Fairclough, G., 2004, Using Historic Landscape Characterisation: English Heritage's review of HLC Applications 2002 - 03. English Heritage & Lancashire County Council

Department for Environment Food and Rural Affairs, 2002, Safeguarding Our Seas: A Strategy for the Conservation and Sustainable Development of our Marine Environment. Defra

Department for Environment Food and Rural Affairs, 2002, Suffolk Coast and Estuaries Coastal Habitat Management Plan Final Report. Defra

Department for Environment Food and Rural Affairs, 2002, Essex Coast and Estuaries Coastal Habitat Management Plan Final Report. Defra

Department for Environment Food and Rural Affairs, 2006, A Marine Bill: A consultation document of the Department for Environment, Food and Rural Affairs. Defra

D'Olier, Wallingford, B. H. R., 2002, Southern North Sea Sediment Transport Study, Phase (appendix 10). Technical Report. CEFAS/UEA

Dymond, D., 1999, An Historical Atlas of Suffolk. Suffolk County Council

Edwards, R., 1991, The Suffolk Coast. Terence Dalton Ltd

Fairclough, G., Lambrick. G & McNab, A., 1999, Yesterday's World, Tomorrow's Landscape: The English Heritage Historic Landscape Project 1992-94. English Heritage

Fleming, N.C. 2002, The scope of Strategic Environmental Assessment of North Sea areas SEA3 and SEA2 in regard to prehistoric archaeological remains. Department of Trade and Industry

Hill, M., Briggs, J., Minto, P., Bagnall, D., Foley, K., & Williams, A., 2002, Guide to Best Practice In Seascape Assessment. The Marine Institute

Jacobi, R. M., 1980, 'Late-glacial settlement in Essex. In Buckley, D. G. (ed.), 1980, Archaeology in Essex to AD 1500: in memory of Ken Newton. Counc. Brit. Archaeol. Rep. 34, 12-13

Leader Lines. Available at: http://www.leader-lines.com/ (07/03/2007)

Louwe Kooijmans, L. P., 1970-71, Mesolithic bone and antler implements from the North Sea and from the Netherlands. *Ber Rijksdienst oudheidk. bodemonderz.* 20/21, 27-73, plus plates

Malster, R., 1969, Maritime East Anglia. Maritime Museum for East Anglia

MSPP Consortium, 2006, Marine Spatial Planning Plot: Final Report. MSPP Consortium

Parker, A. J., 2001, Maritime Landscapes. In Muir, R. (ed.), Landscapes. Windgather Press

Suffolk District Council, 2001, Suffolk Coastal Local Plan Incorporating the First Alteration.

Suffolk Coastal District Council

Wessex Archaeology, 2006, England's Historic Seascapes: The Liverpool Bay Pilot. Wessex Archaeology

Wessex Archaeology, 2005, Strategic Environment Assessment Sea 6: Irish Sea; Maritime Archaeology. Wessex Archaeology

Wheatley, K., 1990, National Maritime Museum Guide to Maritime Britain. Webb & Bower

Williamson, T., 2006, England's Landscape: East Anglia. English Heritage

Wren, W. J., 1976, Ports of the Eastern Counties: The Development of Harbours on the Coast of the Eastern Counties From Boston in Lincolnshire to Rochford in Essex. Dalton

9 Bibliography

Aldred, O., & Fairclough, G., 2002, Historic Landscape Characterisation: Taking Stock of the Method. English and Somerset County Council

Andersen, S. H., 1987, Mesolithic Dug-Outs and Paddles from Tybrind Vig, Denmark, *Acta Archaeologica,* **57:** 87-106

Austin, L., 1997, Palaeolithic and Mesolithic. In Glazebrook, J., ed., 1997, Research and Archaeology: A Framework for the Eastern Counties, 1. Resource 5-11 Assessment. EAA occ. paper 3 Sole Archaeological Committee: Norwich

Bowskill, D. 1998, The East Coasts, A Pilots Guide From the Wash to Ramsgate. Imray, Laurie, Norie & Wilson

Clark, J., Darlington, J. & Fairclough, G., 2004, Using Historic Landscape Characterisation: English Heritage's review of HLC Applications 2002 - 03. English Heritage & Lancashire County Council

Cooper, N., 2002, Erosion of the salt marshes of Essex between 1988 and 1998. Report to Environment Agency

Department for Environment Food and Rural Affairs, 2002a, Safeguarding Our Seas: A Strategy for the Conservation and Sustainable Development of our Marine Environment. Defra

Department for Environment Food and Rural Affairs, 2002b, Suffolk Coast and Estuaries Coastal Habitat Management Plan Final Report. Defra

Department for Environment Food and Rural Affairs, 2002c, Essex Coast and Estuaries Coastal Habitat Management Plan Final Report. Defra

Department for Environment Food and Rural Affairs, 2006, A Marine Bill: A consultation document of the Department for Environment, Food and Rural Affairs. Defra

Department of Trade and Industry, 2004, Mean Spring Tidal Range: Atlas of UK Marine Renewable Energy Resources. Department of Trade and Industry

D'Olier, Wallingford, B. H. R., 2002, Southern North Sea Sediment Transport Study, Phase 2 (appendix 10). Technical Report. CEFAS/UEA

Dymond, D., 1999, An Historical Atlas of Suffolk. Suffolk County Council

East Anglian Daily Times

Edwards, R., 1991, The Suffolk Coast. Terence Dalton Ltd

Embree, S and Stevens J, 2005. English Heritage Research Agenda: An Introduction to English Heritage's Research Themes and Programmes. English Heritage

English Heritage, 2002, Historic Landscape Characterisation: Template Project Design For EH-supported country-wide HLC projects. English Heritage

English Heritage, 2005, Making the Past Part of Our Future: English Heritage Strategy 2005-2010. English Heritage

English Nature, 1997, Greater Thames Estuary Coastal Natural Area Profile. English Nature

English Nature, 1997, Suffolk Coast Maritime Natural Area Profile. English Nature

English Nature, 2002, State of nature: Maritime - getting onto an even keel. English Nature

Erskine, B., 2003, Hiding from the Light, HarperCollins

Essex County Council, Nd., Manningtree Town Assessment Report. Essex Extensive Urban Survey. Essex County Council

Fairclough, G., Lambrick. G & McNab, A., 1999, Yesterday's World, Tomorrow's Landscape: The English Heritage Historic Landscape Project 1992-94. English Heritage

Field, J. 1992, Learning Through Labour: Training, unemployment and the State, 1890-1939. University of Leeds

Fleming, N.C. 2002, The scope of Strategic Environmental Assessment of North Sea areas SEA3 and SEA2 in regard to prehistoric archaeological remains. Department of Trade and Industry

Foynes, J. P., 1994, Battle of the East Coast (1939-1945). J. P. Foynes

GE Wind Energy, 2002, Gunfleet Sands Offshore Wind Farm Non Technical Summary. Gunfleet Ltd

Golding, N., Vincent, M. A., & Connor, D. W., 2004, Irish Sea Pilot - Report on the development of a Marine Landscape classification for the Irish Sea. JNCC

Gray, J.M. 1988. Coastal cliff retreat at Walton on the Naze, Essex since 1874: patterns, rates and processes. Proc. Geol. Ass. 99(4) 335- 338.

Greater Gabbard Offshore Winds Ltd, 2005, Wind Farm Non-Technical Summary. Greater Gabbard Offshore Winds Ltd.

