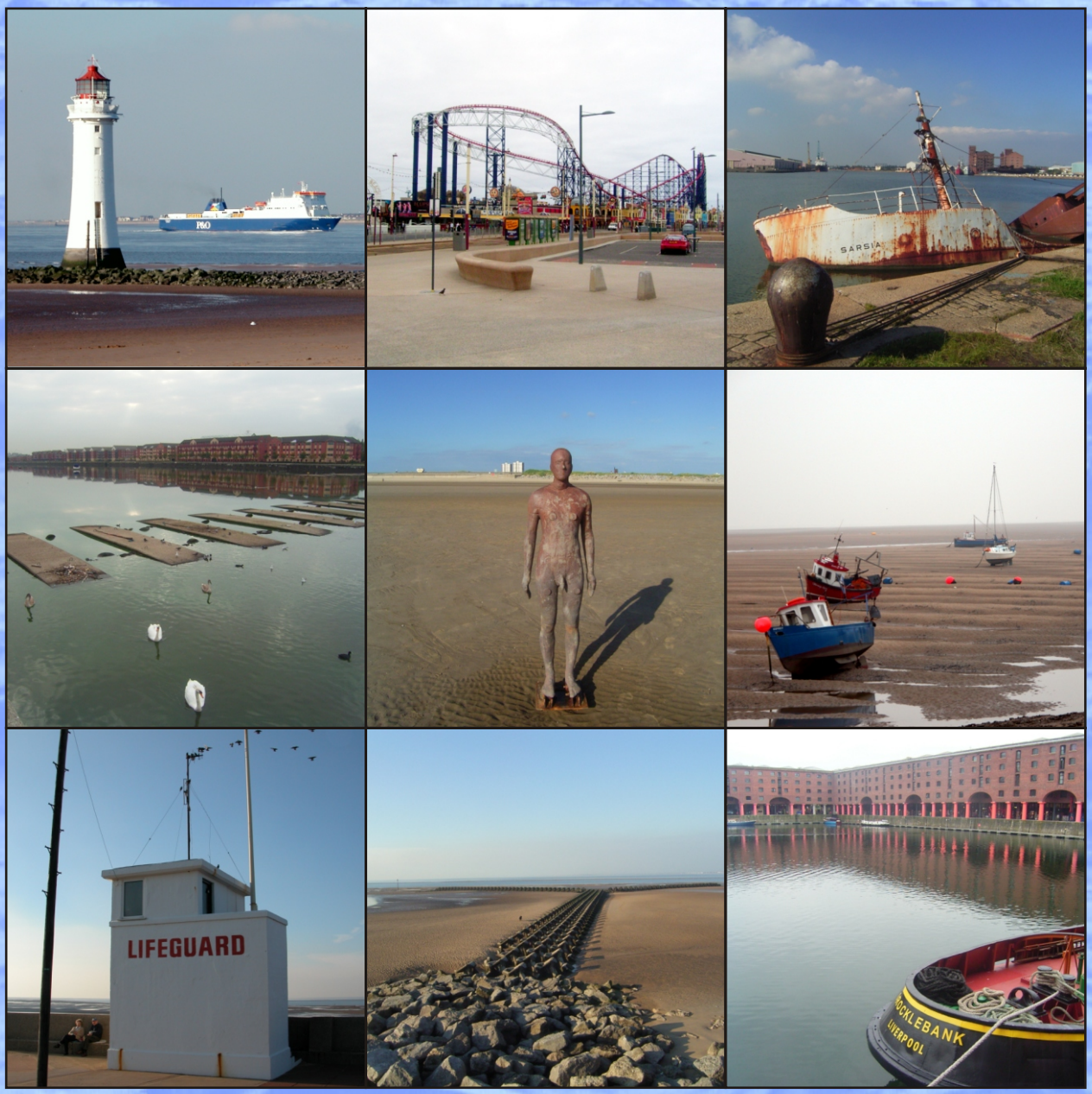
Wessex Archaeology

England's Historic Seascapes

Final Report



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March 2006

AGGREGATE LEVY SUSTAINABILITY FUND

MARINE AGGREGATES AND THE HISTORIC ENVIRONMENT

ENGLAND'S HISTORIC SEASCAPES

FINAL REPORT

Prepared for:

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SUMMARY

Wessex Archaeology has been commissioned by English Heritage to develop a methodology for undertaking Historic Landscape Characterisations (HLC) for the intertidal and marine zones. The aim of the project is to create an intertidal and marine historic characterisation for a Pilot Area in Liverpool Bay, using a method that can later be applied to other intertidal and marine areas. This document outlines the process of intertidal and marine characterisation as undertaken by Wessex Archaeology.

The report revisits the project aims and objectives and how they have been met or by necessity reviewed in light of the special nature of the intertidal and marine zones. 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 intertidal and marine 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 some potential applications for the pilot marine and intertidal HLC, and how it can inform and assist in development planning, archaeological research frameworks and consultation among other uses.

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Wessex Archaeology would also like to thank the various attendees of the project stakeholder meetings for their suggestions and interest in the project.

The report was compiled by Deanna Groom and Brian Hession. The Characterisation work was undertaken by Olivia Merritt, Dr. Virginia Delino-Musgrave, Brian Hession, Margaret Christie and Niall Callan. Technical support was provided by Chris Brayne, Jens Neuberger, James Cheetham and Karen Nichols. Deanna Groom managed the project for Wessex Archaeology. Quality Assurance is provided by Dr Antony Firth, Head of Coastal and Marine Projects.

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1. INTRODUCTION

1.1. PROJECT BACKGROUND

1.1.1. Wessex Archaeology (WA) has been commissioned by English Heritage to develop a methodology for extending Historic Landscape Characterisation (HLC) to the intertidal and marine zones of England, out to the 12 nautical mile limit of territorial waters. The project initially focused on a Pilot Area comprising Liverpool Bay and the Ribble, with a small test area defined at the mouth of the Mersey **(Figure 1).**

1.2. STRUCTURE OF THE REPORT

1.2.1. This report is intended to describe WA's development of a marine HLC (MHLC). It consists of five parts.

1.2.2. The first part provides a description of the character mapping developed by WA, and outlines the principle WA used to guide the development of the characterisation.

1.2.3. The second part provides a wider description of the historic environment of the Pilot Area according to different themes of character.

1.2.4. The third discusses the approach and principles of the intertidal and marine characterisation undertaken by WA and addresses in detail the problems encountered in the course of the development of the characterisation. This includes an outline of WA's approach to source material, the differences between terrestrial and marine characterisation and the wider reasoning behind decisions that affected the final characterisation.

1.2.5. The fourth part describes the methodology of producing the final characterisation map, with reference to the wider principles of the 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 (WA 2006 report ref 58370.05).

1.2.6. The final part describes the fulfilment of project aims and objectives as described below.

1.2.7. The aims of the intertidal and marine historic landscape characterisation are as follows:

A1 To define, test in the Liverpool Bay and Fylde Pilot Area, review and finalise a desk-based methodology for extending historic landscape characterisation to the present landscape in the intertidal and marine zone of England to the limit of UK territorial Waters.

A2 To create a GIS-based characterisation of the historic and archaeological dimension in the present landscape of the intertidal and marine zones of England to the limit of UK Territorial Waters.

A3 To contribute to government agendas in favour of integrated spatial planning of the intertidal and marine zones by creating a historic environment GIS database for the project area which will readily integrate with analogous databases for the natural environment.

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

A5 To enhance and contextualise the Maritime Record of the National Monuments Record and those County SMR/HERs working within the project area.

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

A7 To improve the awareness, understanding and appreciation of the historic dimension of the project area to professional and non-professional users of the database.

A8 To be a demonstration project and specifically to produce a model for extending its methodology to further project areas encompassing a greater diversity of environmental and management conditions.

1.2.8. The project's key objectives are as follows:

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.

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.

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.

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

O5 To produce a Project Design for applying the project's HLC methodology to a further four areas in subsequent projects which will validate that methodology against major contrasts in coastal and marine environmental and management context.

O6 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.

O7 To assess present uses and potential for the HLC in informing broader sustainable management of change, spatial planning, outreach and research programmes.

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.

O9 To disseminate information on the progress and results of the project through professional popular publication and other media.

1.3. THE FINAL PRODUCT AND USER INTERFACE

1.3.1. The final product comprises an easy to use .html interface, which requires no knowledge of GIS to be able to access the characterisation. It also includes the relevant GIS shapefiles for those familiar with GIS to use more flexibly.

1.3.2. The .html 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 (**Figure 2**). The .html pages contain the full characterisation narratives for each different character area with multimedia links to video and still images (**Figure 3**). The user has the ability to access the .html pages via ArcGIS or by the index on the .html home page.

1.3.3. The ArcGIS project provides access to the attribute analysis layer allowing the user to query the attributes behind each polygon and view a number of themed maps based on attributes stored in the underlying geodatabase. The ArcGIS project also contains the metadata for the component datasets used in the characterisation.

1.4. KEY TERMS

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

Character Areas

1.4.2. Character Areas comprise a layer of polygons based on place names derived from charts and named locations. The 'character area' layer is separate from the 'attribute analysis' polygon layer and holds no character attribute information apart from a unique identifying number (UID) for the polygon and the name of the character area. Character Areas form a contiguous layer across the Pilot Area. The character

narratives created by WA relate directly to the Character Area polygons and are a synthesis of the varied character elements they contain supported by secondary sources.

Broad Character Type

1.4.3. Broad Character Type is the highest level of characterisation summarisation. It describes the Pilot Area under headings such as Industry, Navigation, Settlement and Military. It is an amalgamation of similar Character Types. Detailed definitions of the different Broad Character Types are provided in the Method Statement (WA, 2006:58370.05)

Character Type

1.4.4. Character Type represents a summarisation of Sub-Character Type and provides the baseline map for the interpretation of the character of the Character Areas. Detailed definitions of the different Character Types are provided in the Method Statement (WA, 2006:58370.05)

Sub-Character Type

1.4.5. Sub-Character is the finest scale of characterisation and represents a character assessment based on different features or attributes identified and digitised from different source maps. 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 (WA, 2006:58370.05)

1.5. FINAL DATA STRUCTURE

1.5.1. The final data structure of the Liverpool Bay and Fylde Pilot 'Character Analysis' layer consists of the following attributes:

Attribute	Population method	Example of Terminology
Object_ID	AutoID	1211
Shape	Auto populated	
WAID	Auto populated	210002
HLC_ref	Auto populated from terrestrial HLC attributes	14577
Broad_character	Auto populated by character_type via database	Navigation
Character_type	Auto populated by sub_character via database	Navigation Activity
HLC_character_type	Auto populated from terrestrial HLC project attributes	N/A
Period	Manual entry from assessment of model of coastal change and documentary sources	Post-medieval
Primary_attribute	Auto populated from database table showing feature type categorisation.	Primary Intrusive Industry
Primary Landscape	Manual entry	Cockling Area
Other Landscape	Manual entry	Modern Drying Area
Primary_Intrusive_industry	Auto populated from industry map	Aggregate Dredging
Primary_Non-	Auto populated from industry	Commercial Shipping

intrusive_industry	map	
NLO_area	Auto populated from NLO map	Mockbeggar Wharf
Sediment	Used to inform characterisation narratives, but removed from GIS delivered to NMR as a result of unresolved licensing issues.	Sand
Morphology	Used to inform characterisation narratives, but removed from GIS delivered to NMR as a result of unresolved licensing issues	Sand Wave
Habitat	Auto populated from JNCC data	Fine sediment plains
Tidal_range	Auto populated using a tidal range map, derived from the DTI Atlas of Marine Renewable Energy Resources in the public domain.	High - Variation >7 metres
Sealevel	Auto populated from model of sea level change	Very high
Potential Impact	Manual entry	Moderate
Location	Auto populated from Pilot Area designations	Marine
Sub-character	Manual Entry. Checked for accuracy and confidence.	Active historic channel
Confidence	Manual Entry	High
Shape Length	Auto populated	5299.811462
Shape Area	Auto populated	1394484.629236
Checked By	Manual Entry	NC

Table 1: The final 'Character Analysis' layer data structure devised by WA.

2. GUIDING PRINCIPLES

2.1. INTRODUCTION

2.1.1. This section describes the principles adopted by WA to guide the development of the pilot intertidal and marine HLC.

2.2. GUIDING PRINCIPLES OF INTERTIDAL AND MARINE CHARACTRISATION

2.2.1. WA 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.

2.2.2. These principles required some amendment to render them suitable for application to intertidal and marine HLC. For example, WA noted that there are numerous activities that take place in the maritime sphere that do not alter the appearance of the seabed to any detectable degree. Hence, WA determined that where human activity of this kind took place it should be recorded among the attributes and assessed in determining the character as they comprise an essential component of the intertidal and marine landscape. This practice is analogous to the terrestrial practice of recording a present land use.

2.2.3. As a pilot project, Seascapes sought to identify the most readily available and consistent mapping available for the Liverpool Bay and the Fylde coast Pilot Area. For example, the scale of the most continuous mapping of coastal waters is the coastal series of Admiralty charts at a scale of 1:50,000. Charting at larger scales is available for areas that experience concentrations of navigation activity, such as the approaches to harbours. As is suggested by the report of Cornwall's HLC project, the quality of the data maps and charts contain and the mapper's ability to interpret it is the most important factor in determining character (Herring 1998).

3. THE PRODUCT OF CHARACTERISATION

3.1. ANALYSIS AND INTERPRETATION

3.1.1. 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 (**Figure 4**).
- A map of period or time depth - this map can be compared against other themed mapping such as the map of primary intrusive industry. A comparison of these maps indicates how it is a primary element in driving seascape change in the modern period (**Figure 5**).

3.1.2. On the basis of the character mapping produced it is possible to make a number of broad statements about the character of Liverpool Bay supported by secondary sources described below under thematic headings.

General Patterns

3.1.3. The Liverpool Bay and Fylde Pilot Area largely consists of accessible open navigable waters heavily contrasted inshore by a dynamic band of shifting channels and sandbanks. It is perhaps important to note when considering the England's wider coastal landscape, that there are no enclosed bays to provide much contrast to the predominantly linear aspect divided by three major estuaries. Whilst the coastline is in general exposed to the open waters of the Irish Sea, the Wirral peninsula by

contrast is in an unusually sheltered position for a coastal peninsula, defined more by the estuaries of the Dee and Mersey than the open sea.

3.1.4. These maps reveal an intensity of 'character' changes close in shore and in the south, with large areas to the north and north-west noticeable being formed by one character (modern fisheries).

3.1.5. The coastline is low lying, and has a softy profile with areas of sand dunes protecting the coastal plains inland. The inshore sands and the processes that sustain and replenish them have been affected by the construction of training banks in the main navigation channels into Ribble and Mersey. Although the full long term impact of the training walls is not clear and the inshore zone remains dynamic and changeable.

3.1.6. The sandbanks also provide the habitat for shellfish, which are commercially exploited along most of the close inshore areas. The sandbanks are also the source of fine grained aggregates that are won off the Sefton coast. However industrial activities, such as cockling and sand winning, do not appear to visibly intrude on the perceived 'naturalness' of the seascape and the beaches remain the foci for popular recreational activities. Even at Crosby, where the non-bathing beach is right beside the busy commercial waterway of the Crosby Channel, the shore has been transformed into an open air art gallery. A public information board associated with the temporary sculpture installation by Antony Gormley reveals that the installation is to 'explore man's relationship with nature' in a place where 'the prevalence of sky seems to question the earth's substance'.

3.1.7. Recreational use of the coast is also evident along the North Wirral coast and in urban areas like New Brighton, where varying degrees of development affect whether the recreational user utilises the shore to obtain a sense of wilderness or to partake of water sports facilities on the marine lakes.

3.1.8. Extractive industry and fisheries dominate the open sea. Fishing vessels trawl the seabed for sole and plaice and hydrocarbons are extracted from the Lennox and Hamilton Oil and gas fields. The Lennox oil and gas platform is highly visible from much of the coast, although it lies some distance offshore. The development of wind farms off the coast will introduce a new form of industry to the marine environment.

3.1.9. Commercial shipping, and the supporting infrastructure typified by docks, berths and container handling facilities, dominates the River Mersey. Liverpool is the main commercial port of the Pilot Area, although some degree of docks character is retained in the built environment of the now obsolete port of Preston.

3.1.10. Large commercial vessels cross the offshore areas along well-established ferry routes and shipping lanes. Smaller vessels use the whole expanse of the open waters to access fishing grounds or for recreation. These navigational activities represent an important aspect of the character of the marine landscape, as they date back to the origins of seafaring in the area. This activity however, leaves no permanent mark on the sea surface, and instead is represented by the presence of wrecks and related materials that survive on the seabed across the whole area.

Navigation

3.1.11. The foci of navigational activity, historic and present, are the Dee, Mersey and Ribble Estuaries.

3.1.12. The Mersey Estuary, as a water highway, port, source of food and power supply, has been exploited intensively during the past 400 years (Stammers 1994). The narrow mouth of the Mersey at Liverpool ensured that a scouring effect is created by the fast flowing tides. This provides a natural guarantee of deep water and absence of silting at least in this area (Youde 2004).

3.1.13. However, an account from the early 19th century noted that 'the approaches to the land, between the mouths of the Dee and Mersey, have a most formidable aspect, and a stranger casting his eye over the puzzling confusion of banks which break the sea, would scarcely believe that these dangerous passes are avenues to the great port of Liverpool' (Brownbill 1928: 62). Supporting this impression, historic charts show a variety of approaches to the Mersey, all used and buoyed to aid navigation past dangerous areas such as Burbo Bank. For example, vessels heading for Liverpool once used the now disused channels to the south of the Burbo bank to access the Mersey via the Rock Channel, which was noted as 'a very good roadstead to proceed to Liverpool' (Brownbill 1928: 53). Rock Channel is still charted but it exists now as more of a 'pool' than a channel with a greatest depth of only 6.8m.

3.1.14. However, the position and size of the sandbanks such as Burbo Bank could change substantially over time making navigation in the area difficult. Vessels unfamiliar with the area required pilots with navigational skill and local knowledge (Youde, 2004: 12). Sustained losses of vessels on the approaches to Liverpool led to the passing of the first Liverpool Pilotage Act in 1766 to ensure that pilots were licensed (Youde, 2004: 42-43). In recent times the approaches to Liverpool have been formalised and engineered to cater for increasing size of vessels. The training of the Formby channel and regularly maintained buoyage and dredging works provide a safe approach, very different to the multiple, sinuous, and shifting channels that characterised navigation in the past.

3.1.15. Historical charts of the Dee Estuary show the mobility of sandbanks and how significantly the estuary changed through time. Although Chester is an ancient port and the Romans were established there, silting has prevented its continuance as a major port. The first complaints were noted in the 1450s, and the merchants of Chester began to build a new base in Neston. Until the 17th century, sea-borne trade of northwest England passed through Chester and other smaller ports on the estuary of the River Dee. Most travellers departed from the Dee shores in the boats to Ireland (Marker, 1967; 66; Marriott, 1952; 25). However, in 1674 vessels of 20 tons could scarcely reach the town, and ships of burthen were obliged to lie under Neston. This was the origin of the assemblage of houses on the adjacent shore, called Parkgate (Tunnicliff, 1784; 389). From 1730, Parkgate was the port and fashionable centre which was later suppressed by the rapid development of Liverpool (Marker, 1967; 66).

3.1.16. The sandy flats of the Dee estuary have been famous for cockling and other forms of fishing, especially shrimps near Parkgate. However, due to the silting up of the channels, fishing boats had to anchor as far as Thurstaston, between Caldy and

Heswall (Lake, 1952; 19). Eventually, the few fishing boats that remained were moved to Heswall moorings.

3.1.17. The appearance of the river Ribble, its channels and banks, is also likely to have changed substantially over time. The find of possibly Bronze Age dug-out canoes during the construction of Preston Dock in 1885-89 (Middleton, 1996; 46) may indicate navigation of the Ribble at least as far back as this period. Little is known of the area in the Iron Age, except for just before the Roman conquest, when it is reported that a tribe known as the *Setantii* inhabited the area.

3.1.18. There is some speculation that the Roman settlement at Kirkham may have been reached by tidal waters and provided a sea landing for the movement of goods and troops inland via the Ribble to the fortress at Ribchester (Buxton and Shotter, 1996; 88). The Ribble also lies on the route between Ireland, the Isle of Man and the Scandinavian settlements of the east coast of England, and it is likely to have been used by Viking settlers during this period (Newman, 1996; 95).

3.1.19. In the 19th century efforts were made in the hope of developing Preston as a major port. The construction of the docks and training walls for the channel were intended to improve navigation for larger vessels. Several phases of training bank construction were undertaken between 1840 and 1910 (Williams, 2004). The construction of the training banks was opposed by the town of Southport as it was recognised that the construction could cause silting of the South Channel route to the Ribble, important as a channel for the fishermen and the excursion steamers that used Southport Pier (Williams, 2004).

3.1.20. Despite the approval of the central route and the brief success of Preston as the first roll-on-roll-off port, the channels and dock facilities limited the size of vessels that could be accommodated. In 1980, the port closed and the maintenance of the central channel into the Port of Preston was abandoned. Today, the docks serve as a safe mooring place for small recreational craft, many of which access the Ribble through the South Gut and Penfold Channels (Williams, 2004).

3.1.21. The navigable channels into the Ribble have largely silted up and Reed's Nautical Almanac (Featherstone and Lambie, 2004; 547) notes that the best water for approaching the Ribble is now South Gut rather than the main Gut Channel which leads into the trained river. Small vessels can now approach the river via a gap in the southern training wall. It is also noted that the channels are liable to shift and cannot be navigated at low water.

3.1.22. The difficulties of navigation are revealed by the characterisation of the large areas of seabed which are exposed at low tide (drying areas) in the Dee, north of the Wirral and at the entrance to the Ribble. There are also areas of seabed where ship losses are highly concentrated and which are still considered hazardous to navigation.

Industry

3.1.23. Port industries are located primarily on the north and south shores of the Mersey and on the north shore of the Ribble.

3.1.24. Liverpool's dock systems were built between 1715 and 1974, dominating approximately seven miles of the north shore of the Mersey. Passenger traffic in particular is high with Irish Sea ferries, cruise liners and local ferries regularly using the port. The cargo traffic handled in the north-end docks is particularly important to the local economy. The Royal Seaforth and Gladstone docks for example have terminals for containers, grain and other bulk cargoes. There is also a Freeport warehousing complex and a multi-nodal transport system (i.e. railway, road and boat) linking the port to Europe.

3.1.25. The upper River Mersey includes the entrance to the Manchester Ship Canal. Begun in 1887 and opened in 1894, the canal stretches for 36 miles from Eastham, on the southern shore of the Mersey, almost to the centre of Manchester. Thus the canal transformed an inland city into a major port.

3.1.26. The Runcorn area has been the axis of a network of important waterways. Five major canal undertakings were constructed in the vicinity in the 18th century. All were devised to supply the Port of Liverpool with the products of the Industrial Revolution from factories and mines in inland population centres. The Duke of Bridgewater's Canal built in 1760 (Warrington), the Mersey and Irwell Company's Runcorn to Latchford Canal opened in 1740, and the Sankey Canal with its later expansion to Woodend (Widnes), all had their termini near Runcorn (Starkey 1998: 8). Runcorn docks are equipped to handle a variety of bulk and semi-bulk cargoes up to 5000 tonnes. Adjacent to Runcorn Docks is Runcorn Layby, with its deepwater berth. It is suitable for discharging/loading petroleum products and other approved liquids in bulk. Next to Runcorn Layby is Runcorn Saltworks, operated by Salt Union Ltd and primarily used to load salt in bulk. Along the coast, there are also power stations (e.g. Fiddler's Ferry Power Station) and chemical works. Ellesmere Port presents a mixture of light industry, residential and recreational activities illustrated by its marina with restaurants and private apartments, leisure centres and the Boat Museum.

3.1.27. The offshore industries, the Hamilton Gas Field and Lennox Oil and Gas Field dominate the south-western edge of the Pilot Area. In 1989 and 1991, the Hamilton Oil Company Ltd. was awarded licensing blocks for oil and gas exploration and since then the character of the area has become dominated by the hydrocarbon extraction industry and its infrastructure.

3.1.28. Other offshore industries include marine aggregate extraction areas at the mouth of the Mersey and at the western edge of the Pilot Area. Coastal aggregate extraction industry includes sand winning in Ribble estuary and at Southport. To the north west of Formby Point, there is an area allocated for dredging spoil disposal and another between the entrance to the Queen's Channel and the Hamilton Gas Field.

3.1.29. The routes taken by commercial shipping fan out from the westward end of the Queens Channel approach to Liverpool and from the Lune Deep approach to Fleetwood.

3.1.30. Liverpool Bay is one of many fishing grounds in the Irish Sea, but closer definition of particular areas of fisheries activity is problematical. The area is worked mainly by the Fleetwood and Conway inshore fleets, with the outer parts worked

intermittently by European and Irish trawlers. Brown shrimps are one of the stable catches of the close inshore fisheries. Wrecks and debris along the main shipping routes are likely to restrict fishing in places, however documentary sources suggest particular concentrations of trawling activity in the north (west of the Lune Deep) and to the south of the Hamilton Gas Field (JNCC 2004; Dept of Environment 1972).

Recreation

3.1.31. Unsurprisingly, tourist destinations, such as Blackpool and Southport, dominate foreshore character through a variety of activities and features representative of seaside leisure. The fashion for visiting Blackpool for sea-bathing dates back to the early 1700s, when the small settlement began to attract its first visitors. In 1788, William Hutton described how the rich rode in carriages or on horseback along the sands, whilst poorer visitors 'find equal pleasure in using their feet'. He also noted the six yards wide, two hundred yard long promenade of grass, on which 'a perpetual assemblage of company when the weather permits, may be seen upon' (Hutton 1789).

3.1.32. In 19th century, Blackpool's seaside resort 'character' became even more firmly established. In 1819, Henry Banks purchased Lane End Estate and built the first holiday cottages. His son-in-law, Dr John Cocker built Blackpool's first assembly rooms in 1837. In 1863, Blackpool obtained its first pier (the North Pier) designed by Eugenius Birch, and by the 1890s it was estimated that Blackpool's 7,000 dwellings could accommodate 250,000 holiday makers as well as its permanent population of 35,000. Whilst the traditional areas of Lancashire, Yorkshire and Scotland still provide the bulk of the resort's 5 million plus visitors per year, overseas visitors are also attracted by the world-famous illuminations, themed funfair parks, beach entertainment, gaming and conference facilities.

3.1.33. Southport, in its present form, was founded by William Sutton in 1798 and developed into a substantial seaside resort in the late 19th century with a reputation for being a more refined than Blackpool. Tourism still plays a large part of the economic make-up of Southport with miles of sandy beach and recently restored seafront, a Victorian pier, Pleasureland fairground, six golf courses, and shopping facilities flanking the wide town centre boulevard, Lord Street.

3.1.34. New Brighton on the North Wirral Coast also played a substantial part in the North West's tourism and leisure industry in the late 19th and early 20th century. When the New Brighton Tower and Recreation Company Limited purchased the Rock Point Estate of over 20 acres, their plans for the site included a 544 feet high tower modeled on the Paris' Eiffel Tower, with Assembly Hall, Winter Gardens, Refreshment Rooms, and cycle track. After World War II, the condition of the Pleasure Grounds deteriorated and the buildings fell into dis-use. The Tower was destroyed by fire in 1969, following which the site was cleared to create a community open space and housing estate. Fort Perch Rock (now a museum) provides a focus for recreational beach and leisure activities on the North Wirral Coast today.

3.1.35. Other areas characterised as recreational include the sand dunes system of the Sefton coast and areas of saltmarsh in the Ribble Estuary protected for the habitat they

provide for wildfowl. Hence, activities such as bird watching and walking predominate.

Environment

3.1.36. Only where no discernible human activities could be detected were environmental definitions used for characterisation. The exception being the prehistoric land surfaces which have particular archaeological interest. Areas containing peat bed and submerged forests were recorded on the north Wirral coast. The deposits retaining human footprints at Formby are the other instance of prehistoric land surface characterised under this category.

3.1.37. It is important to emphasise that the characterisation of an area as 'environment' does not imply that there is no human element to the landscape, but merely that none was reliably identified in the process of characterisation. As knowledge of the Pilot Area improves, the interpretation of these areas may well require reinterpretation.

Settlement (Maritime Safety)

3.1.38. Analysis and interpretation of settlement patterns has been discussed in the reports of the neighbouring terrestrial HLC projects, However, one aspect of settlement or the built environment which has particular pertinence to HLC are structures and features relating to maritime safety.

3.1.39. Historic charts reveal the importance of coastal landmarks when navigating close to the coast. Many contain information on features on the shore and how their alignment will augment safe navigation into anchorages and buoyed channels. For example, Great Burbo Flats contains navigation lines to Leasowe Light and Kirby Church on the north Wirral Coast, and alignments for safe passage into Hoylake and the anchorages among the channels and sandbanks on the approaches to the Mersey.

