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Historic Seascape Characterisation (HSC): Consolidating the National HSC Database

Final Report
Prepared by LUC
July 2017

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1 Introduction

Project background

1.1 Partly as a result of the recognition that there was increasing development pressure in the marine environment, English Heritage's (now Historic England's) statutory curatorial responsibilities were extended to England's share of Territorial Waters in 2002, and the Marine and Coastal Access Act 2009 was enacted, defining, amongst other matters, England's Inshore and Offshore Regions. In response to this, English Heritage (EH) extended its land-based Historic Landscape Characterisation (HLC) programme to the coast and seas, developing and testing a national method for Historic Seascape Characterisation (HSC) (Tapper 2008, revised version Tapper and Hooley 2010).

1.2 It was not considered to be practical in management terms to implement a single national HSC project, so national coverage was undertaken in eight separate implementation projects from 2008 to 2015. The eventual need for integrating these separate projects was recognised from the start, so accordingly all projects worked to the national HSC methodology, using the same GIS attribute table, controlled terminology and symbology, and the need for inter-project consistency was emphasised to all HSC contractors.

1.3 However, there are some inconsistencies across the projects, which are inevitable given the considerable differences in the character of the historic seascape across the different project areas, the number of different people involved, and the increasing availability of data sources over the years. Some of these inconsistencies were recognised and addressed at the time of the projects implementation, but some, although not anticipated to be substantial, remained to be addressed as part of a national consolidation project.

1.4 Whilst separate projects' HSC data have been successfully applied in combination for informing marine planning, including the MMO Seascape Assessment for the South Marine Plans, and the North Devon and Exmoor Seascape Character Assessment, the lack of a unified, consistent NHSC database means that data usage at a national scale makes it impractical for the HSC to be fully utilised for its intended national strategic application.

1.5 The more extensive inconsistencies in England's terrestrial HLC coverage are concurrently being addressed through a separate project (the National HLC project) managed by Natural England. The consolidation work on the NHSC database will interface with the NHLC work, providing full, consistent national historic characterisation coverage across England's land, coasts and seas, which will be a major achievement for the understanding and management of England's historic environment.

Research Aims and Objectives

1.6 The main aims of the project were:

- to ensure that the strategic-level management of change affecting England's seascape and the heritage assets for which it provides context is underpinned by consistent, comprehensive baseline evidence for that seascape's historic character.
- to enable prompt, well-informed and fully contextualised responses to proposals for change affecting England's historic seascape by providing promptly accessible and retrievable strategic-level baseline information about its character.
- to structure, inform and stimulate future research programmes and agendas relating to the coastal and marine historic environment.

- to create a resource that will improve the awareness, understanding and appreciation of the historic dimension of the coastal and marine environment to its professional and non-professional users.

1.7 The main objectives were:

- to use the GIS databases and linked texts produced by the eight HSC Implementation Projects to compile a unified and internally consistent NHSC database covering the full extent of England's Inshore and Offshore Regions and those parts of England's coastal land with a distinct maritime character.
- to complement the GIS and relational/geo database elements of the NHSC database with a structured texts element, drawn directly from those produced by the HSC implementation projects, documenting each Character Type in the project area from national and regional perspectives, in non-specialist language and supplemented by imagery.
- to ensure that the resulting NHSC database is internally consistent throughout in structure and format.
- to ensure that the NHSC database is structured and presented in a manner that accommodates its size while enabling efficient storage, manipulation, query, retrieval, supply and updating of its content.
- to ensure that the NHSC database is capable of selective and/or comprehensive updating and to document how that can be undertaken.
- to ensure that the NHSC database is fully compliant with the approach contained in the revised working draft of the National HSC Method Statement (Tapper and Hooley 2010) and meets the available data and metadata standards of Historic England (HE) and the main anticipated end-users for the NHSC database to enable their engagement with it.
- to produce a Project Report documenting in detail the project's implementation of its Stages and Tasks and evaluating the extent to which it meets these project aims (this report). To meet needs for transparency and to assist future database updates, the Report provides:
  - a technical overview of the structure of the NHSC GIS, its geodatabase and text linkages
  - an overview of the database's HSC structure, including a table giving the hierarchical arrangement of the HSC terms used
  - a statement of the data and metadata standards to which the NHSC database has been compiled and their extent of compliance with identified end-user requirements
- to produce technical guidance relevant to Historic England (HE) needs in respect of the NHSC database: its amendment for future selective or comprehensive updating; its storage and options for its data supply with particular consideration to the database size and any tools and rules beyond those normal to GIS.
- to produce a concise User Guide to the NHSC database for dissemination with it to its future end-users: covering both its GIS and HSC structures, database querying, display and data retrieval, and accessing the linked text data.

Project Scope and limitations

1.8 The Project draws together the eight HSC national implementation projects, while maintaining links to their associated text data, to produce a single unified NHSC database applying the approach in the latest update of the National HSC Method Statement (Tapper and Hooley 2010) across the full extent of England's Inshore and Offshore Regions (Marine and Coastal Access Act 2009, Section 322) and extending landward as far as those implementation projects identified a distinctively maritime historic cultural character across coastal land. This consolidation project has not undertaken extensive re-working of the eight project databases' characterisations but some limited reworking of specific areas was needed to resolve issues of consistency between the contributing project databases. Beyond that, the internal content of their characterisations has been accepted as received.

1.9 Where reworking of the data has been required, it is important to note that only limited source data was available for this work; in some cases, this data was not the same as that used in the original projects.

1.10 The Project has drawn heavily on the knowledge and experience of Historic England's Project Assurance Officer (PAO), Dave Hooley, in resolution of several identified issues. The PAO has extensive knowledge of the development and implementation of HSC, having been involved since its inception. Where resolutions deployed in this Project have been influenced by the advice of the PAO, this is noted in the explanatory text.

2 Method

2.1 This section provides an overview of the tasks undertaken to consolidate the eight project databases into a single NHSC database. In the next section, each of these tasks is explained in more detail, describing the findings and resolution of each issue encountered.

Table 2.1 Overview of project methodology

Task	Overview of actions
Stage 1: Set up, data acquisition and familiarisation	
1. Data acquisition	• Requesting and obtaining HSC project data • Obtaining contextual GIS data and information
2. HSC project familiarisation	• Familiarisation with National HSC Method Statement • Familiarisation with HSC projects' products • Creation of project log
3. Inception meeting and stakeholder notification	• Discuss and agree overall aims and objectives • Gain understanding of history and development of HSC methodology • Notification of stakeholders
Stage 2: Review of project databases and identification of inconsistencies	
4. Projection review	• Investigation into GIS data projections • Review of project reports • Visual inspection of data against Ordnance Survey basemapping
5. Project grids and axial alignment	• Review project reports to understand origins of project grids • Visual examination of project grids • Inspection of grids at project interfaces • Logging of grid alignment issues – vertical and horizontal discrepancies
6. Geometry and topology review	• Running data through data checking tools • Identification and logging of topology and geometry problems • Identification of gaps and overlaps
7. Attribute table review	• Identification of attribute table inconsistencies • Creation of attribute concordance tables
8. Hyperlink and character description review	• Review of supporting texts • Hyperlink functionality check • HSC Thesaurus conformity check
9. Terminology review	• Review of controlled terminology usage • Identification of terms not consistent with HSC Thesaurus
10. Project interfaces	• Review of GIS polygons at project interfaces (gaps, overlaps) • Visual review of characterisation at project

Task	Overview of actions
	interfaces
11. Functionality and ease of use	• Logging project loading speeds • Testing data functionality (for use in geoprocessing tools)
Stage 3: Resolution of issues	
12. Project meeting	• Presentation of review findings • Establishing course of action to resolve each issue identified
13. Geometry repair	• Data cleansing to correct geometry problems
14. Merging databases	• Creation of single HSC geodatabase • Importing and merging all project databases into a single feature class • Realignment of attributes
15. Automated topology corrections	• Categorisation of topology issues • Identification and elimination of small or thin gaps • Identification and elimination of overlaps (within land data) below 1ha • Rule-based elimination of larger land overlaps • Resolution of land/sea overlaps • Resolution of project interface data overlaps • Infilling of gaps between project areas (uncharacterised areas)
16. Thesaurus updates	• Agreement on additional terms to be included in the HSC Thesaurus based on review of terminology
17. Terminology alignment	• Correction of fields with controlled terminology • Use of terminology concordance tables to batch update Broad Type, Type and Sub-Type • Use of additional contextual data to correct or refine character terms • Manual update of remaining inconsistencies with recourse to source data
18. Manual topology corrections	• Manual resolution of remaining gaps and overlaps with recourse to source data
19. Characterisation corrections	• Identification of project interface characterisation unconformities • Re-characterisation to enhance strategic characterisation patterns
20. Geodatabase set up and data loading speed improvements	• Creation of final NHSC geodatabase and supporting files • Creating domains and indexes
21. National Perspective texts	• Addition of hyperlinks to National Perspective Texts
22. Creation of project outputs	• Set up of project mxd • Creation of supporting file structure • Reporting • Creation of Technical Advice Note and User Guide • Creation of metadata • Creation of project grids • Creation of sample raster version with 500m

Task	Overview of actions
	resolution

3 Task Execution

3.1 This chapter is set out by the tasks in the method table (**Section 2**) and describes each process or task under these headings.

Stage 1: Set up, data acquisition and familiarisation

3.2 This stage involved a 'light touch' examination of all of the project outputs and familiarisation with the HSC method.

Task 1 Data acquisition

HSC project data

3.3 At the outset of the study, all of the final HSC GIS project files, reports and linked texts were supplied on DVD by HE. The files were organised by project and totalled approximately 900 individual files.

3.4 With the exception of one of the project areas, no fully gridded (undissolved grids) were available. Furthermore, none of the project datasets included a definitive study area shapefile that formed the bounds of the project areas.

Further contextual data

3.5 A number of supporting documents were provided:

- Historic Seascape Characterisation (HSC): National HSC Method Statement 2010 v2.5 – the latest version of the method statement.
- HSC Character Type Structure Terms v2.5 – the latest version of the HSC Thesaurus.
- HSC Style Sheet – latest agreed colour palette.

3.6 Whilst it was considered essential to have access to some of the GIS data layers that had informed the original projects, it was not considered feasible to obtain all of the datasets that had been used by each of the project teams.

3.7 Taking a pragmatic approach, it was considered most important to have access to detailed base-mapping information for the project interfaces. The project team loaded all of the HSC project databases into GIS and drew a line at each of the project interfaces. From this, a 25 km buffer was created and these areas formed the data request area. Within these areas, the following data was obtained:

- OS MasterMap;
- OS25k;
- OS50k;
- OS Historic Mapping[1]; and
- Seazone Hydrospatial data[2].

[1] Raster tiles for Epochs 1 – 7 at 1: 2,500 (County Series and National Grid), 1:10,560 (County Series) and 1:10,000 (National Grid) scales.

[2] Layers received *BathymetryAndElevation*, *ConservationAndEnvironmentalProtection*, *NaturalAndPhysicalFeatures*, *SocioEconomicAndMarineUse* and *StructuresAndObstructions*

3.8 These were understood to be the key common sources used in attribution by the implementation projects. The above data was provided by HE as spatially separate files covering each of the project interfaces.

3.9 All received data was logged and filed in an orderly manner to make it easily accessible for the project team. To aid usability, the spatially separate SeaZone data for project interfaces was merged on a theme by theme basis[3].

3.10 UKSeaMap data was not supplied for the project but a revised version was downloaded from JNCC (JNCC, 2017).

Task 2 HSC project familiarisation

Approach to review

3.11 Project familiarisation was carried out by completing a review of the project reports and by loading the project data in GIS in order to become familiar with the different project areas and identify usability issues.

3.12 A template was set out to record the process of project familiarisation, and log specific issues. A sample of the project familiarisation log is shown in **Table 3.1**. Project information such as the study area, project team name and completion date were recorded. Information from the report relating to data projection and the source of the project grid were also recorded. In addition, transformation issues, loading speed and hyperlink function were noted in this task.

3.13 The project team familiarised themselves with the latest iteration of the HSC methodology as well as the development and history of HSC.

Issues identified

3.14 The review highlighted that file names were inconsistent between projects, data was stored in different formats (some in geodatabases and some as shapefiles) and the project folder structures were complex, with a large number of subfolders nested in each.

3.15 During the review of data, slow loading speed was noted for some project areas; in addition, some projects contained hyperlinks which did not work. These issues were recorded for resolution later in the project programme.

3.16 Unconformity in the sea grid between projects was highlighted as an issue in the Project Brief. A review of the project reports revealed that the source and origin point of the grid was unclear in some cases. Investigation of grid conformity was noted for resolution later in the project programme.

3.17 In order to make the files easier to work with, the study area names were simplified to a letter and the main HSC data set from each project was saved in a single new geodatabase for ease of access.

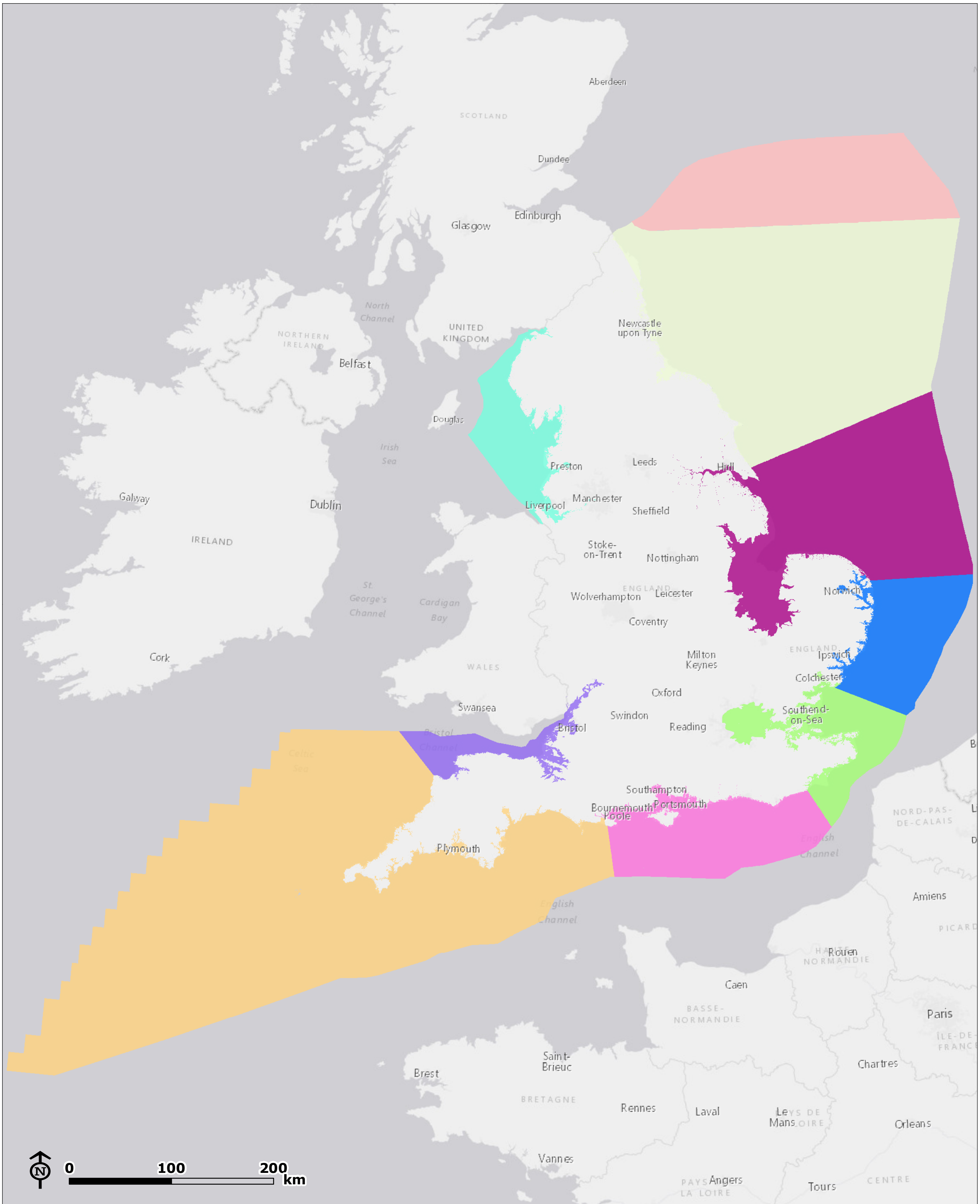
3.18 **Table 3.1** shows the letter that was assigned to each project. The table is organised in chronological order. These letters are used throughout this report to reference study areas. **Figure 3.1** shows the location of each of these project areas.

3.19 Whilst working with the data in GIS, it became apparent that it was not possible to perform some simple geoprocessing tasks (such as clipping out subsets of data), indicating that the basic geometry and topology of some of the datasets required checking and possibly repairing in order to make the data usable.

[3] i.e. the spatially separate layers for *SocioEconomicAndMarineUse* supplied and covering each join were merged into a single *SocioEconomicAndMarineUse* layer within our project GIS.

Table 3.1 Project detail summary (links accessed April 2017)

LUC project labels	Historic England project number	Study area name	Project team	Date project completed	Online report link	Speed of loading	Report reference
H	5555	North East Coast and Seas	SeaZone Solutions Limited	2009	Link	Fast	SeaZone Solutions Limited, 2009
D	5726	Hasting-Purbeck	Maritime Archaeology SeaZone Solutions Limited	2011	Link	Slow	Maritime Archaeology and SeaZone Solutions Limited, 2011
F	5735	Newport-Clacton	Oxford Archaeology	2011	Link	Fast	Oxford Archaeology, 2011
A	5843	Irish Sea	Newcastle University	2011	Link	Fast	Newcastle University, 2011
B	5844	Bristol Channel-Severn Estuary	Cornwall Council SeaZone Solutions Limited	2011	Link	Fast	Cornwall Council and SeaZone Solutions Limited, 2011
I	6228	East Yorkshire to Norfolk Area 1	Newcastle University	2012	Link	Fast	Newcastle University, 2012
G	6228	East Yorkshire to Norfolk Area 2	Newcastle University	2012	Link	Fast	Newcastle University, 2012
C	6230	South West Peninsula	Cornwall Council	2014	Link	Very slow	Cornwall Council, 2014
E	6265	Thames-Kent	Cotswold Archaeology	2014	Not available	Fast	Cotswold Archaeology, 2014



- A: Irish Sea
- B: Bristol Severn
- C: South West Peninsula
- D: Hastings Purbeck
- E: Kent Thames
- F: Newport Clacton
- G: East Yorkshire to Norfolk Area 2
- H: North East Coast
- I: East Yorkshire to Norfolk Area 1

Source: Historic England

Map Scale: 1:5,300,000 @ A4

Consolidating the National Historic Seascape Characterisation Database

Figure 3.1: HSC project extents and naming

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Historic England

CB:KS EB:Stenson_K LUC FIG3_1_6738_r1_Project_Extent_A4P 15/05/2017

Task 3 Inception meeting and stakeholder notification

3.20 Following a period of familiarisation, a project inception meeting was held with the HE PAO, Dave Hooley, and key members of the project team. This provided an opportunity to discuss the overall aims and programme for the study as well as share key contacts with the project team.

3.21 The HE PAO provided useful contextual information on the history and development of the HSC methodology over the past decade.

3.22 Following the inception meeting a number of stakeholders were notified about the project. Stakeholders included:

- ALGAO Maritime Committee
- Natural England
- Landscape Institute
- Marine Management Organisation
- National HLC project team (via Natural England NHLC Project Lead)

Stage 2: Review of project databases and identification of inconsistencies

3.23 This stage included an in depth examination of each dataset to identify any issues that would affect the consolidation process. During this stage, steps were agreed to resolve each of the identified issues – all of which were resolved in Stage 3. To assist in this process the HE PAO was able to arrange contacts for database queries with the contractors who undertook HSC project areas A, B, C, F, G and I.

Task 4 Projection review

Approach to review

3.24 The project brief noted inconsistencies in the HSC grid between project areas, issues with projection was suggested as a potential cause. Some investigation was carried out into the projection of the individual HSC grids to ascertain whether there were inconsistencies in the projections between project areas.

3.25 A comparison of an HSC grid was made when projected in BNG versus WGS84. **Figure 3.2** shows the comparison of the grid, the 'stretched' appearance of the grid in WGS84 alongside the 'uniform' appearance of the grid in BNG indicates that the grid was created in BNG. This was the case for all of the project areas.