Hill, M., Briggs, J., Minto, P., Bagnall, D., Foley, K., & Williams, A., 2002, Guide to Best Practice In Seascape Assessment. The Marine Institute

Hitchman, H., 1984, Harwich: A Nautical History. P. Driver Autoprint Lithographic Company

Hitchman, H. G. & Driver, P., 1987, Maritime Harwich as a Ferry Port: A Miscellany Since 986 (Or Thereabouts). The Author

Ipswich Evening Star

Jacobi, R. M., 1980, 'Late-glacial settlement in Essex. In Buckley, D. G. (ed.), 1980, Archaeology in Essex to AD 1500: in memory of Ken Newton. Counc. Brit. Archaeol. Rep. 34, 12-13

Jacobi, R. M., 1980, 'The Mesolithic of Essex'. In Buckley, D. G. (ed.), 1980, Archaeology in Essex to AD 1500: in memory of Ken Newton. Counc. Brit. Archaeol. Rep. 34, 14-25

Jarvis, S., 1990, East Anglia Shipwrecks. Countryside Books

Jones, L. A., Coyle, M. D., Evans, D., Gilliland, P.M., & Murray, A. R., Southern North Sea Marine Natural Area Profile: A contribution to regional planning and management of the seas around England. Peterborough: English Nature.

London Array. Non-Technical Summary, London Array Ltd. June 2005

London Array Newsletter, December 2006

Louwe Kooijmans, L. P., 1970-71, Mesolithic bone and antler implements from the North Sea and from the Netherlands. *Ber Rijksdienst oudheidk. bodemonderz.* **20/21***,* 27-73, plus plates

Malster, R., 1969, Maritime East Anglia. Maritime Museum for East Anglia

May, V. J. & Hansom, J. D., 2001, Coastal Geomorphology of Great Britain. JNCC

Moore, J. & Bamber, R., 1995, Diving Survey of an Unusual Rocky Habitat off Thorpeness Point, Sizewell, Suffolk. Porcupine Newsletter, 5 (10): 239-245

MSPP Consortium, 2006, Marine Spatial Planning Plot: Final Report. MSPP Consortium

Parker, A. J., 2001, Maritime Landscapes. In Muir, R. (ed.), Landscapes. Windgather Press

Ransome, A., 1939, Secret Water, Jonathan Cape Children's Books

Roberts, P and Trow, S. 2002. Taking to the Water: English Heritage's Initial Policy for the Management of Maritime Archaeology in England. English Heritage

Rogers, S. I., 1997, A review of closed areas in the United Kingdom Exclusive Economic Zone. CEFAS Science Series Technical Report No. 106

RPS, 2005, Environmental Statement: Non-Technical Summary London Array Limited July 2005. RPS

Soanes, C. & Stevenson, A., 2005, Oxford Dictionary of English. Oxford University Press

Strachan, D., 1998, Essex from the Air, Essex County Council

Suffolk County Council, 2006, Suffolk Intertidal Field Survey Assessment Report, v. 1. Suffolk County Council

Suffolk District Council, 2001, Suffolk Coastal Local Plan Incorporating the First Alteration. Suffolk Coastal District Council

Suffolk District Council, 2004, The Stour and Orwell Estuaries. Suffolk District Council

UKHO, 1953, Close's Fishermen's Chart of the North Sea United Kingdom Hydrographic Office

UKHO, January 2006, Thames Estuary Black Deep: Assessment of the Analysis of Routine Resurvey Area TE6A from the 2005 Survey. UKHO

UKHO, March 2006, Thames Estuary Long Sand Head: Assessment on the Analysis of Routine Resurvey Area TE5A from the 2005 Survey. UKHO

UKHO, March 2006, Thames Estuary Long Sand Head: Assessment of the Analysis of Routine Resurvey TE5B from the 2005 Survey.

UKHO, February 2006, Thames Estuary North Shipwash: Assessment on the Analysis of Routine Resurvey Area TE2A from the 2005 Survey. UKHO

UKHO, March 2006, Thames Estuary South Ship Head: Assessment on the Analysis of Routine Resurvey Area TE3 from the 2005 Survey. UKHO

UKHO, February 2006, Thames Estuary Sunk: Assessment on the Analysis of Routine Resurvey Area TE3A from the 2005 Survey. UKHO

Weaver, L., 1990, Harwich-Gateway to the Continent. Terence Dattan Limited

Wessex Archaeology, 2005, Strategic Environment Assessment Sea 6: Irish Sea; Maritime Archaeology. Wessex Archaeology

Wessex Archaeology, 2006, England's Historic Seascapes: The Liverpool Bay Pilot. Wessex Archaeology

Wheatley, K., 1990, National Maritime Museum Guide to Maritime Britain. Webb & Bower

Wilkinson, T. J. & Murphy, P. L., Essex: 1995, The Archaeology of the Essex Coast Hullbridge

Survey Project. Essex County Council, Archaeology Section

Williamson, T., 2006, Coastal Marsh Characterisation. Suffolk County Council

Williamson, T., 2006, England's Landscape: East Anglia. English Heritage

Wren, W. J., 1976, Ports of the Eastern Counties: The Development of Harbours on the Coast of the Eastern Counties From Boston in Lincolnshire to Rochford in Essex. Dalton

Individual Works

Barker, R. HMS Gypsy. Available at: http://www.raybaker.co.uk/poems/GIPSY.htm. (07/03/2007)

Hopkins, G. M., 1918, The Wreck of the Deutschlandhttp://www.bartleby.com/122/4.html. (07/03/2007)

Websites

About Nelson. Available at: http://www.aboutnelson.co.uk/ (07/03/2007)

Bob Le-Roi. Available at: http://www.bobleroi.co.uk/Home/Home.html (07/03/2007)

English Heritage. Available at http://www.english-heritage.org/ (07/03/2007)

English Nature. Available at: http://www.english-nature.org.uk/ (07/03/2007)

Essex County Council. Available at: http://www.essexcc.gov.uk/vip8/ecc/ECCWebsite/dis/hom.jsp (07/03/2007)

Harwich Haven Authority. Available at: http://www.hha.co.uk/default.asp?detected=true (06/03/2007)

Hometown. Available at: http://www.hometown.aol.co.uk/ (o6/03/2007)

Leader Lines. Available at: http://www.leader-lines.com/ (07/03/2007)

Marine Log. Available at: http://www.marinelog.com/ (06/03/2007)

Offshore Echoes. Available at: http://www.offshoreechos.com/ (07/03/2007)

Port of Felixstowe. Available at: http://www.portoffelixstowe.co.uk/ 9)6/03/2007)

Walton on the Naze. Available at http://www.walton-on-the-naze.com (07/03/2007)

Walton & Frinton Lifeboat. Available at: http://www.waltonfrintonlifeboat.co.uk/ (07/03/2007)

Wikipedia. Available at: http://en.wikipedia.org/wiki/Main_Page (07/03/2007)

Television

Anglia Tonight, 2007. ITV, Feb 19.

10 Glossary

10.1.1 A general knowledge of GIS and maritime archaeology are expected throughout. However a number of technical terms are specific either to the software used or Marine HLC. Most of them are also defined within the text but the following glossary should help re-orient the reader when browsing

10.1.2 Broad Character

A super-category of abstract character types that enable polygons within the project GIS to be compared directly with those from other projects, thereby permitting a limited level of interoperability between separate Marine HLCs. There are six Broad Character Types: INDUSTRY, MILITARY, NATURAL LANDSCAPE, NAVIGATION, RECREATION and SETTLEMENT. Definitions for each are given in Appendix I below.

10.1.3 Buffer

A tool within ArcGIS that creates a polygon feature (or set of features) based on an input dataset by extending the boundary by a given distance. Points, lines or polygons can be buffered. For instance, buffering a circular polygon 2km in diameter by 1km will produce a circular polygon with the same centre-point but 4km in diameter (= 1km + 2km + 1km). Buffering points will always produce circular polygons of twice the buffering value. Buffering polylines will produce lozenge-shaped polygons with a width twice the buffering value and a length twice the value + the length of the line.

10.1.4 Character Type

An intermediate-level abstract character type. All Subcharacter Types belong to a specified Character Type category, hence polygons can be aggregated together into simpler, and potentially clearer groups. Character Types are defined according to the needs of particular projects, however, they all belong to universally-defined Broad Character Type categories, allowing polygons to be assimilated to yet larger units, and thus compared to other Marine HLC projects. Definitions for Character Types are given in Appendix I below.

