Hulk Assemblages: assessing the national context (Part Two)

Final Report

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Executive Summary

This document details the Hulk Assemblages Part Two Project: completing the national context, undertaken by Museum of London Archaeology (MOLA). The project was funded by the National Heritage Protection Commission (formerly the Historic Environment Enabling Programme), administered by English Heritage.

The primary aim of the Hulks Part Two project is to fill geographical data gaps that were encountered in the Hulk Assemblages Project: Part One, and thus complete the audit of known hulk assemblages in England above the line of low water during low spring tides. A hulk is defined as an old vessel deliberately abandoned and subsequently stripped of fittings and permanently moored, whilst an assemblage is two or more such vessels within 100m of each other.

The scope of Hulks Part Two covers south Kent, East and West Sussex, North and North East Lincolnshire, Lincolnshire, North Yorkshire, the Humber region, Cumbria and Merseyside. This stage of the project brings together the results gathered primarily from Historic Environment Records (HERs) and Rapid Coastal Zone Assessments (RCZAs) from within the study area and incorporates these with the results from Hulks Part One. The project did not entail any field survey to discover and record previously unknown hulks, and makes use of existing records only. The sites described in this report and entered into the project database have not been visited to verify their existence, as this was outside of the scope of the project.

The results of the project provide a snapshot of what is known about the hulks resource in England at present. Hulks Part Two identified an additional 10 hulk assemblages. Including earlier results from Hulks Part One, a total of 209 hulk assemblages have been identified in mainland England, ranging in size from two to more than 80 vessels; nine assemblages contained more than 20 vessels. Assemblages are most likely to be found in estuaries, creeks and harbours, however their distribution around England is biased by past recording, especially systematic recording done by local maritime and nautical archaeology societies and university departments.

The study has revealed much variation in how hulks are recorded in HERs, and in how they are described. A 'hulk' as a deliberately abandoned vessel is rarely distinguished from a historic 'wreck' which has been accidentally lost, suggesting that terminology based on the manner of loss of a vessel, rather than its current appearance can be misleading.

Hulk assemblages have been plotted against natural environment designations, to show which are located on land that is currently afforded some kind of protection. Over half of the assemblages recorded are located in Sites of Special Scientific Interest (SSSI), RAMSAR sites and Special Protection Areas.

The Hulks Part Two project included a pilot study comprising an assessment of readily and freely available online satellite imagery provided by the two best known providers of such information, Google Earth and Bing Maps, of the Humber estuary. The aim of the study was to determine if it was possible to confidently identify hulks and hulk assemblages using freely available satellite imagery alone. The Humber estuary was selected as it was the only part of the Hulks Part Two project area that had not been subject to the National Mapping Programme (NMP) aerial survey in its entirety and there were very few hulks recorded in the HER. Six potential hulk assemblages are identified. Five had not been identified by any other source during Hulks Part One or Part Two. One assemblage on Goxhill foreshore was already known of from HER records, but the visual survey identified possible additional vessels as part of the assemblage. The pilot study demonstrated that the use of satellite imagery as a preliminary means of identifying the presence of previously unrecorded hulk assemblages over a large survey area was quick and effective, although only effective for relatively recent craft not deeply buried.

1 Introduction

1.1 Background

1.1.1 This document details the Hulk Assemblages Part Two Project: completing the national context, undertaken by Museum of London Archaeology (MOLA). The project was funded by the National Heritage Protection Commission (formerly the Historic Environment Enabling Programme), administered by English Heritage. The business case for the project and how it contributes to published English Heritage priorities is set out in the Hulks One project (MOLA 2011a).

1.1.2 The overall aim of the Hulks Assemblage project was to create a method for quantifying known hulk assemblages in England, and to create a nationwide database of hulk assemblages, that could be used to identify thematic, geographic and temporal gaps in the known data. A hulk is defined as an old vessel deliberately abandoned and subsequently stripped of fittings and permanently moored, whilst an assemblage is two or more such vessels within 100m of each other.

1.1.3 The project brings together data from multiple sources, including Historic Environment Records (HERs), the National Record of the Historic Environment (NHRE), Rapid Coastal Zone (heritage) Assessments (RCZAs), the National Historic Ships Register (NHSR), and that held by specialist societies and research groups. The project did not entail any field survey to discover and record previously unknown hulks, and makes use of existing records only. The sites described in this report and entered into the project database have not been visited to verify their existence, as this was outside of the scope of the project.

1.1.4 The primary aim of the Hulks Part Two project is to fill data gaps that were encountered in the Hulks Part One project, and thus complete the audit of known hulks in England above the line of low water during low spring tides.

1.1.5 Great Britain is a series of islands, the population of which once had a strong maritime culture and for whom the development and use of boats, barges and ships was crucial. The archaeological study of those vessels is thus of considerable historic significance. Hulks differ from most other historic environment asset types in that their location, visibility and condition are all subject to change. Such vessels can be moved, may be covered by estuarine silts or uncovered by tidal scour or foreshore dredging, mud berth digging and exposed to the elements. Without statutory protection, they can and are broken up or removed. The significance of these vessels lies not just in the individual contribution each vessel can make to technological and structural aspects of nautical archaeology, but in the enhanced value that such a group of vessels can make to economic, social or military studies in a local, regional or national context. Assemblages of hulks in England can contribute to the story of a landscape, demonstrating how landscapes have been used in the past and continue to be used in the present. They have often been deliberately deposited in large numbers to serve a purpose such as to reinforce a river bank.

1.1.6 The results of the project will identify priorities for future work and inform proposals for future management and asset designation. The project will complement Heritage Protection Reform and contribute towards the facilitation of an integrated approach to marine and riverine resources management in partnership with other agencies and interests in line with the Marine and Coastal Access Act 2009 and current European Maritime Policy. The project report will provide recommendations for expansion of the English Heritage Thesaurus of Maritime Craft for vessel types.

1.2 The Hulk Assemblages Part One Project (2011)

1.2.1 The *Hulks Part One* project (MOLA 2011a) recorded 199 hulk assemblages in England above the mean low water line, of between two and 80 vessels. This was based on information from a number of sources:

1.2.2 **HERs:** three quarters of HERs within the project area responded and provided 1680 records. A quarter (26%) of the HERs did not respond for various reasons, primarily resourcing issues or for other unknown reasons, including East Sussex, North East Lincolnshire, North Yorkshire and Merseyside. The data provided by HERs was in various forms and sometimes required considerable processing before inclusion in the GIS project. The numbers of hulks recorded in different HERs varied considerably, with Cumbria, Lincolnshire, North Yorkshire, and Somerset all exhibiting a surprisingly limited number of entries considering their lengthy coastlines (MOLA 2011a, 16).

1.2.3 **RCZAs:** RCZAs are English Heritage funded archaeological resource assessments that comprise two or three phases: a desk-based assessment of the coastline, a rapid field survey, and an assessment of aerial photos. Data from 11 of the 13 RCZAs was included in *Hulks Part One;* the RCZA of Devon and Cornwall and the South East of England (comprising south Kent, East Sussex and West Sussex) was not available because they were in progress at the time of writing.

1.2.4 **The NRHE**: 314 records were created from data held by the NRHE.

1.2.5 **The NHSR**: data on 16 'laid-up' (i.e. permanently moored) vessels was incorporated in the *Hulks One* project.

1.2.6 **Stakeholders:** A large number of organisations were invited to become stakeholders in the project including Maritime societies and organisations, Government organisations, and local interest groups. Stakeholders supplied information about various detailed hulk surveys that have taken place along the English Coastline, such as surveys of hulks from the counties of Hampshire and Devon and along the Thames (MOLA 2011a, 10).

1.2.7 Following collation of the data sources within a project Geographical Information System (GIS), assemblages of hulks were identified and recorded in the project database. 199 hulks assemblages were identified. These were entered into the NRHE database.

1.2.8 The data was queried to determine the geographic distribution, age range, vessel types and size of assemblages. Land ownership and any statutory protection of the land on which the assemblages were located were also assessed. Based on the results of this analysis, various recommendations were made regarding further research into large or interesting assemblages, monitoring of assemblages without statutory protection, changes to the Thesaurus of Maritime Craft Types and data relating to hulks within HERs, NRHE and RCZAs.

1.3 The Hulk Assemblages Part Two Project (present report)

1.3.1 The aim of the Hulks Assemblages Part Two Project, the subject of the present report, was to fill gaps in the data identified by the original project (Hulks Part One), specifically to incorporated data from:

- the HERs of East and West Sussex, the south Kent coast, Humber, North Yorkshire, Lincolnshire, Cumbria and Merseyside
- the recently completed RCZAs of South East of England.

1.3.2 Section 3 of this report provides an update of the resource assessment originally presented in the Hulks Part One report, and presents and analyses the findings of the combined data from of both the *Hulks Part One* and the *Hulks Part Two* project. The report will be downloadable from the Archaeological Data Service.

1.3.3 The Hulks Part Two project also includes an analysis of the usefulness of satellite imagery freely available on the internet for identifying hulks and hulk assemblages and has been documented in Appendix 3.

Aims

1.3.4 The aims of the Hulks Part Two project, as set out in the Project Design (MOLA

2012), are as follows:

- To identify and quantify all hulk assemblages within navigable inland, estuarine and marine waters above the line of low water during mean low water, within East and West Sussex, the south Kent coast, Humber, North Yorkshire, Lincolnshire, Cumbria and Merseyside.
- To plot the location of hulk assemblages within a GIS containing information on the locations, ownership, date range, and sources of information on each assemblage where this information is available.
- To audit NRHE data through creating NRHE records for newly identified hulk assemblages and if necessary amend/update existing records.
- To provide recommendations for the expansion of the English Heritage Thesaurus of Maritime Craft Types and liaise with National Historic Ships UK in relation to the National Historic Fleet Core Collection.
- To structure, inform and stimulate future research programmes and agendas relating to the coastal and marine historic environment in general and hulk assemblages in particular.
- To improve the awareness, understanding and appreciation of hulk assemblages to professional and non-professional users of the coastal and marine environment.

Objectives

1.3.5 The aims of the Hulks Part Two project were achieved through a series of objectives:

- **Objective 1:** To identify all known hulk assemblages within East and West Sussex, the south Kent coast, Humber, North Yorkshire, Lincolnshire, Cumbria and Merseyside from HERs, aerial photographs, South East of England RCZA data (which was not available during the previous *Hulks Part One* project) and data in private ownership (where readily available).
- **Objective 2:** To produce NRHE compatible data of known hulk assemblages in tandem with spatial data included in a project GIS.
- **Objective 3:** To cross reference hulk assemblages identified during this *Hulks Part Two* project against hulk assemblages recorded during the earlier *Hulks Part One* project, in order to avoid duplication.
- **Objective 4:** To identify and map ownership of assets and the ownership of the riverbed where possible.
- **Objective 5:** To identify spatially where hulk assemblages are located in areas with Natural Environment designations.
- **Objective 6:** To audit the NRHE data in order to provide information (where available) on date range, ownership of the asset and riverbed, past investigations, source of data, type of hulk represented, Natural Environment designation and relevant NRHE, HER and National Historic Fleet Core Collection details.
- **Objective 7:** To consult with local, community and special interest stakeholders (including National Historic Ships UK) regarding the origin and development of the project and its final outcomes.
- **Objective 8:** To recommend sites for selective detailed investigation.
- **Objective 9:** To develop and maintain relationships with relevant national and local stakeholders to ensure the project is relevant to current needs and policy.
- **Objective 10:** To recommend expansion to the Thesaurus of Maritime Craft Types as appropriate.

- **Objective 11:** To make general recommendations for the management of hulk assemblages including proposals for further research to fill gaps in available datasets and identify opportunities for local community involvement.
- **Objective 12:** To produce a digital resource for wider dissemination and public consumption through existing online and offline heritage resources (e.g. Heritage Gateway).
- **Objective 13:** To produce an Archive and a Project Report documenting all aspects of the project, and available in digital form.

1.4 Management and Personnel

1.4.1 This project was undertaken by MOLA at Mortimer Wheeler House, 46 Eagle Wharf Road, London N1 7ED.

1.4.2 The English Heritage (EH) Project Assurance Officer was Brian Kerr.

1.4.3 The management team consisted of:

- **Project Executive**: David Bowsher, MOLA Director, Research.
- **Project Manager**: Jon Chandler, MOLA Lead Consultant, Historic Environment Assessment. Jon was responsible for quality assurance, technical editing and review.
- **Project Officer**: Leonie Pett, MOLA Senior Assessments Team Archaeologist. Leonie carried out day to day project work, co-ordinated the input of the experts and produced the report.

1.4.4 Project Experts:

- Dr of nautical archaeology Damian Goodburn, Ancient Woodwork Specialist, Museum of London Archaeology – provided specialist advice and first-hand experience of the practical management of hulk assemblages
- Gustav Milne, Project Director of the Thames Discovery Programme – provided specialist advice and first-hand experience of the survey and investigation of hulk assemblages
- Mark Beattie-Edwards, Programme Director of the Nautical Archaeology Society – provided specialist advice and first hand experience of the practical management of hulk assemblages

1.5 Project area

1.5.1 The project study area comprises every part of England above the line of mean low water. Hulks along the coastline, on areas of inland marsh, and in rivers, estuaries, bays and harbours were included.

1.5.2 The project study area for Hulks Part Two, discussed in the present report, comprises every part of the counties and administrative areas of the following counties above the mean line of low water: East and West Sussex, the south Kent coast, Humber, North Yorkshire, Lincolnshire, Cumbria and Merseyside. Hulks along the coastline, on areas of inland marsh, and in rivers, estuaries, bays and harbours were included.

1.6 Report structure

1.6.1 Section 1 provides a description of the project background, aim, objectives and personnel;

1.6.2 Section 2 sets out the methodology;

1.6.3 Section 3 is the resource assessment, analysing the spatial distribution and densities of assemblages; their size; the types of vessels, including possible additions to the EH Maritime Craft Type Thesaurus; the age range of vessels; and

their location in relation to statutorily protected land.

1.6.4 Section 4 has the conclusions;

1.6.5 Section 5 is the recommendations.

1.6.6 Bibliography (Section 6) and Appendices (Sections 7 to 9).

1.7 Acknowledgements

1.7.1 The project team wishes to acknowledge the help and support of all those who have assisted with the project including Mark Dunkley and Brian Kerr of English Heritage, and the project experts Gustav Milne and Damian Goodburn; also the HERs who replied to the data request and provided valuable data for the study; Wessex archaeology for providing the RCZA South East data; MOLA staff including Pete Rauxloh, Sarah Jones and Louise Davies for their assistance.

2 Methodology

2.1 Introduction

2.1.1 This section outlines the overall project methodology, and the enhancement carried out as part of the present Hulks Part Two project. The project comprised five stages, set out below and contained in the Project Design (MOLA 2012);

Stage 1: Set up, familiarisation and data collection

- Initial project team meeting - project design, English Heritage brief, and current planning and management context discussed. Internal project targets set.
- Data providers identified and contacted.
- Data from local authority HERs and RCZAs obtained in GIS, Excel, Word or PDF format.
- Project webpage on MOLA updated.
- First Steering Group meeting.
- Highlight Report 1 produced.

Stage 2: Data Processing and Assemblage identification

- Data converted from Excel, Word or PDF into ArcGIS format.
- Data plotted in ArcGIS.
- Data audited.
- Hulk assemblages identified – two or more hulks within 100m of each other.
- Location of each hulk assemblage recorded in a spreadsheet, done on a county by county basis.
- Assemblage data sent to English Heritage to be input into AIME.
- Trends identified.
- National designations plotted.

Stage 3: Assessment of data held in Google Earth and Bing maps

- Google Earth and Bing Maps resources evaluated
- Method for Google Earth and Bing Maps survey developed and tested
- Google Earth and Bing Maps survey undertaken for Humber region of project area
- Second Steering Group meeting – preliminary results presented and discussed.
- Highlight Report 2 produced.

Stage 4: Project Report

- Draft report produced.

Stage 5: Editing and dissemination

- Data returned to HERs.
- Results disseminated.
- Project archived and OASIS form submitted.

2.2 Definition of the study area

2.2.1 The study area was classed as any part of the following counties/areas above the line of mean low water; East and West Sussex, the south Kent coast, Humber, North Yorkshire, Lincolnshire, Cumbria and Merseyside. The extent of low water used was the limit of mean low water, otherwise known as the 'Extent of Realm', defined by the Territorial Waters Jurisdiction Act 1878 and the Territorial Waters Order in Council 1964. This had been obtained as a GIS polygon shapefile from Ordnance Survey, via English Heritage during *Hulks One*.

2.2.2 Hulks were plotted as points in ArcGIS, and those located outside the line of low water polygon were selected and deleted from the study. A limitation of this technique is that point grid references may be inaccurate, meaning some legitimate hulks may be excluded from the survey, and others included.

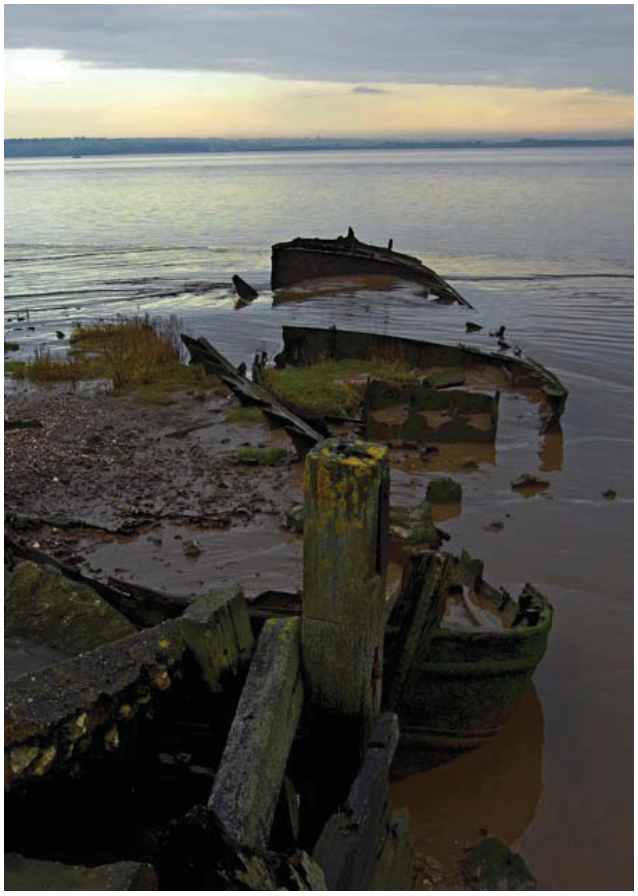


Plate 1: Former barges by the Humber, near to Barton-Upon-Humber, North Lincolnshire (Image Copyright Paul Harrop. This work is licensed under the Creative Commons Attribution-Share Alike 2.0 Generic Licence. To view a copy of this licence, visit http://creativecommons.org/licenses/by-sa/2.0/)

2.3 Terminology

2.3.1 Traditionally, 'hulk' has been used to describe a vessel as an old, unseaworthy boat or ship that had been stripped of its fittings and converted for another use, such as storage, which did not require it to move under its own power. This description is reflected in the definition of 'hulk' in the EH Maritime Craft Type Thesaurus:

HULK

- COAL HULK
- PRISON HULK

- SHEER HULK
- STORAGE HULK
  - GRAIN HULK
  - POWDER HULK

2.3.2 The definition of hulk for the purpose of this project is that described in the Oxford English Dictionary: 'an old ship stripped of fittings and permanently moored'. This is the definition used by current maritime and nautical archaeologists to describe a laid-up or derelict vessel that has usually been deliberately abandoned, and sometimes serves a purpose such as reinforcing a bank or section of shoreline.

2.3.3 The traditional definition of a 'wreck' is a vessel that has been accidentally lost. This suggests that terminology based on the manner of loss of a vessel, rather than its current appearance or its presence on the foreshore can be misleading.

2.3.4 An 'assemblage' for the purposes of this assessment is two or more vessels within 100 metres of each other.

2.4 Data collection

HER data

2.4.1 Of the 10 HERs within the study area, five had undertaken the full search and responded with data during Hulks One. These HERs were therefore only asked for any further data that had been entered since the end of the data collection phase during Hulks One (April 2010). The remaining five HERs were asked to conduct a full search for all Hulks records, which was for various reasons not carried out for Hulks One (see Table 1 below).

2.4.2 Each HER was sent an introductory email explaining the project and requesting data as GIS files. HERs were also issued with a list of key words, which could be used to search their records for data on hulks to ensure all relevant data was captured for isolated hulks and those already forming assemblages. The keywords were derived from the English Heritage Craft Type Thesaurus with additional vessels not currently included, which had been identified by the project experts and those terms identified during Hulks Part One. Key word searching using the craft types not currently included in the thesaurus was also used to search HERs where possible. The keywords were as follows:

hulk	lighter
coal hulk	warship
storage hulk	trawler
grain hulk	smack
wreck	fishing boat
hulk assemblage	swimhead barge
ship	Tyne Trow
barge	Narrow boat
boat	Tyne Keel
vessel	Yorkshire Keel
craft	Humber Keel
steamer	Flat
launch	Launch
dredger	Steamer
yacht	Flyboat
tug	Punt
punt	Dugout
skiff	

2.4.3 Additional terms noted during Hulks Part One

Boat graveyard
Hulked vessel

2.4.4 These additional 7 terms were identified as a result of Hulks Part One and suggested for inclusion in the EH Maritime Craft Thesaurus:

Paddle steamer
Pleasure Craft
Dory
Bomb scow
North Sea Trader
Dinghy
Mine Counter Measures Vessel

2.4.5 'Hulks' are rarely mentioned in HERs, although HERs do contain information on hulks.

2.4.6 Hulks were sometimes mentioned in HERs as the 'hulk of a boat', 'hulk of a wreck', or a 'hulked vessel'. HERs also rarely distinguish between a wreck, that has been accidentally lost at sea, often in antiquity, and a hulk that has been deliberately abandoned and may have been added to the HER from aerial photo evidence. This has meant that some vessels that are strictly 'wrecks', only identified through historic sources, have been included in this project.

2.4.7 Only one HER, Cheshire, used the term 'hulk assemblage', but also used 'boat graveyard'.

2.4.8 All HERs promptly responded and supplied the relevant data with the exception of Merseyside HER, which had closed due to lack of funding. Consequently it was not possible to access this data, although the former HER Officer thought it unlikely that additional Hulk records had been added to the HER since the last data transfer to the NRHE.

2.4.9 Of the HERs that responded, seven provided data and two had no data to send. The responses from HERs are recorded in Table 1 below.

Table 1 HER responses as part of the Hulks Part Two project

Historic Environment Record	**Data request**	**Responded**	**Data available**	**Data format**
Cumbria	Data added since April 2010	Y	Y	GIS shapefile
East Sussex	Full	Y	Y	GIS shapefile
Humber	Full	Y	N	—
Kent	Data added since April 2010	Y	Y	Word doc
Lincolnshire	Data added since April 2010	Y	Y	Word doc
Merseyside	Full	N	—	—
North East Lincolnshire	Full	Y	—	—
North Lincolnshire	Data added since April 2010	Y	Y	PDF
North Yorkshire	Data added since April 2010	Y	Y	GIS shapefile
West Sussex	Full	Y	N	—

2.4.10 MOLA requested the HER data in GIS format, so it could be loaded directly into the project GIS. This was not always possible, and data was received in a variety of formats. Some GIS data was sent as a combination of points and polygons and required extra processing. Data not in GIS format (eg Kent) was converted into Excel spreadsheets from the HER records provided in PDF or Word format. Spreadsheets were given standard minimum headings of:

- Location/name
- National Grid Reference – Easting (6-figures)
- National Grid Reference – Northing (6-figures)
- HER ref.

2.4.11 At this stage HER entries that were obviously not relevant, such as boat houses, jetties, weirs etc, were removed.

2.4.12 The HER entries were then plotted on the GIS as single points, along with the data that had been received as shapefiles.

2.4.13 Table 2 sets out the HER data on hulks returned from both Hulks Part One and Hulks Part Two, after those located below the line of mean low water had been removed, but prior to removal of records associated only with documentary reports of wrecks and prior to processing as part of the present study in order to identify possible hulked assemblages. A total of 29 HERs returned data for inclusion in Hulks One, and seven HERs returned data for inclusion in Hulks Part Two.