Consolidating the National Historic Seascape Characterisation Database

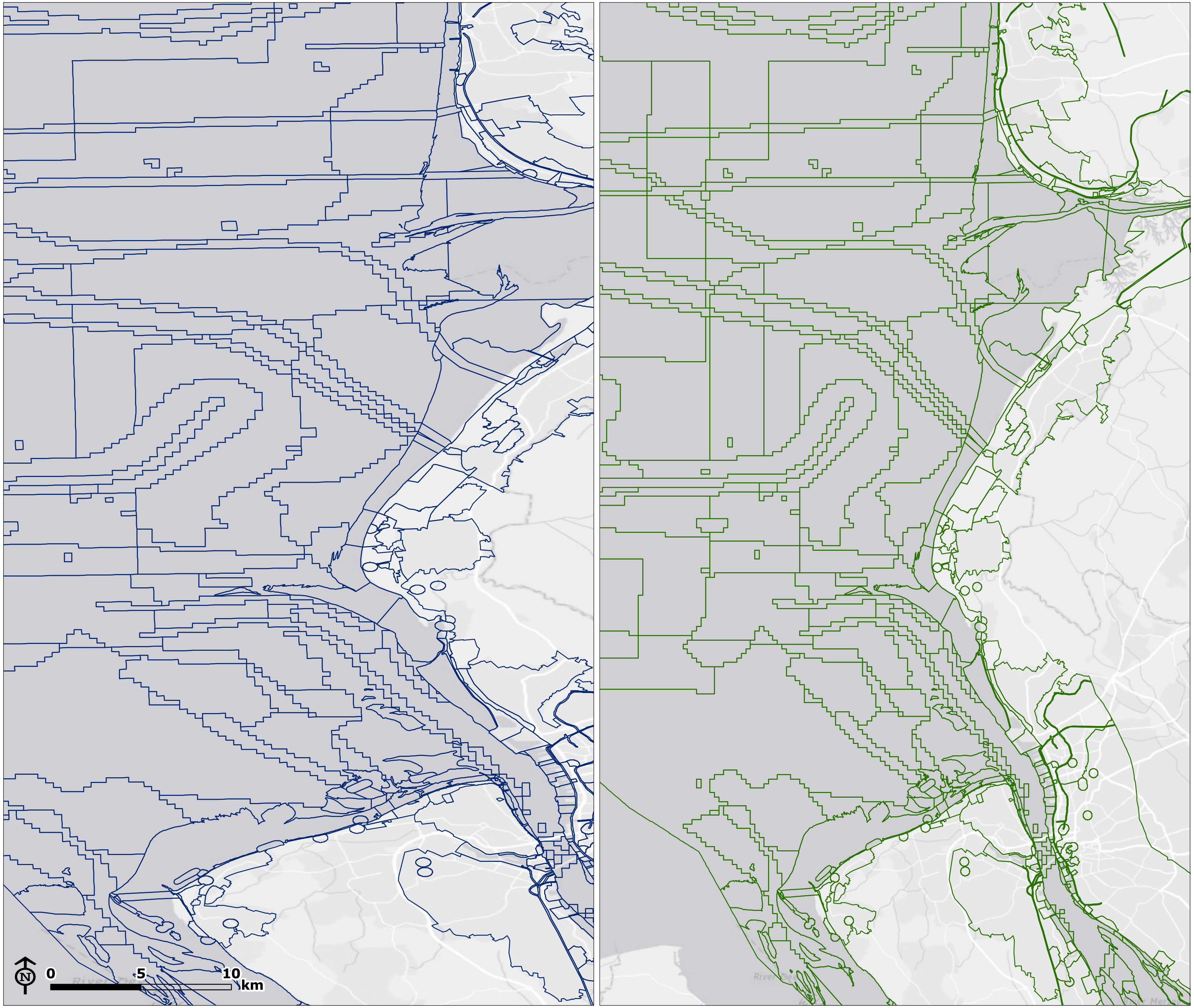

Figure 3.2: HSC grid compared in BNG and WGS84

HSC in WGS84

HSC in BNG

Source: HE

Map Scale: 1:300,000 @ A4

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Historic England

3.26 The project reports were reviewed in order to investigate what projection the marine data was collated in and the data was also checked to identify the current projection; findings are outlined in **Table 3.2**. All project outputs were found to have been delivered in British National Grid (BNG) as per the specifications of the individual project briefs. All project reports stated that the marine data used a geographic coordinate system based on the WGS84 datum and was projected to the British National Grid for final project delivery.

Table 3.2 Review of data projection description in project reports

LUC project labels	Relevant text from reports
A	*UK reference datum for terrestrial datasets are typically in the Ordnance Survey British National Grid based on the Ordnance Survey Great Britain 1936 (OSGB36) datum which is intended to provide as little distortion as possible for the UK as a whole. However distortion increases the further one gets away from the centre of the UK, and for this reason, maritime datasets use the World Geodetic System 1984 datum (WGS84) which gives a better fit for the earth as a whole. Terrestrial sources were transformed into OSGB36 prior to inclusion in the character assessment. All marine source data were transformed into OSGB36 using conversion algorithms in ArcGIS.*
B	*The project work was therefore undertaken using a WGS84 based and Transverse Mercator projected Coordinate Reference System (CRS). The WGS84 / UTM Zone 31N CRS (EPSG: 32631) was suitable for this project. Data is delivered referenced to British National Grid as required by the project terms of reference. Datum transformations between OSGB36 and WGS84 were undertaken using a version of the OSTN02 transformation that has been extended for use beyond its normal 10km offshore limit.*
C	*Final characterisation was produced to British National Grid co-ordinates (OSGB36). However, as maritime datasets are produced for below MLW they use a WGS84 projection. Therefore the initial data preparation stages for marine datasets used a WGS84 based and Transverse Mercator projected Coordinate Reference System (CRS). The WGS84 / UTM Zone 31N CRS (EPSG: 32631) was suitable for this project.* *Datum transformations between OSGB36 and WGS84 were then undertaken using a version of the OSTN02 transformation that has been extended for use beyond its normal 10km offshore limit. All marine datasets were therefore transformed in this way for processing below MLW and were converted back to British National Grid, before integration with the character areas above MLW.*
D	*The project work was therefore undertaken using a WGS84 based and Transverse Mercator projected Coordinate Reference System (CRS). The WGS84 / UTM Zone 31N CRS (EPSG: 32631) was suitable for this project. Data was delivered referenced to British National Grid as required by the project terms of reference. Datum transformations between OSGB36 and WGS84 were undertaken using a version of the OSTN02 transformation that has been extended for use beyond its normal 10km offshore limit.*
E	*Mapping of the marine area was undertaken using a WGS84 based and Transverse Mercator projected Coordinate Reference System (CRS). The WGS84 / UTM Zone 31N CRS (EPSG: 32631) was suitable for this project.*
F	*All the projects destined for marine data and analysis were Projected into the WSG84 / UTM Zone 31N CRS, whilst the landward project were set-up under the British National Grid Projection.*
G	*Terrestrial sources were transformed into OSGB36 prior to inclusion in the character assessment. All marine source data were transformed between OSGB36 and WGS84 using conversion algorithms in ArcGIS.*
H	*The project work was therefore undertaken using a WGS84 based and Transverse Mercator projected Coordinate Reference System (CRS). The WGS84 / UTM Zone 31N CRS (EPSG: 32631) for the marine area. Data capture on land was undertaken referenced to British National Grid. Datum transformations between OSGB36 and WGS84 were undertaken using a version of the OSTN02 transformation that has been extended for use beyond its normal 10km offshore limit. All marine datasets were therefore transformed in this way for processing below MLW and were converted back to British National Grid, as required by the project terms of reference, before integration with the character areas above MLW.*
I	*Terrestrial sources were transformed into OSGB36 prior to inclusion in the character assessment. All marine source data were transformed between OSGB36 and WGS84 using conversion algorithms in ArcGIS.*

3.27 The data was visually spot checked against Ordnance Survey maps in BNG. Any data incorrectly converted between projections or digitised without the correct transformation would be indicated by an offset from base maps.

Issues identified

3.28 Whilst it was sometimes unclear what transformation had been used to project the data into BNG, no projection issues were identified. This meant that the misalignment of the HSC grid between project boundaries required further investigation (see **Task 5**).

3.29 Whilst characterising gaps (**Task 10**) in the data at Portsmouth, it was noted that the data appeared to be offset between Warsash and Portsea Island. This originally appeared possibly related to a transformation issue, as the offset was in the same direction and of the same magnitude in all cases, but on review appears more likely to be a digitising error and not caused by incorrect projection.

Implications for consolidation

3.30 No implications regarding projection issues were identified.

Assumptions and limitations

3.31 The findings of this review were based on visual assessments of the data, the information documented in the project reports and professional judgement. Without access to the original working files and further information on the transformations used, issues relating to projections within each study area are difficult to identify. However, the project team felt confident ruling out projection issues as a factor causing the misalignment of the HSC grids.

Task 5 Project grids and axial alignment

Approach to review

3.32 H (North East Coast and Seas) was the first project to be completed. During this study, a grid building tool was created by Seazone Ltd for use in future HSC projects. The tool was designed to create grids with conforming structure in order to ensure project alignment, and was described in the report as:

> "*an ESRI-compatible GIS tool was created to enable a range of sized vector grid tiles (polygons) to be produced across the project area. The tool is designed to ensure that all grids produced for future HSC projects can conform to the same grid structure, aligning themselves when viewed alongside each other, thus encouraging coherence and interoperability between different project areas. The tool is designed to produce cells referenced to British National Grid co-ordinates (OSGB36)*."

3.33 Later Project Briefs made reference to the need to "*ensure its marine vector grid mesh conforms in orientation and axes with that already applied by other projects contributing to the national HSC database."*

3.34 Unfortunately the Tool itself was not available for the consolidation exercise, but it is understood that each project grid was created using the ET Geowizards Vector Grid Tool which creates a polygon vector grid using user defined extents and cell size.

3.35 The project familiarisation information collected during **Task 2** was used to identify the source of the grid for each project and any issues identified with the grid during the project.

3.36 The data was examined for grid offset between projects, grid dimension consistency (i.e. whether the grids were 250 m x 250 m) and axial alignment.

Issues identified

3.37 **Table 3.3** and **Table 3.4** show the extent of the horizontal and vertical discrepancies when comparing project grids. This assessment used the Project I grid as the origin against which all other grids were measured.

3.38 Project reports for A, B, D, E and F described using the grid tool to construct the grid framework, however none aligned/meshed with project H, something that use of the grid tool should have ensured. Grids for projects A, D, E, F did align (or mesh) with each other.

3.39 Projects C, G and I did not use the grid tool.

3.40 The grid for project C was built using the description in **Table 3.3** and it was acknowledged in the report that the grid did not align to the neighbouring project areas.

3.41 The grid for G and I (completed as the same project by Newcastle University) was described as having been built off the grid for project H, and it was acknowledged that the grid did not align to project F. However, there is also an offset between projects G/I and H.

Table 3.3 Summary of grid sources from project reports

Project	Grid source	Issues identified
A	ET Geowizards Vector Grid Tool	
B	ET Geowizards Vector Grid Tool	
C	Produced using the Universal Transverse Mercator (UTM) grid for 30N and 29N in WGS84 projection. The grid was then reduced in size to 1 km2 squares and finally down to 250 m2. The 250 m2 grid was then converted into OSGB36 projection.	This was then visually compared with the grids used in the Bristol Channel-Severn Estuary and Hastings-Purbeck project areas, with a small visible displacement observed with the South West Peninsula project area.
D	ET Geowizards Vector Grid Tool	
E	ET Geowizards Vector Grid Tool	
F	ET Geowizards Vector Grid Tool	
G	Grid built off the grid in project H.	No match to grid in F
H: first project	ET Geowizards Vector Grid Tool	
I	Grid built off the grid in project H.	No match to grid in F

3.42 **Table 3.4** shows the extent of the horizontal and vertical discrepancies when comparing project grids. This assessment used the Project I grid as the origin against which all other grids were measured.

Table 3.4 Summary of project grid discrepancies

Project	Grid matches	Grid shift	
		x	y
A	Match	94 m	29 m
B		12 m	20 m
C		12 m	33 m
D	Match	94 m	29 m
E		94 m	29 m
F		94 m	29 m
G	Match	0 m	0 m
H: first project		<1 m	4.4 m
I	Match	0 m	0 m

3.43 Lack of grid alignment created gaps and overlaps between project areas. This is described in more detail under **Task 15**.

3.44 **Figure 3.3** shows the impact of these horizontal and vertical discrepancies at each of the project interfaces.

3.45 No issues with axial alignment were identified.

3.46 Grid dimension inconsistency was identified in project B, H and D. Projects H and D had slight variation in grid size throughout the project areas, and project B had consistent grid sizes but were not exactly 250 m x 250 m.

Implications for consolidation

3.47 Grids that did not mesh/align meant that it was not a straightforward exercise of stitching the project areas together in order to get a seamless dataset. A number of options were considered at this stage, and explored with the PAO. These options are explored in **Table 3.5** below.

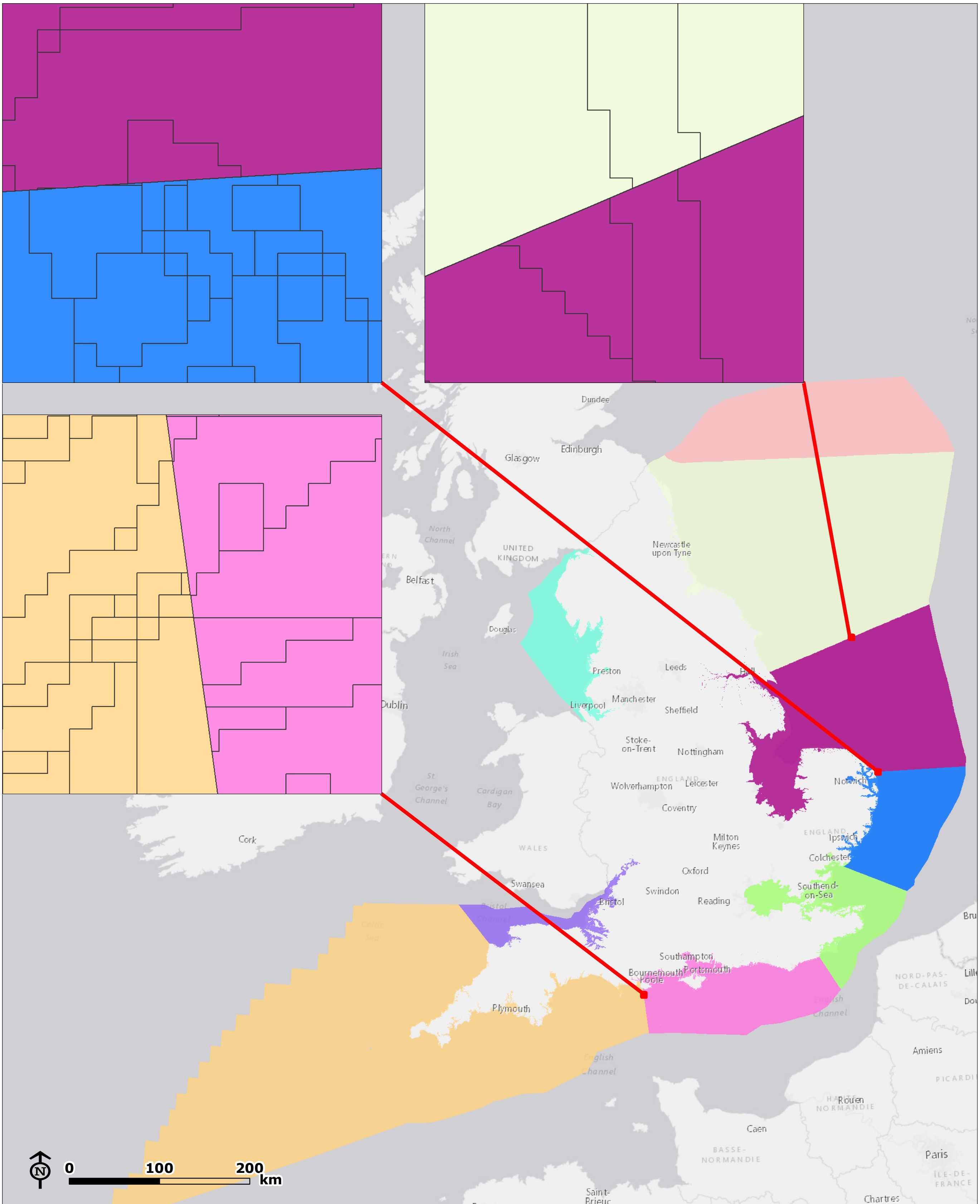
Table 3.5 Options explored for grid consolidation

Option	Description	Pros	Cons	Pursue?
1) Force the grids to align by shifting them	Move the datasets in their entirety to stitch the grid cells together in a single, aligned grid.	The grid cells would have a neat, uniform appearance.	Shifting the sea data would result in a loss of the relationship to the source data. Land data cannot be shifted as it is relates to existing boundaries and features.	No
2) Reconstructing a new national grid and forcing the data into it	Use ETGeowizards to create a new vector grid and force the gridded data into this.	A single grid covering the entire extent. Polygons on land could be left as is.	Would need to use existing grid cell centre points to retrofit the existing data into a new grid framework. This would result in a loss of the relationship to the source data.	No
3) Rasterising the data	Create a 250m resolution raster dataset from the existing vector data.	A single layer with a consistent land and sea grid framework. Much less data heavy.	Loss of detail on land and similar shifting of data to fit a new grid framework resulting in a loss of the relationship to the source data.	No, but this rasterisation was trialled – see para. 3.172 of this report for further information.
4) Retaining existing grid framework and dealing with overlaps and gaps created as a result	Take all existing grid frameworks and merge them together (using a union in GIS), allowing for zones of undersized grid cells at the project interfaces.	Retains the integrity of the data – maintaining the relationship with the source data.	Creates multiple overlapping polygons at the project interfaces and in some cases gaps that require filling. Grid is not tidy at the interface.	Yes

3.48 Each option was explored and discussed with the PAO. Ultimately, it was agreed that the benefits of retaining the integrity of the data (and the link to the original source data) outweighed the benefits of forcing the data into a neat grid, and Option 4 was taken forward.

Assumptions and limitations

3.49 Cell size variation was no greater than 0.1 m from the required 250 m x 250 m grid. This level of error is not considered an issue as the NHSC database is designed for use at a strategic level and due to the method of data collection an error of up to 125 m^2 is acceptable (Tapper and Hooley 2010).



- A: Irish Sea
- B: Bristol Severn
- C: South West Peninsula
- D: Hastings Purbeck
- E: Kent Thames
- F: Newport Clacton
- G: East Yorkshire to Norfolk Area 2
- H: North East Coast
- I: East Yorkshire to Norfolk Area 1

Source: Historic England

Map Scale: 1:6,000,000 @ A4

Consolidating the National Historic Seascape Characterisation Database

Figure 3.3 Examples of grid alignment issues at project interfaces

LUC

Historic England

CB:KS EB:Stenson_K LUC FIG3_3_6738_r1_Grid_Alignment_Issues_A4L 15/05/2017

Task 6 Geometry and topology review

Approach to review

3.50 In earlier stages of the study, it had emerged that it was not possible to undertake relatively simple geoprocessing tasks such as clipping on some of the datasets, indicating that there may be some geometry and topology issues in the datasets.

3.51 Each dataset was tested using the ArcMap Check Geometry tool. Data was checked for geometry problems to ensure compliance with the Guidelines for English Heritage projects involving GIS (Historic England, 2004).

3.52 The Check Geometry Tool in ArcMap identifies the following geometry issues, creating an output table with identified issues:

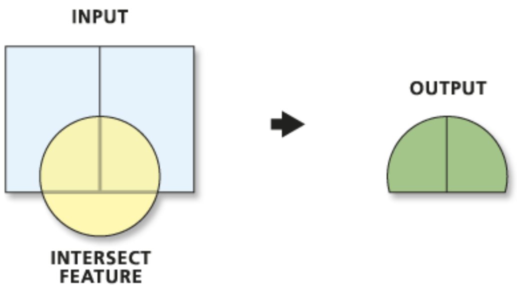
- Short segment
- Null geometry
- Incorrect ring ordering
- Incorrect segment orientation
- Self-intersections
- Unclosed rings
- Empty parts
- Duplicate vertex
- Mismatched attributes
- Discontinuous parts
- Empty Z values
- Bad envelope
- Bad dataset extent

3.53 Unfortunately, despite projects' reports generally stating compliance with the HE GIS data guidance, issues were identified in all but one of the datasets (the exception being project I). These issues were unexpected, and some were affecting the usability of the datasets – loading times, ability to perform geoprocessing tasks, etc.

3.54 In addition to geometry issues, topology issues were investigated, these included data overlaps and gaps (within single project areas rather than between project areas).

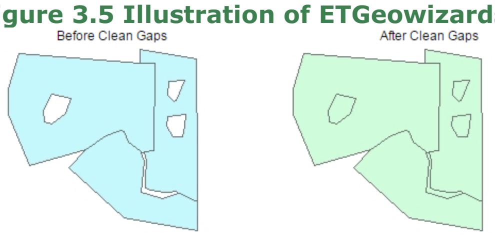
3.55 Overlapping polygons had been anticipated between project areas, but not within individual project datasets. The Intersect tool in ArcMap was used to identify if there were any overlapping polygons within individual project datasets. Each project dataset was run through the Intersect tool in order to produce a set of polygons indicating where the data overlaps. **Figure 3.4** illustrates what the Intersect Tool does.

Figure 3.4 Illustration of ArcMap Intersect Tool (ESRI, 2017a)



3.56 Similarly, whilst gaps between project areas had been anticipated at the outset, gaps within individual project datasets had not been anticipated. The Clean Gaps tool in ET Geowizards was used to identify where there were gaps within project datasets. This tool generates a dataset that has all gaps (voids enclosed by other polygons) filled with polygons, attributed only with the term 'gap'. **Figure 3.5** illustrates the effect of using the Clean Gaps Tool.

Figure 3.5 Illustration of ETGeowizards Clean Gaps Tool (ET Spatial Techniques, 2017)



Issues identified

3.57 The results of geometry and topology checks are summarised in **Table 3.6**. Project I was the only data set with no geometry or topology issues. Projects A through H contained large numbers of overlaps, gaps in the data and various other geometry issues. Whilst some problems were located in the sea data, the majority of issues were found within the land data.

Table 3.6 Geometry and topology check results

Project	Intersect result	Geometry Check result	Clean Gap result
A	Overlaps in data	Self-intersects	Gaps in data
B	Overlaps in data	No problems	Gaps in data
C	Overlaps in data	Self-intersects, null geometry	Gaps in data
D	Overlaps in data	Self-intersects	Gaps in data
E	Overlaps in data	Self-intersects	Gaps in data
F	Overlaps in data	No problems	Gaps in data
G	Overlaps in data	Self-intersects	Gaps in data
H	Overlaps in data	Self-intersects, bad envelopes, unclosed rings	Gaps in data
I	No overlaps	No problems	No gaps

Implications for consolidation

3.58 Geometry issues can slow data loading speed and can prevent geoprocessing tasks from completing successfully.

3.59 Topology issues (gaps and overlaps) in the project data makes the data inconsistent with the National HSC Method Statement and the HE GIS data guidelines, thus requiring addressing in order for the consolidation to be successful.

Task 7 Attribute table review

Approach to review

3.60 A tool built in Python script was used to export all the attribute details of each project dataset into a spreadsheet for review. Using the NHSC database attribute specification in the National HSC Method Statement (Tapper and Hooley 2010), the exported project attribute tables were compared to the attributes outlined in the method statement using the VLOOKUP function in Microsoft Excel.

3.61 The aim of this review was to ensure that all attribute tables were consistent with the National HSC Method Statement (Tapper and Hooley 2010) as well as to identify issues that would affect the merging of project attribute tables into a single database.