10.1.5 Character Area

The main output of Marine HLC, Character Areas are spatially delimited regions which are considered to form a 'conceptual whole'. Unlike terrestrial HLC, they are not generated automatically by aggregating units of similar character, but rather through interpretation by Marine specialists based on the analysis of Near-level spatial information, secondary GIS sources and library-based research. Character Areas have unique names (e.g. Kentish Knock) based on either local tradition or dominant features. A lengthy description of each Character Area is held in conjunction with the GIS, along with relevant visual media and a bibliography.

10.1.6 Clip

An ArcGIS tool which enables the user to extract a smaller spatial dataset from a large one by using a further dataset to set the maximal bounds of the output features. This method is sometimes compared to the process of (and even referred to as) 'cookie-cutting'. Clip effectively has the opposite effect of **Erase** (see below).

10.1.7 CSS

Cascading Style Sheets (CSS) is a 'Styling Language' with which one can write files that instruct a browser how to represent Markup Language edocuments (such as HTML or XML). This has the advantage that the visual formatting of all the pages within a website can be managed within in a single file, whilst the pages themselves must only define content and content type.

10.1.8 Dissolve

A tool in ArcGIS which aggregates all polygons in a dataset that have the same (specified) value(s) into a single polygon. Where such polygons are contiguous any mutual boundary will be removed. Where such polygons are not contiguous, no visible change will occur, but the underlying attribute table will assign them all to a single entity. The dissolving process will allow the output table to maintain the fields (and hence values) upon which the dissolve is based, but any other fields will be lost.

10.1.9 Erase

An ArcGIS tool which removes areas of spatial dataset based on the extent of a further input dataset. Erase may be used to delete both peripheral and internal regions. Features which fall partially within the deleted region will only have their spatial dimensions changed. Features which fall entirely within the region will be lost. Erase has the opposite effect to **Clip** (see above).

10.1.10 HTML

Hyper Text Markup Language is the most common markup language for documents on the world wide web. It is a way of describing to web-browsers (such as Internet Explorer or Firefox) how text should be formatted, and to create links to pages which are located elsewhere.

10.1.11 JSON

JavaScript Object Notation (JSON) is a lightweight computer data interchange format. It is a text-based, human-readable format for representing data structures and can be used as simple way of storing multi-faceted lists within web-pages.

10.1.12 Kernel Density

In statistics, the 'kernel density estimation' is a way of estimating the probability density function of a random variable (http://en.wikipedia.org/wiki/Kernel_density). Within GIS this is commonly used to create 'heat maps' from point data which indicate the likelihood of encountering a point if moving randomly and hence distribution in manner which can be represented as a field magnitude and even as polygons to a limited extent.

10.1.13 Near-level Dataset

The Near-level Dataset is the product of the second stage of the Marine HLC process and provides a layer containing a large number of contiguous polygons which give complete coverage of the study area. The form and data attached to the polygons are an amalgam of the contributory Primary datasets, and the relative priority of specific Subcharacter Types potentially assigned to them. Near-level data contains information about each tier of the marine zone associated a polygon. As a result, polygons can be assigned up to three different Subcharacter Types. Near-level polygons also record wreck and obstruction density as either High (3), Medium (2) or Low (1).

10.1.14 Primary Dataset

Primary Datasets are polygonal GIS data sources (although they may be derived from point or line data) that are combined to create the Near-level dataset which forms the main basis for Marine Characterisation. The data may represent a very wide variety of different aspects of sea-use and perception, but two guidelines are generally adhered to:

- features should be spatially static. i.e. Shipping lanes are fixed and hence acceptable, whereas shipping traffic (which involves moving vessels) is not.
- datasets should provide information about the entire study area. i.e. Absence of a feature implies that an entity is not known to exist in the area.

10.1.15 Raster to Polygon

Raster data, i.e. a dataset composed of a grid of squares, each containing a value representing a single attribute (e.g. elevation), cannot be integrated directly with vector data which represent individual points, lines, and bounded features. In order to do so, ArcGIS provides a tool which will create polygons which demarcate groups of cells within a raster that have the same value.

10.1.16 Reclassify

An ArcGIS tool which allows the user to update the values of cells in a raster grid by grouping them together into sets. For example, the distribution of values in the grid may vary from 1-1000 but be greatly skewed toward the lower end of the scale. Values can be reclassified to an e.g., log10 scale so that they are more evenly distributed.

10.1.17 Secondary Dataset

Secondary Datasets are GIS data sources which cannot be incorporated in to the Near-level Dataset, either for licensing reasons or because they cannot be meaningfully rendered as polygons. Secondary Sources are used in conjunction with the Near-level Data to provide contextual information whilst researching and writing descriptions of Character Areas.

10.1.18 SQL

Structured Query Language (SQL) is a standardised way of interacting with relational databases. It provides syntax by which to interrogate, create or update one or more tables in a database. Although SQL is an official ISO standard, various database vendors have 'expanded' it in order to improve or simplify functionality. Consequently, Microsoft Access SQL deviates slightly from the 'offical' variety, but the SQL templates described in this report are restricted to core functionality and should be applicable to any relational database.

10.1.19 Subcharacter Type

Subcharacter Type is the lowest-level abstract definition of a maritime activity or feature. Subcharacter Type categories are associated with a particular tier of the marine or coastal zone and ranked in order of priority from a heritage perspective. All polygons in primary datasets are assigned a Subcharacter Type, and using this information, all polygons in the Near-level dataset will be assigned a Subcharacter Type for each tier (-1 is the default 'null' value) as well as a dominant Subcharacter Type (which will be drawn from on of the three tiers). Subcharacter Type categories

are grouped into higher superclasses of Character Type, which in turn belong to Broad Character Types. Subcharacter Type categories are specific to particular Marine HLC projects, although there is likely to be a good deal of similarity between them. Formal comparison between projects can only be done at Broad Character Type level, however.

10.1.20 Topology

A Topology is a set of rules that can be applied to a GIS dataset, such as that there be no overlapping polygons or gaps. This makes digitisation and repair (or 'cleaning') of GIS data much simpler as users are restricted from altering the data in way which contravenes the rules. Typically it will also give users the option of identifying violations of the ruleset (when applied to data that has been created previously) and possible solutions to fixing them.

10.1.21 Tier

Maritime activity and features which relate to it are spatially distributed not only horizontally, throughout the region, but also vertically, at different levels within the marine zone. The water-body (including its surface), the geophysical surface of the earth (including the adjacent coastline), and the ground beneath the surface are three separate 'tiers' to which Subcharacter Type can be assigned. This allows the Near-level data to be interrogated to show, for example, all activity taking place on the seabed within a specific region.

10.1.22 Union

Union is a tool within ArcGIS that enables the user to take a number of input spatial datasets and combine them into a single dataset which is subdivided in order to preserve all boundaries. This has the inevitable result of creating many more polygons than the original datasets possessed collectively. The attribute table of the output dataset contains at least one field for each input dataset, recording the ID and/or attributes of any polygon that is spatially co-extensive. In cases where an input dataset has internally overlapping polygons, the union cannot store both values in the same field and so two identically shaped polygons will be created for the overlapping region, but with different attribute data.

10.1.23 XML

eXtensible Markup Language (XML) is a Markup Language that enables users to describe the content type of various elements of a document independently from its style. The advantage to such an approach is that, by describing what the content is, a computer is able to decide what to do with it, depending on context. XML is not limited to enabling context-dependent formatting, but that has been its primary use in this project.

10.1.24 XSL

eXtensible Stylesheet Language (XSL) is a transformation language used in conjunction with XML (see above) to format documents dynamically. The output from the combining of an XSL and XML document can be anything from visual formatting to a complete change in content and even structure.

