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The Inner Humber Estuary Rapid Coastal Zone Assessment: Aerial Investigation and Mapping Project

F Fleming, C Royall

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The Inner Humber Estuary
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SUMMARY
The Inner Humber Estuary is a distinctive coastal landscape shaped by a long history of physical influences and human intervention. The rich archaeology of the area has a long time-depth that reflects the human story of the place as well as its fragility and vulnerability to external factors such as climate change. This report covers the Aerial Investigation and Mapping (AI&M) component of the Inner Humber Estuary Rapid Coastal Zone Assessment Survey (RCZAS) aimed at enhancing county and national databases and providing increased understanding of the heritage resource in order to better determine future planning and management decision-making. Analysis and mapping from a range of aerial photographs and lidar imagery provided the identification and interpretation of a range of archaeological sites visible as earthworks, cropmarks and structures, which revealed the complexity of a historic landscape reaching back into prehistory. The results will contribute to the second stage desk-based assessment of the RCZAS and the combined resource will be available for use by local communities, researchers, policy makers and managers of the historic and natural environment.

CONTRIBUTORS
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ARCHIVE LOCATION
The Historic England Archive
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Swindon
SN2 2EH

DATE OF SURVEY
The analysis, mapping and recording were carried out in 2019

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Of skies and scarecrows, haystacks, hares and pheasants,
And the widening river's slow presence,
The piled gold clouds, the shining gull-marked mud
'Here', Extract, Philip Larkin

1. INTRODUCTION

1.1 Technical summary

In 2018 Cornwall Archaeological Unit (CAU) was commissioned by Historic England (HE) to undertake stage one of the Inner Humber Estuary Rapid Coastal Zone Assessment Survey (RCZAS). This consists of two elements; an initial Aerial Investigation and Mapping (AI&M) component followed by a desk-based assessment. The RCZASs are part of a national drive to provide a broad assessment of the range of historic coastal assets in order to more fully assess their significance and vulnerability to future change. Identification, interpretation and synthesis of these heritage assets is aimed at enhancing national and local records of coastal archaeology in order to permit effective management of the resource into the future. Being the first stage of the RCZAS, the mapping results will be aimed at informing and aiding planning for further research and fieldwork.

The aim of Historic England AI&M projects is to enhance understanding of past human landscapes and to add information to local Historic Environment Records in order to inform planning and strategic decision-making as well as promote research into, and enjoyment of, the historic environment. The method of survey and recording used by AI&M focusses on aerial photographs taken since the early 20th century and modern lidar survey data. Use of these sources provides a comprehensive record of archaeological features visible from the air, including those that may have been lost, removed or obscured by outside factors such as modern development. AI&M is therefore an ideal first stage of an RCZAS, enabling better understanding of the archaeology of an area and the context of any surviving remains.

The mapping phase of the Inner Humber Estuary RCZAS followed Historic England standards for AI&M survey to carry out a systematic examination of all readily available aerial photographs (mainly from the Historic England Archive) and Environment Agency (EA) lidar imagery. Online digital sources of aerial photographs held by Google Earth were also consulted. Aerial photographs were rectified using the AERIAL (v 5.36) rectification programme and archaeological features were digitally transcribed from the aerial sources using AutoCAD Map3D 2015. Each archaeological site was recorded into a Historic Buildings, Sites and Monuments Record (HBSMR) database; directly into the North Lincolnshire Council (NLC) HER and into a standalone database created by the project team for the North East Lincolnshire (NEL) and Hull City Council (HCC) HERs for later integration by the ExeGesIS team. The records created were also supplied to HE as portable document format (.pdf) and rich text format (.rtf) files.

This report describes the results of the AI&M component through technical summary and synthesis, using a discussion of selected themes to illustrate some of the key findings. The aim of the report is to communicate the results to the general public and heritage professionals and to inform subsequent phases of the RCZAS through recommendations for further work and a review of existing designations. Where specific sites are mentioned the relevant HER and National Monument Database numbers are included in brackets (prefixes MLS (NLC); MHU (HCC); MNL (NEL), MCX, Cornwall Council (CC)). The MCX numbers refer to the records created within the standalone database created by the project team in Cornwall and these will be retained within the Hull City Council and North East Lincs HERs once migrated. All illustrations in the following report which include sections of project mapping parts are reproduced using AI&M conventions (see Appendix 1).

1.2 Project background

The Humber Estuary is a remarkable landscape of salt marshes and inter-tidal siltlands that now support rich farmland and hotspots of coastal industry and docklands. The history of physical and social change within this fluid estuarine landscape is deeply integrated with its underlying geology and patterns of land loss and reclamation. The estuary has been a focus of human activity from later prehistory forwards; as a resource base for local communities, as a transport route and as a locus for coastal trade and industry. Evidence for the earliest peoples to inhabit the area is sparse and largely artefact-based but where burial mounds and earthworks of Neolithic and Bronze Age date survive, these testify to increasingly more permanent occupation; particularly along the river valleys and on outcrops of glacial till. The discovery of three Bronze Age boats at North Ferriby (MHU3674) confirms that the estuary was an important link even then, facilitating transport and trade within and around the estuary and further afield.

The evidence for Iron Age and Roman settlements and fields systems within the project area demonstrates that the estuary sides were densely settled during these periods. Linear complexes typical of Roman 'Ladder Settlements' border the major Roman roads and trackways and a number of Roman villas are known on the higher ground of the Yorkshire and Lincolnshire Wolds and the North Lincolnshire Edge (Bennet 2006; East Riding of Yorkshire 2018). The Roman port of Old Winteringham (MLS2068) is situated on Ermine Street at a ferry crossing point to Brough (Roman Petuaria). A marine transgression in the 4th century led to an abandonment of settlement on the lower-lying wetlands but on the higher ground there was some continuity into the early medieval period. The developing settlement pattern of this time bears evidence of both Anglian and Scandinavian colonisation through place-name elements and material culture specific to these social groups (East Riding of Yorkshire 2018).