Issues identified

3.62 A review of the prescribed attribute structure in the method statement raised three issues that require clarification:

- The AREA field is described as a string format, however this format is not suitable for a numerical value, all projects used a numerical format in contrast to the method statement. When HSC data is stored in a geodatabase, a default area (in metres squared) field is created and updates automatically if the area changes. This is a more appropriate format for this area data.
- The CELL_SZ field is described as a numeric format. There are several options for numeric formats in GIS data such as 'double', 'single', 'long', 'short', 'float'. Lack of clarification on the required numeric format in the method statement has led to inconsistency in numeric format between projects.
- The Previous HSC Type fields imply that the field should hold information on Type, whereas the GIS field names are PRVS_SBTY1, 2 etc. which implies the data should be at Sub-type level. This inconsistency resulted in some projects recording data on Types, and some on Sub-types.

3.63 All projects used different field lengths to those outlined in the method statement; project C had the least inconsistencies. All projects also had naming inconsistencies or missing fields, a few projects had additional fields. Inconsistencies in field naming are summarised in **Table 3.7**.

Table 3.7 Inconsistencies between method statement and project attributes

Project	Summary of attribute issues		
	Missing field	Incorrectly named field	Other issues
A	CA2	All PRVS fields had the number in the wrong place (e.g. PRVS1_SBTY instead of PRVS_SBTY1) and CA1 was called CA1CA2 (CA2 missing)	
B		CRT_DT incorrectly named CRTR_DT	Additional fields included PRVS_TY1 and PRVS_TY2
C	CA2	CA instead of CA1	
D	CA1, CA2	CRT_DT incorrectly named CRTR_DT	
E	CA1		
F	SSRFC_BDTY, SSRFC_TY, SSRFC_LINK, WTRCL_BDTY, WTRCL_TY, WTRCL_LINK, SFLR_BDTY, SFLR_TY, SFLR_LINK SBFLR_BDTY, SBFLR_TY, SBFLR_LINK	Instead of CC for conflated, PRSNT was used	Additional fields included NAT_LINK, REG_LINK, HYPERLINKS, NOTES
G	CA2	All PRVS fields had the number in the wrong place (e.g. PRVS1_SBTY instead of PRVS_SBTY1) and CA1 was called CA1CA2 (CA2 missing)	
H		All PRVS_NTS fields incorrectly named, e.g. PREVS_NTS2	
I	CA2	All PRVS fields had the number in the wrong place (e.g. PRVS1_SBTY instead of PRVS_SBTY1) and CA1 was called CA1CA2 (CA2 missing)	

Implications for consolidation

3.64 Inconsistent field naming and inconsistent data formats mean that datasets cannot simply be appended to each other; fields will require manual joining where naming and formats are not consistent.

3.65 In the case of project F, where Type and Broad Type fields were missing, data for these fields would need to be generated from Sub-type data. Data for missing hyperlink fields would need to be generated from Type data.

Task 8 Hyperlink and Character Type description review

Approach to review

3.66 A review of the supporting texts for each project area was undertaken. This involved checking that the hyperlinks worked and additionally checking whether the associated texts were consistent with the expected Types as found in the HSC Thesaurus. A detailed record of the review was created. This review looked at both National and Regional Perspective texts which were prepared by each of the HSC projects, their National Perspective texts building on the work of the previous and contemporary projects to assist with consistency.

Issues identified

3.67 Supporting texts were found to be in either word documents or pdf documents. Naming conventions for the files were inconsistent. It became apparent relatively quickly that there were a number of text documents that referenced terms that were not found in the HSC Thesaurus.

3.68 The HE PAO also noted several known issues with both the National and the Regional Perspective texts inherited from the projects. The National texts from the final tranche of HSC projects still needed bringing into consistency with each other in content and format, and a measure of updating.

3.69 The Regional Perspective texts, which, unlike the National Perspective texts, contain supporting imagery, also required review to ensure consistency of format and that their content respected the HSC Thesaurus terminology. A check was also needed to ensure their imagery does not infringe any third-party licence requirements. Consideration would also be required on where and how to express 'Regional boundaries' and whether overlapping boundary zones may better reflect varying perceptions on where regional boundaries lie and how they extend into offshore areas. As the Regional Perspective texts are more numerous than those covering the National Perspective and involve a greater range of issues, so too the scale of the task required to incorporate them into the National HSC database is a much larger one.

3.70 In view of that, it was agreed with the HE PAO that within the scope of this project, hyperlinks would only be provided to the National Perspective texts, in accord with the national strategic-level framework that the database provides. While taking that approach, it is accepted that it will be desirable at some point after this project also to provide hyperlinks to the Regional Perspective texts when the work required for their incorporation is undertaken.

Implications for consolidation

3.71 In order to consolidate the datasets, and create a single set of linked perspective texts, a thorough review and alignment of the terminology used within the projects was required. In addition, in order to make the National Perspective texts appropriate for use within the NHSC database, these required rewriting and some updating by the HE PAO.

Task 9 Terminology review

Approach to review

3.72 The National HSC Method Statement (Tapper and Hooley 2010) has controlled terminology lists for some attributes. Attribute data was checked against the National HSC Method Statement

(Tapper and Hooley 2010) controlled terms list and the HSC Thesaurus. Fields that have controlled terminology lists include those with the following names or suffixes:

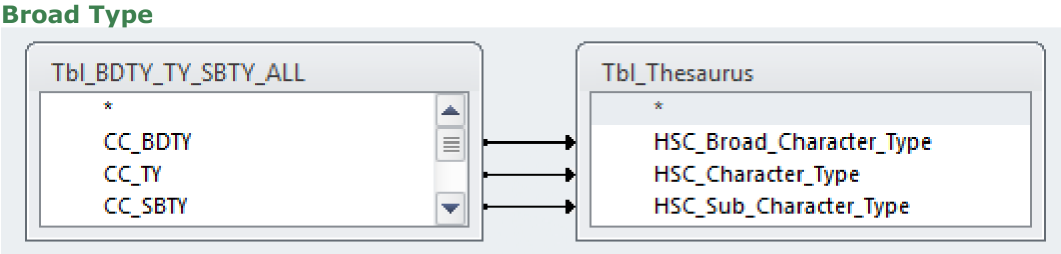
- PRD
- CNF
- SBTY
- TY
- BDTY
- PRVS_SBTY1, 2 etc.
- LCTN
- CELL_SZ

3.73 In addition, CA1 and CA2 should be blank, awaiting data at a future date.

3.74 A list of terms for PRD, CNF and LCTN were listed in the National HSC Method Statement (Tapper and Hooley 2010), these fields were reviewed in ArcMap for inconsistencies. As outlined in the National HSC Method Statement (Tapper and Hooley 2010), all gridded sea data should contain '250' in the CELL_SZ field as all project grids were built using 250 m x 250 m grid cells.

3.75 The data in SBTY, TY, BDTY fields are linked. For example, the term 'Buoyage' is a Sub-type falling under the Type 'Maritime Safety' and the Broad Type 'Navigation'. 'Buoyage' should not be found with any other Type and Broad Type combination. To test this relationship was intact for all data entries, the SBTY, TY, and BDTY fields (from all marine levels and Previous Types) and the HSC Thesaurus were added in to an Access database for checking. A number of queries were used to check the combinations against the HSC Thesaurus – as illustrated in **Figure 3.6**.

Figure 3.6 Example of queries run to test relationship between Sub-type, Type and Broad Type



Issues identified

3.76 A large number of terminology inconsistencies were identified in all fields, examples of which are shown in **Table 3.8**. The majority of inconsistencies in PRD, CNF and LCTN fields were spelling mistakes, incorrect case or missing words or characters.

Table 3.8 Examples of terminology inconsistencies

Field	Examples of inconsistent terms identified	Acceptable terms
PRD*	• Modern • Modern (AD1900 – Present • Modern - 1953 AD? To 2008 AD	Modern (AD1900 - Present)
CNF	• Unconfident • Uncertain • Probabale	• Certain • Probable • Possible

Field	Examples of inconsistent terms identified	Acceptable terms
LCTN	• COASTAL • Coastal • Coastal land • Estuary • INSHORE • INTER-TIDAL • Inshore • Inshore marine • Intertidal • OFFSHORE • Offshore • Offshore marine • Offshore waters	• Offshore Marine • Inshore Marine • Inter-tidal • Coastal Land • Estuarine
CELL_SZ**	• 62500 • 500 • NULL	250

*Modern (AD1900-Present) used as an example, other inconsistencies were identified

**Only relevant to the sea data which is in grid format

3.77 Although projects G and I had data in field CA1, this field should have been blank.

3.78 There were a large number of inconsistencies identified in the SBTY, TY and BDTY fields when considered on their own, but also when testing the combinations of these fields. Examples of the type of inconsistencies identified are shown in **Table 3.9**. Almost 400 different combinations emerged from this review. This highlighted additional terms that had not been through the proper agreed channels for incorporation into the HSC Thesaurus.

Table 3.9 Examples of terminology inconsistencies

BDTY	TY	SBTY	Description of problem
Fishing	Palaeolandscape component	Palaeolandscape component	BDTY is not consistent with TY and SBTY
		Shellfish farming	No BDTY or TY
Industry	Extractive industry	Mining (metals)	SBTY does not match HSC Thesaurus terms
Semi-natural environment	Island	Island	BDTY, TY, SBTY do not match HSC Thesaurus
Coastal infrastructure	Flood and erosion defence	Sea defences	SBTY should be 'Sea defence'
		Cultural topography	BDTY term used in SBTY field. Use of BDTY or TY terms in SBTY field is a common problem in PRVS fields.

3.79 Additional terminology inconsistencies relating to SBTY, TY and BDTY included:

- Use of the term “NEW” in the BDTY fields was identified, this was a problem specific to project A. No information was provided in TY and SBTY fields.
- Some records containing no data in CC, but did contain data in PRVS fields.
- Records in the sea data missing data in some or all marine levels (CC, SSRFC, WTRCL, SFLR, SBFLR).

Implications for consolidation

3.80 Inconsistent or incorrect use of allowable terms prevents the NHSC database from meeting the standards set in the National HSC Method Statement (Tapper and Hooley 2010). In cases where there are incorrect combinations of Broad Type, Type and Sub-type, the data is incorrect and needs rectification. Terminology issues of this nature affect ease of searching and mean that the symbology palette will not pick up all of the information in the database – leading to blanks on the map.

Task 10 Project interfaces

Approach to review

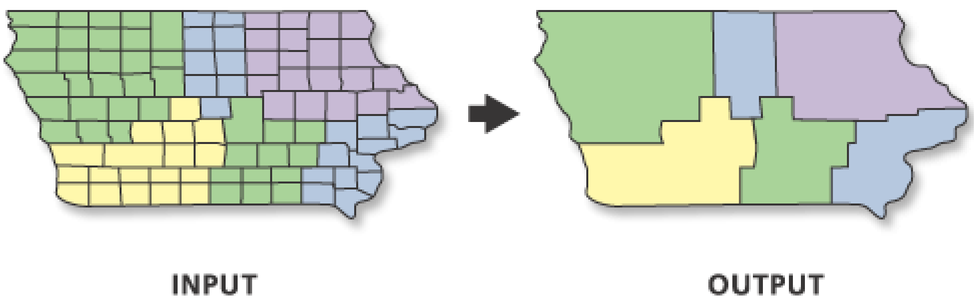
3.81 There were two parts to the project interface review:

- A topology review that included checks for gaps, overlaps and other issues at the project boundaries
- A visual review of the characterisation at the project interfaces identified where projects were not consistent at boundaries.

Topology review

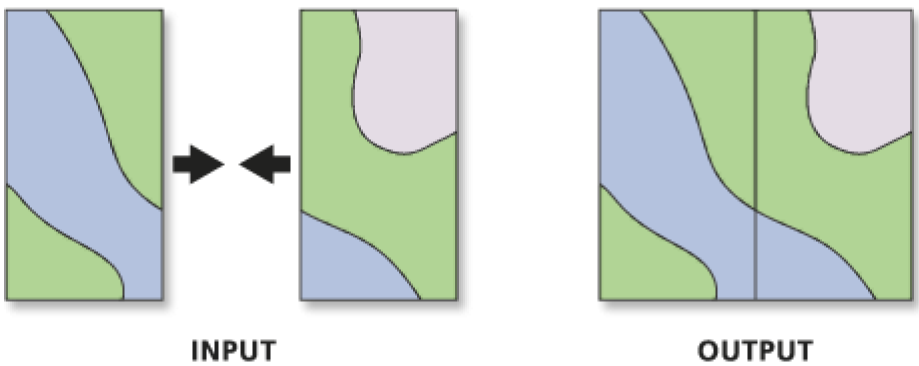
3.82 In the absence of a clearly defined study area boundary, the ArcMap Dissolve tool (**Figure 3.7**) was used on each of the project data sets in order to create an outline for each project.

Figure 3.7 Illustration of ArcMap Dissolve Tool (ESRI, 2017b)



3.83 The ArcMap Merge tool (**Figure 3.8**) was then used to add all the project outlines into one data set representing the full extent of all areas covered by the projects.

Figure 3.8 Illustration of ArcMap Merge Tool (ESRI, 2017c)



3.84 The Intersect tool in ArcMap and the Clean Gaps tool in ET Geowizards were then used to identify data overlaps and gaps between the study areas (see **Task 6** for further details of these tools). The output gave an indication of the extent of the problems between project boundaries, and identified areas to focus on when the datasets were merged into a single dataset.

Characterisation review

3.85 Project boundaries were visually checked for inconsistency between projects. The review highlighted a number of 'step changes' in Types and Sub-types between projects at each marine level as well as in the Coastal and Conflated layer. At this stage, it was agreed that it was not possible to establish the extent of any inconsistencies in characterisation approach until the terminology alignment had been undertaken. Some of the visual changes were likely to be caused by incorrect use of terminology (including typos) rather than a more fundamental inconsistency in approach. This was re-examined in **Task 17**.

3.86 During the character review, ranking of project reliability emerged from assessment of characterisation and terminology accuracy. Ranked most reliable to least reliable, the project ranking is as follows:

- C
- B
- G and I
- D, E, F
- A, H

Issues identified

3.87 The review of project interface topology highlighted two project boundaries with overlapping data:

- H-I
- G-H

3.88 Two project interfaces had a gap between them:

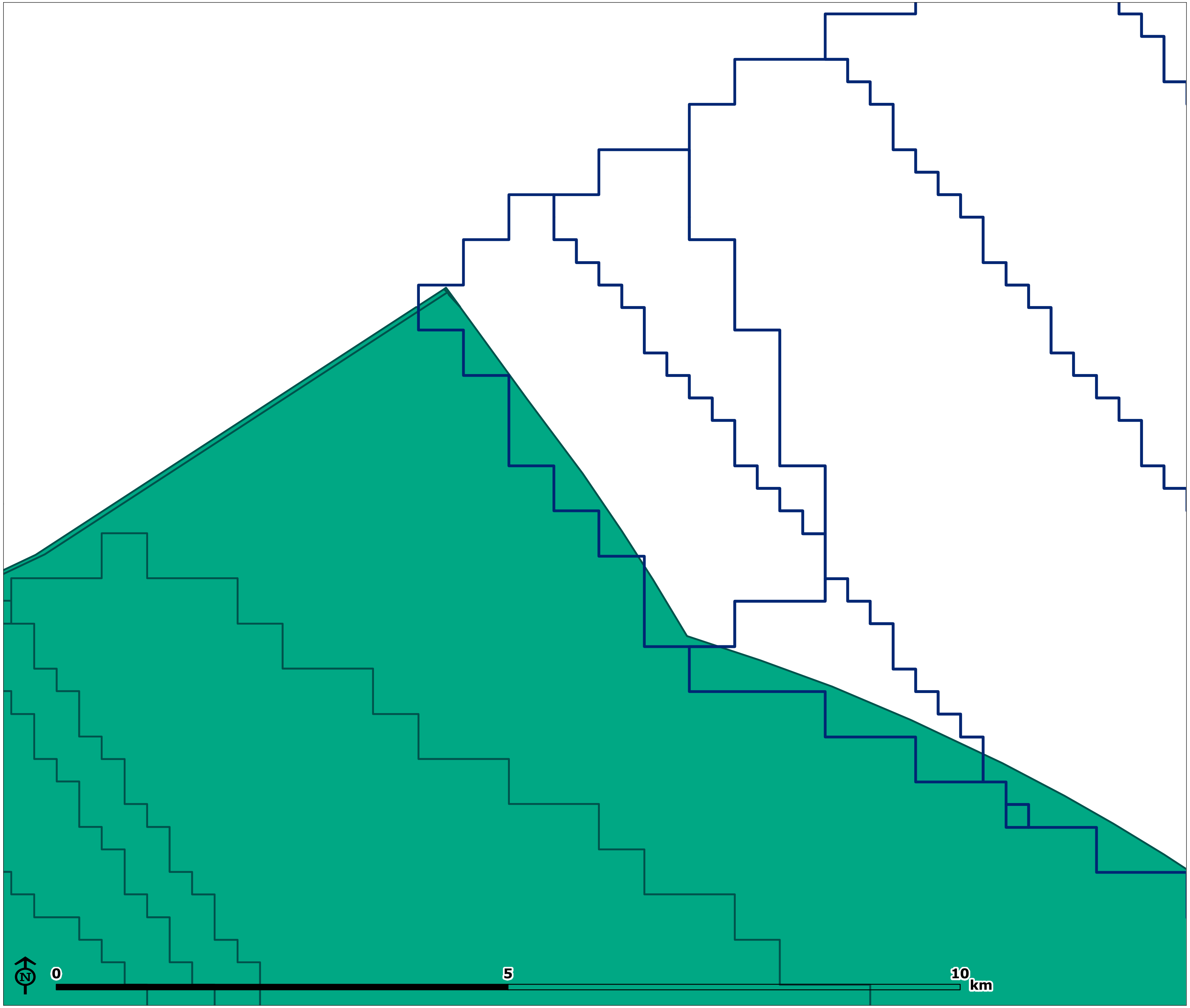
- H-I
- F-G

3.89 It was noted that project H had a thin polygon surrounding the sea data; this polygon was not gridded. Additionally in project H, there was a line that appeared to represent a buffer of coast, the line cuts through the gridded sea data representing the change between inshore marine and off shore marine data, this line is not gridded and creates inconsistency in the sea data.

3.90 **Figure 3.9** shows the H-I interface. A small gap between projects, significant project overlaps and the thin polygon surround H are all shown.

Implications for consolidation

3.91 Once the datasets were merged, there would need to be a thorough examination of the gaps and overlaps at project interfaces. In some instances this may require reference to source materials. These could be dealt with at the same time as the overlaps and gaps within datasets.

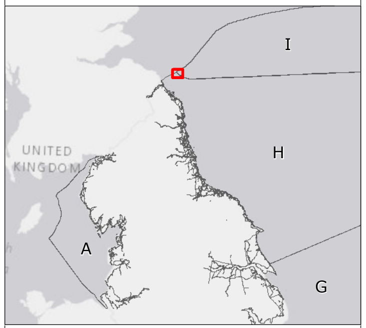


Consolidating the National Historic Seascape Characterisation Database

Figure 3.9: Project Boundary Issues (Projects H and I)

H North East Coast

I East Yorkshire to Norfolk Area 1



Source: HE

Map Scale: 1:60,000 @ A4

LUC

Historic England

CB:KS EB:Stenson_K LUCBRIFIG3_9_6738_r1_Project_Boundary_Issues_A4L 15/05/2017

Task 11 Functionality and ease of use

Approach to review

3.92 Functionality and ease of use were determined through general use of the data sets; navigating to different areas of the project, inspecting attribute tables, running data through tools and checking loading speed.

Issues identified

3.93 Loading speed varied across the projects, notably projects C and D had the slowest loading speed. Loading speed was influenced by number of polygons in the data set and geometry or topology issues in the data sets. Some of the issues identified in **Task 6** were the likely cause of loading speed variability.

Implications for consolidation

3.94 Functionality and ease of use should improve as geometry and topology issues are resolved and data sets are dissolved to lower the number of polygons. The project team explored the use of field indexes to improve handing speeds.

Stage 3: Resolution of issues

3.95 Having explored the datasets in a lot of detail throughout Stages 1 and 2, the project team moved on towards resolving the issues identified in order to produce the consolidated dataset.

Task 12 Project meeting

3.96 At this stage, a project meeting was held with the PAO to demonstrate the range of issues explored and to recommend a course of action to resolve each issue.

3.97 The outcome of the meeting was a series of steps to take the consolidation process forward. These included:

- Repairing the geometry and topology for each project dataset
- Merging the project datasets into a single new dataset within a geodatabase
- Automatically dealing with gaps and overlaps (within projects and between project areas) that meet particular requirements
- Updating the HSC Thesaurus
- Re-aligning terminology to match the HSC Thesaurus
- Resolving outstanding gaps and overlaps through manual editing and inspection

3.98 The project team resolved to begin the process of consolidation, but remain in close contact with the PAO to highlight any new issues that emerged.

Task 13 Geometry repair

Identified issues

3.99 Self-intersects, bad envelopes, unclosed rings and null geometry were identified in the data set using the Check Geometry tool during **Task 6**.

Approach to resolution of issues

3.100 The Repair Geometry tool in ArcMap was used to correct the geometry issues in each data set. Removing geometry issues allows other tools to be run on the data without errors occurring.

Assumptions and limitations

3.101 Gaps and overlaps still remained in the data set.

Task 14 Merging databases

Identified issues

3.102 Field naming inconsistencies between projects identified during **Task 7**.

3.103 As identified in **Task 2**, some datasets are in shapefile format and some are geodatabases.

Approach to resolution of issues

3.104 A working geodatabase was created to contain the HSC data, and a new feature class added. The feature class included all the fields outlined in the National HSC Method Statement (Tapper and Hooley 2010) with a few changes and additions:

- All string (text) field lengths were set to 254 in order to prevent truncation of the data. Truncation could occur because many of the data sets had fields set to 254 rather than some shorter field lengths set out in the National HSC Method Statement (Tapper and Hooley 2010).
- Contrary to the National HSC Method Statement, the Shape_Area field is a numeric field automatically generated by the database; this data type is more appropriate for the data included in this field.
- Field order was changed, moving fields likely to be used more frequently to the start.
- STUDY_AREA is a new field that has been added to indicate which project the data originated from, an essential element in enabling an audit trail for the resulting NHSC database.
- DATA_TYPE is a new field containing either 'Gridded' or 'Not gridded' to clearly identify which records are gridded sea data and which records are non-gridded land data.
- Additional LINK fields were added in order to allow one field (ending N_LINK) to contain the National Perspective text URL and a second field (ending R_LINK) as a placeholder for Regional Character texts URLs.
- HSC_LINK_ID is a new field to contain a unique ID which will ultimately facilitate the hyperlinks to National Perspective texts (and the Regional Character Texts at a later date) (see Task 22 for more detail).