2.4.14 During Hulks Part One, 26 HERs did not respond for the request for data. Two of these non-responsive HERs were included in the scope of Hulks Part Two, one of which, Merseyside, remained non responsive due to the closure of that department.

2.4.15 Taking into account the combined data of Hulks Part One and Hulks Part Two, the varied amount of data received from each county did not appear to relate to the length of coastline, but probably other factors such as surveys and HER resourcing. Counties with lengthy coastlines but a notable lack of relevant HER entries were Cumbria, Lincolnshire, North Yorkshire, and Somerset. This may point towards gaps in the data set rather than lack of hulks in these areas. Surveys of vessels may have been done in West and East Sussex and Southern Kent, but the data has not yet found its way to the HERs.

2.4.16 Large densities of vessels were present in Devon, Hampshire and Kent. This is a direct reflection of the number of hulk surveys that have been done by local groups in these areas and subsequently incorporated into the HER.

2.4.17 Lancashire HER also returned a large number of entries for vessels, although as part of the data processing it was apparent that many of these were ‘casualty reports’ of historic wrecks rather than records of hulks observed during survey or aerial photo analysis.

2.4.18 Fig 2 shows the amount of HER data returned from each county, prior to processing and the identification of hulk assemblages.

Data from RCZAs

2.4.19 Over the last 12 years, Rapid Coastal Zone Assessments have been conducted in England regionally. The objective of the assessments is to enhance knowledge of the coastal historic environment in an effort to inform future Shoreline Management Plans (SMPs), to ensure effective mitigation of coastal change through the 21st century. The only area that appears to be outstanding is Cornwall and Devon.

2.4.20 Wessex Archaeology provided the GIS data for the South East RCZA (covering East and West Sussex and south Kent), which was completed after the Hulks Part One project. Data from the RCZA was extracted used the same search terms as the HER. The GIS data was cross-referenced with the known HER data in order to remove duplicates.

2.4.21 The RCZAs only extend 1km inland. As was apparent from the current project, hulks

and hulk assemblages are more likely to be found on rivers and estuaries rather than coastlines. Another limitation is that RCZAs do not appear to be consistent in the terminology used for hulks; often 'hulk' and 'wreck' are used interchangeably. The North West England RCZA describes one hulk assemblage in the River Mersey as a 'cluster of abandoned wrecks'.

Data from NMP

2.4.22 National Mapping Programme (NMP) data for the north side of the west end of the Humber estuary falls within the Hull Valley NMP and the Vale of York NMP (http://www.english-heritage.org.uk). These NMPs were reviewed for hulk assemblages but neither survey included records of hulks.

Table 2: Data Returned for Hulks Part One and Hulks Part Two

HER (shaded entries were included in Hulks Two)	**No. of HER entries returned for Hulks Part One**	**No. of HER entries returned for Hulks Part Two**	**No. of RCZA entries returned for Hulks Part Two**
Cheshire	13	–	–
Cornwall and Scilly	40	–	–
Cumbria	4	None	–
Devon	297	–	–
Dorset	53	–	–
Dudley	1	–	–
Durham	8	–	–
East Sussex	113	111	194
Essex	55	–	–
Exmoor National Park	24	–	–
Gloucestershire	20	–	–
Greater London	26	–	–
Greater Manchester	2	–	–
Hampshire	242	–	–
Humber	–	5	–
Isle of Wight	42	–	–
Kent	292	1	554
Lancashire	149	–	–
Lincolnshire	8	1	–
Norfolk	102	–	–
North Lincolnshire	4	5	–
North East Lincs	–	22	–
North Yorkshire	1	4	–
Northumberland	24	–	–
South Gloucs	3	–	–
Southampton	23	–	–
Suffolk	114	–	–
Tees	1	–	–
Tyne and Wear	14	–	–
West Sussex	None	1	54
Winchester	1	–	–
Worcestershire	4	–	–
Total	**1680**	**147**	

2.5 Identifying hulk assemblages

2.5.1 Once data from all available sources had been converted to GIS files and added to the project GIS as points, it was analysed to locate hulk assemblages.

2.5.2 Each point on the map was buffered with a 50m radius buffer. Areas of the map

were then zoomed to and examined in detail to see where buffers clustered. Where two or more buffers were found to touch, i.e. where points were located 100m or less from each other, this was classed as an assemblage of hulks. The points were cross-referenced and checked for duplicates. Vessels located more than 100m apart were discarded from the study as it was beyond the scope of this study to verify if every single vessel record marked the location of physical remains of a hulk, or were records created from 'casualty reports' of historic wrecks.

2.5.3 In some cases there were multiple hulks each having the same grid reference and were not therefore immediately recognisable as an assemblage. Other records were derived from 'casualty reports' of historic wrecks, often added to the HER from contemporary newspaper articles describing ship wrecks, rather than records of hulks observed during survey or aerial photo analysis. These points were therefore removed from the data.

2.5.4 Some individual HER and NRHE records were found to relate to a group of hulks, rather than a single vessel, but only showed as one point on the map. It was apparent from looking at the GIS attribute data and also the detailed descriptions that these were in fact assemblages (eg described as 'assemblage', 'group', 'pair', 'hulks', 'wrecks', 'barges', 'boats' etc).

2.5.5 Once assemblages were identified, a central point for each assemblage was taken from the GIS as two, six-figure national grid references. These grid references were recorded in a spreadsheet to create a definitive table of assemblages. It was not within the scope of this project to include much detail in the records of individual vessels (child records). Relevant detail was therefore added to the Hulk assemblages record (parent record), including fields such as:

- location of assemblage
- number of vessels in assemblage
- local authority unit
- HER/NRHE reference number
- provisional age of vessels
- Any additional dating/vessel name information
- types of vessels
- material of vessels

2.5.6 The final table of all assemblages identified in Hulks Parts One and Two can be found in Appendix 1.

2.5.7 The assemblage spreadsheet was then used to plot the assemblages onto the GIS map as points to show their distribution (Fig 1b).

2.6 Project database

2.6.1 The results of this Hulks Part Two survey were added to the Microsoft Excel spreadsheet that formed the main project database that had been developed as part of Hulks Part One (MOLA 2011a, 11). Excel is GIS compatible.

2.7 Data audit (resource assessment)

2.7.1 Data collected during Hulks Part Two was incorporated with the results from Hulks Part One to establish if the new data had changed any of the earlier conclusions.

2.7.2 Once assemblages had been plotted in the project GIS the data for both Hulks Part One and Hulks Part Two was audited to find information on:

- Spatial distribution and density of assemblages
- Number of vessels in the assemblages
- Type of vessels in assemblages
- Provisional age range of vessels present

- Where assemblages were located on statutorily protected land/Natural Environment designation

2.7.3 The audit enabled geographic, thematic or temporal gaps in the available hulk assemblage data to be identified, and provided an update on the original Hulks Part One audit.

Ownership of assemblages

2.7.4 One of the project aims stated in the project design was to provide data on the ownership of assemblages. Ownership of assemblages could be interpreted as the ownership of the vessels themselves, or the ownership of the land upon which the vessels are located. The ownership of vessels themselves is extremely difficult to ascertain, especially if they have been abandoned for more than 50 years. Due to confidentiality issues and lack of available data it was not possible during the course of the project to establish this.

2.7.5 The majority of vessels were located on the foreshore/in the intertidal zone. The Crown Estate owns over half of the foreshore around the UK coast, including much of the coast of England, and leases it to third parties such as local authorities and Natural England. Other large foreshore land owners in England are:

- The Duchy of Lancaster: foreshore between the centre point of the River Mersey and Barrow-in-Furness
- The Duchy of Cornwall: much of the coastline, rivers and estuaries in Cornwall and Devon
- Port of London Authority: majority of the River Thames
- The Duke of Beaufort: Severn Estuary
- Smaller sections owned by bodies such as local authorities, port authorities, statutory bodies, and government departments

2.7.6 It was possible to ascertain land ownership for 106 out of the 209 assemblages.

2.7.7 GIS files showing areas of statutorily protected land were downloaded from the Natural England website and plotted in the project GIS. GIS queries were used to establish how many assemblages are located in statutorily protected land, and therefore have some level of protection already (see section 3.7).

2.8 Review and dissemination

Data

2.8.1 As part of Hulks Part One each assemblage record was entered into the NRHE by the Project Officer and each assemblage record created in AMIE was taken from the main assemblage spreadsheet and supplemented with the long records provided by HERs. The Project Officer was trained in creating and modifying AMIE recrods at the National Monuments Record in Swindon.

2.8.2 Some individual vessel records forming part of assemblages were already existent in AMIE. In these cases, the individual vessel records were linked to the newly created assemblage records with a parent-child relationship. No new individual vessel records were added to AMIE; however these may be added at a later date.

2.8.3 An AMIE Event record for the Hulk Assemblages Project was created (UID 1524494), and added as an Associated Event in the background menu of each assemblage record. This was used to tie all the assemblage records together so they could be searched for easily within AMIE.

2.8.4 The term ‘Hulk Assemblage’ was added as an alternative to the already existing NRHE Thesaurus Maritime Monument Type ‘Ship Graveyard’; the description being ‘an area of the sea or coastline where vessels have been abandoned’. This was used as the Monument Type for each assemblage record created.

2.8.5 As much information as possible was added to each AMIE record created. Fields completed were:

- Name
- Location: Parish, District, County
- Grid Reference, converted to latitude and longitude
- Date of loss
- Summary: brief description of the assemblage
- Monument Types: 'Hulk' was always added, along with Maritime Craft Type: 'barge', 'keel', 'flat' etc)
- Evidence, i.e. 'documentary' or 'vessel structure'
- Land use, i.e. 'inter-tidal', 'salt marsh')
- General Descriptive Text, included a description of individual vessels within the assemblage along with their HER reference etc.
- Source (i.e. local authority HER, RCZA etc)

2.8.6 The result of using AMIE directly is that the project database is not directly linked to the project GIS. The GIS is linked to an Excel spreadsheet with basic information about each assemblage. This spreadsheet does not contain any summary or long general descriptive text information, but the spatial information and assemblage numbers in the spreadsheet otherwise match the corresponding AMIE records.

2.8.7 Hulks Part Two resulted in the location of 10 additional Hulk assemblages, the details of which have not yet been added into NRHE. Rather than the Project Officer undergoing training in inputting into AIME, it was agreed during a meeting with EH that it would be more efficient to submit the results to EH along with the report and AMIE officers will input the data directly.

Report

2.8.8 The draft report will be reviewed by Project Experts after review by English Heritage. The agreed final report will be disseminated to English Heritage as Word and PDF documents along with three hard copies. The project report and data will be sent to the Archaeological Data Service (ADS) website.

3 Resource assessment

3.1 Introduction

3.1.1 The resource assessment/data audit presented here is an update of the results presented in the Hulks Part One project report (MOLA 2011a) and supersedes the original analysis.

3.1.2 The Hulks Part One project documented and located 199 hulk assemblages.

3.1.3 The Hulks Part Two project, which aimed to fill in gaps in the data from the Hulks One project, due to missing HER returns and ongoing RCZA surveys, added a further 10 hulk assemblages.

3.1.4 Both of the phases of survey have identified **209 hulk assemblages** in total.

3.2 Geographic distribution of assemblages

3.2.1 Not every county that had records of individual hulks also had hulk assemblages; also one assemblage is recorded in Merseyside, despite no HER entries being returned from this area. This assemblage has been picked up from the North West England RCZA. The distribution of assemblages is shown in Fig 1b.

Table 3 Areas where assemblages were identified in Hulks Part One and Part Two

County	No. of assemblages identified (Hulks One)	No. of assemblages identified (Hulks Part Two)
Cheshire	7	n/a
Cornwall	9	
Devon	10	
Dorset	4	
East Riding of Yorkshire	n/a	1
East Sussex	n/a	1
Essex	15	n/a
Gloucestershire	8	
Greater London	22	
Greater Manchester	1	
Hampshire	14	
Isle of Wight	8	
Kent	60	2
Lancashire	2	n/a
Lincolnshire	3	
Merseyside	1	
Norfolk	10	
Northumberland	2	
North Lincolnshire	n/a	1
North East Lincolnshire	n/a	3
South Gloucestershire	1	n/a
Southampton	2	
Suffolk	17	
Tyne and Wear	3	
West Sussex	n/a	2
Total	**199**	**10**

3.2.2 The county with by far the greatest density of assemblages is Kent. Assemblages were especially prevalent in the Medway and Swale estuaries, reflecting the amount of work that has been done in this area in terms of hulk surveys, RCZA, and aerial

photo surveys, but also the geographical suitability of this area for preserving hulks (ie estuaries and marshes not part of main shipping routes and made up of numerous inlets and smaller channels where abandoned vessels would remain relatively undisturbed and perhaps well preserved in waterlogged estuarine deposits).

3.2.3 Of the 209 assemblages, only four were located on sections of coastline, the rest were located in bays, estuaries, harbours and rivers. This indicates the type of environment in which hulks are most likely to survive.

3.2.4 Very few assemblages were found in inland rivers and canals. The assemblages found the furthest in land are located in Runcorn in Cheshire, in Boothstown in Greater Manchester and in the Norfolk Broads.

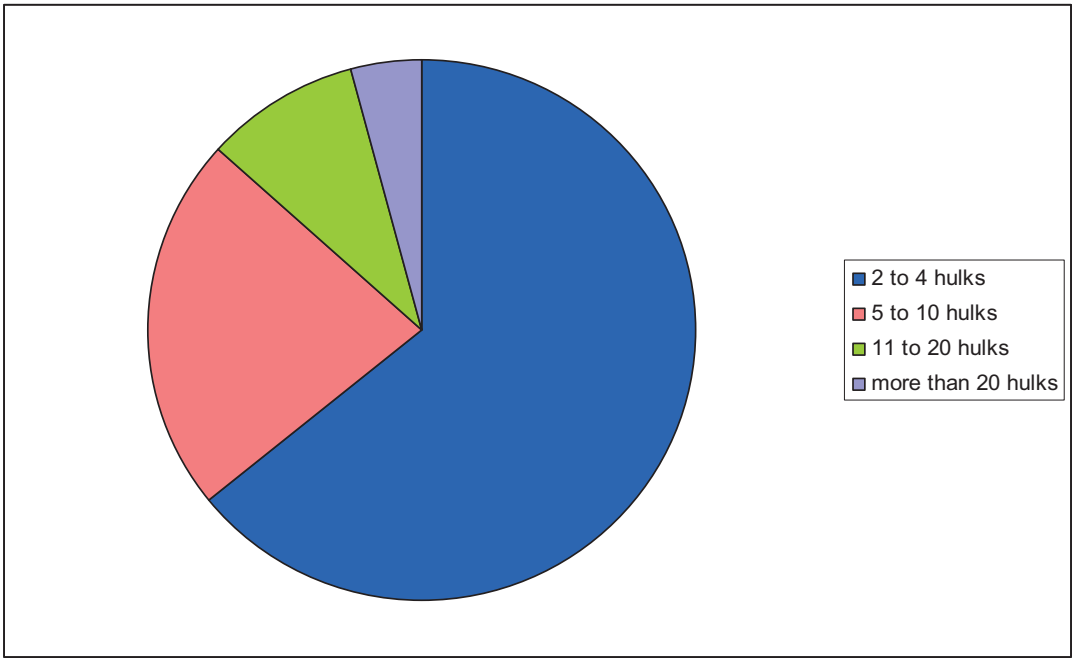
3.2.5 There are very few hulks currently recorded in the Humber Estuary. However, Stage 3 of the Hulks Part Two project (see Appendix 3) identified a potential six assemblages on the Humber Estuary from a pilot visual survey of satellite imagery held in Google Earth and Bing Maps. It is expected that there may be more examples in this area and should be an area targeted for future fieldwork survey.

3.3 Size of assemblages

Summary

3.3.1 The number of vessels within each assemblage varied greatly from two vessels to more than 80. The vast majority of assemblages were small, containing between two and four vessels. The number of vessels in each assemblage is summarised in the chart below, listed in the assemblages table in Appendix 5, and shown on Fig 4.

Chart 1 Number of vessels within each assemblage



3.3.2 Only nine of the 209 assemblages contained more than 20 vessels. The largest assemblage by far was that recorded at Purton in Gloucestershire, with more than 80 hulks recorded.

3.3.3 Other large assemblages discovered were:

- 42 at Big Pool, Runcorn, Cheshire
- 37 at Old Basin and Bridgewater Canal locks, Runcorn, Cheshire
- >30 at Old Port Basin, Chester

- >25 at Barksore Marshes, Kent
- >25 at Sutton Locks, Cheshire
- 24 at Boothstown, Greater Manchester
- 23 at Brentford, Greater London
- 22 at Holes Bay, Poole, Dorset

3.3.4 The most notable assemblages are discussed briefly below.

Purton, Gloucestershire

3.3.5 This assemblage has been well documented, researched and recorded, and is described in detail on the Friends of Purton website (www.friendsofpurton.org.uk). At Purton, boats were deliberately run aground at high tide, from 1909 until the 1970s, to strengthen the canal bank and prevent erosion. The assemblage is diverse containing many different types of vessel, including Schooners, Severn Trows, Lighters, and Barges (wooden and ferro concrete barges). The assemblage includes the remains of one vessel, The *Harriett*, which is the last known example of Kennet built barge within the UK, and is included in the National Historic Ships Register, and is a scheduled monument.

Big Pool, Runcorn, Cheshire

3.3.6 The data for this assemblage comes from the Cheshire HER. The assemblage is listed under one HER number, and is one of the only HER records received from any area to use the term 'hulk assemblage'.

3.3.7 The assemblage comprises around 42 'Mersey Flats' in Big Pool in Runcorn. Mersey Flats are a type of shallow draft barge, used locally on inland and coastal waters. They were built in large numbers from the early 18th century and were used to transport goods. This assemblage of Mersey flats could be seen on a plan of Big Pool dated to 1927, and were still present on aerial photos dating to the 1970s.

3.3.8 Big Pool has now apparently been filled in and the hulks covered over. This assemblage would not therefore be suitable for future study at present.

Old Basin and Bridgewater Canal locks, Runcorn, Cheshire

3.3.9 An assemblage of 37 Mersey Flats listed in Cheshire HER under one record. The Mersey Flats were sunk or abandoned in an old flight of locks and adjacent basins on the Bridgewater canal at Runcorn in the early 1950s. The area has apparently been since filled in and the hulks covered over. This assemblage would not therefore be suitable for future study.

Old Port Basin, Chester

3.3.10 An assemblage of over 30 vessels, most likely Mersey Flats, is listed in the Cheshire HER under one entry. The vessels are known to have been deliberately sunk at the Dee canal basin in Chester in the 1950s. One of these boats, *The Earl*, is documented in the HER as being registered in 1804. Exploratory archaeological trenches were dug in 1996 prior to the redevelopment of the area, to locate and record this boat which was a 72 foot long Mersey Flat.

3.3.11 It is not known whether this area has since been filled in and the hulks covered over. A sketch plan from the Ellesmere Port Boat museum archives apparently shows the locations and names of the vessels abandoned, and would provide valuable information if the site was excavated.

Barksore Marches, Kent

3.3.12 This assemblage of probably more than 25 barges, comprises two records of individual hulks from the Kent HER; and three records, each for multiple hulks, from

the NRHE. One of the NRHE records describes a group of 16–20 barges. All hulks in the assemblage are thought to be concrete barges, dating to the mid-20th century.

3.3.13 The Kent HER gives the most detailed information about these barges, stating that no barges are present in this location on aerial photos dating to 1960, but have appeared by 1967, and are again present in 1990. The two vessels listed in Kent HER were noted during surveys for the North Kent Coast RCZA in 2002.

3.3.14 A brief view of modern online aerial mapping shows ten, apparently identical concrete barges in this location. Due to the barges' location on mud, some may be periodically covered and exposed by the tide. This assemblage would be a good candidate for future detailed survey.

Sutton Locks, Cheshire

3.3.15 This assemblage is listed in Cheshire HER under one record number, and is referred to as a 'boat graveyard'. The assemblage comprises at least 25 vessels that have been abandoned here since the Sutton Locks on the Weaver Navigation were abandoned in 1955.

3.3.16 The assemblage comprises canal narrow boats and Mersey Flats. These include the flat the *Daresbury* built in 1772 for the Weaver Navigation Company and still in use in 1957.

3.3.17 Modern online satellite mapping shows a large number of hulks in this location, some overgrown with grass and others partially submerged in water. This assemblage would be a good candidate for future detailed survey.

Boothstown, Greater Manchester

3.3.18 This assemblage of 24 hulks was discovered when a rectangular basin on the north side of the Leigh branch of the Bridgewater Canal was drained. The hulks were arranged in two layers. The condition of the hulks and safety issues precluded the removal or accurate survey of the vessels at the time, although some features were removed and saved. The assemblage consisted of 14 wide barges, five early box barges, two inspection boats, one narrow boat, one narrow or box barge, and one hulk. The area has since been redeveloped, therefore would not be suitable for future survey.

Brentford, Greater London

3.3.19 An assemblage of 23 hulks, mainly barges of various types, was recorded at Brentford during the Thames Archaeological Survey, conducted in the 1990s. The survival of hulks in this assemblage is not currently known. The hulks are not recorded in the Greater London HER. Some hulks are visible in the mud in this area on modern online aerial photos. This site would merit further detailed survey.

Holes Bay, Poole, Dorset

3.3.20 This assemblage comprises 22 individual records in Dorset HER, each describing one 'hulked vessel', dating from the 1950s. The hulks were recorded from 2009 aerial mapping. This assemblage would merit further detailed survey in the future to ascertain the types of hulks present.

3.4 Types of vessels

3.4.1 Wherever possible vessel types within an assemblage were recorded, and are listed in the table of assemblages in Appendix 1. Vessel type was recorded for some or all of the hulks within 141 of the assemblages.

3.4.2 A broad range of vessel types were encountered during the audit of the hulk assemblages data. Barges were the most common hulk type, with 99 of the 209

assemblages containing them.

3.4.3 The majority of assemblages contained vessels of the same or similar type. One assemblage, located at the western end of Forton Lake, in Hampshire, contained 10 different types of vessels: Motor fishing vessel; WWII minesweeper; barges; pinnaces; ferries; motor gunboats; landing craft; lifeboats; and a WWII bomb scow.

Plate 2: Sunken Barges in the Humber estuary near to Paull, East Riding of Yorkshire (Image Copyright Andy Beecroft. This work is licensed under the Creative Commons Attribution-Share Alike 2.0 Generic Licence. To view a copy of this licence, visit http://creativecommons.org/licenses/by-sa/2.0/)

3.5 Regional variations in vessel types

3.5.1 The data collected for this project allowed regional vessel types to be mapped against their locations. In general, this process showed that apart from undifferentiated 'barges', which are present all over England, hulk types defined regionally were found in areas local to where they had been produced and used. The distribution of hulk types is shown on Fig 5.

3.6 Age range of vessels

3.6.1 An assessment of the age of vessels within assemblages was one of the objectives of the project.

3.6.2 There are two ways of interpreting this, one is the date at which vessels were abandoned, and the other is the age of the actual vessels themselves.

3.6.3 It was rarely possible to get an exact date for the age of vessels. Very few vessels within assemblages were identifiable to such an extent. Some, for example some of those in Forton Lake in Hampshire, had been the subject of detailed research, from which the vessel names had been established. It was therefore possible to know the history of the vessel in terms of when it was built, and any subsequent re-fittings and change of use.

3.6.4 In most cases it was only possible to establish a broad date range based on vessel type, or based on the date at which a vessel was first noted on aerial photos.

3.6.5 It was not possible to date 58 of the assemblages; 74 of the assemblages were classed as 'post medieval', probably late 19th or 20th century; 28 were 'modern', probably 20th century; 28 assemblages could only be dated as pre-dating aerial photos that they had been recorded from; and 18 vessels were dated to the 19th or 20th centuries.