Management and drainage of the estuary margins was taking place as early as Roman times. This intervention was more evident during the medieval and post medieval periods, formerly under land ownership regimes and latterly as a

result of industrial-scale drainage schemes. Existing villages typically expanded during the medieval period with a large number of new villages and field systems created by large landowners looking to increase their incomes through expanding cultivation (East Riding of Yorkshire 2018). Many of these landowners were monastic institutions whose outlying estates were controlled by a system of granges; many of which still survive as present-day farmsteads. Known medieval harbours along the estuary include Hedon and Patrington; Hedon was founded as a port in the 12th century (*ibid*). A small-scale medieval industry found along the estuary edges was salt making and there is potential evidence for medieval salterns (e.g. MLS26145) within the project area.

Earthworks associated with the full range of medieval settlement types are to be found across the project area, along with extensive areas of surviving medieval ridge and furrow cultivation. These are more noticeable in low-lying areas such as Holderness and the Vale of York, where early enclosure by agreement has preserved the historic field pattern, thus avoiding the re-organisation brought about by Parliamentary Enclosure during the 18th and 19th centuries. Along some parts of the estuary the historic settlement patterns have been interrupted by marine transgression between the later medieval and post medieval periods.

From the post medieval period forwards developing industries along the estuary sides included chalk, clay and gravel extraction, brick and tile making, ship-building and fishing. Old clay pits associated with historic brickworks are particularly extensive along parts of the estuary, many now converted to nature reserves or used for water sports. Shipyards and fish traps evidence smaller-scale maritime industry, some of this now absorbed by the modern dock complexes at Hull and Immingham.

The strategic defence of the Humber Estuary during periods of conflict saw the construction of large fortifications such as Hull Citadel and Paull Fort, both having 16th Century origins. Paull Fort saw subsequent re-use during the Napoleonic War and to a lesser extent during the First and Second World Wars. Relentless enemy attack during both World Wars had devastating impact on the city and port of Hull and the docks at Hull and Immingham. During this period the estuary was the focus of large-scale wartime defences and anti-invasion schemes designed to confuse, disorientate, and deter any German offensive.

There has been some historic excavation of known sites along both sides of the estuary and some thorough research overviews of the area, particularly the Humber Wetlands (e.g. Van de Noort 2004). Nonetheless gaps in the knowledge and understanding of the archaeological legacy of the Humber Estuary and its defining periods of change still remain. With the modern impacts of commercial development and shoreline management along the estuary's coastal margins, and increased vulnerability to the physical processes associated with climate change events, it is becoming more critical than ever to assess and record the heritage of this dynamic but fragile landscape before permanent loss occurs.

2. THE PROJECT AREA

The project area comprises 256 square kilometres of coastal and riverine strip centred on and to either side of the Inner Humber Estuary, from Sunk Island/Grimsby in the east to Trent Falls in the west (Fig 1). It falls within the Unitary Authorities of North East Lincolnshire, North Lincolnshire, East Riding of Yorkshire and City of Hull. Hull is the principal city within the project area with smaller towns at Brough, North Ferriby, Hedon, Hessle, New Holland, Barton-upon-Humber and Winteringham. The major south-bank port at Immingham is situated at the far east of the project area.

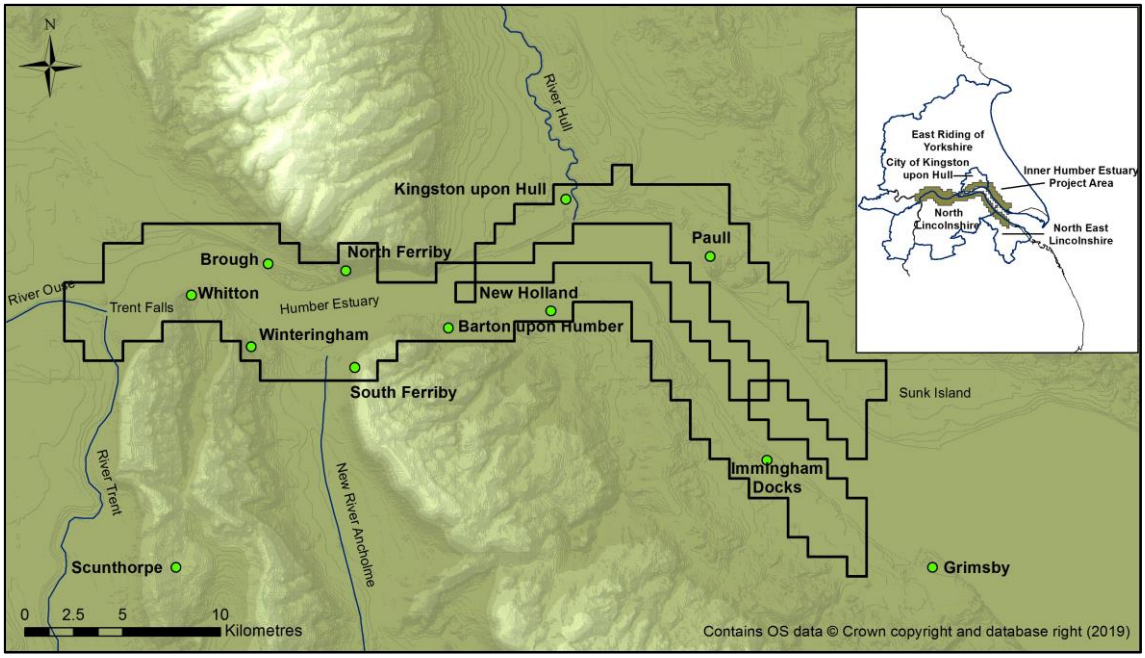


Figure 1 The location of the Inner Humber Estuary AI&M project area.