3.105 The order and content of the NHSC database fields are shown in **Table 3.10**.

Table 3.10 NHSC database fields

Field name	Field alias	Description and guidance, terminology	Population method	Data type	Field length
Shape	Shape	Shape of data (i.e. polygon), automatically generated and updated by database	Automated	Geometry	0
OBJECTID	OBJECTID	ID automatically generated and updated by database	Automated	Integer	10
NAME	Name	Name of area or topographic identifier, local or popular name	Manual	String	254
CC_SBTY	Coastal and Conflated Sub-Character Type	Sub-character type (present, dominant; local level). Landward (above MHW) this will relate to coastal land HSC, whereas seaward it will relate to the 'conflated' HSC as derived from the marine levels.	Manual	String	254

Field name	Field alias	Description and guidance, terminology	Population method	Data type	Field length
CC_TY	Coastal and Conflated Character Type	Character type (present, dominant; regional level). Landward (above MHW) this will relate to coastal land HSC, whereas seaward it will relate to the 'conflated' HSC as derived from the marine levels.	Manual	String	254
CC_BDTY	Coastal and Conflated Broad Character Type	Broad Character Type (present, dominant; national strategic level). Landward (above MHW) this will relate to coastal land HSC, whereas seaward it will relate to the 'conflated' HSC as derived from the marine levels.	Manual	String	254
SSRFC_SBTY	Sea Surface Sub-Character Type	Present and dominant historic character of the sea-surface (recorded at sub-character, character and broad character levels)	Manual	String	254
SSRFC_TY	Sea Surface Character Type		Manual	String	254
SSRFC_BDTY	Sea Surface Broad Character Type		Manual	String	254
WTRCL_SBTY	Water Column Sub-Character Type	Present and dominant historic character of the water column (recorded at sub-character, character and broad character levels)	Manual	String	254
WTRCL_TY	Water Column Character Type		Manual	String	254
WTRCL_BDTY	Water Column Broad Character Type		Manual	String	254
SFLR_SBTY	Sea Floor Sub-Character Type	Present and dominant historic character of the sea-floor (recorded at sub-character, character and broad character levels	Manual	String	254
SFLR_TY	Sea Floor Character Type		Manual	String	254
SFLR_BDTY	Sea Floor Broad Character Type		Manual	String	254
SBFLR_SBTY	Sub-Sea Floor Sub-Character Type	Present and dominant historic character of the sub-sea floor (recorded at sub-character, character and broad character levels)	Manual	String	254
SBFLR_TY	Sub-Sea Floor Character Type		Manual	String	254
SBFLR_BDTY	Sub-Sea Floor Broad Character Type		Manual	String	254
STUDY_AREA	Study Area	Identifies which project area the data originated from	Manual	String	254
DATA_TYPE	Data Type	Identifies if data is 'Gridded' sea data or 'Not gridded' land data	Manual	String	254
CC_PRD	Coastal and Conflated Period	Benchmark period of origin of the area represented in the polygon or cell. Recorded for present historic character. Landward (above MHW) this will relate to coastal land HSC, whereas seaward it will relate to the 'conflated' HSC as derived from the marine levels.	Manual	String	254

Field name	Field alias	Description and guidance, terminology	Population method	Data type	Field length
CC_SRC	Coastal and Conflated Source	Sources used to identify present and previous historic character. Attribute values to record supplier, date, precise GIS file name. To include reference to the scale of original data used. Landward (above MHW) this will relate to coastal land HSC, whereas seaward it will relate to the 'conflated' HSC as derived from the marine levels.	Manual	String	254
CC_CNF	Coastal and Conflated Confidence	Degree of certainty/confidence of HSC interpretation of present historic character. Landward (above MHW) this will relate to coastal land HSC, whereas seaward it will relate to the 'conflated' HSC as derived from the marine levels.	Manual	String	254
CC_NTS	Coastal and Conflated Notes	Further background information on history of the polygon. Expansion on information recorded at broad character and sub-character levels.	Manual	String	254
CC_N_LINK	Coastal and Conflated National Link	URL hyperlink to Character Type texts and multi-media. Landward (above MHW) this will record coastal land HSC, whereas seaward it will record the 'conflated' HSC as derived from the marine levels.	Manual	String	254
SSRFC_PRD	Sea Surface Period	Benchmark period of origin of the area represented in the polygon. Recorded for present historic character levels and previous historic character.	Manual	String	254
SSRFC_SRC	Sea Surface Source	Sources used to identify historic character. Attribute values to record supplier, date and precise GIS file name. To include reference to the scale of original data used.	Manual	String	254
SSRFC_CNF	Sea Surface Confidence	Degree of certainty/confidence of HSC interpretation of present historic character.	Manual	String	254
SSRFC_NTS	Sea Surface Notes	Further background information on history of the polygon. Expansion on information recorded at broad character and sub-character levels.	Manual	String	254
SSRFC_N_LINK	Sea Surface National Link	URL hyperlink to Character Type texts and multi-media.	Manual	String	254
WTRCL_PRD	Water Column Period	Benchmark period of origin of the area represented in the polygon cell.	Manual	String	254
WTRCL_SRC	Water Column Source	Sources used to identify historic character. Attribute values to record supplier, date, precise GIS filename. To include reference to the scale of original data used.	Manual	String	254
WTRCL_CNF	Water Column Confidence	Degree of certainty/confidence of HSC interpretation of present historic character.	Manual	String	254

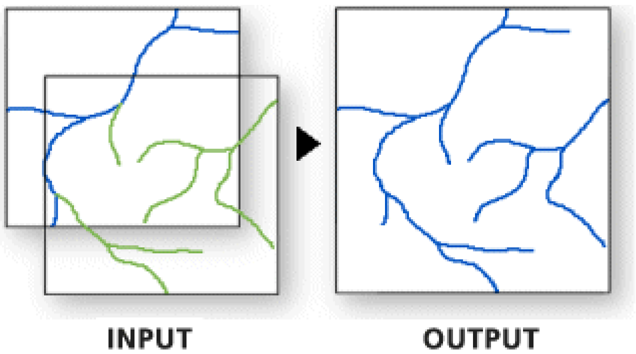
Field name	Field alias	Description and guidance, terminology	Population method	Data type	Field length
WTRCL_NTS	Water Column Notes	Further background information on history of the polygon. Expansion on information recorded at broad character and sub-character levels.	Manual	String	254
WTRCL_N_LINK	Water Column National Link	URL hyperlink to Character Type texts and multi-media.	Manual	String	254
SFLR_PRD	Sea Floor Period	Benchmark period of origin of the area represented in the polygon cell.	Manual	String	254
SFLR_SRC	Sea Floor Source	Sources used to identify historic character. Attribute values to record supplier, date, precise GIS filename. To include reference to the scale of original data used.	Manual	String	254
SFLR_CNF	Sea Floor Confidence	Degree of certainty/confidence of HSC interpretation of present historic character.	Manual	String	254
SFLR_NTS	Sea Floor Notes	Further background information on history of the polygon. Expansion on information recorded at broad character and sub-character levels.	Manual	String	254
SFLR_N_LINK	Sea Floor National Link	URL hyperlink to Character Type texts and multi-media.	Manual	String	254
SBFLR_PRD	Sub-Sea Floor Period	Benchmark period of origin of the area represented in the polygon cell.	Manual	String	254
SBFLR_SRC	Sub-Sea Floor Source	Sources used to identify historic character. Attribute values to record supplier, date, precise GIS filename. To include reference to the scale of original data used.	Manual	String	254
SBFLR_CNF	Sub-Sea Floor Confidence	Degree of certainty/confidence of HSC interpretation of present historic character.	Manual	String	254
SBFLR_NTS	Sub-Sea Floor Notes	Further background information on history of the polygon. Expansion on information recorded at broad character and sub-character levels.	Manual	String	254
SBFLR_N_LINK	Sub-Sea Floor National Link	URL hyperlink to Character Type texts and multi-media.	Manual	String	254
PRVS_SBTY1	Previous Sub-Character Type 1	Previous historic character for which evidence is available. Recorded for multiple time-slices on basis of source dataset.	Manual	String	254
PRVS_SBTY2	Previous Sub-Character Type 2		Manual	String	254
PRVS_SBTY3	Previous Sub-Character Type 3		Manual	String	254
PRVS_SBTY4	Previous Sub-Character Type 4		Manual	String	254
PRVS_SBTY5	Previous Sub-Character Type 5		Manual	String	254
PRVS_PRD1	Previous Period 1	Benchmark period of origin of the area represented in the polygon. Recorded for present historic character levels and previous	Manual	String	254
PRVS_PRD2	Previous Period 2		Manual	String	254

Field name	Field alias	Description and guidance, terminology	Population method	Data type	Field length
PRVS_PRD 3	Previous Period 3	historic character.	Manual	String	254
PRVS_PRD 4	Previous Period 4		Manual	String	254
PRVS_PRD 5	Previous Period 5		Manual	String	254
PRVS_SRC 1	Previous Source 1	Sources used to identify historic character. Attribute values to record supplier, date, precise GIS filename. To include reference to the scale of original data used.	Manual	String	254
PRVS_SRC 2	Previous Source 2		Manual	String	254
PRVS_SRC 3	Previous Source 3		Manual	String	254
PRVS_SRC 4	Previous Source 4		Manual	String	254
PRVS_SRC 5	Previous Source 5		Manual	String	254
PRVS_CNF 1	Previous Confidence 1	Degree of certainty/confidence of HSC interpretation of present historic character.	Manual	String	254
PRVS_CNF 2	Previous Confidence 2		Manual	String	254
PRVS_CNF 3	Previous Confidence 3		Manual	String	254
PRVS_CNF 4	Previous Confidence 4		Manual	String	254
PRVS_CNF 5	Previous Confidence 5		Manual	String	254
PRVS_NTS 1	Previous Notes 1	Further background information on history of the polygon. Expansion on information recorded at broad character and sub-character levels.	Manual	String	254
PRVS_NTS 2	Previous Notes 2		Manual	String	254
PRVS_NTS 3	Previous Notes 3		Manual	String	254
PRVS_NTS 4	Previous Notes 4		Manual	String	254
PRVS_NTS 5	Previous Notes 5		Manual	String	254
PRVS_LINK1	Previous Link 1	URL hyperlink to Character Type texts and multi-media.	Manual	String	254
PRVS_LINK2	Previous Link 2		Manual	String	254
PRVS_LINK3	Previous Link 3		Manual	String	254
PRVS_LINK4	Previous Link 4		Manual	String	254
PRVS_LINK5	Previous Link 5		Manual	String	254
CA1	Character Area 1	Unique Character Area.	Manual	String	254
CA2	Character Area 2		Manual	String	254
LCTN	Location	General location (eg. Offshore marine, inshore marine, estuary, coast etc).	Manual	String	254
CELL_SZ	Cell Size	Size of grid used for gridded sea data (eg. 250m etc), un-gridded	Manual	Double	19

Field name	Field alias	Description and guidance, terminology	Population method	Data type	Field length
		land data should have the value 0..			
CRT_DT	Creation Date	Date of dataset /polygon creation/completion.	Manual	String	254
CRTR	Creator	Name of the person/organisation who compiled the HSC.	Manual	String	254
HSC_LINK_ID	Link Table ID	ID for link to hyperlink summary table.	Manual	Double	19
CC_R_LINK	Coastal and Conflated Regional Link	URL hyperlink to Character Type texts and multi-media. Landward (above MHW) this will record coastal land HSC, whereas seaward it will record the 'conflated' HSC as derived from the marine levels.	Manual	String	254
SSRFC_R_LINK	Sea Surface Regional Link	URL hyperlink to Character Type texts and multi-media.	Manual	String	254
WTRCL_R_LINK	Water Column Regional Link	URL hyperlink to Character Type texts and multi-media.	Manual	String	254
SFLR_R_LINK	Sea Floor Regional Link	URL hyperlink to Character Type texts and multi-media.	Manual	String	254
SBFLR_R_LINK	Sub-Sea Floor Regional Link	URL hyperlink to Character Type texts and multi-media.	Manual	String	254
Shape_Length	Shape Length	Polygon length in metres automatically generated and updated by database.	Automated	Double	19
Shape_Area	Shape Area	Polygon area in metres squared, automatically generated and updated by database.	Automated	Double	19

3.106 The Append tool (**Figure 3.10**) in ArcMap was used to individually add each data set to the new feature class.

Figure 3.10 Illustration of ArcMap Append Tool (ESRI, 2017d)



3.107 The Append tool matches fields automatically where the field name and type match, where fields do not match it is possible to manually match the fields.

3.108 Each time a data set was appended to the new feature class, the new STUDY_AREA field was populated with the project letter and project name, in order to keep track of the source project.

3.109 Once all data sets were appended to the new feature class, the DATA_TYPE field was populated. The correct term for each record was determined by the data in CELL_SZ. Non-gridded data had no value in this field and was assigned the value 'Polygon', gridded data was assigned the value 'Grid'.

Assumptions and limitations

3.110 Through exploration, CELL_SZ was found to be the only field in the data that allowed the distinction between gridded and non-gridded data to be made. There were a few instances of the CELL_SZ data being incorrect in the original projects; as a result the 'Polygon' and 'Grid' assignments had to be adjusted manually in a few cases.

Task 15 Automated topology corrections

Identified issues

3.111 Topology issues (gaps and overlaps) were identified during **Task 6.**

Approach to resolution of issues

3.112 Gaps were infilled using a combination of the Dissolve and Erase tools in ArcMap.

3.113 Overlaps were identified using a combination of the Intersect and Union tools in ArcMap. Overlaps were assigned an ID in order to make it possible to identify which datasets overlapped each other.

3.114 The gaps and overlaps were categorised in the data set under the following 'headings':

- Land gap – an enclosed, but uncharacterised polygon on land
- Sea gap – an uncharacterised area of sea
- Land/sea gap – gaps between the gridded sea data and non-gridded land data
- Land/land overlap – polygons on land that were coincident
- Land/sea overlap – locations that had been characterised as part of the sea as well as the land (gridded and non-gridded)
- Sea/sea overlap – grid cells in the sea that overlapped with each other
- Project boundary overlap – areas at project interfaces that had been characterised on both sides of the join
- Project boundary gap – areas along project interfaces that had not been characterised

3.115 Some of the categories of gaps and overlaps were corrected in an automated way, based upon a set of rules; the rest were left to be corrected using a more manual approach (**Task 18**).

3.116 Land gaps less than $20m^2$ **or** less than 1 hectare with a thickness ratio less than 0.1 (polygons with a thickness ratio less than 0.1 are considered to be sliver polygons) were automatically corrected, the remaining gaps were left for manual correction. The Eliminate tool in ArcMap was used to correct the land gaps, the tool merged the land gaps in to the neighbouring polygon with which it shared the longest boundary.

3.117 Land/land overlaps less than 1 hectare in size were automatically corrected, the remaining land/land overlaps were left for manual correction. The Remove Duplicates tool in ET Geowizards was used to correct the land overlaps, the tool keeps the first record and removes any duplicates found.

3.118 Investigation was made into the combinations of Character Sub-types included in land/land overlaps in order to identify any combinations that could potentially be corrected automatically by applying a 'rule'. Of the combinations found, it was agreed with the PAO to allow the Character Sub-type 'Daymark' to be retained over other Character Sub-types.

3.119 Land/sea overlaps were addressed by keeping the land data and removing the overlapping sea data. The approach was taken in order to maintain a land/sea boundary consistent with the coastline, as opposed to allowing the gridded boundary to encroach the land.

3.120 Where project boundary overlaps occurred, the project with greater data reliability was kept and the overlapping data from the other project was removed. The two project boundaries with overlaps were H-I and G-H, I and H was considered more reliable data and therefore overlapping data from H was removed.

3.121 Where project boundary gaps occurred, the grid from the project with greater data reliability was extended to fill the gap, the areas filled were merged into the adjacent grid. The two project boundaries with gaps were H-I and F-G, the grid was extended from project I and project G to fill the gaps.

3.122 Sea gaps, land/sea gaps and sea/sea overlaps were all set aside to be corrected manually.

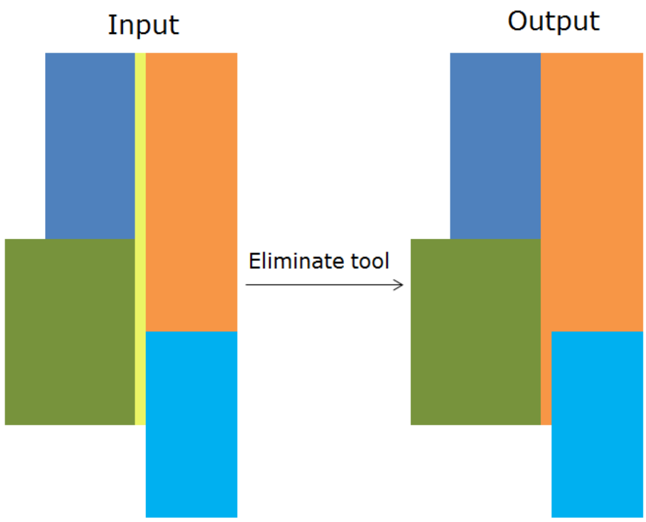
Assumptions and limitations

3.123 1 Hectare was used as a cut off size for many of the automated corrections; this is based upon the use of a 1 hectare cut off in the HLC methodology (Aldred and Fairclough, 2003).

3.124 Automated topology corrections are a blunt approach to data cleaning where no user intelligence is applied to the corrections, this means no assessment of characterisation was carried out on polygons 'corrected' in this way.

3.125 The Eliminate tool in ArcMap merges the selected polygons into a neighbouring polygon with which it shares the longest boundary. In some cases, the Eliminate tool can create polygons with jutting features where other polygons have been merged (as shown in **Figure 3.11**).

Figure 3.11 Illustration of ArcMap Eliminate tool



Task 16 Thesaurus updates

Identified issues

3.126 During **Task 9** terminology inconsistencies were identified in the character terms, some inconsistencies required new or adjusted terms in order to be addressed.

Approach to resolution of issues

3.127 New terms and updated terms were added to the HSC Thesaurus and are shown in (**Table 3.11**). All changes were confirmed or suggested by the PAO prior to use. The full list of HSC character terms can be found in the National HSC User Guide.

Table 3.11 Additions or updates to the HSC Thesaurus during the HSC consolidation

Broad Character Type	Character Type	Character Sub-type	Terminology notes
Civic provision	Civic provision	Government office	Term added by PAO during consolidation project
Civic provision	Civic provision	Educational establishment	Term added by PAO during consolidation project
Cultural topography	Cultural topography (marine)	Cultural topography (marine) (unspecified)	Term added by PAO during consolidation project
Commerce	Financial administration	Financial institution	Term added by PAO during consolidation project

Broad Character Type	Character Type	Character Sub-type	Terminology notes
Fishing	Fishing	Fish processing facility	Term added by PAO during consolidation project
HLC	HLC	HLC	Term added by PAO during consolidation project
Military	Military facility	Admiralty telegraph station	Term added by PAO during consolidation project
Navigation	Navigation activity	Quarantine area	Term added by PAO during consolidation project
Navigation	Navigation feature	Navigation channel (unspecified)	Term added by PAO during consolidation project
Ports and docks	Ports and docks	Hulk (unspecified)	Term updated by PAO during consolidation project
Recreation	Recreation	Recreational open ground	Term added by PAO during consolidation project
Recreation	Recreation	Managed heritage asset	Term added by PAO during consolidation project
Settlement	Settlement	Urban settlement	Term updated by PAO during consolidation project
Unimproved land	Coastal rough ground	Heathland	Term updated by PAO during consolidation project
Unimproved land	Coastal rough ground	Rough grassland	Term updated by PAO during consolidation project
Unimproved land	Coastal rough ground	Scrub	Term updated by PAO during consolidation project

3.128 An entirely new HSC term introduced as a result of this process was "HLC". The term acts slightly differently to others used in the HSC Thesaurus. It was used to attribute the current Type for records having HSC data in PRVS fields but lacking any positive HSC attribution for TY, BDTY or SBTY in fields relating to present HSC. All such records existed within the land data and reflected areas that the original HSC assessor considered to have had a maritime or maritime-linked character which is no longer the dominant character within the present landscape (such as the sites of former coastal fortifications and daymarks which now have only limited or no surface expression). The term "HLC" was agreed with the HE PAO as it conveys that land encompassed by the polygon has historically had some maritime relevance but that users of the HSC data should refer to the relevant HLC dataset for the area's present non-maritime character.

Task 17 Terminology alignment

Identified issues

3.129 During **Task 9** terminological inconsistencies were identified in the fields that should contain controlled terms as outlined in the National HSC Method Statement (Tapper and Hooley 2010). Inconsistencies included incorrect spelling, incorrect case, incorrect terminology, incorrect number and incorrect use of field. During **Task 10**, apparent inconsistencies at project interfaces also highlighted terminological issues as these were visible as mismatches in characterisation across the boundary due to use of subtly different terms.

Approach to resolution of issues

3.130 The fields with the following suffixes have fixed terms that can be used and all contained terms inconsistent with the National HSC Method Statement (Tapper and Hooley 2010):

- LCTN
- CNF
- PRD
- BDTY
- TY
- SBTY

3.131 Additional fields with inconsistency included:

- CA1 and CA2
- CELL_SZ

3.132 LCTN was automatically updated using the Field Calculator in ArcMap; inconsistencies in this field only included incorrect spelling or incorrect case, and these were amended.