3.6.6 Three assemblages were found to contain hulks that pre-dated the 19th century. These were:

- A late 18th century hulk located at The Saltings in the London Borough of Bexley;
- A Mersey Flat, the *Daresbury*, built in 1772, now located at Sutton Locks in Cheshire; and
- The *Grace Dieu*, King Henry V's flag ship and a Protected Wreck. The ship was launched in 1418 and is now located in the River Hamble in Hampshire.

3.6.7 New hulks are still being 'laid up' (abandoned) in England, but the rate of deposition has drastically reduced in the last 20 years. Hulks are a finite resource. Boats are no longer as commonly used for transportation as they were in the past and are therefore no longer being abandoned in great numbers.

3.7 Assemblages located on statutorily protected land

3.7.1 A total of 149 assemblages are located in protected land, meaning 60 assemblages are not located in any form of protected land. Many assemblages are located in multiple types of protected land, the largest number being eight separate types of designation recorded for two assemblages in Suffolk. Norfolk also has assemblages located on many different types of protected land.

3.7.2 No assemblages in Cheshire, Lincolnshire or Tyne and Wear are recorded on protected land; and only two assemblages in London are located in protected land, both located in Kew Gardens World Heritage Site.

3.7.3 Appendix 2 shows which assemblages are located on protected land. A summary of the results of the analysis is below:

- 139 assemblages in Sites of Specials Scientific Interest (SSSI) (67%)
- 126 assemblages in Special Protection Areas (60%)
- 125 assemblages in RAMSAR sites (60%)
- 62 assemblages in Special Areas of Conservation (30%)
- 35 assemblages in Areas of Outstanding Natural Beauty (AONB) (17%)
- 30 assemblages in Environmentally Sensitive Areas (15%)
- 14 assemblages in Local Nature Reserves (7%)
- 12 assemblages in Heritage Coasts (6%)
- 11 assemblages in National Nature Reserves (5%)
- 7 assemblages in National Parks (4%)
- 2 assemblages in World Heritage Sites (1%)

4 Conclusion

4.1.1 The Hulk Assemblages Project has been undertaken by Museum of London Archaeology. The project was funded by the Historic Environment Enabling Programme, administered by English Heritage. The aim of the project was to create a method for quantifying known hulk assemblages in England, and to create a nationwide database of hulk assemblages, that could be used to identify thematic, geographic and temporal gaps in the known data.

4.1.2 The project did not entail any field survey to discover and record previously unknown hulks. The sites described in this report and entered into the project database have not been visited to verify their existence, as this was outside of the scope of the project.

4.1.3 The resulting data was entered directly into the National Record of the Historic Environment database. A total of 182 new records were created and added during Hulks One, with a further 17 new records identified by the end of this phase of the project. Subsequently after Hulks Part Two, the total number of assemblages recorded in this project has risen to 209. A comprehensive table of assemblages is located in Appendix 5.

4.1.4 The significance of hulks can come from their group value as an assemblage. Assemblages of hulks in England can contribute to the story of a landscape, demonstrating how landscapes have been used in the past and continue to be used in the present. They have often been deliberately deposited in large numbers to serve a purpose such as to reinforce a river bank, or have accumulated in an area of the landscape that has unofficially been designated as a graveyard for boats.

4.1.5 Hulk assemblages might represent three main types:

- A uniform ‘industrial’ assemblage (Mersey Flats or canal barges of the same general form abandoned in a lock or basin where they were last used)
- A mixed local/regional assemblage (e.g. Forton Lake - ferries, lifeboats, fishing boats, WWII landing craft: small, medium and large)
- A bank reinforcement assemblage similar to a mixed local/regional assemblage, but with vessels selected for a particular purpose (often focused on medium to larger vessels)

4.1.6 Clearly, the study of each of these three types would draw different conclusions: the first type relates particularly to a specific industrial complex, throwing light on transportation issues, capacity/loads/cargo-handling as well as the degree of standardisation (or lack of) in vessel design and structure. The latter two have a rather broader reach, and can inform not just national, local and regional studies of vessel types, uses and structure, but also wider comparative social, economic and military studies.

4.1.7 The vast majority of assemblages recorded in this project were small, containing between two and four hulks. Nine assemblages were of considerable size, i.e. contained more than 20 vessels, the largest of which is that located at Purton in Gloucestershire. Several other large assemblages have been highlighted as meriting future survey. Information on vessel provenance and vessel type, as well as detailed locational data, would add to the overall significance of an assemblage of hulks.

4.1.8 A particular density of assemblages is located in north Kent, in the Medway and Swale estuaries. Clusters of assemblages often coincide with areas where local specialist societies are particularly active.

4.1.9 Despite the Hulks Part Two second phase of desktop survey, carried out to address data gaps in Hulks One, geographic gaps in the distribution of assemblages remain in North Yorkshire, Lincolnshire, southern Kent, East Sussex and West Sussex. These areas are known to contain hulk assemblages (D Goodburn 2012, pers. comm., 12 Dec); however data about them has not been entered into the HER or

NHRE. These areas would benefit from further surveys, such as field survey or aerial photo survey. It was thought that RCZA data would fill the gaps in the case of southern Kent, East Sussex and West Sussex, however as these surveys only extended 1km inland many hulks in rivers, wetlands and estuaries may have been missed. The Humber estuary in particular has very few recorded hulks for such a large area of foreshore. This area was chosen to undergo a visual survey using online imagery as part of Hulks Part Two. The results of this survey can be seen in Appendix 3 of this report.

4.1.10 There remain none or very few examples from Dorset, Cumbria and Somerset.

4.1.11 Available information on vessel types has been incorporated into the project, and a variety of regional vessel types noted. The distribution of vessel types around England has shown that hulks are largely abandoned in areas local to where they were used and produced. Assemblage records created in the NHRE had to conform to vessel types already in the English Heritage Maritime Craft Type Thesaurus. Additional terms were suggested as part of Hulks Part One that could be added to the Maritime Craft Thesaurus; however there are no new suggestions as a result of Hulks Part Two.

4.1.12 One hulked vessel in England, the *Harriett*, located within the Purton hulk assemblage, has been classed as being nationally important and is a scheduled monument and is on the National Historic Ships Register; also the *Grace a Dieu*, part of an assemblage in the River Hamble in Hampshire is a Protected Wreck Site. Although hulks have general protection as heritage assets under the UK Marine Policy Statement (HM Government *et al* 2011) as well as the National Planning Policy Framework (DCLG 2012), they currently have no specific protection as unique historic environment assets. Their ownership is dubious and they are often located on land where ownership is not known. They are underrepresented in the register of National Historic Ships.

4.1.13 This project has shown that the deposition of hulks in England has drastically reduced in the last 20 years. Hulk assemblages are constantly at risk from tidal erosion and many hulks can currently be broken up or removed without permission. Hulk assemblages have been plotted against natural environment designations, to show which are located on land that is currently afforded some kind of protection. Over half of the assemblages recorded are located in SSSIs, RAMSAR sites and Special Protection Areas.

4.1.14 The results of the project provide a snapshot of what is known about the hulks resource in most of England's coasts and estuaries at present. This has revealed much variation in how hulks are recorded in HERs, and in how they are described. A 'hulk' as a deliberately abandoned vessel is rarely distinguished from a historic 'wreck' which has been accidentally lost, suggesting that terminology should be based on the manner of loss of a vessel, rather than its current appearance. The key to the future preservation, recording and promotion of hulk assemblages lies with the detailed local knowledge held by local societies and specialist interest groups, which should feed into HERs so these assets can be more easily taken into account in shoreline management plans, coastline re-development, and the preservation of our coastal, estuary and freshwater heritage and promoted to the wider public.

5 Recommendations

5.1.1 A number of recommendations for future work have come out of the project and are listed below.

5.1.2 Assemblages have been identified from secondary sources only. Some of these have been examined on online aerial photos, however many, especially the larger assemblages, would merit site inspection on the ground to verify their existence.

5.1.3 Other than at Purton, large assemblages which would merit further research and survey are:

- Old Port Basin, Chester. The current state of this site is not known. It may have been destroyed by development. A plan of this site is located in Ellesmere Port Boat Museum, which would be useful if there site were ever excavated.
- Barksore Marshes, Kent. An assemblage of apparently at least 25 barges, even though only ten are visible on modern aerial photos. As all the vessels in this assemblage are likely to be the same type of barge, the site would benefit from targeted survey.
- Sutton Locks, Cheshire. An assemblage of at least 25 vessels abandoned in the old locks. These vessels are mainly flats and barges, including reputedly one flat dating to 1772. Many vessels can be seen in this location on modern aerial photos although the much of the area is overgrown with vegetation.
- Brentford, Greater London. This assemblage of 23 hulks was recorded in the Thames Archaeological Survey in 1990s. The site could now be re-visited to check if any have been removed or destroyed in the intervening years.
- Holes Bay, Poole, Dorset. An assemblage of 22 vessels is recorded here, from individual records in the Dorset HER. The hulks were recorded from 2009 aerial mapping. This assemblage would merit further detailed survey to ascertain the types of hulks present.

5.1.4 Once recorded in some form, it is recommended that hulks with no statutory protection should be regularly monitored (i.e. re-surveyed every few years). Vessels deteriorate once exposed, through human or natural agencies, and as they fall apart new structural details can be revealed. Such a monitoring programme is beyond the scope of county archaeological services, but if it is to be done at all, would rely on volunteer effort. Realistically, hulks can only be preserved by record, and the majority of those records will only be made by volunteer/student groups. Standardised terminology, recording forms and monitoring forms therefore need to be developed and adopted if the value of these vessels is to be rescued.

5.1.5 Notable gaps in the distribution of assemblages were found in East and West Sussex, the south Kent coast, North Yorkshire, Lincolnshire, Cumbria and Merseyside, all of which are counties with lengthy coastlines. This appears to point towards gaps in the data set rather than lack of hulks in these areas, indicating these areas should be prioritised for future field or aerial photo surveys. The Humber region was the subject of a pilot sutudy in using online satellite imagery and aerial photographs to visually survey a wide area and identifies possible hulks and six hulks assemblages in an area where only one is recorded in HER records. The results of this study can be found in Appendix 3.

5.1.6 Visual survey using available online imagery (Appendix 3) is a cost-effective and rapid method of locating hulks and could be applied to high potential areas which have curently returned fewer examples of hulks than expected, such as North Yorkshire and Teeside, Cumbria, Somerset and Dorset. This method could identify potential hulks and hulk assemblages that could be enhanced by selective on-site

survey.

5.1.7 Some RCZA data has been added to HERs, and has provided valuable information for this project, for example in the North Kent Coast area. All RCZA data, especially field survey and aerial photo survey data, should be added to HERs. This may fill some gaps in the available HER data.

5.1.8 Many hulks in greater London have been identified from the Thames Archaeological Survey, conducted in the 1990s. However, this data does not appear in the Greater London HER, and so should be added, along with the more up-to-date Thames Discovery Programme survey data.

5.1.9 All the assemblages identified in Hulks Part One have been input into the NRHE, but the 10 results from Hulks Part Two are yet to be added. It was agreed at the final steering meeting that the data for these 10 examples will be submitted to English Heritage who will ensure they are entered into the NRHE.

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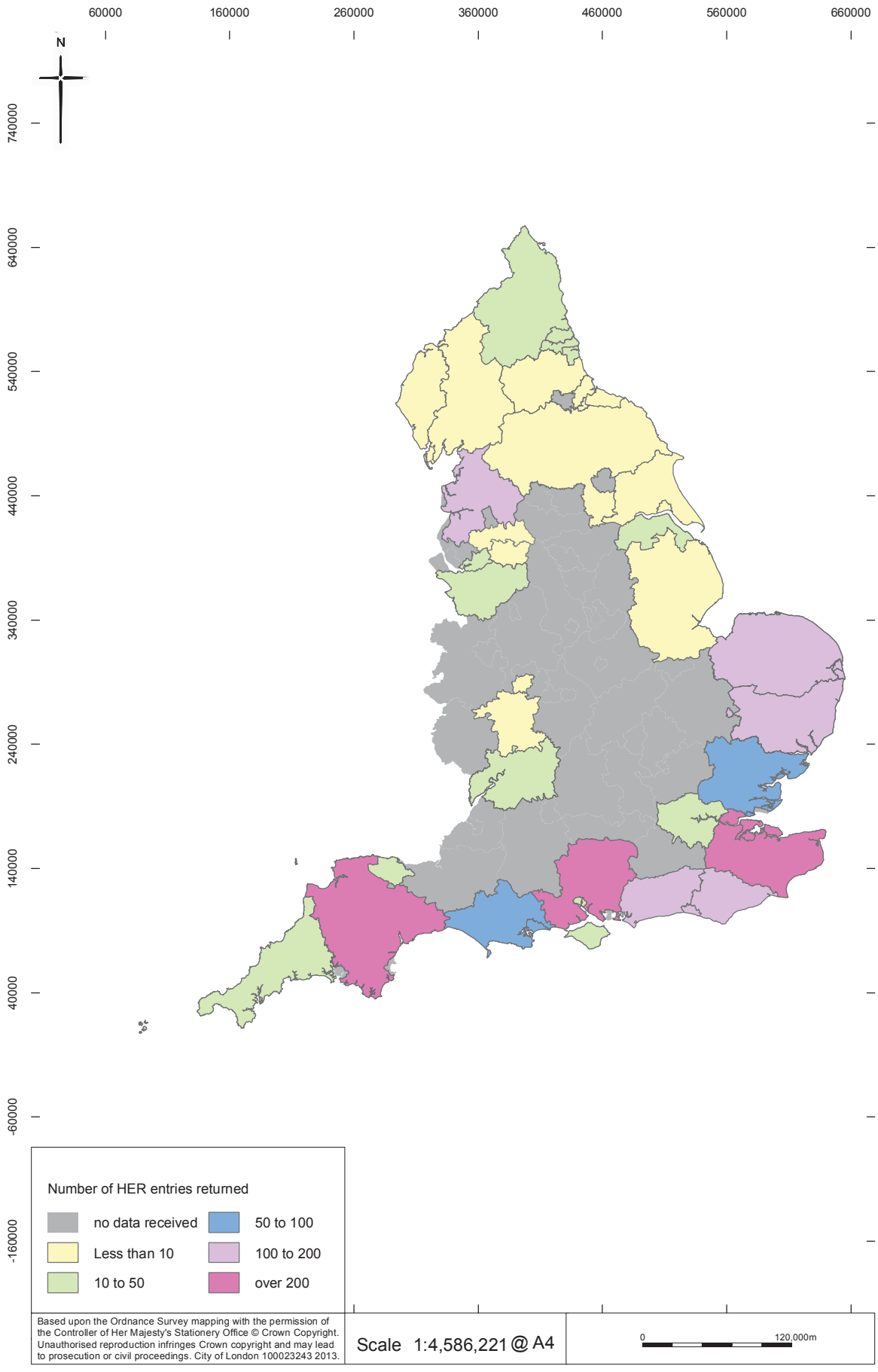
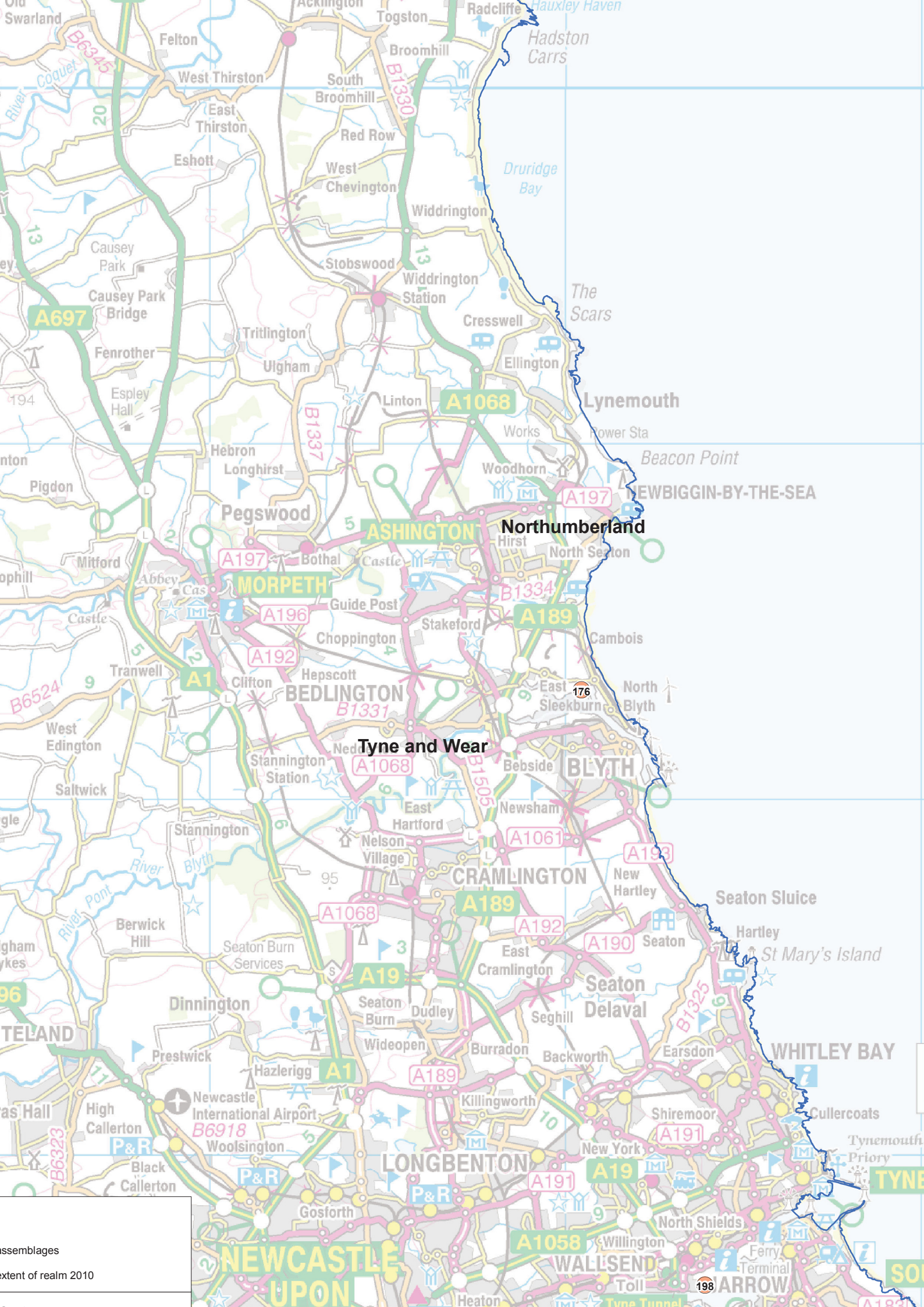
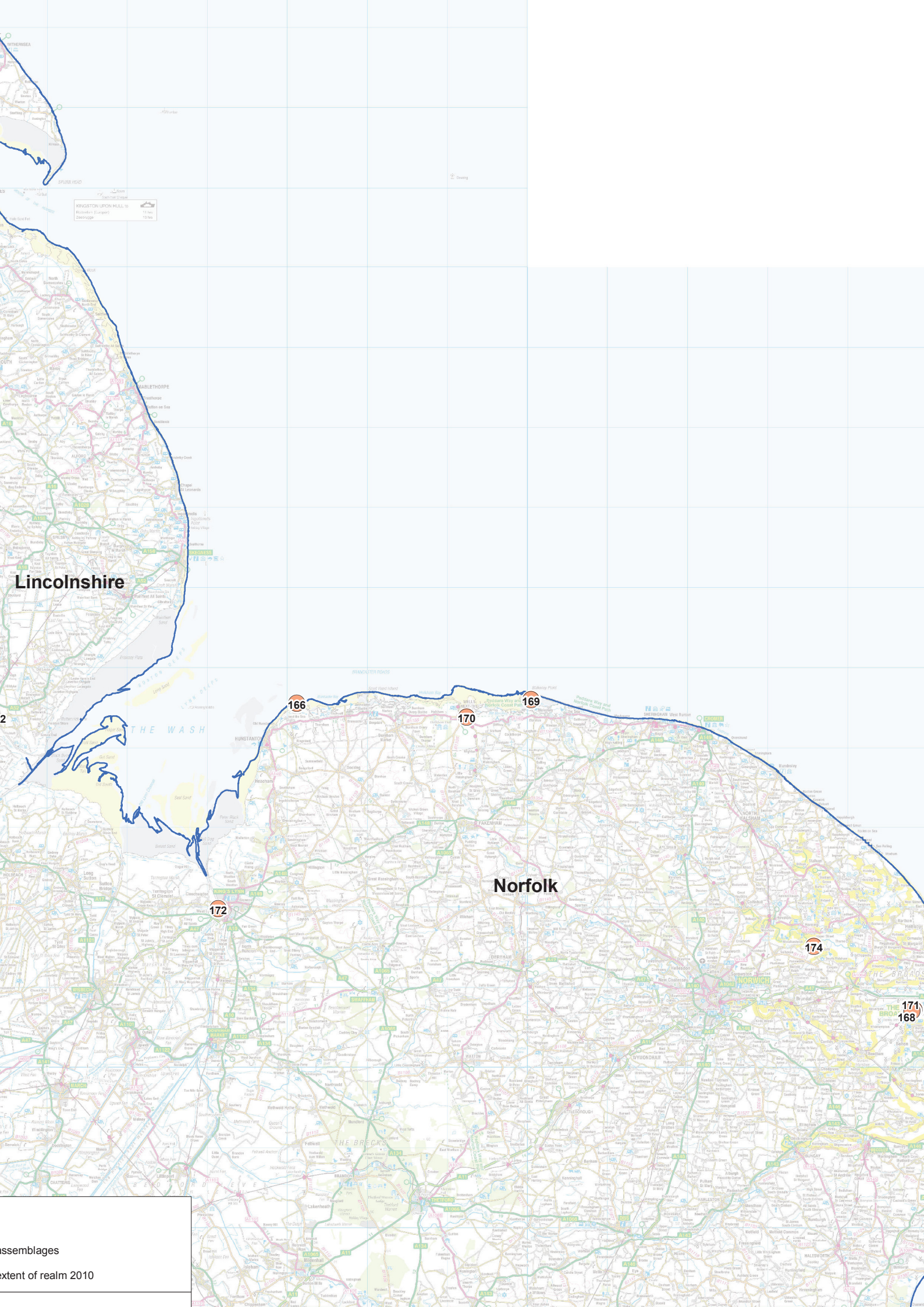