Parts of the project area were previously mapped by the Yorkshire Wolds (Stoertz 1997), Vale of York (Kershaw 2001) and Lincolnshire (Bewley 1998) aerial mapping projects (Fig 2).Except for the Wolds, these projects were mapped to National Mapping Programme (NMP) standards but all of the projects were pre-digital and new sources have become available since their completion. Therefore these areas were re-mapped to current Historic England standards as part of the Inner Humber Estuary RCZAS. Part of the northern shore of the Humber, centred on Hessle, was mapped by the Hull Valley NMP project (Evans *et al* 2012). Because this was undertaken to current Historic England standards it was not remapped as part of the present project.

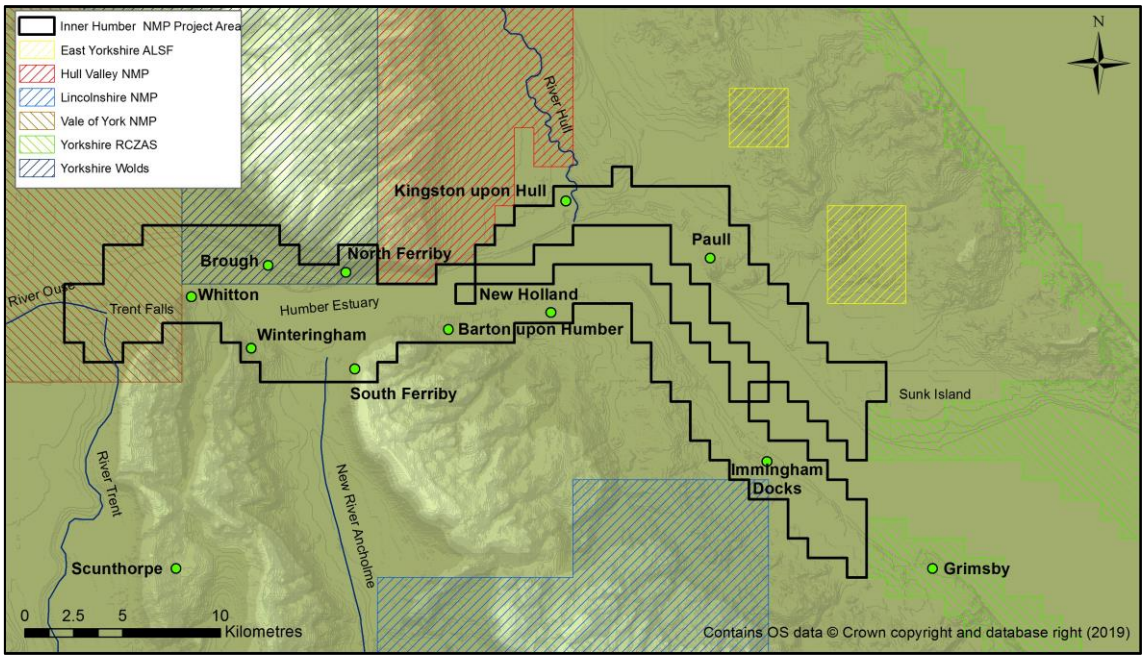


Figure 2 Previous Historic England (and predecessors) aerial investigation and mapping projects relative to the project area.

2.1 Geology, soils and landscape character

The Humber Estuary is typically a low-lying estuarine landscape of inter-tidal mudflats, salt marsh, coastal dunes and wetlands contained by the higher slopes and scarps of the Lincolnshire and Yorkshire Wolds and North Lincolnshire Edge. The bedrock geology in the east of the study area is Cretaceous Period White Chalk, in the west Triassic Period sands and mudstones and Jurassic Period marls, limestones, sandstones and clays (East Riding of Yorkshire Council 2018, 13; Van de Noort 2004, 15-17). Tectonic movements in the Earth's Crust caused the buckling and tilting of the bedrock that formed the rolling Wolds landscapes and the more dramatic inclines of the Jurassic limestone ridge between the Rivers Ancholme and Trent (Fig 3).

The Humber Estuary was formerly a river valley which widened out inland to create a wide basin that captured glacial meltwaters in the form of a large shallow lake; Lake Humber (Van de Noort 2004, 19). During the Quaternary Period the river valley on the seaward side of Lake Humber was scoured by successive ice ages, allowing the flow of sea water in and creating the estuary we see today. The ebb and flow of the ice deposited large quantities of glacial tills and alluvium over parts of the estuary, laying down the basis for the rich arable farmland that later formed in these areas. Smaller areas of sands and gravels and wind-blown sand have given rise to lighter acidic soils supporting open heathland and conifer plantations (Fig 4).