3.133 CNF and PRD contained incorrect terms (in addition to incorrect spelling or incorrect case). Where the incorrect term did not have a logical fix, amendments were discussed and agreed with the PAO. For example, it was agreed that the terms 'Uncertain' and 'Unconfident' which were found in CNF, should be changed to 'Possible'.

3.134 All instances of inconsistencies in BDTY, TY and SBTY identified during **Task 9** were assigned a batch correction where possible and updated using an update query in Microsoft Access. Terms that were assigned a batch correction are listed in **Appendix 2.**

3.135 It was possible to correct a number of other inconsistencies in automated ways. For example, the incorrect SBTY 'Forest' could be assigned to either 'Ancient woodland' or 'Plantation. By using a Natural England open source data set containing ancient woodland locations, it was possible to select all the incorrect SBTY that coincided with the ancient woodland and update the data accordingly.

3.136 Remaining inconsistencies were updated manually on an individual basis as many required the source data to be checked. Updates included characterisation of records with no data in CC_BDTY, CC_TY and CC_SBTY, as well as characterisation of the fields containing only "NEW" in the BDTY fields. All records which contained "NEW" in BDTY fields were in the gridded data and confined to Project Area A. The resolution process used for these records is described in **Appendix 3**.

3.137 As described in the National HSC Method Statement (Tapper and Hooley 2010), CA1 and CA2 should remain blank whilst the NHSC database is being compiled, the fields are for future users to record their perception of the historic marine environment. Any data in CA1 and CA2 was cleared and left blank.

3.138 CELL_SZ was automatically corrected, all sea data was created using a 250 m X 250 m grid, therefore CELL_SZ was populated with '250' for all sea data and left blank for all land data (where no grid was used).

Assumptions and limitations

3.139 Most of the terminological fixing was done based upon the existing terms, for example, in LCTN the term INTERTIDAL was updated to Inter-tidal. It was not within the scope of the project to re-assess the appropriateness of the characterisation to areas it was applied to during this process.

Task 18 Manual topology corrections

Identified issues

3.140 Gaps and overlaps from the following categories remaining following **Task 15**:

- Land gap
- Sea gap
- Land/sea gap
- Land/land overlap
- Sea/sea overlap

Approach to resolution of issues

3.141 All land gaps and sea gaps were assessed and characterised using a variety of data sources. Many of the land gaps were not considered to have a maritime expression, these gaps were not characterised and were removed from the data set.

3.142 Overlaps ranged from instances where two polygons overlapped to instances where 128 polygons overlapped. Overlaps were inspected manually and a decision was made as to which was the dominant feature. The following issues were found and suitable solutions applied:

- Overlapping polygons contained duplicate data: one record was retained.
- Overlapping polygons contained similar data: the most detailed record was retained or data from all records were combined in to one record.
- Overlapping polygons contained different data: inspection of the records to pick the most accurate record to retain, where required the character assessment was altered.

Assumptions and limitations

3.143 Characterisation carried out during this task was not completed comprehensively on the whole NHSC database, characterisation was only completed when required for gaps, or where review of the overlap characterisation was needed.

3.144 This task introduced a new assessor adding new data to the NHSC database. Techniques for assessing are likely to differ from techniques used by previous assessors. In addition to this, during the NHSC database consolidation there was less source data available for use than there was during previous assessments.

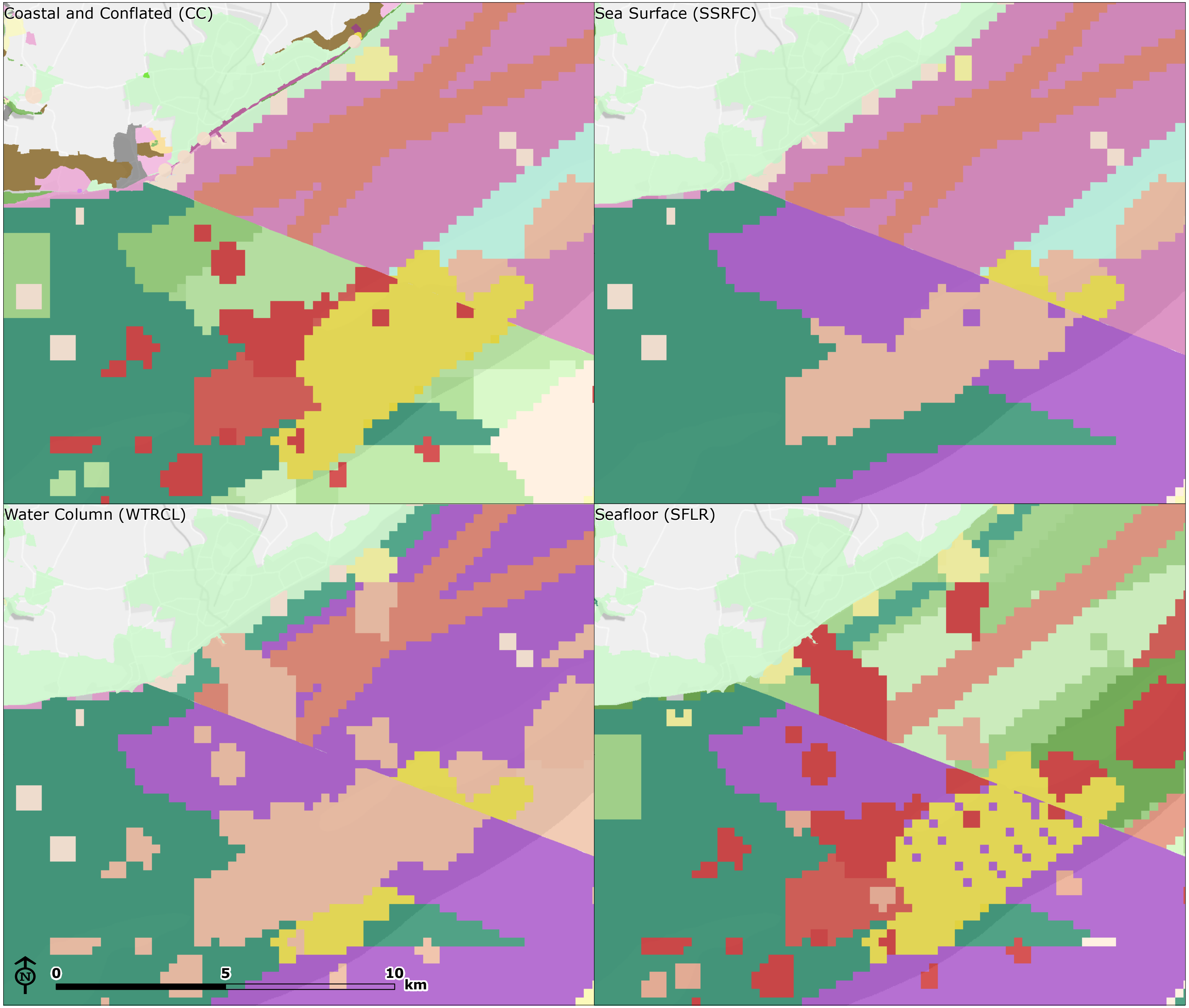
Incidental finding

3.145 Whilst characterising gaps in the data situated in Portsmouth, it was noted that the data appeared to be offset between Warsash and Portsea Island. This issue is not caused by incorrect projection; instead it is likely to be a digitising error. Whilst gaps and overlaps in the data around Warsash and Portsea Island were addressed, correcting the data offset required significant time to re-work or possibly re-characterise completely, this was beyond the scope of this project and has not been completed.

Task 19 Characterisation corrections

Identified issues

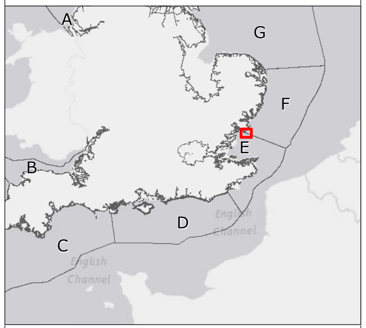
3.146 During a visual check of categorisation at project interfaces, most boundaries were found to have inconsistencies. Boundary matching at E-F and F-G contained extensive mismatches, an example of inconsistencies at boundary E-F is shown in **Figure 3.12**.



Consolidating the National Historic Seascape Characterisation Database

Figure 3.12: Project Boundary Categorisation Issues (Projects E and F):

- Other
- Boat yard
- Buoyage
- Commercial shipping route
- Harbour pool
- Hazardous water
- Hydrocarbon installation
- Leisure beach
- Leisure sailing
- Military practice area
- Navigation route
- Potting
- Renewable energy installation (wind)
- Saltmarsh
- Sea defence
- Shellfish dredging



Source: HE

Map Scale: 1:160,000 @ A4

LUC

Historic England

CB:KS EB:Stenson_K LUCBRIFIG3_12_6738_r1_Project_Boundary_Categorisation_A4L 16/05/2017

3.147 A summary of project interface categorisation inconsistencies is in **Table 3.9** and detailed notes are in **Appendix 3**.

Table 3.12 Project interface categorisation inconsistency summary

	Project boundary							
	A-B	B-C	C-D	D-E	E-F	F-G	G-H	H-I
CC	N/A	Match	Minor mismatch	Several mismatches	Extensive mismatches	Extensive mismatches	Minor mismatch	Very minor mismatch
SSFRC	N/A	Match	Minor mismatch	Minor mismatch	Extensive mismatches	Extensive mismatches	Minor mismatch	Very minor mismatch
WTRCL	N/A	Match	Minor mismatch	Several mismatches	Extensive mismatches	Extensive mismatches	Minor mismatch	Very minor mismatch
SFLR	N/A	Match	Minor mismatch	Several mismatches	Extensive mismatches	Extensive mismatches	Minor mismatch	Match
SBFLR	N/A	Match	Minor mismatch	Several mismatches	Extensive mismatches	Extensive mismatches	Minor mismatch	Minor mismatch

3.148 Visual inspection of linear features between projects revealed inconsistencies in the use of the 'Navigation route' and 'Commercial shipping route' Character Sub-types, resulting in abrupt changes in Sub-type at project boundaries.

3.149 Similarly, inconsistency in characterisation of the Atlantic Crossing 1 telecommunications cable occurred between projects C, D and E, resulting in an abrupt change in characterisation at the project boundaries. Inconsistency in characterisation of telecommunications cable at SBFLR also occurred, projects A through F showed telecommunications cables at SFLR and SBFLR, whilst G through I only showed telecommunications cables at SFLR creating inconsistency at the F/G project boundary in SBFLR.

3.150 Project F made extensive use of the Sub-Type 'Palaeolandscape component' at SBFLR, whilst all other projects predominantly used Sub-Types falling under the 'Cultural topography (marine)' Type. Evidence does not support the extensive use of 'Palaeolandscape component' in project F and furthermore the inconsistent approach creates boundary inconsistencies with projects E and G.

3.151 As an incidental finding during visual inspection of the project boundaries, it was noted that some character terms were used at inappropriate marine levels such as 'Watercourse', 'Shellfish dredging' and 'Seaside entertainment' in SBFLR.

3.152 During **Task 18**, there were four circular gaps identified in the gridded sea data. The gaps were identified as No Mans Fort, Spitbank Fort, Horse Sand Fort and St Helen's Fort in the Solent. Following discussion with the PAO, characterisation corrections were deemed necessary to address the presence of these forts (see 3.158 below), collectively referred to as the *Spithead Forts*.

Approach to resolution of issues

Boundary issues

3.153 Updates to terminology, discussed above, to align each HSC dataset correctly with the approved HSC Thesaurus resolved some boundary issues. Those remaining lay entirely within the gridded data. In order to interrogate the remaining mismatches across interfaces, the baseline data obtained from Historic England for interfaces (see 3.7 above) was reviewed. The aim of this was to establish which HSC implementation project was correctly characterised and, by recourse to the baseline data, update the characterisation in that identified as incorrect[4]. In practice, it was

[4] This process assisted in establishing a hierarchy of implementation project reliability. This is discussed further in Appendix 3.

only possible to address some of the mismatches with this baseline data alone. This is because many of the issues related to HSC Types (chiefly aspects of fishing and palaeolandscapes) which were not fully covered by the supplied baseline data. In the majority of these cases, sources other than SeaZone were cited which were not available to the project. Information on these was previously available from these project's websites but, in some cases, links were no longer functioning. With regards to Cefas data, from the level of detail used to describe the HSC source in the data, it was not evident which of this organisation's many sources on fishing had been used to derive the attribution from. This aspect highlighted a wider issue with attribution of HSC Types, namely a frequent lack of adequate specificity on attribution source when using complex data. In other cases, as seen at the interfaces of D through F, some sources were cited beyond their geographical scope (such as the South Coast REC, which did not extend to this part of the sea). Issues with sources are explored in more detail in **Appendix 3** and discussed in the *Summary* Section below.

3.154 Progress was possible on other mismatches due to further work on terminology. Following agreement with the PAO, all instances of the 'Commercial shipping route' Character Sub-Type were changed to 'Navigation route' in order to maintain consistency across project boundaries. This decision was made because 'Commercial shipping route' is a particular subset of 'Navigation route'. The difference in characterisation between implementation projects appears to have arisen as earlier projects had access to Anatec shipping data which allowed identification of specific commercial routes within general navigation routes. This data ceased to be supplied to the later implementation projects when English Heritage felt its high costs and poor resolution left it no longer cost-effective against the digital chart data already supplied freely to the projects.

3.155 Further sources were available on submarine cables to address differences in characterisation between projects (KIS-ORCA, 2017). This allowed those sections of the Atlantic Crossing 1 telecommunication cable that had been misclassified as the 'Submarine power cable' Sub-Type in D to be corrected to 'Submarine telecommunications cable'.

3.156 Following discussion with the PAO 'Submarine telecommunications cable' in SFLR of projects G, H and I were copied down to SBFLR in order to create consistencies between the projects. Similarly, it was agreed to re-classify 'Palaeolandscape component' Sub-Types in SBFLR of project F to the Sub-Types in SFLR. Where the terms in SFLR were not appropriate for expression at SBFLR, 'Cultural topography (marine) (unspecified)' was used. 'Cultural topography (marine) (unspecified)' was a Sub-Type provided by the PAO to act as a 'place holder' where more specific detail was not available. These changes created greater project consistency, particularly at the F/G project boundary.

Other

3.157 Discussion with the PAO and recourse to the HSC Method Statement indicated that some Sub-Types related to fishing (chiefly those including dredging) should not occur within the Sub-Sea Floor. Several instances of these Sub-Types occurring in the Sub-Sea Floor were noted in data checking. Where possible, these were corrected through recourse to data on the geological make-up of the Sea Floor. This used the same data sources as for the adjacent (correctly characterised) data. Many of these correctly characterised records cited UKSeaMap data. This data was used to update instances of dredging recorded in the Sub-Sea Floor. However, as indicated in the Project Brief and at 1.8 above, it was beyond the scope of the project to attempt a wider review and reworking of the characterisation already undertaken by the HSC projects.

3.158 Following discussion with the PAO, the gridded sea data surrounding the Solent forts was merged in to the forts, making the forts in to gridded sea data rather than land data.

Assumptions and limitations

3.159 Variability in characterisation between projects was inevitable due to the different assessors working on the projects, their varied access to source data sets and development of those source data sets themselves through the total duration of the HSC projects.

3.160 Visual assessment of characterisation inconsistencies was focussed at the project boundary, the project did not have scope to examine the whole data set at great detail but it makes incidental findings on consistency of approach between projects. These are summarised in **Appendix 3** and include aspects such as differing treatment of coastal fortifications between each dataset, the way in which daymarks are handled and how PRVS Types are recorded and ranked.

Task 20 Geodatabase set up and data loading speed improvements

Approach

3.161 A new geodatabase was created, domains were added and populated with the corrected HSC terminology (PRD, CNF, LCTN, SBTY, TY, BDTY).

3.162 The consolidated HSC data was dissolved using the Dissolve tool in ArcMap in order to minimise the number of records and improve loading speed. The data was saved in to the geodatabase. The relevant fields were linked to the geodatabase domains, allowing the correct terms to be chosen from drop down menus during any future work on the data set.

3.163 Each field was given an alias, each alias a brief description of the data in the field. For example, CC_SBTY was given the alias 'Coastal and Conflated Character Sub-type'.

3.164 The following fields were indexed in order to maximise data search speed:

- OBJECTID (default index)
- CC_SBTY
- SSRFC_SBTY
- WTRCL_SBTY
- SFLR_SBTY
- SBFLR_SBTY

3.165 Loading speed can be managed by the user via use of definition queries and by loading the data from a local source.

Task 21 National Perspective texts

Approach

3.166 A full set of updated and internally consistent National Perspective texts was provided by the PAO.

3.167 All N_LINK fields in the NHSC database were populated with the following hyperlink text and the relevant Character Type: ..\NationalTexts**[TY]**.pdf. This hyperlink allows the user to open the relevant National Perspective text from the HSC data set using the ArcMap hyperlink function. To facilitate easier access to the National Perspective texts, additional tables were related to the main dataset (linked by the HSC_LINK_ID) in order to allow the user to use the information tool to bring up a complete list of hyperlinked texts for each marine level as well as the previous Types.

Task 22 Creation of project outputs

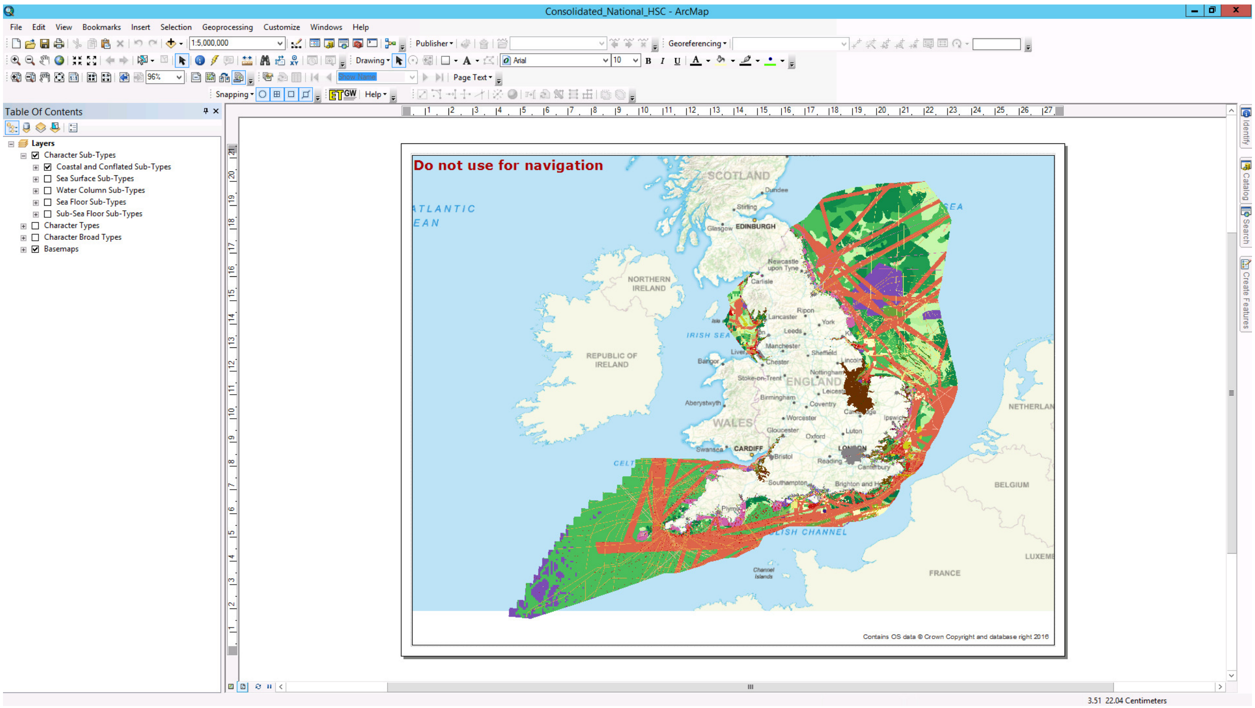
Approach

ESRI MXD

3.168 An HSC project MXD was generated to display the NHSC data. The MXD contains three groups: 'Character Sub-types', 'Character Types', Broad Character Types', each group containing the HSC data displayed at each marine level (**Figure 3.13**) using a consistent colour palette.

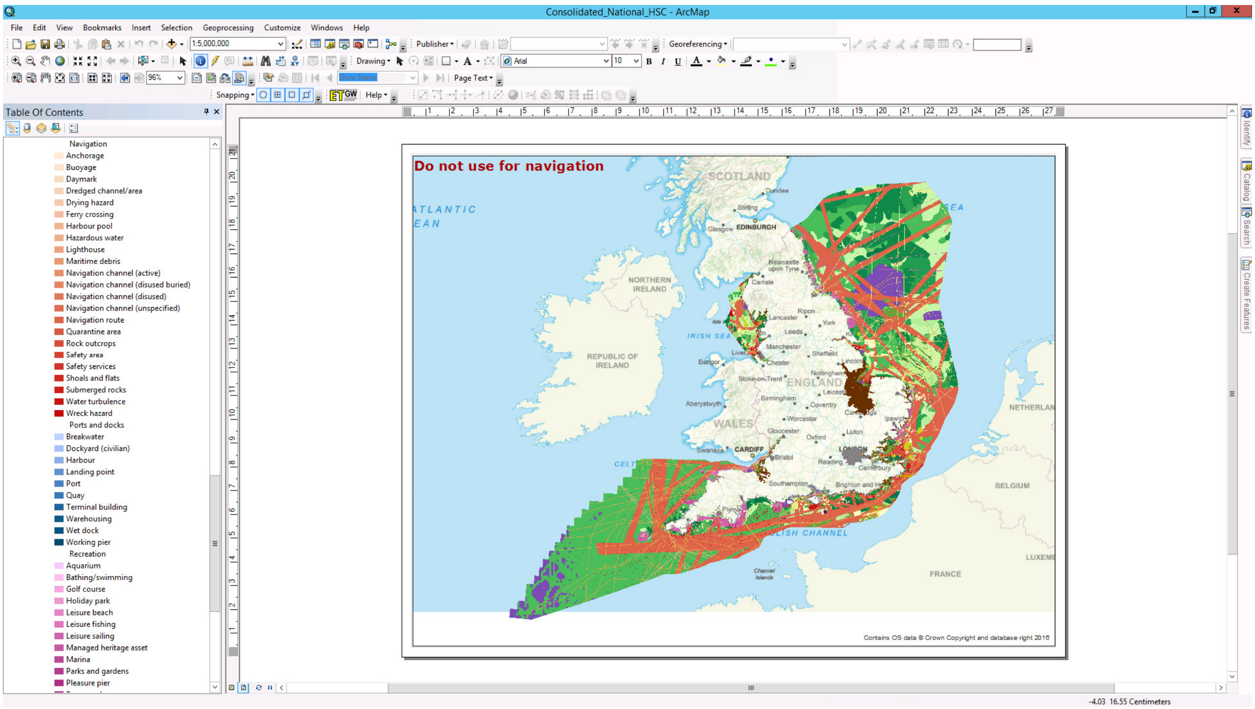
3.169 In the layout view of the MXD, 'Do not use for navigation' is displayed in the top left corner. In addition, open source base mapping (OS Open Raster) has been added to the MXD.