3.1.40. Hence structures with a navigational function include not only civil structures such as prominent buildings on the land, but also the structures whose function is solely navigational such as the landmark constructed amongst the low lying sand dunes of the Sefton coast. Leasowe Lighthouse is another such structure. Standing on Leasowe Common, it is a well known landmark on the Wirral and the oldest brick built lighthouse in Britain. It was built in 1763 by the Liverpool Corporation together with another lighthouse and they were known as Sea Lights (Brownbill 1928: 53). Both were erected on the coast of Leasowe; a 'lower light' on the shore and an 'upper light' on the site of the present building. They were used to assist shipping and therefore safely guide ships into the entrance to the Rock Channel and the port of Liverpool. The 'lower light' was washed away by a strong storm and the building collapsed (Brownbill 1928: 53). After this event, Leasowe Lighthouse became the 'lower light' when the 'upper light' was built in Bidson in 1771.

3.1.41. Other features include the Coastguard station south of Formby, the life boat station at West Kirby and lifeguard stations at the main pleasure beaches.

Military

3.1.42. The Liverpool Bay Pilot Area contains two areas of foreshore, which have been utilised by the Ministry of Defence for firing practice ranges, one near the mouth of the River Alt on the Sefton coast and one at Bidston on the Dee.

3.1.43. Although never fully developed as a naval base, Liverpool's terrestrial defences against attack from the sea include Fort Perch Rock, now a museum, which was constructed by Captain J. Sykes Kitson between 1826 and 1829 with later additions (Stammers 1994: 29).

3.1.44. Three Maunsel anti-aircraft sea forts are one aspect of Second World War defence infrastructure, placed in Liverpool Bay to defend the city from air attack. No upstanding remains of these forts remain in the area, although the NMR and UKHO record the dismantled and fallen remains of these forts within the Pilot Area.

4. DISCUSSION

4.1. INTRODUCTION

4.1.1. The following section of this report discusses established ideas of character and their validity in establishing intertidal and marine character based on the issues and ideas raised and debated in the course of WA's characterisation of the Liverpool Bay and Fylde Coast Pilot Area.

4.2. ESTABLISHING INTERTIDAL AND MARINE CHARACTER

4.2.1. Fundamental to establishing 'landscape character' is the ability to recognise human influences on the landscape. In the terrestrial context, research in various disciplines has shown that vegetation types have usually been created or modified in varying degrees by people, and that landscapes widely regarded as natural are the outcome of earlier types of land use (Aalen 1996). Built environments, which can wholly or partially change the landscape are also modified, abandoned and extended, adding to the diversity of human interaction with the landscape.

4.2.2. 'Character' is defined as a distinct and recognisable pattern of elements that occur consistently in a particular type of landscape (Hill *et al* 2001, Swanwick 2002). The elements are drawn from geology, landform, soils, vegetation, land use, field patterns and human settlement. Hence, exploring and understanding the character of any area requires systematic investigation of many different factors that have helped to create and influence that location. Such an exploration can result in relatively objective value-free descriptions, but inevitably incorporates an element of subjective, personal judgement. Visual appearance implies perception, and suggests that the impressions of the observer are also recorded. Perceptual aspects are likely to be coloured by the experience of the individual and the senses. For example, visual impressions might include a sense of wildness, a sense of security, the quality of light, and perceptions of beauty or scenic attractiveness. Factors perceived by other senses might include noisiness, tranquillity and exposure to the elements.

4.2.3. Whilst the ambiguity of the more perceptual impressions might be criticised for being 'elusive', 'ill-defined' or 'vague', the alternate view is that its very subjectivity is a strength, revealing landscapes to be rich repository of human values, the embodiment of attitudes, ideals and beliefs, and infused with cultural symbolism and imagery (Relph 1981).

4.2.4. While these concepts of character are relatively well established for the terrestrial context and provide widely agreed and accepted common values and ideas on which approaches to characterisation can be based, not all of the assumptions that go into making clearly defined character types on land are readily transferable to the intertidal and marine zones without some adjustment or sometimes substantial reconsideration.

4.2.5. The intertidal and marine landscape is very rich in perceptual impressions and cultural associations, but they are difficult to pin down to identifiable parcels of character. In many instances perceptions of an area are too different to be grouped under a single impression. A wide sandy beach that extends miles from the shore can be seen as a popular recreational area to local inhabitants and visitors, but from the sea, it represents a significant navigational hazard should a vessel get too close in the wrong set of sea conditions. In many cases it is hard to choose between these two perceptions unless one takes a particular viewpoint.

4.2.6. In some instances, examining how the area and areas around it are used helped the characterisation mapper make a judgement on the dominant character. For example, reviewed here are two contrasting examples from the characterisation, the area north of the Wirral and the area around Blackpool and Lytham St Annes.

4.2.7. The characterisation of the north Wirral area emphasises the sand banks and coastal sands of the area as navigational hazards due to their proximity to the heavy maritime traffic that converges on Liverpool (**Figure 6**). Recognising that the area has an important perception as a recreational area has not been lost however, as it is described in the character narrative that relate to this area (North Bank) as '*a popular area for bathing and other recreation activities. The low-lying banks provide an unobscured view out to the Irish Sea from the shore…*'.

4.2.8. In contrast to this the characterisation of the area of Blackpool and Lytham St Annes (Crusader Bank), notes a surprisingly industrial character to this area as intrusive industries like sand winning and less intrusive commercial cockling dominate much of the wider area (**Figure 7**). Again, while the industrial aspect has an undoubtedly strong influence on the area, the recreational character of the inshore part of this area is also emphasised '*the nearby recreational centre of Blackpool has a strong influence on the overall impression of the area. Funfair rides, public art and amusement arcades line the shore at Blackpool and illuminate the waterfront at night, and Blackpool's three piers extend out onto the foreshore dominating the low generally featureless sands.'*

4.2.9. The absence of a reference to the area as a navigational hazard might be questioned, given that the wide sandbanks of this area are superficially very similar of those off the Wirral mentioned above. However, while making a judgement of character for the area the demise of the Ribble as a commercial port and the dominance of small craft use in the area suggested that in the present landscape at least this area is seen as much less of a navigational hazard than it might have been in the past.

4.2.10. These examples illustrate how the guiding principle of generalisation adhered to during the characterisation process has revealed the human element that is embodied in an intertidal and marine landscape. It illustrates the diversity that can be found

within what might be seen as homogenous, featureless parts of the intertidal and marine landscape in terms of topology and morphology.

4.2.11. There is less upon which to base judgements of this kind in other parts of the Pilot Area. In cases where it was felt that there was insufficient contextual information for the MHLC mapper to have confidence in their assessment, the confidence in the data was marked as high, moderate or low to inform the user of the possibility for error or misinterpretation.

4.3. CONSTRAINTS ON DEFINING INTERTIDAL AND MARINE CHARACTER TYPES

4.3.1. Herring notes that there are a number of key operational variables affecting the selection of character types that can be mapped (Herring, 1998: 15). These include the available sources (pre-existing systematic mapping), the available resources (project time) and the requirements of the assessment (known and likely end users of the product), the scale of the project and knowledge (the ability to interpret character type).

4.3.2. The effects of these variables were also encountered during the development of a characterisation for the Liverpool Bay and Fylde Pilot Project. Of all of these variables, the issues of sources, scale and knowledge created the greatest difficulties in distinguishing and defining character types.

Suitability of sources for purpose

4.3.3. As with any pilot project where established methods are found not to apply, it was considered best to go from what was known with some degree of certainty before attempting to base a characterisation on speculative information. Information that is possibly accurate within its own terms of reference, but when incorporated into characterisation process would so far deviated from its original intent or purpose, as to result in inaccurate and invalid characterisation. Hence the first stage of the characterisation process involved assessing different data sources and making a judgement not only of their usefulness but also of their reliability.

4.3.4. The review of appropriate, accurate sources on which to base the intertidal and maritime characterisation highlighted many issues which would have to be addressed before the sources could be assessed to determine how they could be interpreted to make a judgement of their contribution to a final dominant character type. The review and assessment of sources was a much more drawn out process than anticipated. In some cases, promising sources had to be discarded and the interpretation of other sources provided less insight into aspects of the Pilot Area's character than might have been expected.

4.3.5. As a pilot project, Seascapes sought to identify the most readily available and consistent mapping for the Liverpool Bay and the Fylde coast area. As is clear form the Cornwall HLC the quantity of sources is not necessarily the most important factor in determining character, but the quality of the data they contain and the mapper's ability to interpret it. The sources examined and used by WA are discussed below.

Physical Properties and Environmental Sources

4.3.6. The first step towards adopting a useful approach was to question the usefulness of different sources for characterisation. Some of the more objective and consistent data for the seabed and intertidal zones is environmental data.

4.3.7. Marine and intertidal areas display many physical attributes. The most fundamental to defining character is the underlying geology, but other physical attributes include:

- Water depth - varied by tidal range and changing seabed geomorphology;
- Water budget - varied by the inflow and outflow from oceanic current systems and freshwater runoff, and the excess of precipitation over evaporation;
- Water temperature - varying spatially and through seasonal thermoclines;
- Water salinity - varying spatially and through the water column;
- Water quality - including suspended sediment load, amounts of trace elements and chemicals, etc.;
- Wave exposure - varying due the openness of the coast and frequency of storm force conditions;
- Tidal stream exposure - driven by the influence of amphidromic systems;
- Geomorphology – the shape of the seabed and foreshore evolving through erosion and deposition driven by the energy of the sea, the hardness of the rock, the amounts of mobile sediment, etc.

4.3.8. Further consideration of which marine environmental characteristics should be included led a review of environmental criteria as indices for archaeological preservation. In the 1977, Keith Muckelroy published an early influential paper concerning environmental factors and the preservation of wreck sites. He described taking factors from parallel studies in marine biology and coastal geomorphology and assessing these in a matrix against 5 classes of wreck sites (Muckelroy 1977). The eleven environmental factors noted by Muckelroy are as follows:

- Maximum offshore fetch, within 30 degrees of the perpendicular to the coast;
- Sea horizon from the site, i.e. sector within which there is more than 10km of open water;
- Percentage of hours during which there are winds of Force 7 or more from directions within the sea horizon;
- Maximum speed of tidal streams across the site;
- Minimum depth of site;
- Maximum depth of site;
- Average slope of the seabed over the whole site;
- Underwater topography: the proportion of the site on which sea-bed consists of geologically recent sedimentary deposits;
- Nature of coarsest material within these sedimentary deposits;
- Nature of finest deposits within these sedimentary deposits.

4.3.9. The conclusions of his research suggested that the fetch, the frequency of stormy weather, and the strength of tidal currents have little effect after the initial deposition. The strongest correlations proved to be between the nature of the seabed (slope, topography and constitution of the deposits) and the exposure of the site to varying forces disturbing the substrate.

4.3.10. The ongoing research being carried out by The Mary Rose Trust into the Mary Rose site and the site's recovered assemblage has broadly confirmed Muckelroy's hypothesis, however they have reduced the number of key factors to those listed below (Mark Jones, Mary Rose Trust, pers. com.):

- Nature of sea-bed deposits;
- Frequency of stormy weather;
- Strength of tidal movement across site;
- Depth of site;
- Burial depth;
- Biological activity (e.g. presence of organisms in seawater and/or sediment capable of degrading the particular material such as bacteria, actinomycetes, fungi and wood boring crustaceans and molluscs).

4.3.11. Of all the possible environmental characteristics and attributes that might be included, tidal movement, seabed morphology, seabed sediments, and storminess/prevailing wind direction were initially selected to explore further for inclusion as these were the most likely to have national data coverage.

4.3.12. The bathymetry, topography and composition of the seabed are recorded on both navigational and geological charts. The assessment of this data highlighted it as useful for determining distinctions in the seabed based on its physical geography. Bedform data, for example, distinguishes bumpy elevated areas of seabed such as sand waves and sand ripples from flat mud plains. This data was considered as potentially useful as it had resonance with distinguishable physical features on land, such as low-lying coastal plains and low hills.

4.3.13. An example from the Lancashire HLC illustrates this. It makes use of physical properties to define character types like 'Moorland Plateaux', described as 'generally characterised by a level or gently rolling landform, although they may include steep high level escarpments, and they are found at elevations of between 300 and 600 metres' (Lancashire County Council, 2000; 31), and Moorland Hills, 'generally at lower elevations then the higher Moorland Plateaux. Although grit crags and glacial erratics provide some texture to the smooth profiles, the steep escarpments create distinctive and dramatic landforms which are steeply incised and drained by fast flowing streams.' (Lancashire County Council, 2000: 35).

4.3.14. One of the problems associated with marine attributes such as bedforms is their mobility. Seabed features such as sandwaves and ripples do not remain static, nonetheless, they do occur in reasonably well-defined areas where factors such as sediment supply, bottom stress and tidal regime combine to create and maintain them. The availability of models of tidal streams and sediment transport systems on which to base MHLC mapping is problematical. For example, the direction and strength of tidal streams are mapped at the temporal scale of a tidal cycle, whilst sediment transport systems are often represented simply as directions of flow. Further exploration of the availability, and then the collation and processing of raw observation data to compile more accurate models was felt to be outside the remit of the Liverpool Bay and Fylde Pilot Project. However, future pilots might wish to take this aspect of mapping environmental characteristics further.

Cultural Sources: Present Activities

4.3.15. In terrestrial HLC, a cursory glance at a map shows clear differences across a landscape. Farmland is easily recognised through fields and farmsteads; settlements are recognised by the clusters of houses and other constructions. It is even possible to distinguish between the industrial and residential components of urban areas. All of these examples tell us more about the human component of the landscape than a description of an area as a 'plain' or a 'hill' can. The farmland illustrates agricultural activity, the houses a domestic and residential built environment and the industrial areas the working urban built environment.

4.3.16. The review and assessment of sources for the seascapes pilot project quickly revealed how markedly different the established mapping of the land differs from the sea. Maritime charts also provide a wealth of cultural information and provide clues to sea use. However, the map of sea use depicted on a chart is focussed primarily on the use of the sea as a medium for navigation. The charts show buoyed channels and depict seamarks and lines of sight, but with few exceptions it does not reveal the different types of sea use.

4.3.17. Some clues about activity or even the absence of certain kinds of activity can be derived from charts. Areas demarcating anchoring, fishing exclusion zones, dumping grounds and offshore installations are all marked on charts and provide some basis for locating activities on the sea, but these occur as isolated small areas leaving large blank areas over the rest of the map.

4.3.18. To establish the true extent of all activities in the Pilot Area it was necessary to turn to other sources for activity. The most important of these proved to be the Joint Nature Conservation Committee (JNCC). The JNCC data provided useful information on fish habitat and fishing effort, which allowed fishing, a major human activity at sea, to be included in the characterisation.

Cultural Sources: Historic Activities

4.3.19. The assessment and interpretation of sources for determining the extent and nature of past human activity in the Pilot Area raised further issues for the development of the character map.

4.3.20. The inclusion of a wider selection of sources provided more detailed information on activities in the Pilot Area, but significant differences in a characterisation mapper's ability to interpret these data sources remain, particularly for past sea use. For example, in terrestrial contexts spatial activity is settled and exclusive, while on the sea, human activity is predominantly transient and non-exclusive. In addition, on land, previous activity often physically restructures the landscape. This can constrain its subsequent use. At sea, past activities tend not to physically constrain subsequent activity as they have not physically shaped the sea or seabed in the same way.

4.3.21. Terrestrial maps, even if they date to the 19th century, are actually mapping the known activity from the prehistoric to Post Medieval periods, insofar as it has physically altered the landscape. As previous activity at sea has not altered the sea or

seabed, marine charts do not implicitly map landscape use and change over these periods.

4.3.22. Past navigational activity such as anchoring and the use of channels was a readily identifiable past activity to plot on a map of the Pilot Area. The extent and nature of other activities however, was much more difficult to define.

4.3.23. For example, it is beyond doubt that fishing vessels of different kinds exploited the fishing grounds of the Pilot Area in the past, but it is not clear exactly where. As a result it was not possible to determine with any degree of confidence any differences in the nature and extent of past fishing activity from that of the present in a way that could be represented on a character map. As a consequence, it was decided that details of past activities such as fishing should be described in more general terms in the final character area narratives to provide a greater sense of time depth to the descriptions of theses areas.

4.3.24. In addition it was always an aim of the project to be clear about what could not determined reliably about aspects of the Pilot Area, and this uncertainty is noted in the character area narratives and confidence ratings of each character type where this is the case.

4.3.25. The evidence for past maritime activity exists as physical remains on the seabed. The earliest archaeological remains comprise submerged terrestrial landscapes, surviving as relict land surfaces and palaeochannels. After the most recent marine transgressions, archaeological inputs take the form of shipwrecks, lost cargoes, marine debris and downed aircraft.

4.3.26. However, past human activity in the Pilot Area is not confined to sea use. Most of the Pilot Area existed either as dry land or an intertidal landscape since the beginning of the Holocene. To include this aspect of the past character of the seabed it was necessary to devise a model of sea level change in the Pilot Area to provide an approximation of the course of marine transgression in the region in the post glacial period. This past dry land use of the seabed was difficult to draw through the characterisation process as its survival and influence on the present intertidal and marine landscape is difficult to establish in the Pilot Area. However, the possibility of past dry land landscapes surviving in some form at least is noted in the narrative texts for the final character areas so that it was not lost merely because its survival and influence in the Pilot Area is poorly understood.

4.3.27. Searches for other sources revealed a great number of secondary sources, useful for building narratives to contextualise the character types, and these allowed WA to better interpret the character types of the Pilot Area and make decisions on the dominance or significance of the components of character identified and used to create the final characterisation.

4.3.28. In the context of the intertidal and marine historic environment, the phrase ‘maritime cultural landscape’ was originally associated with the interests of resource management to embrace the remains at the shoreline, under or above water, and later extended to the implications of landscapes and social interactions (Westerdahl 1991, 1994). It was recognised that in addition to the historical and archaeological

attributes that allow the mapper to characterise the intertidal and marine landscape, there are more 'intangible' aspects relating to social and cultural perceptions:

Archaeological/Historical Characteristics	Social/Cultural Characteristics
Defences (castles, invasion beacons)	Sea shanties (ballards, songs associated with particular ship-board tasks)
Sea and flood defences (harbours, seawalls, groynes)	Migration and immigration (population demographics, arrival and departure)
Safety (lifeboats, lighthouses, bouys)	People (fishermen, dock workers, naval personnel, explorers, famous mariners)
Communications (bridges, transport hubs such as harbour and dock complexes)	Art (paintings, poetry, plays, novels)
Maritime (ships, shipwrecks, boats, boat and shipyards, ferries)	Language (dialect, seafaring terms)
Contraband (smuggling, piracy, revenue and coastguard services)	Leisure and Recreation (holidays)
Extractive industry (quarrying, salt-making, sand-winning)	Religion (seamen's missions, burial practices)
Dumping (fill, ballast, dredging resources)	Education (schools for seafarers, training ships)
	Politics and social institutions (trade unions, bequests, influence of wealthy ship-owners)
	Social hierarchies (classes, roles of men, women and children)
	Customs (superstitions, festivals)

Table 2: Differences between the archaeological and historical elements of a seascape, and the cultural characteristics (after Hill et al 2001: 28).

4.3.29. As can be seen, even in the present when society is distanced from and yet still highly dependent upon the sea, a multiplicity of rich associations are present. A characterisation that attempted to reduce humanity to polygons and attributes was unlikely to fully capture that richness. Consequently, the development of a multimedia facet to accompany the GIS was explored.

Persistence of evidence for human activity

4.3.30. Early analysis of the various original map sources sought to find correlations between different datasets to draw wider conclusions and establish some generalisation about activities in the Pilot Area that could be developed and used for characterisation. An example of this was the examination of seabed sediment data against data for sea use and habitats preferred by commercial fish species to establish which fishing methods might be in use and how persistent the evidence for such fishing methods might be. The basic concept being that a persistence of evidence for human activity would help define overall character.

4.3.31. This analysis revealed that, broadly, plaice, which is commercially fished using trawling gear, favours areas of muddier sediment. The use of this gear would impact a soft muddy seabed leaving a more durable mark than on a mobile sandy seabed. However, the presence of sole in the areas with sandier seabed sediments suggested that commercial trawling is unlikely to be confined to the muddier seabeds (as sole is

also an important commercial species). The seabed in these areas would probably not retain the marks of trawling for as long as a muddy seabed.

4.3.32. Whilst these analyses suggest, to some degree, the level to which evidence for trawling impact on seabed sediments is likely to preserved in the Pilot Area, these broad assumptions were difficult to translate into generalisations useful for building themed intermediate maps and ultimately a character map. Future pilots may be better able to establish useful correlations in other baseline data sources that are suitable for informing characterisation.

Time depth

4.3.33. The establishment of time depth has been one of the major conceptual challenges of the Liverpool Bay and Fylde Pilot Project.

4.3.34. The potential time-depth of British archaeology is some 650,000 years, but there are difficulties in making inferences about human activities in the Lower and Upper Palaeolithic because of the limits of available archaeological evidence and understanding of the effects of glacial cycles.

4.3.35. The compilation and caveats associated with the model of sea level change have already been described. However, by focusing on the last marine transgression, the time-depth of the Liverpool Bay Seascapes pilot has been established to range from Late Glacial (some 12,500 BP) up to present day.

4.3.36. If one takes the view, as in most terrestrial HLCs, that tracing time-depth can inform what elements of the historic 'landscape' may survive into the present. Then, as the present day seascape character of the offshore areas of Liverpool Bay proved to be chiefly navigation, offshore industry and modern fisheries, the time depth could be said to correlate to when such human activities are likely to have begun.

4.3.37. What we know from the discovery of isolated examples, is that different styles of boat-building were extant in north-west Europe more than 6,000 years ago, e.g. at Starr Car, Yorkshire, hunter-fisher communities were building light-framed craft covered with birch bark, as well as using log-boats. From the Bronze Age, distinctive pottery styles reflect the movement of human populations across the English Channel. Evidence for this includes the cargoes of Bronze tools and weapons of continental origin found on the seabed off Dover, and boat finds in the Humber Estuary at Ferriby (built of massive timbers fastened edge to edge with yew withies and calked with moss). At the same time as log-boats, extended boats and plank boats were developing; it is likely that light-framed skin boats evolved in response to available materials. There is some evidence to indicate that curraghs were extensively used in the Irish Sea by the late Iron Age/Roman period (e.g. Broighter Boat, a tiny model with mast and oars made of fine gold sheet, found at Derry, Ireland, in a hoard of goldwork generally dated to the 1st century BC) (Throckmorton 1987). It seems certain that by the time that the Liverpool Bay coastline had evolved to its present form, coastal and riverine trade and fisheries were well organised and had sophisticated craft at their disposal. Hence, in many areas, 'period' attribution simply tracks the retreating coastline east to west across the Pilot Area. The lack of knowledge precludes any more sophisticated interpretation.

4.3.38. The date ranges used for the 'period' attribute in this HLC pilot are those suggested by MIDAS Data Standard (RCHME 1998) and Inscription lists (http://fish-forum.info):

Late Glacial/Late Upper Palaeolithic	13000 to 10000 BC
Mesolithic	10000 to 4000 BC
Early Mesolithic	10000 to 7000 BC
Late Mesolithic	7000 to 4000 BC
Neolithic	4000 to 2200 BC
Early Neolithic	4000 to 3000 BC
Middle Neolithic	3500 to 2700 BC
Late Neolithic	3000 to 2200 BC
Bronze Age	2500 to 700 BC
Iron Age	800 BC to AD 43
Roman	AD 43 to AD 410
Saxon	410 to 1065
Medieval	1066 to 1540
Post-medieval	1540 to 1901
Modern	1901 to present

4.3.39. More reliable information on which to base assessments of time-depth dates from the 17th century onwards and information relating to change comes primarily from inception of offshore industries and the deepening and training of navigation channels (e.g. instigated in the last 80-90 years) (see inset **Figure 5)**. This suggests that the broad time periods 'post-medieval' and 'modern' might be subdivided further to give greater refinement.

Scale

4.3.40. Finalising a working scale for the project also raised questions regarding evenness of the final characterisation. 1:50,000 is the scale of coastal charts published by the UKHO which gives complete coverage of England's coastal waters. As a result some offshore mapping used smaller scales than the preferred 1:25,000 used in terrestrial HLC. The use of OS mapping on the adjacent coastline and mapping from other sources at scales varying from 1:10,000 to 1:25,000 compounded this problem. The scale of data was recorded explicitly in the project metadata for transparency. This lack of source mapping at scales close to the 1:25,000 scale was one consideration in deciding on the final assessment of confidence recorded in the final character layer.

Visibility

4.3.41. Terrestrial HLCs all have as a primary aim the characterisation of the 'current appearance of the landscape' (Lancashire County Council, 2000: 2), 'on the basis of the *visible* evidence within the modern landscape' (Wigley, Forthcoming: 2). This is the basis of any approach to a terrestrial HLC, and unfortunately it is not available to marine HLC. To begin to approach a similar level of 'visibility' would involve an extensive programme of reviewing marine geophysical data (particularly side scan sonar data). WA recognises the variability of quality in survey data (e.g. instrument resolution, survey line spacing) and the commercial sensitivity that often surrounds gaining access to such data. However, access to such surveys might by pursued and scoped in future pilots.

4.3.42. As a consequence, with the absence of visible evidence as a guide, intertidal and marine characterisation required difficult judgements, and some characterisations rely on a smaller collection of evidence than the character mapper would have preferred. Nonetheless, the character map created represents a baseline of best knowledge and judgement.

5. METHODOLOGY OF INTERTIDAL AND MARINE HLC

5.1. INTRODUCTION

5.1.1. This section of the report describes the steps taken by WA in building the pilot intertidal and marine HLC. This is a broad description of the method, whereas the Method Statement (WA, 2006: 58370.05) provides greater technical detail of the use of GIS to build the characterisation.

5.2. REVIEW OF PREVIOUS TERRESTRIAL AND MARINE HLC PROJECTS

5.2.1. WA undertook a review of previous HLC projects and commentaries on them such as English Heritage's national HLC methodological review (Aldred and Fairclough 2002). WA adopted as far as possible the guiding principles summarised in this report as described above. Where close adherence to these principles could not be achieved WA attempted to find solutions and the reasoning and details of these decisions and changes are explained where relevant in this section.

5.2.2. During the initial stages of the Seascapes project, guidance documentation relating to HLC were reviewed to gain a clear understanding of HLC and the processes used to develop character areas on land. The guidance documentation reviewed included that produced by national heritage bodies:

- English Heritage
- Scottish Natural Heritage/The Countryside Agency
- Countryside Council for Wales/Brady Shipman Martin/University College Dublin

5.2.3. The review also included a detailed analysis of examples of terrestrial Historic Landscape Characterisation (HLC) projects. These projects included:

- Buckinghamshire
- Lancashire (countryside and historic towns)
- Cornwall (countryside and historic towns)
- North Kent
- Shropshire

5.2.4. In addition, examples of marine characterisation projects were reviewed to identify the datasets used and methods. These projects included;

- Bristol Channel Marine Aggregates Environmental Assessment
- Irish Sea Pilot

- Isles of Scilly RCZAS

5.2.5. The review of the latter found that previous attempts to characterise the intertidal and marine zones were based primarily on bathymetry and environmental characteristics rather than human dimensions (Johns *et al*, 2004). For example, where coast edge and intertidal characterisation had been incorporated into terrestrial HLC projects, environmental features such as 'sand dunes' and 'mud flats' as defined by underlying OS mapping had also been utilised to define 'character'.

5.2.6. The Seascapes project attempted to address the absence of the 'human element' in these previous attempts at characterising the intertidal and marine zones by seeking to describe the human influence on the marine and intertidal landscapes where possible. This includes a description and interpretation of historic and modern activity across the Liverpool Bay and Fylde Coast Pilot Area in the final characterisation.

5.3. ESTABLISHING GOOD PRACTICE

5.3.1. The document resulting from the national HLC review undertaken in 2002, *Historic Landscape Characterisation Taking Stock of the Method (*Aldred and Fairclough 2002) identified four generations of HLC projects. These reflected an increasingly sophisticated use of GIS, not just as a display tool, but also for analysis. GIS has been recognised as a very valuable tool for amalgamating map overlays to identify draft landscape character types and subsequently to amend and confirm GIS linked databases of information. Its chief advantage has been in enabling more, and more complex, methods of querying the database.

5.3.2. The report also identified four 'families' of HLC projects, which were borne in mind in the development of WA's conceptual models:

- Classification-led – using interpretation as the means of identifying criteria and attributes areas to pre-defined HLC types;
- Document-led – very firmly use historic maps as a starting point;
- Attribute-led – record attributes rather than attributing areas to pre-defined HLC types;
- Multi-mode – base their characterisation on manipulating computer data.