Fig 2 Volume of data received



assemblages

extent of realm 2010



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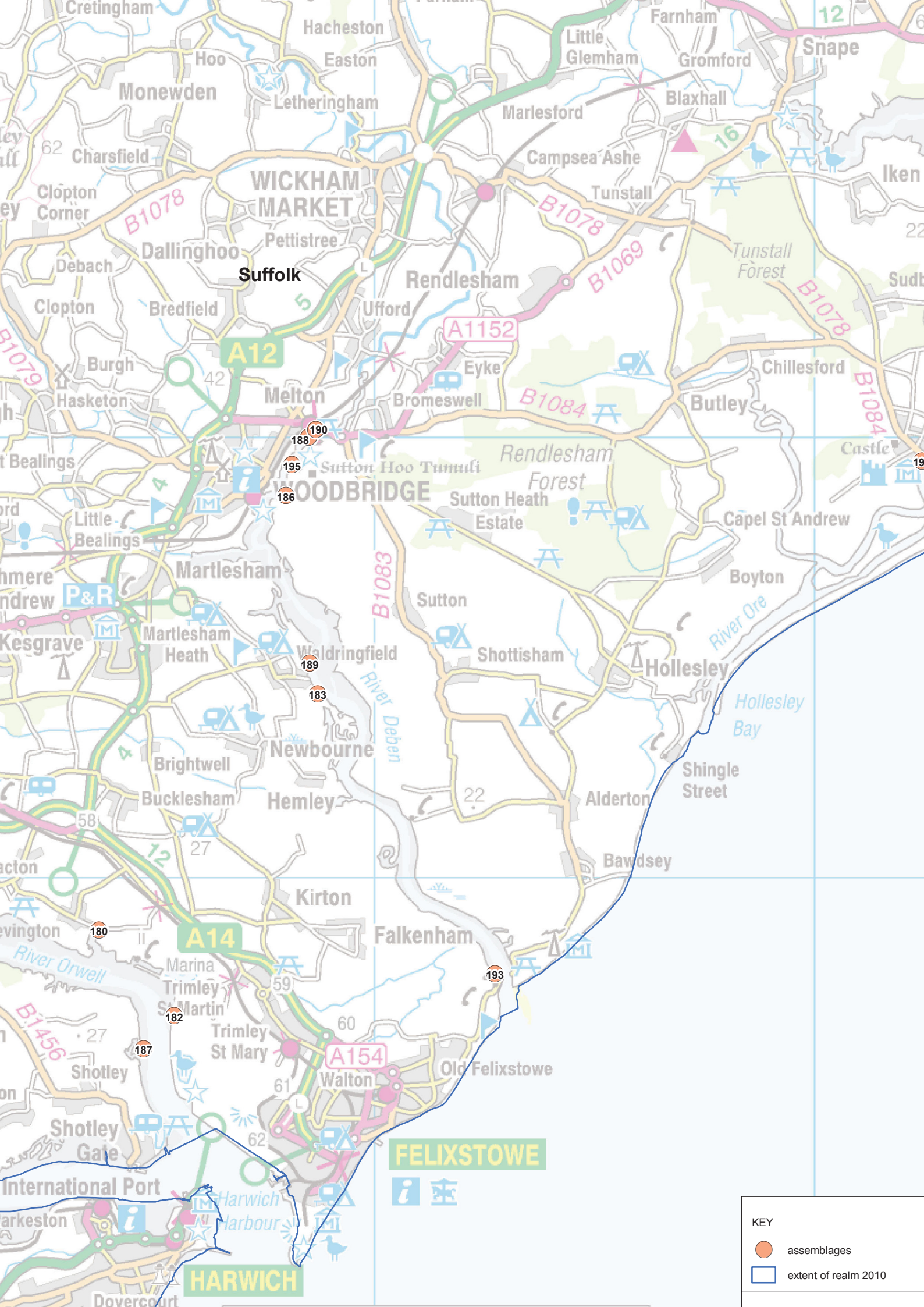
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WOODBRIDGE
FELIXSTOWE
HARWICH
Sutton Hoo Tumuli
Rendlesham Forest
Tunstall Forest
Sutton Heath Estate
Hollesley Bay
Shingle Street
River Deben
River Ore
River Orwell
Harwich Harbour
International Port
A12
A14
A154
A1152
B1078
B1069
B1084
B1083
B1456
P&R
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KEY
assemblages
extent of realm 2010


Essex
Kelvedon
Messing
Smythe's Green
Birch
Birch Green
B1026
Layer de la Haye
Abberton
Langenhoe
B1029
River Colne
Layer Marney
Layer Breton
Shalom Hall
Abberton Reservoir
Inworth
Services
Rivenhall End
Tiptree
Layer Marney Tower
Peldon
Great Wigborough
East Mersea
MERSEA ISLAND
Tumulus
Copt Hall
Tolleshunt Knights
Little Braxted
Tiptree Heath
Great Braxted
Wickham Bishops
Great Totham
Little Totham
Tolleshunt D'Arcy
Salcott-cum-Virley
B1023
WEST MERSEA
Virley Channel
The Nass
Mersea Flats
Tolleshunt Major
Broad Street Green
Langford
Goldhanger
Tollesbury
Heybridge
Heybridge Basin
Osea Island
Northey Island
BLACKWATER RIVER
Bradwell Waterside
Bradwell on Sea
Chapel
St Peter's Flat
Sales Point
Ramsey Island
MALDON
St Lawrence
Steeple
Tillingham
Dengie
Dengie Flat
Mundon
Maylandsea
Cold Norton
Latchingdon
Mayland
Asheldham
Ray Sand
B1018
B1010
B1012
B1021
B1022
Althorne
North Fambridge
Southminster
Ostend
Stoneyhills
Montsale
BURNHAM-ON-CROUCH
South Fambridge
Canewdon
River Crouch
Holliwell Point
Foulness Point
Ridgemarsh
Courtsend
Ashingdon
Paglesham Churchend
River Roach
Churchend
FOULNESS ISLAND
Rochford
Great Stambridge
Paglesham Eastend
Potton Island
Hawkwell
The Old House
London Southend Airport
Barling
Havengore Island
MAPLIN SANDS
Eastwood
Shopland Hall
Great Wakering
Little Wakering
Prittlewell
North Shoebury
Leigh-on-Sea
A13
Southchurch
Thorpe Bay
Shoeburyness
Shoebury Ness
Westcliff-on-Sea
Chapman Sands
SOUTHEND-ON-SEA
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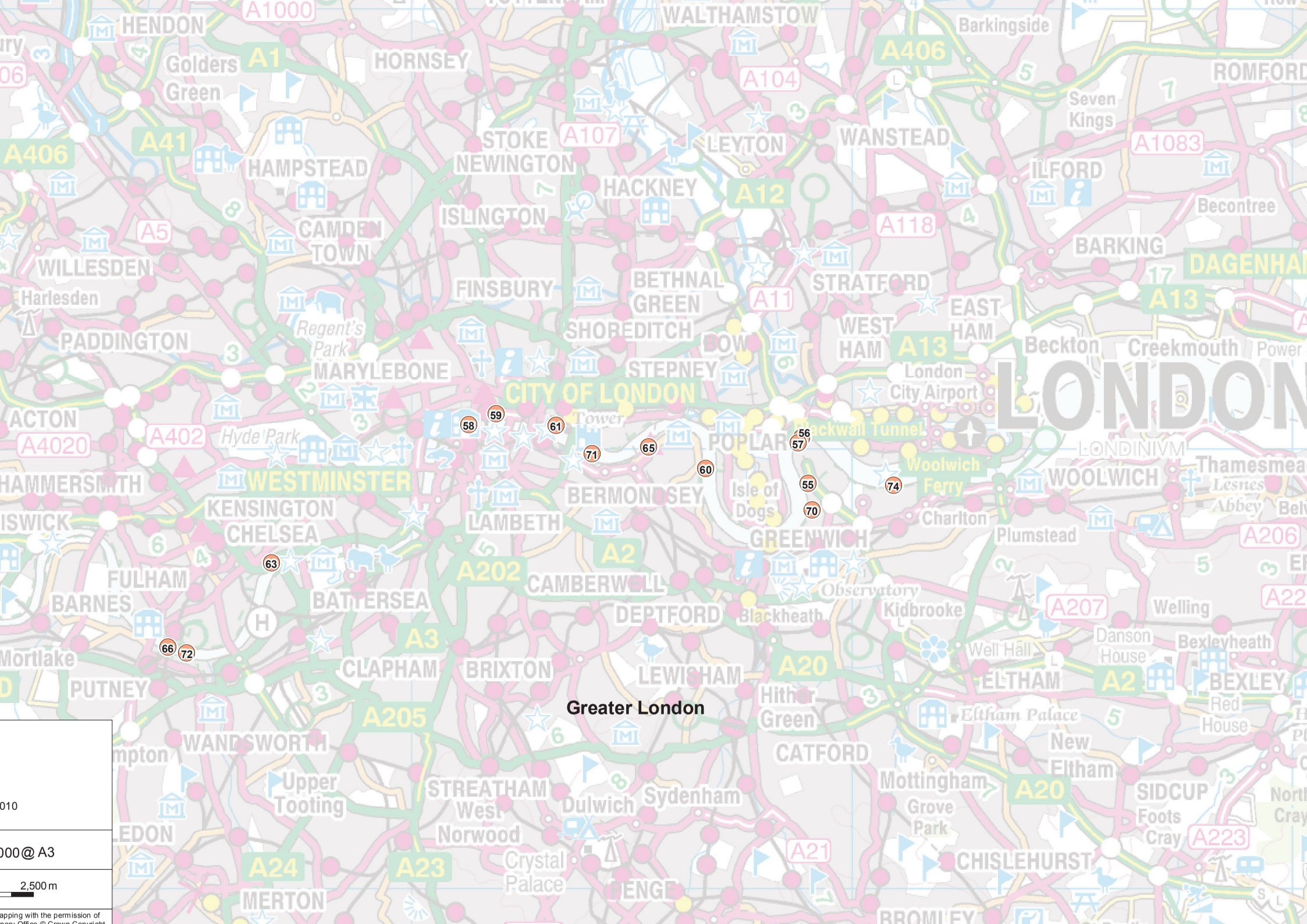
assemblages
extent of realm 2010



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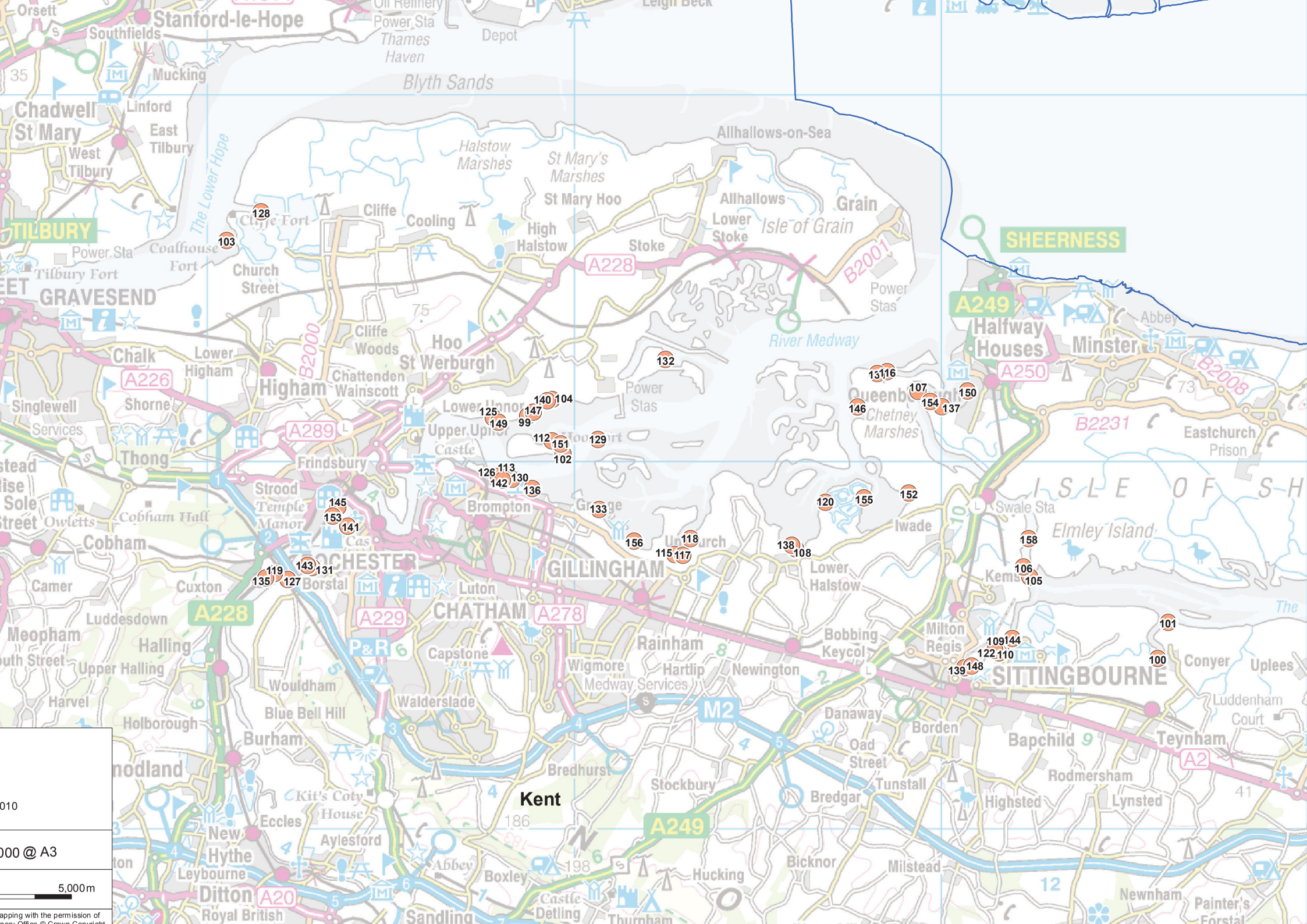

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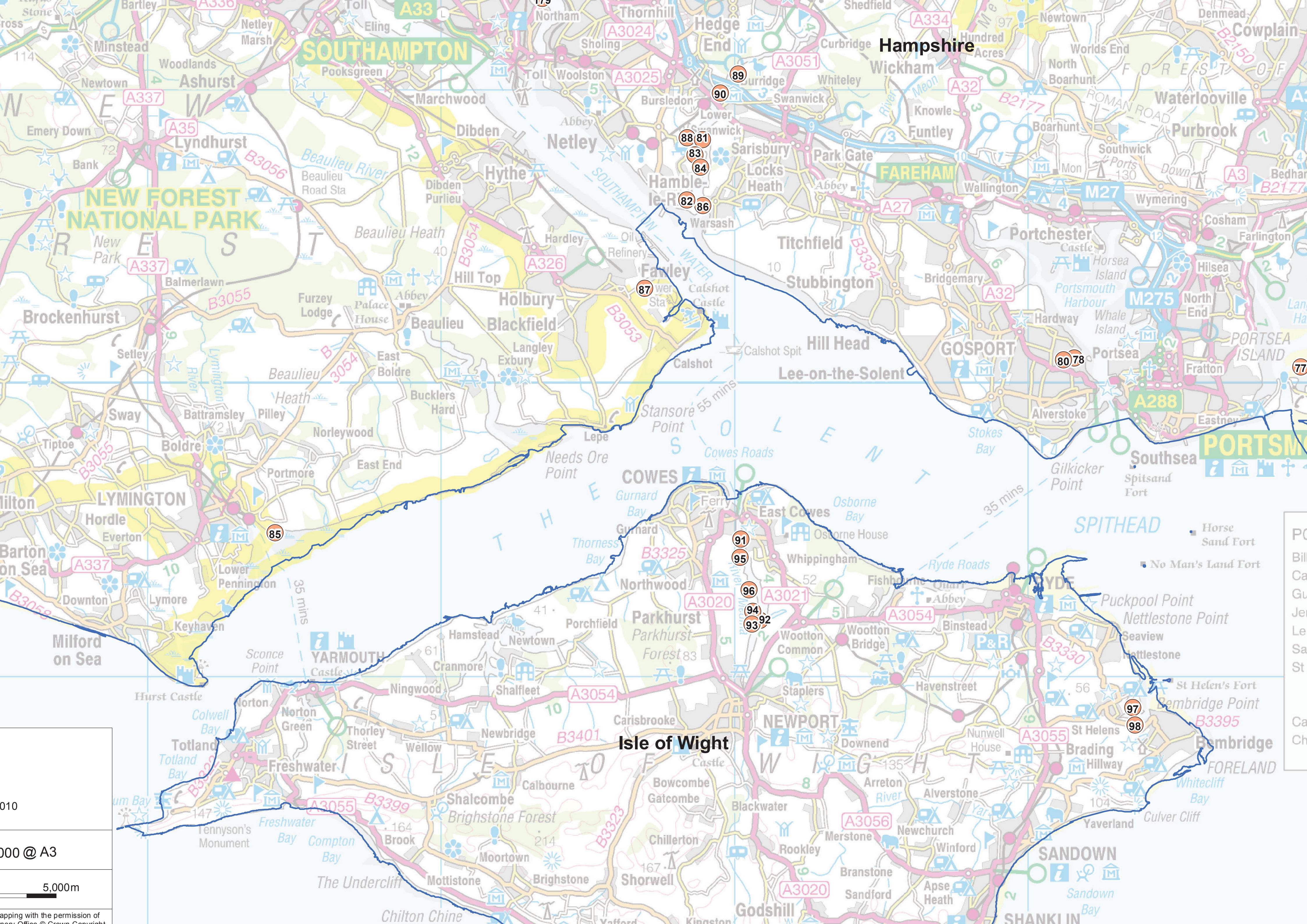
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GOSPORT
PORTSEA ISLAND
PORTSM
COWES
YARMOUTH
NEWPORT
SANDOWN
SHANKLIN
LYMINGTON
THE SOLENT
SPITHEAD
Southampton Water
Minstead
Ashurst
Lyndhurst
Emery Down
Bank
Brockenhurst
Setley
Sway
Tiptoe
Boldre
Battramsley
Pilley
Hordle
Everton
Milford on Sea
Barton on Sea
Downton
Lymore
Keyhaven
Lower Pennington
Portmore
East End
Norleywood
Bucklers Hard
Beaulieu
East Boldre
Furzey Lodge
Palace House
Beaulieu Heath
Beaulieu River
Beaulieu Road Sta
Balmerlawn
Marchwood
Dibden
Dibden Purlieu
Hythe
Hardley
Hill Top
Holbury
Blackfield
Langley
Exbury
Fawley
Calshot
Calshot Castle
Calshot Spit
Lepe
Stansore Point
Needs Ore Point
Netley
Hamble-le-Rice
Warsash
Bursledon
Lower Swanwick
Sarisbury
Locks Heath
Park Gate
Titchfield
Stubbington
Hill Head
Lee-on-the-Solent
Woolston
Sholing
Thornhill
Hedge End
Curbridge
Wickham
Whiteley
Knowle
Funtley
Boarhunt
North Boarhunt
Southwick
Wallington
Portchester
Wymering
Cosham
Farlington
Hilsea
North End
Fratton
Portsea
Eastney
Southsea
Alverstoke
Hardway
Bridgemary
Stokes Bay
Gilkicker Point
Spitsand Fort
Horse Sand Fort
No Man's Land Fort
Waterlooville
Purbrook
Cowplain
Denmead
Newtown
Worlds End
Hundred Acres
Pooksgreen
Eling
Totton
Netley Marsh
Woodlands
Whale Island
Horsea Island
Portsmouth Harbour
Gurnard Bay
Gurnard
Thorness Bay
Northwood
Porchfield
Parkhurst
Parkhurst Forest
Hamstead
Newtown
Cranmore
Shalfleet
Ningwood
Norton
Norton Green
Thorley Street
Wellow
Totland
Totland Bay
Colwell Bay
Freshwater
Freshwater Bay
Tennyson's Monument
Compton Bay
Brook
Mottistone
Brighstone
Brighstone Forest
Shalcombe
Calbourne
Newbridge
Carisbrooke
Bowcombe
Gatcombe
Chillerton
Shorwell
Godshill
Kingston
The Undercliff
Chilton Chine
Hurst Castle
Sconce Point
East Cowes
Osborne Bay
Osborne House
Whippingham
Wootton Bridge
Wootton Common
Fishbourne
Quarr Abbey
Ryde Roads
RYDE
Binstead
Havenstreet
Staplers
Downend
Arreton
Merstone
Blackwater
Rookley
Newchurch
Alverstone
Winford
Branstone
Apse Heath
Sandford
Nunwell House
Brading
Hillway
St Helens
Seaview
Nettlestone
Puckpool Point
Nettlestone Point
St Helen's Fort
Bembridge Point
Bembridge
FORELAND
Whitecliff Bay
Culver Cliff
Yaverland
Sandown Bay
A33
A35
A337
A336
A3024
A3025
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A334
A32
A27
M27
A3
M275
A288
A326
A3020
A3021
A3054
A3055
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Fig 3h Assemblage distribution: Dorset


BRISTOL CHANNEL
Devon
Cornwall
EXMOOR NATIONAL PARK
DARTMOOR NATIONAL PARK
DARTMOOR FOREST
BARNSTAPLE OR BIDEFORD BAY
BUDE BAY
LUNDY
PLYMOUTH
SWANSEA ABERTAWE
PORTHCAWL
20
24
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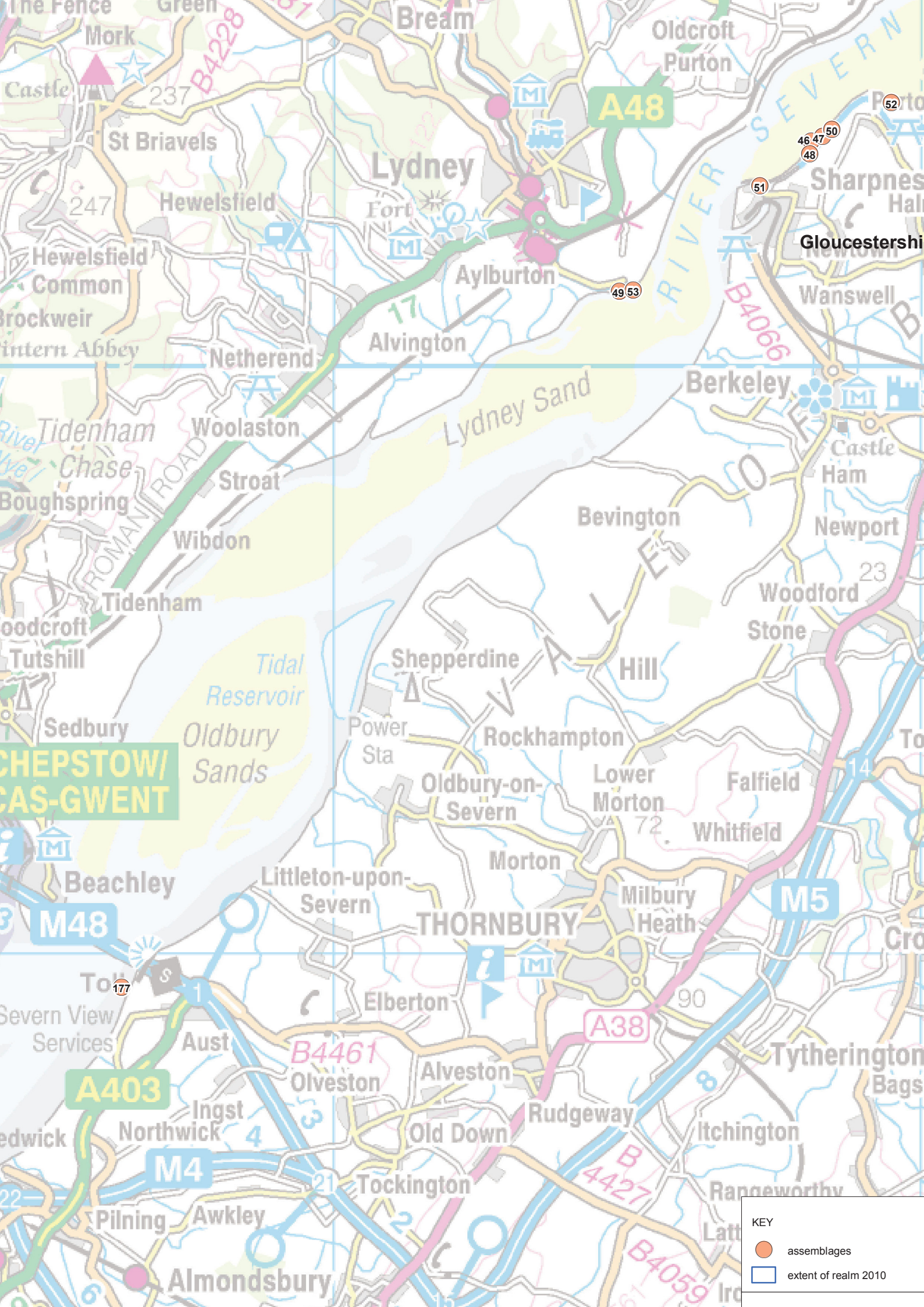
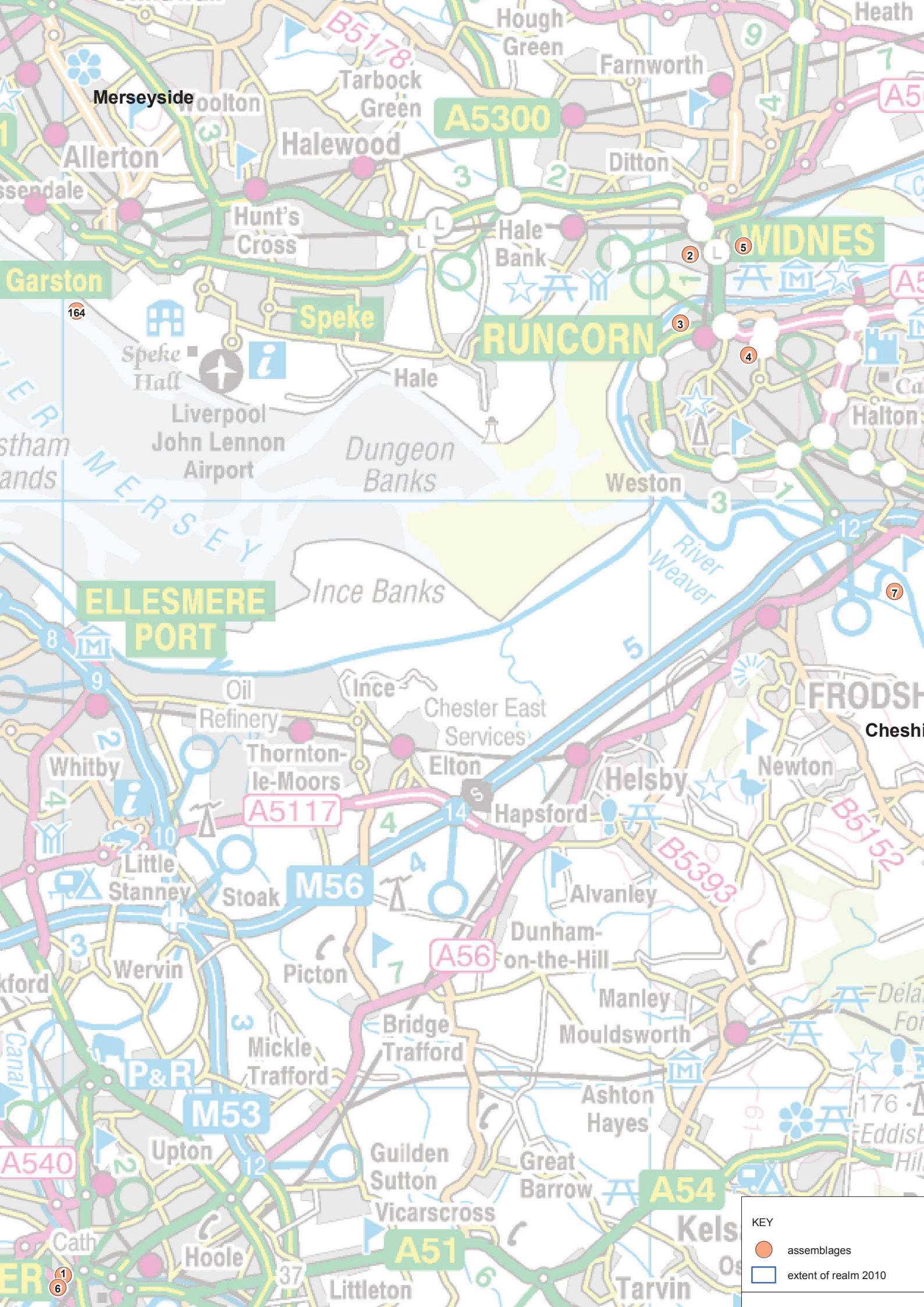
KEY
assemblages
extent of realm 2010