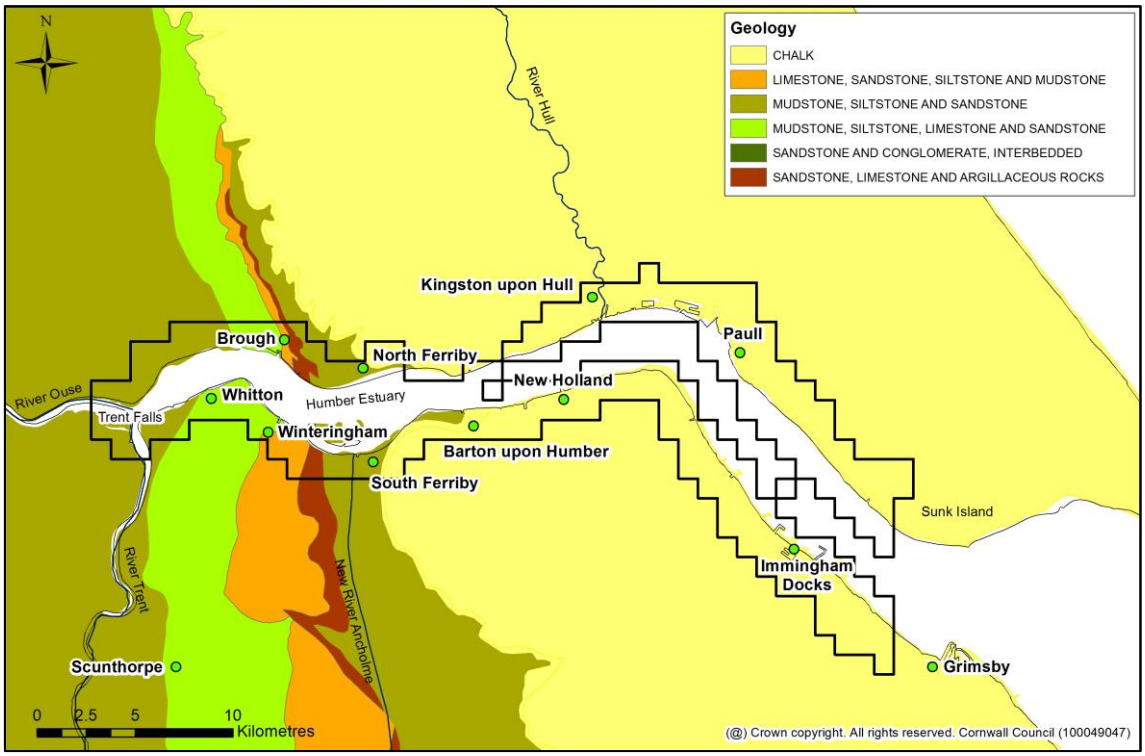


Figure 3 Map showing bedrock geology for the project area.

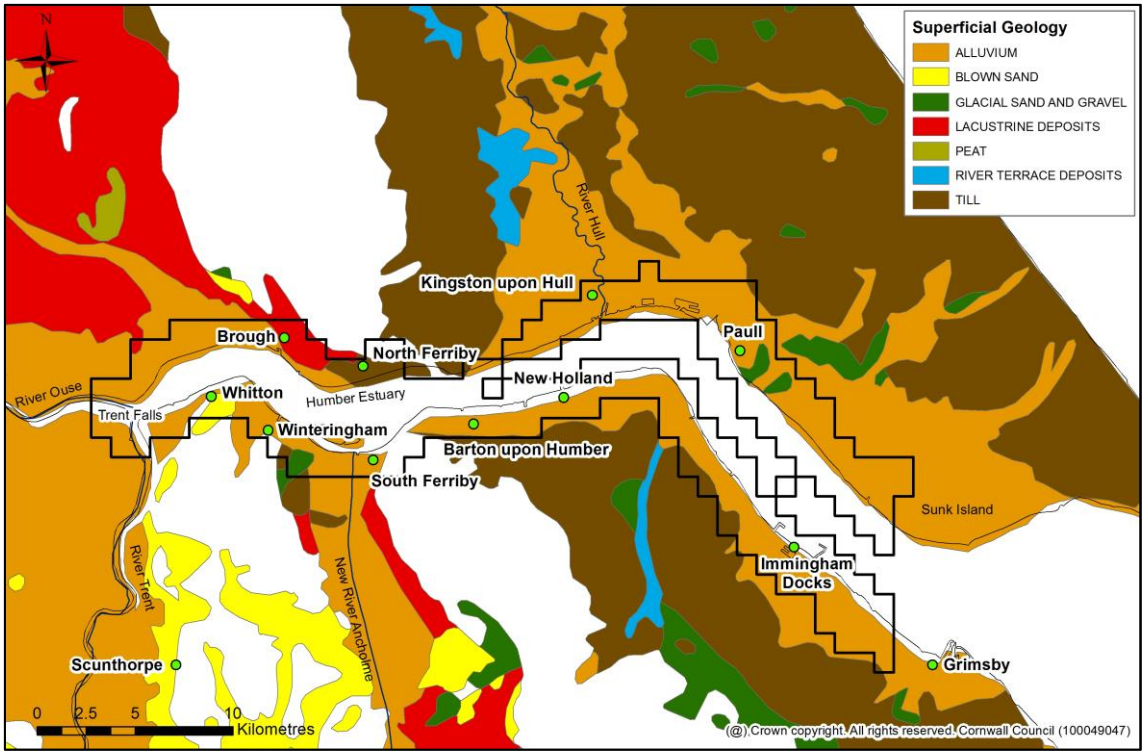


Figure 4 Map showing the superficial geology for the project area.

The combination of geology, soils and human adaptation and intervention have combined over centuries to form distinctive landscape character areas around the Humber Estuary. The project area covers parts of six National Character Areas (NCAs) defined by Natural England (2014a) on the basis of their unique combination of landscape, biodiversity, geodiversity, history, and cultural and economic activity (Fig 5).