11 Abbreviations

ADS	Archaeology Data Service
AHDS	Arts and Humanities Data Service
AJAX	Asynchronous Javascript and XML
ALSF	Aggregates Levy Sustainability Fund
AONB	Area of Outstanding Natural Beauty
BGS	British Geological Survey
BP	Before Present
CHaMP	Coastal Habitat Management Plan
CSS	Cascading Style Sheets
DEFRA	Department for Environment, Food and Rural Affairs
DTI	Department of Trade and Industry
EH	English Heritage
EIA	Environmental Impact Assessment
ESRI	Environmental Systems Research Institute
EUS	Extensive Urban Survey
ESFJC	Eastern Sea Fisheries Joint Committee
GIS	Geographical Information system
GML	Geography Markup Language
HLC	Historic Landscape Characterisation
HTML	Hyper Text Markup Language
ISO	International Standards Organisation
JPEG	Joint Photographic Experts Group (graphics format)
JSON	JavaScript Object Notation
KESFC	Kent and Essex Sea Fisheries Committee
MCA	Marine and Coastguard Agency
MHW	Mean High Water
NMR	National Monuments Record
NNR	National Nature Reserve
OA	Oxford Archaeology
OS	Ordnance Survey
OSGB36	Ordnance Survey Great Britain 1936 (Reference Datum)
RYA	Royal Yachting Association

SAC	Special Area of Conservation
SEA	Strategic Environmental Assessment
SMR	Sites and Monuments Record
SPA	Special Protection Area
SQL	Structured Query Language
SSSI	Site of Special Scientific Interest
UAD	Urban Archaeological Database
UKGEMINI	UK GEo-spatial Metadata INteroperability Initiative
UKHO	UK Hydrographic Office
WGS84	World Geodetic System 1984 (Reference Datum)
XML	eXtensible Markup Language
XSL	eXtensible Stylesheets Language

APPENDIX I: Character Type Descriptions

Broad Character Type

INDUSTRY

This category is relevant where industrial activity is or has been the dominant source of character and influence on the seascape and landform in the area (e.g. oil and gas installations, aggregate dredging).

MILITARY

Used by or connected with the armed forces for defence, operational bases, or for supply and provisioning. Includes firing ranges, practice areas, coastal batteries, naval dockyards etc.

NATURAL LANDSCAPE

Defines a seascape where the predominant character is 'natural' or undeveloped. These include prehistoric land surfaces, mudflats, saltmarsh areas, sand dunes, subtidal sands and estuarine areas.

NAVIGATION

Related to the action or practice of travelling on water in a ship or other vessel (Oxford Dictionary).

RECREATION

Those activities done for pleasure and amusement. This type includes sailing areas, marinas and beaches.

SETTLEMENT

Nucleated areas of built environment interest, where people live including historic, medieval and modern towns, coastal villages.

Character Type

Navigation feature

Distinctive navigational aspect mainly related to shipping traffic such as channel (disused), channel (disused, buried). (Wessex Archaeology: The Liverpool Bay pilot)

Broad character: Navigation

Navigation activity

Related to the human activities linked to navigation such anchorage, anchorage (disused), channel, channel (disused), channel (disused, buried), canal, quarantine area. (Wessex Archaeology: The Liverpool Bay pilot)

Broad character: Navigation

Navigation hazard

Features that represent a risk of collision, stranding etc. leading to damage or total loss of a vessel such as drying area. (Wessex Archaeology: The Liverpool Bay pilot)

Broad character: Navigation

Intrusive offshore industry

Referring to any industrial activity at sea that continuously disrupts and impacts on the marine environment (particularly for the seabed) through time. For example, aggregate dredging, trawling, oil and gas installations, amongst others. (Wessex Archaeology: The Liverpool Bay pilot)

Broad character: Industry

Non-intrusive offshore industry

Referring to any industrial activity at sea that does not have a continuous and incremental impact on the seabed such as commercial shipping, recreation etc. (Wessex Archaeology: The Liverpool Bay pilot)

Broad character: Industry

Ports, docks & harbours

Related to functioning of ports, docks and harbours such as dock and port related industry, industrial port area, industrial dock area, historic dock, and historic harbour among others. (Wessex Archaeology: The Liverpool Bay pilot)

Broad character: Navigation

Fisheries and Mari-culture

Activities associated with the business, occupation, or industry of harvesting or cultivating fish and shellfish from the sea or rivers such as modern fisheries and historic fisheries amongst others. (Wessex Archaeology: The Liverpool Bay pilot)

Broad character: Industry

Coastal industry

Any industrial activity undertaken along the coast such as historic salt-making, water extraction, and boat and shipbuilding yards, coastal quarries, brickworks, sewage works etc. (Wessex Archaeology: The Liverpool Bay pilot)

Broad character: Industry

Coastal recreation

Areas accessible to the general public for the pursuit of leisure and recreational activities.

This seascape character type includes golf courses, sports grounds, parklands, sailing and boating areas, marine lakes, water parks, etc. (Wessex Archaeology: The Liverpool Bay pilot)

Broad character: Recreation

Offshore recreation

Areas of sea associated with activities undertaken by the general public during leisure time, including dive sites, leisure fishing areas, sailing areas, etc. (Wessex Archaeology: The Liverpool Bay pilot)

Broad character: Recreation

Coastal environment

This type includes undeveloped mudflats, saltmarsh areas, sand tunes, subtidal sands and estuarine areas. (Wessex Archaeology: The Liverpool Bay pilot)

Broad character: Natural landscape

Prehistoric land surface

Currently submerged land which may retain evidence of prehistoric human usage, such as areas of prehistoric foot prints, palaeochannels and submerged forests. (Wessex Archaeology: The Liverpool Bay pilot)

Broad character: Natural landscape

Coastal settlement

Nucleated occupation areas predominantly characterised by the built environment, including historic and modern towns, coastal villages, etc. (Wessex Archaeology: The Liverpool Bay pilot)

Broad character: Settlement

Coastal military

Used by or connected with the armed forces including naval dockyard, coastal batteries, army bases, airfields and artillery or rocket testing ranges, etc.

Broad character: Military

Offshore military

Used by or connected with the armed forces including military practice areas and dumping grounds.

Broad character: Military

Subcharacter Type

Administrative region

An area designated for administrating activities at sea and within river estuaries. These include entrances and approaches to harbours and dockyards.

broad character: Industry;

character: Ports, docks & harbours;

level: Physical surface

confidence: High

Anchorage

A place suitable for anchoring vessels in relation to the wind, seas and seabed located in a navigational watercourse or channel.

broad character: Navigation;

character: Navigation activity;

level: Water body

confidence: Low

Anchorage (disused)

An area of sea or coast where ships anchored in the past, located in a historical navigational watercourse or channel, not currently used by modern commercial traffic.

broad character: Navigation;

character: Navigation activity;

level: Water body

confidence: Low

Beach

The shore of the sea that is washed by waves or tides sufficiently to prevent all or most terrestrial plant growth. It is generally used for recreational purposes.

broad character: Recreation;

character: Coastal recreation;

level: Physical surface

confidence: Medium

Canal

An artificial navigable waterway used for the transportation of goods. Nowadays often used for recreational purposes. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Navigation;

character: Navigation activity;

level: Water body

confidence: High

Caution area

On modern Admiralty charts, a caution area is an area dangerous for navigation due to frequent changes in depths. (after Wessex Archaeology: The Liverpool Bay pilot)

broad character: Navigation;

character: Navigation hazard;

level: Physical surface

confidence: High

Channel

Navigational watercourse or channel that is currently in use.

broad character: Navigation

character: Navigation feature;

level: Physical surface

confidence: Medium

Channel (disused)

Historic shipping channels are named on historic charts although their limits, if defined, tend to be roughly demarcated by buoyage rather than by continuous lines. The dynamic nature of the seabed means that these shipping channels move spatial and, in some cases, fall out of use altogether.

broad character: Navigation;

character: Navigation feature;

level: Physical surface

confidence: Low

Channel (disused, buried)

Historic shipping channels, named on historic charts which have fallen out of use and silted up.

broad character: Navigation;

character: Navigation feature;

level: Physical surface

confidence: Low

Cliff

A significant vertical, or near vertical, rock exposure. Cliffs are categorised as erosion landforms due to the processes of erosion and weathering that produce them.

broad character: Natural landscape;

character: Coastal environment;

level: Physical surface

confidence: Medium

Coastal/estuarine settlement

An area of human settlement along the coast or around an estuary.