Mork
Bream
Oldcroft
Purton
A48
St Briavels
Lydney
Hewelsfield
Fort
Aylburton
Hewelsfield Common
Brockweir
Alvington
Netherend
Tidenham Chase
Woolaston
Lydney Sand
Berkeley
Castle
Ham
Stroat
Boughspring
Wibdon
Bevington
Newport
Tidenham
Woodford
Stone
Tutshill
Shepperdine
Hill
Tidal Reservoir
Oldbury Sands
Sedbury
Power Sta
Rockhampton
Oldbury-on-Severn
Lower Morton
Falfield
Whitfield
CHEPSTOW/ CAS-GWENT
Beachley
Morton
Littleton-upon-Severn
Milbury Heath
M5
M48
THORNBURY
Elberton
Severn View Services
Aust
A38
B4461
Alveston
Olveston
Tytherington
A403
Ingst
Northwick
Rudgeway
Old Down
Itchington
M4
Tockington
Pilning
Awkley
Almondsbury
B4427
B4059
RIVER SEVERN
VALE OF
ROMAN ROAD
B4066
Wanswell
Gloucestershi
KEY
assemblages
extent of realm 2010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Hough Green
Farnworth
Heath
Tarbock Green
Woolton
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Allerton
Halewood
Ditton
Hunt's Cross
Hale Bank
WIDNES
Garston
Speke
RUNCORN
Speke Hall
Hale
Liverpool John Lennon Airport
Dungeon Banks
Halton
Weston
River Weaver
Ince Banks
ELLESMERE PORT
Oil Refinery
Ince
Chester East Services
Whitby
Thornton-le-Moors
Elton
Helsby
Newton
A5117
Hapsford
B5152
B5393
Little Stanney
Stoak
M56
Alvanley
Dunham-on-the-Hill
A56
Wervin
Picton
Manley
Mouldsworth
Bridge Trafford
Mickle Trafford
P&R
M53
Ashton Hayes
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KEY
assemblages
extent of realm 2010

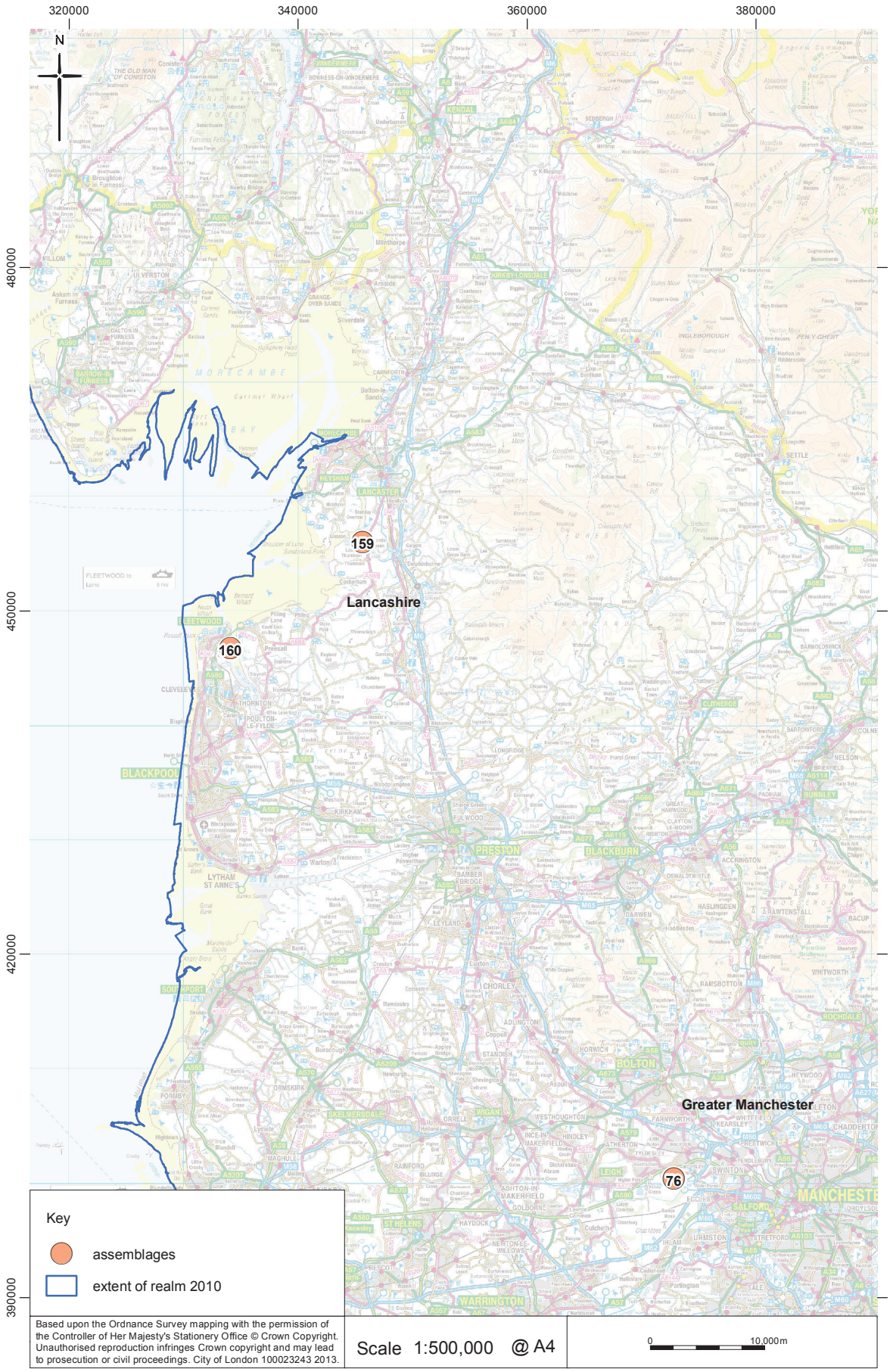
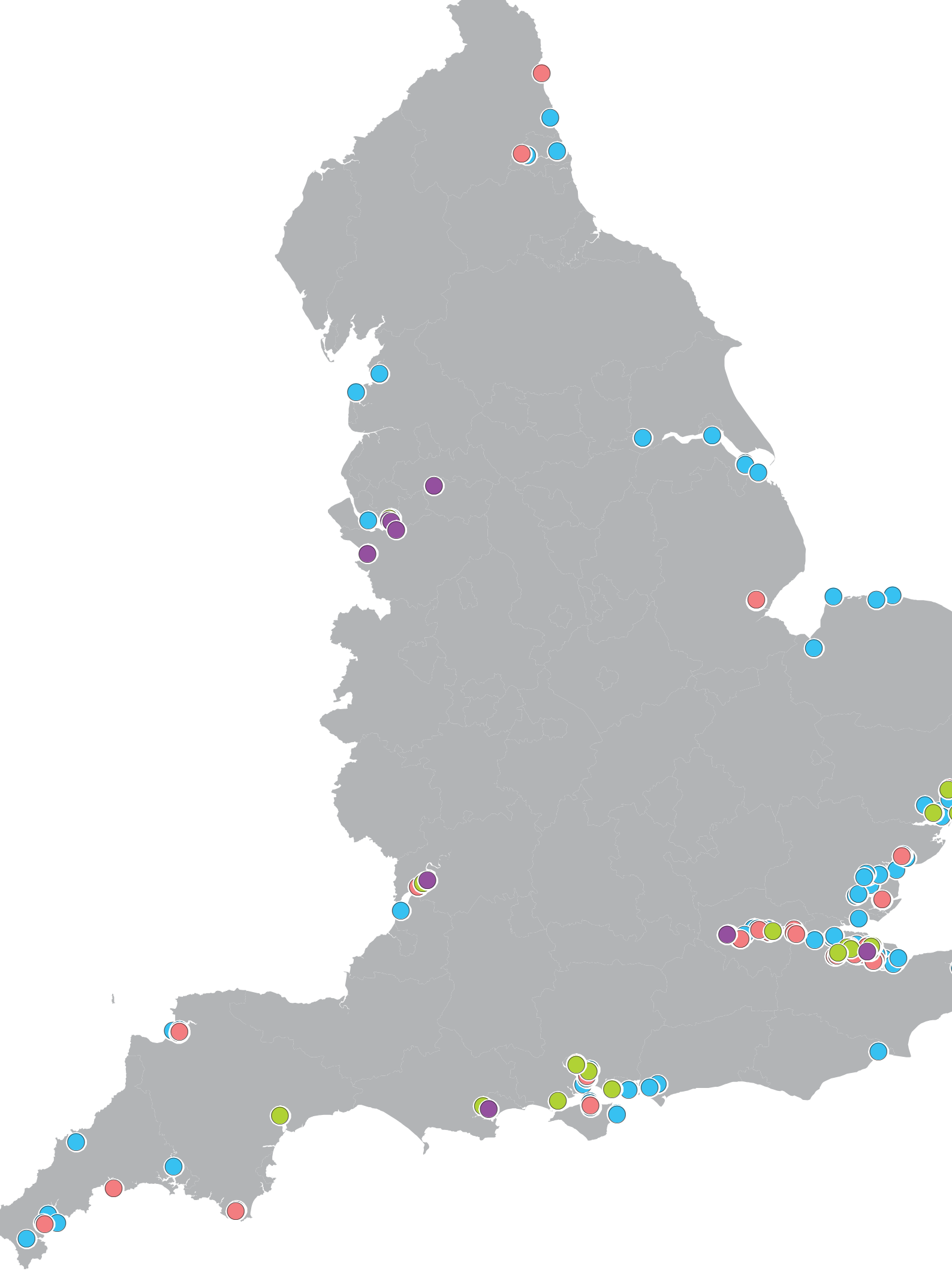