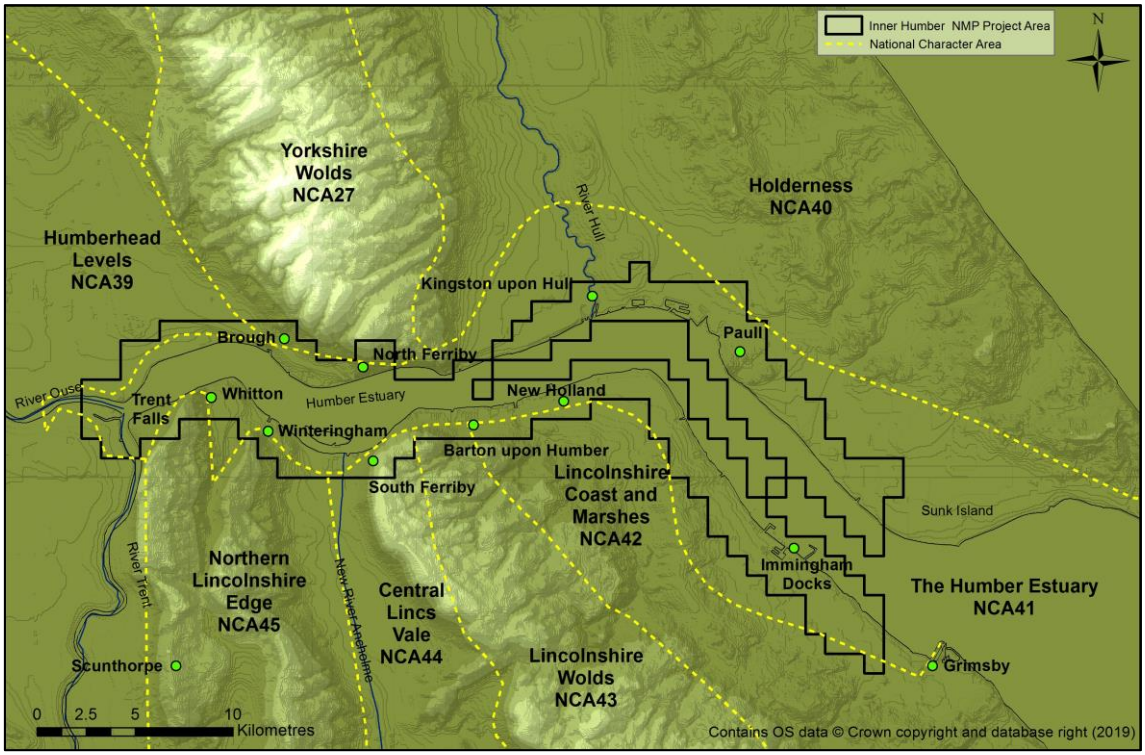


Figure 5 Map showing the Natural England National Character Areas for the project area.

The Humber Estuary (NCA 41)

The underlying geology of the Inner Humber Estuary character area is Cretaceous White Chalk overlain by Quaternary Period glacial tills and alluvium (Fig 3). Soils across more freely draining areas are brown earths, with more waterlogged or gleyed soils within the flatter more poorly draining areas. Inland of the estuary edge, beyond banked sea walls, the land is high quality arable farmland and market gardens established on reclaimed grazing and salt marshes and mudflats. Outside of the towns, settlement typically comprises large dispersed farmsteads and small villages situated on higher areas of ground. The landscape character of this area is typically open and expansive with long views and big skies. Tranquil and remote places contrast with the conurbation of Hull and large-scale industrial and dockland complexes at Hull, Immingham and Saltend. Grimsby, to the southeast, lies outside the project area (East Riding of Yorkshire Council 2018; Natural England 2014b; North East Lincolnshire Council 2010).

The Yorkshire and Lincolnshire Wolds (NCA 27 and 43)

Enclosing the chalk basin of the Humber Estuary to the west are the rolling hills of the Yorkshire and Lincolnshire Wolds. These north-south running ridges of relatively higher ground are formed of escarpments of Cretaceous period White Chalk (Fig 3). These are sparsely overlain along parts of the Lincolnshire Wolds with patches of Quaternary Period glacial deposits.

On the northern side of the estuary the soils of the Yorkshire Wolds are typically thin and chalky and support a largely arable farming regime with characteristically large regular fields crossed by long drove roads, dating to the Parliamentary enclosure of the 18th century. Remnant tracts of sheep-grazed chalk grasslands survive across the plateau tops. The gently rolling landscape of this area is sparsely wooded except on the higher ground and steeper valley slopes and settlement is typically dispersed, with scattered farms and villages, although with some large estates and designed parklands with large country houses (East Riding of Yorkshire Council 2018; Natural England 2015a; North East Lincolnshire Council 2010).

On the south side of the estuary the rolling chalk hills of the Lincolnshire Wolds have a pronounced scarp edge to the north and panoramic views across the surrounding land. The chalk escarpment is cut by deep dry valleys within which are sinuous beech woods. The plateau tops have shallow lime-rich soils with deeper lime-rich loamy soils within the valley bottoms. Agriculture is predominantly arable with some pasture fields. Isolated chalk and neutral grasslands are typically to be found on the steepest uncultivated slopes. The settlement of the area comprises small market towns, small nucleated villages hidden within the valley folds and scattered farmsteads. Modest country houses associated with small parklands are also to be found (Natural England 2015b).

The Central Lincolnshire Vale (NCA 44)

East of the Wolds, the project area extends as far as Trent Falls, where several contrasting landscape character areas converge on the estuary edge. The low-lying Central Lincolnshire Vale, the northern end of which drains into the River Ancholme, is formed of Jurassic Period limestone, sand, silt and mudstones overlain towards the estuary margins with Quaternary Period alluvium and clays. Discontinuous deposits of wind-blown sand (coversand) and river-derived sands and gravels (Fen Edge Gravels) also occur (Fig 4). The wetland soils have seen a history of agricultural improvement and land use is largely arable farmland with pasture on the heavier clays. Locally occurring sandy acidic soils have also formed localised contrasting landscapes of heathland and coniferous plantation. The landscape character of this area remains largely remote and undeveloped with a deeply rural, tranquil open landscape and expansive skies. Settlement is sparse and comprises small nucleated settlements and isolated farmsteads (Natural England 2013).

The Northern Lincolnshire Edge (NCA 45)

To the east of the Central Lincolnshire Vale the northern tip of the Northern Lincolnshire Edge meets the southern estuary sides in the vicinity of Whitton and Winteringham. The Northern Lincolnshire Edge comprises a north-south ridge of Jurassic limestone overlain in the Scunthorpe area by post-glacial wind-blown coversands (Figs 3 and 4); the western side and northern edge of the ridge form a steep scarp slope. The Edge gives wide panoramic views out to the west over Trent Falls and further northwest towards the low-lying Humberhead Levels. The good agricultural soils along the northern end of the ridge support cereals and root crops along with pig and poultry rearing. Farmsteads of large buildings and sheltering copses are dispersed along the plateau. The Edge forms a watershed between the catchments of the Trent and Ancholme Rivers and this ridge of higher ground was also the route of Roman Ermine Street, which ran north from Lincoln to a crossing point over the Humber (Lord and Mackintosh 2011; Natural England 2014c).