broad character: Settlement;

character: Coastal settlement;

level: Physical surface

confidence: High

Coastal marsh

An area of marshy ground along the coast.

broad character: Natural landscape;

character: Coastal environment;

level: Physical surface

confidence: Medium

Coastal Way

Footpath located along the coast for recreational purposes. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Recreation;

character: Coastal recreation;

level: Physical surface

confidence: High

Dive site

An area, buildings, sites and structures associated with the sport of diving. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Recreation;

character: Offshore recreation;

level: Water body

confidence: Low

Drained fields

A form of field drainage along the coast. These may be nested within an area of earlier sinuous drainage or have overwritten the prior drainage patterns or be a new area of drained reclaimed land. The drainage pattern often contains scars of earlier field patterns.

broad character: Settlement;

character: Coastal settlement;

level: Physical surface

confidence: Medium

Dredging (aggregates)

Often implies sand and gravel removal. More specifically, this industry comprises activities engaged in the mining and quarrying of sand, gravel, clays, ceramic and refractory materials, and/or the beneficiation by washing, screening and otherwise preparing the mined sand, gravel and clays. The principal activity of this industry is the production of sand and gravel for use as aggregates in the construction of buildings and infrastructure (e.g. highways). (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Industry;

character: Intrusive offshore industry;

level: Subsurface

confidence: High

Dredging (unspecified)

Often related to the excavation of material to deepen or create navigational channels and berths to provide additional harbour infrastructure or provide access for deeper draught vessels. eg deepening of a channel, creation of a new dock. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Industry;

character: Intrusive offshore industry;

level: Subsurface

confidence: High

Drying area

Sandbanks that are exposed at low tides.

broad character: Natural landscape;

character: Coastal environment;

level: Physical surface

confidence: Low

Dumping ground (military)

An area where military ammunition and other materials have been disposed of at sea.

broad character: Military;

character: Offshore military;

level: Physical surface

confidence: High

Dumping ground (industrial)

An area where industrial waste products, dredged soils, drilling waste and possible treated sewage have been disposed of at sea.

broad character: Industry;

character: Intrusive offshore industry;

level: Physical surface

confidence: Medium

Energy installation (coastal)

An energy facility located along the coast, usually for access to water and supply by ships and close proximity to cables and pipelines.

broad character: Industry;

character: Coastal industry;

level: Physical surface

confidence: High

Energy installation (offshore)

Especially built installations to generate energy from natural resources such as wind or water. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Industry;

character: Intrusive offshore industry;

level: Physical surface

confidence: High

Ferry route

Related to a route across a river, an area of port, lake or sea used by ferry services. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Navigation;

character: Navigation activity;

level: Water body

confidence: Medium

Fisheries

An area engaged in the occupation or industry of catching fish or taking seafood from the sea or rivers.

broad character: Industry;

character: Fisheries and Mari-culture;

level: Water body

confidence: Low

Fish farming

An area, sites and structures associated with the farming of fish. The fishing industry depends on good water conditions, the maintenance of good habitat conditions for spawning and as nursery areas, and the maintenance of plankton productivity. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Industry;

character: Fisheries and Mari-culture;

level: Water body

confidence: High

Fisheries (shellfish)

Areas used for the cultivation of Oysters, often distinguished by a characteristic patterning of small rectangular pits, usually in serried rows along coastal shores, in the inter-tidal zone. They represent a significant 18th -19th century economic activity, which dates back to the 18thC or possibly earlier.

broad character: Industry;

character: Fisheries and Mari-culture;

level: Physical surface

confidence: Medium

Historic town core (OS 1st edition)

Core of current settlement as mapped on the Ordnance Survey 1st edition.

broad character: Settlement;

character: Coastal settlement;

level: Physical surface

confidence: High

Industry (coastal, unspecified)

Includes those industrial areas that are active today as represented on modern maps. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Industry;

character: Coastal industry;

level: Physical surface

confidence: Medium

Intertidal land (unspecified)

A tidal area that does not have a predominant landscape feature.

broad character: Natural landscape;

character: Coastal environment;

level: Physical surface

confidence: Medium

Leisure fishing area

An area, buildings and structures associated with fishing activities for leisure purposes only. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Recreation;

character: Offshore recreation;

level: Water body

confidence: Low

Lost settlement

Site of an historic settlement now lost through actions such as erosion or depopulation and abandonment.

broad character: Settlement;

character: Coastal settlement;

level: Physical surface

confidence: Medium

Marina

A facility primarily for the accommodation of boats comprising berths, pontoons, piers, boat launching ramp and public jetties. It may also include land based areas for car parking and associated facilities and services.

broad character: Recreation;

character: Coastal recreation;

level: Water body

confidence: High

Maritime safety installation

A building or group of buildings close to the sea used by coastguards to enable them to monitor the coastline. (http://thesaurus.english-heritage.org.uk)

broad character: Navigation;

character: Navigation activity;

level: Physical surface

confidence: High

Military installation

An installation for use by non-naval forces. These will include installations for use by the army and air force from army bases to airfields, coastal batteries, artillery or rockets testing ranges etc. Example: the radar and nuclear bomb testing facilities at Orford Ness.

broad character: Military;

character: Coastal military;

level: Physical surface

confidence: High

Military installation (disused)

An installation for use by non-naval forces. These will include installations for use by the army and air force from army bases to airfields, coastal batteries, artillery or rockets testing ranges etc. Example: the radar and nuclear bomb testing facilities at Orford Ness.

broad character: Military;

character: Coastal military;

level: Physical surface

confidence: Medium

Military practice area

A military practice area, which includes both areas for practising manoeuvres and live firing, offshore such areas have arbitrary boundaries based on the needs of other sea users.

broad character: Military;

character: Offshore military;

level: Water body

confidence: High

Mineral extraction (oil/gas)

Area associated with the extraction of oil and/or gas involving facilities such as production platforms, storage tanks and tanker moorings.

broad character: Industry;

character: Intrusive offshore industry;

level: Subsurface

confidence: Low

Mineral extraction (other, coastal)

Area associated with the extraction of minerals other than oil or gas within the coastal zone involving facilities such as production platforms and storage tanks.

broad character: Industry;

character: Intrusive offshore industry;

level: Subsurface

confidence: Medium

Mineral extraction (other, offshore)

Production platforms and associated structures, including tanker moorings, storage tankers and platforms on pipelines, generally exhibit Mo(U) lights, aircraft obstruction lights, and audible fog signals. Unauthorised navigation is prohibited within 500 m of all such structures, including storage tankers which can swing about their moorings. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Industry;

character: Intrusive offshore industry;

level: Subsurface

confidence: Low

Mudflats

Flat un-vegetated wetlands on the edge of the saltwater subject to periodic flooding and minor wave action.

broad character: Natural landscape;

character: Coastal environment;

level: Physical surface

confidence: Medium

Named area

An area of water that is given a name, often relating to topographic features such as sandbanks. These named sea areas often date back beyond living memory and may preserve memories of events or topographic features such as hazardous areas.

broad character: Industry;

character: Coastal environment;

level: Water body

confidence: Medium

Natural channels

A natural channel of water such as rivers and streams.

broad character: Natural landscape;

character: Coastal environment;

level: Physical surface

confidence: Low

Naval dockyard

A naval dockyard designed to serve Royal Navy vessels, often including refuelling, ship-building, repair and supply facilities.

broad character: Military;

character: Coastal military;

level: Physical surface

confidence: High

Palaeochannels

An ancient or fossil stream channel preserved in the geological record. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Natural landscape;

character: Prehistoric land surface;

level: Physical surface

confidence: Low

Palaeolandscape

Currently submerged land which may retain evidence of prehistoric human usage, such as areas of prehistoric foot prints, palaeochannels and submerged forests. The North Sea plain would have been home to hunter gather societies and animals and fauna before the end of the last ice age resulted in it being submerged.