Fig 3l Assemblage distribution: Lancashire and Greater Manchester



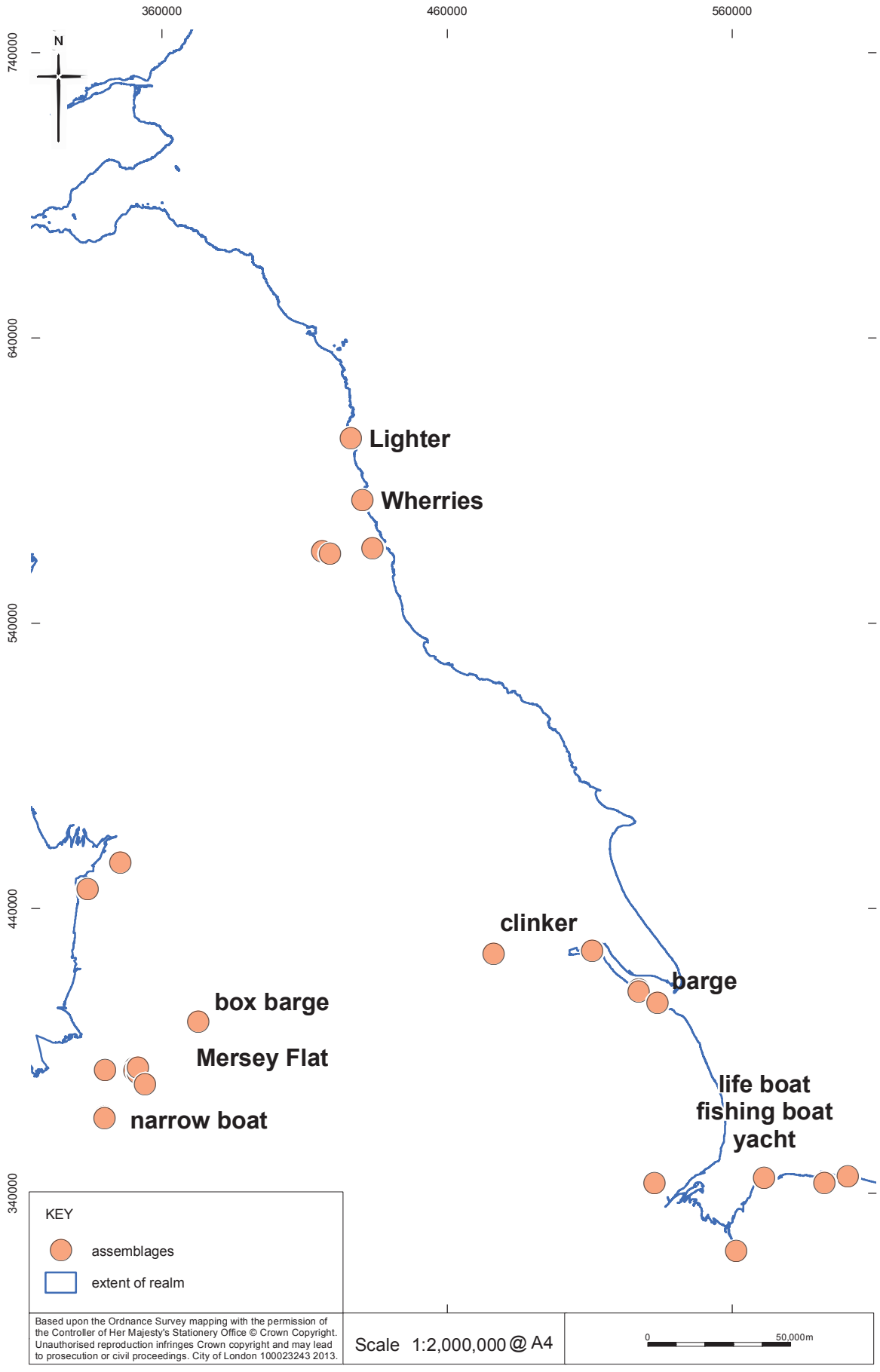


Fig 5a Vessel types

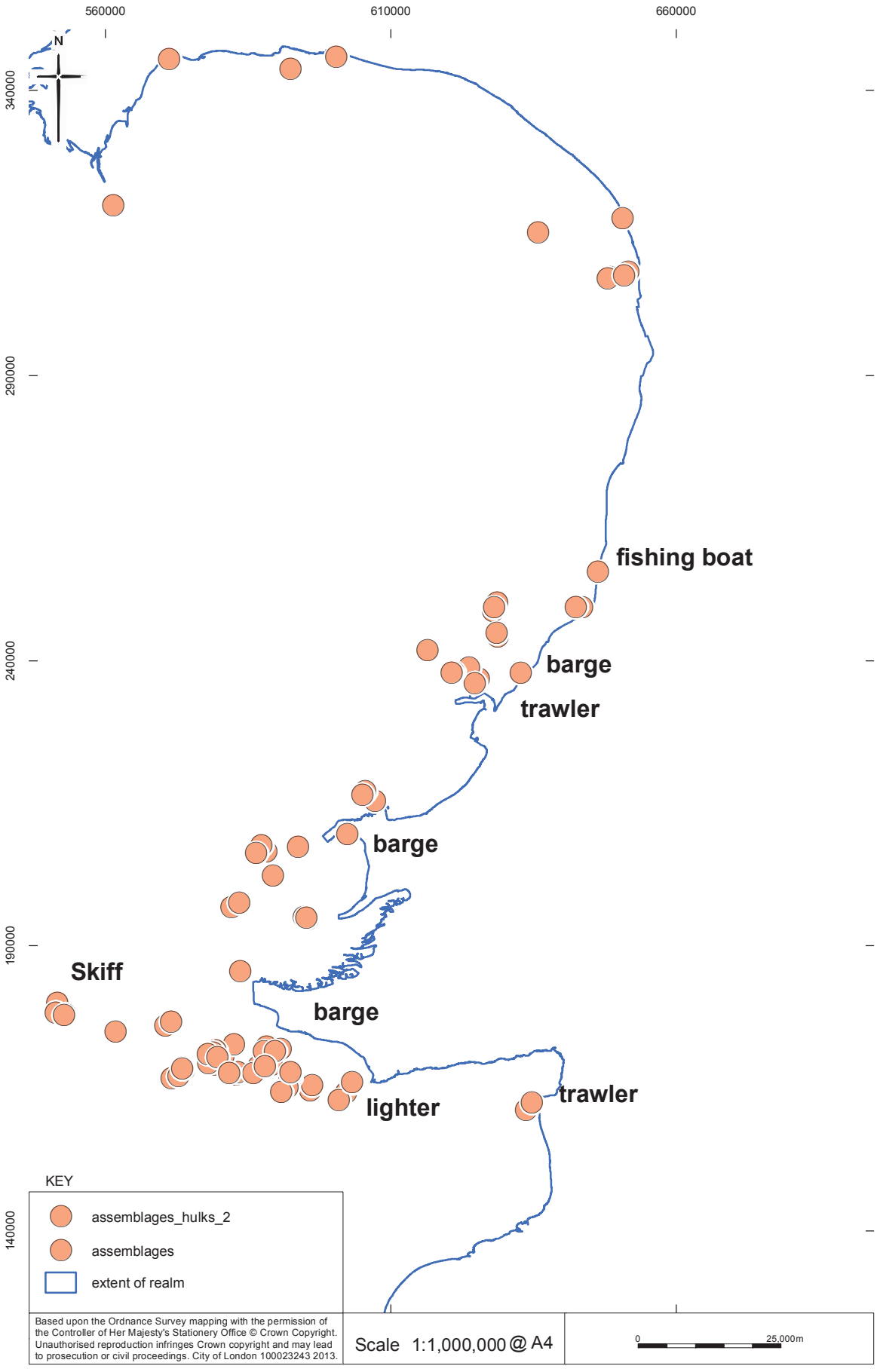


Fig 5b Vessel types

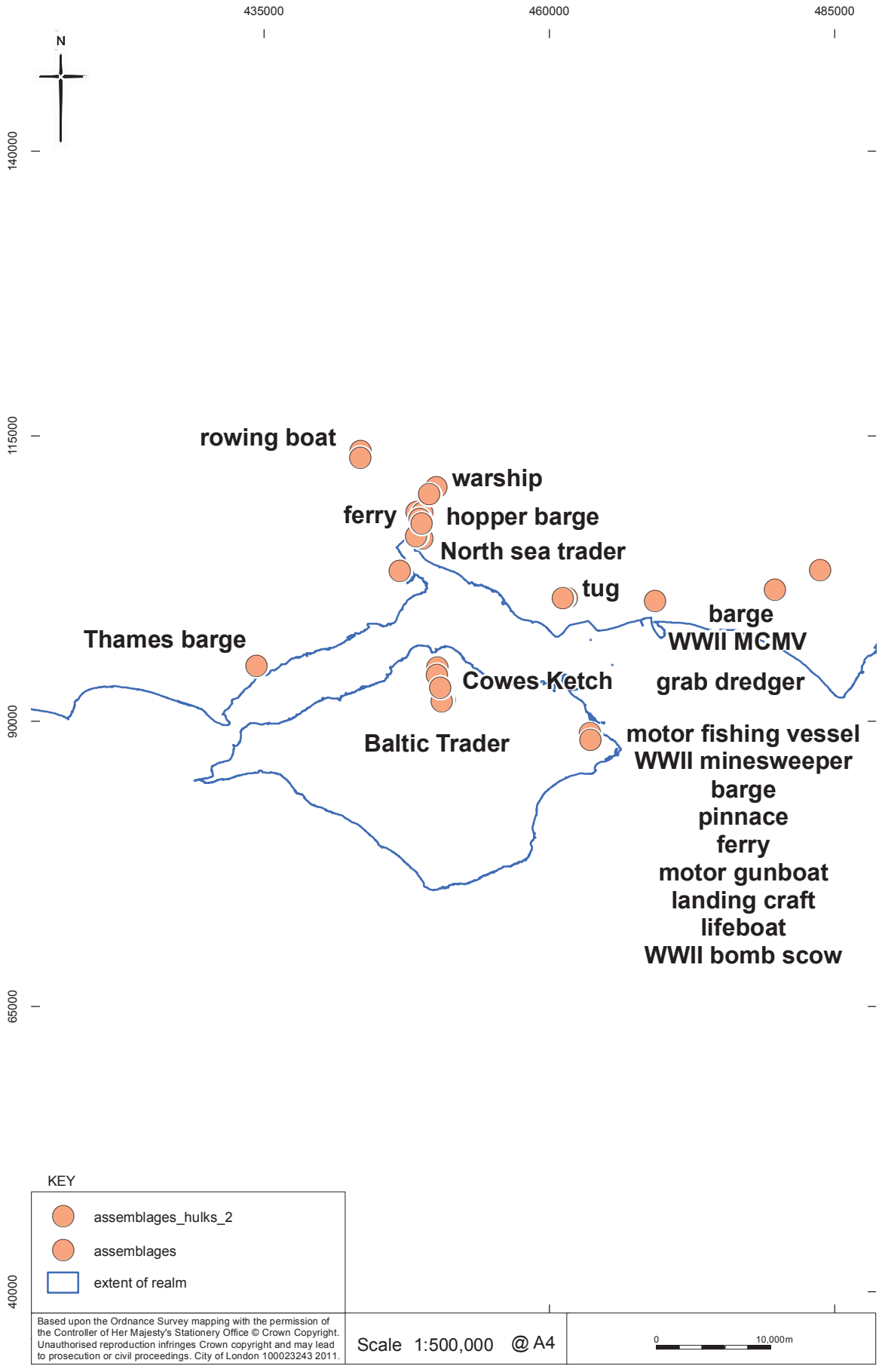


Fig 5c Vessel types

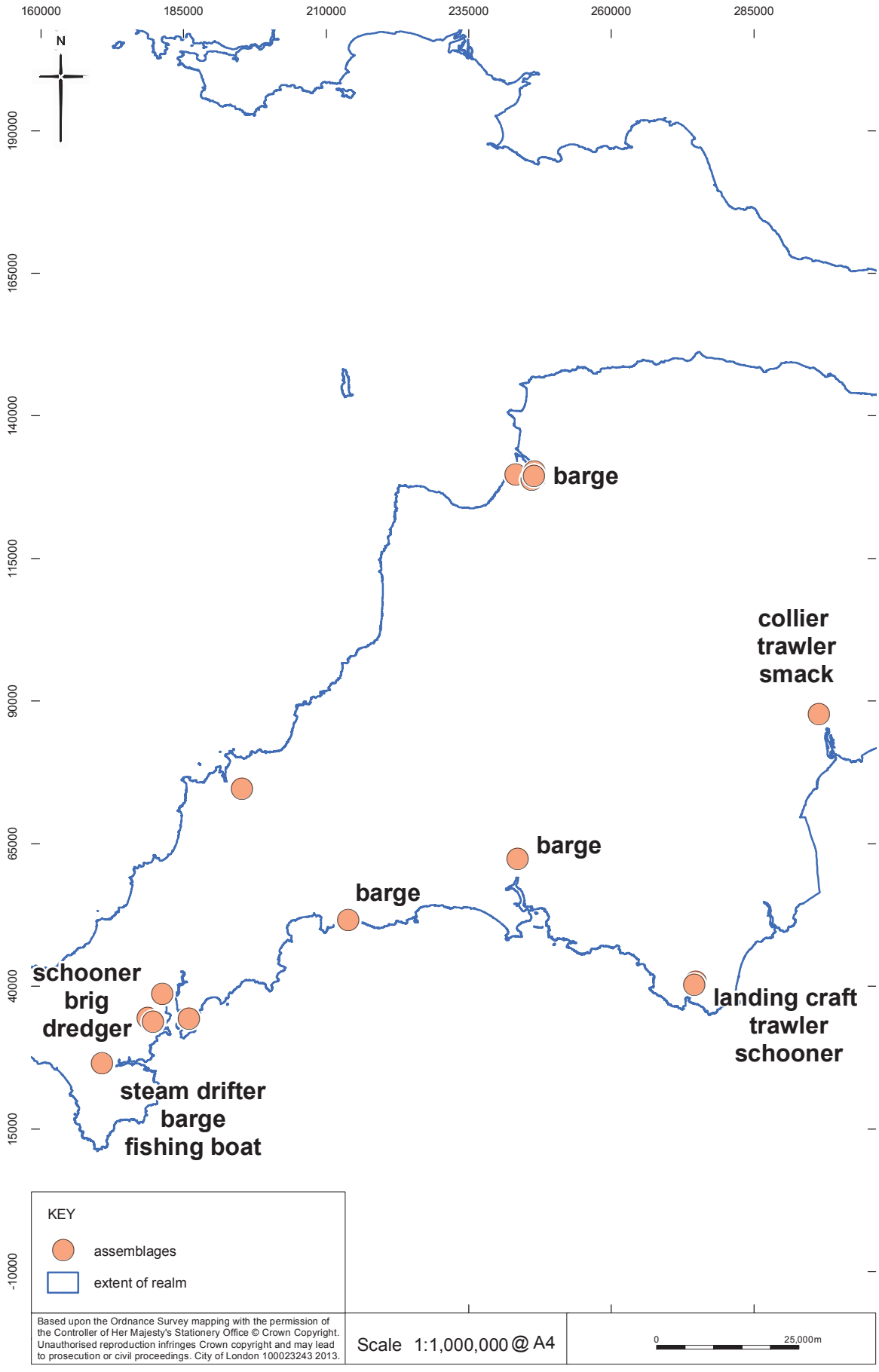


Fig 5d Vessel types

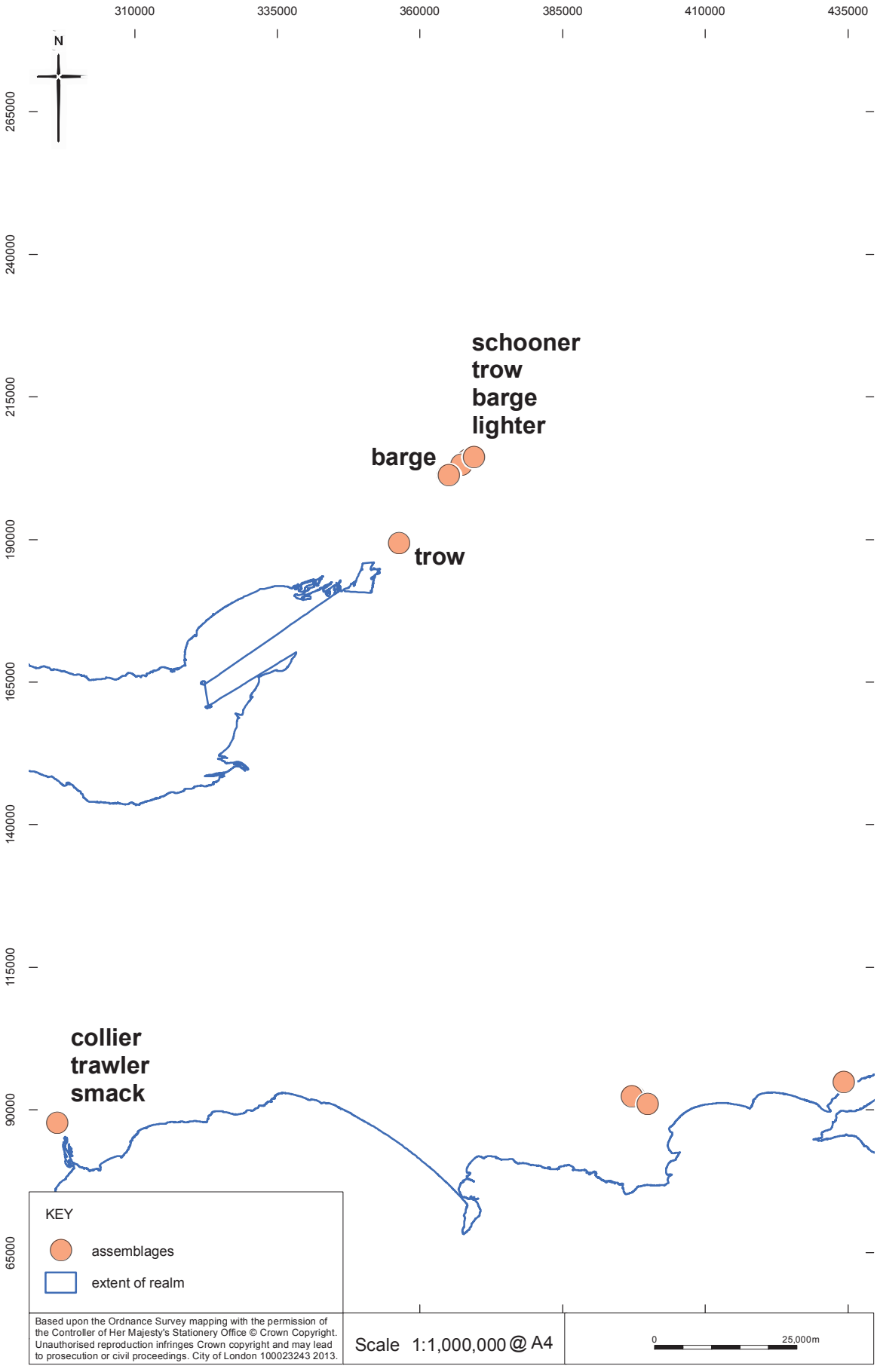


Fig 5e Vessel types

ame	No. in assemblage	County	Easting	Northing	NRHE Assemblage No.	HER reference	NRHE vessel records	Broad date of assemblage	Any additional dating/vessel name information	Vessel type
th Basin,	10	Cheshire	340010	366790	1527054	5020; MCH15369		Post Medieval	five of the boats could be dated : Linnet (1835), Coronet (1863), John (1864), Onward (1869), Herbert (1872)	Mersey flat
dnes	20	Cheshire	350690	384190	1527050	5010; MCH15357		Post medieval	most intact boat: Sir Robert Peel (1843)	Mersey flat
d Basin anal	37	Cheshire	350530	383020	1527046	5006; MCH15352		Post medieval	19th to 20th C	Mersey flat
g Pool,	42	Cheshire	351690	382470	1527042	5003; MCH15350		Post medieval	19th to 20th C	Mersey flat
ike Island	>2	Cheshire	351600	384330	1527038	4843; MCH15343		Modern	the Eustace Carey (1905)	Mersey flat
of Mersey rt basin,	>30	Cheshire	339920	366580	1527060	5035; MCH15386		Post medieval	one of the boats (the Earl) registered in 1804	Mersey flat
Sutton vigation	>25	Cheshire	354180	378440	1527027	4842; MCH15342		18th C	the flat Daresbury dated to 1772, still used in 1957	canal narro boats; Mers flats
as Creek,	2	Cornwall	178800	34500	1526871	38979		Post Medieval	steam drifter 'Fisher Girl' broken on beach 1947	steam drifter possible scho
	2	Cornwall	181285	38656	1526877	38883; 38884		Modern	1906	dredger
	2	Cornwall	185985	34321	1526880	50717.10; 50717.20;		Post medieval		unknown
ver	3	Cornwall	195300	74650	1526874	50624		Post Medieval		unknown
Pengegon)	3	Cornwall	213640	51570	1526977	39331; 39333; 39334		Post Medieval		barge
reen,	3	Cornwall	243600	62400	1526865	50027		Modern		barge
	5	Cornwall	213890	51600	1526981	39335; 39336; 39337; 39338; 39339		Post Medieval		unknown
harden	5	Cornwall	179700	33850	1526868	38977		Post Medieval	Louise (1877), Volant (1941), Lord Landsdown, Emma, Lady Margaret	schooner, brigantine, r ketch, Plymo barge, Tham Barge
	2	Cornwall	170715	26530	1526973	140274; 140275		Post Medieval		barge; fishi vessel
	2	Devon	243260	129760	to add	58099		Post Medieval		unknown
ween leigh	3	Devon	246150	128560	1527304	58145	1518356; 1518368;	unknown		barges

										smack
th of	4	Devon	246050	128845	832360	66189/53865	832360	Modern	19th C	carvel bui
oledore	5	Devon	246506	129544	832364	53867; 53866	832364	Modern		unknown
sbridge	6	Devon	274550	40280	no ref	68099; 68100; 68101; 68102; 68103; 68104		Post Medieval	Rose of Devon schooner (1869) converted into a yawl 1871; trawler Rulewater (1917) converted into yacht 1950 ; Yawl Cresta (1902); Racing Cutter Lverna (1890)	trawler, schoo yawl, racin cutter, fibregl vessel
	12	Devon	296430	87750	no ref	71159		Modern		keels
east of e	2	Dorset	399750	91070	1527080	MDO25072; 25073		Modern	1950-2000	unknown
e (east)	4	Dorset	397550	92390	1527075	MDO25082; 25184; 25185; 25186		Modern	1950-2000	unknown
e (west)	12	Dorset	397170	92440	1527078	MDO25187; 25188; 25191; 25193; 25194; 25195; 25196; 25197; 25198; 25199; 25200; 25202;		Modern		unknown
	22	Dorset	399925	91015	1527083	MDO25050; 25051; 25052; 25053; 25054; 25055; 25056; 25057; 25058; 25059; 25060; 25061; 25062; 25063; 25064; 25065; 25066; 25067; 25068; 25069; 25070; 25071		Modern		unknown
well	2	Essex	602400	209600	1526645	MEX32621		unknown		unknown
eek	2	Essex	582050	196820	1526658	MEX1031598		unknown		unknown
oint,	2	Essex	595500	194700	1526648	MEX41714		unknown		unknown
hend-on-	2	Essex	583640	185550	832404		832404	unknown		barges
	2	Essex	589400	202300	1526676	MEX1035421		unknown		unknown
	2	Essex	607240	215470	1526643	MEX31404		unknown		unknown
	2	Essex	588200	206600	1526661	MEX1033407		unknown		unknown
	2	Essex	593800	207400	1526655	MEX1031365		unknown		unknown
w Creek	2	Essex	583400	197600	1526652	MEX41953		unknown		unknown

	4	Essex	605500	217100	1526669	MEX1035418		unknown		unknown
	6	Essex	605045	216505		Possible the same as MEX1035420, but incorrect grid ref		unknown		
oint,	>4	Essex	595200	195000	1526640	MEX31389		unknown		unknown
Ponds,	2	Gloucs	368135	203840	1389853	26100	1389853	Post Medieval		barges
Ponds,	3	Gloucs	368330	203920	1389862	26102	1389862	Post Medieval		barges
d Timber	5	Gloucs	368110	203625	1389865	26103	1389865	Post Medieval		barges
our	6	Gloucs	364860	201280	1002183	26111	1002183	Post Medieval		barges
d timber	7	Gloucs	368480	204040	1389860	26101	1389860	Post Medieval		barges
	16	Gloucs	367260	203075	1526859	9528		Modern		barges
	>80	Gloucs	369500	204500	1389847	9525	1389847	Post Medieval		boats; barg
arbour	>2	Gloucs	365100	201300	1526845	9500		Post Medieval	The Canterbury	trows
at end of	2	Greater London	518120	177450	1527219	TAS FHL09 A104; A115		Post Medieval		barge?
harf	2	Greater London	539000	179220	1527273	TAS FGW07 A112; A113		Post Medieval		boat
all Point	2	Greater London	538870	180260	1527270	TAS FGW09 A122; A123		Post Medieval		boat
nce Wharf	2	Greater London	538780	180140	1527267	TAS FGW09 A109; A114		Post Medieval		unknown
beth	2	Greater London	531300	180560	1527250	TAS FSW10 A106; A107		Post Medieval		unknown
, east of	2	Greater London	531920	180800	1527253	TAS FCY01 A102; A104		Post Medieval		boat; barg
d's Wharf	2	Greater London	536680	179560	1527265	TAS FSW08 A118; A120		Post Medieval		barge
	2	Greater London	533280	180540	1527256	TAS FCY04 A106; A109		Post Medieval		unknown
d Ait east	3	Greater London	518640	177820	1527229	TAS FRM22 A117; A118; A119		Post Medieval		boats
	3	Greater London	526810	177420	1527245	TAS FKN01 A101; A109; A115		Post Medieval		barges; bo
and on low	3	Greater London	519430	177640	1527232	TAS FHL12 A102; A103; A107		Modern		unknown
er Stairs	4	Greater London	535390	180050	1527262	TAS FSW03 A103; A105; A116; A149		Post Medieval		house boa boats; barg

		London				MLO75807				
gs	7	Greater London	552940	178000	1527293	GLHER MLO98252; 98254; 98261; 98262; 98264; 98265; 98266; FBX15 A101; A102; A103; A113; A114; A115; A116		18th C	end of 18th century to modern	barges; skif boats
Wharf	7	Greater London	539100	178620	1527276	TAS FGW06 A102; A103; A104; A105; A106; A108; A109		Post medieval		boat; barge
Wharf	8	Greater London	534100	179900	1527259	TAS FSW01 A144; A145; A150; A151; A152; A153; A169; A170		Post medieval		barges; pont
	9	Greater London	524890	175370	1527238	TAS FWW05 A110; A111; A112; A113; A114; A115; A120; A121; A125		Post medieval		barges; boa
, Bexley	10	Greater London	552690	177900	1527290		025339; 1025340; 1025342; 1025345; 1025346; 1025347; 1025348; 1025349; 1025350; 1025351	unknown		barges
m Wharf	13	Greater London	540950	179180	1527279	TAS FGW14 A305; A306; A308; A313; A315; A316; A318; A319; A325; A329; A330; A331; A333		Post medieval		barge
and ntford Ait	23	Greater London	518380	177700	1527225	TAS FHL10 A105; A106; A107; A108; A109; A110; A111; A112; A113; FRM22 A120; A123; A124; A125		Post medieval		boats; barg

										1 narrow boa narrow or b barge, 14 w barges
r	2	Hampshire	469293	100565	1526715	27974; 27976		Modern	1941	tug; grab dred
d	3	Hampshire	461575	100860	1526686	59222; 53065; 59217		Post Medieval		barges; carv built; Secon World War M (Mine Coun Measures Ve
enor	3	Hampshire	479747	101618	911260	These are in Chichester Harbour. Need survey details from HWTMA.	911260	unknown		
d	19	Hampshire	461200	100800	1526681	53066; 53067; 53068; 53069; 53070; 53071; 53073; 53074; 57860; 57861; 57862; 57866; 57869; 57872; 57874; 57876; 57878; 57879; 60108		Post Medieval	Post Medieval to Modern; 1939-45	Motor fishir vessel; WW minesweep barges; pinna ferries; mot gunboats; lan craft; lifeboa WWII bomb s
ny	3	Hampshire	448900	108310	1526729	55491; 55492; 55594		Post Medieval		lifeboat
mble	3	Hampshire	448365	106250	1526744	55565; 55566; 55569		unknown		unknown
chell	6	Hampshire	448640	107790	1526735	55512; 55514; 55515; 55516; 55517; 56040		Post Medieval		one hospital s or North Se trader
ny	7	Hampshire	448840	107370	1526738	55495; 55595; 55607; 56033; 56034; 60057		Modern	1914-1945	warships; fish boat; moto minesweep
r	12	Hampshire	434340	94907	1526718	27701; 58146		Modern	1960-1980	mooring barg pontoons; di
rsash	2	Hampshire	448910	106060	1526741	55568; 56078		Post Medieval		unknown
yley	2	Hampshire	446930	103235	1526721	27889; 27890		Modern		unknown
nam	2	Hampshire	448380	108370	1526732	42510		Post Medieval	the Five Sisters (1891-1980)	Ferry; Tham

of	18	Hampshire	449504	109899	1527144	42536; 55520; 55539; 55540; 55541; 55542; 55543; 55544; 55545; 55546; 55547; 55709; 56045; 56046; 57136; 57138; 57139; 57140	1371138; 1371143; 1371148; 1371149; 1371188; 1371196; 1371197; 1371203	Modern	20th C	hopper barg crane barg Thames bar seaplane tow tender; ordna barge; landi assault cra
r E Cowes	2	IOW	450210	94700	1526778	IOW: 5228; 5229		unknown		unknown
nt Marina	2	IOW	450860	91920	1526801	IOW: 4782; 5222; 10692; Hants: 28128; IWSMR 6086;EIW163		Modern	20th C	one Baltic Tra others unkno
orks	3	IOW	450590	91800	1526797	IOW: 5173; 5174; 5175		unknown		unknown
th of	3	IOW	450610	92230	1526792	IOW: MIW4781; 5165; 5166		Post Medieval		one cowes ke
nerton	4	IOW	450180	94070	1526783	IOW: 5211; 5212; 5213; 5225		unknown		unknown
xmead	5	IOW	450490	92970	1526788	IOW: MIW5168; 5169; 5170; 5171		unknown		unknown
Bembridge	2	IOW	463570	88950	1526805	IOW: 4833; 4834		Modern		unknown
r	3	IOW	463640	88360	1526810	IOW: 5066; 5067; 5068		Modern		unknown
Marina	2	Kent	578730	171250	1526372	17752; 17756		Modern	1910-1980	unknown
nyer	2	Kent	595910	164640	1526369	17800; 17803		Post Medieval	pre 1946	barges
ek mouth	2	Kent	596190	165625	1525853	14729; 14728;	1025215; 1025214	Pre 1961		barges
of Hoo	2	Kent	579690	170220	1526406	17765; 18792		Modern		barge; Barge/light
nt	2	Kent	570525	176035	1525610	14886; 14887	1025417; 1025418	Pre 1961		barges
	2	Kent	579400	171700	1526379	18033; 18034		Post Medieval		barges
	2	Kent	592410	166860	1025230		1025230	unknown		possible bar
Sewage	2	Kent	592250	167130	1025231		1025231	unknown		possible bar
the Swale	2	Kent	589375	171915	1526009	18744; 18745		Post Medieval	unknown, but pre-2000	barges
th of	2	Kent	586030	167620	1526988		1025128; 1025129	unknown		possible bar

							1025120			
	2	Kent	578090	169660	1526365	14828;	1025358; 1025359	Pre 1985		barges
	2	Kent	601670	163930	1525923	14766; 14768	1025252; 1025254	Pre 1985		barges
outhern	2	Kent	582740	167470	1526984		1025175; 1025176	unknown		barges
	2	Kent	588530	172460	1525964	14782; 14783;	1025298; 1025299	Pre 1961		barges
an Park,	2	Kent	582960	167450	831759		831759; 1025177; 1025178	unknown		craft; barge
	2	Kent	583170	167910	1527090		1025179; 1025180	unknown		possible barg
	3	Kent	571820	166950	1527103		1025374; 1025375; 1025376	unknown		barges
eek,	3	Kent	586846	168893	900654		900654	unknown		barges
down	3	Kent	603280	166050	1526361	14777;	1025292; 1025293; 1025294	Pre 1961		barges
ch	3	Kent	591472	164856	1525848	18130;		Post Medieval		barges
	3	Kent	600850	162960	1525913	14769; 14771; 14772	1025255; 1025257; 1025258	Pre 1961		barges
vesend	3	Kent	561800	175000	1527138	MKE 14822; 14823; 14824	1025352; 1025353; 1025354	Pre 1961		barges
a, Gull	3	Kent	577790	171200	1526335	14637; 14638; 14639;	1025123; 1025124; 1025125	Pre 1961		barges
	3	Kent	577930	169600	1527096	14825;	1025355; 1025356; 1025357	Pre 1961		barges
s, west of	3	Kent	572190	166790	1527093		1025295; 1025296; 1025297	unknown	Alan, Pimlico, Violet	barge
	4	Kent	571470	176810	1525830	14893; 14892; 14894; 14895	1025423; 1025424; 1025425; 1025426	Pre 1967		barges
	4	Kent	580650	170605	1526356	14719; 14720; 14721; 14722	1025205; 1025206; 1025207; 1025208	Pre 1990		lighters; bar
Marina	4	Kent	578290	169525	1526054	18816; 14830; 14831; 14832	1025360; 1025361; 1025362	Pre 1985		lighter; barg

y	4	Kent	582490	172790	1527132		900731; 1025334; 1025335	unknown	Silica, Miranda	barges
	4	Kent	580670	168700	1526089	17771; 14671; 14672; 14673	1025157; 1025158; 1025159	Pre 1985		sailing yach barges
Chetney	4	Kent	588254	172408	900724		900724	unknown		craft
Estate	5	Kent	571590	166830	1527099		1025370; 1025372; 1025366; 1025367; 1025369 (check this on GIS).	unknown		barges
s	5	Kent	578850	169265	1526099	19187; 19188; 19189; 19191; 19192	900674; 1025363; 1025363; 1025363; 1025363; 1025363	Pre 1961		lighters; bar
ch	5	Kent	590020	171500	1525977	14707; 14708; 14808; 14809; 14756;	1025193; 1025194; 1025324; 1025325; 1025242	Pre 1990		barges
	5	Kent	585930	167720	1526343	18242;	1025126;	Post Medieval		barges
end),	5	Kent	590650	164380	1526119	14751; 14754; 14749; 14750; 14755;	1025235; 1025236; 1025237; 1025240; 1025241	Pre 1961		barges
ks, Hoo	5	Kent	579260	171660	1526376	18035;		Post Medieval		barges
ay Court	5	Kent	573820	168240	1527118		1025393; 1025394; 1025395; 1025397; 1025398	unknown		barges
Marina	6	Kent	578040	169500	1526081	18196; 18197		Post Medieval		barges
arina	7	Kent	572740	167170	1527113		1025381; 1025382; 1025383; 1025385; 1025386; 1025387; 1025388	unknown		barges
ch Wharf	8	Kent	591940	165180	1525850	14732; 14733; 14734; 14736; 14737; 14738;	1025218; 1025219; 1025220;	Pre 1946		barges