The Humberhead Levels (NCA 39)

The Humberhead Levels are low-lying wetland areas formed of Quaternary Period alluvium over Triassic Period mud, silt and sandstones (Figs 3 and 4). The naturally wetland soils have seen long term historic management and drainage to produce highly productive agricultural land used for growing root crops and cereals. In many areas historic field and drainage patterns remain well-preserved in the modern landscape. Important wetland habitats are found along the floodplains, washlands and traditionally grazed alluvial meadows (known locally as *ings*). This character area is crossed by several important road, rail and water routes and modern installations such as water towers, power stations and wind turbines are visually prominent in views across the landscape. Nonetheless, remote tranquil areas are still to be found and, as with much of the landscape within the project area, this area is characterised by long views and expansive skies (Lord and Mackintosh 2011; Natural England 2014d).

2.2 Landscape Significance

The significance of a landscape is invariably a product of how that landscape was naturally formed and how human intervention and adaptation has shaped it over time. Human responses to the landscapes they inhabit are complex and varied and typically have a long time-depth, which further introduces layers of subtle, and sometimes not so subtle, change. The evidence for such change is often embedded in the physical and cultural landscape and can be interpreted by archaeologists and historians through the tangible patterns and markers left behind. Surviving documentary evidence further relays how landscapes were perceived, used and controlled.

Perhaps more than many historic landscapes, those bordering the Humber Estuary are a product of man's modification of the physical landform and persistence against natural forces such as climate and sea level change. The coastal resources around the estuary would have made it a focus for hunter-gather communities and early settlers alike, whilst its proximity to the Continent and the reach of its principal tributaries inland would have given it important status as a major transport and trade route. Maximising productivity of the estuary margins would have been critical to the subsistence of local communities and efforts to achieve this over centuries of habitation have left an indelible physical imprint on the modern landscape.

Exploitation and possibly active management of the wetland areas along the edges of the Humber Estuary was taking place from as early as the Roman period, with evidence for ditched field systems and industries such as salt production dating to this period (see section 5.1). Successive periods of inundation between the 4th century and into the post medieval period, however, resulted in a discontinuity of historic development in some areas and variable loss and gain of land. This has made the legibility of historic landscape change harder to read in some places. At the Roman town and port of Old Winteringham, for example, an offshoot of Roman Ermine Street probably led to a quay or jetty (MLS2068) extending from an earlier shoreline, the line of which is now disguised by later land reclamation. In parts of Holderness the medieval landscape disappeared under inundation by the 13th century and was reclaimed for a second time over the 16th to 19th centuries, obscuring earlier features (Sheppard 1966, 5). Sunk Island in South Holderness, was probably dry land during the medieval period and an island by the late 16th century, only to be in-filled and reclaimed once again by the 19th century (*ibid*, 6). At Broomfleet and Flaxfleet, on the north side of Trent Falls, historic patterns of land drainage and reclamation during the medieval period clearly informed subsequent landscape development and are still very evident to the eye today (*ibid*, 16).

There is also distinct contrast along some sections of the Humber Estuary between the historic agricultural landscape - sparsely settled rich farmland, and the concentrated hotspots of 20th century industry - large installations of manufacture and storage sited close to the major dock complexes of Immingham and Hull. Several of these civilian sites also have a long back history of military use during the two World Wars.

AI&M methods are particularly suitable for investigating and interpreting the coastal landscapes around the Humber Estuary and the historic sites they contain. Aerial photographs of the 1940s capture a rural landscape before the major development of the post war years: earthworks and structures visible on these images can reveal new details about previously recorded sites. Aerial photographs taken during and just after the Second World War also potentially capture ephemeral detail of military remains and wartime sites, which may have been relatively short-lived. The scale of visibility for wartime sites around the estuary margins has proved particularly informative to the project.

The rich arable farmland around the estuary has also provided particularly rewarding cropmark evidence; with many complex Roman settlement sites and road networks in the vicinity of Whitton, Winteringham and South Ferriby being of particular note.

Modern lidar imagery has opened up new areas of investigation to more recent aerial mapping projects and has proved particularly useful to the project as it has identified large numbers of earthworks associated with historic land management and organisation during the medieval and post medieval periods. This has informed a stand-alone chapter (5.1) on historic landscape change, principally the result of land management and reclamation during the medieval and post medieval periods. Finer detail on the scale of medieval ridge and furrow has also been made possible, along with some finer detail of earthworks associated with sites such as medieval moated manors, deserted medieval villages and also a double motte and bailey castle at Barrow Haven (MLS374).

The results of the AI&M stage of the Inner Humber RCZAS project will be used to enhance local record databases and form recommendations for the Statutory Designations list in order to inform local research and permit effective management of heritage assets within the Inner Humber Estuary into the future. The results will also inform the stage 2 desk based assessment of the RCZAS in aiding recommendations for further research and fieldwork.

3. AERIAL INVESTIGATION AND MAPPING

3.1 Overview of methodology

The project followed current Historic England AI&M standards. These have been developed over time by Historic England and it precursors. Numerous landscape mapping projects carried out by RCHME, such as the Yorkshire Wolds (Stoertz 1997) and Thames Gravels (Fenner, V and Dyer, C 1994), helped develop a set of techniques and standards which became formalised as the NMP (Evans 2019).

The aim of the NMP was 'to enhance our understanding about past human settlement, by providing information and syntheses for all archaeological sites and landscapes (visible on aerial photographs) from the Neolithic period to the twentieth century' (Bewley 2001, 78). The guiding principle of NMP was 'to map, describe and classify all archaeological sites recorded by aerial photography in England to a consistent standard' (English Heritage 2017).

AI&M standards facilitate a systematic methodology to the interpretation and mapping of archaeological features visible on aerial photographs and lidar (Winton 2015, Evans 2019). This includes not only recording sites visible as cropmarks and earthworks but also upstanding and removed structures, some of which relate to 20th century military activities. This comprehensive synthesis of the archaeological information available is intended to assist research, inform planning and guide protection of the historic environment.

The Inner Humber RCZAS project involved the systematic examination of all readily available aerial photographs (mainly from the Historic England Archive) as well as lidar imagery held by the Environment Agency (EA). Georeferenced Pan Government Agreement (PGA) vertical photograph tiles were made available to the project team and the online digital sources of aerial photographs held by Google Earth were also consulted. Scanned aerial photographs were rectified using the AERIAL (Version 5.36) rectification programme and archaeological features visible on them transcribed using AutoCAD Map3D 2015 (infrastructure design suite).