Figure 3.13 NHSC MXD layout view



3.170 Symbology was created for each term in the HSC Thesaurus, the symbology was saved as three layer files (for BDTY, TY and SBTY). SBTY and TY terms were grouped by BDTY and given different shades of the same colour (**Figure 3.14**). **Figure 3.15** and **Figure 3.16** show the symbology for Broad Character Type, Type and Sub-Type.

Figure 3.14 NHSC MXD grouped Sub-types



3.171 Two tables were created to store a set of hyperlinks relevant to each record in the NHSC database. The tables were saved into the geodatabase then used as related tables linked to the HSC_LINK_ID field in the NHSC database. This setup allows the user to easily scroll through marine levels using the Identify tool, view the relevant data and select each National Perspective text link (**Figure 3.17**). If Regional Perspective texts are added to the NHSC database in the future, an additional link table can be generated, allowing the user to select Regional Perspective texts in a similar way.

Broad Type Symbology

- Civic provision
- Coastal infrastructure
- Commerce
- Communications
- Cultural topography
- Enclosed land
- Fishing
- HLC
- Industry
- Military
- Navigation
- Ports and docks
- Recreation
- Settlement
- Unimproved land
- Woodland

Grouped Type Symbology

Civic provision

- Civic provision

Coastal infrastructure

- Flood and erosion defence

Commerce

- Financial administration

Communications

- Telecommunications
- Transport

Cultural topography

- Cultural topography (inter-tidal)
- Cultural topography (landward)
- Cultural topography (marine)
- Palaeolandscape component

Enclosed land

- Reclaimed land

Fishing

- Aquaculture
- Fishing

HLC

- HLC

Industry

- Energy industry
- Extractive industry (minerals)
- Processing industry
- Shipping industry

Military

- Military defence and fortification
- Military facility

Navigation

- Maritime safety
- Navigation activity
- Navigation feature
- Navigation hazard

Ports and docks

- Ports and docks

Recreation

- Recreation

Settlement

- Settlement

Unimproved land

- Coastal rough ground

Woodland

- Woodland

Consolidating the National Historic Seascape Characterisation Database

Figure 3.15: Broad Character Type and Type Symbology

LUC

Historic England

Civic provision

- Educational establishment
- Government office
- Prison hulk

Coastal infrastructure

- Flood and erosion defence
- Flood defence
- Sea defence

Commerce

- Financial institution

Communications

- Bridge
- Canal
- Civilian airfield
- Railway
- Road
- Submarine telecommunications cable
- Telecommunications
- Tramway
- Tunnel

Cultural topography

- Cliff
- Cultural topography (marine) (unspecified)
- Palaeolandscape component
- Coarse sediment plains
- Dunes
- Exposed bedrock
- Fine sediment plains
- Lagoon
- Lake, pond
- Mixed sediment plains
- Mud plains
- Mudflats
- Palaeochannel
- Peat deposit
- Reservoir
- Rocky foreshore
- Saltmarsh
- Sand banks with sand waves
- Sandflats
- Sandy foreshore
- Shingle foreshore
- Submerged forest
- Watercourse
- Wetland

Enclosed land

- Reclamation from sea
- Reclamation from tidal marsh
- Reclamation from wetland

Fishing

- Bait digging
- Bottom trawling
- Drift netting
- Fish farming
- Fish market
- Fish processing facility
- Fish trapping
- Fish warehousing
- Fishing ground
- Fixed netting
- Hand netting
- Longlining
- Pelagic trawling
- Potting
- Seine netting
- Shellfish collection
- Shellfish dredging
- Shellfish farming

HLC

- HLC

Industry

- Aggregate dredging
- Aggregate quarrying
- Boat yard
- Chemical works
- Clay and mud extraction
- Commercial shipping route
- Hydrocarbon field (gas)
- Hydrocarbon field (oil)
- Hydrocarbon installation
- Hydrocarbon pipeline
- Hydrocarbon refinery
- Industrial production (unspecified)
- Iron and steel works
- Lime production
- Mining (coal)
- Mining (metals)
- Mining (other)
- Mining (unspecified)
- Nuclear reprocessing
- Overhead power cable
- Power station (fossil fuel)
- Power station (nuclear)
- Quarrying
- Renewable energy installation (tidal)
- Renewable energy installation (wave)
- Renewable energy installation (wind)
- Salt production
- Sewage works
- Ship yard
- Spoil and waste dumping
- Submarine power cable

Military

- Admiralty telegraph station
- Barracks
- Coastal fortification (unspecified)
- Early modern fortification
- Firing range (land)
- Medieval fortification
- Military airfield
- Military base
- Military practice area
- Modern fortification
- Naval battlefield
- Naval dockyard
- Naval firing range
- Ordnance dumping
- Post-medieval fortification
- Roman fortification
- WW1 fortification
- WW2 defence area
- WW2 fortification

Navigation

- Anchorage
- Buoyage
- Daymark
- Dredged channel/area
- Drying hazard
- Ferry crossing
- Harbour pool
- Hazardous water
- Lighthouse
- Maritime debris
- Navigation channel (active)
- Navigation channel (disused buried)
- Navigation channel (disused)
- Navigation channel (unspecified)
- Navigation route
- Quarantine area
- Rock outcrops
- Safety area
- Safety services
- Shoals and flats
- Submerged rocks
- Water turbulence
- Wreck hazard

Ports and docks

- Breakwater
- Dockyard (civilian)
- Harbour
- Hulk (unspecified)
- Landing point
- Port
- Quay
- Rope making
- Terminal building
- Warehousing
- Wet dock
- Working pier

Recreation

- Aquarium
- Bathing/swimming
- Golf course
- Holiday park
- Leisure beach
- Leisure fishing
- Leisure sailing
- Managed heritage asset
- Marina
- Parks and gardens
- Pleasure pier
- Promenade
- Recreational dive area
- Recreational open ground
- Seaside entertainment
- Sports facility
- Wildlife watching

Settlement

- Urban settlement
- Village

Unimproved land

- Heathland
- Rough grassland
- Scrub

Woodland

- Ancient woodland
- Plantation

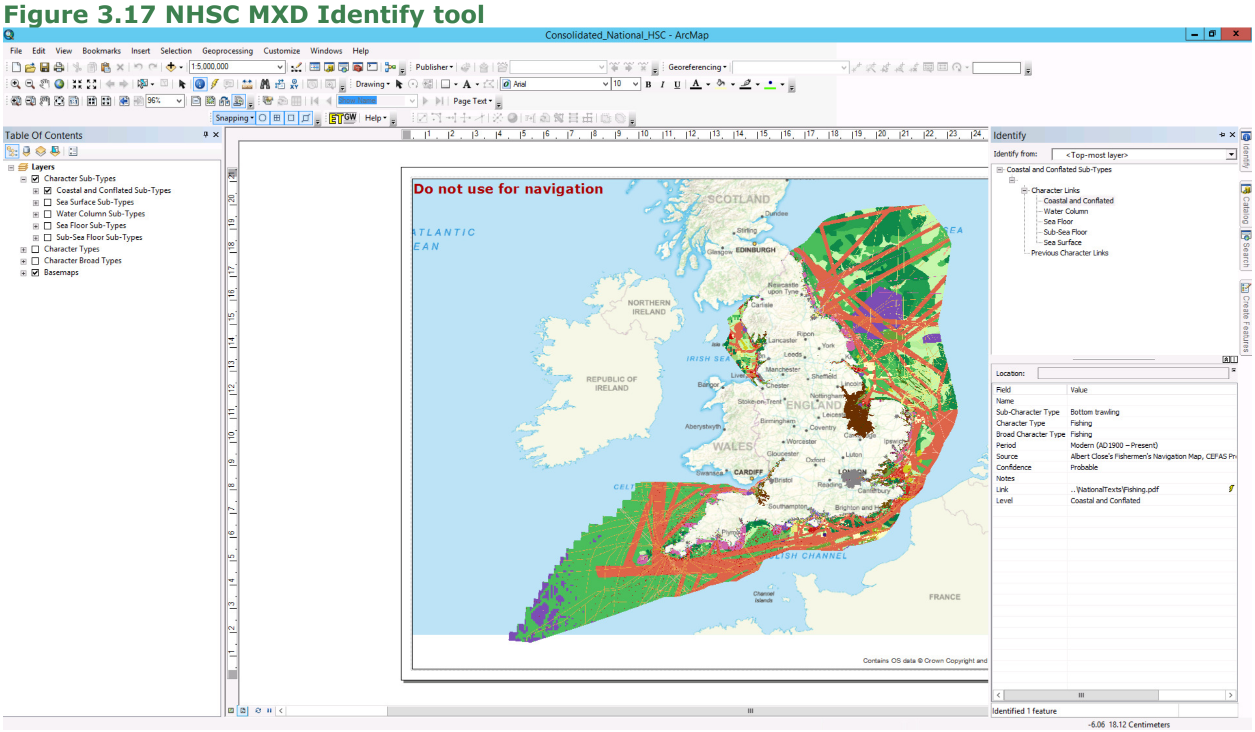
Consolidating the National Historic Seascape Characterisation Database

Figure 3.16: Sub-Type Symbology

LUC

Historic England

Figure 3.17 NHSC MXD Identify tool



500 m and 250 m grid demonstration

3.172 In order to understand the implications of resampling the dataset to 500m resolution, it was agreed that examples of the data at this resolution would be produced. The simplest way to achieve this is by rasterising the dataset to a 500m resolution. The whole HSC data set was converted to raster data with a 500m resolution. In order to make use of the style file (which is designed for vector data rather than raster), the raster data was converted back to vector data in order to produce a 500m gridded data set for the entire project as a demonstration. This process was repeated at 250m resolution. 250m and 500m gridded datasets were produced for Character Sub-Type at each marine level (10 grids in total). This demonstration data is saved in the NHSC database. It needs to be noted that this exercise will have resulted in a loss of the direct link between source datasets and the HSC dataset (as highlighted as a concern in **Table 3.5**).

Project grids

3.173 As only one undissolved project grid was available for this project, it was agreed that where possible, the project team would regenerate an undissolved project grid for the various project areas. Whilst able to regenerate project grids for projects A, C, D, E, G, H, I (saved in the NHSC database), due to grid cell inconsistency (as noted in Task 5), it was not possible to regenerate all of the project area grids.

Metadata

3.174 Metadata is provided in a spreadsheet conforming to the UK GEMINI standards v2.2, an xml version is also provided as a .xml in INSPIRE format.

Technical Advice Note and User Guide

3.175 A Technical Advice Note and User Guide have been produced. The Technical Advice Note contains greater detail about the structure of the NHSC database and how it can be updated; this document is intended for use by HE as guidance for any updates of the database.

3.176 The User Guide provides succinct set of instructions for using the NHSC database, the document is intended for both HE users and external users of the NHSC database. The User Guide covers the NHSC database content, navigation and querying, as well how to make use of the MXD set up.

Exported NHSC database maps

3.177 A series of maps were exported to give a snapshot view of the NHSC database Character Types for CC, SSRFC, WTRCL, SFLR, SBFLR (**Appendix 4**). This series of maps is only one example of the type of output that can be produced from the NHSC database: the database can be queried and filtered using GIS software to create a range of outputs.

4 Project outputs

4.1 Final project outputs include:

- National HSC Consolidation Project Report (this document)
- Technical Advice Note
- User Guide
- NHSC database with accompanying MXD, layer files and style file (symbology) and file structure (detailed in full in the Technical Advice Note)
- Symbology style sheets
- Exported maps drawn from the NHSC database at Character Type (**Appendix 4**).

5 Summary

Summary of issues addressed

5.1 The NHSC consolidation project has addressed the following issues:

- Geometry issues that slowed loading speed and prevented use of tools;
- 69,992 gaps were addressed;
- 1,095 gaps were classed as having no maritime expression and remain as intentional gaps in the characterised areas;
- 54,653 overlapping polygons were addressed;
- Large numbers of terminology inconsistencies throughout the data sets;
- Minor characterisation inconsistencies at project boundaries; and
- Some larger, linear characterisation inconsistencies between projects.

5.2 The final NHSC database:

- Is one consolidated project in geodatabase format;
- Contains no geometry or topology issues;
- Contains field naming and terminology consistent with the National HSC Method Statement (Tapper and Hooley 2010);
- Contains functional hyperlinks to the National Perspective texts; and
- Has been dissolved and indexed to maximise loading speed.

5.3 The following issues were considered beyond the scope of this project:

- Issues requiring large scale re-characterisation of data;
- Addressing inconsistent interpretations of the National HSC Method Statement (Tapper and Hooley 2010) between projects; and
- Characterising sea data in projects A and H where SSRFC (11 records), WTRCL (11 records), SFLR (54 records), SBFLR (227 records) were left blank.

6 References

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Tapper, B. and Hooley, D., 2010. *National HSC Method Statement.* Historic England.

Appendix 1:
Terminology

General:

- GIS: Geographic Information Systems
- ESRI: Supplier of GIS software including ArcMap
- ET Geowizards: Supplier of add-on containing toolboxes for use in ArcMap
- Geometry: The measures and properties of points, lines, and surfaces. In a GIS, geometry is used to represent the spatial component of geographic features (ESRI, 2017e)
- Topology: the arrangement that constrains how point, line, and polygon features share geometry. Topology defines and enforces data integrity rules (for example, there should be no gaps between polygons) (ESRI, 2017e)
- Geodatabase: A database or file structure used primarily to store, query, and manipulate spatial data. Geodatabases store geometry, a spatial reference system, attributes, and behavioral rules for data. Various types of geographic datasets can be collected within a geodatabase, including feature classes, attribute tables, raster datasets, network datasets, topologies, and many others (ESRI, 2017e)
- MXD: A map document containing one map, its layout, and its associated layers, tables, charts, and reports (ESRI, 2017e)
- Raster: A spatial data model that defines space as an array of equally sized cells arranged in rows and columns, and composed of single or multiple bands (ESRI, 2017e)

Project specific:

- HSC: Historic Seascape Characterisation
- NHSC database: National Historic Seascape Characterisation database
- HLC: Historic Landscape Characterisation
- National HSC Method Statement: National HSC Method Statement (Tapper and Hooley 2010)
- Sea data: the gridded part of the National HSC data, generally below Mean Low Water.
- Land data: the non-gridded part of the National HSC data, generally above Mean Low Water and with a distinctively maritime expression

HSC acronyms:

- CC: Coastal and Conflated
- SSRFC: Sea Surface
- WTRCL: Water Column
- SFLR: Sea Floor
- SBFLR: Sub-sea Floor
- PRVS: Previous
- SBTY: Character Sub-type
- BDTY: Broad Character Type
- TY: Character Type
- PRD: Period of historic character
- SRC: Source used to identify character

- CNF: Confidence of character interpretation
- NTS: Additional notes
- CA: Character Area

Appendix 2:

Batch* character terminological realignments between incoming HSC projects and National HSC finalisation

Original SBTY	Corrected SBTY	Notes
Administration & Regulation	Urban settlement	
Admiralty telegraph	Admiralty telegraph station	
Amusement park	Seaside entertainment	
Birdwatching site	Wildlife watching	
Boatyard	Boat yard	
Caution area	Hazardous water	
City	Urban settlement	
Commercial	Financial institution	
Cultural resource	Managed heritage asset	
Custom house	Government office	
Customs house	Government office	
Demersal trawling	Bottom trawling	
Disused navigation channel	Navigation channel (disused)	
Dive site	Recreational dive area	
Dockyard	Dockyard (Civilian)	
Dredged channel	Dredged channel/area	
Dumping spoil ground	Spoil and waste dumping	
Early medieval fortification	Medieval fortification	
Esplanade	Promenade	
Fish factory	Fish processing factory	
Fish production	Fish processing factory	
Fortification	Coastal fortification (unspecified)	PRVS fields correction only
Government offices	Government office	
Hamlet	Village	
Historic shipping route	Commercial shipping route	
Hydrocarbon extraction area (oil)	Hydrocarbon field (oil)	
Industrial production	Industrial production (unspecified)	
Industrial production(unspecified)	Industrial production (unspecified)	
Jetty	Working pier	PRVS fields correction only
Landing stage	Landing point	
Low level fishing	Fishing ground	
Military coastal defences	Coastal fortification (unspecified)	
Mining	Mining (unspecified)	
Mining (metals)	Mining (unspecified)	
Mixed maritime activity	Fishing ground	
Navigation channel	Navigation channel (unspecified)	
Navigation light	Daymark	

Original SBTY	Corrected SBTY	Notes
Navigation route/area	Navigation route	
Obstruction	Hazardous water	Correction for CC, WTRCL and SSRFC fields
	Maritime debris	Correction for SFLR field
Palaeolandscape	Palaeolandscape component	
Peat deposits	Peat deposit	
Post medieval fortification	Post-medieval fortification	
Prehistoric fortification	Coastal fortification (unspecified)	
Renewable energy installation	Renewable energy installation (wind)	
River channel	Watercourse	
Rocky outcrop	Rock outcrops	
Rope-making	Rope making	
Rough ground	Rough grassland	
Safety area (offshore)	Safety area	
Salt marsh	Saltmarsh	
Saltern	Salt production	
Saltmaking	Salt production	
Sandbank	Sandbank with sand waves	
Set netting	Fixed netting	
Settlement	Urban settlement	
Shipyard	Ship yard	
Spoil & waste dumping	Spoil and waste dumping	
Sports site	Sports facility	
Submarine cable	Submarine telecommunications cable	
Submarine forest	Submerged forest	
Swimming/bathing	Bathing/swimming	
Warehouse	Warehousing	
Water works	Processing industry	
Watersports	Sports facility	
Wreck cluster	Wreck hazard	

*Table only shows character term realignments that were completed as a batch update, further character term realignments were made on a more individual basis.

Appendix 3:

Detailed characterisation notes

Task 10 – Project Interfaces

General

Noted inconsistencies are summarised in the tables below. All inconsistencies were found within the sea data. This may reflect the fact that although HSC data for both land and sea is interpretative and based on multiple sources, on land both the HSC data and source data are held in polygons defined by palpable real-world boundaries (such as an edge of settlement or woodland) whereas at sea HSC data is held in the cells of an arbitrarily-defined and relatively coarse grid mesh which may intersect with a range of source options which themselves may not be sharply defined.

Resolution of boundary issues was hampered, particularly for fishing and palaeolandscape-related Types, as transparency and accuracy in data source used for the original HSC assessors' attribution was often poor. This included instances where a source was cited which demonstrably does not extend to the project boundary join in question. This was the case with the South Coast REC[5] which was cited as a source for different attributions either side of the D-E join but, having checked the GIS data available online for this project, none of the relevant layers extended far enough to reach this join. This raises questions on the quality of attribution in both source HSC projects. In many more cases, it was impossible to interrogate which attribution was correct as the HSC assessor's attribution lacked sufficient specificity. This was a particular issue where SeaZone or Cefas data was cited since these are complex multi-themed data sources with extensive use of coded values. As such, simply citing "SeaZone Hydrospatial" as the source does not aid in interrogating where the attribution came from and, in many cases, no matching information appeared to be present in the current SeaZone data supplied to this Project.

There were also issues in accessing some of the sources used by implementation projects. These partly related to the specificity of data source used (see above) but also due to the online hosting of several specific projects having expired. They also related to published sources, particularly where palaeolandscape were concerned. The Project Report for project D stated that for palaeolandscapes "*the majority of data was drawn from the results of the MEPF Waterlands project undertaken by ABPmer (Goodwin et al, 2010)*"[6]. Project E stated that "*Additional information with regard to leisure boating and sailing with associated facilities was queried from various relevant leisure sailing and cruising guides. Much of the information relating to fishing areas was sourced from Close's Fishing Chart and checked alongside information available through CEFAS, JNCC, REC, MESH, Defra, and documentary sources UKHO charts*"[7]. These are both instances of the use of poorly accessible sources of information which were not available to this Project for checking attributions derived from it.

The transition from neighbouring projects to project F was very abrupt at all levels of the data, most obviously so at Sub-sea Floor level. Changes were made to the 'Palaeolandscape components' classification in project F which created more consistent project boundaries with projects E and G.

Table 6.1 Coastal and Conflated

	Description of issue	Resolution
B-C	No issues	Not applicable
C-D	C – Military practice area; D = Mixed sediment plains.	Reviewed UK SeaMap and SeaZone data to establish correct attribution.