							1025411; 1025412; 1025413; 1025414			
	9	Kent	587720	171490	1525940	14797; 14798; 14799; 14792; 14791; 14790; 14793; 14794; 19875;	1025306; 1025307; 1025308; 1025309; 1025310; 1025313; 1025314; 1025315	Post medieval	remains of Kingfisher barge built in 1899	barges
Wharf	10	Kent	578880	171350	1526429	17754 (2); 17755; 19713; 19722; 19728; 19729; 19732; 19734; 19735		Post Medieval		barges; ligh
gbourne	10	Kent	590840	164430	1526106	18261; 18265		Post Medieval		barges
ort Reach,	11	Kent	577940	171080	1526410	17751;		Modern		lighter
	11	Kent	590730	171925	1525619	18065; 19818; 18066; 19817; 18067; 18070; ; 18068; 14497; done: 18069; 14757; 14758	971015; 1025243; 1025244	Pre 1961	possibly includes Spritsail barge, built in 1879	barges; bo
	12	Kent	579630	170490	1527141	12932; 14625; 14626; 14627; 14629; 14630; 14631; 14632; 14896; 14897; 18795; 19681;	900691; 1025111; 1025112; 1025113; 1025115; 1025116; 1025117; 1025118; 1025427; 1025428	Pre 1985	pre 1990, pre 1985; Post Medieval	unknown; bar lighter
Kent	17	Kent	589120	169150	1525841	14654; 14655; 14656; 14657; 14658; 14659; 14660; 14661; 14662; 14663; 14646; 14647; 14648; 14650; 14651; 14652; 14653	1025140; 1025141; 1025142; 1025143; 1025144; 1025145; 1025146; 1025147; 1025148; 1025149; 1025132; 1025133; 1025134; 1025136;	Pre 1961		barges

							1025402; 1025403; 1025404; 1025405; 1025406			
, w of	19	Kent	589700	171645	1527321	14700; 14701; 14702; 14703; 14709; 14711; 14712; 14713; 14714; 14715; 14801; 14802; 14803; 14804; 14811; 14812; 14814; 14815; 14816;	1025186; 1025187; 1025188; 1025189; 1025195; 1025197; 1025198; 1025199; 1025200; 1025201; 1025317; 1025318; 1025319; 1025320; 1025327; 1025328; 1025330; 1025331; 1025332	Pre 1967		barges
	26	Kent	587900	169010	1526019	14664; 14665	900655; 1025150; 1025151; 1025152; 1025153	Pre 1961		barges
er	10	Kent	581640	167830	1526350	14675; 14676; 14677; 14678; 14679; 14680; 14681; 14682; 14683; 14684	1025161; 1025162; 1025163; 1025164; 1025165; 1025166; 1025167; 1025168; 1025169; 1025170	Pre 1961		barges
e of the	>2	Kent	603203	166086	900618		900618	unknown		craft
tern bank	>2	Kent	592388	167909	900635		900635	unknown		craft
	2	Lancs	345640	456040	to add	MLA13384; 30100	909265; 909266;	unknown		unknown
ck	2	Lancs	334045	446727	to add	25231	909256; 1483590	Post Medieval		unknown
ton	4	Lincs	532830	343450	1527315	MLI97540		Post Medieval		fishing boa
	5	Lincs	532670	343220	1527318	MLI97538; 97539		Modern		yacht; fishi boats
ton	8	Lincs	532800	343730	1527312	MLI97534;		Post Medieval		life boats; fis

lakeney	2	Norfolk	600450	345960	1526579	46103; 46124		Post Medieval		unknown
	2	Norfolk	592400	343800	1526591	46059; 46060		unknown		unknown
	3	Norfolk	648040	307090	1526626	47457; 47802; 47803		Post Medieval		unknown
	>2	Norfolk	561330	319840	1526583	44526		Modern		unknown
ts, River	>5	Norfolk	650870	307560	1526600	46240; 46241; 46587; 49125; 49298		Post Medieval		unknown
	>2	Norfolk	635798	315158	to add	MNF48907		Modern	Modern, post 1960	unknown
r	9	Northumberland	426310	605070	to add	23824; 23826; 23827; 23829; 23831; 23832; 23833; 23834; 23835	907647; 907649; 1469582	Modern		boats or light
	3	Northumberland	430456	583073	to add	24130	907643	Pre 1947		unknown
ern	2	South Gloucs	356380	189420	to add	17038		Pre 1946		trows
of railway	8	Southampton	443500	113700	1526747	S'hants: 2964; 2975		Post Medieval	1850-1945;Post Medieval to Modern	barges
am	13	Southampton	443440	113114	1527324	Hants: 55524; 55526; 55527; 55528; 55529; 55530; 55531; S'hants: 1635; 1725; 1726; 1728; 1729; 1730; 1769; 1770; 1771; 1772; 1773; 1774; 1775; 1776; 2622		Post medieval	19th C; 1920-39; 1901-97; post 1945	barges, row boat
	2	Suffolk	623740	238820	1526528	20853		unknown		unknown
	2	Suffolk	643340	249330	1526487	20822		Modern		unknown
	2	Suffolk	625450	236870	1526532	20846		Modern		unknown
ield	2	Suffolk	628710	244190	1526509	20693; 20694		unknown		boat
er Orwell	3	Suffolk	616420	241850	1526526	20279		unknown		unknown
	3	Suffolk	643500	249400	1526493	20818; 20819		unknown		unknown
Cliff	3	Suffolk	627990	248690	1526445	17226; 20621; 20622		Post Medieval	The Dover Castle 1872; others Post Medieval	barge; boa
	4	Suffolk	624750	236120	1526443	20886; 19586		Post Medieval	pre 1945	unknown
ver	4	Suffolk	628500	250020	1526469	19630; 20649		Post Medieval		boat; other unknown
	4	Suffolk	628530	244880	1526519	20706; 20710; 20711		unknown		unknown; bo cruiser

						20917; 20918				steamer; mo launch
rks	16	Suffolk	628120	249390	1526564	17227; 20626; 20627; 20629; 20632; 20633; 20639; 20641; 20643; 20645; 19631; 19674		Post Medieval		barges; bo
	>10	Suffolk	642440	249480	1526481	20807		Post Medieval		unknown
rn bridge,	5	Tyne and Wear	416360	565170	EH to add	11986		Modern		wherries
ock near	>3	Tyne and Wear	433930	566340	EH to add	12693		Modern		boat
	>3	Tyne and Wear	419020	564290	EH to add	4959		unknown		boat
er Stour	2	Kent	633,677 .000000	161,287.0 00000	EH to add	MWX43286				
Stour	2	Kent	634,743 .000000	162,547.0 00000	EH to add	TR 36 SW 84; TR 36 SW 85			Harvest Moon; Alfred Colebrook	trawler; unkn
e edge of	2 to 4	East Sussex	593,330 .000000	119,610.0 00000	EH to add	1340205		Modern	river barge Primrose; 20th Century	barge
	2	West Sussex	483,778 .000000	103,283.0 00000	EH to add	MKM1860; MKM1858		Modern	19th-20th Century	unknown
enor	>5	West Sussex	479,799 .000000	101,585.0 00000	Same as No. 79 plus extra vessels	MKM1543; MKM1544; MKM1565		Modern	19th-20th Century	unknown
	4 to 7	North Lincs	510,926 .000000	425,309.0 00000	EH to add		MLS22406; MLS22407; MLS22408; MLS22409	unknown		unknown
ondge of foreshore	3	East Riding of Yorkshire	476,400 .000000	424,100.0 00000	EH to add	19544		Modern	20th century	clinker
by Royal	2	North East Lincs	527,233 .000000	411,567.0 00000	EH to add	1000/10/0; 1000/09/0	1532769; 908333		Post Medieval to 20th Century	unknown
ssible Ship	>5	North East Lincs	527,194 .000000	410,783.0 00000	EH to add	1000/0/0; 1000/35/0; 1000/36/0; 1000/37/0;1000/38/0		Modern	late Post Medieval to 20th Century	unknown
each	2	North East Lincs	533,814 .000000	407,033.0 00000	EH to add	1000/20/0-1000/21/0		Modern	late Post Medieval to 20th Century	barge; cra

County	Site of Special Scientific Interest	Special Protection Area	Ramsar site	Special Area of Conservation	Area of Outstanding Natural Beauty	Environmentally Sensitive Area	Local Nature Reserve	Heritage Coast	National Nature Reserve	National Park	World Heritage Site
Cheshire											
Cheshire											
Cheshire											
Cheshire											
Cheshire											
Cheshire											
Cheshire											
Cornwall											
Cornwall					AONB						
Cornwall	SSSI			SAC	AONB			HC			
Cornwall					AONB						
Cornwall					AONB			HC			
Cornwall	SSSI	SPA		SAC	AONB						
Cornwall					AONB			HC			
Cornwall											
Cornwall					AONB						
Devon	SSSI				AONB						
Devon	SSSI										
Devon	SSSI										
Devon	SSSI										
Devon	SSSI				AONB		LNR				
Devon	SSSI	SPA	Ramsar								

Devon	SSSI				AONB		LNR				
Devon	SSSI	SPA	Ramsar								
Dorset	SSSI	SPA	Ramsar								
Dorset	SSSI	SPA	Ramsar								
Dorset	SSSI	SPA	Ramsar								
Dorset	SSSI	SPA	Ramsar								
Essex	SSSI	SPA	Ramsar	SAC					NNR		
Essex	SSSI	SPA	Ramsar	SAC		ESA					
Essex	SSSI	SPA	Ramsar	SAC							
Essex	SSSI	SPA	Ramsar						NNR		
Essex	SSSI	SPA	Ramsar	SAC		ESA					
Essex	SSSI	SPA	Ramsar	SAC					NNR		
Essex	SSSI	SPA	Ramsar	SAC							
Essex	SSSI	SPA	Ramsar	SAC					NNR		
Essex	SSSI	SPA	Ramsar	SAC		ESA					
Essex	SSSI	SPA	Ramsar	SAC							
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Essex	SSSI	SPA	Ramsar	SAC							
Essex	SSSI	SPA	Ramsar	SAC							
Gloucs	SSSI	SPA	Ramsar	SAC							
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Greater London											
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Hampshire	SSSI	SPA	Ramsar	SAC							

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Hampshire	SSSI	SPA	Ramsar	SAC							
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Hampshire	SSSI	SPA	Ramsar	SAC			LNR				
Hampshire	SSSI	SPA	Ramsar	SAC			LNR			NP	
Hampshire	SSSI	SPA	Ramsar	SAC			LNR				
Hampshire	SSSI	SPA	Ramsar	SAC						NP	
Hampshire	SSSI	SPA	Ramsar	SAC							
Hampshire	SSSI	SPA	Ramsar	SAC							
Hampshire				SAC							
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IOW	SSSI	SPA	Ramsar	SAC							
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IOW	SSSI	SPA	Ramsar	SAC							
IOW				SAC							
IOW	SSSI	SPA	Ramsar	SAC							
IOW	SSSI	SPA	Ramsar								
IOW	SSSI	SPA	Ramsar	SAC							
Kent	SSSI	SPA	Ramsar								
Kent	SSSI	SPA	Ramsar			ESA					
Kent	SSSI	SPA	Ramsar			ESA					
Kent	SSSI	SPA	Ramsar								
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Kent	SSSI	SPA	Ramsar			ESA	LNR				
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Kent	SSSI	SPA	Ramsar			ESA					
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Kent	SSSI	SPA	Ramsar								
Kent	SSSI	SPA	Ramsar								
Kent	SSSI	SPA	Ramsar						NNR		
Kent	SSSI	SPA	Ramsar								
Lancashire	SSSI	SPA	Ramsar	SAC							
Lancashire	SSSI	SPA	Ramsar								
Lincolnshire											
Lincolnshire											
Lincolnshire											

Norfolk	SSSI	SPA	Ramsar	SAC	AONB			HC	NNR		
Norfolk	SSSI	SPA	Ramsar	SAC	AONB			HC	NNR		
Norfolk	SSSI	SPA	Ramsar			ESA	LNR			NP	
Norfolk											
Norfolk	SSSI	SPA	Ramsar			ESA	LNR			NP	
Norfolk	SSSI					ESA			NNR	NP	
Northumberland	SSSI			SAC	AONB			HC			
Northumberland	SSSI										
South Gloucs	SSSI	SPA	Ramsar	SAC							
Southampton											
Southampton	SSSI	SPA	Ramsar								
Suffolk	SSSI	SPA	Ramsar		AONB	ESA					
Suffolk	SSSI	SPA	Ramsar	SAC	AONB	ESA		HC	NNR		
Suffolk	SSSI	SPA	Ramsar		AONB	ESA					
Suffolk	SSSI	SPA	Ramsar		AONB	ESA					
Suffolk	SSSI	SPA	Ramsar		AONB						
Suffolk	SSSI	SPA	Ramsar	SAC	AONB	ESA		HC	NNR		
Suffolk	SSSI	SPA	Ramsar		AONB	ESA					
Suffolk	SSSI	SPA	Ramsar		AONB						
Suffolk	SSSI	SPA	Ramsar		AONB						
Suffolk	SSSI	SPA	Ramsar		AONB	ESA					
Suffolk	SSSI	SPA	Ramsar		AONB	ESA					
Suffolk	SSSI	SPA	Ramsar	SAC	AONB	ESA		HC			
Suffolk	SSSI	SPA	Ramsar		AONB	ESA					
Suffolk	SSSI	SPA	Ramsar		AONB			HC			
Suffolk	SSSI	SPA	Ramsar		AONB	ESA					
Suffolk	SSSI	SPA	Ramsar		AONB	ESA					
Suffolk	SSSI	SPA	Ramsar	SAC	AONB	ESA		HC			
Tyne and Wear											

Kent	SSSI	SPA	Ramsar	SAC					NNR		
East Sussex											
West Sussex	SSSI	SPA	Ramsar	SAC	AONB						
West Sussex	SSSI	SPA	Ramsar	SAC	AONB						
North Lincs	SSSI	SPA	Ramsar	SAC							
East Riding of Yorkshire	SSSI	SPA	Ramsar	SAC							
North East Lincs	SSSI	SPA	Ramsar	SAC							
North East Lincs	SSSI	SPA	Ramsar	SAC							
North East Lincs	SSSI	SPA	Ramsar	SAC			LNR				

9 Appendix 3: Satellite imagery survey of the River Humber

9.1 Introduction

9.1.1 The Hulks Part Two project included a pilot study comprising an assessment of readily and freely available online satellite imagery provided by the two main providers of such information, Google Earth and Bing Maps, of the Humber estuary. The aim of the study was to determine if it was possible to confidently identify hulks and hulk assemblages using freely available satellite imagery alone. The Humber estuary was selected as it was the only part of the Hulks Part Two project area which had not been subject to the National Mapping Programme (NMP) aerial survey in its entirety and there were very few records of hulks in the HER.

9.1.2 The scope and methodology for the pilot study was set out in the Project Design (MOLA 2012) and is detailed in this section.

9.2 Study area

9.2.1 The study area comprises the whole of the Humber estuary, from Donna Nook on the south side of the estuary, all the way round to Spurn Head on the north, a distance of *c* 175km. This included some distance up the major tributary rivers; the Rivers Hull (2km upstream surveyed), Ouse (14km upstream surveyed) and Trent (11km upstream surveyed). Given the variable nature of the NMP coverage of survey along the Humber it was decided to subject the whole of the Humber area to the survey. This would allow for the effectiveness of the method to be tested by seeing if the survey would identify vessels and assemblages that were already identified in the HER along the north and north east Lincolnshire coast.

9.2.2 The west end of the north side of the Humber estuary was covered in the Hull Valley NMP and the Vale of York NMP. But revealed no hulk assemblages as part of the main project.

9.2.3 The remainder of the north side of the Humber estuary (*c* 35km long) has not been subject to NMP. The south side of the Humber (on the northern edge of North East Lincolnshire) was not included in the Lincolnshire NMP. The length of the south side of the Humber, excluded from past NMP, is *c* 55km long.

9.3 Survey tools

9.3.1 Google Earth (downloadable from www.google.co.uk/intl/en_uk/earth/index.html) and Bing Maps (www.bing.com/maps) were used to identify previously unrecorded hulk assemblages and assemblages already noted on the HER. The tools are described in detail below, followed by the pilot study methodology.

Google Earth

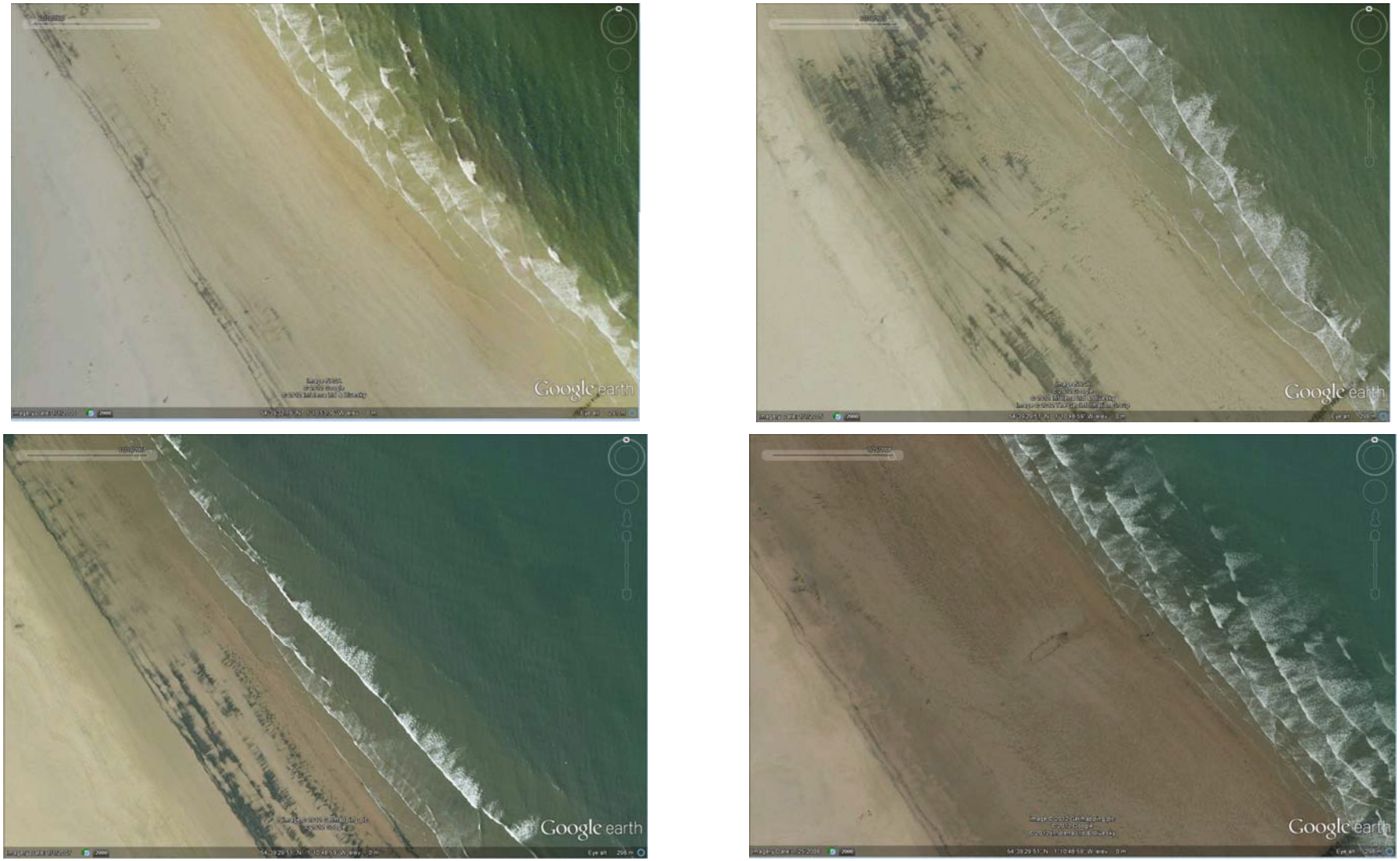
9.3.2 The initial survey was done using Google Earth. This allowed for the comparison of satellite images from different dates that can be accessed through the “history” tab. This feature was introduced in Google Earth version 5.0.

Table 9.1 Summary of Google Earth features

Google Earth feature	Strengths	Weaknesses
Historical imagery function	Google Earth provides a sliding bar that can adjust the date of the satellite imagery (usually from c AD 2000 onwards) and in some in some areas of the country this includes georeferenced aerial	Historical imagery coverage is patchy; at the time of the survey it did not extend to the Humber pilot study area.

Google Earth feature	Strengths	Weaknesses
	photography extending in some cases back to 1945. Imagery that has been acquired in different years can be easily navigated. This makes it possible to look at features over a period of perhaps 7-8 years The exact year of each image, is shown and it is possible to flip between the images in consecutive order. This temporal aspect means that a date at which a feature was last or first visible can be assigned.	
	Because there is a range of images there is higher potential that the study area will be shown at low tide, which is of particular importance for foreshore survey.	No guarantee that you have full coverage of the extent of realm, that there is an example of all area at mean low water.
	The range of images over time can also increase the probability of identifying features that may be covered in silt or sand one year, but not the next.	Some images even when at comparable low tide show that the silt/sand on the foreshore is variable and in some years vessels are visible that are then invisible on surrounding years (see Fig 1 below).
	When trying to identify abandoned vessels the historical imagery allows differentiation between vessels that have been abandoned for perhaps 6 months and then disappear from the foreshore, to those that are in place for 7-8 years.	Some areas have less coverage over time, and even a vessel that may have been abandoned for 5 years may not qualify as a historic hulked vessel.
Image resolution	The resolution can be incredibly detailed, to the point where it could be possible to identify vessel types.	There is variable resolution meaning some areas are very detailed, while others are blurred and indistinct. This could make it difficult or impossible to identify smaller vessels or very broken up vessels.
Data manipulation and transfer	It is possible to draw placemarks, paths, and polygons in Google Earth and save as .kml files, which can then be converted into shapefiles/GIS points The points were accurate in relation to each other. This is important in terms of Hulk assemblage identification because it means that they are the correct distance apart – ie the 50m buffer would be accurate.	Conversion to GIS point and locations from satellite imagery in this case produced a consistent error of about 120m. The points seem to be approx. 120m to the WNW of their true location.
	Because of the ease of translating placemarks in Google Earth into shapefiles in GIS, during the initial Google Earth survey it is possible to be quite indiscriminate about potentially identifying vessels. A placemark was added to even quite unlikely looking points, which could then be interrogated in further detail later with Bing Maps and the Bird's Eye tool. This increases the likelihood of recognising archaeological features.	Where the identification is tenuous and there is not good coverage in Bing maps Bird's Eye view it can be impossible to say with any certainty that some potential vessels have been correctly identified

Fig 9.1: Showing four different years at the same spot. Vessel is only clearly visible in most recent image. (Example from near Hartlepool (452872, 529552) top row: 31/12/2000; 31/12/2005 bottom row: 31/12/2007; 25/7/2012)



Bing Maps

9.3.3 MOLA has Bing maps imagery incorporated into a GIS, but it was too slow to use as an initial survey tool as the software responded slowly to attempts to navigate around the image. Also often it was clear that it only held the same images as Google earth.

9.3.4 Using the online Bing Maps data it was found to be quicker to navigate than in MOLA GIS, but more difficult to navigate both in space and time than the Google Earth maps. For example, Bing maps automatically changes the satellite image displayed when zooming in. This means that it can be impossible to closely interrogate potential features in some images as when zoomed in the satellite image that shows the feature may disappear. Bing maps was also less useful for the purposes of this survey than Google Earth as there was no dating information attached to the images, so there is no way of telling when features were last known and visible on the foreshore..

9.3.5 Bing maps also have no facility for adding markers to the map, which would make translating points to GIS time consuming.

9.3.6 It was noted that when the points were imported from Google Earth into the MOLA GIS that they matched the location of those features that were also visible in the Bing Maps satellite images. This means that the Bing Maps layer in the MOLA GIS has the same error as Google Earth when transferred to a GIS using OSGB. However it does mean that using known points that are shared between the satellite imagery and the OS 10k mapping it was possible to correct the error. Once corrected it is estimated that there would be a resulting error of perhaps 5-10m. If there was OS Mastermap data for the project area this error could probably be further reduced.