broad character: Natural landscape;

character: Prehistoric land surface;

level: Physical surface

confidence: Low

Peat bed

An unconsolidated deposit of semi-carbonised plant remains formed in a water-saturated environment (May & Hansom 2003). Peat only forms in freshwater wetlands and at the coast just above or at sea level. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Natural landscape;

character: Prehistoric land surface;

level: Subsurface

confidence: Low

Port-related industry

Related to functioning of ports, docks and harbours and port related industry, industrial port area, industrial dock area, historic area, historic dock, and historic harbour amongst others.

broad character: Industry;

character: Ports, docks & harbours;

level: Physical surface

confidence: High

Protected area

An area protected from extractive activities such as fishing and industries.

broad character: Natural landscape;

character: Coastal environment

level: Physical surface

confidence: High

Protected recreation area

A recreational area that is generally under the National Trust jurisdiction and is protected from extractive activities. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Recreation;

character: Coastal recreation;

level: Physical surface

confidence: High

Quarantine area

A historical area generally linked to a port where a period of detention was imposed on travellers or voyagers before they are allowed to enter a country or town, and mix with the inhabitants. Commonly, quarantine is also defined as the period during which a ship, capable of carrying contagion, is kept isolated on its arrival at port. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Industry;

character: Ports, docks & harbours;

level: Physical surface

confidence: High

Reclaimed land

Land reclaimed from the sea through the use of artificial structures such as banks and drainage systems.

broad character: Settlement;

character: Coastal settlement;

level: Physical surface

confidence: Low

Restricted area (unspecified)

An area of the sea which can be restricted for a number of reasons, including areas around protected wrecks, dredging areas, wind farms or power boat user areas.

broad character: Navigation;

character: Navigation hazard;

level: Water body

confidence: High

River

A natural waterway that conveys water, derived from either precipitation or glacial meltwater, from higher to lower ground.

broad character: Natural landscape;

character: Coastal environment;

level: Physical surface

confidence: Medium

Salt industry

An intertidal area used for extracting salt from sea water with associated architecture. In the Roman period this is characterised by 'Red hills' but activity can be Prehistoric or medieval.

broad character: Industry;

character: Coastal industry;

level: Physical surface

confidence: Medium

Saltmarsh

An intertidal habitat comprising salt tolerant vegetation. Frequency and duration of tidal inundation determines which plants and animal species are present. Salt marshes are bisected by meandering creek systems, which allow tidal waters to drain in and out. The creeks slow down tidal energy and the marsh plants slow down wave energy.

broad character: Natural landscape;

character: Coastal environment;

level: Physical surface

confidence: Medium

Sandbanks

A submerged bank of sand near a shore or in a river, which may be exposed at low tide.

broad character: Natural landscape;

character: Coastal environment;

level: Physical surface

confidence: Medium

Sand dunes

A mound or ridge of unconsolidated windblown sediment.

broad character: Natural landscape;

character: Coastal environment;

level: Physical surface

confidence: Medium

Sandwaves

Sandwaves are found where water is moved rapidly by strong tidal streams or heavy seas. No sandwaves of any significance are found where the seabed is predominantly mud, but they are found where it is sand or gravel.

broad character: Navigation;

character: Navigation hazard;

level: Physical surface

confidence: Medium

Sailing area

An area, buildings or structures related to the sport of rowing and sailing. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Recreation;

character: Offshore recreation;

level: Water body

confidence: Medium

Safety area (offshore)

An area within defined limits where ships must navigate with particular caution and within which the direction of traffic flow may be recommended.

broad character: Navigation;

character: Navigation activity;

level: Water body

confidence: High

Sea defences

The various methods of coastal defence against erosion. These include groynes, barges sunk

to form coastal defences and seawalls.

broad character: Settlement;

character: Coastal settlement;

level: Physical surface

confidence: High

Seaside leisure area

A recreational area located close to the sea where the general public can have access to a variety of leisure activities such as pleasure piers used as a promenade and amusement park, and seaside areas with cinemas, museums, restaurants, etc. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Recreation;

character: Coastal recreation;

level: Physical surface

confidence: High

Shingle

Areas composed of small pebbles.

broad character: Natural landscape;

character: Coastal environment;

level: Physical surface

confidence: Medium

Shipbreakers yard

A facility for the systematic dismantling and recycling of ships and boats at the end of their life-cycle.

broad character: Industry;

character: Ports, Docks & harbours:

level: Physical surface

confidence: High

Shipping lane

Distinctive navigational aspect mainly related to shipping traffic. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Navigation;

character: Navigation activity;

level: Water body

confidence: High

Shipyard/boatbuilders yard

Dockyards and shipyards are places which repair and build ships. These can be yachts, military vessels, cruise liners or other cargo or passenger ships. Dockyards are sometimes more associated with maintenance and basing activities than shipyards, which are sometimes associated more with initial construction. The terms are routinely used interchangeably, in part because the evolution of dockyards and shipyards has often caused them to change or merge roles.

broad character: Industry;

character: Ports, docks & harbours;

level: Physical surface

confidence: High

Submarine cable/pipeline

Cables or pipes used to transmit (a message, news, etc.), minerals and liquids such as oil and water or power like electricity communicate by submarine telegraph. Submarine cables lying and trenching have an impact on the historical environment that is not continuous and is incremental through time. Although they are intrusive, their impact on the historic environment can be considered as moderate.

broad character: Industry;

character: Non-intrusive offshore industry;

level: Physical surface

confidence: Medium

Submerged forest

Tracks of submerged land with evidence of forests and undergrowth. Submerged forests contain crucial information related to past environments and human action. (Wessex Archaeology: The Liverpool Bay pilot)

broad character: Natural landscape;

character: Prehistoric land surface;

level: Subsurface

confidence: Low

Submerged rocks

An area of rocks submerged under the surface of the river or sea.

broad character: Navigation;

character: Navigation hazard;

level: Physical surface

confidence: Medium

Watersports area

An area used, buildings or structures for watersports such as water-skiing.

broad character: Recreation;

character: Offshore recreation;

level: Water body

confidence: Medium

Water turbulence

An area subjected to turbulent tides which may pose a danger to people and vessels.

broad character: Navigation;

character: Navigation hazard

level: Water body

confidence: Low

Woodland

Coastal area of land cover with trees usually smaller and less wild than a forest which includes planted woods and woods associated with parklands. (Wessex Archaeology: The Liverpool Bay pilot). Often intimately associated with the proximity of the sea.

broad character: Natural landscape;

character: Coastal environment;

level: Physical surface

confidence: Medium

APPENDIX II: Summary of Primary Datasets Used

Study Area

Derived from: Study Area

Provider: English Heritage

Scale: 1:10 000

Datum: OSGB36

Details: Two meshing study areas needed to be created representing the terrestrial and marine zones.

Processing: The Study shapefile received from EH was reprojected to WGS84. In order to extend the area 2km inland, the entire polygon was buffered to a distance of 2km, and then the marine boundary redigitized back to its original location. A Marine Study Area layer was created by using the ArcGIS erase tool in conjunction with the Seazone 'landcover' shapefile which created a new layer without the terrestrial zone. This was in turn used to create a Coastal Study area by 'erasing' the maritime portion of the original study area. The result was two interlocking sections of the study area which could be used to clip the other datasets, as well as provide broad template areas for continuous layers such as 'palaeolandscape' and 'terrestrial component'.

Historic Town Cores

Derived from: Ordnance Survey 1st Edition

Provider: Ordnance Survey

Scale: 1:10 560

Datum: OSGB

Details: Ordnance Survey 1st Edition maps provide a useful snapshot of Britain before many of the massive agricultural and urban transformations of the 20th Century. We were interested specifically in Historic Town cores which could indicate where historic harbours may have been.

Processing: A rasterised first edition map was georeferenced to WGS84. Historic town cores were identified and digitized by hand onto a separate vector layer. These were then clipped to to the coastal study area so as to mesh with the marine data where appropriate.

Protected Areas (Coastal)

Derived from: szCE_PROTECTED_AREAS_region

Provider: Seazone Solutions Ltd.

