ENGLAND'S HISTORIC SEASCAPES: WITHERNSEA TO SKEGNESS PILOT STUDY

AGGREGATE LEVY SUSTAINABILITY FUND
MARINE AGGREGATES AND THE HISTORIC ENVIRONMENT

REVISED FINAL REPORT

Museum of London Archaeology Service

Mortimer Wheeler House, 46 Eagle Wharf Road, London N1 7ED
tel 0207 410 2200 fax 0207 410 2201 email molas@molas.org.uk

MUSEUM OF LONDON

Archaeology Service

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SUMMARY

The Museum of London Archaeology Service has been commissioned by English Heritage to undertake a pilot project to develop a methodology for Historic Seascape Characterisation (HSC). The aim of the project is to create a coastal, intertidal and maritime historic characterisation for a pilot area between Withernsea and Skegness, extending out to the median line with Holland. The intention of the project is to build on the methodology developed by Wessex Archaeology in their Liverpool Bay Pilot Study (WA Method Statement and Final Report 2006) and trail methods that could be used in the development of a nation-wide HSC. This document outlines the process of marine characterisation as undertaken by the Museum of London Archaeology Service.

The report addresses the project aims and objectives and how they have been met. It describes and discusses the decisions made regarding the choice of baseline data for characterisation, the processing and interpretation of the various datasets to create the final character map and character areas. This discussion includes details on how methods of Historic Seascapes Characterisation follow and diverge from established methods of Historic Landscape Characterisation. In addition, the report looks beyond methodology (outlined in greater detail in the Method Statement) to the wider concepts of HLC and attempts to illustrate how the basic principles of HLC were applied during the process of intertidal and marine characterisation.

The report also examines updated potential applications for Historic Seascapes Characterisation and how it can inform and assist in development planning, archaeological research frameworks and consultation among other uses.

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1 Introduction

1.1 Project background

The Museum of London Archaeology Service (hereafter referred to as MoLAS) has been commissioned by English Heritage to carry out a pilot research project to develop a methodology that builds on Wessex Archaeology's initial pilot (Wessex Archaeology 2006) for extending Historic Landscape Characterisation (HLC) to the coastal, intertidal and marine zones of England. The pilot project area runs from Withernsea to Skegness, takes in the tidal extent of the Humber Estuary and extends out into the North Sea to the median line with Holland (Fig 1).

1.2 Structure of the report

This report is intended to describe MoLAS's development of a Historic Seascape Characterisation (HSC) project. It consists of five parts.

- The first part (Guiding principles) provides a description of the character mapping developed by MoLAS and outlines the principles used to guide the development of the characterisation.

- The second part (The Product of characterisation) provides a wider description of the historic environment of the pilot area according to different themes of character. It also outlines the approach and principles of the HSC undertaken by MoLAS and how it compares to Wessex Archaeology Liverpool Bay pilot. It addresses in detail the problems encountered in the course of the development of the characterisation project. The section includes an outline of MoLAS's approach to source material, the differences between terrestrial and marine characterisation and the wider reasoning behind decisions that affected the final characterisation.

- The third part (Methodology of Historic Seascape Characterisation) describes the method by which the final characterisation map was produced, with reference to the wider principles of characterisation that influenced the process. A description of the technical aspects of the characterisation, including full descriptions of each character and sub-character type is given in the project Method Statement (MoLAS 2009).

- The final part (Potential applications) describes the fulfilment of project aims and objectives as described below.

1.3 Project Aims

- To apply and if necessary develop the Wessex Archaeology Liverpool Bay methodology in a different type of coastal and marine environment (the Withernsea to Skegness and adjacent marine zone pilot area).

- 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.

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

- 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.

- To enhance and contextualise the Maritime Record of the National Monuments Record and those County 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.

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

- To improve the awareness, understanding and appreciation of the historic dimension of the project area to professional and non-professional users of the database.

- 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.

1.4 Project objectives

- 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 Withernsea to Skegness and adjacent marine zone pilot area, while retaining compatibility of the database with the interfacing or partly overlapping terrestrial characterisation databases.

- 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.

- 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.

- To analyse and interpret HLC to produce preliminary syntheses from it.

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

- To assess present uses and potential for HLC to inform broader sustainable management of change, spatial planning, outreach and research programmes.

- 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.

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

1.5 The final product and user interface

The final product comprises an ARCGIS project, web-pages and interactive map, a report, method statement and archive.

The web interface requires no knowledge of GIS to be able to access the characterisation. The web pages consist of a gazetteer and interactive map to allow the user to either access character areas descriptions by name or via the interactive map (see Method Statement). The pages contain the full characterisation narratives for each different character area with multimedia images (see Method Statement).

The ArcGIS project provides access to the Characterisation_polygon layer allowing the user initially to view the project by top most, or most dominant, layer. Querying the Characterisation_polygon layer reveals the layered internal structure of the project, revealing the rationale behind the project's basic construction. Polygons can be queried in different ways, according to the specific attributes that are of interest.

1.6 Key terms

The terminology used in this report conveys the underlying hierarchy of terms used by MoLAS in the development of the character map. The key terms are outlined here.

1.6.1 Attributes

The term attribute is used to describe the criteria that each polygon is measured and identified against. Every polygon has an attribute table and the range of different attributes that each

polygon can posses in the GIS project are the same for every polygon, ie broad character type, sub character type, etc. The polygons in the GIS project are generated using the information contained in the attribute table. The attributes were chosen during initial study of all the activities/features that took place/existed in the study area. The attributes are designed to make explicit various bits of information about each feature's character. It was really through deciding and then studying the attributes in each area that characterisation occurred.

Attribute tables were populated via automatic or manual means, depending on the type of information it was necessary to capture. Detailed definitions of attribute types are given in the Method Statement (Section 4.1.7).

1.6.2 Character_Areas

Character_Areas essentially represent an aggregation of similar sub-character polygons, which can be found in close spatial proximity to one another. Character_Areas are named after their topographic location or in some cases according to the predominant human uses evident in the area. The Character_Area layer is separate from the Characterisation_polygon layer and forms a contiguous layer across the pilot area.

1.6.3 Characterisation polygons

Term used throughout the project to refer collectively to the layer of sub-character polygons from which the GIS project is generated and which form the finest scale of polygonisation in the database.

1.6.4 Broad Character Type

Broad Character type is the highest level of characterisation summarisation. The Pilot Area has been split up into seven different broad character categories: Coastal industry, Offshore industry, Flood defence and reclamation, Military, Navigation, Settlement and Recreation. Detailed definitions of the different Broad Character types are provided in the Method Statement (Section 6.3).

1.6.5 Character Type

Character Type is the intermediate level of characterisation summarisation, between Broad Character and Sub-Character type. Detailed definitions of the different Character Types are provided in the Method Statement (Section 6.3).

1.6.6 Sub-Character Type

Sub-Character is the finest scale of characterisation and represents a character assessment based on different features or attributes identified and digitised from different map and in some cases documentary sources. It is the base map for the higher levels of characterisation. More detailed definitions of the different Sub-Character types are provided in the Method Statement (Section 6.3).

1.7 Final data structure

The final data structure of the Withernsea to Skegness pilot area 'Character Analysis' layer consists of the following attributes:

Attribute	Population method	Example of terminology
OBJECTID	Automatically populated	279
SHAPE	Automatically populated	Polygon
BROAD_CHARACTER	Manual entry	Broadest level of characterisation – ie Coastal industry, Navigation, etc
CHARACTER_TYPE	Manual entry	Intermediate level of characterisation – ie Docks ports and terminals, Navigation feature
SUB_CHARACTER	Manual entry. Dominant primary character of area in question. Checked for accuracy and confidence	Finest level of characterisation and most primary attribute in this table – ie. Historic fish dock, Active historic channel, etc
CHARACTER_AREA	Auto populated by sub_character type via database	Topographical location – each character area contains groups of polygons with similar attributes, ie 'Markham's Hole'
PERIOD	Manual entry from assessment of maps and documentary sources	Benchmark period of origin of the area represented in the polygon, ie 'Post medieval'
PR_INT_ACT	Manual entry from assessment of sub_character type and associated documentary sources	Primary Intrusive Activity – ie. Aggregate dredging, Maintenance dredging
PR_NON_INT_ACT	Manual entry from assessment of sub_character type and associated documentary sources	Primary None Intrusive Activity – ie. Commercial shipping, Water sports
OTHER_USE	Manual entry. Assessment of sub_character type and associated documentary sources	Other secondary seascape uses that are apparent, but are not the dominant characteristic of the polygon, ie 'Nature reserve'
MORPHOLOGY	Manual entry from study of map and documentary sources.	Form and structure of sea floor/coastal area, ie 'Coastal plain'
IMPACT	Manual entry, derived from study of documentary sources	Impact of primary activities/characteristics evident in polygon on area of coast/sea represented in polygon. Assessed broadly as High, Moderate or Low
PREV_CHAR	Manual entry, derived from study of documentary sources and map regression	The previous character of the current seascape (where known), ie 'Active historic salterns'
LOCATION	Manual entry	Where the polygon is physically

		located: Estuarine, Coastal or Sea
DATASOURCE	Manual entry	Where raw info used for characterisation was collected from
NOTES	Manual entry	More background information on the history of the polygon. Basically an expansion of information recorded in Broad_Character, Character_Type and Sub_Character
CONFIDENCE	Manual entry	Degree of certainly assigned to interpretation. Assessed broadly as High, Moderate or Low
SHAPE_LENGTH	Automatically populated	Automatically generated number
SHAPE_AREA	Automatically populated	Automatically generated number
CHECKED_BY	Manual entry.	Initials of the person responsible for checking the information before final output

Table 1: The attribute table associated with the final Characterisation_polygon layer produced by MoLAS

2 Guiding principles

2.1 Introduction

This section describes the principles adopted by MoLAS to guide the development of this pilot Historic Seascape Characterisation project.