5.3.3. Aldred and Fairclough (2002) suggest that the criteria used to determine historic character were dependent upon the attributes drawn from the following themes:

- Time-depth;
- Previous land-use;
- Present day land-use;
- Morphology (e.g. shape of field);
- Enclosure process;
- Documentary sources.

5.3.4. During WA's analysis of the data structures (i.e. tables, attributes and terms) amongst more recent terrestrial HLC initiatives, two levels of characterisation were

identified, referred to hereafter as 'Character Analysis' and 'Character Area Analysis'.

5.3.5. The 'Character Analysis' level represents an analysis of landscape features (e.g. field boundary patterns and human usage of individual parcels of land) and included three groupings of attributes;

- Observations of features (e.g. field boundary morphology, settlement pattern)
- Interpretation (e.g. origin of landscape features linked to an historic period or specific edition of mapping)
- System Administrative (e.g. unique identification number for polygon, recorder's identity)

5.3.6. The 'Character Area Analysis' level was considered to represent an amalgam of 'Attribute Analysis' level polygons with similar characteristics, and incorporated descriptive text and an estimate of sensitivity or vulnerability to large-scale development.

5.3.7. With regard to standards for GIS, mapping, and terminology, the Seascapes project has adhered to *Guidelines for English Heritage projects involving GIS* (English Heritage 2004), utilised EH online thesauri (*Inscription*), and the ESRI metadata editor within ArcGIS 9 software. ESRI's metadata editor closely follows the UKGEMINI metadata structure recommended by the Cabinet Office's e-Government Unit (see WA, 2006: 58370.05 Method Statement).

5.3.8. Apart from its review of relevant heritage and mapping standards, WA gathered information about current initiatives to develop integrated coastal and marine zone mapping. Sources included the reports of workshops held by CEFAS/DEFRA in 1999 and 2002 to promote the development of integrated mapping in the UK and marine coastal zone. One of the main achievements of this meeting was that it facilitated the partnership between the Ordnance Survey (OS), British Geological Survey (BGS) and the UK Hydrographic Office (UKHO) to develop common base maps for the UK coastal zone. It was noted that the UKHO's trading subsidiary (SeaZone Solutions Ltd) has recently begun to explore the use of satellite imagery to improve the mapping of close inshore and estuaries (http:/www.seazone.com).

5.4. REVIEWING USER EXPECTATIONS

5.4.1. HLC has been recognised as having the potential for being a very useful tool for providing information to assess planning applications, promote coastal and marine heritage management and to raise awareness of the historic environment in other government agencies and among landowners and developers. Therefore, WA sought to undertake the project with a clear understanding of the expectations of potential users and to taken into account their information needs.

5.4.2. While local archaeologists' planning responsibility ends at the low water mark, this need not reflect their interests and their role as local stakeholders. Local Authorities are consulted during the process of developing environmental impact assessments and are showing a greater desire to be involved in offshore developments, particularly where they may have impacts on the adjacent coast.

5.4.3. WA identified that primary end users of HLC are likely to be central and local government representatives involved in marine planning. It was thought that HLC would be accessed in their responses to development applications to place HER data in a wider historical context. At present the local authority curators adjacent to the Pilot Area (Lancashire, Cheshire and Merseyside) do not have any significant involvement with offshore planning, although it is anticipated that this may increase.

5.4.4. WA arranged a series of structured meetings with curatorial staff from English Heritage and from Local Authorities who were identified as potential end-users of the HLC. Interviewees were selected on the basis of their role in the management of the marine and intertidal resource. The meetings were designed to gather experience of terrestrial HLC and information on expectations for HLC, anticipated applications, and potential problems.

5.4.5. A short questionnaire was developed to give structure to these meetings and to allow interviewees to prepare themselves for the issues to be discussed. The meetings gave WA a better understanding of current curatorial decision-making practices and addressed curators' aspirations for seascape characterisation.

5.4.6. The following people representing local authorities and national agencies were interviewed:

Name	Position	Organisation
Sarah-Jane Farr	Archaeological Officer	Merseyside Archaeological Services
Graham Fairclough	Head of Characterisation	English Heritage
Dave Hooley	Characterisation Inspector	English Heritage
Peter Iles	Sites and Monuments Record	Lancashire County Council
Jennie Stopford	Inspector, NW Regional Team	English Heritage
Caroline Salthouse	Regional Coastal Project	North West Regional Assembly
Martin Newman	Datasets Development Manager	English Heritage
Andrew Davison	Inspector	English Heritage
Steve Waring	NMR Maritime Section	English Heritage
Gillian Grayson	Head of Heritage Data Management	English Heritage
Ian Oxley	Head of Maritime Team	English Heritage
Mark Dunkley	Maritime Archaeologist	English Heritage
Jesse Ransley	Maritime Archaeologist	English Heritage
Judith Nelson	Regional Planner	English Heritage
Jill Collens	Project Leader – Historic Environment	Cheshire County Council
Sue Stallibrass	Science Advisor for North West England	English Heritage

5.4.7. The views expressed during interview are summarised below:

- Terrestrial HLC is used by some Local Authorities largely to inform planning applications. Discussions with local representatives suggested that HLC was most commonly used in conjunction with other data layers such as SMR/HER data and NMR data to provide a wider context for known monument data. The HLC could also be overlaid with development plans to give an initial assessment of the landscape character, so that the possible effect on character could be quantified.

- The end users consulted made a number of suggestions regarding datasets they would like to see considered in the characterisation process. These included recently or soon to be declassified Ministry of Defence side scan survey data (in an initiative working with British Geological Survey to improve seabed mapping), UKHO survey records and local reports of the Marine Conservation Society.

- The characterisation of intertidal areas in existing terrestrial HLCs is quite broad and end users wanted to see this characterisation enhanced as part of the Seascapes project. It was suggested that WA would develop more character types within the intertidal zone that can be overlaid on the existing intertidal characterisation without altering it. It was suggested the level of resolution of characterisation for the intertidal zone should be determined by the sources available to WA for characterisation.

- The final landscape characterisations should contain text descriptions or narratives in the back of the GIS to aid the interpretation of the character map. These descriptions should be produced under fixed categories so that the descriptions for each character type can be applied consistently across the characterisation.

- It was hoped that intertidal and marine characterisation will be useful as a means of facilitating greater interaction and communication between agencies such as EH and EN as well as CEFAS or government departments like DEFRA. It was also noted that bringing intertidal and marine HLC to the attention of agencies like CEFAS would enhance the profile of the historic environment as a consideration in spatial planning, as it is the co-ordinator of a variety of datasets and the main contact for a number of organisations. This was considered an important end user aspiration – to raise the profile of heritage and the historic environment in spatial planning.

- A number of end users expressed a desire to for images and views to be included in characterisations. Local Authorities were found to provide aerial photographs and other historic views to illustrate particular aspects of the landscape to assist their end-users (e.g. developers and consultants). Discussion touched upon other forms of multi-media such as sound files and video clips, but these were thought unlikely to be a useful or as immediate in suggesting ‘character’ as a ‘picture’.

- Interviewees with previous experience in using and developing HLCs noted how the methodology for developing terrestrial HLCs had developed and evolved

over the past decade. Lessons learnt from earlier projects were applied to later projects, resulting in variations between the approaches to HLC. The variability in methods used was highlighted as a problem when combining different HLCs into regional HLCs.

- Concerns were expressed about the eventual public availability of the completed HLC. Almost all end user interviewees agreed that the intertidal and marine HLC should be available to the public, not least because organisations like the NMR hold information in the public domain. However, making the final HLC available on the Internet upon completion was considered undesirable. It was believed that it would run the risk of presenting developers with a means to carrying out their own archaeological assessments to meet the minimum archaeological requirements without interpreting HLC properly.

- The maintenance of the completed intertidal and marine HLC was considered, and many different views were put forward. It was noted that many of the existing terrestrial HLCs have not been altered since their creation. According to some end users, this was to be expected of HLC as the character of an area can absorb a number of changes over a long period without its character being substantially altered. In some cases a review of HLCs every ten years was suggested, but it was conceded that it was unclear as of yet how any resources to maintain the HLCs would be allocated. Another point of view favoured more frequent maintenance and review of the HLC, though the issue of resources was raised again on this point. It was also thought that the longer-term popularity and usefulness of the final intertidal and marine HLC needed to be established before issues of maintenance should be examined in greater detail.

- The incorporation of sensitivity mapping into the character areas was discussed. It was agreed that it was necessary to provide a measure of each character area's sensitivity but that a simple grading system such as 'High/Medium/Low' would be most suitable as these measures would have to be defined.

5.5. REVIEW SOFTWARE/HARDWARE OPTIONS

5.5.1. The review of software and hardware options included discussion with HER software company ExeGesIS, local authority curators, the NMR's HER co-ordinator and the Project Management Group.

5.5.2. The main GIS platforms currently being utilised by HERs and by the NMR are MapInfo and ArcGIS. Both software packages were available in-house to WA, but the project team decided to use ESRI's ArcGIS 9. The software is written using Visual Basic, which allows WA to develop its own tools and solutions to software problems where necessary. Moreover, files generated by ESRI's software are interoperable with other software.

5.5.3. Discussions were undertaken with ExeGesIS about their new HLC module and its possible application to marine and intertidal characterisation. Following discussion with the Project Management Group and bearing in mind requests from local authority curators not to be 'locked' into additional licensing costs, this option was not pursued further.

5.6. DEVELOPING CONCEPTUAL MODELS

5.6.1. Following on from general familiarisation with HLC methods, three concepts for MHLC data structure and associated terminology were generated as a paper exercises or entity-attribute-relationship models.

5.6.2. Entity-attribute-relationship models are a technique most often utilised in the design of relational databases. These models or logical designs allow the definition of the 'subjects' to be covered (called entities). Attributes are the details about the state of each entity or the properties of the things we want to know about the entity. Relationships are the significant associations between two entities represented as a line joining two entities. Each relationship line has two ends. Each end named after how many of each object can be related to how many of the others (e.g. one to one, one to many, or many to many).

5.6.3. Undertaking these paper exercises also helped explore software limitations for example, ArcGIS only allows 255 characters to be recorded for each attribute field, hence for longer textual descriptions to be included these would need an MS Access application to be devised (as is the case in most land HLCs) or the development of .html resource. The three conceptual models are shown in **Figures 8-10**.

'Classification' Led:

5.6.4. The classification led model was envisaged as heavily dependant on a single definition of a seascape type (i.e. no hierarchy of terms such as broad-character, character-type and sub-character) and developing descriptive text and bibliographic resources linked to a simple, potential large polygon reflecting maritime place-names and topographic features (see **Figure 8**). It was anticipated that the method of generating polygons might follow a 'placenames' approach or be based on bibliographic research in combination with the observation of features on charts Time-depth and seascape change would be explored in descriptive text. Definitions of potential seascape types were generated to identify the features that might help to define a seascape:

Seascape	Definition (Elements or features):
Oil and Gas Production	Production rigs; capped exploratory wells; dumped drillings/spoil heaps and scatters; pipelines. Underwater protective 'landscaping' – mounds of spoil designed to deflect currents away from well heads Anchor scarring from tugs manoeuvring rigs also from support/rescue vessels; marshalling areas for rescue vessels
Fishing Grounds	Marine habitat that supports commercial species (may be seasonal linked to appearances of shoals, e.g. herring); featured in fishery statistics; areas reflecting closed seasons to protect spawning grounds Wrecks acting as reefs to attract commercial fish species; high number of obstructions and fishermen's fastenings; higher proportion of fishing boat wrecks which include local vernacular boat types Special cultural significance – folklore, music, art, etc

Table 3: Examples of seascape definitions developed for the 'Classification' led approach

'Attribute' Led

5.6.5. The attribute led approach was envisaged as including more attributes at analysis level summarising environmental features, aspects of human usage and archaeological potential (e.g. numbers of wrecks, preservation character of the seabed, depth of Holocene deposits overlying submerged land surfaces). It was anticipated that the method of generating polygons might follow a 'placenames' approach or be based on bibliographic research in combination with the observation of features on charts (see **Figure 9**). Time depth would be established by noting or benchmarking 'character' at intervals corresponding with particular base mapping sources (e.g. 1st edition OS or the chart compiled by Murdoch Mackenzie in late 18th century)

5.6.6. It was anticipated that the patterning of attributes would reveal areas of similar character that could be defined and have descriptive text attached to them plus a multi-media resource. The attributes were grouped by the themes of system administrative, observation and interpretation. Initial lists of terminology were defined for each attribute, for example:

System Admin:	**Interpretation:**	**Observation:**	**Observation:**	**Observation:**	**Interpretation:**
Polygon UID	**Seascapes Type**	**Environment Sub Type**	**Usage Broad Type**	**Number of shipwrecks and obstructions**	**Date of Last Marine Transgression**
Auto-generated	Oil and Gas Production	Saltmarsh	Communication	(Density per km^2)	Late Upper Palaeolithic (12000-10000BC)
	Fishing Grounds	Dune	Industrial		Mesolithic (10,000-4000 BC)
	Leisure / recreation	Mudflat	Military		Mesolithic (10,000-4000 BC)
	Trade and transport (developed)	Mobile sandy shore	Recreation		Earlier Neolithic (4,000-3000 BC)
	Ship Building and Repair	Estuary	Navigation		Later Neolithic (3000-2400BC)
	Military	Fine sediment plain	Maritime safety		Bronze Age (2400-700BC)
	Mari-culture (foreshore and intertidal)	Sediment Wave	Settlement		Present Day

Table 4: Examples of attributes and terminology lists developed for the 'Attribute' led approach

'Multi-mode'

5.6.7. The multi-mode model was envisaged as a method that would manipulate underlying data as a base for characterisation. Any subjectivity is controlled and made transparent by an advanced use of GIS (e.g. underlying GIS layer can be returned to and queried to update attributes). The terminology used for each attribute in the final polygon layer would be generated by the underlying source data layers, hence no list of prescriptive criteria is generated at the outset (see **Figure 10**).

5.6.8. Initially the data structure of these models was planned to include the collation of information about the broad scale factors which are considered to be important in site preservation, namely:

- Nature of sea bed deposits = attributes 'sea_bed_sediments' and 'morphology'

- Frequency of stormy weather = attributes 'Primary_env_cond_ty' and 'Env_cond_unit'
- Strength of tidal movement across site = attributes 'Tidal_range' and 'Morph_stability'

5.6.7. The search for and initial assessment of suitable sources of this kind showed that in many cases the data existed in a form that would require extensive processing (e.g. numerical or another form of environmental modelling) and that the data was not consistently available across the Pilot Area. As a result, the attributes 'Primary_env_cond_ty' and 'Env_cond_unit' were subsequently dropped from the data structure.

5.6.9. The counts of recorded historic and archaeological features as indications of density and overall potential were also dropped from the data structure, recognising that MHLC is most likely to be used in conjunction with HER and NMR data.

5.6.10. The multi mode model was further developed with data from sources such as BGS, JNCC and secondary sources to facilitate grouping under three broad themes – Sea Use Present, Sea Use Past and Environment. The mapping layers grouped under these themes reflecting topics and themes often found in research frameworks. For example, *An Archaeological Research Framework for the Greater Thames Estuary* (Williams and Brown 1999) and for Chichester Harbour (MOLAS 2004). Themes explored in these documents include Holocene palaeoenvironments, transport and trade, fishing and associated industries, military, etc.

5.6.11. From the early draft attribute model below it can be seen that the intermediate themed mapping determines the polygon attributes on 3 levels of 'character' and contributes to the auto-population of 14 other attributes. It is facilitates a seamless join or reference to the neighbouring terrestrial HLC by including the terrestrial character type attribute and unique system reference to the terrestrial HLC polygon.

Attribute	**Proposed population method**	**Example of terminology**
U-ID	AutoID	1211
WAID	Auto populated	210002
HLC_ref	Auto populated from terrestrial HLC attributes	N/A
Broad_character	Auto populated by character_type_1 via dbase	Navigation
Character_type	Auto populated by character_type_2 via dbase	Navigational feature
Character_type_2	Manual entry	Disused buried channel
HLC_character_type	Auto populated from terrestrial HLC attributes	N/A
Period	Manual entry	Post-Medieval
Primary_attribute	Auto populated from database table showing feature type categorisation.	Gross_landscape feature
Gross_landscape feature	Manually populated	Buried historic navigational channel
Maritime_feature_count	Auto populated from database count	12
Arch_feature_count	Auto populated from database count	24

Primary_Intrusive_industry	Auto populated from industry map	Aggregate dredging
Primary_Non-intrusive_industry	Auto populated from industry map	Commercial shipping
NLO_area	Auto populated from NLO map	Mockbeggar Wharf
Sediment	Auto populated for seabed sediment mapping	Sand
Morphology	Auto populated using a morphology map	Sandwave field
Primary_env_cond_ty	Manual entry from secondary sources	Prevailing wind
Env_cond_unit	Manual entry from secondary sources	SSW
Tidal_range	Auto populated using a tidal range map	High - Variation >7 metres
Morph_Stability	Auto populated from shoreline management plan data and drying areas map	Very high
Sea_level_exposure	Auto populated from map produced from sea level model	Holocene
Sensitivity	Manual entry	Medium
Location	Auto populated from location map	Intertidal

Table 5: The anticipated multi-mode data structure.

5.6.12. The concept borrows aspects from the 'classification' and 'attribute' led approaches in that it presumes that patterning will highlight areas with similar attributes that can be brought together to define a 'character' area. At this stage, descriptive text and multi-media resources could be linked as .pdfs and other file types directly to the polygons in the GIS or via offline HTML pages which offers a more 'user-friendly' interface.

5.6.13. The 'multi-mode' approach was selected as the approach to trial further and is described in more detail in Method Statement (WA, 2006: 58370.05).

5.6.14. As can be seen from the above table the final data structure of the 'Character Analysis' layer (see Section 1.5.1) is different to the proposed data structure above. This reflects how early attempts to provide more detailed environmental mapping were discarded, either because the data was not available in readily mapable forms or because when MHLC is used in conjunction with HER and NMR data the attribute would be redundant.

5.7. TESTING METHODS OF DIVIDING THE PILOT AREA

5.7.1. Unlike terrestrial HLC where a field or the top left hand corner of an OS map can serve to start the process of moving steadily across a 'landscape', characterising as one goes, approaching the characterisation of seascapes in this way with an Admiralty Chart has revealed that it is unlikely to produce a continuous layer of polygons. As a consequence of the above and, in addition to developing three conceptual models, WA has also explored three different ways of dividing the Pilot Area (see **Figures 11a-d**).

Place-names

5.7.2. Pursuing an approach based upon 'place-names' had been WA's tender submission suggestion, bearing in mind that place-names at sea often denote major physiographic features such as banks and channels. Frequently place-names also have a measure of archaeological potential associated with them through their use by the NMR as 'named locations'. For example, the sandbank Burbo Bank at the mouth of the Mersey, is featured in documentary references to ship losses and is also a 'named location'. Place-name polygons could serve as spatial mechanism for accessing and querying the datasets underlying characterisation. The grain of the resulting characterisation is likely to be large, in comparison to neighbouring terrestrial HLC projects (**Figure 11a**).

Gridding

5.7.3. It was noted that the *JNCC Irish Sea Pilot* had utilised a grid system for displaying data, and the same approach was trialled for MHLC. Grids of differing resolution (500m and 100m) were trialled to explore which best reflected the underlying data. For example, a 500m grid was used to analyze maritime monument point data to produce a vector density map showing areas of high, medium and low point density (shipwrecks). The data was also gridded using a 100m grid, however the results did not give such a good representation of point density. The data was queried by location using a vector grid in order to allow the count from the wreck points to be incorporated into attributes for the individual grid cells. The gridded methodology provides for the layers to be combined together by joining the data by location to produce a layer where the attributes of each grid cell contain the data from the underlying layers, even if the underlying layers have different grid resolutions. The resulting characterisation is displayed as squares rather than polygons, and visually presents an extremely regulated grain pattern in comparison to neighbouring terrestrial HLC projects (**Figure 11b**).

Unions

5.7.4. A third method was 'unions' or the topological overlay of two or more polygon spatial datasets that preserves the features that fall within the spatial extent of either input dataset; that is, all features from both datasets are retained and extracted into a new polygon dataset. The method provided for the development of intermediate themed maps from which the polygons from each themed map could be combined into a single layer, and then queried by location to populate the polygon's attributes with data from the spatially corresponding polygons within underlying themed mapping layers. Where polygons in the themed mapping overlap (unions) decisions have to be made as to which of the attribute dominates in the overall character of the area. The resulting characterisation is displayed as irregular polygons which reflect shapes cutting other shapes. In coastal areas, in particular, the grain size is comparable to neighbouring terrestrial HLC projects (**Figure 11c**).

5.7.5. Of the three methods described above, it was decided to pursue the 'unions' approach for more extensive trialling (see WA 2006: 58370.05 Method Statement).

5.8. POLYGON GENERATION

5.8.1. During the testing of the three methods of dividing the seabed, the potential benefits and drawbacks of each were analysed. As the project has progressed, these have become clearer still:

PLACE-NAMES

Benefits:

- Reflects areas that are recognised and known to sea-users;
- Defined by local conditions i.e. topography.
- Often associated with a ready-collated measure of potential in the NMR recording practice of 'Named Locations';
- Likely to ease documentary and bibliographic research as place-name provides the means to search and collate data;
- Method most likely to produce 'simple, derived data' in terms of copyright.

Drawbacks:

- Place-name areas have diffuse boundaries and these boundaries are not charted;
- Charted name areas can move spatially through time;
- Charted name areas can overlap;
- Occurrences of place-names is decidedly coastal and further offshore fewer place-names are used;
- Definition of polygons based on place-name is likely be subjective based on each HLC compiler's perception, and maintaining a consistent and transparent methodology across multiple projects with different compilers would be difficult;
- Forming a continuous polygon layer may be problematic based on place names alone (particularly where there are large areas of flat featureless seabed) and other conventions may have to be drawn upon (e.g. the perceived hierarchy of precision in the NMR's Named Locations recording practice);
- Likely to be large polygons in terms of grain size and hence the boundary between terrestrial HLC and HLC will be obvious (e.g. large polygon abuts small polygon).

GRIDDING

Benefits:

- Through its visual appearance, gridding immediately flags to the user the diffuse nature of offshore character areas (i.e. user will know that the edge of marine habitat is extremely unlikely to be perfectly straight line, and hence the user recognises a level of summarisation);
- Uses the power of GIS queries to populate attributes;
- Visually highlights the boundary between HLC and terrestrial HLC (e.g. grid square abuts polygon);
- Eases 'density' analysis, for example wreck concentrations;
- Produces intermediate theme mapping which may be useful as stand-alone information sources (e.g. extents of palaeoenvironmental exposures);
- Approach being utilised by marine spatial planning initiatives such as the JNCC Irish Sea Pilot, which may bring as yet unknown benefits for creating integrated marine spatial planning.

Drawbacks:

- Considerable data preparation required to convert data and attributes into a format ready for auto-population;
- Treatment and preparation of 'point' data (e.g. monument data) for inclusion utilises GIS generated buffering that may or may not accurately reflect the true extent of the site;
- Basic premise of querying mapping layers and auto-population may place too great an emphasis on the availability of mappable data;
- Inclusion of external data requires good quality metadata to ensure that the limitations associated with the external data's use are understood by HLC compiler;
- The visible difference between the terrestrial and intertidal/marine character maps may perpetuate the perceived barrier to treating archaeology seamlessly from the terrestrial across the intertidal and into the marine zone.

UNIONS

Benefits:

- Produces polygons which can be traced back to their underlying data sources to ease transparency of the method for generating 'character' and repeatability of the method;
- Uses the power of GIS queries to populate attributes;
- The boundary between HLC and terrestrial HLC is more likely to be similar in terms of pattern and grain size (e.g. small polygon abuts small polygon);
- The boundaries of the polygons are preserved in the unified layer, which allows the eye to follow features over extended areas (e.g. shipping channels, even though the predominant character type in each of the polygons may not necessarily be 'navigation');
- Produces intermediate theme mapping which may be useful as stand-alone information sources (e.g. extents of exposures of peat and other palaeoenvironmental evidence);

Drawbacks:

- Considerable data preparation required to prepare data and attributes into a format ready for auto-population;
- Treatment and preparation of 'point' data (e.g. monument data) for inclusion utilises GIS generated buffering, which may or may not accurately reflect the true extent of the site;
- Once the bringing together of all the polygons from the intermediate mapping into a single layer has been undertaken, the potential to included additional data and information (e.g. another layer of polygons which may effect or change predominant character) is more complex to achieve through preserving the intersections of overlying polygons in the intermediate mapping layers;
- Large areas may appear to have no mappable 'character' (particularly offshore areas), however some way of dividing those areas is still required to facilitate the inclusion of other attributes (e.g. model of coastal change);
- Basic premise of auto-population may place too great an emphasis on the availability of 'mappable' data;

- Inclusion of external data requires good quality metadata to ensure that the limitations associated with the external data's use are understood by MHLC compiler;
- Produces high numbers of relatively small polygons, which suggests that sensitivity and vulnerability analysis of such tiny units is somewhat spurious at 'character analysis' level and hence such analysis may need to be moved to 'character area' level;
- Produces slivers, reflecting the overlaps and gaps in the different maps used during the union/combining process, which requires considerable data cleaning.

5.8.2. All three polygon generation techniques explored have produced a continuing tension between being evidence based (when similar occurrences appear in base mapping the same interpretation can be made and hence the method is transparent and repeatable) and what is allowed to be derived and reproduced by the copyright and data usage agreements with offshore data suppliers.

5.8.3. The current Liverpool Bay and Fylde Coast Pilot Project GIS features combinations of all the three methods and allows their benefits and drawbacks to be further explored by ends users and future MHLC developers.

5.8.4. At 'Character Analysis' level, 'unions' and 'gridding' have been combined, chiefly to overcome the problem the lack of data for the northwest of the Pilot Area (**Figure 11d**). The predominant 'character' was fisheries, but a single large polygon would not have allowed, for example, the progress of relative sea level change to be tracked across the expanse losing part of the sense of time depth that this would convey. To overcome this drawback, a grid was utilised to break up the larger areas into smaller components which could have varying attributes.

5.8.5. Two interpretative methods were combined during 'Character Area' definition. Adopting the terrestrial HLC premise that 'character areas' are defined by the patterning of polygons with similar attributes, again the north west of the Pilot Area presents as one large expanse dominated by fisheries within 'character analysis' mapping. The decision at this point was whether to attempt to divide up that large expanse by more qualitative means (place-names utilised by mariners and fishermen such as the Rossall Oyster Grounds and Lune Deep), or to accept this large expanse in its entirety as the basis on which to generate a character area narrative. The decision was ultimately taken to depart from the terrestrial premise, and bringing in elements of place-names approach from one the underlying themed mapping layers (e.g. NMR Named Locations).

5.8.6. Although there is a train of logic and justification for the use of each method or combination of methods, there is still much to be said for finding a single, simple solution which can be utilised nationally. Hence, future pilots might take each method and implement it strictly (without combination) to assess more fully the benefits and drawbacks.

5.9. DEVELOPING INTERMEDIATE THEMED LAYERS FOR THE MULTI-MODE METHOD

Historic Sea Use

5.9.1. As the name of this layer suggests, the aim was to create mapping solely concerned with past seafaring activities and to incorporate historic use of the intertidal zone and a model of sea level change.

5.9.2. The creation of historic sea use character types draws largely on historic charts, OS mapping, and secondary sources, to identify other historic sea use/intertidal activities not marked on historic charts. Archaeological evidence was also drawn upon from NMR and SMR monument data.

Modern Sea Use

5.9.3. The aim of the Modern Sea-Use layer is to collate and visually present information about current marine and coastal activities which may impact the historic environment or may affect its assessment during the planning process.

5.9.4. Modern sea use character types are based largely on modern admiralty charts, marine industry data for offshore and coastal developments, recent OS mapping and JNCC sea use data. As with historic sea use, secondary source material aided interpretation and decision making to devise the final modern sea use type.

Environmental Processes

5.9.5. The aim of the environmental characterisation is to reflect the variability in dynamic environment and the nature of the seabed, highlighting features such as dynamic sandbanks, coastal erosion, sediment type or ecological character which may impact on the historic environment. Secondary sources were consulted to support interpretation and establish relevance to historic landscape characterisation.

5.10. DEVELOPING TERMINOLOGY AND CHARACTER TYPE DEFINITIONS

5.10.1. From the outset, it was anticipated that a new range of character types unique to MHLC would be required. The 'Classification-led' and 'Attribute-led' models had included initial definitions of terminology and Seascapes 'character' types, but in choosing to develop the 'unions' approach it became clear that the attributes and terminology of the final layer polygons would be driven by the data structure of the intermediated themed mapping layers. Some of the terminology would be governed by the language used by the organisation supplying an external data source, and careful thought was given to structuring the terminology in the WA generated intermediate mapping layers. Where possible, national reference terminology sets were utilised, for example *Inscription* lists.