[5] http://www.southcoastrecgis.org.uk/sc/

[6] Maritime Archaeology and SeaZone 2011 Section 6.2.2.8

[7] Cotswold Archaeology 2014 Section 4.2.9

	Description of issue	Resolution
	The odd grid square, some of which were grid overlaps, looks erroneously characterised on D side in Coarse sediment plains.	Resolved by removal of grid overlaps. Remainder resolved by review of UK SeaMap and SeaZone data to establish correct attribution.
	A total mismatch adjacent to the shore affecting a length of 4km: in C characterised as Military practice area and Hazardous water whereas in D characterised as Buoyage, Drying hazard, Fishing ground, Navigation route.	Reviewed UK SeaMap and SeaZone data to establish correct attribution. This resulted in an extension of C (SW) interpretation as this appeared to be more appropriate.
D-E	Extensive mismatches. Very abrupt transition in shoreward 11km with mismatches in grain and attributes (D = Commercial shipping route, Potting, Sand banks with sand waves; E = Palaeolandscape component, Bottom trawling, Shoals and flats). Also 8km near outer edge of grid (D = Shellfish dredging; E = Palaeochannel).	Not addressed as lacking either source data to enable update or sufficient transparency in original attribution to enable checking.
E-F	Several mismatches (F = Fishing ground; G = Longlining), (F = Navigation Route; G = Seine netting), (F = Commercial shipping route; G = Navigation Route), (F = Navigation Route; G = Submarine telecommunications cable), (F = Navigation Route; G = Hydrocarbon pipeline), (F = Longlining; G = Navigation Route), (F = Leisure sailing; G = Longlining, Drift netting).	Issues related to Navigation route and Commercial shipping route resolved by the overarching subsuming of Commercial shipping route into Navigation route and reattribution of grids with this value. Others not addressed as lacking source data to enable update. Particularly problematic for fishing and palaeolandscape-related Types.
F-G	Extensive mismatches (E =Palaeolandscape component; F = Navigation Route), (E =Commercial shipping route; F = Fishing Ground, Navigation Route), (E =Coarse sediment plains; F = Navigation Route).	Issues related to Navigation route and Commercial shipping route resolved by the overarching subsuming of Commercial shipping route into Navigation route and reattribution of grids with this value. Others not addressed as lacking source data to enable update.
G-H	Grid square overlap along whole project boundary but join otherwise ok.	Issue resolved by edit to overlap.
H-I	Minor issue at interface whereby some grid squares are wrongly characterised, making it look like a sliver.	Wrongly attributed squares updated.

Table 6.2 Sea Surface

	Description of issue	Resolution
B-C	No issues	Not applicable
C-D	C = Military practice area; D = Mixed sediment plains.	Reviewed UK SeaMap and SeaZone data to establish correct attribution.
	The odd grid square, some of which were grid overlaps, looks erroneously characterised on D side in Coarse sediment plains.	Resolved by removal of grid overlaps. Remainder resolved by review of UK SeaMap and SeaZone data to establish correct attribution.
	Mismatch adjacent to the shore affecting a length of 4km.	Reviewed UK SeaMap and SeaZone data to establish correct attribution. This resulted in an extension of C (SW) interpretation as this appeared to be more appropriate.
D-E	Extensive mismatches. Very abrupt transition in shoreward 11km with mismatches in grain	Not addressed as lacking either in source data to enable update or sufficient

	Description of issue	Resolution
	and attributes (D = Commercial shipping route, Potting, Sand banks with sand waves; E = Palaeolandscape component, Bottom trawling, Shoals and flats). Also 8km near outer edge of grid (D = Shellfish dredging; E = Palaeochannel).	transparency in original attribution to enable checking.
E-F	Several mismatches (F = Fishing ground; G = Longlining), (F = Navigation Route; G = Seine netting), (F = Commercial shipping route; G = Navigation Route), (F = Navigation Route; G = Submarine telecommunications cable), (F = Navigation Route; G = Hydrocarbon pipeline), (F = Longlining; G = Navigation Route), (F = Leisure sailing; G = Longlining, Drift netting).	Issues related to Navigation route and Commercial shipping route resolved by the overarching subsuming of Commercial shipping route into Navigation route and reattribution of grids with this value. Others not addressed as lacking source data to enable update.
F-G	Extensive mismatches (E =Palaeolandscape component; F = Navigation Route), (E =Commercial shipping route; F = Fishing Ground, Navigation Route), (E =Coarse sediment plains; F = Navigation Route).	Issues related to Navigation route and Commercial shipping route resolved by the overarching subsuming of Commercial shipping route into Navigation route and reattribution of grids with this value. Others not addressed as lacking source data to enable update.
G-H	Grid square overlap along whole project boundary but join otherwise ok.	Issue resolved by edit to overlap.
H-I	Minor issue at interface whereby some grid squares are wrongly characterised, making it look like a sliver.	Wrongly attributed squares updated.

Table 6.3: Water Column

	Description of issue	Resolution
B-C	No issues	Not applicable
C-D	A total mismatch adjacent to the shore affecting a length of 4km.	Reviewed UK SeaMap and SeaZone data to establish correct attribution. This resulted in an extension of C (SW) interpretation as this appeared to be more appropriate.
D-E	Minor mismatch (D = Commercial shipping route; E = Bottom trawling and Shellfish dredging).	Not addressed as lacking either in source data to enable update or sufficient transparency in original attribution to enable checking.
E-F	Several mismatches (E =Military practice area; F = Longlining), (E = Commercial shipping route; F = Navigation Route), (E = Military practice area; F = Harbour Pool) (E = Hazardous Water; F = Renewable energy installation (wind)), (E = Military practice area; F = Navigation Route, Hazardous Water)	Not addressed as lacking either in source data to enable update or sufficient transparency in original attribution to enable checking.
F-G	Some mismatches (F = Ferry crossing; G = Longlining), (F = Ferry crossing; G = Seine netting), (F = Navigation route; G = Seine netting), plus 6km length near shore total mismatch, (F = Navigation channel (active); G = Fixed netting), (F = Shellfish dredging, Navigation route, Navigation channel (active); G = Drift netting)	Not addressed as lacking either in source data to enable update or sufficient transparency in original attribution to enable checking.
G-H	Five small mismatches: 4 are Leisure sailing in H that do not continue into G and the remaining one is Fixed netting in H and Potting in G.	Not addressed as lacking either in source data to enable update or sufficient transparency in original attribution to enable checking.

	Description of issue	Resolution
H-I	Minor issue at interface whereby some grid squares are wrongly characterised, making it look like a sliver.	Wrongly attributed squares updated.

Table 6.4: Sea Floor

	Description of issue	Resolution
B-C	No issues	Not applicable
C-D	Mismatch over 1km at shore (C = Submerged rocks; D = Drying hazard)	Reviewed UK SeaMap and SeaZone data to establish correct attribution. This resulted in an extension of C (SW) interpretation as this appeared to be more appropriate.
D-E	Several mismatches (D = Fishing ground; E = Bottom trawling), (D = Palaeochannel; E = Shellfish dredging), (D = Sand banks with sand waves; E = Shoals and flats), (D = Submerged rocks; E = Shoals and flats), (D = Sand banks with sand waves and Submerged rocks; E = Potting)	Not addressed as lacking either in source data to enable update or sufficient transparency in original attribution to enable checking.
E-F	Extensive mismatches (E =Military practice area; F = Bottom trawling), (E = Shoals and flats; F = Sand banks with sand waves), (E = Military practice area; F = Coarse sediment plains, Wreck hazard, Mud plains), (E = Military practice area, Renewable energy installation (wind); F = Renewable energy installation (wind))	Not addressed as lacking either in source data to enable update or sufficient transparency in original attribution to enable checking.
F-G	Very extensive mismatch largely associated with one Type in F (Bottom trawling) transitioning to multiple Types in G (Fine sediment plains, Coarse sediment plains). Also total mismatch over nearshore 12km (F = Navigation channel (active), Shellfish dredging, Sand banks with sand waves, Mixed sediment plains; G = Fine sediment plains)	Not addressed as lacking either in source data to enable update or sufficient transparency in original attribution to enable checking.
G-H	No issue	Not applicable
H-I	Minor issue at interface whereby some grid squares are wrongly characterised, making it look like a sliver.	Wrongly attributed squares updated.

Table 6.5: Sub-Sea Floor

	Description of issue	Resolution
B-C	No issues	Not applicable
C-D	Mismatch over 1km at shore (C =Exposed bedrock; D = Coarse sediment plains).	Reviewed UK SeaMap and SeaZone data to establish correct attribution. This resulted in an extension of C (SW) interpretation as this appeared to be more appropriate.
D-E	Several mismatches (D = Coarse sediment plains; E = Palaeochannel), (D = Palaeochannel; E = Coarse sediment plains). Also 2 areas characterised as Palaeolandscape component stop at transition, present in E but D has Fine sediment plains or Palaeochannel.	Not addressed as lacking either in source data to enable update or sufficient transparency in original attribution to enable checking.
E-F	Extensive shoreward mismatch (E =	Not addressed as lacking either in source

	Description of issue	Resolution
	Submarine power cable; F = Palaeolandscape component), (E = multiple Type including Palaeochannel; F = Palaeochannel), (E = ; F = Palaeolandscape component)	data to enable update or sufficient transparency in original attribution to enable checking.
F-G	Extensive mismatch largely associated with one Type in F (Palaeolandscape component) transitioning to multiple Types in G (Fine sediment plains, Coarse sediment plains). Also Submarine telecommunications cable in F which stops in G. Bottom trawling present, counter to HSC Thesaurus expression indicator.	Palaeolandscape component changed to either the term in SFLR (if suitable) or Cultural Topography (marine) (unspecified). Submarine telecommunications cables were copied down from SFLR to address the boundary inconsistency. Bottom trawling addressed by reference to UK SeaMap.
G-H	Bottom trawling present, counter to HSC Thesaurus expression indicator.	Bottom trawling addressed by reference to UK SeaMap.
H-I	Minor issue at interface whereby some grid squares are wrongly characterised, making it look like a sliver.	Wrongly attributed squares updated.

Task 18 - Manual topology corrections

Background

Two types of geometry issues were identified; gaps and overlaps. These notes focus on the manual review of those gaps and overlaps remaining following tool and rule-based elimination of other gaps.

Gaps in the data included those present in the implementation projects that were highlighted through earlier processing of the HSC data. To create a single dataset, they were infilled by geoprocessing tools resulting in the creation of a number of polygons with null values in all attributes.

Overlaps were found in both polygon and grid data.

Any record edited in this process by the Project Team has been flagged in the attribute table so that updates undertaken within this project are obvious and can be differentiated from the source HSC datasets.

This process highlighted that there were issues with the quality of data creation in several of the source HSCs (particularly A, D and H) as these contained multiple gaps and overlaps. It also highlighted that data creation in project C appeared to be of the highest quality of the HSC datasets as all gaps checked within this project area were legitimate gaps (with no maritime expression) and there were no polygon overlaps.

Gaps

Gaps were checked to establish whether or not they were intentional (left uncharacterised by the source HSC dataset), or whether they represented land which appeared as if it should have been characterised by the original HSC dataset. In the process of reviewing these, attributes were added as notes to indicate the project team member’s findings.

Gaps were found to fall into the following categories:

- Incidental infill by geoprocessing tools;
- Land/sea gaps (i.e. places where the original HSC polygon data and HSC grid data did not meet);
- Land/sea gap created by Portsmouth area alignment issue

- Gaps lacking attributes (i.e. land that appeared as if it should have been characterised by the original HSC project).

For the latter category, comparison with neighbouring characterised HSC polygons and baseline data was used to add an appropriate attribution from the HSC Thesaurus.

Polygon Overlaps

These were found in all projects except project C. Overlaps were particularly prevalent in project H and appear to reflect issues with the manner in which data was created in this project area. These appear to relate to the use of buffers to create polygons associated with particular HSC Sub-types. Overlaps appear to be most commonly associated with Railways and to navigational aids (including Daymarks). This may be associated with the use of buffers to cut other data sources to form the resulting polygon associated with this HSC Sub-type (e.g. Daymark was frequently found overlapping identically shaped, but differently attributed polygons). The issue also arose where polygons of identical shape and HSC Sub-type existed but had different names or source recorded.

Overlaps were resolved by review of each incidence against baseline data, chiefly modern Ordnance Survey base mapping but also aerial photography, to establish which took precedence. Once this had been established, the remaining overlapping polygons at that location were identified for deletion. In those cases where a differing name or source was recorded, these were reviewed and information combined into the relevant attribute field where appropriate.

Grid Overlaps

Grid overlaps were present across all project areas but the vast majority (560 out of 697) lay at the G-H transition. The G–H transition was related to the sliver of polygons along the entire boundary and addressed by review of which characterisation was correct and removal of the incorrect records.

In the remaining cases, grid overlaps appeared to be derived from accidental repeat characterisation of the same grid square with subtly different values at various levels in the data (i.e. the same square could have matching attributes in all levels apart from one or in multiple levels). Review indicated that particular attributes[8], due to their highly specific nature, were likely to be recorded correctly to a location. In these cases, the grid squares containing these attributes were retained whilst the overlapping grid square or squares were marked for deletion. For all other cases, the grid square most consistent with the characterisation of the surrounding area was retained.

Task 19 – Characterisation corrections

Type attribution

Review of attributions as part of the terminology checks earlier in the project highlighted some issues with the use of certain HSC Types and also gaps in the characterisation. The former focused chiefly on consistency of how certain HSC Types were used with between projects and extended into attribution of PRVS Types. Gaps in the characterisation were highlighted by the occurrence of the value “New” as a BDTY in SSFRC, WTRCL and SFLR.

These are examples of issues with the characterisation which have come to light incidentally through our work on consolidating the individual HSCs and do not represent a comprehensive assessment of issues which there may be with individual characterisations.

Consistency

Issues observed with the use of trawling and dredging Types and with those related to fortifications.

[8] Aggregate dredging, Buoyage, Anchorage, Ordnance dumping and Hydrocarbon pipeline.

Trawling and dredging

Those related to trawling and dredging focused chiefly on the use of this Type in the Sub-sea Floor level of the data. This was contrary to the HSC Thesaurus and general understanding of such activities, which sees them as affecting the Sea Floor but not penetrating into the Sub-sea Floor level. Where possible, UK SeaMap data was used to revise. As discussed in the main project report, it has not been possible to update all instances of this due to the extensive re-characterisation and access to additional sources that would be required.

Fortifications

Coastal fortifications appear to have been dealt with inconsistently between projects. That they do not have consistent or coherent visibility in the HSC dataset is a source of concern since these are some of the most recognisable land-based features which have maritime character as well as many being designated heritage assets of the highest significance and having a high level of public recognition.

Table 6.6: Examples of Types used for fortifications between project areas

Project Area	Fortification name	CC SBTY	PRVS SBTY	Representation	notes
D	Hurst Castle	Daymark	Post-medieval fortification	buffered	n/a
D	Calshot Castle	Daymark	Post-medieval fortification	shape	n/a
D	Fort Gilkicker	Daymark	Post-medieval fortification	shape	n/a
D	Fort Monckton	Daymark	Post-medieval fortification	shape	n/a
E	Garrison Point Fort, Sheerness	Early modern fortification	Dockyard	shape	Incorrect attribution - current remains are largely 19th Century, it was not previously a dockyard
E	Tilbury Fort	Post-medieval fortification	Post-medieval fortification	shape	Unclear why it is recorded with an identical SBTY in both current and previous levels
C	Verne Citadel	Early modern fortification	Early modern fortification	shape	Unclear why it is recorded with an identical SBTY in both current and previous levels
C	Drake's Island	WW2 fortification	WW1 fortification/Early modern fortification/Post-medieval fortification/Daymark	shape	Order of PRVS is odd with Daymark at bottom.
B	Brean Down	Early modern fortification	Scrub	shape	Seems inconsistent with date of remains (Iron Age promontory fort with Palmerstonian defences at seaward end)
A	Pilling	WW2 fortification	n/a	buffered	No sign of them on aerials or current mapping

Project Area	Fortification name	CC SBTY	PRVS SBTY	Representation	notes
					so unclear why they are included as a current Type
A	Lancaster Sands	WW2 fortification	n/a	buffered	Not on aerials or current mapping so unclear why they are included as a current Type
A	Ravenglass	Roman fortification	n/a	shape	
G	Castle Rising	Medieval fortification	n/a	shape	
G	Haile Sand Fort	WW1 fortification	Palaeolandscape component	buffered	Buffered 200m from centroid and cut out of sea grid
G	Bull Sand Fort	WW1 fortification	Palaeolandscape component	buffered	Buffered 200m from centroid and cut out of sea grid
F	Bell Hill	WW2 fortification	n/a	shape	Only one in project area entire dataset
H	Flamborough Castle	Fortification	n/a	shape	
H	Bamburgh Castle	Fortification	n/a	shape	

"New" as BDTY for SSFRC, WTRCL and SFLR

This is an issue specific to project A and affected 62 records. In all cases, characterisation had been undertaken at CC level and at Sub-sea Floor level but was missing from intervening levels.

The following instances were readily updatable based on that which was recorded in either CC or SBFLR:

- Seven had "Maritime debris" as CC_SBTY – these were updated to "Hazardous water" for SSFRC and WTRCL;
- One had Aggregate dredging as CC_SBTY – SSFRC and WTRCL changed to Navigation route to match neighbours;
- One recorded as Ferry crossing – this value was transferred into SSFRC and WTRCL;
- One recorded as Submerged rocks - SSFRC accordingly updated to "Hazardous water";

The remainder were split across a variety of Types[9] and covered extensive areas of project A. This highlighted a wider issue, namely that there were large expanses of sea with no characterisation for WTRCL and SSFRC. Many of these were contiguous with one another so it was impossible to extrapolate from adjacent grid squares what the appropriate values should be. This was problematic since HSC lacks a generic Type for zones without overarching or particular marine character so the records could not simply be given such an attribute. Review of further data sources indicated that the whole project area lay within EU fishing ground subdivision VII a (Irish Sea)[10] so may legitimately be regarded as falling within the Fishing ground Sub-type. This value has been added as the Sub-type for these records and the following notes added "area not characterised at this level of the data in original source data. As this entire area lies in EU fishing ground subdivision VII a (Irish Sea), generic Fishing ground Sub-type has been applied."

[9] Coarse sediment plains, Fine sediment plains, Hydrocarbon pipeline, Sewage works (outfall pipelines), Shellfish collection, Spoil and waste dumping, Submarine power cable and Submarine telecommunications cable

[10] https://ec.europa.eu/fisheries/sites/fisheries/files/docs/body/fishing_areas_en.pdf

PRVS Type issues

Several issues were identified relating to the attribution of PRVS Types, the majority were in land data. These ranged from peculiar attributions to odd ordering of PRVS Types. The latter comprise records where the PRVS Types have been inserted in a seemingly illogical order whereby there is no chronological progression (either from most recent to oldest, or vice versa) between the Types recorded.

In terms of incorrect attributions, these fell into two categories:

- Seemingly unjustified attributions of PRVS Types; and
- Polygons where PRVS Types are recorded but no CC was recorded.

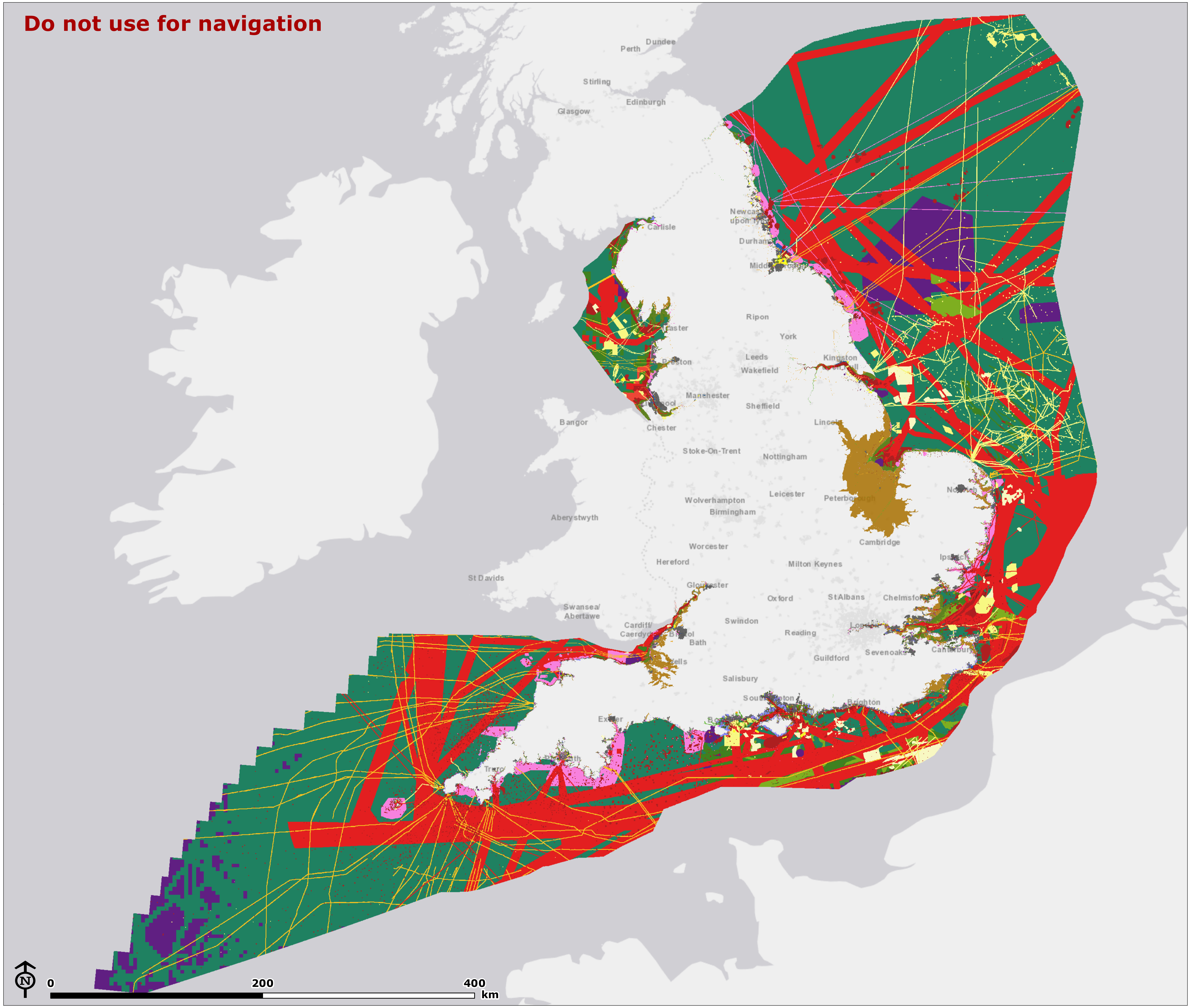
The latter are discussed in the main project report (**Section 2, Task 16)** which deals with the adoption of the "HLC" Sub-type so this discussion focuses on the former aspect.