2.2 Guiding principles of Historic Seascapes Characterisation

MoLAS noted the guiding principles for HLC projects as listed in the English Heritage national HLC methodological review (Aldred and Fairclough 2002). The document described theoretical and methodological developments since the first HLC undertaken in Cornwall in 1994, and the guiding principles outlined below:

- Characterise the whole landscape in the present day;
- Be straight forward, consistent, repeatable and verifiable with further assessment;
- Be as far as possible objective, with areas of subjectivity made transparent;
- Consider no part of the landscape to be greater in value than another;
- Generalise, i.e. identify dominant historic landscape;
- Use a concept of mainly visible time-depth over long periods of time;
- Use present day 1:25,000 Ordnance Survey (OS) maps as the primary base;
- Maps discrete area of HL character within the present day landscape;
- Provide a common, easily understandable language for users and a starting point for further research;
- Use an archaeological approach to the interpretation of HL.

MoLAS followed the initial approach pioneered by Wessex for amending these principles to render them suitable for application to HSC. For example, Wessex noted that while there are some activities that take place on land based HLC that do not alter the character of the land to any detectable degree, there are numerous examples of this kind of activity that occur in the marine environment. Like Wessex, MoLAS determined that where human activity of this kind took place it should be recorded among the attributes and assessed in determining the character as it comprises an essential component of the intertidal and marine landscape.

3 The product of characterisation

3.1 Analysis and interpretation

Following terrestrial HLC practice, mapping was produced for analysis as follows:

- Analysis of Sub-Character Types - the analysis of these reveals the activities and features in the intertidal and marine landscape that ultimately lead to characterisation.
- Map of period or time depth - this map can be compared against other themed mapping such as maps of primary intrusive industry. A comparison of these maps indicates how primary intrusive industry is a primary element in driving seascape change in the modern period.

3.1.1 General Patterns

On the basis of the character mapping produced it is possible to make a number of broad statements about the character of the Withernsea to Skegness pilot area.

The study area comprises approximately 80 km of coastline between Withernsea and Skegness but also includes 120 km length of the tidal Humber Estuary, which has a tidal shoreline in excess of 600 km. The study area is set within a highly dynamic estuarine, coastal and marine seascape. Its form has been largely influenced by local accumulations of Pleistocene deposits and Holocene sea level change, erosion and sediment deposition. The area around Spurn Head and the Humber Estuary has a particularly well recorded history of coastal seascape changes.

The backshore area and hinterland of the study area is characterised by a mixture of different landscapes, which are directly related to historic sea-use. These range from the heavily industrialised banks of the Humber to the touristic holiday beaches of the Cleethorpes to Skegness coast. The offshore area is heavily characterised by activities related to industry and navigation. For instance there are eleven licensed aggregate dredging areas in the study area as well as active channel dredging in the Humber Estuary. Other industrial activity includes important inshore and offshore fisheries, hydrocarbon extraction on the Amethyst, Pickering and Sole Gas Fields with major pipeline terminals at Easington and Theddlethorpe. There are proposed offshore wind farms on the Inner Dowsing and Lynn banks. Major shipping lanes are defined on the approaches to the Humber Estuary for craft using the ports of Grimsby, Immingham and Hull and there is a large offshore military training area based around the Donna Nook Firing Range.

The modern coastline has been formed by a complicated mix of different coastal processes, which continue to act upon it in specific ways. Many areas of the coast are currently eroding away, such as Holderness and the beaches between Mablethorpe and Skegness, while other areas are accreting, such as between Cleethorpes and Mablethorpe and Skegness to Gibraltar Point. As a result of this, some parts of the study area consist of land reclaimed from the sea during the medieval and post-medieval periods (specifically around the Humber Estuary). In many other areas villages have been lost to the advancing sea over the last one hundred years

alone. The situation is complicated by the fact that some areas that are now being eroded only emerged from the sea or salt marsh during the last five hundred years. In the more agricultural areas like Lincolnshire, landuse has changed little over the past five hundred years and, as a result of reclamation, many areas which were once coastal (with associated coastal landuses) are no longer technically coastal but situated literally miles inland.

The situation is complicated by the fact that many of the more ancient, prehistoric land surfaces, either buried under the boulder clay deposited during the last ice age, or the marine silts deposited during the marine transgression of the Mesolithic and Neolithic periods, are now being uncovered in some areas where coastal erosion is at its severest. This is particularly evident along the flat Lincolnshire coast where land surfaces are exposed and then become susceptible to erosion. The situation along the Yorkshire coast is very different as the coastal interface is composed of cliffs, which erode by breaking off in chunks and falling into the sea. Underlying ancient land surfaces are, therefore, not exposed prior to erosion.

As with the Wessex approach, the Withernsea to Skegness project works on the principle that there are key themes/activities, which broadly characterise the study area (WA Final Report 2006, 3). Although the Withernsea to Skegness pilot has themes in common with the Wessex pilot, some of the definitions of these themes differ. In addition, the Withernsea to Skegness pilot study has identified themes not made explicit in the Wessex study and has chosen not to include the theme identified by Wessex as 'Environment' (see Section 3.3 for more information). An outline of each of the Withernsea to Skegness pilot broad themes now follows. The process by which these themes were developed into broad character levels and the rationale behind the sub-character type choices is outlined in Section 4.7. The process is described in more detail in the Method Statement.

3.1.2 Navigation

Navigation has historically characterised large areas of the sea and coast in the pilot area. For instance, the Humber Estuary has been historically maintained primarily so that navigation can take place. This usage can be traced back via historical sources to at least the 9th century, when Grimsby was founded and first grew into a port. Documentary sources also indicate that the trading port of Hull was founded in the 12th century, at the junction of the rivers Hull and Humber. Archaeological sources allow us to trace the navigational significance of the Humber back even further, with the discovery of the world famous Bronze Age boats on the foreshore at North Ferriby.

Most of the navigational activity that has historically taken place in the Estuary is related to the fishing, and other cargo trading industries, and transportation in general. Traffic volume in the Humber Estuary increased during the 1800s when the trawling trade began to grow exponentially, due to the development of sail trawling technology. By the end of the 1800s Hull and Grimsby were the world's biggest fishing ports.

The Estuary is a highly dynamic environment and the waters are heavily laden with sediment. The sediment moves around continually, changing the shape of the channels in the Estuary and creating semi-permanent islands. The Estuary has a history of being very treacherous, especially for smaller vessels that don't always stick to the dredged channels. Consequently the Estuary has a high volume of shipwrecks, many of which are clustered in the most historically treacherous locations. Many of these wreck sites are now navigational hazards, as well as being

of archaeological interest. In recent years attempts have been made to stabilise some of the channels by dredging and putting training works in.

Offshore evidence for historic navigation activities is more ephemeral in that it hasn't always resulted in creation of tangible features that relate to it. This is largely because depth of water prevents this from happening. In some cases routes have been found to follow certain seabed features and there tend to be higher concentrations of wrecks in these areas.

3.1.3 Coastal industry

Many of the inshore fisheries are an important part of the local (and national) economy and fishing and fishing related industries play an important part in the life of many of the communities in the coastal zone of the study area. As a result coastal industry is very historic in nature and has a lot of time depth. It is closely related to the category of settlement.

The NESFC dates earliest documented use of coastal fishing areas at 1840, but historical sources and archaeological evidence shows that these areas have been in use for as long as communities have lived along the coastline. Although technological advances have changed the type of fishing that takes place, many techniques have remained relatively unchanged. For instance the crab and lobster potting area of the East Riding coast has been fished for a long time using relatively unchanged traditional methods.

3.1.4 Offshore industry

Most of the offshore extractive industry that takes place in the pilot area is modern and has been occurring on a large scale for the past 50 years or so. These industries have fewer long term historic links with some of the local settlements but have come to dominate the character of the coastal areas since the industrial revolution.

In many cases oil and gas are piped directly to terminals on the shore, such as at Easington and Theddlethorpe. Many of the offshore fishing areas have probably been fished for a very long time but this cannot be documented, using historic evidence. During the 'fishing life' of these offshore areas, the way that they have been fished and managed has probably changed a great deal. Specifically, current fishing patterns can be traced back to the advent of commercial trawling in the 1800s, which changed how much fish could be extracted from the sea at any one time. This in turn was related to the advent of the railways, which could transport these large amounts of fresh fish around the country quickly. So, although these same fishing areas have in many cases been fished for a long period of time, they have only been commercially fished for the last 200 or so years and it was during this period that fishing activities most affected nature of development in places like Hull and Grimsby.

Although fish species live in areas of the sea to which they are best adapted, human beings have ensured that these areas survive for human use and so spawning grounds and fishing areas can certainly be seen as being actively managed and maintained even where there is no tangible evidence of this.

3.1.5 Settlement

It was felt that maritime settlements were an active part of how seascapes are generated, and vice versa, and are a significant part of the maritime cultural heritage of the study area. The

Withernsea to Skegness pilot was, therefore, also seen as an opportunity to make the connections between coastal settlements and historic use of the sea explicit.

3.1.6 Recreation

The category of recreation dates almost exclusively from the post-medieval period, the Withernsea to Skegness pilot area, and is linked to the advent of railway travel. The railways allowed people from other areas of the UK to get easy access to the coast for the first time. The coastal areas went from being exclusively characterised as fishing areas, etc, to also being identified with a booming tourist industry. Many of the areas where coastal recreation takes place today has a dual use as coastal/offshore fishing and mariculture areas. Many of the 'Recreation' and 'Coastal industry' uses are seasonal in nature.

The overall effect that recreation has had on keeping the coastline constant over the past 200+ years cannot be denied.

3.1.7 Military

Numerous areas with military character were identified on this section of coast during the characterisation process. Military activity has clearly been very important to the historic development of the coast and use of the sea in this area. Military activity has also been responsible for deposition of many WWII war plane wrecks immediately offshore. Although the Withernsea to Skegness seascape is no longer actively military in nature, many features still exist and so the military nature of the landscape is still evident.