5.10.2. In its review of terrestrial HLC projects, it was noted that 'character type' was often defined in a hierarchy of consisting of three tiers. A three-level hierarchy was also adopted by WA:

- broad character
  character type
  sub character

5.10.3. The primary differences in character definitions between terrestrial HLC and intertidal and marine HLC are the inclusion of character type groupings relating to navigation and offshore industries. To assist with auto-population, the lists were developed into a small database application which supplied the broad character and character type to the final polygon layer based on the hierarchical relationships. However, to avoid simply creating a software generated map, the auto-populated elements of the final polygon layer were checked, assessed and where necessary, changed. This helped to ensure that the principle of generalisation was followed and properly applied and that the final polygon layer was based upon a human interpretation of the intertidal and marine landscape. The checking process was undertaken in two parts described below.

5.10.4. The checking of the final polygon layer was initially done by the selection of groups of sub-character types and confirming their accuracy and assessing their relationship and contribution to the character and broad character types. The second phase of checking was undertaken while drafting the Character Area narratives. This checking was based on the mappers' assessment and understanding of the character of the Pilot Area. The mapper took into consideration how well the character map reflected his or her overall interpretation of the character of the area, and checked the attributes of the map as appropriate.

5.10.5. A full listing of terminology in its three-tiered hierarchy can be found in the Method Statement (WA, 2006: 58370.05).

5.11. ESTABLISHING TIME-DEPTH

5.11.1. WA's analysis of the ways in which establishing time-depth was approached in terrestrial HLC revealed two principle methods:

- Benchmarking – recording the date of origin of a historic character as obtained from different editions of OS maps resulting in multiple attributes relating to map editions in the data structure each allowing landscape character at that particular point in time to be recorded;

- Interpretative – recording against a single attribute a value representing the known or estimated date/period of origin of the present-day character type, based on the periods associated with certain landscape features, historical research and professional judgement.

5.11.2. Since maritime archaeological interest included tracking the process of marine transgression as well as maritime activity spanning back far beyond the first editions of admiralty charting, the interpretative method was chosen as likely to be the more appropriate means of establishing time depth for the pilot intertidal and marine HLC.

5.11.3. A model of sea level change was generated to gain a better understanding of the archaeological potential of Liverpool Bay. The model was based on SeaZone bathymetric data adjusted to the OS datum from the Formby Chart Datum (CD = -4.93 m OD). This point dataset was then run through Surface Terrain Modelling Software to create a digital elevation model (DEM).

5.11.4. The sea levels attributed to differing periods (relative sea levels or RSLs) were obtained from bibliographic sources, primarily Lambeck 1991, but also Plater et al 1999. Levels were attributed to different periods as follows:

Late Upper Palaeolithic 12,500BP	-28m mean, intertidal range 5m
Early Mesolithic 10,000BP	-23m mean, intertidal range 5m
Late Mesolithic 8,000BP	-14m mean, intertidal range 4m
Neolithic 6,000BP	-3m mean, intertidal range 4m
Bronze Age 4,000BP	-1m mean, intertidal range 4m
Iron Age 2,700BP	0m mean, intertidal range 5m

5.11.5. The trends for Liverpool Bay show a rapid rise in the sea level between 8,000BP and 6,000BP. This interpretation is supported by evidence collected from the sediments of Downholland Moss (Tooley 1978) and Morecambe Bay (Zong & Tooley 1996).

5.11.6. In order to gain a more realistic model, it would be necessary to remove the depths of overlying Holocene deposits associated with marine transgression, for which there is little data (e.g. one transect published for the area within BGS seabed sediment mapping). The net sediment transport systems at work in Liverpool Bay is accumulative with sediment being transported eastward between the Isle of Man and Isle of Anglesey. Closer inshore the sediment transport trend is northerly (Dean 2002, Jackson *et al* 1995) and the WA model does not make allowances for what may be fairly localised trends of erosion and deposition.

5.11.7. There is also the problem of accurately estimating and removing isostatic movement from the sea level calculations. For example, the axis of glacial rebound across Scotland and England suggests that the NW region has subsided by 0.6m (Brown 1999).

5.11.8. The modern day tidal regime of Liverpool Bay is produced by two sets of movement (tides and Corioli) combining to create amphidromic systems (i.e. the tide moves around a nodal point where rise and fall is minimal). Two amphidromic systems combine to produce the 7m plus tidal range of Liverpool Bay. The most significant is the degenerate amphidromic nodal point south of Dublin, the other is in the north, off the Mull of Galloway. However the location of amphidromic systems and tidal ranges from early periods is unknown, hence estimations have been utilised based upon a mean of the ranges experienced around the coast of England.

5.11.9. Although the model is speculative, it was useful as an aid in the interpretation time-depth and of prehistoric data, for example as a chronological reference for palaeoenvironmental evidence such as peat bed exposures. The results of the sea level model are illustrated in **Figure 12.**

5.11.10. With the exception of mostly coastal areas where OS mapping or historic charts begin to provide more reliable data from the late 18th century onwards, the interpretation of time-depth for much of the Study Area is reliant on the sea level change map as its sole data source. Future pilot projects may be able to develop models with a greater level of accuracy and confidence by addressing the issues outlined above.

5.12. IDENTIFYING CHARACTER AREAS

5.12.1. The purpose of the Seascapes 'character area' layer is to define and summarise areas where polygons with similar attributes are found in close spatial relationships. WA have utilised the following principles for the creation of 'character areas':

Primary principle:

- Based on the patterns of human activity observed by displaying the 'attribute analysis' polygon layer by 'character type'. Hence, character areas are created from amalgams of 'sub-character' types.

Secondary principle (where large 'homogenous' offshore areas exist and little differentiation was possible):

- Place-names featured in documentary sources and on modern admiralty charts, such as deeps or fishing grounds.
- Where a place-name or natural feature could not be identified, NLO polygon boundaries have been used.

5.12.2. Forty-four character areas were defined for the Liverpool Bay area. A descriptive text for each character area was generated containing the following information:

- Present Day Form
- Sea-Use: Present
- Sea-Use: Past
- Archaeological Potential
- Perceptions
- References (key sources utilised to generate that descriptive text)

5.12.3. The 'character area' polygons were given a hyperlink to an offline .html page displaying the descriptive text and multimedia resources. An offline .html introductory page was developed (including interactive map) to facilitate the user being able to access the .html pages as a stand-a-lone application, if required.

5.13. VULNERABILITY/SENSITIVITY ANALYSIS

5.13.1. Used alongside other planning and environmental management tools, one of the intentions of HLC is try and ensure changes are 'positive', contribute to the enhancement of the landscape, or at least achieve an 'appropriate fit' (Swanwick 2002: 52-53). The concepts used in terrestrial HLC for this evaluation process are as follows:

- Landscape character - a sense of place created by a combination of geology, landform, vegetation, land use and settlement;
- Landscape quality - a judgement regarding the physical state of the landscape;
- Landscape value – concerned with the relative value that is attached to different landscapes
- Landscape capacity - referring to the degree in which a particular landscape character type is capable of accommodating change without significant effects on its character.

5.13.2. Of these four factors above, none have been implemented with regard to the offshore historic environment.

5.13.3. In a terrestrial context, the criteria for evaluating 'quality' can include the following (Hill 2001: 32):

- Intactness: scale = complete > remnant
- Condition: scale = maintained > abandoned
- Detractors: scale = none > many
- Typicality: scale = representative > unusual
- Clarity: scale = clear > muddled
- Fragility: scale = delicate > robust
- Rarity: scale = common > rare
- Distinctiveness: scale = bold > indistinct

5.13.4. Although the 'unions' approach has shown that polygons can be determined, the concepts of 'clarity', 'intactness' and 'distinctiveness' are difficult to apply to MHLC as the criteria implies visual inspection has been carried out. An evaluator would see a 'sea surface' of particular uniformity.

5.13.5. 'Typicality' and 'rarity' are also difficult to benchmark, as this is the first time MHLC has been undertaken (i.e. what may be typical in Liverpool Bay, may be rare elsewhere along England's coast).

5.13.6. The scale of values for 'Condition' implies pro-active human management of the historic environment of the seascape. At present time, it is probably true to say that human interactions with the sea are likely to be seen more in terms of reducing impacts on archaeological deposits, rather than in terms of restoring or maintaining features.

5.13.7. Landscape 'value' is based on different underlying aesthetic systems. For example, we place a higher value on 'naturalness'. It is noted that the subjectivity of aesthetic systems can be made more transparent by explicit criteria, such as rarity, fragility, integrity, diversity, tranquillity, and wilderness value (Swanwick 2001:57). As the sea-surface and seabed are dominated by natural processes, 'value' is then likely to be universally high.

5.13.8. An assessment of 'capacity to change' is most likely to be arrived at by an expression of 'quality' of the seascape and the form, function and scale of changes that are likely to significantly effect the opinion of the assessor (or the perceived value of the seascape).

5.13.9. Marine seascapes might be viewed as having both a uniform low and uniform high capacity to absorb change. On one hand, the immense scale of offshore areas suggests that they can absorb a small change without affecting overall character – especially if the development is well away from a land based receptor. On the other hand, one salient object in the sea, such as a wind farm turbine cluster, can radically change undeveloped character. At present time it is extremely hard to judge what might be the 'saturation point' beyond which further change becomes over development, especially since the wider impacts on sediment transport systems and

the potential of changes to impact on archaeological sites elsewhere are still poorly understood.

5.13.10. After considering the approaches pursued on land and their potential application, WA returned to the approach commonly utilised for archaeological desk-based assessments. The equation below has the benefit in that it is familiar to both the archaeological community and curators.

Scale and potential impact of development
+
Importance of archaeology

= Significance of effect

5.13.11. Given the need to consider types of development, WA returned to the matrix developed by the JNCC Irish Sea Pilot. Early on in the project, during review of the JNCC Irish Sea Pilot Project, WA noted that the matrix and the suggestion that it could be 'used for the assessing the likely impacts of human activities at the broad scale' (JNCC 2004: 40). For the Liverpool Bay and Fylde pilot, it was perceived that utilising a similar matrix may have the potential benefit of fostering communication between archaeological and marine environmental interests.

5.13.12. As trialled by WA, the matrix measures the impacts of human activities by whether the area is currently or likely to be effected by them and the potential scale of those impacts to estimate 'vulnerability'. A measure of 'sensitivity' is achieved by assessing a combination of the importance of the archaeological potential of the area and vulnerability to achieve an estimate of the significance of the effect. Scales of 'high', 'moderate' and 'low' have been used for both vulnerability and sensitivity.

Scale and potential impact of development (vulnerability)
+
Importance of archaeology (archaeological potential as noted in Character Area descriptive text)

= Significance of effect (sensitivity)

5.13.13. The trial revealed the importance of the information base on which to undertake analysis, particularly with regard to activities which may impact on seabed archaeology. For example, the difficulty in obtaining fisheries information has already been noted, but without a programme of work to assess available marine geophysics only an estimate of the impact from trawl scarring across Liverpool Bay can be made. The central repository of offshore marine geophysical survey data is the UKHO. Gaining access to raw survey data has not been pursued by WA, but forthcoming pilots might wish to explore this possibility further.

5.13.14. Categories such as 'offshore development' and 'coastal development' might also be refined further into more particular scheme proposals, such as renewable energy installations' or 'reclamation' where such proposals are known to be in their early scoping stages.

5.13.15. WA's vulnerability/sensitivity matrix might also be developed to include a column that summarises the importance of archaeological potential of the area (e.g. of national interest, of regional interest, of local interest, etc), so that the three measures can be viewed together.

5.13.16. Whilst the provision of a vulnerability/sensitivity matrix should not be seen as a replacement for the need for a fully targeted archaeological evaluation of each development proposal, however the question remains - at which scale should the assessment be conducted? Whilst Character Area level would appear to be the most appropriate, close inshore there is a greater degree of complexity than might be appropriate to the broad scale of the matrix. For this reason, the attribute relating to 'potential impact' has been retained within the 'character analysis' map data structure whilst recognising that the combination of tripartite factors (i.e. past impact, present impact and potential future impact) is not ideal.

5.13.17. Whilst the current pilot project has addressed aspects of 'landscape value' through the inclusion of 'perception' in the offline .html pages, future pilots might chose to explore further the concepts of 'Landscape Quality', 'Landscape value' and 'Landscape capacity' and their potential application to MHLC.

5.14. GAPS IN KNOWLEDGE, COPYRIGHT AND USAGE AGREEMENTS

5.14.1. Of the wide range of marine data collators and potential suppliers, WA targeted Proudman Oceanographic Laboratory, the JNCC and British Geological Survey with requests to gain an understanding of copyright and usage agreement and the potential problems associated with negotiating access.

5.14.2. The intricacies of the process of each request are complex and not detailed in this report, but the reasons for non-supply or slow supply of data are understandable and appreciated. For example, organisations contacted were neither under contract to supply data or being renumerated for their time to prepare data, consequently requests for data were not given a high priority. Data may be collected but not yet published or worked up into a usable and understandable GIS format, hence institutions are reluctant to release data. Another contributory factor may be that data generated by an organisation is based on a dataset under the copyright of another organisation, hence the organisation is constrained by the licensing agreements of the original data supplier.

5.14.3. The OS allows simple derived data to be generated through the licencing and use of its base mapping, however other organisations are more restrictive. Particular concerns were expressed with regard to the digital transfer to third parties. For example, it was felt important that third parties should not be able to re-engineer source mapping through manipulating the Seascapes attributes, as this would undermine the supplier's commercial interests and reduce potential income generation. 'Transfer to third parties' in some instances also included the use of data by WA for external MS PowerPoint presentations. There are also concerns with regard to liability should a legal case ever be brought by a third party, which may bring into question the source of derived data. These and other unresolved copyright and usage issues are the principal reason why intermediate themed mapping and

attributes in the 'attribute analysis' layer were removed from the final GIS project passed for curation to the NMR.

5.14.4. The data sourcing undertaken by WA determined that the spatial and temporal scales, comprehensiveness, and quality of marine data is variable. Moreover, marine data is likely to have been collated for a variety of purposes and by methods not normally associated with archaeological research. To ensure that errors and limitations are not compounded by inclusion in HLC, an understanding of these purposes and methods of collation is necessary.

5.14.5. Information which proved particularly difficult to find in mappable form included:

- Fisheries data – mostly available as measures of catch landings and numbers of vessels licensed rather than primary fishing grounds. It is noted the JNCC Irish Sea Pilot based their fishing intensity mapping on number of fishing vessels visible on aerial flyovers.
- Tidal-streams (i.e. the force delivered to seabed in terms 'bed stress' or ability to raise sediments into suspension)
- Stability – areas of accretion or deposition along the coast – FutureCOAST data and that of Sefton Coast Shoreline Management Plan. It was noted that these datasets would be difficult to extend across the whole Pilot Area
- Commercial shipping routes - shown in the JNCC Irish Sea Pilot, but eventually estimated from pilotage instructions in nautical almanacs, routes generated during the ALSF-funded England's Historic Shipping Project, and estimates of the most direct routes to Irish Sea destinations.

5.14.6. The provision of appropriate 'data release' agreements for data collected with public funds or as a consequence of government public agency contracts is one of the recommendations of the JNCC Irish Sea Pilot, and would also have assisted the Seascapes project if these were generally in place for the marine sector. The Liverpool Bay and Fylde Pilot Project would also have been helped by a national marine information network allowing access to comprehensive metadata to facilitate information sourcing, again another recommendation of the JNCC Irish Sea Pilot (JNCC 2004: 21).

5.14.7. With regard to developing the multi-media resource, organisations such as Merseyside Maritime Museum, the British Library, Peabody Museum Essex and the Francis Frith Collection were approached with regard to the possibility of including historic photographs, digital scans of artistic representations and oral testimony recordings. The protracted negotiations often included providing detailed information about how each image was likely to be used, including specifying the need to able to transfer the digital image to English Heritage and ultimately the need to make the offline .html pages available on the world-wide web. It was found that each organisation had its own licensing and usage agreements with corresponding scales of cost implications.

5.14.8. With regard to oral testimonies, the Merseyside Maritime Museum has a collection in the process of being catalogued and transcribed. The collection includes interviews with former employees of the Mersey Docks and Harbour Board (e.g. marine surveyor and members of the salvage teams), Isle of Man Steam Packet Company

(piermaster) and interviews with owner/operators of Mersey Flats (barges of a particular local vernacular type). Most of the interviews were undertaken in the 1970s and it was discovered that copyright assignment and permissions documentation needed to allow their usage had not been collated at the time of interview. Over the intervening 30 years, it is likely that the interviewees will have passed away and hence acquiring the appropriate releases retrospectively would not be possible for this project.

5.14.9. The multi-media resource developed for the Liverpool Bay pilot is by no means exhaustive. Rather it is a testing of technical capability and illustrative of the range of material that might be incorporated. At present time, the resources are particularly coastal in their focus. Future pilots may decide to focus on particular types of material and through early liaison with local providers facilitate coverage that is more even over the whole of their respective study areas.

5.15. RECOMMENDATIONS ON HOW OFTEN TO UPDATE THE HLC

5.15.1. In early discussion with end-users, there were varying views of how often HLC should be reviewed and updated. Whilst all the interviewees agreed that periodic review and updating would be necessary to take into account significant new research, some felt that every 10 years would be sufficient whilst others thought more frequent intervals might be required. The chief concern expressed was the availability of EH funding to undertake substantial reviews.

5.15.2. It is likely that the pace of seascape change will dictate the frequency of updating, linked to the demands of the planning role that HLC is performing.

5.15.3. The most obvious suggestion for timing is to link significant phases of HLC review to major offshore industry licensing initiatives. For example, Round Two of offshore wind farm licensing was launched in July 2003. The fifteen successful projects include sites within and beyond territorial waters. As the global necessity to find more sustainable forms of energy continues, it is likely that more rounds will be announced in the future, although the exact timing is currently uncertain.

5.15.4. With regard to marine aggregates, the Crown Estate produces an annual review of production and licence areas. An update on characterisation might be timed with the production of these reviews, or with the Crown Estate's commitment to producing a 10-year review (first one planned for 2008).

5.15.5. Although archiving with the Archaeology Data Service should ensure that the project is migrated to newer versions of the software, the need to keep the GIS accessible may also prompt cycles of review and updating.

6. POTENTIAL APPLICATIONS

6.1. INTRODUCTION

6.1.1. 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).

6.1.2. The practical applications of the Seascapes pilot are linked to the niche Marine HLC (MHLC) might find as an information source in management initiatives. Consequently a range of hypothetical scenarios were generated to assist with evaluation. Each scenario has a basis in local coastal and marine heritage issues noted during the project, but the detail and present state of scheme proposals and curatorial responses is largely unknown. The intention is only to use each case as broadly illustrative of management priorities that might also be experienced in other parts of the coasts:

6.2. MARINE SPATIAL PLANNING

6.2.1. In simple terms, 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. In Government and in many sectors, there is a growing imperative to develop marine spatial planning to facilitate more effective management of the coastal and marine environment. There are a number of major policy drivers including:

- OSPAR and the North Sea Declaration;
- Development planning for wind energy, aggregates and commitment to biodiversity;
- European Union initiatives, such as the Communication *Towards a strategy to protect and conserve the marine environment* (COM2002(539)) and Integrated Coastal Zone Management Recommendation (May 2002);
- National Heritage Act 2002 which extended English Heritage's curatorial remit to the limit of territorial waters at 12 nm;
- The Marine Bill, currently in draft stages, which proposes to update existing piecemeal legislation and management regimes in coastal and marine waters;

6.2.2. The benefits of spatial planning are seen as the following (CoastNET 2003):

- Enabling government and agencies to put commitments to sustainable development into action;
- Enabling greater integration of the management of areas of sea to avoid duplications of effort and wasted resources;
- Improving the quality of decision making, routine administration and information provision;
- Providing clarity of process and greater certainty in consenting, planning and resource allocation for developers and environmental managers;
- Implementing appropriate environmental management for areas of sea which avoids the duplication of effort each new development sparks;

6.2.3. The Government's first Marine Stewardship Report, *Safeguarding our Seas* (2002) set out the Government's strategy and suggested that the JNCC Irish Sea Pilot, a Review of Marine Nature Conservation, be developed into a regional marine spatial planning pilot. The *Safeguarding our Seas* report promoted an ecosystem approach to managing human activities in the marine environment. Hence the importance of evaluating the human dimension of MHLC in relation to JNCC marine landscapes classification of the Irish Sea (JNCC 2004:40). For Liverpool Bay, by far the most

predominant marine landscape is 'fine sediment plain'. There are small areas of 'coastal sediment' extending out from Formby Point and the mouth of the Ribble and along the Fylde coast. 'Estuary' is the only other classification utilised, and these areas are enclosed by a line drawn across the mouths of the rivers Dee, Mersey and Ribble.

6.2.4. In general terms, the objectives for the regional marine spatial plan would be to (CoastNET 2003: 15):

a) develop a shared understanding and appreciation of the characteristics of the region through assessing current knowledge of its:
   - Biological and physical characteristics;
   - Community and cultural values;
   - Current uses and pressures;
   - Future uses and opportunities;
   - Value of marine resources;
   - Threats to natural system;
   - Management and institutional arrangements.

b) design a regional sea plan that is a decision making and planning framework for management across sectors that:
   - Identifies shared values of the region, including environmental, economic, social and cultural values;
   - Identifies new information needed;
   - Integrates resource management on an ecosystem basis;
   - Identified the methods of assessing performance;
   - Is adaptive to changing conditions and improved knowledge;
   - Adds value to existing management arrangements.

6.2.5. Looking at these objectives and comparing them with the data structure of Liverpool Bay and Fylde HLC, there are shared components of information content. MHLC records environmental characteristics such as marine landscapes, seabed sediment and morphology. The character area descriptions include synthesis of maritime history, archaeological potential and cultural values. The benchmarking of MHLC to characterise the present day seascape also helps to reveal the patterning of current uses. Moreover, building vulnerability/sensitivity analysis into the MHLC can begin to explore development pressures and threats.

6.2.6. Whilst MHLC provides a seascape-scale information resource on the same spatial scale as natural environmental interests, the objectives and priorities of archaeological marine spatial planning remain unclear because the concept is at such an early stage. However, the rationale may be driven by an assessment of overall character, key characteristics of the seascape and the dynamics of the seascape in terms of recent change, current trends and future forces. The most likely forms of planning outputs (following terrestrial models) are the development of strategies, guidelines, the attachment of status (designations) and zoning based on archaeological potential. However, as previously noted in section 5.13, one of the key missing components is a methodology to assign 'value' to historic seascapes, particularly to areas offshore. A useful product of future MHLC pilots would be to address this issue.

6.3. MARINE AGGREGATES EXTRACTION

6.3.1. The Crown Estate owns the mineral rights to the seabed extending to the edge of the UK continental shelf and issues consents for non-exclusive samples and licences for commercial aggregate extraction. To obtain a licence, companies that have been successful in a tender round run by The Crown Estate must go through a Government View procedure which includes the submission of an Environmental Impact Assessment. The Government View procedure is administered by the Office of the Deputy Prime Minister (ODPM). If the government view is favourable, then the Crown Estate will issue a production licence. There are currently over 70 production licences in operation around Britain's coast producing approximately 22 million tonnes of material per annum (http://www.thecrownestate.co.uk/40_aggregates.htm).

6.3.2. Government's policies on marine mineral extraction are 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. The OPDM can also ask the Applicant to provide such further information relating to environmental effects as might be reasonable. Among such information is a description of the aspects of the environment likely to be significantly affected by the proposed project. The application process is characterised by a series of consultation stages eliciting comments from organisations identified by the ODPM (BMAPA/EH, 2003). English Heritage is one of the organisations consulted and provides curatorial advice with regard to appropriate archaeological mitigation.

6.3.3. To assess the role that HLC might play in that process, the hypothetical scenario of assessing the environmental impact of marine aggregates extraction for the area encompassed by licences 175/1, 193/1 and 195/1 (current licence holders RMC Marine Ltd, United Marine Dredging Ltd and North West Sand & Ballast Co – all members of BMAPA) was explored from the viewpoint of aggregate company resource managers and the EH maritime team.

6.3.4. The possible effects of aggregate extraction on the marine historic environment include:

- Any derived artefacts such as prehistoric tools, flakes and other materials contained within aggregates deposits may be removed from their context and lost within the general volume of dredging spoil;
- Any *in situ* artefacts and/or deposits of palaeoenvironmental interest within or beneath aggregates deposits may be seriously disrupted and individual elements lost;
- Any *in situ* artefacts/deposits of palaeoenvironmental material lying at or close to the surface of aggregates deposits may be seriously disrupted destroying the relationships between artefacts and their surroundings;
- Direct damage to wreck structure and their contents;
- Disturbance to relationships between structures, artefacts and their surroundings;
- Destabilisation of sites prompting renewed corrosion, decay, etc.
- Loss of artefacts associated with wrecks within the general volume of dredged spoil;

- Erosion leading to damage, disturbance and instability in the medium to long term.

6.3.5. Aggregates are essential materials for the construction industry and for many coastal protection schemes. For example, for the construction industry, a continuous supply of consistent quality required throughout the year (e.g. aggregates used in concrete need to be delivered as a mix of around 55% gravel and 45% sand). Terrestrial supplies are becoming increasingly constrained, and the importance of marine resources to aggregate companies is increasing. Licences to dredge offshore have been issued for over 30 years and members of BMAPA have committed to work with regulators, wider industry and stakeholders to manage the resource and assess environmental impacts. From the point of view of aggregates resource manager, decision making is more likely to focus on the consequences of broader environment effects as follows (East Channel Association 2003):

- Magnitude (dredging activity and production levels)
- Spatial extent (local/regional, km^2)
- Duration (short/long term)
- Value (conservation significance of the habitat/area of seabed)
- Sensitivity/Recoverability (level of tolerance of the marine habitats and their likelihood of recovering)
- Confidence in prediction (the level of uncertainty)
- Margins (where set values are exceeded where appropriate, for example water quality standards)

6.3.6. Unlike a marine habitat, archaeological sites and deposits will not recover if impacted; the effect is likely to be permanent. Hence the basic premise of archaeological mitigation is to avoid disturbance and preserve *in situ* where possible. In this context, MHLC may be particularly useful for aggregates resource managers in raising awareness of the human dimension of the seabed in the early stages of scoping commercially viable resources. However, MHLC should not and could not ever replace a fully targeted archaeological assessment/evaluation of a proposed aggregates licensing area.

6.3.7. From a marine aggregates industry perspective, it is probably true to say that the end result of any system (e.g. marine spatial planning) that regulates activity is more important that the mechanism that delivers it. Security for both ongoing and future operations, timely decisions by regulators, increased availability of data, and confidence to make strategic decisions (economic and environmental) would be the major concerns. The development of a marine spatial planning initiative, to be effective, would need to deliver increased consistency, through an integrated and holistic approach, that is simple, understandable, robust and pragmatic (Singleton, BMAPA, in CoastNET 2003: 49).

6.3.8. From the EH curatorial viewpoint, the primary usefulness of HLC is the context it gives to the NMR monument records. It is true to say that the marine historic environment of the UK continental shelf is still little known and its importance as yet poorly understood (BMAPA/EH, 2003). Yet recognising those present limitations, HLC provides a synthesis of what is currently known and is capable of periodic

updating and review as new data, interpretations and methodologies become available.

6.3.9. As an example the licensed aggregate extraction area 175/1, lies within the character area Bootle Bay and is characterised as an area of active navigation and a long established channel for navigation to and from the Mersey. It notes the seabed is sandy with some surviving wrecks but notes the seabed has already been substantially modified by dredging. In terms of potential it is noted that any remains of wrecks have been subjected to dispersal to keep the channel clear for navigation. The high level of shore-side development is also likely to have destroyed much of the foreshore archaeological resource.

6.4. RAPID COASTAL ZONE ASSESSMENT SURVEY

6.4.1. 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
Survey Phase II	Field Assessment

6.4.2. The broad aims of each RCZAS, paraphrased from English Heritage's *Brief*, are as follows:

- To provide an enhanced HER and NMR record for coastal heritage assets, to a nationally common minimum data standard, to permit an improved curatorial response and to provide data that is compatible with the needs of other managers and researchers;
- To provide an overview of coastal change from the Late Upper Palaeolithic onwards;
- To provide an assessment of the degree and nature of threat to coastal and historic assets that has regard to the forecasts of coastal change provided by relevant Shoreline Management Plans;
- To provide a broad assessment of the likely archaeological potential and vulnerability of all stretches of the coast;
- To provide a sound basis for developing management and research priorities in respect of specific sites and areas of potential;
- To enhance public understanding and enjoyment of the coastal zone.