Scale: 1:12 500-75 000

Datum: WGS84

Details: Seazone provide information about a number of important protected areas, including NNRs, RAMSARs, SACs SPAs and SSSIs. These areas often incorporate both marine and terrestrial areas. As such, they are not only important areas in terms of man's

relationship with the natural environment, but they also show an important interface between the two study zones.

Processing: The szCE_PROTECTED_AREAS_region shapefile was clipped to the Coastal study area. The dataset was dissolved to remove overlapping areas, and the erase tool was used to remove any historic town cores that fell within them.

Ordnance Survey (Current)

Derived from: Ordnance Survey MasterMap

Provider: Ordnance Survey

Scale: 1:1 250

Datum: OSGB36

Details: MasterMap provides the most up-to-date a complete digital coverage of the UK. It is a seamless and continuous dataset and each polygon is assigned a type, although there is no strict taxonomy of possible types which leads to type assignments which may overlap, or are even analogous.

Processing: MasterMap is provided in GML format, which contains points, lines, polygons and text, so it first had to be transformed into separate shapefiles using ESRI Map Manager (http://www.esriuk.com/products/product.asp?groupid=18&prodid=67). The polygon shapefile was reprojected to WGS84 and then clipped to the coastal study zone, so as to mesh with the marine data and exclude information outwith the study area. It was then filtered to extract only polygons with maritime-related attributes, specifically: Beach, Cliff, Coastal [P/p]ath, Dock, Harbour, Holiday Village, Leisure [B/b]each, Leisure Pier, Leisure Promenade, Oyster bed, Port, Promenade, Spit, Yacht club and harbour.

The erase tool was then used to remove areas falling within historic town cores or protected areas. In cases where the data was clearly intended to be adjacent to the marine zone (e.g. Beaches, piers, docks) but was not, the polygons were extended by hand to beyond the coastal study area, and then the entire dataset was reclipped in order to create a continuous layer.

Suffolk Coastal Marshland HLC

Derived from: Suffolk Coastal Marshland Historic Landscape Characterisation

Provider: Suffolk County Council

Scale: 1: 10 000

Datum: OSGB36

Details: The Suffolk Coastal Marsh HLC was an interesting dataset insofar as being unique to our study area, whereas we have otherwise used datasets which would be applicable to all regions. As the nature of the information was directly relevant to this inquiry however, and it also provided a useful supplement to the Suffolk HLC we decided it would be useful to incorporate.

Processing: The HLC shape file was reprojected to WGS84 and then clipped to the coastal study zone, so as to mesh with the marine data and exclude information outwith the study area.

The erase tool was then used to remove areas falling within historic town cores, protected areas or the Maritime Mastermap polygons.

Suffolk HLC

Derived from: Suffolk County Historic Landscape Characterisation

Provider: Suffolk County Council

Scale: 1: 10 000

Datum: OSGB36

Details: Essex HLC provides a terrestrial Characterisation of the northern and central region of our study area. One of the difficulties encountered with this dataset is that is not seamless, with numerous gaps and slivers. It was also provided as a MapInfo TAB file which led to other processing difficulties.

Processing: The TAB file was first converted to a shapefile using the ArcGIS 'export data' function and then reprojected to WGS84. It was then filtered to extract only polygons with which the SUBCATEGOR field had maritime-related attributes, specifically: Built up area, Coastal marsh, current industrial landscape, Current mineral extraction, Disused military, Former coastal marsh, Former marsh or fenland, Freshwater fen or marsh, Managed wetland, Modern leisure, Shingle spit.

The ArcGIS Repair Geometry tool was then used to ensure that there were no 'soft' errors in the data. The HLC shape file was clipped to the coastal study zone, so as to mesh with the marine data and exclude information outwith the study area. The erase tool was then used to remove areas falling within historic town cores, protected areas, Maritime MasterMap and Coastal Marsh polygons. Finally, to prevent a number of overlaps occuring within the dataset, the 'Built up area' polygons were extracted into a spearate dataset and unioned separately.

Essex HLC

Derived from: Essex County Historic Landscape Characterisation

Provider: Essex County Council

Scale: 1:10 000

Datum: OSGB36

Details: Essex HLC provides a terrestrial Characterisation of the most southerly region of our study area. Incidentally, it was created by David Lock, one of this project's original team members. Like the OS Mastermap, it provided seamless polygonal data that could be filtered to extract those with maritime relevance.

Processing: The HLC shape file was reprojected to WGS84 and then clipped to the coastal study zone, so as to mesh with the marine data and exclude information outwith the study area. It was then filtered to extract only polygons with which the SUBCATEGOR field had maritime-related attributes, specifically: 20TH CENTURY LEISURE, BUILT-UP AREAS, - URBAN DEVELOPMENT, DISUSED INDUSTRIAL, DRAINED RECLAMATION – RECTILINEAR – 19thC/20thC, DRAINED RECLAMATION – CURVILINEAR – PRE-18thC, DRAINED RECLAMATION – CURVILINEAR – 18thC, HISTORIC

EARTHWORK, INDUSTRIAL, MINERAL EXTRACTION, RESTORED LAND, SALTINGS, SEA DEFENCES, UNIMPROVED INTERTIDAL.

The erase tool was then used to remove areas falling within historic town cores, protected areas or the Maritime Mastermap polygons.

Terrestrial Component

Derived from: All Coastal Primary Datasets; Coastal Study Area

Provider: n/a

Scale: 1: 25 000

Datum: WGS84

Details: In order to provide a continuous surface, polygons were created to fill the remaining extent of the coastal study area that was not considered to be of maritime significance.

Processing: Once the terrestrial datasets had been prepared, the 'erase' tool was used to remove all areas with maritime subcharacter from a dataset coextensive with the coastal study area. This created a single layer that filled any gaps between the primary sources with the coastal zone.

Protected Areas (Marine)

Derived from: szCE_PROTECTED_AREAS_region

Provider: Seazone Solutions Ltd.

Scale: 1:12 500-75 000

Datum: WGS84

Details: Seazone provide information about a number of important protected areas including NNRs, RAMSARs, SACs SPAs and SSSIs. These areas often incorporate both marine and terrestrial areas. As such, they are not only important areas in terms of man's relationship with the natural environment, but they also show an important interface between the two study zones.

Processing: The szCE_PROTECTED_AREAS_region shapefile was clipped to the Marine study area and the dataset was dissolved to remove overlapping areas.

Offshore Cables and Pipelines

Derived from: szSO_INSTALLATIONS_polyline

Provider: Seazone Solutions Ltd.

Scale: 1:12 500-150 000

Datum: WGS84

Details: This dataset provides information about the location of submarine cables and pipelines as linear data. This needed to be converted into polygonal data in order to be incorporated.

Processing: In order to create areas which could be characterized as containing cables or pipes, the data was buffered to 2km on either side of each line feature. This also had the benefit of merging together areas which contained several pipelines. The areas were then clipped to the marine zone.

Offshore Fishing Industry

Derived from: szSO_INSTALLATIONS_region

Provider: Seazone Solutions Ltd.

Scale: 1:12 500

Datum: WGS84

Details: This dataset provides information about several maintained shellfish beds.

Processing: The polygons were clipped to the marine zone to ensure seamless integration (although this was probably not required).

Wrecks

Derived from: Seazone Wrecks & Obstruction.mdb/UKHO/unrestricted

Provider: Seazone Solutions Ltd.

Scale: 1:12 500-150 000

Datum: WGS84

Details: This dataset provided the location or approximate location of all known wrecks in the study area. The issue with such a dataset was in how to integrate this point data in a meaningful way without creating very large numbers of polygons which may not in fact accurately represent the location of specific wrecks. Our solution was to identify areas of high, medium and low wreck density.