3.1.8 Flood defence and reclamation

There are many areas of the coastline that can be described as being 'historic reclaimed land' and this project does not claim to have accounted for all of them. There were not enough resources available to carry out a full assessment of reclamation in the study area and this would be a lengthy project in itself. An attempt has been made to document the areas where reclamation has been actively documented as part of this project. In order to discover this, documentary sources, map evidence and aerial photographs were used. It has been possible to give a rough idea of which bits might have been reclaimed in the post-medieval period and which might date to the medieval and earlier periods.

In most cases, recent episodes of reclamation have taken place in areas prone to accretion. For instance, Sunk Island, on the north bank of the Humber, and the Isle of Axholme to the west were purposely and systematically reclaimed in the post-medieval period. Reclamation has also historically been strongly associated with coastal salt making industries. This is because the process of salt making resulted in mounds of silt being deposited, as a by-product, which helped along the accretion process. Salt making is known to have taken place along the Lincolnshire coast for millennia and many of the early medieval settlements along the coast may have been founded on saltern mounds.

3.2 Establishing coastal, intertidal and maritime character

Wessex note that establishing historic seascape character is about recognising human influences on the landscape and that this process does not stop at built heritage, but can also include features that might ostensibly be considered to be natural, such as vegetation types (WA final

Report 2006, 13). Character is drawn from the different elements that make up a landscape, like geology, cultural heritage, etc, and so requires research into many different elements (ibid).

The problem is that although these concepts have been well discussed and considered for terrestrial HLC, it is difficult to apply them directly to maritime contexts (ibid 14). Character values associated with the marine landscape are sometimes not immediately visible and the opportunities for observing these values can be limited. One particular area may have many different characters and values depending on who is looking at it and for what purpose. This is difficult to capture using traditional HLC methods.

Wessex identified the possibility of a multitude of values as a potential problem, because of the fact that GIS is the tool being used to view these characteristics and it is a two dimensional viewing device, so that only one thing can be seen at a time (ibid 13-15). Essentially this forces the mapper to choose what he/she considers to be the dominant characteristic. The other more secondary characteristics are still a part of the project, however, but it is not possible to view them while the project is layered according to the most dominant characteristic. The secondary characteristics can be viewed by querying the attribute fields accordingly.

Although HLC is supposed to be a value-free mapping process, there is no doubt that it is carried out according to the opinion of the mapper. The Withernsea to Skegness pilot project recognises that the action of the mapper in choosing what should be the dominant character or the previous character, etc, may introduce subjective and difficult to measure variables into the project. For instance, if characterisation involves choosing a dominant feature, the process of deciding what is and what isn't dominant should be carried out against a set of criteria, so that the intent of and choices made by the mapper can be made visible. Once this has been carried out the mapper assesses his/her decision making according to a confidence rating.

In the case of the Withernsea to Skegness pilot area, dominance is measured by considering a combination of impact and consistency of use. So for example, something that is only characterised in a certain way at particular times of the year is perceived as being less dominant than something that is characterised all year long. Similarly a feature or activity that causes a high impact will be considered more dominant than one that does not. Measuring dominance by these criteria reflects the fact that as heritage managers we might want to be made immediately aware of activities and features that will or have caused the greatest impact. This approach was applied consistently, when assessing the character of polygons in the study area. In many cases it was difficult to choose one dominant character out of a range of possible, seemingly equal, character types.

The project has been deliberately layered by dominance. Bias and loss of information has been limited by polygonising the less dominant characteristics and including these in the project too. This has been done as opposed to simply including the less dominant characteristics as attributes of the dominant characteristic or summarising them in the character area descriptions (as Wessex did in their seascapes project in line with other examples of HLC). This means that the project can be queried and ordered according to a range of different attributes, depending on the nature of the enquiry.

For example, in the busy Humber Estuary some areas have multiple uses and therefore multiple characters. The Cleethorpes foreshore has a number of different uses. It is a historic drying area

and its proximity to Grimsby means that it presents a navigational hazard to shipping, heading to and from the port. In addition it has mariculture uses as a bait digging area, contains an inactive licensed shellfish area and has recreational uses as a pleasure beach. There are, therefore, four different character polygons in this relatively small area alone. Within the GIS project the polygons are arranged in layers, with the character type considered to be the most dominant at the top. In this case the historic drying area is considered to be most dominant because of its year round status as a navigation hazard. Although the bait digging activities literally have more impact, this activity only takes place in a small area and on an ad-hoc basis. It could also be argued that the use of the foreshore as pleasure beach is actually the dominant characteristic. Using the criteria of impact and continuity, however, it is not the most dominant feature as there is low impact and use for recreation purposes is localised and seasonal.

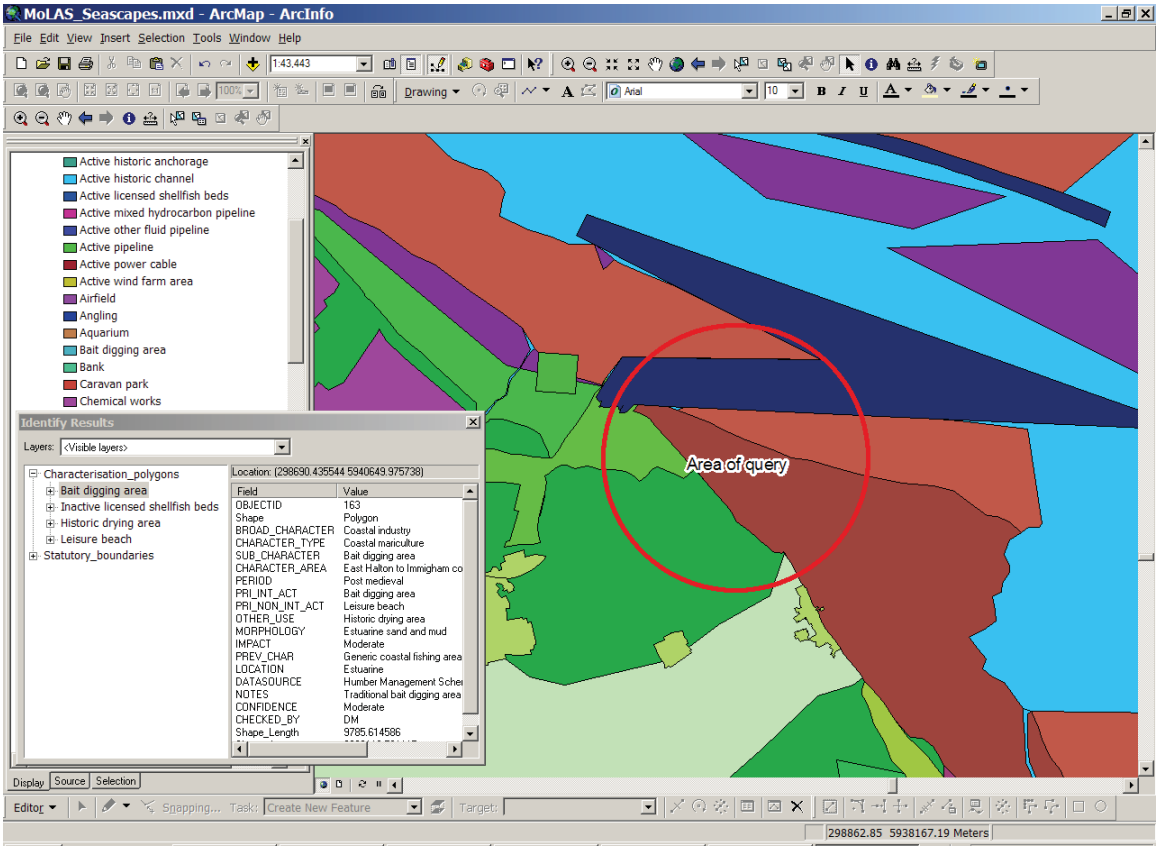

Fig 3: Example of layering strategy

3.3 Suitability of sources

The success or failure of accurately capturing the character of any given area ultimately depended on access to and quality of the primary and secondary sources. Data sources were very disparate across the study area and, because of differential quality and the time constraints of the overall project, only certain of these could be utilised.

The initial stages of the pilot project were involved with identifying source data types and assessing suitability for characterisation purposes. Some sources were provided as a baseline to start working from. It was during initial analysis of these that complimentary data types were

identified and analysed. Analysis of sources was a fairly lengthy process as was extraction of useful information from sources.

After considering the Wessex approach, it was decided that rather than organise the data by splitting it into environmental, present cultural and past cultural information sets and creating a series of intermediate information layers, it would be better to store extracted data in one project as a number of separate layers, not organised by theme but by data type.

It was decided at the outset that the project would not be developed with a separate, broad character type called 'Environment'. This is partly because it was concluded there were no areas in the Withernsea to Skegness study area that fell neatly into this broad category. It was noted that as cultural facets were being expressed via the integral attributes of each character polygon, informing on overall character of historic human use, so environmental features should be part of the attributes of each polygon also. In reality, both cultural and environmental factors have a bearing on the character of any one area of sea/land and it was decided that this would be better expressed in the individual attribute table of each polygon.

It was also noted that many of the data sets did not split up neatly into 'Environmental' sources and 'Historic cultural' sources, or into sea use present and sea use past. Identification of character using the attribute table was limited to identifying elements of the physical form of the sea, the current uses of the sea and previous use of the sea. In this way continuity could be properly traced between present and past uses and the extent to which the physical attributes of the sea might be connected to these uses could be analysed.

Many of the primary data sets that were used in the characterisation process were already split up into 'cultural' and 'environmental' data types. One of the first tasks was to extract the data types and put them together so they could be studied as one.

3.3.1 Physical Properties and Environmental Sources

A number of sources contained information about the physical nature of the sea and the initial data trawl led us to isolate a wide variety of data types that could be useful for the purposes of characterisation. Most of the information came from SeaZone, UKHO and BGS map sources in both digital and hardcopy format, and documentary sources, primarily the relevant SMPs.