A Monument record was created for all mapped sites. These records included all relevant site information including location, site type, period, condition and source. Two separate HBSMR databases were used. Those features located within North Lincolnshire were recorded directly into the North Lincolnshire HER database via a remote link; all other sites were recorded in the Cornwall Archaeology Unit HBSMR and supplied to the various HERs and HE as portable document format (.pdf) and rich text format (.rtf) files.

3.2 Overview of the aerial photographs

Nearly 100 years of aerial reconnaissance has taken place in the Humber Estuary. The earliest photographs available to the project were oblique images dating from the 1920s and 1930s from the Aerofilms Collection (see below). Extensive programmes of vertical photography were carried out by the Royal Air Force (RAF) in the years during and after the Second World War. Blanket vertical cover has continued up until the present day, the flights carried out initially by the Ordnance Survey (OS) in the 1960s and, later, from the 1970s onwards, by Meridian Air Maps, the OS and the various County and Unitary Authorities.

The primary source of aerial photographs used in this project was the Historic England Archive (HEA) collection in Swindon; over 9,400 prints, laser copies and digital images were loaned from this collection. The Cambridge University Collection (CUCAP) also contains important photographic prints of the area although these were unfortunately unavailable during the lifetime of this project. North Lincolnshire Council provided composite digital aerial photographs from 1999 and 2006. Pan Government Agreement geo-referenced digital aerial photographs provided by HE were also available as well as digital photographs from Google Earth accessed via the internet. Details of photographs used during the project are contained in Appendix 1.

Specialist oblique photographs

Systematic programmes of national aerial reconnaissance, specifically to record archaeological sites, important buildings, historic landscapes and other features of interest, have been undertaken since the later 1940s by The Cambridge University Committee for Aerial Photography (CUCAP) and by the Royal Commission on the Historic Monuments of England, latterly as part of Historic England, since the 1970s. The photographs collected by the National Monuments Record (NMR), now HEA, provided the bulk of the oblique coverage available to this project. The earliest specialist oblique photographs held include those taken by OGS Crawford in the 1930s and later in the 1970s and 1980s by Derrick Riley and Jim Pickering.

Oblique photographs taken in slanting sunlight (either during the winter months or in the early morning or late evenings of summer) are an ideal medium for defining earthwork monuments as well as upstanding historic buildings, early 20th century military installations and intertidal structures including wrecks (Fig 6).

Many sites recorded on oblique aerial photographs are levelled features visible only as cropmarks. Cropmark sites have been photographed in the project area since the 1970s. More recent aerial reconnaissance has recorded new sites as well as adding new detail to previously known sites; this demonstrates that the

continued potential for further discovery of sub-surface remains through programmes of reconnaissance in the summer months.

Figure 6 Earthwork banks of a medieval motte and bailey castle at Castle Farm, Barrow Haven are clearly picked out in low sunlight.

MLS374. Photograph: NMR 12437/72, 15 November 1993 © Historic England NMR.

Aerofilms Collection

The earliest photographs available to the project were oblique images from HE Aerofilms Collection, many of which date to the 1920s and 1930s. Aerofilms Ltd was a pioneering air survey company set up in 1919 by First World War veterans Francis Lewis Wills and Claude Grahame-White. In addition to their own imagery the firm purchased smaller collections including those of AeroPictorial (1934-1960) and Airviews (1947-1991). The collection of historical air photographs was bought in 2007 by Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS now Historic Environment Scotland (HES)), English Heritage (now Historic England), and the Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) and is now partially available on the internet on the Britain from Above website (HES, HE and RCAHMW 2016).

The images from the Aerofilms collection which cover the project area are almost exclusively low-level panoramic shots of towns and industrial sites such as Hull, Immingham Docks, and Barton-upon-Humber. Their main focus is industrial buildings, hotels and railways; features generally outside of the AI&M remit for mapping, although there are occasional rural landscape images. The collection presents an unparalleled picture of the changing face of Britain in the 20th century and its images are of great historic interest. Whilst of limited use

in mapping archaeological features, the available images were of great value in providing historic context and an understanding of early 20th century settlement development (Fig 7).

Figure 7 Clarence Mills and Drypool Bridge, River Hull, 1923.

This historic image of the River Hull at Drypool was taken in the inter-war years. Note the large numbers of barges moored up along the river which serviced the numerous mills, docks and timber and coal yards that lined the river edge. Photograph: EPW009378 1923 © Historic England (Aerofilms Collection).

Military oblique photographs

A small number of military oblique photographs were available for the study area. These were almost entirely from sorties carried out in June 1951 of Hull and its docks. Whilst of historic interest they proved of little use to the project.

Vertical photographs

Vertical photographs provide coverage of all parts of the project area and have been taken at regular intervals from the early 1940s onwards. As part of the routine AI&M process all readily available vertical aerial photographs were examined. A three-dimensional view of the landscape, including any extant archaeological features, was achieved by using a hand-held stereoscope. The advantage of vertical photography is that large areas are usually surveyed. A

potential disadvantage is that photographs may not always be taken at the most favourable times of day or year to maximise the visibility of archaeological features.

The value of the RAF images taken in the 1940s cannot be overstated. These historic photographs provide a snap-shot of the landscape prior to the development of a widespread intensive arable regime. Much of the area was still pasture and extensive areas of now levelled medieval ridge and furrow were plotted as well as high numbers of relatively ephemeral structures dating to the Second World War (Figs 8 and 9).

Figure 8 Steam meets sail, Humber Estuary 1951.

This oblique photograph taken northwards across the Humber to Hull by the RAF shows a traditional Humber Sloop under sail passed in the foreground by steam barges. Barges were used for inshore and inland cargo transport around the Humber Estuary prior to the construction of the Humber Bridge and associated road networks. Photograph: RAF 540/539 SFFO-0066, 25 June 1951 Historic England RAF Photography.