6.4.3. 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). Assessing MHLC against the broad aims of a survey being undertaken on the Sefton coast suggests that the aims and objectives are comparable and overlap in several instances (Sefton MBC 2004). For example, although HLC does not include creating or updating individual NMR/local SMR monument records, the intermediate themed mapping layers locate maritime features and have the potential to add polygonised extents to monument records. The multi-media resource would help enhance understanding and enjoyment

by providing publicly available synthesis. HLC also contains useful bibliographies, and the information gaps noted would help to identify research priorities.

6.4.4. MHLC is primarily desk-based and does not include extensive programmes of fieldwork. However, the generation and inclusion of digital photography, panoramic views and video footage whilst primarily aimed at introducing the user to the general landscape, could include the rapid recording of key monuments.

6.4.5. In the RCZAS undertaken by WA (e.g. 2004, 51958.05), the coast has been divided into stretches broadly homogenous in terms of topography rather than 'character'. Descriptions of stretches have included notes of accretion and erosion. Sourcing and mapping information on morphological stability, whilst perceived as useful, was subsidiary to determining overall character and has proved difficult to acquire in an easily mappable form. Hence, the assessment of vulnerability/sensitivity to coastal erosion has not been included in the matrix.

6.4.6. The Liverpool Bay and Fylde Pilot Project does include a model of coastal change, however the scale is regional and likely to prove too broad for specific locations on the Sefton coast. However both these issues could be addressed in the future pilot projects.

6.5. SHORELINE MANAGEMENT PLANS

6.5.1. 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). The relationships between the components of SMPs are outlined in the table below:

Stage	SMP	Strategy plan	Scheme
Aim	To identify policies to reduce risk	To identify appropriate scheme types to implement policies	To identify the nature of works to implement preferred scheme
Delivers	Broad- brush assessment of risks, opportunities and constraints, areas of uncertainty	Preferred approach (i.e. scheme type) including economic and environmental decisions	Comparison of different implementation options for preferred scheme type
Output	Generic policies (e.g. hold the line, advance the line, etc)	Type of scheme (e.g. beach recharge, seawall, setback, embankment, etc)	Type of works (e.g. revetment wall, recycling, etc)

Table 6: Relationship between the elements of SMPs (DEFRA 2001:1)

6.5.2. Since sediment cell and sub-cell boundaries are defined by coastal processes, it is often necessary for authorities to work jointly with neighbouring authorities in voluntary partnership groups to produce a SMP. This is the case in the Liverpool Bay, where the SMPs for sub cells 11a and 11b were compiled through partnership working. Sub cell 11a is the responsibility of the Liverpool Bay and Tidal Dee Users Group with Wirral Metropolitan Borough Council being the lead authority. Sub cell 11b is responsibility of North West Coastal Group with Blackpool Borough Council providing the lead (http://www.defra.gov.uk/environ/fcd/policy/smptt.pdf).

6.5.3. A first round of SMPs was produced in the 1990s, and these initial SMPS are now to be enhanced with new local data and the results of the FutureCOAST study (http://www.defra.gov.uk/environ/fcd/futurecoast.htm). As part of this review process, the revisiting of the Liverpool Bay's SMPs is scheduled to commence in Spring 2007.

6.5.4. English Heritage's guidance note *Coastal Defence and the Historic Environment* (2003) stresses that 'the key to ensuring proper consideration of the historic environment within the shoreline management planning process is to ensure that adequate and properly interpreted information is integrated into all stages of the shoreline management plan'. The document includes a flow diagram showing the relationship between flood and coastal defence process and archaeological evaluation and mitigation procedures. The diagram is recreated in the table below:

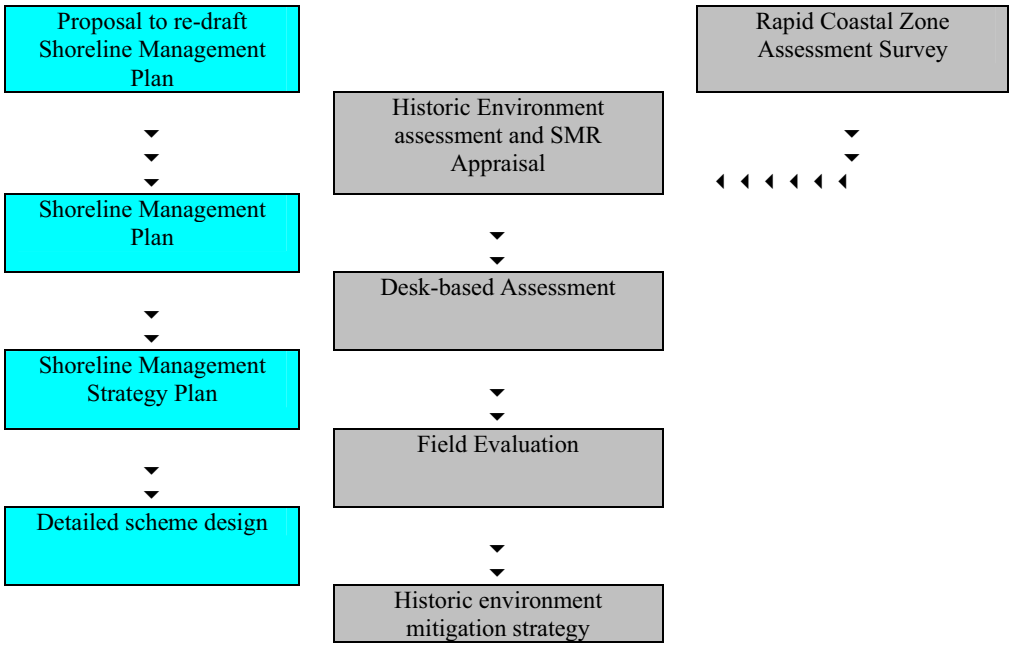

Table 7: The relationship between the development of SMP and archaeological evaluation and mitigation procedures (English Heritage 2003:7)

6.5.5. It is interesting to note that the flow diagram suggests that the archaeological process will be supported by results of RCZAS (the potential of HLC to assist such projects has already been discussed). In addition, the guidance note stresses that a detailed archaeological appraisal is needed, including the systematic gathering of readily accessible sources, including through analysis of local authority HERs, the NMR, lists of scheduled ancient monuments, historic wrecks, listed buildings, registered parks and gardens, registered battlefields, etc; and reference to historic landscape appraisals.

6.5.6. The future updating of the *Shoreline Management Plan for Sub-Cell 11b: Formby Point to River Wyre* (review to begin in Spring 2007 – http://www.sefton.gov.uk/page&4602*)* is taken here as a hypothetical example.

6.5.7. The data collation report contains a substantial amount of environmental information. Estimates of coastal change for the north of the sub cell suggest that the Fylde Coast was much further west of its modern position some 2000 BP. The earliest modern maps from the end of the 16th century show the coastline generally orientated north south. Recent historical mapping of the coastline between Formby and Southport shows little general change in topography and physical form. The sand dunes at Formby point appear at 3500 BP and the most recent phase or widespread stability dates to around the 13th century. During the 19th century stabilisation by the planting of marram grass encouraged accretion seawards by 300m. In the 20th century this trend has reversed. An increase in westerly storms and the dredging and training works associated with the Port of Liverpool and Preston intensified, significantly changing the morphology of the offshore zone and increasing the degree to which wave energy is focussed. Prior to the 19th century, the river Ribble changed its course very frequently but there were two characteristic channels, one on the north side and one on the south. The Ribble is subject to accretion from offshore sediments moved landward by bedcurrents which has led to extensive reclamations in the upper estuary assisted by the training of the channel to a central route preventing scouring of the remaining parts of the estuary (Ribble Estuary Shoreline Management Plan Partnership 1999).

6.5.8. The data collation also contains pages summarising the historical evolution of the sub-cell, and the human and built environment. Lancashire's historic landscape characterisation is also included as a series of illustrations spanning 8 pages (Ribble Estuary Shoreline Management Plan Partnership 1999).

6.5.9. The area influenced by sub cell 11b contains several MHLC character areas. Of these, those of primary interest:

- Blackpool
- Off Blackpool
- River Ribble
- North Shore
- Gut Channel
- Rossall Patches
- Rossall Point
- Crusader Bank
- Off Southport

6.5.10. The assistance HLC may be able to provide is the context of looking at the coast from seaward, rather than purely from a terrestrial perspective, and the opportunity of giving a landscape-scale perspective rather than identifying separate 'assets'. The 'Character Area' descriptions contain descriptions of sea use past and present. For example, the River Ribble narrative explores the influence of the Viking settlers using the Ribble as a water-borne highway and the abundance of fishing activity throughout the estuary. It explores how these influences contribute to the high potential for maritime remains on top of particular palaeoenvironmental interest. The section on archaeological potential notes the impact that coastal erosion, marine dynamics, the training of the river and dredging may have had on archaeological

deposits. For the new round of SMPs, raising awareness of the archaeology which is present and may be impacted by the choice of scheme choices at an early stage.

6.5.11. As previously mentioned in the review of terrestrial characterisation projects (see section 5.2), Lancashire's HLC is one of the projects that chiefly uses natural environment characteristics to define coast edge and intertidal areas. At 'Character Analysis' level, a particular benefit of MHLC may be the highlighting of the human dimension of the close inshore areas.

6.6. NORTH WEST REGIONAL RESEARCH FRAMEWORK

6.6.1. In 1996, English Heritage's review document Frameworks for our Past identified the need for a greater emphasis on research within modern archaeology. The recommendation was for the formulation of Research Frameworks for each of the regions of England to provide a context and a common focus for archaeological work. Many local authorities have recognised that by incorporating agreed research priorities in management and conservation plans, the credibility of the development control process is enhanced. English Heritage (1997) note that frameworks should:

- Provide an infrastructure and means of validating the decision making inherent within the planning process;
- Assist in the formulation of priorities for the distribution of resources (on a national scale);
- Couple curation and research.

6.6.2. English Heritage suggests that Research Frameworks should have three parts (Olivier 1996: 5, fig.1):

- *Resource Assessment* – a statement of the current state of knowledge and a description of the archaeological resource.
- *Research Agenda* – a list of the gaps in that knowledge, of work that could be done, and the potential for the resource to answer questions.
- *Research Strategy* – a statement setting out priorities and method.

6.6.3. Research frameworks for maritime archaeology in particular remain poorly developed for the study of shipwrecks and maritime landscapes. As such, the inclusion of the maritime landscape in a regional research framework is seen as a high priority by English Heritage (2002: 23).

6.6.4. The North West region covers the modern counties of Cheshire, Cumbria, Greater Manchester, Lancashire and Merseyside, along with the Unitary Authorities of Blackpool, Blackburn with Darwen, Halton and Warrington. Work on developing the Research Framework for the North West began as a full-time project in August 2003 initiated by the Association of Local Government Archaeological Officers (ALGAO NW) supported by English Heritage.

6.6.5. The Resource Assessment draft document produced in November 2004 describes the past history of archaeological research within the region (http://www.liverpoolmuseums.org.uk/liverpoollife/archaeology/arf). Amongst the coastal/maritime initiatives noted are the research into archaeological and palaeoenvironmental potential of the wetlands carried out by the North West Wetland Survey, and the on-going exploration of industrial sites such as Liverpool Docks.

6.6.6. The Research Agenda draft document produced in February 2005 notes that the region's maritime archaeological record is a major part of the resource and integral to its history and its later influential position within the wider world. The document makes reference to the region's archaeological potential and notes that the evolution of coastal and estuarine river systems remains under-assessed and poorly understood.

6.6.7. Amongst the suggestions are that the regions HERs take a greater role in the storing of archaeological information relating to the marine environment below the low water line, but this would require greater resources to implement and manage. The two particular initiatives that it recommends are that further studies need to be undertaken within the intertidal and inshore zones and that, with the Environment Agency to commission a Shoreline Management Plan for the North West Region in 2007-8, archaeological surveys and assessments need to be compiled before the programme commences.

6.6.8. The Research Strategy published in draft in July 2005 notes that there is currently no authoritative statement regarding the potential of the maritime resource. It also notes that currently there is no archaeological organisation within the region with a specialism in coastal and marine archaeology, Moreover, that there is a particular need for training for archaeologists based in the North West rather than exclusively using established specialists from elsewhere. Specific themes and priorities listed are as follows;

- Activities:
  - Increase awareness of coastal and marine resource;
  - Discussion and information sharing between all parties interested in coastal heritage issues;
  - Desk-based assessment, air photo mapping, field survey and environmental sampling;
  - SMR enhancement;
  - Cataloguing of finds from the marine environment.

- Requirements and opportunities:
  - Encourage and work in conjunction with Coastal partnerships;
  - Rapid coastal zone assessment, with provision for ground survey and air photo mapping;
  - Compilation of comprehensive wreck data for NW;
  - Instigate training in maritime archaeology for region's archaeologists;
  - Marine finds and findspot project.

6.6.9. Of these priorities, MHLC has particular potential to contribute to the following:

- Activities:
  - Increase awareness of coastal and marine resource;
  - Desk-based assessment;
  - SMR enhancement.

- Requirements and opportunities:
  - Instigate training in maritime archaeology for region's archaeologists;

6.6.10. The inception of the Liverpool Bay and Fylde pilot and the promotional activity which has been undertaken through stakeholder groups meetings has helped to move issues relating to the maritime historic environment into plain view. In the longer term, should the MHLC be made available to local curators then this would provide a significant step forward in improving access to the maritime information base. In the strategy's request to instigate training for the region's archaeologists, MHLC may fulfil its first educational role.

6.7. DEVELOPMENT CONTROL

6.7.1. 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.

6.7.2. In September 2002, Seascape Energy Ltd proposed to build an offshore wind farm on Burbo Flats. The proposed developed will consist of thirty turbines mounted on a steel monopiles (Seascape Energy Ltd 2002). As a consequence, an offshore wind farm was the development control scenario selected to assess the usefulness of HLC.

6.7.3. Offshore wind farms have the potential to adversely affect surviving archaeological remains. Impacts are likely to derive from construction works (e.g. piling, trenching and the anchoring of construction support vessels); during routine maintenance (e.g. the anchoring of support and maintenance vessels during maintenance) and decommissioning (e.g. removing the turbine and substation foundations). Secondary effects might include scouring and possible changes to the sedimentation regime.

6.7.4. The Department of Trade and Industry (DTI) has produced guidance notes for the offshore wind farm consents process which highlight the need for environmental assessment (http://www.dti.gov.uk/energy/leg_and_reg/consents/guidance.pdf). Such a study requires an assessment of the impact of the development on the historic environment, which generally consists of a desk based assessment.

6.7.5. The Institute of Field Archaeologist (IFA) produces a series of standards and guidance notes for its members and for registered organisations. The standard document for desk-based assessments notes that their purpose 'is to gain information about the known or potential archaeological resource within a given area or site (including the presence or absence, character and extent, date, integrity, state of preservation and relative quality of the potential archaeological resource).' Following on from data collation stage, an assessment of the resource's merit is undertaken, leading to formulation of strategies to mitigate impacts and to ensure the recording, preservation or management of the resource (IFA 2001).

6.7.6. In compiling a desk-based assessment a variety of sources are likely to be consulted, including the National Monuments Record (NMR), the UK Hydrographic Office (UKHO), the Ministry of Defence (MOD), and the local Sites and Monuments Record (SMR).

6.7.7. From the curatorial viewpoint, the primary usefulness of HLC would be the context it gives to the NMR monument records. HLC character area descriptions provide quick access to a synthesis of what is currently known to help better inform advice and comment on proposed scheme mitigation.

6.7.8. In discussion during the review stage of the project, local authority curators suggested that they provided printouts of terrestrial HLC in response to requests for SMR information for planning and development control purposes. The particular circumstances cited were proposals for forestation, where HLC would be used to try and ensure that the form of plantations respected older field systems and relict landscape features such as trackways.

6.7.9. In marine terms, these landscape features might be seen to equate to the Rock Channel, an historic navigation channel now mostly disused, and its associated anchorages. The NMR might choose to make HLC available to developers and archaeological contractors to be utilised in a similar way to terrestrial HLC, although the value assigned to these seascape features and the priority for conservation that these features should receive in terms of marine spatial planning remains unclear at present.

6.8. NMR INFORMATION SUPPLY FOR SEA

6.8.1. European Directive 2001/42/EC (the SEA directive) was integrated into UK law in 2004 and provides for the aims and principles of environmental impact assessment to be carried out the level of an individual project level to be 'strategic' levels, where alternative approaches and their implications for the environment can be more easily and appropriately considered (Parliamentary Office of Science and Technology, Postnote, July 2004).

6.8.2. The Department of Trade and Industry (DTI) voluntarily initiated a series of SEAs addressing the environmental implications of further oil and gas production on the UK continental shelf (UKCS) in 1999. SEA assessments for all eight sectors of the UKCS will be undertaken by 2008.

6.8.3. The SEAs developed for the oil and gas industry cover large expanses of sea extending beyond the limit of territorial waters at 12nm, the initial limit set for the gathering of maritime information for the NMR. These SEAs have faced the same particular challenges with regard to the collation of baseline environmental information as faced by MHLC. It is noted that the further proposed pilots for MHLC include the UKCS to reflect the same sphere of interest as SEAs (English Heritage Dec 2005).

6.8.4. The reports of recent SEAs (E.g. SEA 6) have sections dealing with maritime archaeology and submerged prehistoric archaeology. The maritime archaeology section is taken to refer to archaeology based on the investigation of the remains of ships, boats, maritime infrastructure and such other material remains as provide insights into past societies by way of their seafaring and sea-use. Archaeological issues relating to the wrecks of aircraft are not included. The area of SEA 6 encompasses the Irish Sea and the report comprises the following sections:

- Legal and Policy Framework;
- History of Maritime Activity in the Irish Sea;
- Archaeological Remains: spatial distribution;
- Previous Investigations;
- Possible Impacts of Oil and Gas Activities;
- Methods of Investigation

6.8.5. The gathering of archaeological information involves the collation of information from four national monuments records (e.g. the shipwreck records contained within the NMRs of England, Wales, Scotland and Northern Ireland) within a very short time period (2-3 months).

6.8.6. The UKHO holds data for 3162 shipwrecks and obstructions. There are more than 3000 wrecks within the Northern Ireland shipwreck database, with the bulk of these being located along the east coast. There are also at least 1163 wrecks around the Isle of Man. Furthermore, there is no comprehensive record that can be relied upon for shipwreck losses prior to the eighteenth century and the recording of such wreck events is sporadic. A substantial proportion of losses are related to hazards such as sandbanks, reefs, islets, headlands, areas of turbulent water and strong tidal currents. Gauging the spatial distribution of unrecorded wrecks is to consider the distribution and volume of historic shipping in general. Shipwrecks tend to cluster along shipping routes, particularly the approaches to ports and harbours.

6.8.7. Although, the Liverpool Bay and Fylde Pilot Area only covers a small portion of the total area of SEA 6, the benefit of having easy access to summarised maritime-activity information can be seen. Attributes reveal shipping routes and modern and historic channels, and record hazards such as sandbanks. The character area narrative texts provide useful summaries of ‘sea use present’ and ‘sea use past’ in the wider context of the Irish Sea trade and fisheries, as well as useful maritime-orientated bibliographies.

7. SUMMARY OF ACHIEVEMENT OF PROJECT AIMS AND OBJECTIVES

7.1. The task lists that were defined at the project's inception have had to change as the project has evolved. Nevertheless, as shown below, the overall aims and objectives of developing adapting the methodology of HLC to England's inter-tidal and marine zone have still been met:

Aims:

A1: To define, test in the Liverpool Bay and Fylde Pilot Area, review and finalise a desk-based methodology for extending historic landscape characterisation to the present landscape in the intertidal and marine zone of England to the limit of UK territorial Waters.
A1 fulfilment: Three conceptual data structures defined and three methods of drawing polygons/dividing the study trialled.
A2: To create a GIS-based characterisation of the historic and archaeological dimension in the present landscape of the intertidal and marine zones of England to the limit of UK Territorial Waters.
A2 fulfilment: A series of intermediate themed maps was generated and a combination of the unions and gridding methods was used to generate the final character areas. Character Areas were defined, based primarily upon the characterisation, for which was generated a textural description of present form, sea use past, sea use present, archaeological potential, perceptions, and bibliographies.
A3: To contribute to government agendas in favour of integrated spatial planning of the intertidal and marine zones by creating a historic environment GIS database for the project area which will readily integrate with analogous databases for the natural environment.
A3 fulfilment: The gridded method of dividing the seabed used by *JNCC Irish Sea Pilot* was trialled to assess its applications in a MHLC project and was utilised to characterise part of the Pilot Area. The matrix of vulnerability/sensitivity also produced by the JNCC was also trialled to see if MHLC could use the same broad scale measures. The 'attribute analysis' layer contained attributes of potential interest to marine environmentalists (e.g. seabed sediment, marine habitats, stability, and seabed morphology). To ease any potential issues with regard to copyright, these attributes were removed from the final GIS project delivered to NMR/ADS. However, information about these aspects of the marine environment is incorporated into textual descriptions for each character 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 assessing the historic environment in the intertidal and marine zones.
A4 fulfilment: Although never intended to replace the targeted evaluation process needed for development control purposes, MHLC presents easily assimilated synthesis of seascape history and archaeological potential. The model of coastal change, although having caveats attached to its use, begins to provide an understanding of potential for prehistoric landscapes. The project has reviewed a series of hypothetical scenarios in which MHLC might be utilised, but the lead for its utilisation in the future must come from English Heritage.
A5: To enhance and contextualise the Maritime Record of the National Monuments Record and those County SMR/HERs working within the project area.
A5 fulfilment: Instead of 'white space' surrounding monument point (primarily representing shipwrecks), the context that MHLC provides includes a provisional representation of prehistoric landscapes, and a synthesis of maritime history and archaeological potential. MHLC also includes a representation of present day human activities at sea, which may be unfamiliar to terrestrial users. The intermediate themed mapping layers are useful as standalone information sources. They map exposures of palaeoenvironmental evidence and the extents of maritime features, 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 multi-media resource allows the user to 'visit' locations from their desktop through digital photograph, video imagery and can be further enhanced with imagery from the NMR collections or from more local collections.
A6: To structure, inform and stimulate future research programmes and agendas relating to the project area.
A6 fulfilment: One of the scenarios reviewed was the contribution MHLC could make to the NW Regional Framework. The Research Agenda suggests that the regions' HERs take a greater role in the storing of archaeological information relating to the marine environment. The Liverpool Bay and Fylde 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

especially maritime activities not related to the mercantile ports. It has also confirmed that process of sea level change and the survival of prehistoric landscapes over the wider region are not fully understood. Features such as the Formby footprints and the submerged forests of the Wirral may prove to be useful starting points for a wider understanding of the development of Liverpool Bay and the Fylde coast in the post-Glacial period. 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 resource provides easily accessible summaries of archaeological and historical information. The inclusion of digital photography, panoramas, and video footage enable the professional and non-professional user to visually explore the seascapes of Liverpool Bay from their desktop.
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, WA has attempted to present an objective evaluation of the work undertaken to assist the compilers of the forthcoming additional pilots. In particular, the benefits and drawbacks of the different methods dividing the seabed have been explored, copyright difficulties have been detailed, and suggestions made for where further work would be particularly beneficial. The project has produced a three-tier hierarchy of terms to define character. The hierarchy is capable of modification and of accepting additional terms and includes suggestions for character types that may be needed in other areas of England's coast but which have not been utilised in the Liverpool Bay and Fylde Pilot Project.

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: The pilot project incorporated a 2km terrestrial buffer, primarily to assist with data collection, of the neighbouring terrestrial HLCs, and 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 Liverpool Bay and Fylde Coast 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 WA. 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.
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 Liverpool Bay 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 produce a Project Design for applying the project's HLC methodology to a further four areas in subsequent projects which will validate that methodology against major contrasts in coastal and marine environmental and management context.
O5 fulfilment: Developed as a separate round of tendering by English Heritage.
O6: To assess present uses and potential for the HLC in informing sustainable management of change and spatial planning issues surrounding marine aggregates extraction in the project area.
O6 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.
O7: To assess present uses and potential for the HLC in informing broader sustainable management of change, spatial planning, outreach and research programmes.
O7 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 multi-media 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 has been 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, two local special interest groups (CBA NW and Formby Civic Society) and is to present a session at the forthcoming IFA 2006 Conference in Edinburgh. Other publicity materials include a suite of six posters, an A5 flyer (**Figures 13 and 14**) and a world-wide web site hosted by WA. Short illustrated articles have been produced for the IFA's *Archaeologist* magazine, CEFAS' *Coastmap* news and for the *Journal of the Historic Society of Cheshire and Lancashire.*

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APPENDIX 1: DOCUMENTARY REVIEW/BIBLIOGRAPHIC SEARCH RESULTS

Title	Date	Author	Location
A descriptive history of Southport / by F.W. Robinson	1992	Robinson, F. W., Francis W., d. 1886	Liverpool Local History Reference or Central Library
A guide to the Cheshire shores : including Birkenhead, New Brighton, Hoylake		Heywood, Abel	Liverpool Local History Reference
A history of Southport : reprinted to mark the bi-centenary of Southport (17	1992	Bailey, F. A.	Liverpool Local History Reference
A history of Widnes / by George E. Diggle	1961	Diggle, George Edward	Liverpool Local History Reference
A pocket-full of memories : recollections of Formby Point / gathered by Jane	1992		Liverpool Local History Reference or Central Library
A short history of Litherland	1935	Storer, E. W.	Local History Reference
A walker's guide to the Wirral Shore Way : an historic walk along the old shore	1994	Rogers, Carl	Liverpool Central Library
Almost an island : the story of Wallasey	1990	Smith, Noël E.	Liverpool Local History Reference
An account of the ancient town of Frodsham in Cheshire	1881	Beamont, William, 1797?-1889	Liverpool Local History Reference
Back to the sea : the true story of Southport / by Frank Bamford	2001	Bamford, Frank (Frank Wallace)	Liverpool Local History Reference
Bebington : of yesteryear	1981	Bidston, Carol E.	Liverpool Local History Reference or Central Library
Blackpool & Preston : Lytham St. Anne's & Leyland	2000	Ordnance Survey	Liverpool Central Library
Black's guide to Liverpool and Birkenhead with environs including New Bright	1886		Liverpool Local History Reference
Black's guide to Liverpool and Birkenhead with environs including New Bright	1868		Liverpool Local History Reference
Bootle : a pictorial study of the dockland community : a community arts project	1978		Liverpool Local History Reference
Bootle in times past / (compiled by) Pat Herington	1979		Liverpool Local History Reference
Bygone Frodsham and district / (compiled by) David Nield	1985		Liverpool Local History Reference
Bygone Widnes	1985	Smith, Geoffrey, 1957-	Liverpool Local History Reference
Crosby, Lancashire : incorporating Great Crosby, Bludellsands, Little Crosby			Liverpool Local History Reference
Ellesmere Port / compiled by Pat O'Brien	1994		Liverpool Local History Reference
Ellesmere Port : the making of an industrial borough / by Peter J. Aspinall	1982	Aspinall, Peter J.	Liverpool Local History Reference
Ellesmere Port 1795-1960	1996	Roberts, T. W., 1924-	Liverpool Local History Reference
Festival of Britain, 1951 : exhibition, history of Crosby	1951	Crosby, Public Library	Liverpool Local History Reference
Fleetwood : a town is born	1986	Curtis, Bill, 1919-	Liverpool Local History Reference
Fleetwood's fishing industry	1991	Horsley, Peter	Liverpool Central Library
Formby and Freshfield in times past	1987	Yorke, Barbara, 1930-	Liverpool Local History Reference or Central Library
Formby remembered : a century of change / Joan A. Rimmer	1992	Rimmer, Joan A.	Liverpool Local History Reference or Central Library
Frodsham : the history of a Cheshire town	1987		Liverpool Local History Reference or Central Library
General & commercial directory of Preston, Blackpool, Fleetwood, Lytham. St.	1898		Liverpool Local History Reference