In summary the information extracted informed on the following physical features of the sea:

- Underlying geology
- Sedimentology
- Bathymetry
- Depth areas
- Natural and physical features (shore and sea)
- Water turbulance
- Tidal stream

Physical and other environmental features are relevant to characterisation only in their capacity to have a bearing on mapped cultural activities. Physical features only directly became a part of the characterisation where they had taken on a cultural meaning, as in they were identified in

particular ways because of their effects on cultural features/activities. A good example of this is that physical features of seabed/coast were included and characterised according to their effect on the process of navigation.

As Wessex found in their pilot study, environmental factors do have an effect on archaeological sites, but this is very difficult to assess in a general way (ibid). The possible effects depend on a combination of different factors, as demonstrated by Muckelroy's study (Muckelroy 1977).

Detailed consideration of environmental affects on cultural/archaeological sites and human activities could be considered to be beyond the remit of a characterisation project. If one considers what happens in terrestrial HLC, there can be no doubt that archaeological/cultural sites on land are also subject to various environmental conditions, but an assessment of these is not built into land based HLC. Much further work needs to be done in this area but the ability for characterisation projects to encompass this kind of research does seem to be limited.

Only the natural and physical features of the coast and shore that had a direct bearing on navigation activity were selected from the datasets and used in the process of characterisation. Other features that were not utilised directly in the GIS project were used to inform on the character area descriptions.

3.3.2 Cultural Sources: Present Activities

The most concise map of current human use of the sea and shore that currently exists has been drawn up by SeaZone Solutions Limited. Along with Mastermap, this was the main resource used in the characterisation process.

Although SeaZone contains a wealth of information, it was found to have limitations. This data set is not an unbiased resource in the same way that a geographic map might be as it was produced primarily to be an aid to navigation. For this reason it was not possible to simply use it to inform on the pilot study without first recategorising the information contained within it.

One major problem is that some data sets in SeaZone are described primarily by what they are while other data sets are described primarily by the possible effect they might have on the process of navigation (with what they actually are being secondary). This made simple extraction of the data for characterisation purposes problematic. A good example of this can be seen in the way the wreck data is contained within SeaZone. Most of it can be found under the 'wrecks' section of the 'Structures and Obstructions' category, but further wreck data is also stored in this category as 'obstruction' (with no immediate indication of which obstructions were actually wrecks). Wreck data also appears as 'caution areas' in the 'Transportation and routes' section of 'Socio-Economic and Marine Use' category. In addition, not all existing wrecks were included in the SeaZone dataset; only the ones that had a possible effect on navigation appeared. The SeaZone data was supplemented with NMR and HER data sets to make sure all wrecks were accounted for.

SeaZone was the main source for characterising the offshore area but some of the data was found to be very general. In particular, data on use of the sea for fishing purposes was not specific enough for this important category to be adequately mapped out. For this reason SeaZone data had to be supplemented with other sources; for example, data on fishing activities was obtained from CEFAS, JNCC, NESFC and documentary sources.

In summary the information extracted informed on the following cultural characteristics of the sea:

- Dredged areas (maintenance)
- Wellheads
- Diffusers
- Foul areas
- Pipelines
- Buoys
- Fishing areas
- Mariculture areas
- Navigation aids
- Wreck data
- Admin and regulation
- Licensed areas (dredging, wind farms,etc)
- Military practice areas
- Transportation and routes
- Conservation and protected areas
- Anchorages
- Property boundaries
- NMR
- SMR
- HER

3.3.3 Cultural Sources: Historic Activities

Collation of information relating to historic activity was not treated as a separate task from defining current maritime activities and indeed it was during the identification of current activities that historic ones were first recognised.

The sources that were utilised to analyse historic maritime use were mainly landmark historic mapping for the coastal areas and historic marine charts for the offshore areas. This was consolidated using documentary sources. Most of this was carried out to study time depth.

Character polygons in coastal areas were found to be fundamentally historic in nature. Indeed, the maritime aspects of many of the coastal areas were found to date back to at least the medieval period. This reflects the primary purpose that coastal areas have as access points to the sea. The nature of land use has been connected to sea use since human beings first occupied the areas. By contrast, the sources used to map current human uses of the offshore environment showed that most uses were modern or post medieval at earliest. Despite this, the ways that human beings have been using the offshore areas will in most cases be directly related to the coastal uses and so many of these will actually have historic time depth. The difference is that activities that have taken place out at sea have in lots of cases left no tangible mark and so primacy is given to what is known about sea use today. There are maps and documentary sources that give information about offshore activities but they are few and those that do exist are not very specific about what took place and where.

The aim of this project is not to reconstruct past landscapes but it is still necessary to be aware of what these past landscapes might have been because one of the aims of the project is to find a way of recognising archaeological potential in the character polygons. Paradoxically, archaeological potential may not actually have anything to do with historical continuity and time depth of specific human uses. This is because buried archaeology may not be related to any current historic land uses. For example, any potential deposits that survive under the sea floor may not be directly related to historic sea-use because they are prehistoric, pre-transgression landscapes. In some ways this creates a difficult contradiction as deposits that have no cultural sea-use connections do not sit easily or logically in a project that is designed to highlight and focus on seascape themes alone.

Maritime activities do have a direct impact on archaeological deposits buried under the sea, however, and because we need to know what is happening to them in order to more effectively manage the archaeological resource, they have to have a place in the project. In addition to the fact that it is not easy to include archaeological deposits a GIS project that is concerned with mapping historic continuity of current sea uses, little is known about the archaeological potential of the North Sea floor, beyond the fact that certain areas may be judged to have higher potential than other areas. For example, it could be argued that gravel terraces along ancient pre-transgression river valleys might be areas of higher archaeological potential, because these areas would have provided the most attractive habitats to prehistoric humans. It is precisely these areas that are targeted for aggregate dredging and so this conflict of interest creates substantial heritage management concerns. The challenge for the project has been to adequately incorporate all these different elements.

A similar problem occurs on the landward side of the seascape study area. The landward side of the study area was limited to include terrestrial elements that are related to maritime use. This was done in order to limit double-handling of areas already being dealt with by land HLC projects. In reality, however, there is no neat measurable zone where land based maritime features begin and end. Sea level and coastline change means that many historic seascapes can now be found miles within land, well away from their former sea contexts. In addition, because of the connections between industrialisation of fishing and the advent of the railways, it could be argued that human interaction with the sea has influenced development in many inland urban centres. For example, the railways enabled cheap fish caught using trawlers to be transported all over the country very quickly. This spurred on growth and development and changed the eating habits of the nation. The extent to which this has happened cannot be made totally visible in a seascapes project, but the fact that there are links at least can be made explicit as a result of the project.

The aims of this project were designed by EH to find ways of identifying historic value of the sea and this is not a separate thing from recognising historic value of the land. In reality the character of the entire British Isles is associated with sea-use, to some extent. After all this is an island. This project should be seen as the first step in the process of recognising this value and then adapting the existing HLC methods to attempt to capture it. MoLAS has come to the conclusion that having one method for the sea and another for the land will only ultimately cause information to be lost. The ultimate method should ideally be holistic and capable of capturing the cultural blurring that occurs between sea and land and the continually changing coastline.

4 Methodology of Historic Seascape Characterisation

4.1 Introduction

This section of the report describes the steps taken by MoLAS in building the pilot characterisation project. This is a broad description of the method, whereas the Method Statement (MoLAS 2007) provides greater technical detail of the use of GIS to build the characterisation.

4.2 Review of previous terrestrial and marine HLC projects

MoLAS undertook a review of previous HLC projects and commentaries on them, such as English Heritage's national HLC methodological review (Aldred and Fairclough 2002). Following's example, MoLAS adopted the guiding principles summarised in Aldred and Fairclough's report (see Wessex Method Statement 2006). In some cases the MoLAS approach has deviated from the one outlined in this document and Wessex's approach. Details of these decisions and any changes are explained where relevant in this section.

In addition to the national Historic Landscape Characterisation (HLC) and Landscape Character (LC) guidance, and examples of county HLC projects consulted, which were essentially the same as the ones Wessex consulted, MoLAS also looked at further examples of marine characterisation projects, including:

- Wessex Archaeology Liverpool Bay Seascapes Pilot
- JNCC Irish Sea Pilot
- Humber Archaeological Partnership RCZA

Review of all the above documents found that although each attempted to characterise maritime elements from a human cultural perspective, the idea that some parts can be separated off into non-human 'environmental' areas is a central theme.

In contrast to the studies listed above, the Withernsea to Skegness pilot has attempted to carry out characterisation from an entirely human perspective. That is not to say that information about the physical environment is not included in the project, it is simply not included as a distinct and separate broad category of its own. One of the central philosophies of the MoLAS approach has been that environmental information should be included as an attribute of every polygon, in the same way as cultural information.

4.3 Establishing good practice

The seascape has followed the best practice principles proposed by Aldred and Fairclough's Historic Landscape Characterisation Taking Stock of the Method (2002). The project has also built on the concept that GIS has great potential to be used not simply as a display tool but as an

interpretation tool. The GIS project has not only been developed as a tool for producing amalgamated map overlays, it has also been used to create a complex layered sequence of character polygons, which can be ordered in different ways depending on how the user wishes to query the database.

The Withernsea to Skegness pilot has adhered to *Guidelines for English Heritage projects involving GIS* (English Heritage 2004) and utilised EH online thesauri (*Inscription*) (see MoLAS Method Statement).

4.4 Reviewing user expectations

MoLAS endeavoured to undertake the pilot project with a clear understanding of the expectations of potential users and their information needs.

MoLAS identified several potential end users of the project and contacted them to provide information. The main potential users were identified as being members of the professional archaeological community and local authorities. To a large extent the project caters for the specific needs of archaeological contractual and curatorial users and planning authorities. This is because these groups showed the most interest in the project and literature about the needs of this community exists in great detail. In addition MoLAS is a member of the archaeological community and so already has a fairly clear idea about the needs of this group, so it is not surprising that the project became heavily biased in this direction.