There were several instances of PRVS recorded as Maritime safety or Daymark when there was no apparent evidence for there being anything of this Sub-type at this location. Historic Ordnance Survey and aerial photography was checked to establish this. In these cases the PRVS Type was nulled and notes made to this effect.

There were 135 examples of records tagged as "rough ground" in PRVS2_SBTY. These are all in H and all lie within the marine zone. As discussed in the main project report, this Sub-type was not within the controlled terminology of the HSC Thesaurus and it was by review of terminology that this issue was highlighted. All 135 records appear to represent areas which were formerly dry land within the early post-glacial *Doggerland* zone. There is nothing in the project report for H which supports attribution of this Sub-type within a marine context as it is focused on coastal land. Having reviewed where it appears in the sequence of PRVS Types, it is likely that it was added to the marine data to highlight that this land would have become marginal and of poor quality prior to its final inundation during marine transgression. The wording in the description of the character type from Volume 3 of the project report for H may explain this (our emphasis) "*This Character Type is characterised mostly by vegetation that has developed after several decades of neglect. Until its abandonment by farmers, vegetation would generally have been herb-rich grassland*". However the various estimated dates for the final submergence of the *Doggerland* areas in the central North Sea all occur well before the earliest evidence for farming activity in north west Europe. Consequently the application of this Type to those areas was inappropriate and added no useful information to understanding the sequence of HSC. All such instances were overwritten with the immediately preceding PRVS_SBTY and previous attributions moved up the fields sequentially (i.e. for each record where this value occurs at PRVS2_SBTY, PRVS2_SBTY replaced with PRVS3_ SBTY, PRVS3_SBTY replaced with PRVS4_ SBTY and PRVS4_SBTY replaced with PRVS5_ SBTY).

Appendix 4:
HSC Character Type maps

The Character Type mapping presented here gives only an example of the many mapped outputs possible from the NHSC database. The database can be queried and filtered on various combinations of its fields to create a range of outputs tailored to the application in hand.



Consolidating the National Historic Seascape Characterisation Database

Coastal and Conflated Character Type

Civic provision
- Civic provision

Coastal infrastructure
- Flood and erosion defence

Communications
- Telecommunications
- Transport

Cultural topography
- Cultural topography (inter-tidal)
- Cultural topography (landward)
- Cultural topography (marine)
- Palaeolandscape component

Enclosed land
- Reclaimed land

Fishing
- Aquaculture
- Fishing

HLC
- HLC

Industry
- Energy industry
- Extractive industry (minerals)
- Processing industry
- Shipping industry

Military
- Military defence and fortification
- Military facility

Navigation
- Maritime safety
- Navigation activity
- Navigation feature
- Navigation hazard

Ports and docks
- Ports and docks

Recreation
- Recreation

Settlement
- Settlement

Unimproved land
- Coastal rough ground

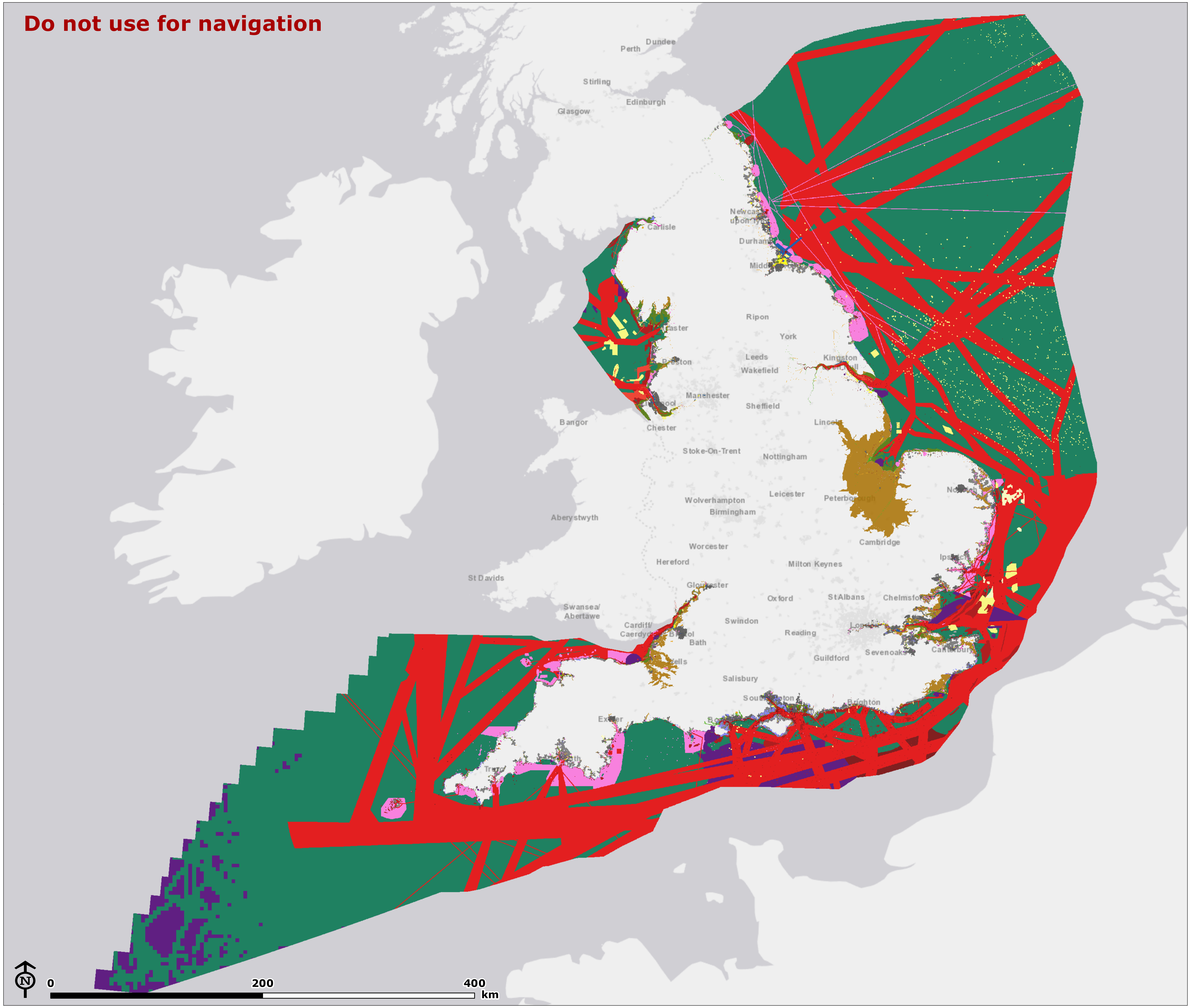
Woodland
- Woodland

Map Scale @A3: 1:3,500,000

LUC

Historic England

CB:KS EB:Manson D LUC Appendix4_6738_r1_CC_A4L 27/07/2017 Source: HE



Consolidating the National Historic Seascape Characterisation Database

Coastal and Sea Surface Character Type

Civic provision
- Civic provision

Coastal infrastructure
- Flood and erosion defence

Communications
- Telecommunications
- Transport

Cultural topography
- Cultural topography (inter-tidal)
- Cultural topography (landward)
- Cultural topography (marine)
- Palaeolandscape component

Enclosed land
- Reclaimed land

Fishing
- Aquaculture
- Fishing

HLC
- HLC

Industry
- Energy industry
- Extractive industry (minerals)
- Processing industry
- Shipping industry

Military
- Military defence and fortification
- Military facility

Navigation
- Maritime safety
- Navigation activity
- Navigation feature
- Navigation hazard

Ports and docks
- Ports and docks

Recreation
- Recreation

Settlement
- Settlement

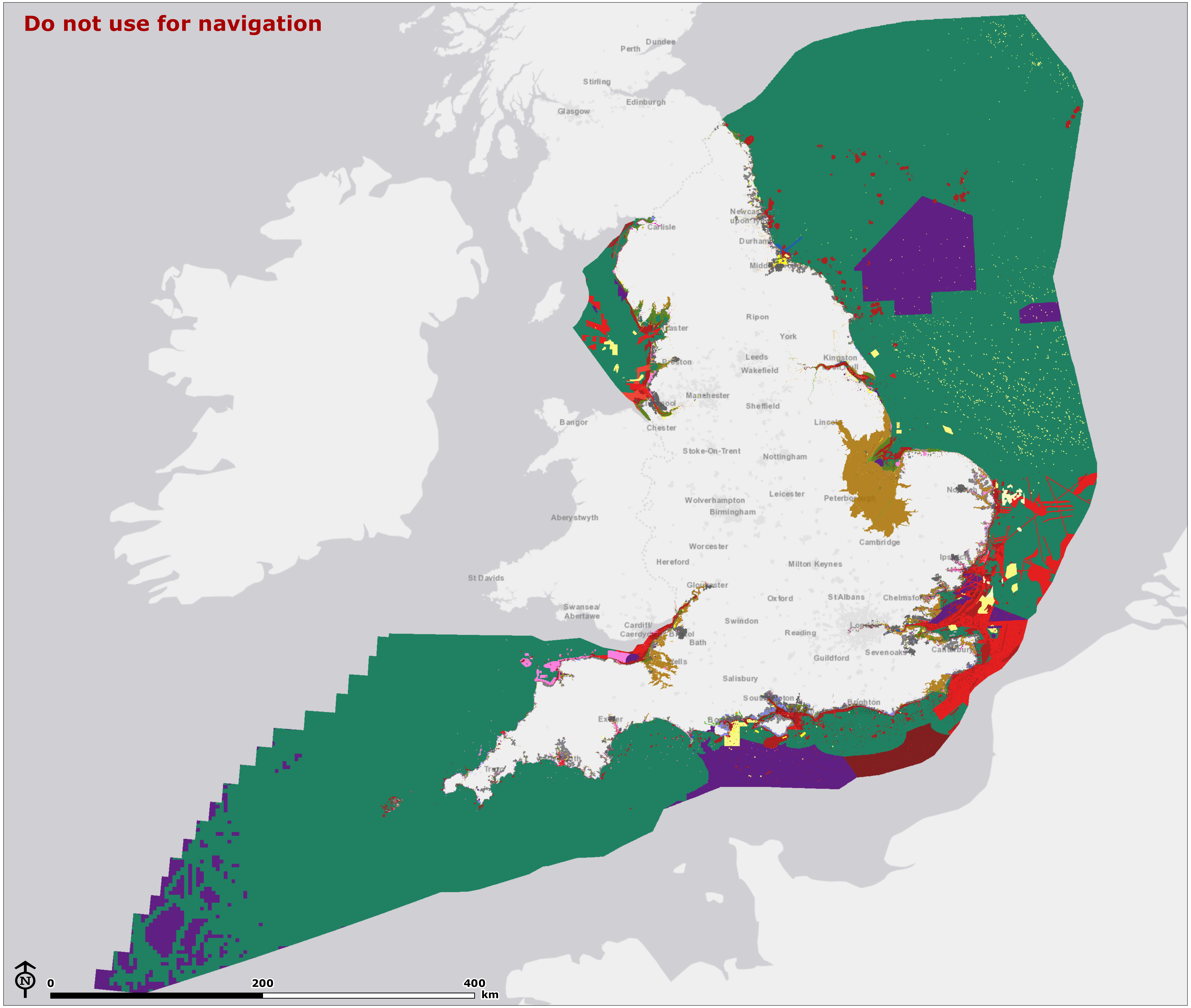
Unimproved land
- Coastal rough ground

Woodland
- Woodland

Map Scale @A3: 1:3,500,000

LUC
Historic England

CB:KS EB:Manson D LUC Appendix4_6738_r1_SSRFC_A4L 27/07/2017 Source: HE



Consolidating the National Historic Seascape Characterisation Database

Coastal and Water Column Character Type

Civic provision

- Civic provision

Coastal infrastructure

- Flood and erosion defence

Communications

- Telecommunications
- Transport

Cultural topography

- Cultural topography (inter-tidal)
- Cultural topography (landward)
- Cultural topography (marine)
- Palaeolandscape component

Enclosed land

- Reclaimed land

Fishing

- Aquaculture
- Fishing

HLC

- HLC

Industry

- Energy industry
- Extractive industry (minerals)
- Processing industry
- Shipping industry

Military

- Military defence and fortification
- Military facility

Navigation

- Maritime safety
- Navigation activity
- Navigation feature
- Navigation hazard

Ports and docks

- Ports and docks

Recreation

- Recreation

Settlement

- Settlement

Unimproved land

- Coastal rough ground

Woodland

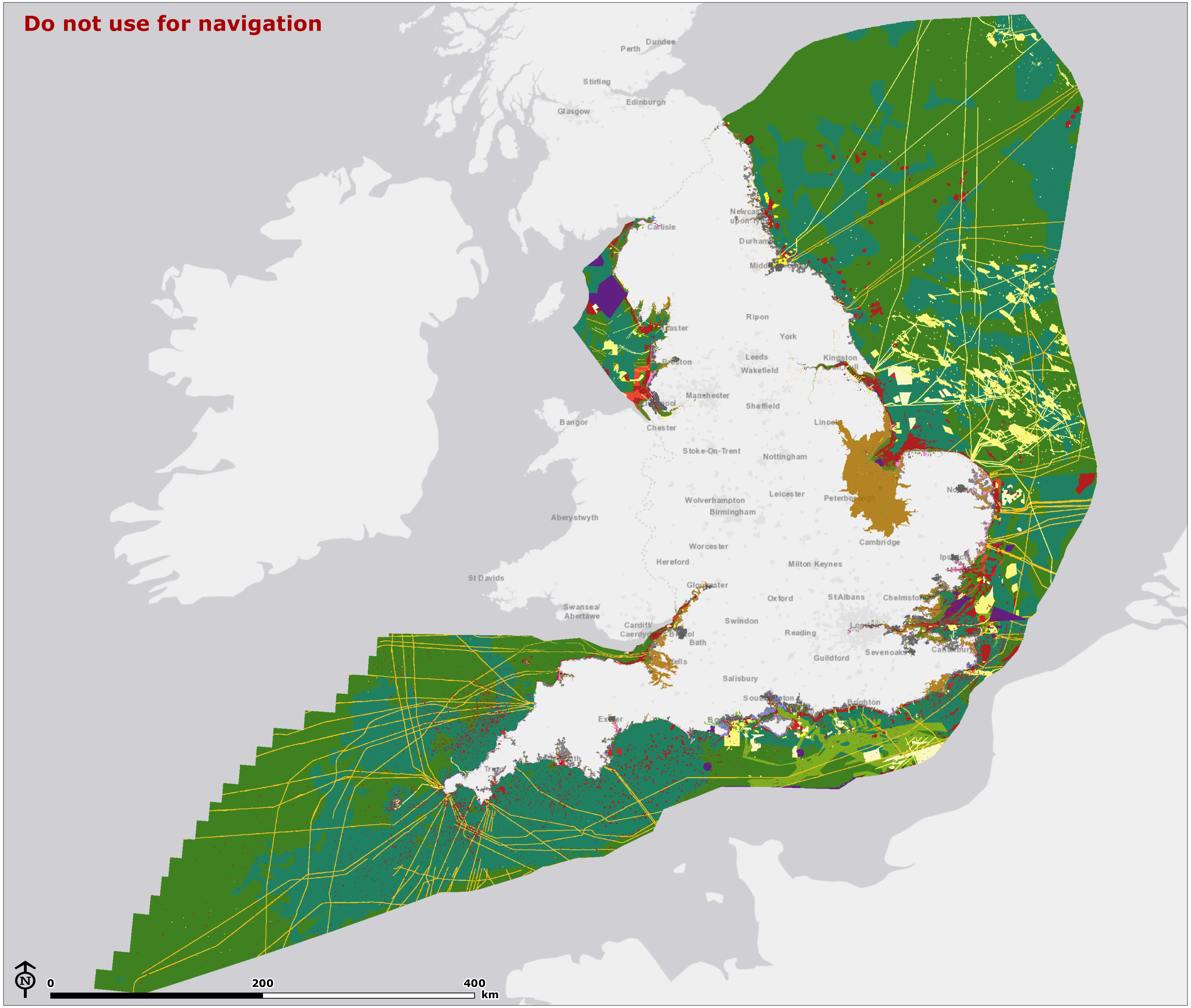
- Woodland

Map Scale @A3: 1:3,500,000

Historic England

CB:KS EB:Manson D LUC Appendix4_6738_r1_WTRCL_A4L 27/07/2017

Source: HE



Consolidating the National Historic Seascape Characterisation Database

Coastal and Sea Floor Character Type

Civic provision
- Civic provision

Coastal infrastructure
- Flood and erosion defence

Communications
- Telecommunications
- Transport

Cultural topography
- Cultural topography (inter-tidal)
- Cultural topography (landward)
- Cultural topography (marine)
- Palaeolandscape component

Enclosed land
- Reclaimed land

Fishing
- Aquaculture
- Fishing

HLC
- HLC

Industry
- Energy industry
- Extractive industry (minerals)
- Processing industry
- Shipping industry

Military
- Military defence and fortification
- Military facility

Navigation
- Maritime safety
- Navigation activity
- Navigation feature
- Navigation hazard

Ports and docks
- Ports and docks

Recreation
- Recreation

Settlement
- Settlement

Unimproved land
- Coastal rough ground

Woodland
- Woodland

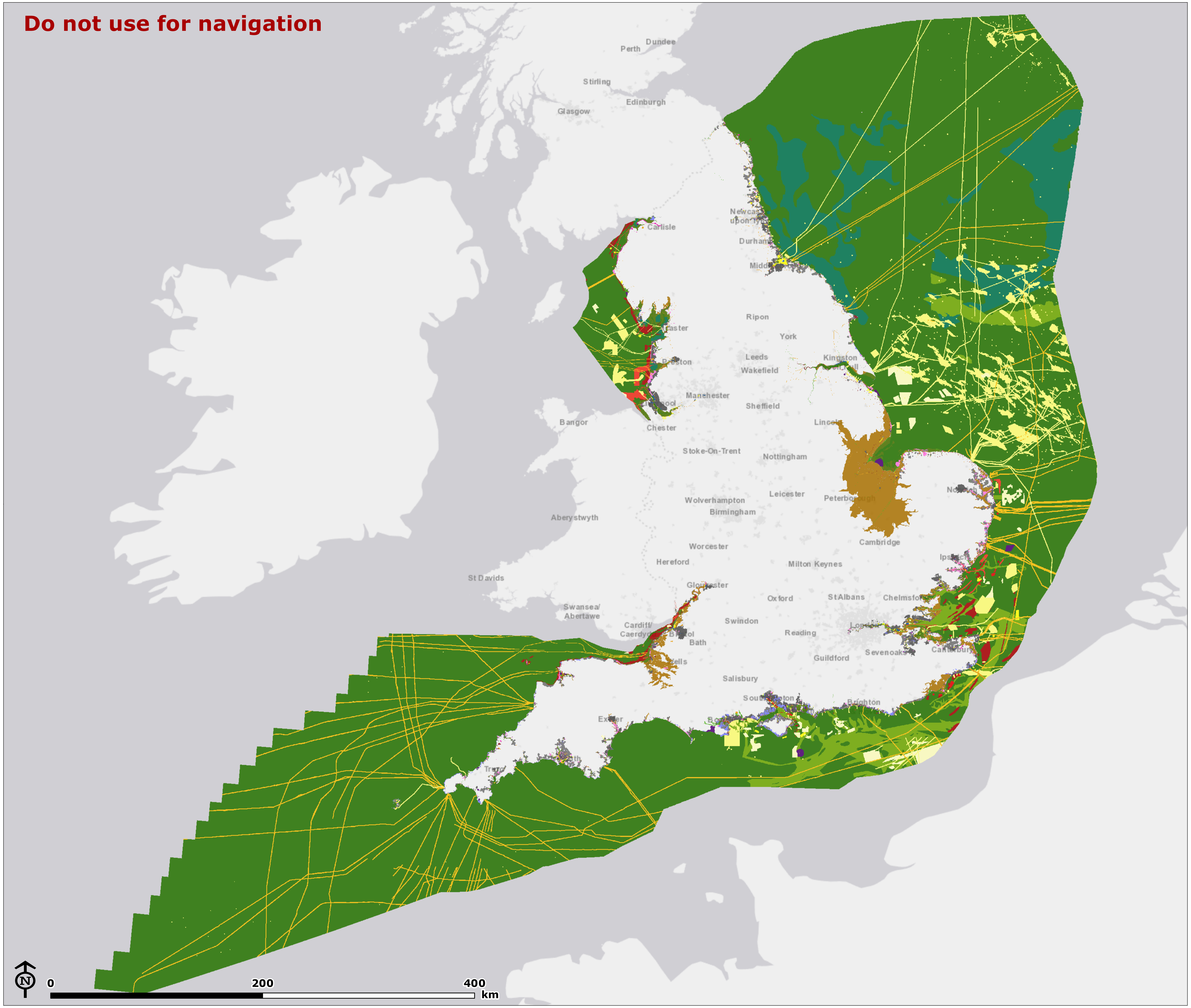
Map Scale @A3: 1:3,500,000

LUC

Historic England

CB:KS EB:Manson D LUC Appendix4_6738_r1_SFLR_A4L 27/07/2017

Source: HE



Consolidating the National Historic Seascape Characterisation Database

Coastal and Sub-Sea Floor Character Type

Civic provision
- Civic provision

Coastal infrastructure
- Flood and erosion defence

Communications
- Telecommunications
- Transport

Cultural topography
- Cultural topography (inter-tidal)
- Cultural topography (landward)
- Cultural topography (marine)
- Palaeolandscape component

Enclosed land
- Reclaimed land

Fishing
- Aquaculture
- Fishing

HLC
- HLC

Industry
- Energy industry
- Extractive industry (minerals)
- Processing industry
- Shipping industry

Military
- Military defence and fortification
- Military facility

Navigation
- Maritime safety
- Navigation activity
- Navigation feature
- Navigation hazard

Ports and docks
- Ports and docks

Recreation
- Recreation

Settlement
- Settlement

Unimproved land
- Coastal rough ground

Woodland
- Woodland

Map Scale @A3: 1:3,500,000

LUC   Historic England

CB:KS EB:Manson D LUC Appendix4_6738_r1_SBFLR_A4L 27/07/2017 Source: HE