Title	Date	Author	Location
Henry Tyrer : a Liverpool shipping agent and his enterprise, 1879-1979	1979	Davies, Peter N. (Peter Neville)	Liverpool Local History Reference
High waters at Liverpool since 1768: the UK's longest sea level record	1999	Woodworth, Philip L.	Liverpool Local History Reference
History of Shipbuilding at Lytham / Jack M. Dakres	1993	Dakres, Jack M	Liverpool Central Library
Hoylake & Meols past / Stephen J. Roberts	1992	Roberts, Stephen J.	Liverpool Local History Reference
Illustrated London news : Liverpool and Birkenhead shipping	197	Merseyside County Museums, County Archives Department	Liverpool Local History Reference
Leaves from an antiquary's note book : mediaeval remains found at Bebington	1897	Cox, Edward W.	Liverpool Local History Reference
Liverpool as it is : its commerce, shipping, docks, public buildings, and port	1870	Abel Heywood & Son	Liverpool Local History Reference
Liverpool Bay shoreline management plan : Sub-cell 11a : Great Ormes Head to Formby Point	1999	Liverpool Bay Coastal Group	Liverpool Local History Reference
Liverpool shipping / with a commentary by Michael Stammers	1974	Stammers, Michael	Liverpool Local History Reference
Liverpool shipping : a short history / [by] George Chandler	1960	Chandler, George, 1915-	Liverpool Central Library
Liverpool shipping groups	2002	Collard, Ian	Liverpool Local History Reference
Liverpool shipping in colour / Philip Parker	2003	Parker, Philip	Liverpool Local History Reference
Liverpool shipping, trade and industry : essays on the maritime history of M	1989		Liverpool Local History Reference
Liverpool, Southport & Wigan : sheet 108	1997	Ordnance Survey	Central Library
Looking backat Ellesmere Port / (compiled by) Pat O'Brien	1986		Liverpool Local History Reference or Central Library
Lytham / by Ed. Ashton	1947	Ashton, Ed	Liverpool Local History Reference
Lytham St Anne's in times past	1978		Liverpool Local History Reference
Lytham, Freckleton, Warton and Wrea Green in times past	1988	Rothwell, Catherine	Liverpool Local History Reference or Central Library
Memories of Bootle beside the sea	1987	Nixon, Ron	Liverpool Local History Reference
Memories of Heswall, 1935-1985	1989		Liverpool Local History Reference
Neston & Parkgate remembered / Jeffrey Pearson	1998	Pearson, Jeffrey	Liverpool Local History Reference or Central Library
Neston 1840-1940 / edited by Geoffrey W. Place / cover painted by David Scot	1996		Liverpool Local History Reference
Old Bebington : postcards from the past	1998	Mitchelson, Dave	Liverpool Local History Reference
Old Widnes and its neighbourhood	1906	Poole, Charles	Liverpool Local History Reference
Out of sight, out of mind: report of a Working Party on the Disposal of Sludge. - Vol.1 : Main report	1972	Great Britain, Working Party on the Disposal of Sludge in Liverpool Bay	Liverpool Local History Reference
Out of sight, out of mind : report of a Working Party on the Disposal of Sludge. - Vol.2 : Appendices	1972	Great Britain, Working Party on the Disposal of Sludge in Liverpool Bay	Liverpool Local History Reference
Out of sight, out of mind : report of a Working Party on the Disposal of Sludge. - Vol.3 : Report for 1972-73	1973	Great Britain, Working Party on the Disposal of Sludge in Liverpool Bay	Liverpool Local History Reference
Pictures from the past / Derek Young and Marian Young. - Collection no. 3 : old photographs of Bromborough, Burton, Eastham, Heswall,	1986	Young, Derek	Liverpool Local History Reference
Postcards of old Widnes / compiled by Cliff Hayes	1993		Liverpool Local History Reference or Central Library
Prehistoric footprints on Formby Point Beach, Merseyside / R.W. Cowell, A. M	1993	Cowell, R. W.	Liverpool Local History Reference
Preston and Blackpool : sheet 102	1983	Ordnance Survey	Liverpool Central Library
Recollections relating to the local history of the Borough of Wallasey	1911	Stubbs, Lucas Peter	Liverpool Local History Reference

Title	Date	Author	Location
Rock Ferry, New Ferry & Bebington : postcards from the past	1998	Mitchelson, Dave	Liverpool Local History Reference or Central Library
Seaforth in camera : early photographs of the district	1999		Liverpool Local History Reference
Sea level changes : North-West England during the Flandrian stage	1978	Tooley, M. J. (Michael John), 1942-	Liverpool Central Library
Shipping enterprise and management, 1830-1939 : Harrisons of Liverpool / by	1967	Hyde, Francis E. (Francis Edwin)	Liverpool Central Library
Shipwrecks in the north-west	1983	Rothwell, Catherine	Liverpool Central Library
Slater's royal national commercial directory of Southport & Birkdale, with t : 1883-4	1883		Liverpool Local History Reference
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Southport & Chorley, Wigan, Formby & Ormskirk	2001	Ordnance Survey	Liverpool Central Library
Southport : 200 years : bicentenary 1792-1992 souvenir	1992		Liverpool Local History Reference
Southport a Century Ago / Geoff Wright	1992	Wright, Geoff	Liverpool Local History Reference
Southport and north Meols fishermen and boat builders	1998	Lloyd, L. J.	Liverpool Local History Reference or Central Library
Southport as it was	1972	Tarbuck, Joan	Liverpool Local History Reference
Southport in times past	1988	Rothwell, Catherine	Liverpool Local History Reference
The antiquities found at Hoylake, in Cheshire	1847	Hume, A.	Liverpool Local History Reference
The Bootle file : a miscellany of local history / researched and compiled by	1998		Liverpool Local History Reference
The home port : Bootle, the Blitz and the Battle of the Atlantic / Bryn Mars	1993	Marsh, Bryn	Liverpool Local History Reference or Central Library
The Liver album of Southport views			Liverpool Local History Reference
The new illustrated guide to Southport and the neighbourhood	1875		Liverpool Local History Reference
The rise and progress of Wallasey : a history of the borough	1974	Woods, E. Cuthbert	Liverpool Local History Reference or Central Library
The story of Blackpool / by Allen Clarke	1969	Clarke, Allen	Liverpool Central Library
The Wirral Peninsula : Birkenhead, Wallasey (including New Brighton), Hoylak			Liverpool Local History Reference
The wonders of Widnes : a new look at an old town / by Andrew F. Richardson	1998	Richardson, Andrew F.	Liverpool Central Library
The wrecks of Liverpool Bay	1994	Michael, Chris	Liverpool
Thetis : disaster in Liverpool Bay : the Admiralty regrets / by C. Warren an	1997	Warren, Charles Esme Thornton	Liverpool Local History Reference
Victorian Hoylake : reollections of Hoylake, 1865-1915	1986	Roberts, Charles	Liverpool Local History Reference
Viking village : the story of Formby / edited by Edith Kelly	1982		Liverpool Central Library
When the sea came in : living memories of Southport	1992		Liverpool Local History Reference
Widnes / compiled by Anne Hall and the Widnes Historical Society	1995		Liverpool Local History Reference or Central Library
Widnes through the ages : an illustrated introduction to the story of Widnes	1991	Whimperley, Arthur	Liverpool Local History Reference
Yesterday's Wirral	2000	Boumphrey, Ian	Liverpool Central Library
Yesterday's Wirral	1980		Liverpool Local History Reference or Central Library
Yesterday's Wirral. – No. 4 : Wallasey and New Brighton including Leasowe / by Ian and Marilyn Bo	1986	Boumphrey, Ian	Liverpool Local History Reference or Central Library
Yesterday's Wirral. – No.3 : West Kirby & Hoylake, including Newton, Caldy & Meols	1984	Boumphrey, Ian	Liverpool Local History Reference or Central Library
Yesterday's Wirral. – No.5 : Wallasey,New Brighton & Moreton / by Ian & Marilyn Boumphrey	1988	Boumphrey, Ian	Liverpool Local History Reference or Central Library
Yesterday's Wirral. – No.6 : Neston, Parkgate, Heswall, including Thurstaston, Irby and Greasby	1991	Boumphrey, Ian	Liverpool Local History Reference or Central Library
Yesterday's Wirral. – No.7 : More of Birkenhead, Oxton and Prenton	1992	Boumphrey, Ian	Liverpool Local History Reference or Central Library
Yesterday's Wirral. – No.8 : Postcard series	1995	Boumphrey, Ian	Liverpool Local History Reference or Central Library

Title	Date	Author	Location
Yesterday's Wirral. – Port Sunlight / by Ian Boumphrey & Gavin Hunter	1991	Boumphrey, Ian	Liverpool Central Library
48 Rimrose Road, Bootle: correspondence, papers and drawings concerning property of Canadian Pacific Steamships Ltd, and war damage to company's property at Gladstone Dock.	1941-1949		Liverpool Record Office
Ainsdale and Birkdale: correspondence and papers concerning land on foreshore to be sold to corporation of Southport.	1926		Liverpool Record Office
Blackpool foreshore: correspondence, papers and plans concerning cases over ownership of parts of foreshore.	1927-1928		Liverpool Record Office
Cammell Laird & Co, Birkenhead: correspondence, papers and plans concerning Cammell Laird & Co Act 1956, acquisition by company of Rock Ferry pier, and purchase of right to foreshore of river Mersey from Crown Estate Commissioners.	1956-1959		Liverpool Record Office
Chadburn's (Ship) Telegraph Company Limited, records.	1898 - 1899		Liverpool Record Office
Cheshire County Council: OS 1" map marked to show smallholdings estate.	1959-1960		Liverpool Record Office
Clarence Dock Power Station: correspondence, papers and plan concerning surveying work for Liverpool Corporation Electric Supply Department.	1929-1931		Liverpool Record Office
Coburg Dock, Liverpool: correspondence and papers concerning valuation of Alexandra and Coburg Granaries of Liverpool Grain Storage & Transit Co in connection with rating assessment.	1924-1926		Liverpool Record Office
Coburg Dock, Liverpool; plan of Coburg Granary of Liverpool Grain Storage and Transit Co Ltd.	nd [c1900]		Liverpool Record Office
Collingwood Dock: correspondence, papers and plans concerning proposed use of accommodation at dock by Penmaenmawr Welsh Granite Co Ltd.	1944-1946		Liverpool Record Office
County borough of Blackpool: plans of South Shore extension and Starr Estate, including papers relating to value of estate, and petition against Blackpool Improvement Bill.	1913-1925		Liverpool Record Office
Duke's Dock, Liverpool: correspondence, plans, schedules and papers relating to arbitration between Manchester Ship Canal Co and Mersey Docks and Harbour Board over sale of dock.	1899		Liverpool Record Office
Duke's Dock, Liverpool: printed copies of plans from leases, etc, 1792-1872.	nd [late 19th c]		Liverpool Record Office
Enclosure Award	1771		Liverpool Record Office

Title	Date	Author	Location
Formby foreshore: correspondence, papers and plan concerning proposed sale by Ince Blundell Estates to Formby Urban District Council.	1930		Liverpool Record Office
Fragments of plans showing commons and old enclosed land in Wavertree, and Wavertree Common as divided in 1770.	c. 1764 - 1770		Liverpool Record Office
George's Dock, Liverpool: correspondence, papers and plans concerning arbitration proceedings (including evidence of EK) between Mersey Docks & Harbour Board and Liverpool Corporation over acquisition of part of site under Liverpool Improvement Act 1898;	1898-1899		Liverpool Record Office
Heswall ordnance map	1899		Liverpool Record Office
Large scale OS map of Heswall and surrounding areas	nd		Liverpool Record Office
Map and schedule showing the re-organisation of parishes made under the Reorganisation Areas Measure, 1944	1945		Liverpool Record Office
Map of the Breck belonging to Everton and rough sketch plans showing divisions of commons	c.1667		Liverpool Record Office
Map showing the townships of Wavertree, Allerton, Garston etc.	n.d. 19 century		Liverpool Record Office
'Mapp of the Breck' by James Chadwick	1722		Liverpool Record Office
Mawdsley's Map of Bootle and suburbs. Scale 6 in to one mile.	1887		Liverpool Record Office
Mersey Docks & Harbour Board: correspondence and papers concerning rating of dock estate, including valuations of Liverpool and Birkenhead docks, including accounts of Mersey Docks & Harbour Board, detailed plans of docks, and some items relating to Bromb	1921-1933		Liverpool Record Office
Mersey Tunnel: plan of suggested emergency exit at Morpeth Branch Dock.	1930		Liverpool Record Office
'Pharus-map of Birkenhead and Wallasey' (Philip, son and nephew Ltd)	nd		Liverpool Record Office
Plan of the Port of Liverpool	nd		Liverpool Record Office
Records Relating to the White Star Line	1894-1927		Liverpool Record Office
Southport Pier: copy documents relating to pier, 1859-1935.	1935		Liverpool Record Office
Southport Pier: correspondence, papers and plans concerning sale of pier by Southport Pier Co Ltd to Southport Corporation.	1935-1936		Liverpool Record Office
Southport Pier: guide books to Southport, Morecambe and Blackpool.	1915-1935		Liverpool Record Office
The "Empire Orwell"			Liverpool Record Office

Title	Date	Author	Location
Thornton Urban District Council: correspondence, papers and plans concerning compulsory purchase of foreshore from Robert and Ruth Bradley; includes proof of evidence of F J Kirby relating to coast erosion and booklet, Thornton Urban District Council: Ris			Liverpool Record Office
Various photographs and glass negatives. Images of ships, docks, foreshore etc. and photographic copies of maps of Liverpool and district (including ordnance survey)	25/11/1910		Liverpool Record Office
What Could Be Expected From A Tailor? ' (Cheshire Life Volume 41 Number 9 September 1975, p59-60 Illus)	1975	Lynn, Roderick	Chester Record Office
(Cheshire) 1741 A Map of Cheshire, North West from London	1742	Badeslade, Thomas	Chester Record Office
(Cheshire) 1761 Cheshire Divided into its Hundreds	1761	Bowen, Emanuel	Chester Record Office
(Cheshire) 1789 A Map of Cheshire Engraved From An Actual Survey	1789	Harrison, J	Chester Record Office
(Chester) 1653 The Ground-Plott of Chester	1656	Hollar, Wenceslas	Chester Record Office
[Cheshire] 1805 A Map of Cheshire From the Best Authorities	1805	Cary, John	Chester Record Office
A Guide to Merseyside's Industrial Past	1984	Rees, Paul	Chester Record Office
A Guide to South-Port, North Meols, in the County of Lancaster: With a Brief Account of the Places in the Immediate Neighbourhood	1809	Glazebrook, Thomas Kirkland	Chester Record Office
A Naturalist's Notebook (Cheshire Life Volume 14 Number 4 April 1948, p12 Illus)	1948	Ellison, Norman F	Chester Record Office
A Naturalist's Notebook Smacks and Nobbies (Cheshire Life Volume 22 Number 7 July 1956, p33 Illus)	1956	Ellison, Norman F	Chester Record Office
A Naturalist's Notebook. Mostly Grayling (Cheshire Life Volume 30 Number 10 October 1964, p73 Illus)	1964	Ellison, Norman F	Chester Record Office
A Naturalist's Notebook: Shrimp Trawling (Cheshire Life Volume 21 Number 12 December 1955, p30 Illus)	1955	Ellison, Norman F	Chester Record Office
A New and Exact Survey of the River Dee or Chester Water 1689	1693	Collins, Capt Greenvile	Chester Record Office
A World of Maps 1: Christopher Saxton (Cheshire Life Volume 46 Number 5 May 1980, p78-79 Illus)	1980	Moore, Christopher	Chester Record Office
Afforestation (Cheshire Life Volume 7 Number 6 November 1940, p9)	1940	Moorhouse, Sydney	Chester Record Office

Title	Date	Author	Location
Ancient Meols: or Some Account of the Antiquities Found Near Dove Point, on the Sea-Coast of Cheshire, Including a Comparison of Them With Relics of the Same Kinds Respectively, Procured Elsewhere	1863	Hume, A	Chester Record Office
Archaeology in the Mersey District 1868 (Offprint from Transactions of the Historic Society of Lancashire and Cheshire (THSLC), Volume 21 1869, p199-218)	1869	Smith, Henry Ecroyd	Chester Record Office
Archaeology in the Mersey District, 1867 (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 20 1868, p 87-130 Illus)	1868	Smith, Henry Ecroyd	Chester Record Office
Archaeology in the Mersey District, 1868 (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 21 1869, p199-218)	1869	Smith, Henry Ecroyd	Chester Record Office
Archaeology in the Mersey District, 1872, and Liverpool Notabilia (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 25 1873, p113-152 Illus)	1873	Smith, Henry Ecroyd	Chester Record Office
Archaeology in the Mersey District, 1872, and Liverpool Notabilia.	1873	Smith, Henry Ecroyd	Chester Record Office
Archaeology in the Mersey District, and Liverpool Notabilia in 1874 (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 27 1875, p85-108 Illus)	1875	Smith, Henry Ecroyd	Chester Record Office
Archaeology of the Mersey District, 1866 (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 19 1867, p169-188 Illus)	1867	Smith, Henry Ecroyd	Chester Record Office
Assessment: Port of Chester	1555-1845		Chester Record Office
Changes in the Landscape of Oxton Township in the Hundred of Wirral from 1795 until its Incorporation in Birkenhead in 1877	1982	Varley, Douglas	Chester Record Office
Changes in the Sea Coast of Lancashire and Cheshire (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 18 1866, p1-88)	1866	Hume, A	Chester Record Office
Cheshire 1787	1787	Cary, John	Chester Record Office
Cheshire 1793	1793	Cary, John	Chester Record Office
Cheshire 1809	1809	Cary, John	Chester Record Office
Cheshire 1885 New Divisions of the County	1885	Jones, Lieut-Colonel R Owen	Chester Record Office

Title	Date	Author	Location
Cheshire in the Dark Ages: A Map Study of Celtic and Anglian Settlement (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 114 1963, p1-22)	1963	Sylvester, Dorothy	Chester Record Office
Cheshire: Sheet VI 15	3rd ed	Ordnance Survey	Chester Record Office
Cheshire: Sheet VI 16	3rd ed	Ordnance Survey	Chester Record Office
Cheshire: Sheet VII 10	3rd ed	Ordnance Survey	Chester Record Office
Cheshire: Sheet VII 13	3rd ed	Ordnance Survey	Chester Record Office
Cheshire: Sheet VII 6	3rd ed	Ordnance Survey	Chester Record Office
Cheshire: Sheet VII 7 & 3. Lancashire: Sheet CVI 1.5 (Parts of)	3rd ed	Ordnance Survey	Chester Record Office
Cheshire: Sheet VII 9	3rd ed	Ordnance Survey	Chester Record Office
Cheshire: Sheet VII NE Lancashire: Parts of Sheets XCIX & CVI	1938		Chester Record Office
Cheshire: Sheet VII NW	1938	Ordnance Survey	Chester Record Office
Cheshire: Sheet VII NW	1913	Ordnance Survey	Chester Record Office
Cheshire: Sheet XII NW	1913	Ordnance Survey	Chester Record Office
Chester 1610		Speed, John	Chester Record Office
Chester 1868	1868	James, Henry	Chester Record Office
Correspondence and evidences relating to ownership of foreshore at Ince	1887-1888		Chester Record Office
Draining the Marshes: The Creation of the South Mersey Waterfront (Cheshire History Number 41 2001 - 2002 p2-15 Illus)	2001-2002	Matthews, Stephen	Chester Record Office
Further Observations on the Alleged Submarine Forests on the Shores of Liverpool Bay and the River Mersey (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 18 1866, p89-126)	1866	Boult, Joseph	Chester Record Office

Title	Date	Author	Location
Handbridge: A Century of Change.		Morgan, Len & Williams, Noel St John	Chester Record Office
Industries with a Difference - I Parkgate Shrimps (Cheshire Life Volume 18 Number 10 October 1952, p19 Illus)	1952	Lake, Ann	Chester Record Office
Kelly's (Gore's) Directory of Liverpool and Including Bootle, Birkenhead, Wallasey and Environs	1958	Gores	Chester Record Office
Kelly's (Gore's) Directory of Liverpool Including Bootle, Birkenhead, Wallasey and Environs 1937.	1930	Gores	Chester Record Office
Kelly's (Gores) Directory of Liverpool, Including Bootle, Birkenhead and Wallasey	1946	Gores	Chester Record Office
Kelly's (Gore's) Directory: Liverpool, including Bootle, Birkenhead Wallasey and Environs, 1952	1950	Gores	Chester Record Office
Kelly's Directory of Liverpool and Bootle with Crosby and Litherland 1970.	1970	Gores	Chester Record Office
Kelly's Directory of Liverpool with Birkenhead, Bootle, Crosby, Wallasey, Bebington, Litherland, 1966	1960	Gores	Chester Record Office
Map of the Townships in the Hundred of Wirral 1842	1842	Evans & Howarth	Chester Record Office
Marine maps of the Board of Trade and its successors	19th - 20th century		Chester Record Office
Merseyside: A Description of the OS One-inch Sheet 100: Liverpool	1964	Gresswell, R Kay & Lawton, Richard	Chester Record Office
Neston 1840 – 1940	1996	Place, Geoffrey W (Editor)	Chester Record Office
Nobbies and Jigger Boats.	1984	Pearson	Chester Record Office
Notabilia of the Archaeology and Natural History of the Mersey District during Three Years, 1863/4/5 Part I (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 18 1886, p194-228 Illus)	1886	Smith, Henry Ecroyd	Chester Record Office
Ogilby and Collins: Cheshire by Road & Sea (Cheshire Round, Volume 1 No. 7 Spring 1967, p210-225)	1967	Harley, J B	Chester Record Office
On the Tides and Datums of the Lancashire Coast (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 49 1898, p171-175)	1898	Veevers, Richard	Chester Record Office
Ordnance Survey of England: Book of Reference to the Plan of the Parish of Neston ... in the County of Chester	1874		Chester Record Office

Title	Date	Author	Location
Outline of the Sea Coast of Cheshire (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 11 1859, p219-232)	1859	Hume, A	Chester Record Office
Places in Lancashire Destroyed by the Sea (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 49 1898, p87-96)	1898	Fishwick, Lieut-Colonel	Chester Record Office
Places of Interest on Merseyside	1951	Wilkinson, H R (Editor)	Chester Record Office
Plan of the Township of Bidston in the Parish of Bidston.	1840s		Chester Record Office
Plan of the Township of Grange in the Parish of West Kirby.	1840s		Chester Record Office
Plan of the Township of Greasby in the Parish of West Kirby and Thurstaston.	1840s		Chester Record Office
Plan of the Township of Great Meols in the Parish of West Kirby.	1840s		Chester Record Office
Plan of the Township of Whitby in the Parish of Eastham / Stoke.	1840s		Chester Record Office
Prime Dee Salmon (Cheshire Life Volume 26 Number 4 April 1960, p60,61,63,101 Illus)	1960	Anthony, Philip V	Chester Record Office
Records Relating to the River Dee, and its Fisheries (Journal of the Chester Archaeological Society (JCAS) 1st Series, Volume 1 1857, p234-250)	1857	Ayrton, William	Chester Record Office
Report Recommending Two New Sea Ports on the Rivers Dee and Mersey, plus Floating Harbour and Ship Canal.	1828	Thomas Telford, Robert Stevenson & Alexander Nimmo	Chester Record Office
Salmon of the Cheshire Dee (Cheshire Life Volume 27 Number 11 November 1961, p80-82 Illus)	1961	King, G Marshall	Chester Record Office
Selections From the Ancient Papers of the Moore Family, Formerly of Liverpool and Bank Hall (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 39 1889, p159-174)	1889		Chester Record Office
Soils in Cheshire 1 Sheet SJ 65 (Crewe West)	1971	Furness, R R	Chester Record Office
Some History of the Coastwise Lights of Lancashire and Cheshire. Part 2 (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 97 1946, p159-180)	1946	Woods, E Cuthbert	Chester Record Office
Some Observations on the Effect of Salt Extraction on the Landscape of Witton-cum-Twambrook 1721-1828	1982	McFarlane, T C	Chester Record Office
Supplement to Ancient Meols. Examination of the Changes in the Sea Coast of Lancashire and Cheshire	1866	Hume, A	Chester Record Office
The Battle of Land and Sea on the Lancashire, Cheshire and North Wales Coasts		Ashton, William	Chester Record Office
The Dee on its Death-Bed (Cheshire Life Volume 23 Number 9 September 1947, p46-47,83,85 Illus)	1947	David, Roger	Chester Record Office

Title	Date	Author	Location
The Fisherman of Parkgate.	1984	Pearson, Jeffrey	Chester Record Office
The Forgotten Shores: Stories of the Wirral Coast from Eastham Ferry to Magazine Brow	1988	Hope, Maurice	Chester Record Office
The Geology of the Neighbourhood of Chester (Explanation of Quarter Sheet 80SW)	1882	Strahan, Aubrey	Chester Record Office
The Hundred of Caldy (Cheshire Notes and Queries No. 1, Volume 3 1898, p31-34)	1898		Chester Record Office
The Manor and Fields of Frodsham 1315-74 (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 128 1979, p27-57)	1979	Booth, P H W	Chester Record Office
The Manor and the Cheshire Landscape		Sylvester, Dorothy	Chester Record Office
The Map-History of the Coast from the Dee to the Duddon. A Search for the Belisama of Horsley (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 31 1879, p83-96)	1879	Rylands, T G	Chester Record Office
The Map-Maker (Cheshire Life Volume 53 Number 12 December 1987, p70-71 Illus)	1987	Skidmore, Ian	Chester Record Office
The Mersey and the Ferries; Their History and Topography; or, the River Excursionist's Guide ...	1853	Gawthrop, Hugh	Chester Record Office
The Submerged Forest (Cheshire Life Volume 36 Number 11 November 1970, p86)	1970	Smith, Jeanette M	Chester Record Office
Three Byzantine Coins Found near the North Wirral Coast in Merseyside (Transactions of the Historic Society of Lancashire & Cheshire (THSLC) for 1998, Volume 148 1999, p197-202)	1999	Philpott, Robert A	Chester Record Office
Traces of Submerged Lands on the Coasts of Lancashire, Cheshire, and North Wales (Transactions of the Historic Society of Lancashire & Cheshire (THSLC), Volume 46 1895, p19-56)	1895	Cox, Edward W	Chester Record Office
Very Plenteous in Fish: A Survey of Fisheries in Wirral (Cheshire History, Number 43 2003 - 2004 p40-46 Illus)	2003	Davey, Elizabeth	Chester Record Office
When the Shrimp was King (Cheshire Life Volume 42 Number 3 March 1976, p60-61 Illus)	1976	Pearson, Jeffrey	Chester Record Office
Wirral Canal and branch to Trafford, deposited 11 Nov 1792	1792		Chester Record Office
Wrecking in Wirral (Cheshire Life Volume 19 Number 4 April 1953, p25 Illus)	1953	Robinson, H A	Chester Record Office
A New Map of Lancashire 1787	1787	Tunnicliff, William	Chester Record Office
A Chorographical Survey of the Country Surrounding Liverpool Circa 1800	1800	Troughton, Thomas	Chester Record Office
Cheshire Lines Railway.	1867		Chester Record Office

Title	Date	Author	Location
Halehead and Widnes Canal Dock and Railway.	1872		Chester Record Office
The History and Development of Ellesmere Port from 1795	1964	Roberts, T W	Ellesmere Port Library
Map of the County Palatine of Chester from Actual Survey (Extract).	1831	Bryant, A	Ellesmere Port Library
Map of Ellesmere Port Showing Post-War Development	1953		Ellesmere Port Library
The Victoria History of the County of Lancaster Volume 2	1908	Farrer, W & Brownbill, J	Warrington Library
Sandy Shores in South Lancashire: The Geomorphology of South-West Lancashire.	1953	Gresswell, R Kay	Warrington Library
The Geomorphology of North- West England.	1985	Johnson, R H (Editor)	Warrington Library
Memoirs of the Geological Survey of Great Britain: England and Wales. Geology of Southport and Formby	1948	Wray, D A & Cope, F Wolverson	Warrington Library
The Lancashire Coast Area	1951	Lancashire Industrial Development Association	Warrington Library
A History of Southport.	1955	Bailey, Francis	Warrington Library
The Authentic Map Directory of South Lancashire	1930s	Bain, James	Warrington Library
History of the Fylde of Lancashire.	1876	Porter, John	Warrington Library
History of Southport Situate in North Meols in the County Palatine of Lancaster.	1830	Glazebrook, Thomas Kirkland	Warrington Library
Kelly's Directory of Liverpool, Including Bootle, Birkenhead, Wallasey and Environs	1949	Gore's	Warrington Library
King on the Persecution and The Mayor, Bailiffs and Burgesses and the Town of Liverpool against Samuel Grimshaw, John Rowles the Elder and John Rowles the Younger. Indictment for a Nuisance in Diverting Water from the River Mersey at Woolston 10 Sep	1820	Lancashire Summer Assizes	Warrington Library
The Ancient Mersey Fisheries.		Boscow, H	Warrington Library
The Wirral Peninsula: A Study of its Growth.	1935	Boscow, H	Warrington Library
Early Warrington Fisheries: An Historical Sketch	1929	Dunlop, G A	Warrington Library
(Salmon Fishing in the Mersey)	1793		Warrington Library

Title	Date	Author	Location
History, Directory and Gazetteer of the County Palatine of Lancaster. Volume III: Illustrations	1824	Baines, Edward	Warrington Library
Journey of the Flats (Photocopy from 'Waterways World' June 1984, p41-43 Illus)	1984	Corbridge, John	Warrington Library