This archaeological user bias in turn brings in other related potential users like central and local government representatives involved in marine planning and marine developers. Indeed the ultimate reason for this work taking place is through the ALSF, set up by the aggregates industry. It is only correct, therefore, that management of historic and archaeological concerns be the main focus of the project.

Attempts were made to engage other, non archaeological groups as part of the project but this was not massively successful. The main reasons for this lack of success can probably be put down to specific nature of the parameters of the brief and the relatively short timescale of the project. It is clear, however, that there is great potential for future engagement of potential non archaeological end users. Some of these have already been identified but there is enough flexibility built into the project, through the multi-layered approach, so that other future potential users can be identified and the project could still accommodate their requirements.

MoLAS arranged two stakeholder meetings and during these meetings various views were expressed about data the stakeholders would like to see included in the project. Suggestions were also made as to where particular data types could be found. A full list of stakeholders is included in the table below.

Name	**Organisation**
Andrew Barron	Environment Agency
Giles Bartlett	North Eastern Sea Fisheries Committee
Mark Bennet	Lincolnshire HER
Trevor Brigham	Humber Archaeology Partnership
Paul Bryan	Defra MFA
John Buglass	Humber Archaeology Partnership
Glyn Coppack	EH East of England Regional Team
Virginia Dellino-Musgrave	English Heritage Maritime Archaeology Team
Paul Eastwood	CEFAS
Dave Evans	Humber Archaeology Partnership
Graham Fairclough	EH Characterisation Team
Helen Fenwick	Hull University
Naomi Field,	Lindsey Archaeology Service
Andy Hammon	EH Yorks and Humber Regional Team
Guy Hannaford	UK Hydrographic Office
Dave Hooley	EH Characterisation Team
Laura Jackson	Lincolnshire HER
Louise Jennings	Lincs CC
Isobel Johnson	Marine Fisheries Agency
Stewart Kemsley	DCMS
Brian Kerr	EH
Tom Lane	APS Archaeology
Kevin Leahy	North Lincs Museum
Edward Lewis	Lincolnshire HER
Malcolm Lillie	Hull University
Beryl Lott	Lincs Principle Arc
Michael Meekums	Defra
Bob Moss	UK Hydrographic Office
Peter Murphy	EH Maritime Archaeology Team
Sally Murray	Natural England
Mark Newman	National Trust
Adam Partington	Lincs CC
Chris Pater	EH Maritime Archaeology Team
Jim Rees	CEFAS
Ian Rowlandson	North Lincs Community Archaeologist
Mark Russell	BMAPA
Alison Williams	North Lincolnshire SMR
Jim Williams	East Midlands EH
Jenny Young	Lincs Heritage

Table 2: List of stakeholders

4.5 Conceptual model

As part of the Liverpool Bay pilot study, Wessex trialled three different conceptual models for carrying out characterisation. In the end they developed their project according to what they termed the 'Multi-mode' approach (WA Final Report 2006, 30-32).

This approach involved selecting relevant data sources, extracting information and putting it into three separate layers called sea use present, sea use past and environment. This was done in order to group information according to methods often used during the development of research frameworks (ibid).

Although the approach followed by MoLAS could be loosely described as 'Multi-mode', MoLAS did not feel it was necessary to construct an intermediate layering system arranged according to different themes. This is because it was considered to be potentially detrimental to the conceptual development of the Withernsea to Skegness pilot, because of the risk of imposing a structure at an early stage that may not be appropriate in the long run. Instead, all potentially relevant data types were extracted from data sources and put into one layer together, without categorising them according to 'past', 'present' or environment. Using this method, polygons from many different sources were overlaid simultaneously, allowing patterns to be made visible. Sub-character polygons were then constructed by studying the layered information and drawing new shapes over the top. This is basically the 'Unions' approach as described by Wessex, but without the under layer of intermediate themed mapping. The end result was a new polygon boundary that takes account of, but equates with none of, the underlying polygons.

4.6 Polygon generation

The specific method by which polygons were generated varied from area to area, depending on the particular data sources used. Generally speaking the main differences occurred between offshore and coastal/nearshore polygon generation. In every case information that had been extracted from relevant map sources was analysed collectively by overlaying prior to polygon creation.

For intertidal areas, information types extracted often included modern and historic map data. For example, in the Humber Estuary the complexity and time depth of the very changeable drying areas was captured by overlaying data from a series of modern and historic maps. Sub-character polygons were then generated of these historic drying areas by summarising the combined information from the underlying polygons. It was noted that the shape of drying areas changes on a monthly basis, according to the regular map surveys that are undertaken of the Estuary, and so the summarised polygons were more likely to accurately represent the historic nature of the drying area and their categorisation as historic navigation hazards. The generation of historic drying area polygons was also aided by looking at the areas in relation to other datasets, such as shipping channels and wreck information.

For polygon generation on coastal land a similar method was employed as above. For example, the creation of historic maritime settlement polygons involved firstly identifying which settlements were both historic and maritime. In order to discover this, current settlements were

identified by overlaying digital modern mastermap and supplementary contemporary map sources, at different scales. The settlements were then traced backwards in time by overlaying with historic Landmark mapping and conservation area maps from local authorities, etc, while simultaneously assessing maritime character by checking documentary historical sources. Only the historic core of small settlements or conserved historic areas of larger settlements that could be proved to relate in some way to the maritime history of a settlement have been included in the characterisation. Modern redeveloped areas of former historic maritime settlements, that were judged to have no direct link to use of the sea, have not been included (see Section 4.7).

For offshore areas the process was simpler because there were fewer sources to overlay. This introduced the potential for copyright issues, however, as SeaZone mapping is the primary source for most offshore areas. When researching into historic fishing areas current fishing areas were first of all identified using a mixture of CEFAS and NESFC data, depth areas, geology and bathymetry from SeaZone and historic time depth was measured using the Albert Close historic fisherman's chart. Polygons were generated based on an amalgamation of these sources.

4.7 Developing terminology and character definitions

MoLAS adopted Wessex's three tier hierarchical approach by constructing the characterisation project according to assessments of broad character, character type and sub character categories. MoLAS did not, however, adopt all of Wessex's broad character types and where broad categories were adopted, a different interpretation of the category was sometimes imposed.

4.7.1 Navigation

The Withernsea to Skegness pilot study has adopted a similar reading of the concept of navigation as Wessex, in that the category can be split up into features that exist as a result of the action of navigation, or that are there to facilitate it, and features that affect where and what kind of navigation can take place (WA Final Report 2006, 8-9). Similar to Wessex, docks and ports are not included in the category of navigation, even though they are technically an important part of facilitating the process of navigation. Their primary function is perceived, in this case, as receiving and discharging cargoes. They are, therefore, better placed in the 'Coastal industry' category.

Within the GIS project the category of navigation relates mainly to features and hazards. Features can be routes, channels and anchorages, which may be physical features on the sea-bed or marked out by buoyage on the surface. Hazards are generally physical features, both natural and human-made, recorded where they are known to represent a hazard to navigation, because this influences the nature of navigation and where navigation can take place. There is also lots of jurisdiction that is related to the process of navigation in the study area, which is totally intangible, but nevertheless has a direct influence on shaping how specific areas of the sea and coast are used. Jurisdiction has, therefore, been included as a distinct character type, unlike in the Wessex study.

4.7.2 Coastal industry

In contrast to the Wessex study, it was decided fairly early on that, due to the complex industrial character of the Withernsea to Skegness study area, it would be beneficial to split the category of industry into coastal and offshore zones.

As industry is the only broad theme which characterises particularly large areas of the coast and the offshore zone, it was considered important to capture the conceptual difference between the two environments and the fact that they are used in different ways. That is not to say they are not considered to be connected, in fact in many cases it is the connections between coastal and offshore industrial activities that has caused character to develop in the specific ways that it has. It was discovered that highlighting the distinction between coast and sea industries, by having separate categories, drew more attention to the ways in which they connect. Making these connections more visible makes the process by which coastal and offshore industrial activities influence one another very explicit and makes the resulting characterisation patterns more visible.

In the GIS project coastal industry includes any industrial structures, processes, activities on the shore/intertidal area that are directly or indirectly related to the sea. This can range from docks ports and terminals and processing industries to mariculture and fisheries. Many of the docks in the study area are quite specialised and can be seen as terminals that relate directly to some of the large offshore industrial areas. For instance there are cargo terminals, some of which receive aggregates, oil, etc, and fishing terminals that often receive certain fish types from particular areas. There are also passenger ports and other terminal types.

4.7.3 Offshore industry

Offshore industry differs from coastal industry in terms of scale and complexity. The offshore industrial character areas tend to be larger and more often used exclusively for one purpose, unlike coastal areas which are smaller and tend to have multiple uses. As a result, offshore industry can be split up into more specific categories. For instance, areas can be split up according to what is being extracted from them, ie gas, oil, aggregates, or even by what fish species is being targeted.

4.7.4 Settlement

The category of settlement, as it has been applied to the Withernsea to Skegness study area, is quite different to the meaning of category as employed by Wessex (WA Final Report 2006, 12). Wessex used this category specifically to account for structural coastal landmarks that are used for purposes of navigation, such as light houses and certain buildings. Although there are similar features in the Withernsea to Skegness pilot, which are part of navigational lines of sight, etc, they are mostly individual features and too small to show up as polygonised sub-character shapes. As well as this, it was noted that virtually all of the coastal settlements in the study area have been historically, strongly associated with the sea and considerable elements of their character can be classed as maritime, in that they came into existence as a result of various maritime activities. For instance, many of the small settlements along the Lincolnshire coast owe their existence at least partly to ancient salt making and fishing industries. Some of the bigger towns and cities, such as Grimsby and Hull, are situated where they are because of the existence of natural harbours or convenient access points to the sea in those areas. Hull and Grimsby in particular became as developed as they did because of the booming fishing industry in the 1700s and 1800s.