9.3.7 So the greatest value of the Bing satellite imagery was having it incorporated into the MOLA GIS which allowed for the 120m error to be corrected.

Bird's Eye in Bing

9.3.8 One strength of the online Bing maps is their 'Bird's Eye' viewing tool. The coverage is highly variable but where good comprises detailed high resolution aerial photographs taken at an oblique angle. In areas without this coverage a flat satellite image is used instead, which is often of poor quality.

9.3.9 Where the coverage is good and detailed this allows for a very clear picture of the foreshore and can make identification of vessels more accurate. It is even possible that types of vessel could be identified from these images.

9.3.10 The coverage is quite variable on this service at the moment, which is why it was not used for initial survey of the foreshore, but only as a tool to confirm or refute possible vessel identification made in Google Earth.

9.3.11 It is possible to look at an area from the four cardinal directions; essentially four photos of each location, the view can be rotated 90 degrees around a central point by using the arrow in the top right corner of the map.

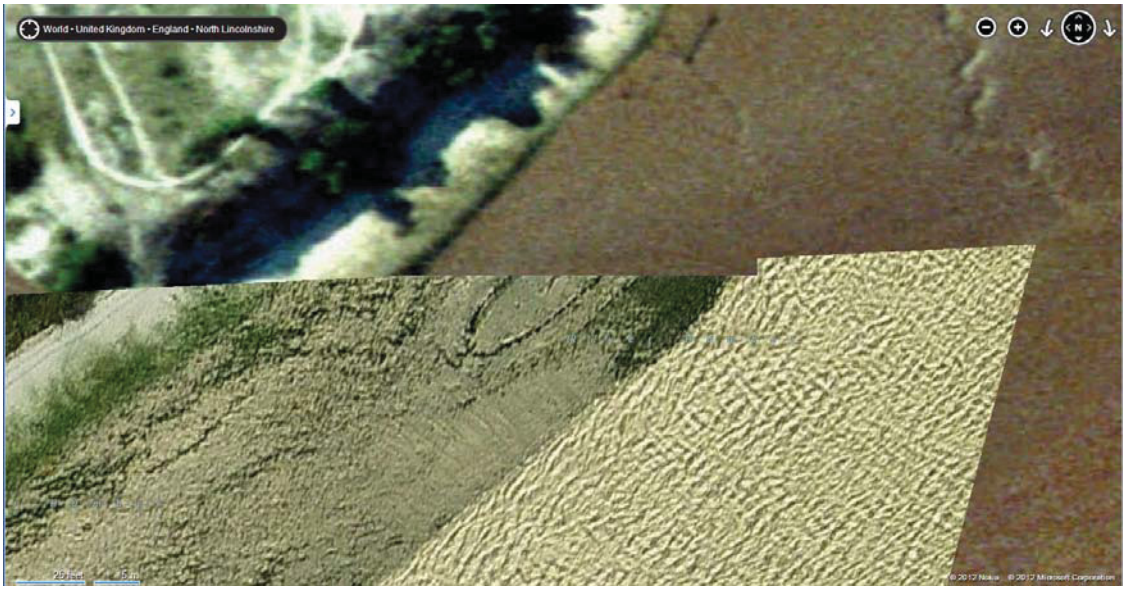
9.3.12 Confirming the identification of vessels in Bing Bird's Eye meant that the assemblages in the results are confidently identified. Although it may be possible to identify individual vessel types using the Bing Bird's Eye imagery this was not attempted as part of this trial survey.

Table 9.2 Summary of Bing Maps features

Bing Maps feature (online)	Strengths	Weaknesses
Automatically selects best image resolution when zoomed in or out	Allows for very quick navigation and the clearest resolution for visual survey. On occasion resolution was better than similar areas in Google Earth, but usually the resolution was of at least a comparable level of resolution as Google Earth and occasionally lower.	The images in Bing Maps have no dating information attached to them. Although there clearly are different images taken at different times it is not possible to navigate chronologically.
		There is no control over which image is being viewed depending on the level of zoom. Features may be visible in one image but closer inspection may be necessary to confirm, however when the relevant image is zoomed into it could be replaced with one in which the tide may be higher and therefore obscure the area, or silt may have obscured the relevant area.
Spatial accuracy	The inclusion of Bing Maps satellite imagery in the MOLA GIS allowed for comparison of satellite imagery with OS mapping and meant that the location hulk assemblages could be referenced in relation to OS mapping allowing for accurate location of identified hulks.	
Bird's Eye View	With Bing Maps Bird's Eye view it is sometimes possible to verify features that may have been only tentatively identified on satellite imagery. Where oblique aerial photography exists the resolution is excellent and it is possible to see some hulks in great detail.	The coverage is very variable. Where there are no oblique aerial photos available in an area then the same satellite image as in the usual Bing Maps view but of poorer resolution.

Fig 9.2: This image, looking east, is an example of how clear a picture the Bird's Eye view can present with the outline of a boat clearly visible on the foreshore adjacent to a possible groyne or jetty structure.

Figure 9.3 This image is of the same potential hulk, but viewed in Bing Bird's Eye looking south. This view only shows part of the same vessel as the coverage is patchy and distorted.



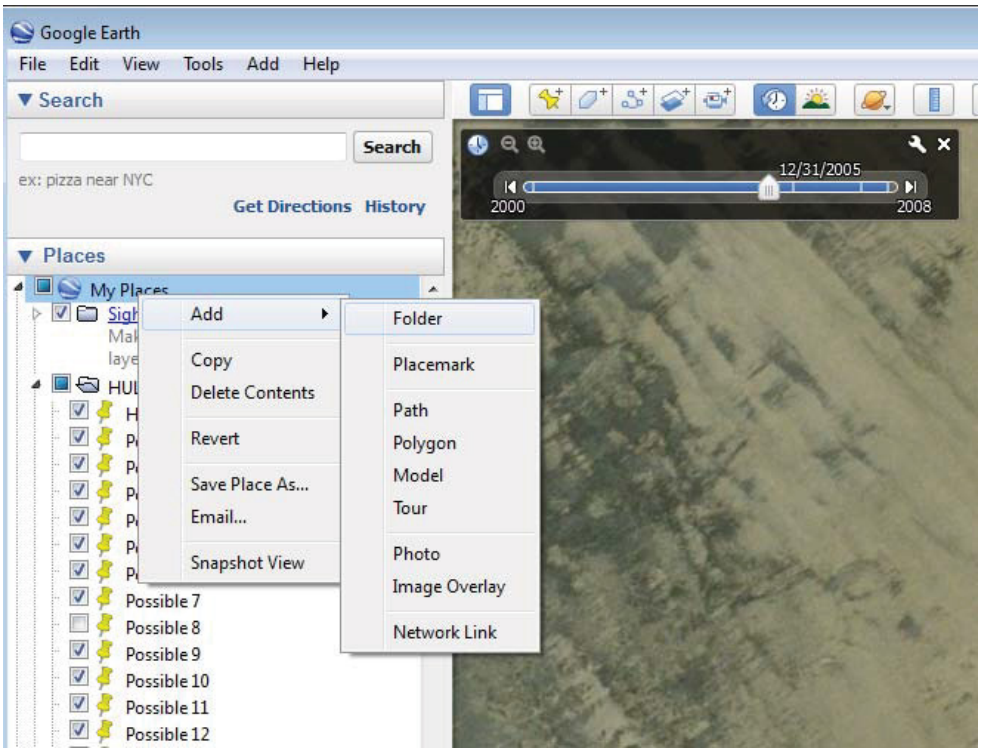
9.4 Methodology

9.4.1 Taking into account the strengths and weaknesses of each of the programs and websites with freely accessible satellite data the following method was developed. Essentially this entailed a quick visual survey of the study area using the downloaded version of Google Earth, navigating in space by clicking and dragging through the satellite images, and through time by using the historical imagery slider. Where potential hulks are identified a marker can be placed in Google Earth that can later be imported into GIS.

9.4.2 The initial feature identifications can then be cross-referenced using the satellite imagery held in the online version of Bing Maps, and where possible also with oblique aerial photographs held in the online Bing Maps Bird's Eye view function. The locations need to be checked by comparing the Bing maps imagery in GIS and the OS 10k map and any errors rectified. Each point identified during the visual survey was buffered with a 50m radius buffer. Areas of the study area were then zoomed to and examined in detail to see where buffers clustered. Where two or more buffers were found to touch, i.e. where points were located 100m or less from each other, this was classed as an assemblage of hulks. In all cases screenshots of the identified assemblages as seen in high resolution in Bing Maps Bird's Eye view were taken to support their identification (see Figs 5–10).

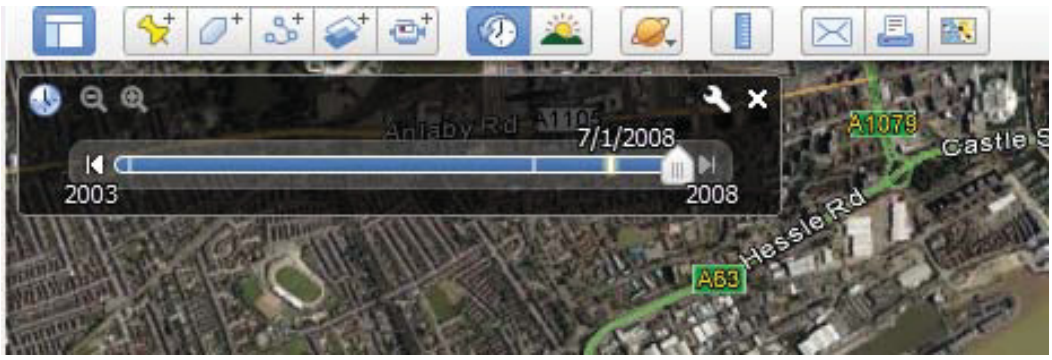
Detailed method

1) Create a sub-folder in the My Places section of Google Earth

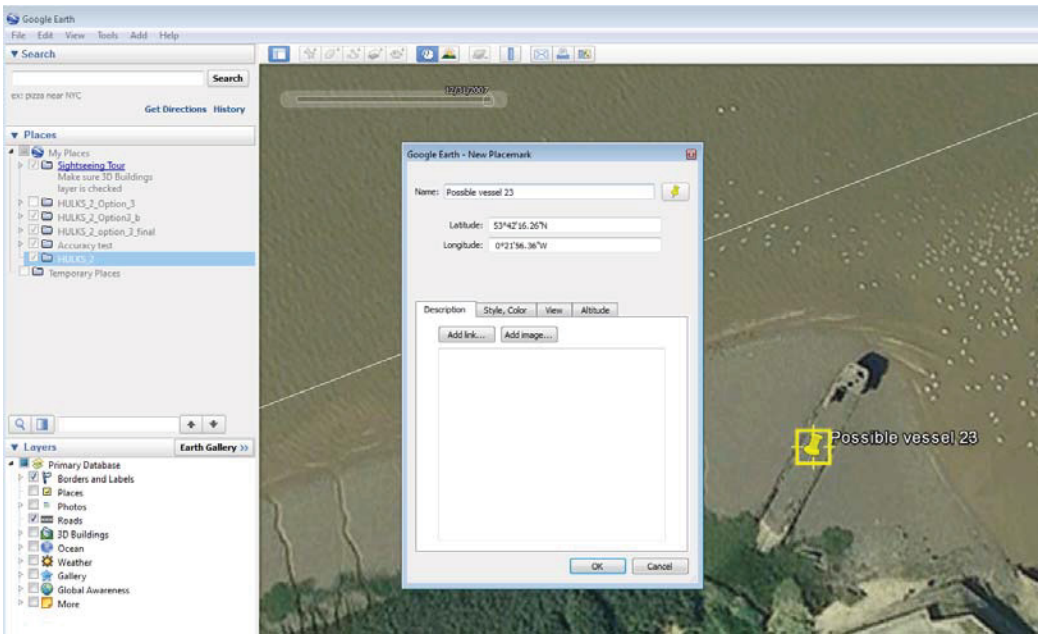


2) Visually survey along the foreshore in Google Earth. The bottom right hand corner displays the view altitude. Keep between 150-350m “Eye alt” for consistency, occasionally zooming further out to gain perspective of location if necessary.

3) At each area use the History slider bar to switch between different imagery.



4) Add ‘Placemarks’ at possible locations for Hulks. It is possible to add labels to the place marks to help with identification.



5) When all potential vessels have been identified 'Save As' the sub-folder with the placemarks in the project folder as a .kml file.
6) Import the .kml file into GIS project using "from KML" conversion tool.
7) Once points are added, select and export the data points instructing GIS to use the project data frame, this will convert the points from being located by longtitude and latitude in the World Geodetic System of 1984 (WGS84) locations into Great British Ordnance Survey Grid (OSGB).
8) Double check each point using the Bing Maps imagery held in the GIS. Cross reference with the online Bing Maps tool – specifically Bird's Eye imagery.
9) When location and vessel is located using Bird's Eye imagery check location from all 4 available cardinal views.
10) Refine vessels identification, by removing points that seem unlikely given the survey of Bing Bird's Eye imagery. Label remaining points with a 'H' number, taking screen shots of the satellite imagery or Bird's Eye imagery to support identification. At this point record level of confidence in vessel identification (High – completely certain; Medium – probable/likely vessel; Low – possible/tenuous).
11) Converting the data points from being located by longtitude and latitude in the World Geodetic System of 1984 (WGS84) locations into Great British Ordnance Survey Grid (OSGB) results in an error. The GIS system used for this survey had a Bing Maps satellite image layer within it that also has the same error. It was possible therefore to correct the 120m error by relocating the survey data points in relation to features that are shown in both the Bing Maps and OS map data layers, eg corners of nearby buildings.
12) Buffer remaining points with 50m buffer, and analyse data to identify assemblages (as per Hulks Part One method).
13) Add assemblage point and record screenshot from online source.

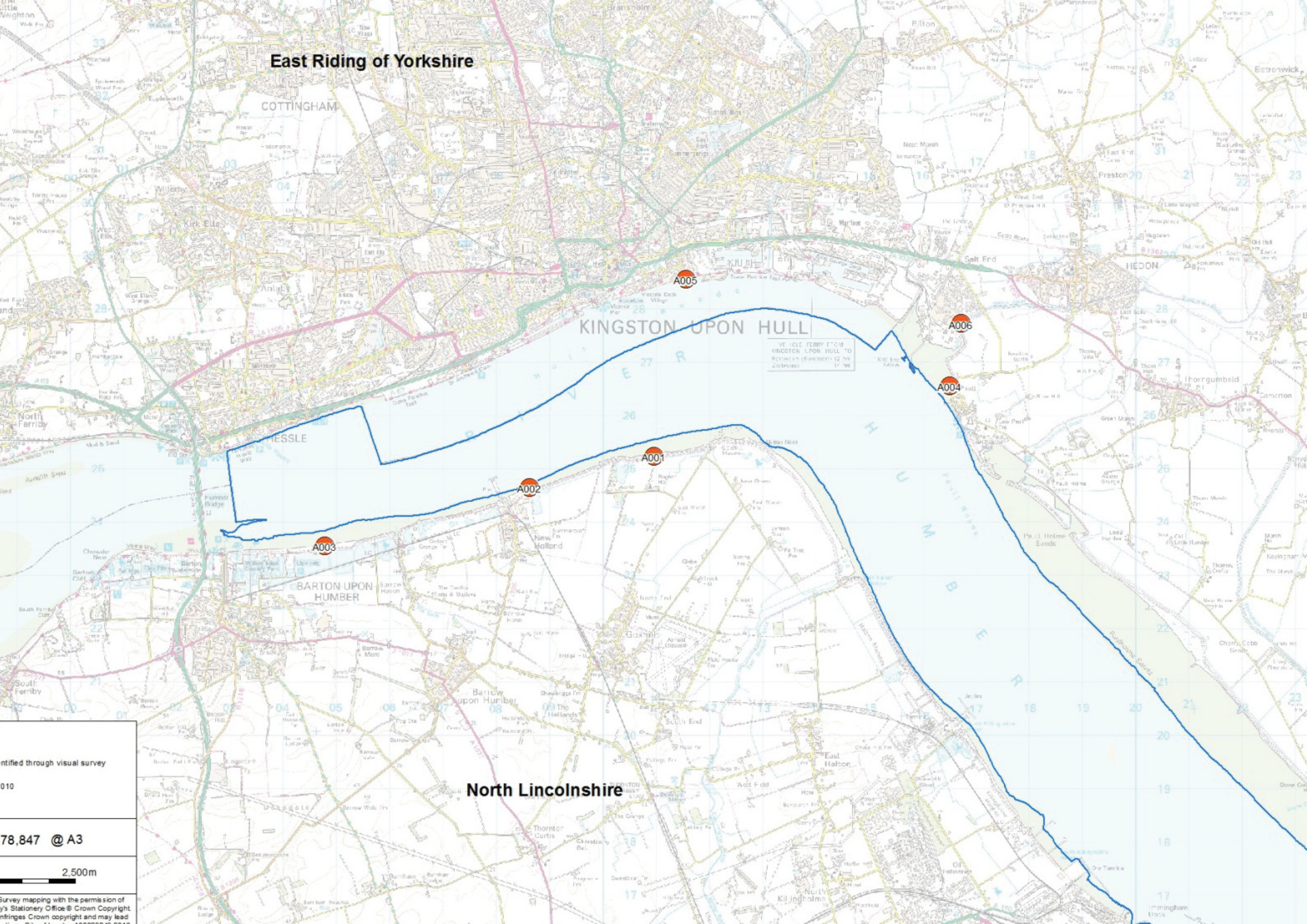
9.5 Results

9.5.1 The survey area was approximately 175km in length based on the edge of the Humber estuary and the north east Lincolnshire coast. In total the survey identified a potential 51 individual vessels with varying levels of confidence (low–high) which resulted in the identification of **six potential assemblages** with high confidence. This included the identification of one assemblage that is already recorded in the HER at Goxhill foreshore, but identified perhaps an extra three potential vessels as part of that assemblage.

Table 9.3 Assemblages identified through Google Earth and Bing Maps

Assemblage No.	Location / Name	No. in assemblage	Authority	x ref	y ref	Fig no.
A001	Goxhill Foreshore (assemblage identified in HER as 4 vessels)	7	North and North-East Lincolnshire	510953	425243	Fig 9.5
A002	New Holland Slipway	2	North and North-East Lincolnshire	508569	424689	Fig 9.6
A003	Pasture Wharf Dock	2	North and North-East Lincolnshire	504838	423499	Fig 9.7
A004	Hedon Haven	4	East Riding	516507	426515	Fig

Assemblage No.	Location / Name	No. in assemblage	Authority	x ref	y ref	Fig no.
			of Yorkshire			9.8
A005	Kingston upon Hull, south of Corinthian Way	3	East Riding of Yorkshire	511506	428499	Fig 9.9
A006	Graving Dock, Paull	7	East Riding of Yorkshire	516665	427706	Fig 9.10


East Riding of Yorkshire
COTTINGHAM
KINGSTON UPON HULL
HESSLE
BARTON-UPON-HUMBER
North Lincolnshire
A001
A002
A003
A004
A005
A006
ntified through visual survey
010
78,847 @ A3
2,500m
Survey mapping with the permission of
y's Stationery Office © Crown Copyright
nfringes Crown copyright and may lead

Evidence of assemblages in Bing Maps Bird's Eye view

9.5.2 The following figures are the supporting screenshots taken from Bing Maps Bird's Eye view of the hulk assemblages identified as a result of the visual survey.

Fig 9.5: A001: Goxhill Foreshore, looking south, showing a possible seven vessels. An assemblage of four vessels is recorded in the HER at this location.

Fig 9.6: A002: New Holland Slipway looking north, possible two vessels

Fig 9.7: A003: Pasture Wharf Dock looking west, possible two vessels

Fig 9.8: A004: Hedon Haven looking east, possible four vessels

Fig 9.9: A005: Kingston upon Hull, south of Corinthian Way looking north, possible three vessels

Fig 9.10: A006: Graving Dock, Paull looking north, possible seven vessels

9.6 Conclusion

9.6.1 The pilot study demonstrated that the use of satellite imagery as a preliminary means of identifying the presence of previously unrecorded hulk assemblages over a large survey area was quick and effective for identifying relatively recent craft not deeply buried. It could be used to identify individual vessels, but there is greater certainty when used as in this case to identify larger assemblages.

9.6.2 This method has the greatest strength when coverage on both Google Earth and Bing maps Bird's Eye is good. These two types of imagery complement each other. It remains a problem that the Bing maps images are not dated.

9.6.3 This method may be of value in other areas of the country that have not undergone NMP, or which have returned fewer than expected examples of hulks. It could also be of use to audit HER data. For example during the course of this survey it was noted that one of the HER points records a hulk in the docks at Grimsby in 2006 that has potentially since been removed based on the most recent Google Earth images.

9.6.4 Depending on the geology or the coastline this method could be less useful. In the Humber estuary it was good as the examples showed up clearly on the sand/silt of a wide foreshore. Identification may be more difficult on a rocky or narrow foreshore, and more completely buried vessels would almost certainly be missed.

Cost effectiveness

9.6.5 It took a while to evaluate all the sources of satellite imagery, and to work out a method. It is likely that as the data and software are updated then the method will also need to evolve. However this is a swift method for covering a large area for visual survey and using multiple sources that most importantly have a historic element of data means that the identification can be quite confident. Particularly on areas like the foreshore it is useful as remains are likely to show up better against sand/silt than potential buried remains inland.

Time breakdown

9.6.6 This was a linear survey, focussed as it was on the foreshore – 10km per day of foreshore to do the initial survey of Google Earth, transfer to GIS, check against Bing and Bird's Eye imagery, and extra 0.5 days per 10 points to label the points, take screenshots from online images and assess for assemblages.

9.7 Recommendations

9.7.1 This method is a swift and effective way of identifying potential archaeological features on the foreshore. As Bing Maps increases their Bird's Eye imagery coverage this will be even more useful. It would be worth keeping a close eye on the development of these free and easily accessible resources and their potential application in archaeology.

9.7.2 The assemblages identified were often concentrated in areas where it would be expected that vessels would be anchored or tied up, such as bays, docks, slipways or even next to groynes. Recognising these patterns means it is possible to predict areas that may have assemblages. It is possible that future work could include identifying former docks or slipways from historic Ordnance Survey maps that are no longer visible or obvious and concentrating on looking at these areas for potential assemblages or vessels.

9.7.3 Quite a few vessels that were tenuously identified during the initial Google Earth survey were later judged to be too tenuous to include as potential vessels or assemblages. Particularly areas that were initially thought to be examples of where vessels had been used to shore up the land. However closer observations using the Bing maps Bird's Eye imagery established that the evidence was not strong enough for a positive identification of an assemblage to be made. There was a danger that

during the survey quite natural curved geological shapes started to form themselves into boat shapes. This became more prevalent after a particularly long stretch of foreshore had revealed no examples.

9.7.4 A known example of a potential boat graveyard within the study area was checked in Google Earth, Bing Maps and Bird's Eye view, and was not identifiable as a hulk assemblage using these sources. However, if in future there was some way of having even tenuous identifications checked in person there is potential for the use of this type of survey to reveal more previously unidentified sites, particularly of the ship graveyard type which are likely to consist of partially buried vessels.

9.7.5 Initial identification could be guided by the professional judgement of a qualified archaeologist, but could be confirmed or denied by a site visit. This approach could use local English Heritage officers, or even volunteers. Perhaps an online interface could publish potential sites and ask for volunteers to check for any physical evidence of hulked vessels.

9.7.6 It is recommended that this method be used in other areas that continue to have significant gaps in the data. For example Cumbria, Merseyside, Dorset and Somerset.

9.7.7 It was recommended during the Steering Group Meeting of 12th December 2012 that the development and results of this Option should be written up as a note perhaps for inclusion in the IfA publication The Archaeologist, and to be circulated to English Heritage Aerial Survey Teams.

9.7.8 It was agreed that English Heritage may want to undertake further evaluation of this method before the potentially new results are entered into the NHRE.