APPENDIX 2: HISTORIC SEA USE/ MODERN SEA USE AND ENVIRONMENTAL DATASETS

Modern Sea Use Charts

Chart Number	Surveyor	Title	Format
1978	UKHO	Great Orme Head to Liverpool	Hard Copy
1981	ÚKHO	Approaches to Preston	Hard Copy
2010	UKHO	Morecombe Bay and Approaches	Hard Copy
3490	UKHO	Port of Liverpool	Hard Copy

Historic Sea-use Charts

Document Number	Shelf Mark	Date	Description	Surveyor	Format
631	15b		Lancashire and Cumbria to Dumfries and Galloway English MS of Solway-Firth and part of the coast of England surveyed by M. MacKenzie	Murdoch MacKenzie	Hard Copy
632	1k		Isle of Man and part of Galloway in Scotland	Murdoch MacKenzie	Hard Copy
633	13e		Coast of England from Ribble	Murdoch MacKenzie	Hard Copy
633	13e		The Coast of England from the Ribble in lancashire to Holy Head	Murdoch MacKenzie	Hard Copy
635	13e		Coasts of Cumberland and Lancashire	Murdoch MacKenzie	Hard Copy
681	Dg	1812	River Mersey and Dee. A New Chart of the Harbour of Liverpool by James Kay, Pilot.	James Kay	Hard Copy
682	Dg	1794	Harbour of Liverpool	Lawrie and Whittle	Hard Copy
683	Of	1814	Survey of Liverpool Harbour	Lt. Evans	Hard Copy
683a/b	3a	1812	River Mersey and Dee	Thomas Evans (Lt. RN)	Hard Copy
684/1	Og	1814	River Mersey and Dee		Hard Copy

Document Number	Shelf Mark	Date	Description	Surveyor	Format
684/2	Og	1815	River Mersey and Dee		Hard Copy
A1677	31a	1866-68	Liverpool Bay	Wells	Hard Copy
A4370	10b	1874	Liverpool Bay	Lt. Com. G. Wells	Hard Copy
A49	Oi	1771	The Harbour of Liverpool	Burdett	Hard Copy
A8051	49a	1883	Ribble River approaches- Fleetwopd to Formby Pt. Lancashire	Staff Com. Wl. Archdeacon	Hard Copy
A8508	Qc	1883	Liverpool Bay- England W. C.	Staff Com. Wl. Archdeacon	Hard Copy
A9260	2c	1882	Liverpool Bay- England W. C.	Mersey Dock and Harbour Board.	Hard Copy
B1412 (1-2)	14d	1843?	Liverpool Bay to Duddon Estuary, including Morecombe Bay Entrance	None	Hard Copy
B1460	72	1843?	Irish Sea, Dublin Bay to Holyhead to St. Abbs Head including the Isle of Man.	Capt. F. W. Beechey	Hard Copy
B2030	14j	1888	River Dee entrance, Check Bar to Queensferry	Staff Com. Wl. Archdeacon	Hard Copy
B2039	Dk	1889	Great Orme Head to Helbe I. Including the River Dee resurveyed.	Staff Com. Wl. Archdeacon	Hard Copy
B2388	Ok*	1889	Ribble River or Gut and North Channels with tidal streams outside	Staff Com. Wl. Archdeacon	Hard Copy
B2725	Qi	1890	Ribble Estuary- England W. C.	From Town Clerk Southport	Hard Copy
B3069	14m	1890	Liverpool Bay. England W. C.	Mersey Dock and Harbour Board.	Hard Copy
B3185	14m	1890	River Ribble Estuary- England W. C. (tracing by Melby for a survey for Board of Trade by Parsons.)	Capt. J. Parsons RN	Hard Copy
B9959	7k	1904	River Ribble, and Estuary (Preston to the Sea) England W. C.	James Barron	Hard Copy
C2160	Do	1906	Rock Light House to eastham- River Mersey, England		Hard Copy
C3147	Dn	1909	Rock Light to Warrinton, R. Mersey, England	Seal Ark, Upper Mersey Navigation Company.	Hard Copy
C3211	Dn	1909	River Ribble and entrance, Preston to the Sea	J. Barron	Hard Copy
C3543	7l	1826	Ribble Estuary, Preston to the Sea, England W. C.	J. Barron CE	Hard Copy
C90	2a		Entrance of River Mersey	English Survey	Hard Copy
D20	De		River Mersey	Hydrographic Office	Hard Copy
D23	3h		Harbour of Liverpool	English	Hard Copy
E1688	7I	1925	Preston Dock to the Sea (River Ribble and Estuary) England W. C.	James Barron (Engineer- Ribble Navigation Department)	Hard Copy
E4188	10f	1933	Liverpool Bay- England W. C.	Mersey Docks and Harbour Board	Hard Copy
H694	Og	1833	The New Channel into the Mersey	Liverpool Paper	Hard Copy
K25	De Ig	1834	Entrances to Liverpool (4 Sheets)	L. Dawkins?	Hard Copy
L1195	Dg		The approaches to Liverpool from the Ad…	Com. Duckham?	Hard Copy
L2976	De		Part of the River Mersey from Rock Lighthouse and Booth Bay to Oglet Pt.	Walker	Hard Copy
L322	Dg	1835	A map of the town and port of Liverpool with their environs		Hard Copy
L3610	De		Design for Docks in Wallasea pool on the Mersey near Birkenhead	Col. Lt. Rendell	Hard Copy
L3877	De		Plan of the floating dock and other works connected therewith proposed to be made in Wallesey Pool at Birkenhead	J. M. Rendel	Hard Copy

Document Number	Shelf Mark	Date	Description	Surveyor	Format
L4466	3e		Coast of Lancashie between the Ribble, Duddon, and the Mouth of Morecombe Bay, contains Walsey island and Pick Harbour.	?	Hard Copy
L7610	3g		The Ribble Estuary from Preston to the Sea	Com. G. Williams	Hard Copy
L7611	396		D? Rough of Dee	?	Hard Copy
L7916	77	1851	The River Dee from Sandy Crofte	Lieut. Aldridge	Hard Copy
L842	England Folio 2	1837	A tracing of the Rock Channel, Liverpool exhibiting the recent alterations in the Buoyage of the Northside thereof.		Hard Copy
L849	De	1836	The River Mersey between the Rock Lighthouse…	Lieut Comdr. Duckham	Hard Copy
L849	De	1836	The River Mersey between the Rock Lighthouse…	Com. Duckham?	Hard Copy
L9057	416	1852	Chart of the River Mersey from Rock Lighthouse and Booth Bay to Oglet Pt.	L. Lord	Hard Copy
L7916	77	1851	The River Dee from Sandy Crofte	Lieut. Aldridge	Hard Copy
L3877	De		Plan of the Floating Dock and other works connected therewith proposed to be made in Wallasey Pool at Birkenhead	J. M. Rendel	Hard Copy
L4466 (1-2)	3e		Coast of Lancashire between the Ribble, Duddon and the mouth of Morecombe Bay…		Hard Copy
678	3h		Bay of Morecombe	Lt. Woolnaugh	Hard Copy

NMR and SMR/HER Data

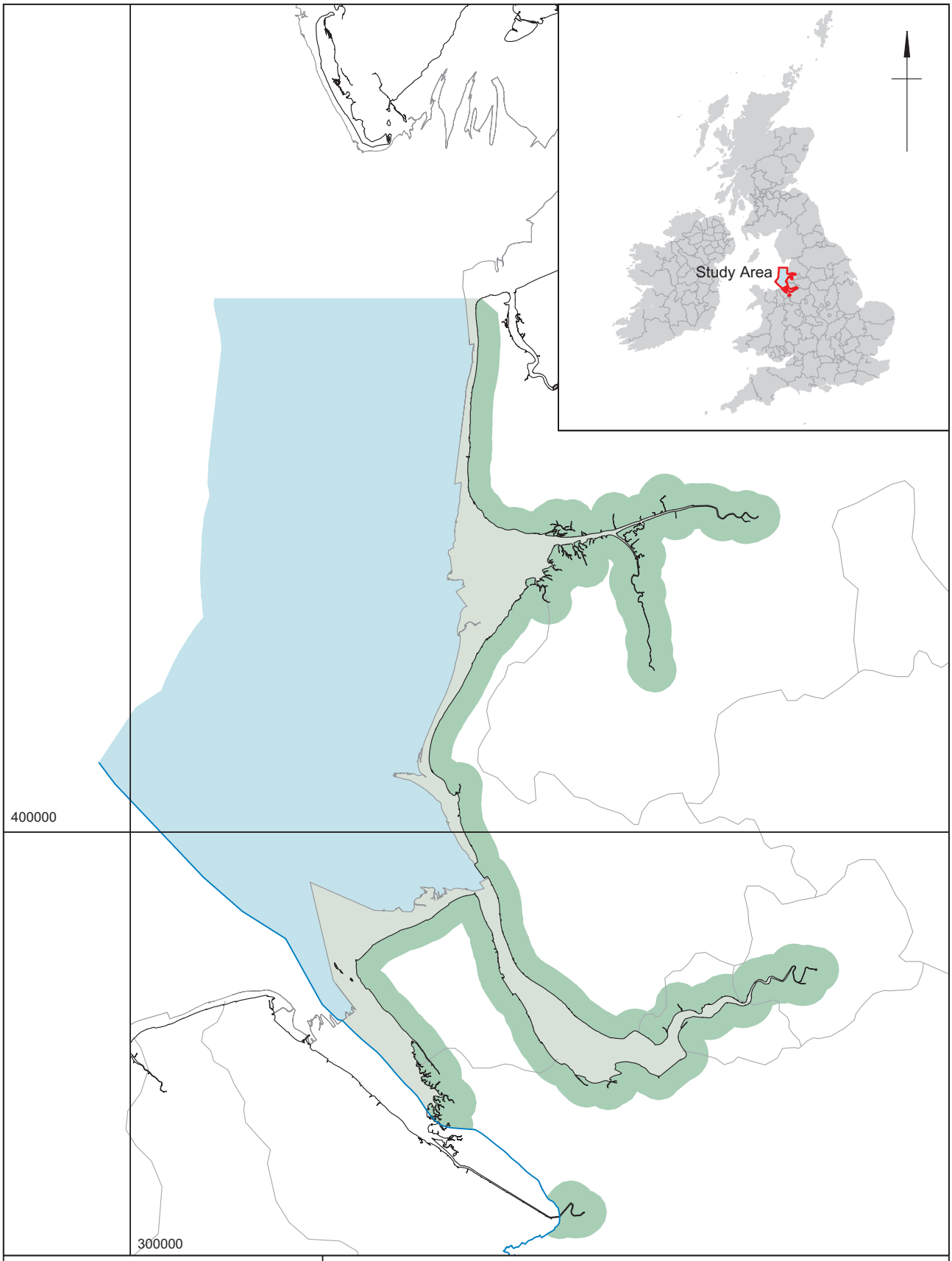
Dataset	Data Description	Format
National Monuments Record	Monuments and sites data	Digital and Hard Copy
Cheshire HER	Sites and monuments point data	Digital
Lancashire HER	Sites and monuments point data	Not received
Merseyside HER	Sites and monuments point data	Digital
Cheshire HLC	Historic Landscape Characterisation layers	Digital
Lancashire HLC	Historic Landscape Characterisation layers	Digital
Merseyside	Historic Landscape Characterisation layers	Digital

Other Marine Datasets

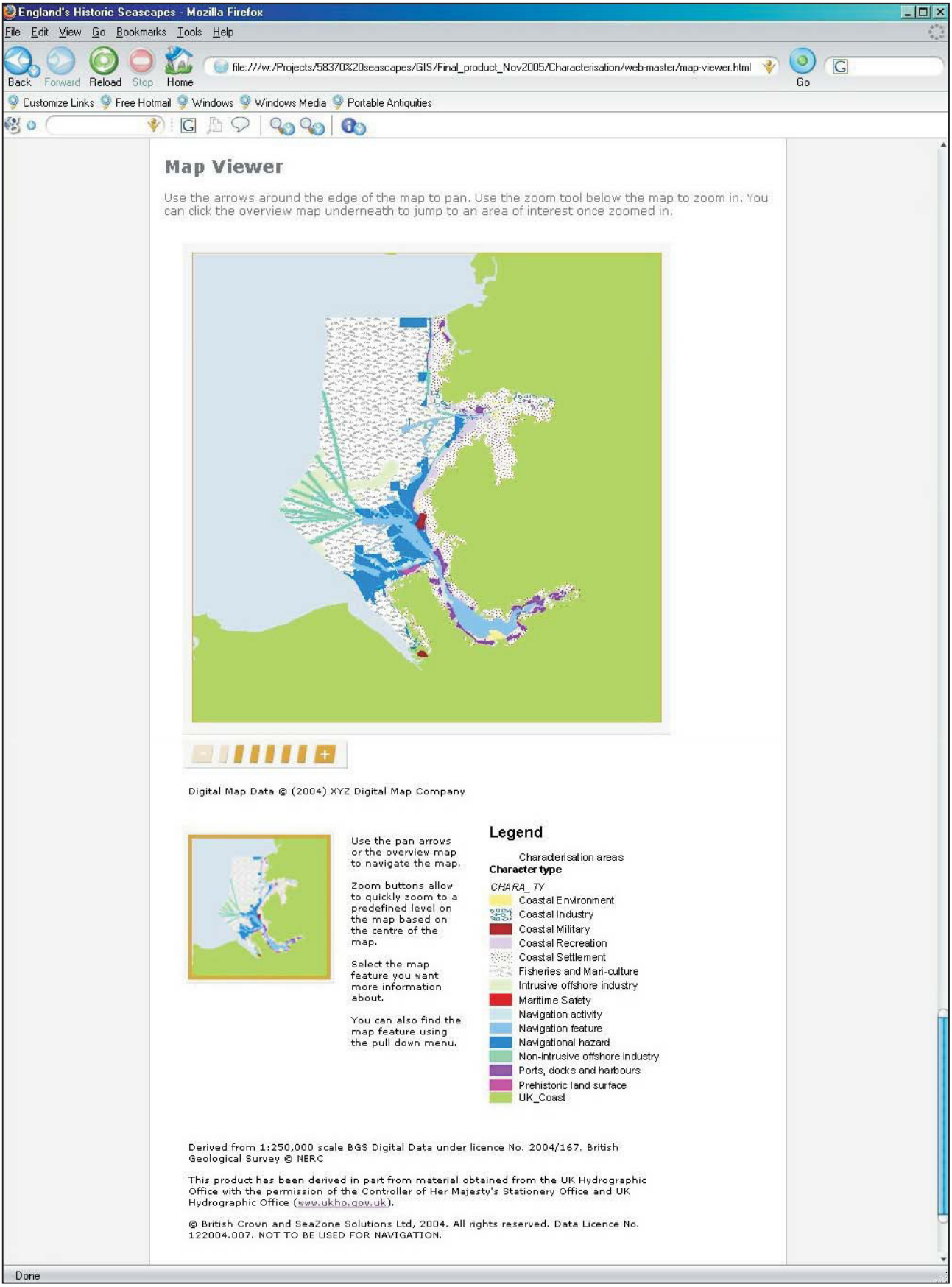
Dataset	Data Description	Format
SeaZone	Wrecks and obstructions	Digital
SeaZone	Offshore installations	Digital
SeaZone	Dumping grounds,	Digital
JNCC	Protected sites. SACs, SPAs, SSSIs (ASSIs), MNR, NNR, LNR, Ramsar, MEHRA	Digital
JNCC	Relative fishing intensity	Digital
JNCC	Fishery closed areas	Digital
JNCC	Dredge disposal sites	Digital
JNCC	Oil and Gas reserves	Digital
JNCC	Coast protection structures	Digital
JNCC	Flood defence structures	Digital
JNCC	Coast protection structures	Digital
JNCC	Coastal development	Digital
JNCC	Wastewater discharges	Digital
JNCC	UK Irish Sea offshore wind SEA area	Digital
NMR	Aerial photographs	Indexed but not utilised
English Nature	Aerial photographs	Indexed but not utilised
English Nature	Coast protection structures	Digital
English Nature	Flood defence structures	Digital
English Nature	Waste water discharges	Digital
English Nature	Projected sea level rise data	Digital

Environmental Data

Dataset	Data Description	Format
English Nature	Bathymetric data on the Dee, Mersey and Ribble estuaries	Digital
English Nature	Coastal erosion data	Digital
SeaZone	Bathymetry	Digital
British Geological Survey	Seabed sediments	Digital
British Geological Survey	Offshore solid geology	Digital
JNCC	Sea bed slope. Shows sea bed profile	Digital



The Liverpool Bay and Fylde Coast Pilot Area. Figure 1



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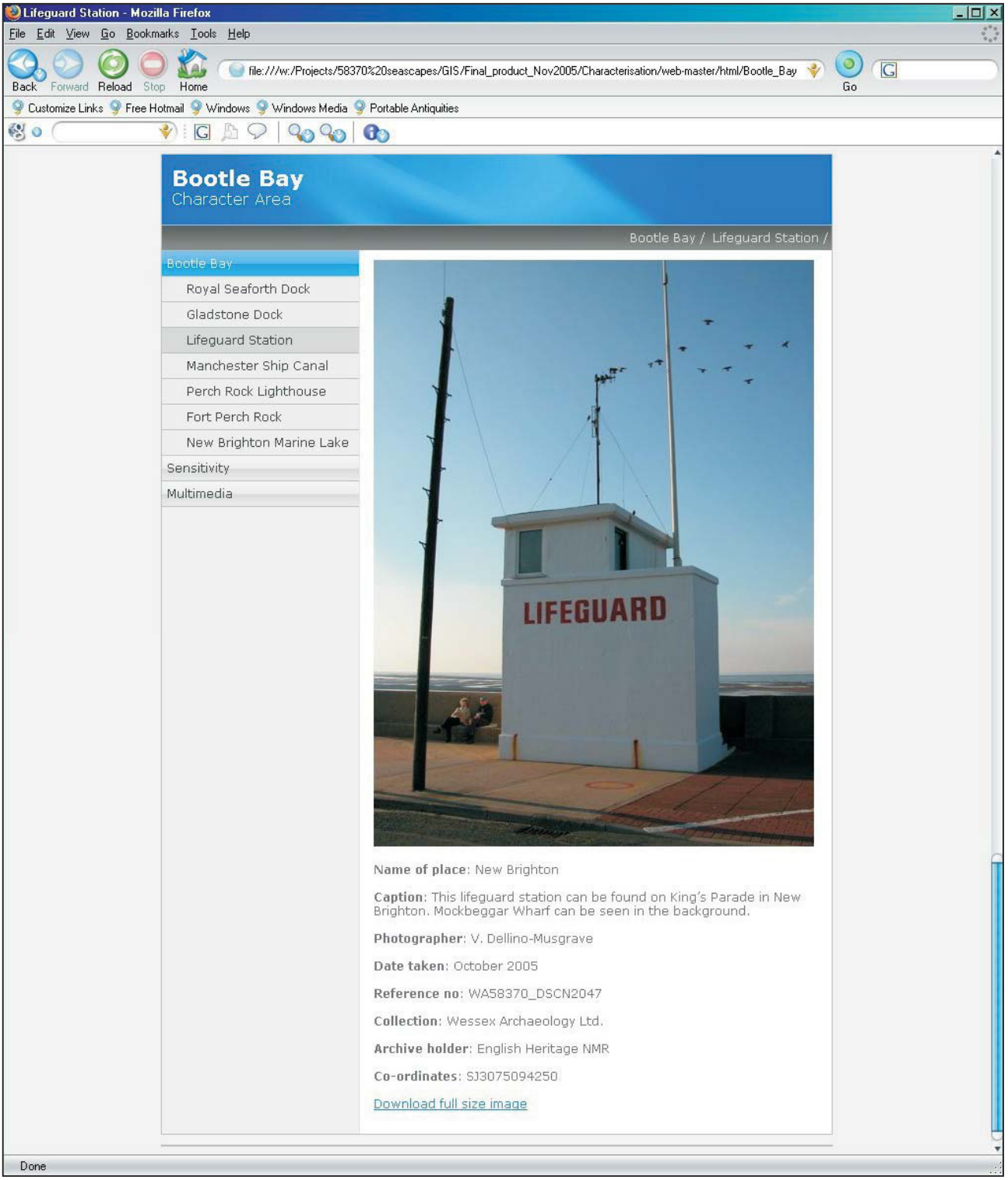
Wessex Archaeology

The interactive characterisation map as it appears on the offline webpages. Figure 2



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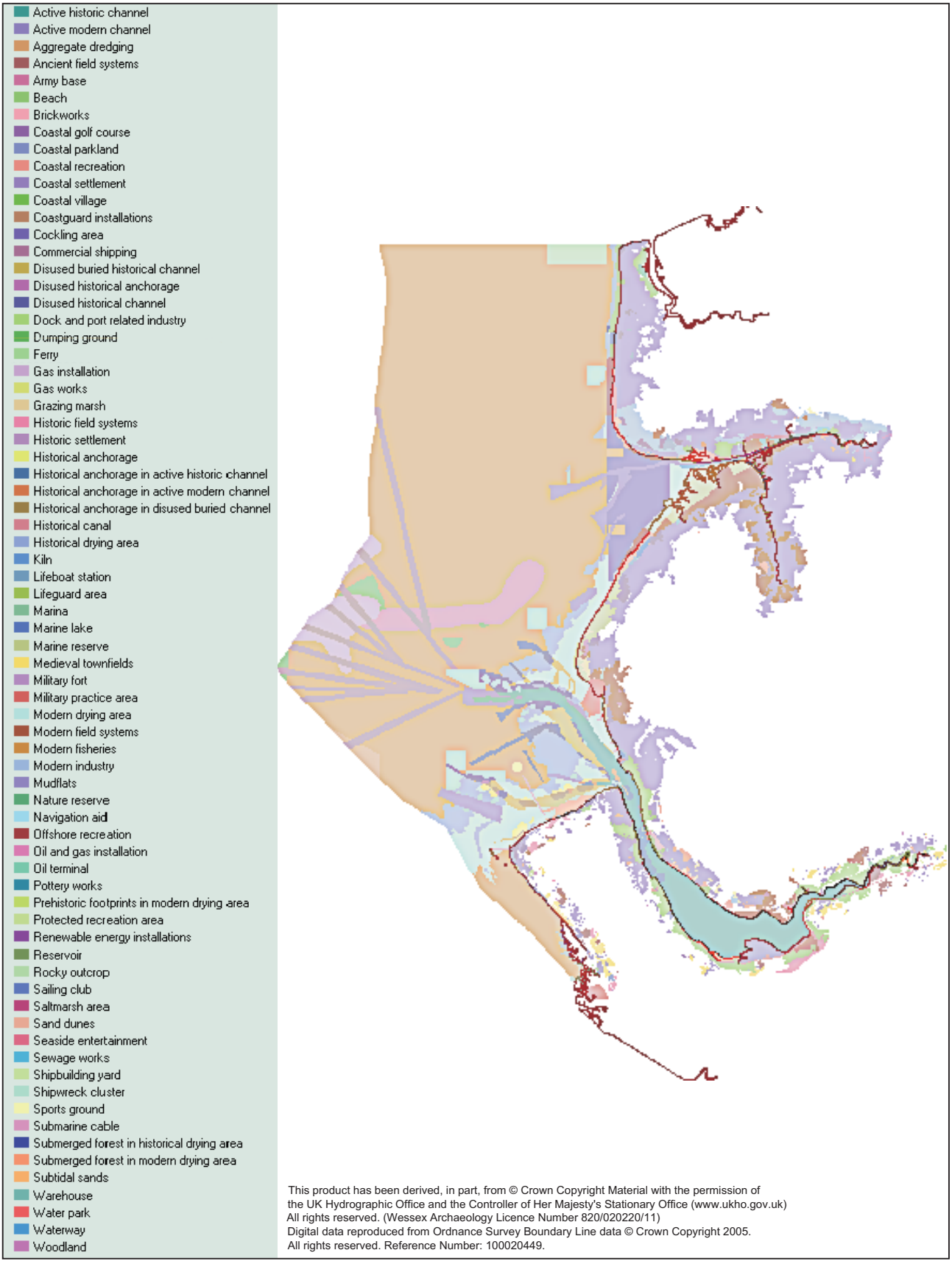
An example of a still image from the offline webpages. Figure 3



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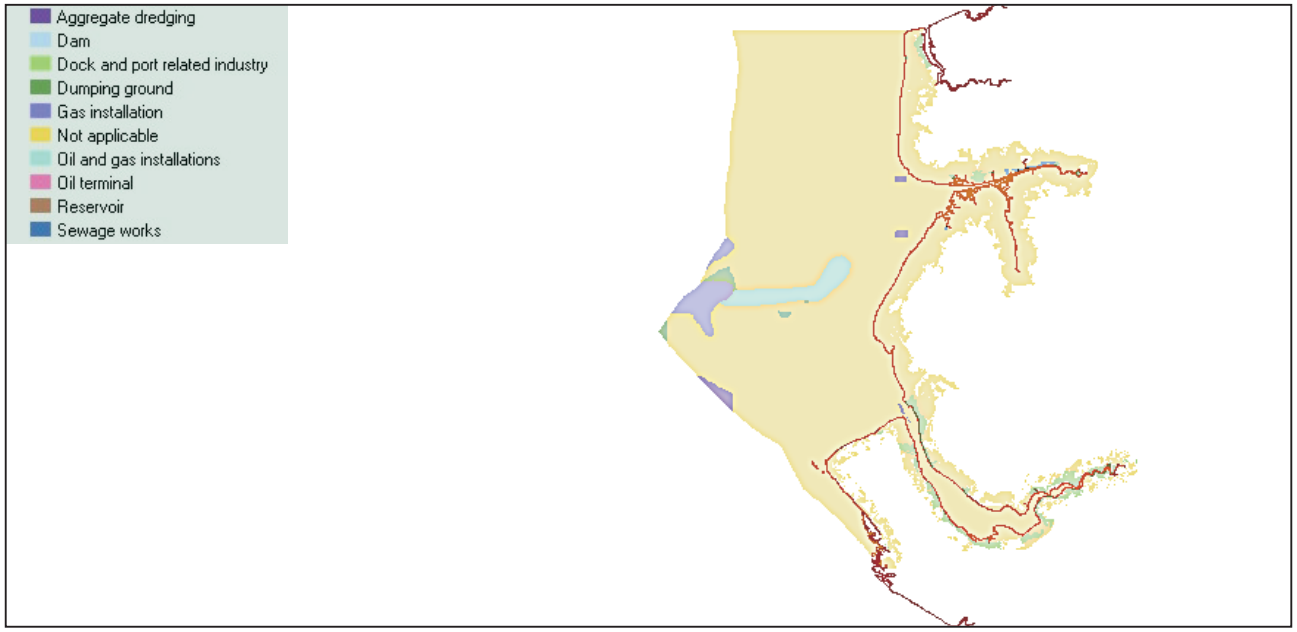
The 'sub-character' map for the Liverpool Bay and Fylde Coast Pilot Area. Figure 4

The 'period' map for the Liverpool Bay and Fylde Coast Pilot Area.



The inception of intrusive offshore industries, such as oil and gas production, gives an indication of seascape change in modern times.