In the GIS project, settlement types are split into villages and larger towns and cities in an attempt to distinguish between historic settlements that retain maritime character through lack of redevelopment and historic settlements that retain character through deliberate conservation of

maritime elements. It was thought to be important to identify these processes to get an idea of what forces are at work that affect maritime character of these settlements. For instance, many of the larger urban settlements have been extensively redeveloped over the past 100 years, causing them to lose maritime character. This reflects, amongst other things, a change in economic priorities of these places.

The criteria used to distinguish between villages, towns and City's was a combination of individual placenames (ie 'village of…', 'town of…' etc), the settlement's general appearance and location and the mapper's perception of comparative sizes of settlements. The presence or absence of historic maritime character in settlements was assessed by studying modern and historic maps in conjunction with historic sources and aerial photographs. Only settlement areas that were judged to have historic maritime character were polygonised and included in the project.

4.7.5 Recreation

This category is almost identical in meaning to the category of recreation used in the Wessex Archaeology pilot study (ibid, 11). The category is an important characteristic of the historic seascape in the Withernsea to Skegness pilot area and includes all things that people do to entertain themselves using the sea/coast and any features that relate to these activities. In Recreation we can include areas of sea and coast set aside and maintained for this specific purpose, that might otherwise have been used for something else. This includes pleasure beaches, nature reserves, offshore heritage, environmentally sensitive areas; basically any areas that are preserved for human education/recreation/tourism purposes.

In the GIS project recreation is split up into features relating to amusement based leisure activities, like beaches and water sports, and areas that have been designated and set aside for cultural/environmental education purposes, like nature reserves and monuments.

4.7.6 Military

Similar to the Wessex Archaeology pilot study, areas of the Withernsea to Skegness pilot area were found to have military character. This character originates from the historical need to defend the coast and sea and carry out military operations in this area. A lot of the coastline, Humber Estuary and offshore areas have remnant military features relating to WWI and WWII, which in many cases are now listed. These are not just individual features but can also be areas of landscape. Areas of the coast are also still used as military practice areas, particularly around Donna Nook.

In the GIS project, military structures and areas are differentiated in order to reflect the fact that in some cases whole areas of landscape are structured in a tangible, military way. Mostly these areas are now disused or used for another purpose. Some of the military areas are intangible and jurisdictive zones, but are nonetheless related to a particular form of usage that has the potential to result in tangible military effects becoming evident.

4.7.7 Flood defences and reclaimed land

This is a new category, drawn up for the purposes of the Withernsea to Skegness pilot study. Flood defence and reclamation are considered to be related concepts because they are concerned with holding the line between land and sea and both efforts may result in more habitable land

being created. Flood defence and reclamation have historically influenced tidal activities in the study area, affected environmental conditions on and offshore and actively changed the shape of the coastline.

Flood defended areas are those areas of land that are currently actively defended from the sea through use of some form of defence, such as sea wall, banks or groynes. The polygonised shape in the GIS project includes the defence line that is being held on the coast and the area that the defence line is intended to protect. In other words, the shape represents the area that would be reclaimed by the sea if the defences were not in place. In a sense the shape created can also be seen as representing a potential future seascape.

4.8 Establishing time depth

The HLC method of benchmarking OS maps and interpretation of surrounding features, professional judgement and historical research was followed in order to establish time depth.

MoLAS looked at Wessex's use of sea level change model but decided that, because of the very complex nature of sea level change in the Withernsea to Skegness Pilot study area, it would be virtually impossible to carry this out.

Wessex's concept of time depth was developed on the premise that ultimately, time depth of maritime use in the offshore environment is related to the date at which transgression occurred (WA Final Report, 21). In a general sense this is certainly true and the time depth of the maritime character of their project area as a whole can be said to relate to this. The problem with this concept is that understanding ultimate time depth as the date that transgression occurred is not really related to depth of human uses for specific purposes, it is only related to the *potential* for humans to have used certain bits of the sea for maritime purposes, based on the fact that they could have a maritime use because they are no longer dry land. This does not really provide continuity with current sea uses. For this reason we chose not to produce a model of sea level change, as Wessex did. We thought it would be too subjective and, unless it could be specifically related to particular polygons, was not directly related to the remit of the project.

The concept of time depth has been applied to the Withernsea to Skegness pilot area in a very specific way. Close scrutiny of Wessex's use of the concept shows a few inconsistencies. In some cases they appear to be referring to the time depth of the activity taking place in the sub-character polygon defined and in other cases they are referring to the time depth of the portion of the seabed in the polygon, referring to the point at which it was inundated. As mentioned, MoLAS's reading of the latter concept is not tracing time depth of human use in that polygon. It is identifying a combination of the possibility for a pre-marine, pre-transgression use and the first time it was possible for the area to have a marine use. In both cases it is not possible to guess at what those uses might have been, however. If anything this should actually be counted as a previous use (although I am not sure in what sense inundation by the sea can really be counted as a previous human use either) not a continuous one.

In other cases it is not clear if the period of origin stated is referring to origin of the polygon or date the seabed was transgressed. For example, one particular polygon that delimits a fishing area had 'Mesolithic' as its benchmark origin. If they mean the fishing area polygon can be traced back to the Mesolithic because this is the date that the sea inundated this area then I

would have to disagree. Just because something is 'the sea' and fish and other sea organisms can be found there, it doesn't necessarily follow that it can be descried as being used by humans as a fishing area, because there is no proof of this. The other issue is that the fishing areas in use today cannot really be traced back beyond the post medieval or possibly medieval period. This is because the size of the areas and the way they are fished today is the result of the fishing technologies that were developed in the 1700s and 1800s.

The concept of time depth developed for the Withernsea to Skegness pilot relates entirely to the benchmark origin for the current uses represented by the sub-character polygon. The main problem we encountered with this is approach is that in most cases this meant time depth did not reach back very far, particularly for offshore areas, which are virtually all modern. Confining period to meaning time depth of current uses alone therefore removes the possibility of alluding to archaeological potential of the seabed. To overcome this problem we chose to adopt the attribute field called 'Previous Character', which is commonly used in HLC practice. In most cases this allows the pre-transgression character of sea floor to be captured. In addition, the offline .html map also gives detailed information on previous character through the 'Archaeological potential' category.

The date ranges used for the 'period' attribute in the Withernsea to Skegness pilot are based on those suggested by MIDAS Data Standard (RCHME 1998) and the nomenclature comes from standard MoLAS style (MoLAS 2007). The full range of possible dates in the range are not reproduced here, only the dates that are relevant to the GIS project are listed.

Period	**Date range**
Prehistoric	c 450,000BP - AD 43
Devensian/Holocene	c 25,000 BP – c 10,000 BP/c 10,000 BP - present
Neolithic	c 4,000 – c 2,000 BC
Roman	AD 43 - 410
Medieval	AD 410 – c 1500
Post medieval	c 1500 - 1901
Modern	1901 – present day

Wessex note that because more reliable information about the post-medieval and modern periods exists, it might be possible to split these periods up more into particular time spans (WA Final Report 2006, 22). We looked into the possibility of doing this but found the date information to be so disparate that it didn't fit into obvious time spans, so we stuck with the method followed by Wessex.

4.9 Identifying character areas

Similar to Wessex, the Character Area layer in the Withernsea to Skegness pilot project is used to define and summarise areas where polygons with similar polygons are found in close spatial relationships.

The main difference between the MoLAS and the Wessex use of the character area concept is that the Wessex character areas hold no character attribute information. MoLAS character areas hold the same character attribute information as the characterisation polygons. So, for instance, the Broad_Character and Character_Type, etc, of the character areas is recorded.

The character narratives created for the offline ARCIMS project relate directly to the Character Area polygons in the GIS project and are a synthesis of the varied character elements they contain supported by secondary sources. Seventy-four character areas were defined in the Withernsea to Skegness pilot study area. A descriptive text for each character area was generated for the ARCIMS .html website, which contained information under the following headings:

- Present Day Form
- Sea-Use: Present
- Sea-Use: Past
- Archaeological Potential
- Perceptions
- References

4.10 Copyright and usage agreements

Due to copyright limitations associated with SeaZone and BGS data in particular, no data was directly reproduced from these sources. Instead, all the characterisation polygons produced can be more accurately described as an amalgamation of these data sources, which resulted in a new character shape derived from these primary sources. Specifically, new polygon boundaries were created which took account of but did not equate with any pre-existing polygons.

Historic information obtained from local SMRs and HERs were also subject to 'data release' agreements. These stipulate that the information given should only be used for purposes of the Withernsea to Skegness pilot study project.

4.11 Recommendations on how often to update this HSC

This issue is still a matter of debate, but general consensus at the moment seems to be around every ten years (WA Final Report 2006, 45).

5 Potential applications

5.1 Introduction

This question of potential application was explored in depth by Wessex in the course of their Liverpool Bay pilot (WA Final Report 2006, 45-59). The assessment they carried out is still directly applicable to the Withernsea to Sekgness pilot and so will not be repeated in depth here but simply outlined in list format, with details added where necessary. The broad context of archaeology policy with regard to coastal and marine zone is set out in *Taking to the water: English Heritage's initial Policy for the Management of Maritime Archaeology in England* (English Heritage 2002).

5.1.1 Marine spatial planning

Marine spatial planning is an area-based strategic plan for regulating, managing and protecting the marine environment that addresses the multiple, cumulative and potentially conflicting uses of the seas.

As noted by Wessex, the objectives of marine spatial planning can be fulfilled by HSC projects. HSC character area descriptions include synthesis of maritime history, archaeological potential and cultural values and reveal patterning of current uses. The most likely forms of planning outputs are the development of strategies, guidelines, the attachment of status (designations) and zoning based on archaeological potential.