Processing: The point data was first filtered in order to remove casualties which are generally mapped in a generic quadrant location and can cause erroneous 'hotspots' in a density distribution. This was done by removing all points with 'null' or 'unreliable' in the POSITION_QUALITY field. A kernel density algorithm was then applied using the Kernel Density tool in ArcGIS in order to create a raster heat map. Output cell size in ArcGIS is defined in proportion to the input dataset – In this case, a value of 0.005 was used, giving a cell width and height of approx. 0.35km. The search radius (i.e. The distance from the centre of each cell in which wrecks will influence weighting) was 0.1 decimal degrees. No weighting was used so all wrecks had a value of 1. The output is a raster grid of relative magnitude values. In order to polygonise the data it was broken down into three categories using a log10 scale using the reclassify tool where Low = < 100, Medium = 100 <> 1000, and High = > 1000. These areas were then converted into a vector layer using the Raster to Polygon tool and then clipped to the marine zone. The end result gives a crude, but nonetheless informative impression of wreck density.

Obstructions

Derived from: szSO_OBSTRUCTIONS_point

Provider: Seazone Solutions Ltd.

Scale: 1:12 500-150 000

Datum: WGS84

Details: This dataset provided the location or approximate location of all known marine obstructions in the study area. The issue with such a dataset was in how to integrate this point data in a meaningful way without creating very large numbers of polygons which may not in fact accurately represent the location of specific obstructions. Our solution was identify areas of high, medium and low obstruction density.

Processing: A kernel density algorithm was applied using the Kernel Density tool in ArcGIS in order to create a raster heat map. Output cell size in ArcGIS is defined in proportion to the input dataset – In this case, a value of 0.005 was used, giving a cell width and height of approx. 0.35km. The search radius (i.e. The distance from the centre of each cell in which wrecks will influence weighting) was 0.1 decimal degrees. No weighting was used so all obstructions had a value of 1. The output is a raster grid of relative magnitude values. In order to polygonise the data it was broken down into three categories using a log10 scale using the reclassify tool where Low = < 100, Medium = 100 <> 1000, and High = > 1000. These areas were then converted into a vector layer using the Raster to Polygon tool and then clipped to the marine zone. The end result gives a crude, but nonetheless informative impression of obstruction density.

Palaeolandscape

Derived from: Study Area; szNP_LAND_COVER_region

Provider: EH; Seazone Solutions Ltd.

Scale: 1:12 500-150 000

Datum: WGS84

Details: The entire region under consideration has been dry land within the period under consideration (i.e. Post-Pleistocene) and hence will have been inhabited by humans although a current lack of data makes it extremely difficult to ascertain which areas are most likely to have been occupied. It was therefore necessary to create a layer of a single polygon indicating that the sub-geosurface tier has been a palaeolandscape and may contain material culture as well as other important environmental information.

Processing: A layer of a single polygon was created coextensive with the marine study area.

Maintenance Dredging

Derived from: szBE_BATHYMETRY_region

Provider: Seazone Solutions Ltd.

Scale: 1:12 500-50 000

Datum: WGS84

Details: This dataset contains information specifying areas of maintenance dredging to allow proper clearance for marine vessels when approaching harbour.

Processing: The szBE_BATHYMETRY_region was clipped to the Marine study area

Transportation

Derived from: szSE_TRANSPORTATION_region

Provider: Seazone Solutions Ltd.

Scale: 1:12 500-150 000

Datum: WGS84

Details: This dataset contains information about marine regions of specific significance to maritime transport such as shipping lanes, piloting areas, etc.

Processing: The szSE_TRANSPORTATION_region shapefile was redigitised slightly to extend it past the Median Line and then clipped to the marine zone. As some polygons in this dataset overlap, it was necessary to extract the data into three separate datasets which were incorporated into the Near-level dataset separately.

Licensed Activities

Derived from: szSE_ACTIVITY_LICENCE_region

Provider: Seazone Solutions Ltd.

Scale: 1:12 500-150 000

Datum: WGS84

Details: This dataset holds information about marine regions in which specific activities have been licensed to take place, such as aggregates dredging, windfarms and military practice areas.

Processing: The szSE_ACTIVITY_LICENCE_region shapefile was redigitised slightly to extend it past the Median Line and then clipped to the marine zone. As some polygons in this dataset overlap, it was necessary to extract the data into two separate datasets which were incorporated into the Near-level dataset separately.

Regulatory Administrative Areas

Derived from: szSE_ADMIN_REGULATION_region

Provider: Seazone Solutions Ltd.

Scale: 1:12 500-75 000

Datum: WGS84

Details: This dataset provides information about specific marine administrative regions.

Processing: The shape file was filtered to extract only polygons with SZFEATDESC value of 'Harbour area (administrative). The output was clipped to the marine zone.

Named Areas

Derived from: szNP_SEA_COVER_region

Provider: Seazone Solutions Ltd.

Scale: 1:12 500-150 000

Datum: WGS84

Details: This dataset provides spatial information about named areas of sea. This was a highly useful dataset, not only because it showed how specific kinds of features were important in terms of local perception, but also enabled us to identify certain types of marine features (e.g. Sandbanks, natural channels, bays, etc) which clearly influence maritime activity. The difficulty presented, which was only partially overcome, was that the dataset contained a lot of internal overlap, as is to be expected from a dataset containing conceptual areas.

Processing: The shapefile was clipped to the marine zone. The dataset was incorporated into the final union in this state and then overlapping regions were merged by hand. This process was very labour intensive and an alternative methodology should be sought.

APPENDIX III:Summary of Secondary Datasets Used

Full name: szNP_GEOLOGY_region

Provider: Seazone Solutions Ltd (BGS)

Datum: WGS84

Details: This dataset holds information about offshore geology and was used to give an overview of the geology of each area. The dataset was not included in the final union due to copyright issues.

Processing: The dataset was supplied by seazone, using information they received from the BGS, as such it matched the datasets which went into the final union, therefore no processing was required to obtain the relevant data. The dataset was viewed in conjunction with the character areas.

Full name: szBE_DEPTH_AREAS_region

Provider: Seazone Solutions Ltd

Datum: WGS84

Details: This dataset holds information about the bathymetry of the seabed, which allowed an overall description of the depths within each character area.

Processing: The dataset was supplied by seazone, as such it matched the datasets which went into the final union, therefore no processing was required to obtain the relevant data. The dataset was viewed in conjunction with the character areas

Full name: Modern charts

Provider: UKHO

Datum: WGS84

Details: This dataset holds information about current navigational features, channels and information for mariners. This was used to identify modern day shipping channels and navigational aids.

Processing: The dataset was georeferenced to match the unioned data. The dataset was then viewed in conjunction with the character areas.

Full name: Historic charts

Provider: UKHO

Datum: Variable

Details: This dataset provided information about historic navigational features, channels and information for mariners. This was used to identify past shipping channels and navigational aids and hazards.

Processing: The dataset was georeferenced to match the unioned data. The dataset was then viewed in conjunction with the character areas.

Full name: NMR data

Provider: EH

Datum: OSGB36

Details: This dataset holds information about scheduled monuments, listed buildings, monuments; including wrecks and records of archaeological investigations. It was used in conjunction with the 'heat maps' of wrecks and obstructions to identify the individual heritage of each character area.

Processing: No processing was required

Full name: SMR data

Provider: Essex/Suffolk County Councils

Datum: OSGB36

Details: This dataset holds information about scheduled monuments, listed building and monuments It was used in conjunction with the 'heat maps' of wrecks and obstructions and the NMR dataset to identify the individual heritage of each character area.

Processing: No processing was required

Full name: Leisure sailing routes

Provider: RYA

Datum: Unknown

Details: This dataset holds information about current routes taken by Royal Yacht Association members, in the form of primary, secondary and tertiary routes. It was used to roughly identify areas where recreational sailing took place and to what extent.

Processing: No processing was required

Full name: Shipping Routes

Provider: Natural England

Datum: Unknown

Details: This dataset holds information about modern shipping routes within the study area and the type of vessels whcih transit the routes.This dataset was approximate but was used to identify the type of shipping traffic in each character area and where routes were positioned.

Processing: The dataset was georeferenced to match the unioned data. The dataset was then viewed in conjunction with the character areas.

Full name: Tidal range

Provider: DTI

Datum: Unknown

Details: This dataset holds information about tidal range around the UK, which was used to give a general overview for each area.

Processing: The dataset was georeferenced to match the unioned data. The dataset was then viewed in conjunction with the character areas.