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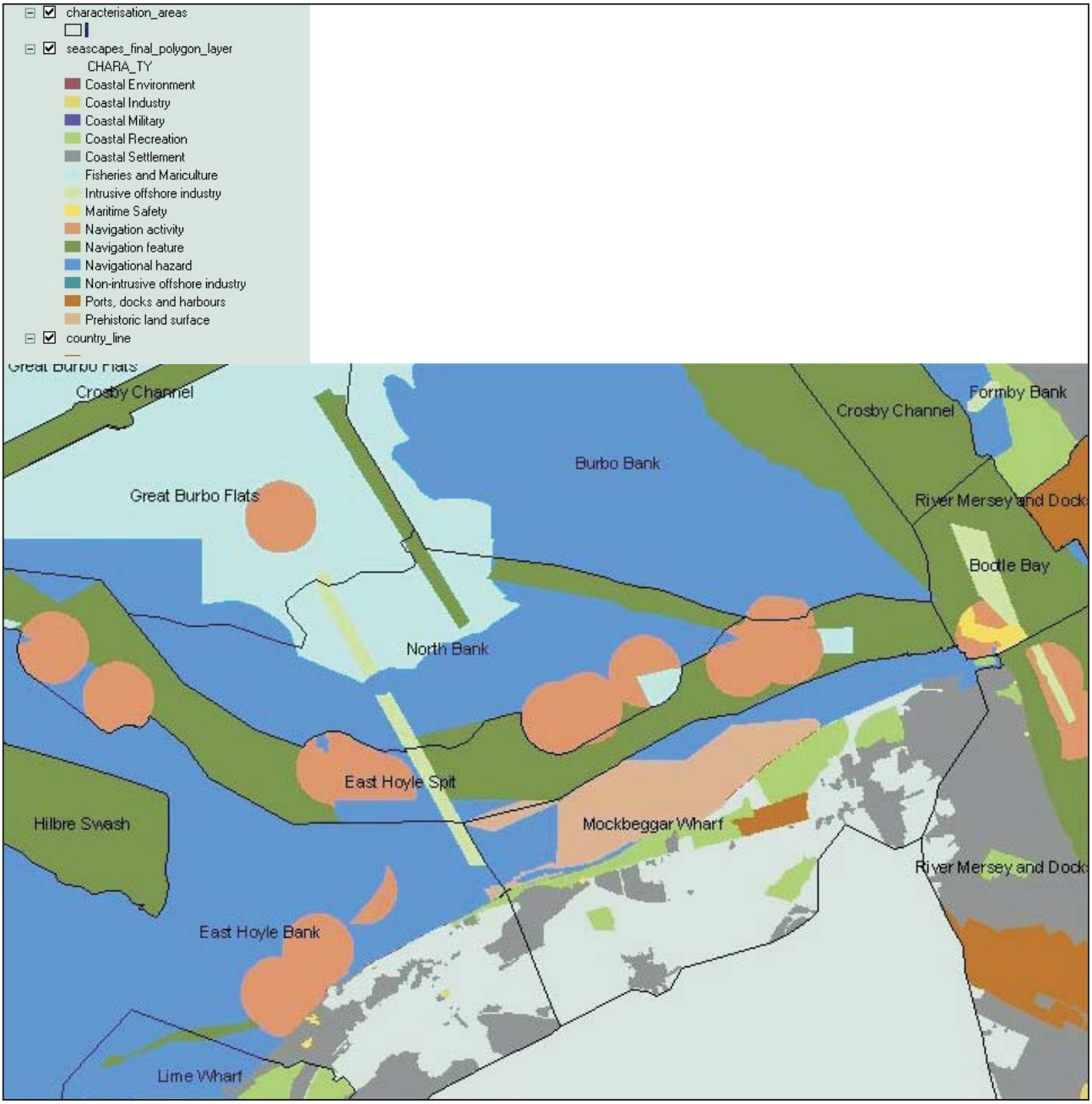
The 'period' map for the Liverpool Bay and Fylde Coast Pilot Area. Figure 5



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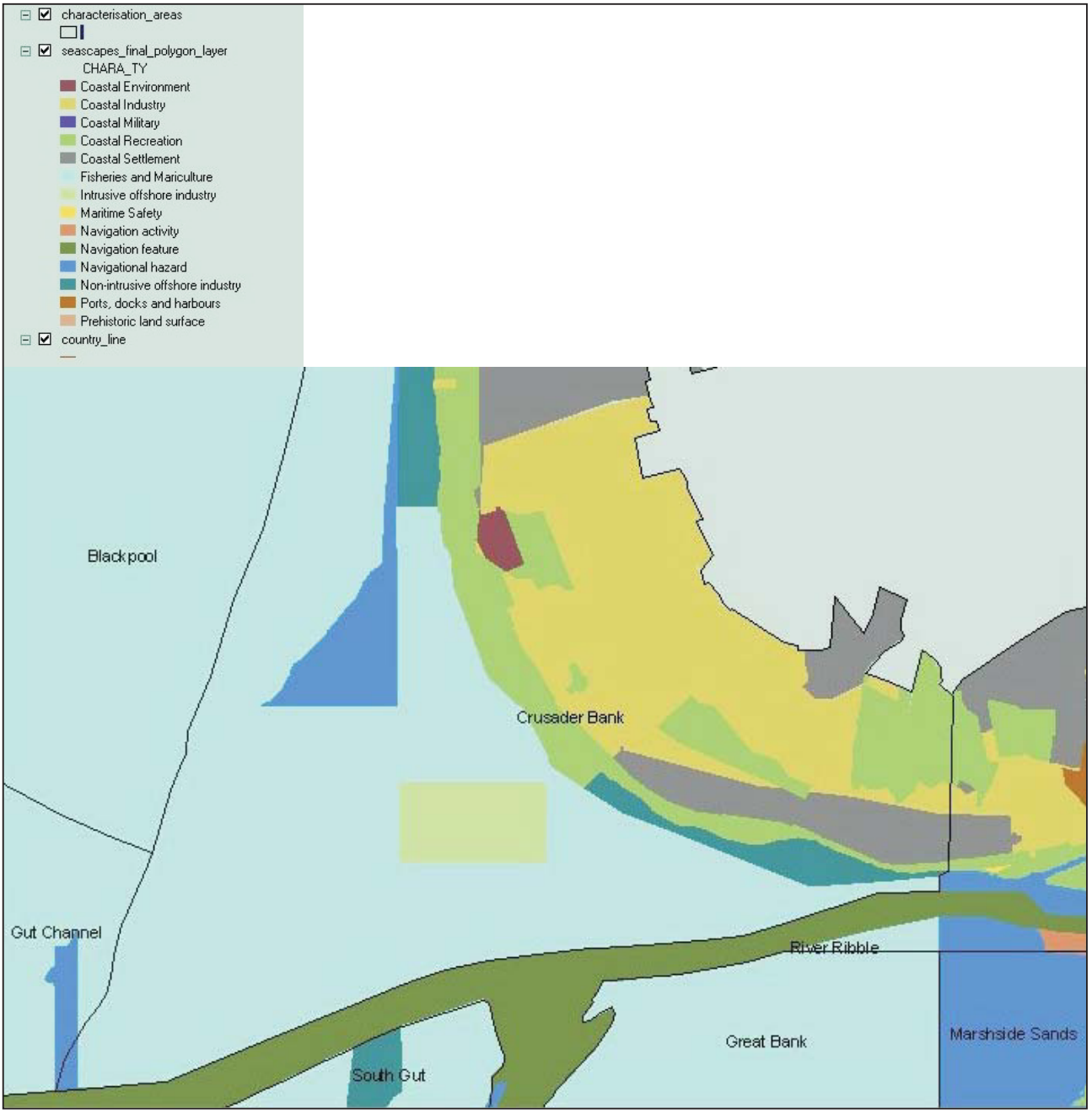
A detail from the character map showing the North Bank Characterisation Area and the Navigational Hazard character polygons off the Wirral.

Figure 6



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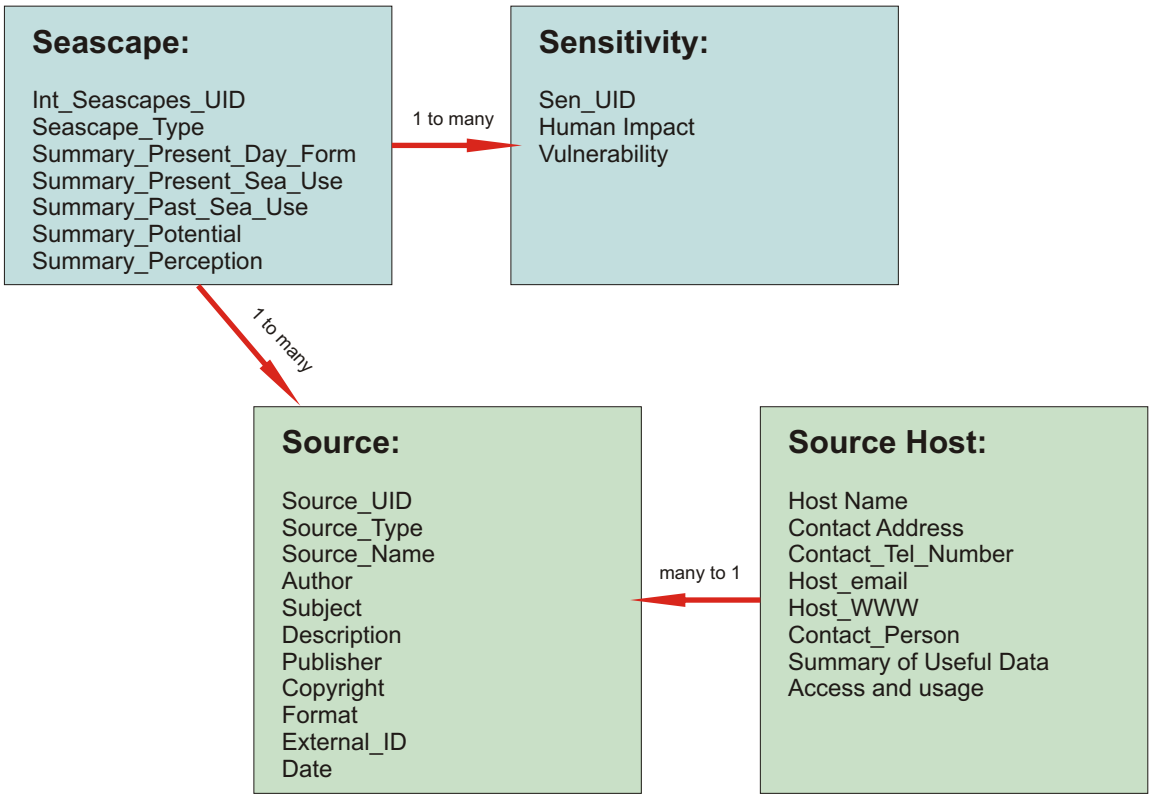
A detail from the character map showing the Crusader Bank Characterisation Area and the Industry character polygons off Lytham St Annes.

Figure 7

Draws reconstructions based on user's interpretation to define 'Seascapes Type', characterise by manual means, simple GIS (single, fairly large manually defined polygon), inked to bibliographic database and multi-media.



Source could be made into **Metadata.**

Model needs a link to
Multi-media and
GIS mapping

(historic views, sounds, video footage of panoramic views, photographs)

GIS layer metadata?

Note : This ArcGIS model has a restriction of 250 characters for its attribute field length suggests MS Access or offline HTML application to incorporate long textual descriptions.

(one to many relationship)
(one to one relationship)
(many to many relationship)

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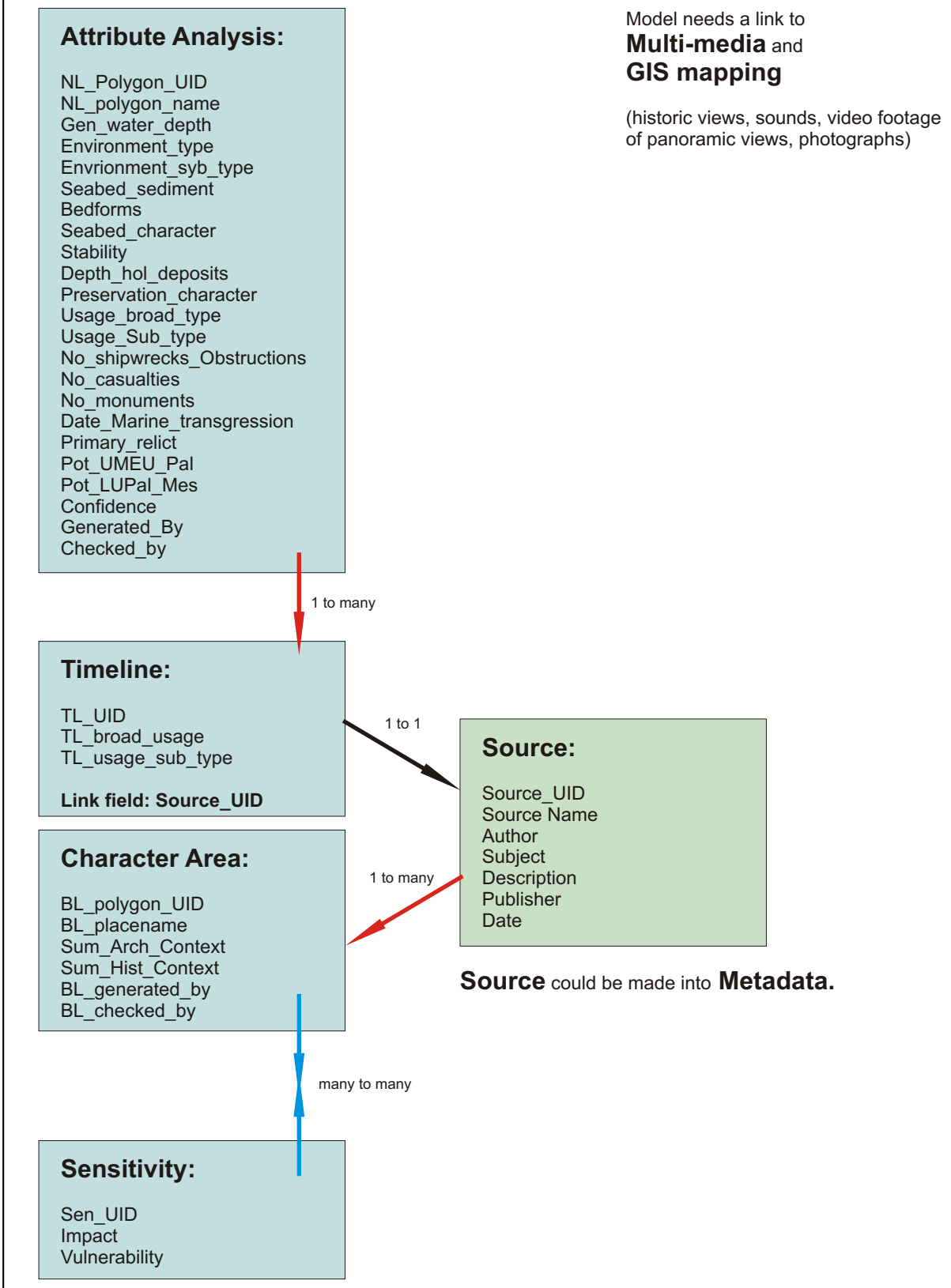
The Classification Led conceptual model explored for the data structure of the GIS project. Figure 8



Note : This ArcGIS model has a restriction of 250 characters for its attribute field length suggests MS Access or offline HTML application to incorporate long textual descriptions of Character Area.

(one to many relationship)
(one to one relationship)
(many to many relationship)

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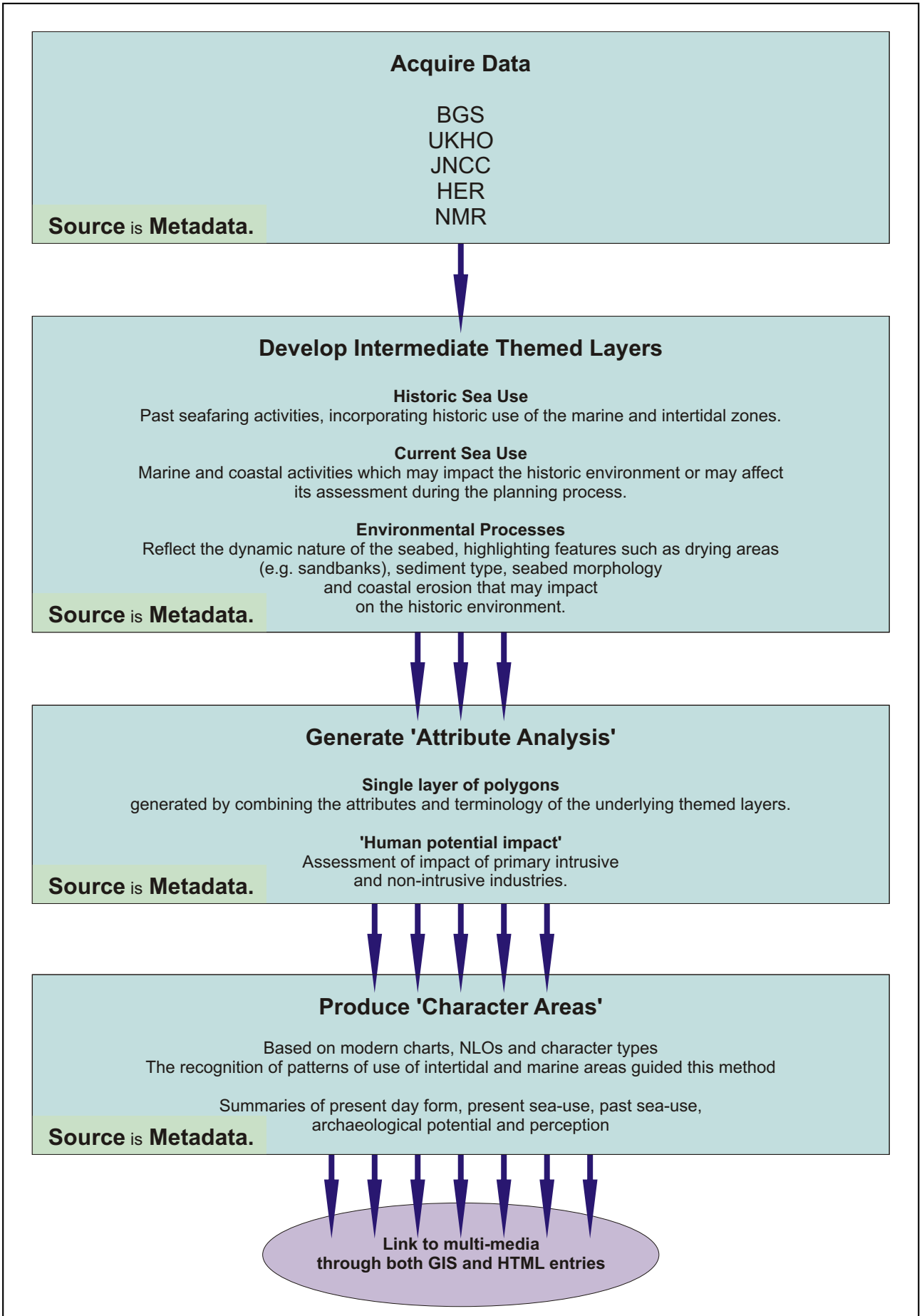
The Attribute Led conceptual model explored for the data structure of the GIS project. Figure 9



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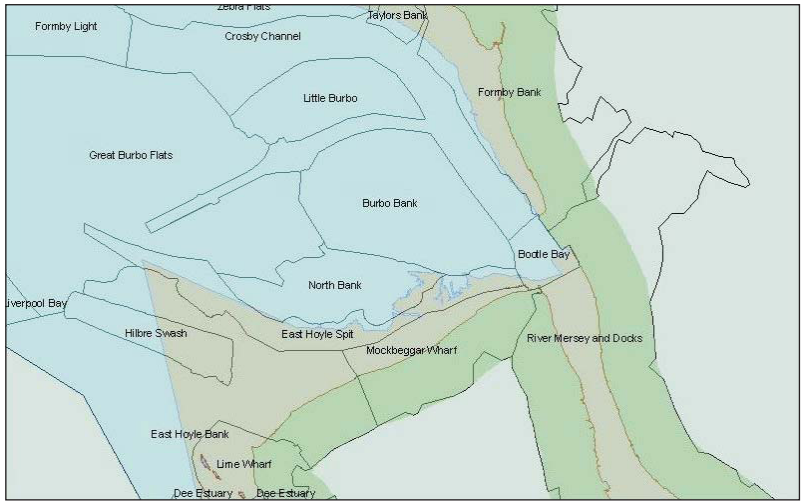
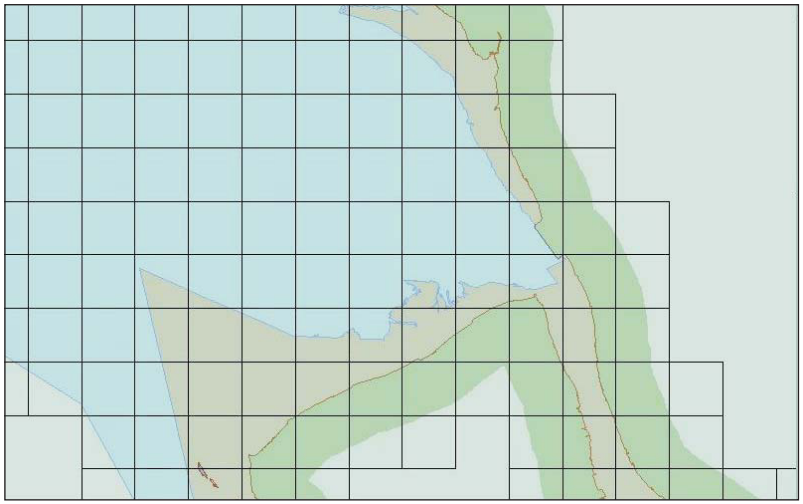
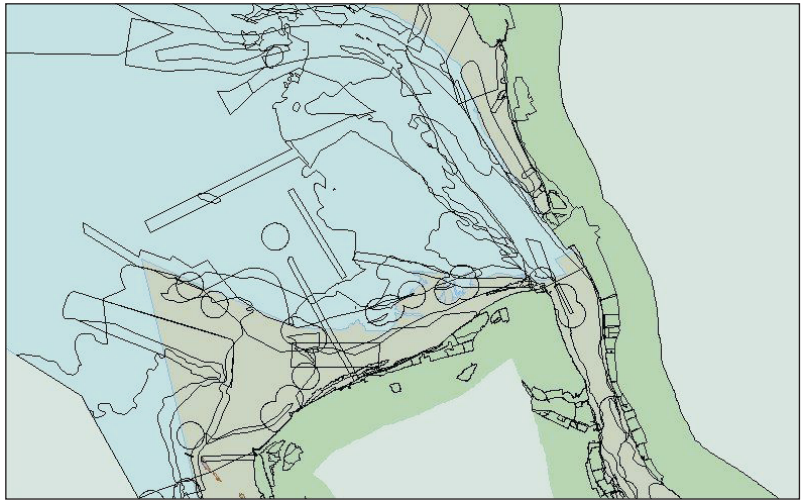
The Multi-Mode conceptual model explored for the data structure of the GIS project. Figure 10



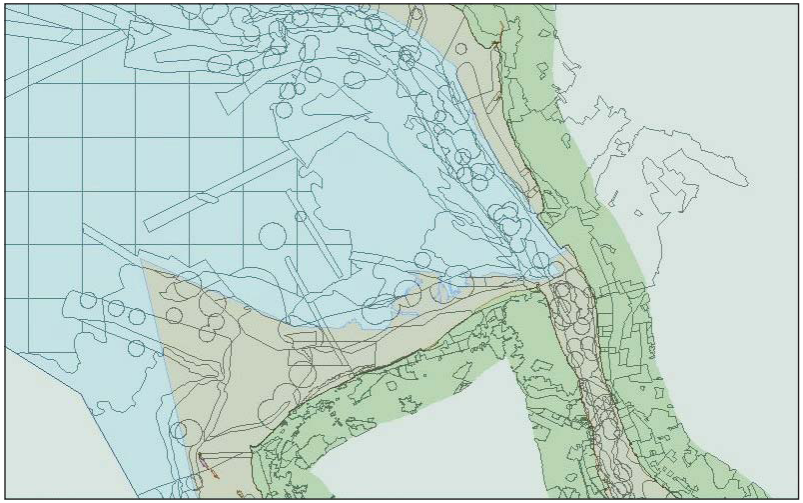
A: Place-names.



B: Gridding.



C: Unions.



D: Combination of gridding and unions utilized in the final characterisation layer.

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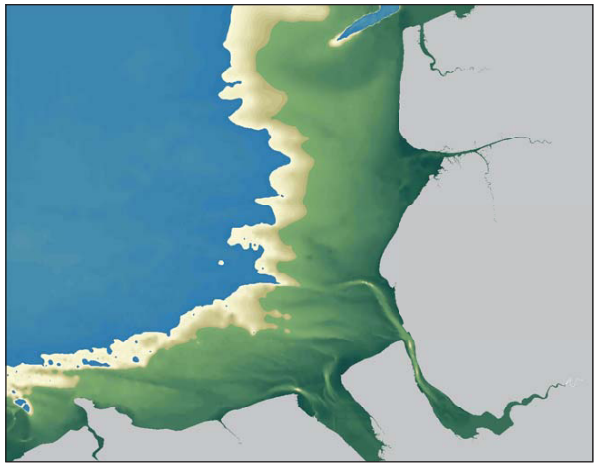
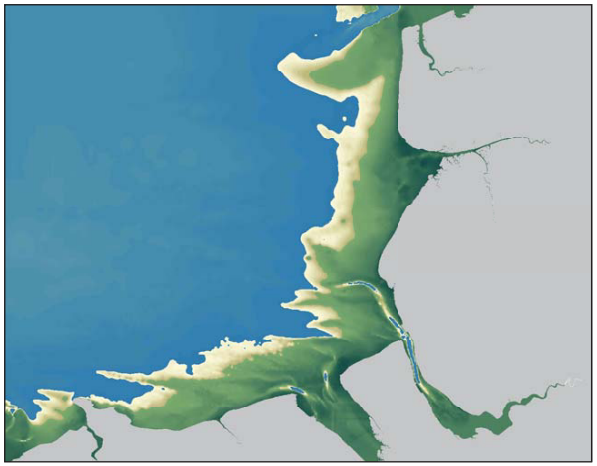
The three methods of dividing the Pilot Area trialed by Seascapes project.

Figure 11

12500BP.



10000BP.



8000BP.

6000BP.

4000BP.

2700BP.

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The sea level change model devised by WA, illustrating the marine transgression across the Pilot Area.

Figure 12

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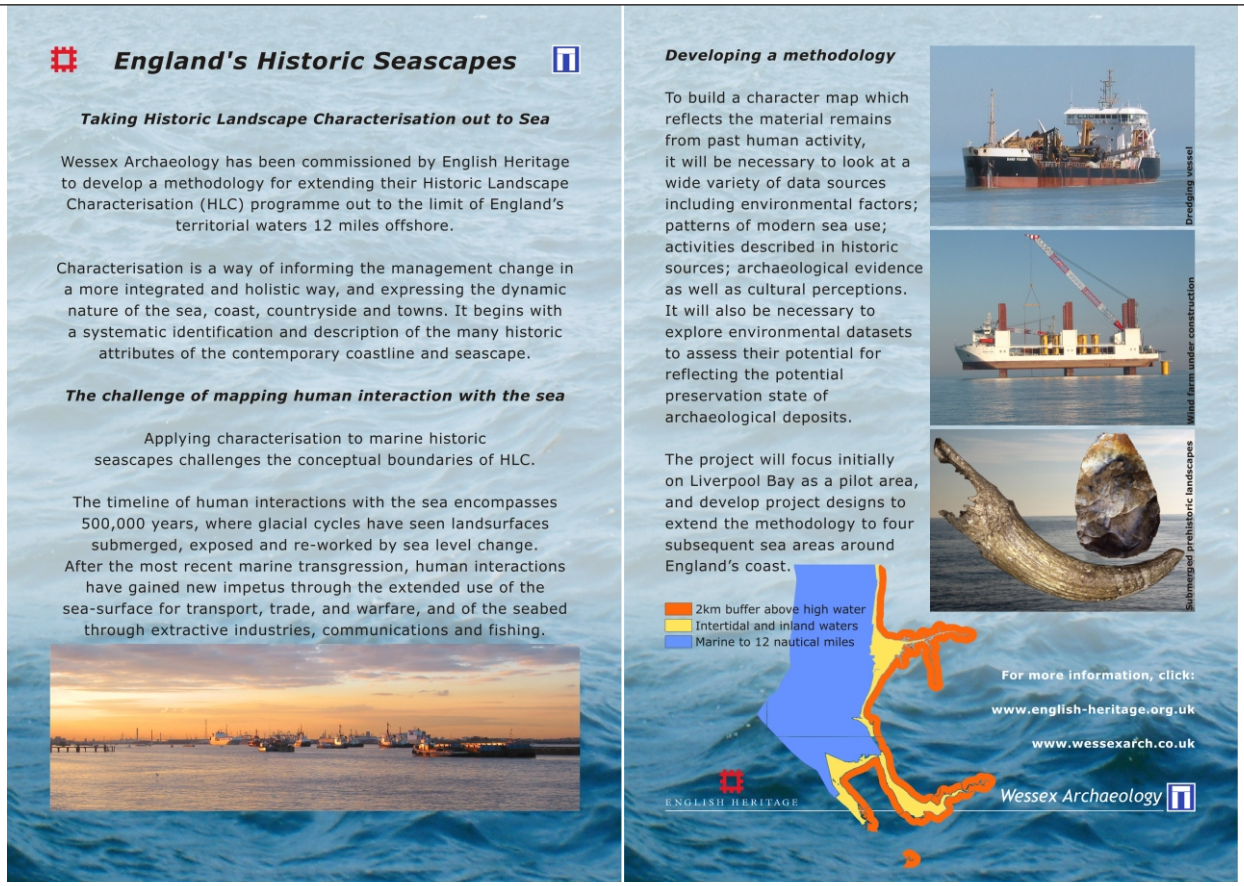
The display produced as part of the project's publicity plan. Figure 13



A: The A5 leaflet produced at the project's inception.

B: The A5 leaflet revised and produced at the project's end.

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The A5 leaflets produced as part of the project's publicity plan. Figure 14

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