5.1.2 Marine aggregates extraction

Government policy on marine mineral extraction is set out in Marine Minerals Guidance Note 1 (MMG 1). MMG 1 states that all applications for dredging permission in previously un-dredged areas will require EIA. There are ten active aggregate dredging areas in the Withernsea to Skegness pilot study area and so issues related to aggregate extraction is one area where this pilot study could be very useful. The assessment of these areas, as seen in the GIS project and the Character Area descriptions, shows that all of the areas have a level of archaeological potential. The possible effects of aggregate extraction on the marine historic environment include artefacts such as prehistoric tools, flakes and other materials being removed from their context and lost within the general volume of dredging spoil, *in situ* artefacts and/or deposits of palaeoenvironmental interest may be seriously disrupted, direct damage to wreck structures and contents, destabilisation of sites prompting renewed corrosion, decay, etc.

HSC could be used very effectively to mitigate against these concerns, in conjunction with EIAs and other preliminary scoping reports.

5.1.3 Rapid coastal zone assessment survey

As outlined by Wessex, English Heritage's *Brief for Rapid Coastal Zone Assessment Surveys* (June 1999), which encourages a common approach to coastal surveys and anticipates two phases: Survey Phase I Desk-Based Assessment and Survey Phase II Field Assessment.

One of the driving forces behind the development of the RCZAS programme has been the realisation of the lack of information about the coastal heritage resources in local HERs and the NMR (English Heritage 1999). The Humber Archaeology Partnership started carrying out an RCZA over a broadly similar area to the Withernsea to Skegness pilot, during the latter stages of this project. As this characterisation project has been completed before the Humber RCZA, it is hoped that it could be useful to its further development. Its main use is envisaged to be in providing polygonised extents to monument records. Also, the historical background provided in the character area text will be useful for identifying research priorities.

5.1.4 Shoreline management plans

Shoreline Management Plans (SMP) provide a large-scale assessment of the risk associated with coastal processes and present a policy framework to reduce these risks to people and the developed, historic and natural environments in a sustainable manner' (DEFRA 2001).

There are two main shoreline management plans that have been produced for the zones in the study area, the Humber Estuary plan and the Lincolnshire plan. Both of these include information on the historic environment but it is very generalised. The Withernsea to Skegness characterisation project would be extremely useful to the development of the next generation of these SMPs, studied in conjunction with English Heritage's *Guidance Note on Shoreline Management Planning* (English heritage 2006). This would allow the new generation of plans to consider aspects of the historic environment in much greater depth. This would in turn raise heritage awareness in the study area, as both documents have a very wide circulation.

5.1.5 Development control

Government policy towards archaeology in marine waters was set out in *England's Coastal Heritage* (English Heritage 1996) which stated that 'the principles set out in Planning policy guidance note 16: archaeology and planning (PPG16) should be applied to the treatment of sub-tidal archaeological remains in order to secure best practice'. PPG 16 advises that the preservation of archaeological remains is a material consideration within the planning process and sets out a presumption in favour of the physical preservation of nationally important archaeological remains. Where preservation *in situ* is not justified, PPG16 states that it is reasonable to require the developer to make appropriate and satisfactory provision for excavation and recording.

The Withernsea to Skegness study area is characterised by a great deal of infrastructure and intrusive industry and so this project could be very usefully applied to the area of development control. All of these infrastructure projects now require EIAs but this project would provide an excellent overview of this area of the North Sea. Displaying the project at sub-character polygon level clearly shows which areas have the most intensive infrastructure activity and this would be a very useful tool for managers involved in development control.

The project also provides a context for HER/SMR/NMR records and a useful overview of historic significance of the area. Along a similar vein the project would also be a useful resource for development-led archaeological companies carrying out desk-based research for EIAs and other such documents. It is a centralised and easily accessible resource.

5.1.6 HLC development in midlands and North East Area

At present no HLC projects have been carried out in North Lincolnshire, North East Lincolnshire, Lincolnshire or the East Riding of Yorkshire, although apparently these may be planned for 2007-8 (Dave Hooley pers comm.). It is hoped that the Withernsea to Skegness pilot study can show-case the usefulness of HLC and encourage these areas to prioritise the development of HLC projects of their own.

6 Summary of Achievement of project aims and objectives

Although the development of the project led to some deviation from the original project design and the Wessex model, the overall aims and objectives of developing and adapting the methodology of HLC to England's inter-tidal and marine zone have been met:

Aims:

A1: To apply and develop the Wessex Archaeology Liverpool Bay methodology in a different type of coastal and marine environment (the Withernsea to Skegness and adjacent marine zone pilot area).
A1 fulfilment: Like the Wessex model three conceptual data structures were defined and three methods of drawing polygons/dividing the study were used.
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.
A2 fulfilment: Analysis of a series of intermediate themed maps was generated and a combination of these and analysis and interpretation of the present day sea and coastal use was used to generate the final character areas. Character Areas defined were based exclusively upon this characterisation. MoLAS used the Wessex model to generate the textural description of present form, sea use past, sea use present, archaeological potential, perceptions, and bibliographies.
A3: To ensure that the historic environment GIS-database for the project area can be readily integrated with analogous databases for the natural environment (see below).
A3 fulfilment: The ArcGIS project provides access to the Characterisation_polygon layer allowing the user initially to view the project by top most, or most dominant, layer. Querying the Characterisation_polygon layer reveals the stratigraphic sequence of the project, revealing the rationale behind the project's basic construction. Specific polygons can be queried in different ways, according to the specific attributes that are of interest. Information on the natural environment is captured in the attribute 'environment' at sub-character level. This allows the relationship between the human historic character and the underlying natural, physical environment to be made explicit. It also means the physical environment can be made visible by querying this attribute at sub-character level. It was felt that there were no broad

character areas that could be identified as 'environment' in the study area.

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.
A4 fulfilment: MHLC presents easily assimilated synthesis of seascape history and archaeological potential. The models of coastal change and historic development, although having caveats attached to its use, begins to provide an understanding of potential for historic and prehistoric seascapes.
A5: To enhance and contextualise the Maritime Record of the National Monuments Record and those County 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.

A5 fulfilment: The MoLAS MHLC presents a representation of present day human activities in the coastal zone and offshore, which may be unfamiliar to terrestrial users. The intermediate themed mapping layers are useful as standalone information sources in their own right as they map the extents of maritime features and activities which can be incorporated into HER/NMR data systems. The layers can be used simply as background mapping or fully integrated to either create new or enhance individual monument records. The ArcIMS resource will allow the user to 'visit' locations from their desktop through text digital photograph and provide easy links to wide variety of WEB based information of particular relevance to each character area especially in terms of the large amount of historical and archaeological data which could not be integrated into the project at this stage.

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

A6 fulfilment: Through the feedback from the stakeholders meetings at which the Seascapes project for Withernsea to Skegness was discussed it is clear that MHLC could make a significant contribution to the planning process in the coastal area and in Regional Research Agendas. The use for offshore planning and management of the offshore historic environment is less clear and this area needs to be explored by English Heritage in conjunction with other governmental agencies involved in this area. The Withernsea to Skegness Pilot Project is a significant step forward in improving access to the maritime information base. This project has revealed that the full extent of historic sea use in the region is a complex interaction of human usage of the sea

especially those maritime activities not related directly to the mercantile ports. It has also confirmed that process of post glacial sea level change in the North Sea and the survival of prehistoric landscapes over the wider offshore region are not fully understood. The relationship of intertidal and marine environmental factors to archaeological preservation is still speculative and only broadly understood. Studies of these relationships in the Pilot Area would prove invaluable for the development of reliable predictive models in the intertidal and marine zones. There is a need to develop a clearly defined, long-term research plan to address the wider questions of the environment's influence on site formation and preservation in the intertidal and marine zones.

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.
A7 fulfilment: The project's multi-media ArcIMS resource will provide easily accessible summaries of archaeological and historical information to non-professional users. The GIS project will be a powerful tool for professional concerned with planning and management in the field of historic environment.
A8: To be a demonstration project and specifically to produce a model for extending its methodology to further project areas encompassing a greater diversity of environmental and management conditions.
A8 fulfilment: In compiling this report and the accompanying GIS method statement, MoLAS has attempted to present an objective evaluation of the work undertaken to assist English Heritage in the formulation of an integrated approach to future Seascapes work. In particular, the benefits and drawbacks of the different methods dividing the seabed have been explored and suggestions made for where further work would be particularly beneficial. Like Wessex the project has produced a three-tier hierarchy of terms to define character. The hierarchy is capable of modification and of accepting additional terms which may be utilised in the other Pilot areas.

Objectives:

O1: To produce a GIS-database structure capable of accommodating the distinctive qualities of the project area while retaining compatibility of that database with the interfacing or partly overlapping terrestrial characterisation databases.
O1 fulfilment: Unlike the Wessex model the Withernsea pilot project did not use a 2km terrestrial buffer but rather let the analysis of the seascape dictate the shape of the landward boundary by its association with the sea. This was to give a clear definition, for terrestrial HLCs to work to in the future. The data structure of the 'attribute analysis' layer includes attributes which allows the UID of the terrestrial HLC polygon to be recorded and its primary character to be brought into HLC polygon layer.

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 having 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 that will, together, encompass all of the polygons and reflect the differing historical processes in their information.
O2 fulfilment: The appendices of this report list the documentary sources accessed during the project. The GIS Method Statement accompanying this report describes how the digital datasets of national coverage were acquired, manipulated and incorporated into the HLC. The three-tier hierarchy of character types was utilised to identify areas of similar character. Detailed definitions and examples for the Withernsea to Skegness Pilot have been included in the GIS Method Statement. The data structure of the 'Character Analysis' map includes additional attributes containing information about secondary characteristic, such as 'primary intrusive industry' and 'primary seascape feature'. This attributes where drawn from background mapping, external datasets or intermediate themed mapping generated by MoLAS. An analysis of 'character type' (the second tier in hierarchy) was used to identify groupings of polygons with similar character to define 'character areas'. Character Area descriptions were generated to summarise present character, the historical processes at work through present and past sea use, and the resulting archaeological potential.
O3: To record the sources and datasets supporting each stage of characterisation, to meet

the needs of transparency and assist future updates against the initial benchmark characterisation.
O3 fulfilment: This report contains a detailed bibliography and a listing of the external dataset accessed by the project. The Method Statement includes descriptions of the attributes of intermediate themed mapping layers and attached to each mapping layer is metadata which records the sources and the geo-processing that has been undertaken. The GIS project contains an arc map and database files.
O4: To analyse and interpret HLC to produce preliminary syntheses from it.

O4 fulfilment: Section 3.1 of this report contains descriptions of the human dimensions of Withernsea to Skegness under headings relating to 'broad character' types (i.e. navigation, industry, recreation, military, settlement and environment). In addition the character narratives that accompany the characterisation map comprise a synthesis of the HLC map.
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.
O5 fulfilment: Section 6.3 of this report includes suggestions for ways in which HLC might be used for utilised in the licensing and environmental assessment process for marine aggregates.
O6: To assess present uses and potential for the HLC in informing broader sustainable management of change, spatial planning, outreach and research programmes.
O6 fulfilment: Whilst the form of archaeological marine spatial planning remains unclear, Section 6 of this report includes suggestions for the ways in which HLC might be used to assist general development control, shoreline management plans, rapid coastal zone assessment surveys and in the development of regional research frameworks. The offline HTML pages and ArcIMS resources have significant outreach potential, and are in a form which can be quickly converted into a world-wide web resource.

O8: To produce an archive and a report reviewing the methodological development and practical application of HLC in the project area and assessing the benefits of extending such characterisation more widely to the historic environment in the intertidal and marine zones to the limit of UK territorial waters.
O8 fulfilment: The report describes the methodological development and highlights aspects which could be tested or developed further by the four forthcoming pilots. The project archive will be deposited with the NMR and digital version of the GIS project submitted to Archaeology Data Service.
O9: To disseminate information on the progress and results of the project through professional popular publication and other media.

O9 fulfilment: The project team have given presentations to two meetings of local stakeholders in Hull and Lincoln. Other publicity materials will include a world-wide web site hosted by the ADS/EH.

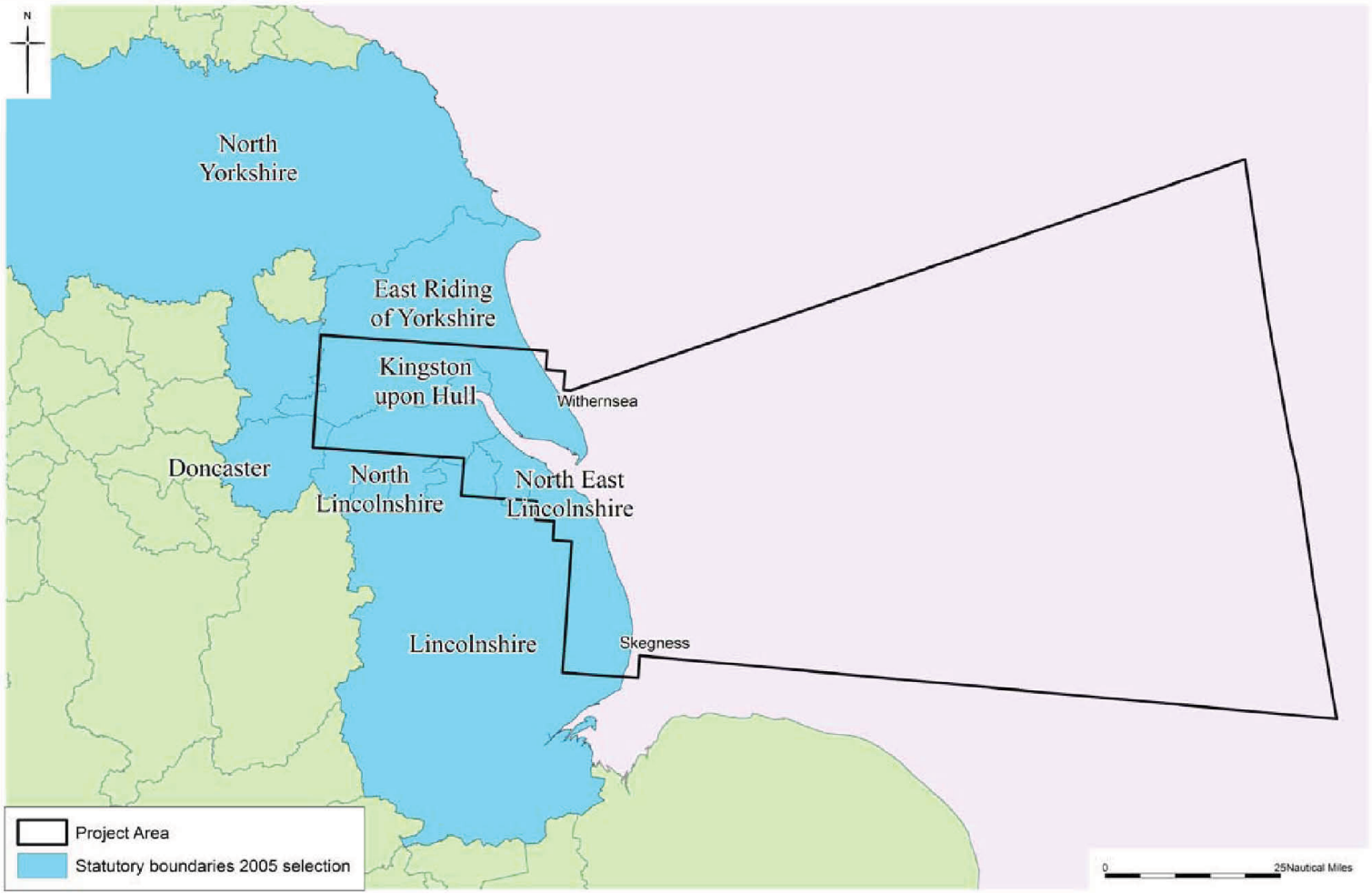

Fig 1: Withernsea to Skegness project study area

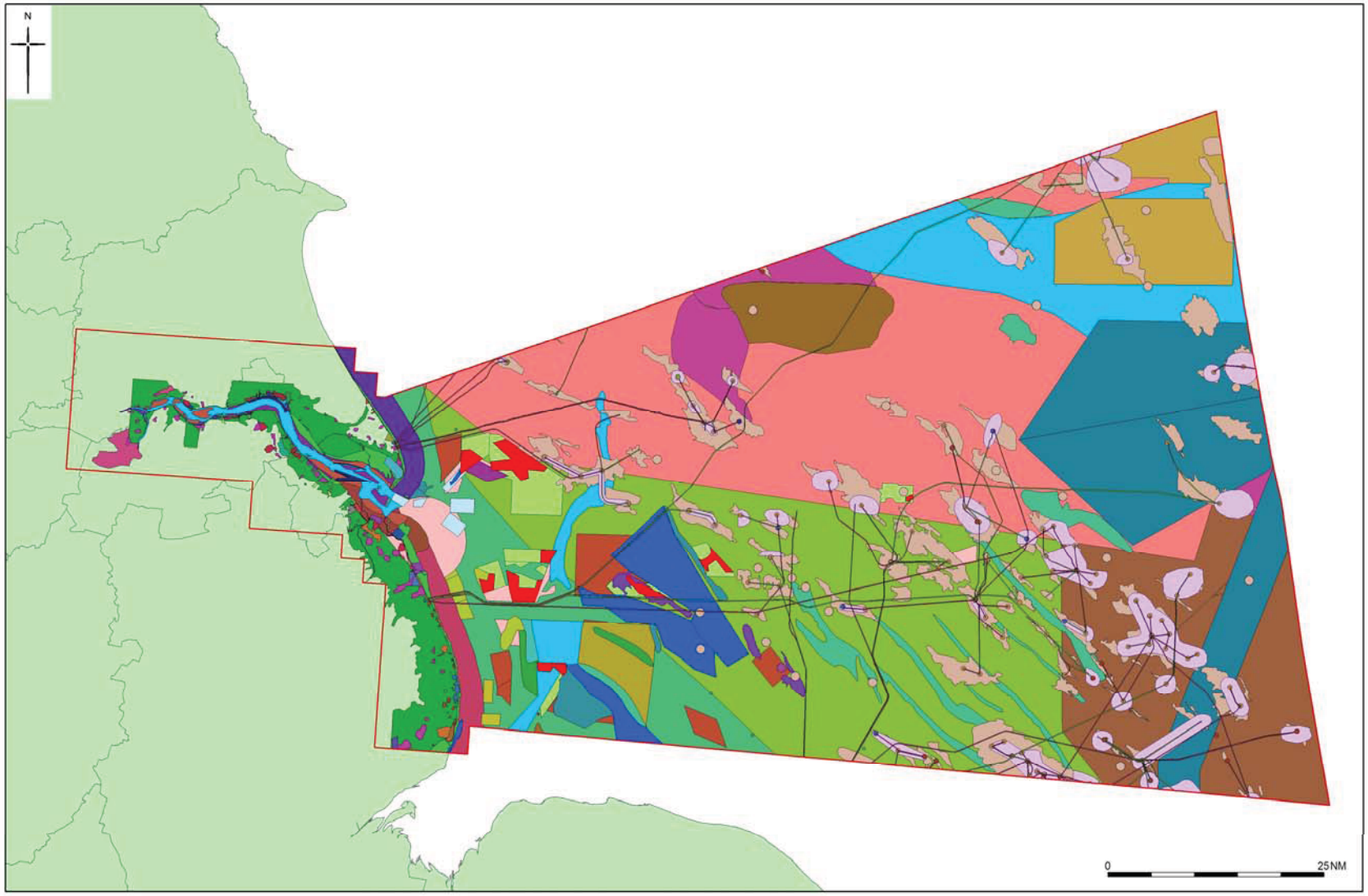

Fig 2 Project displayed at Characterisation_polygon SUB CHARACTER polygons

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