A good range of sources of vertical photography were available to the project. RAF vertical photographs from the 1940s to the early 1960s were an important source of information, particularly for 19th and 20th agricultural and extractive features as well as the small numbers of 20th century military features recorded.

The provision of a wide variety of later sorties (the OS and the Meridian Airmaps (MAL) collections and online digital colour photographs from Google) ensured that coverage from vertical photography was good.

Figure 9 A Second World War barrage balloon flies over extensive anti-landing obstacles at Immingham.

Important yet short-lived defensive features are visible on this vertical photograph taken by the RAF in the early war years (MLS26150). Photograph: RAF 613D BR52 VB 11, 13 March 1941 Historic England RAF Photography.

3.3 Overview of the lidar data

Airborne laser scanning also known as lidar (Light Detection and Ranging) has become an invaluable tool for archaeological survey over recent years (English Heritage 2010). It is particularly useful in areas where conventional aerial photography is of little benefit such as in woodland as well as allowing the identification of very low earthworks in arable fields which would not otherwise be picked up by conventional photography. The benefits of using lidar for archaeological recording have been previously recognized (Bewley *et al* 2005; Devereux *et al* 2005; Royall 2013 and Carpenter *et al* 2016).

Aircraft-mounted pulsed laser beams are bounced off the ground and the speed and intensity of the returning beams recorded. The first beams to return when they first hit a solid surface such as the top of the tree-canopy, a roof or the ground are known as the First Return. Depending on the density of the surface encountered, some laser beams may follow a path between the branches and leaves and bounce back from the ground within woodland (Last Return). This information is used to create a detailed digital elevation model (DEM) of the ground surface. The different visualisations of this data are explained below.

The Digital Surface Model (DSM) is a digital elevation model of the First Return and as such is a model of the surface of the highest points including all trees and buildings. In areas of woodland or dense vegetation it has similar limitations to conventional photography; any archaeological features being obscured (see Fig 10).

The Digital Terrain Model (DTM) are processed using mathematical algorithms to remove all features above the natural ground surface using such as the tree

canopy using the Last Return data. DTMs are essential remote sensing tools for looking at archaeological earthworks within a woodland environment. However, the mathematical processing involved can also smooth out earthworks or create phantom features and therefore DSMs are potentially more effective when looking at the open ground outside of the tree-cover (see Fig 10).

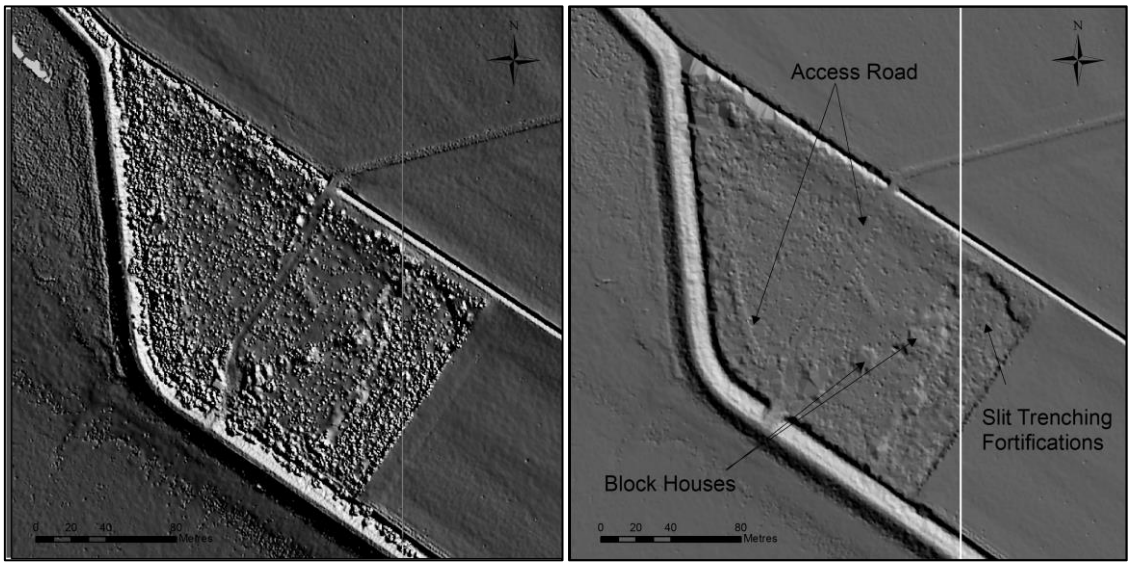


Figure 10 First World War battery at Sunk Island: DSM left and DTM right.

Sunk Island Battery (MHU9587) was constructed upon the outbreak of the First World War to defend the port of Hull and the depot at Killingholme on the south bank of the Humber Estuary. The site of the coastal battery is now very overgrown and little of it is visible on the DSM. Two block houses, an access road and fortification earthworks are clearly showing on the DTM.

The DTMs were manipulated to maximise the visibility of archaeological features. Multiple visualisations were generated for the project team by HE using the Relief Visualization Toolbox (RVT) developed by the The Institute Of Anthropological and Spatial Studies at the Research Centre of the Slovenian Academy of Sciences and Arts (see e.g. Kokalj and Somrak 2019; Zakšek *et al* 2011). These included a Local Relief Model (LRM). An LRM is derived from a high resolution DEM; it isolates subtle local elevation changes from the large-scale global relief and therefore enhances the visibility of small-scale, shallow topographic features irrespective of the chosen illumination angle (Hesse 2010). The LRM's proved invaluable for picking up slight traces of field systems which did not show at all in the elevation models. Hill shadings lit from multiple directions and slope gradient visualisation were also provided (Figure 11).

Lidar Coverage

The resolution of the lidar data will vary depending on how many 3D points were collected per meter (ppm); the greater the number of points, the better the resolution of the resulting model. The Environment Agency (Geomatics) has been carrying out lidar surveys of the country since 2000. There was therefore

good lidar data cover for much of the project area available in resolutions ranging from 25cm to 2m.

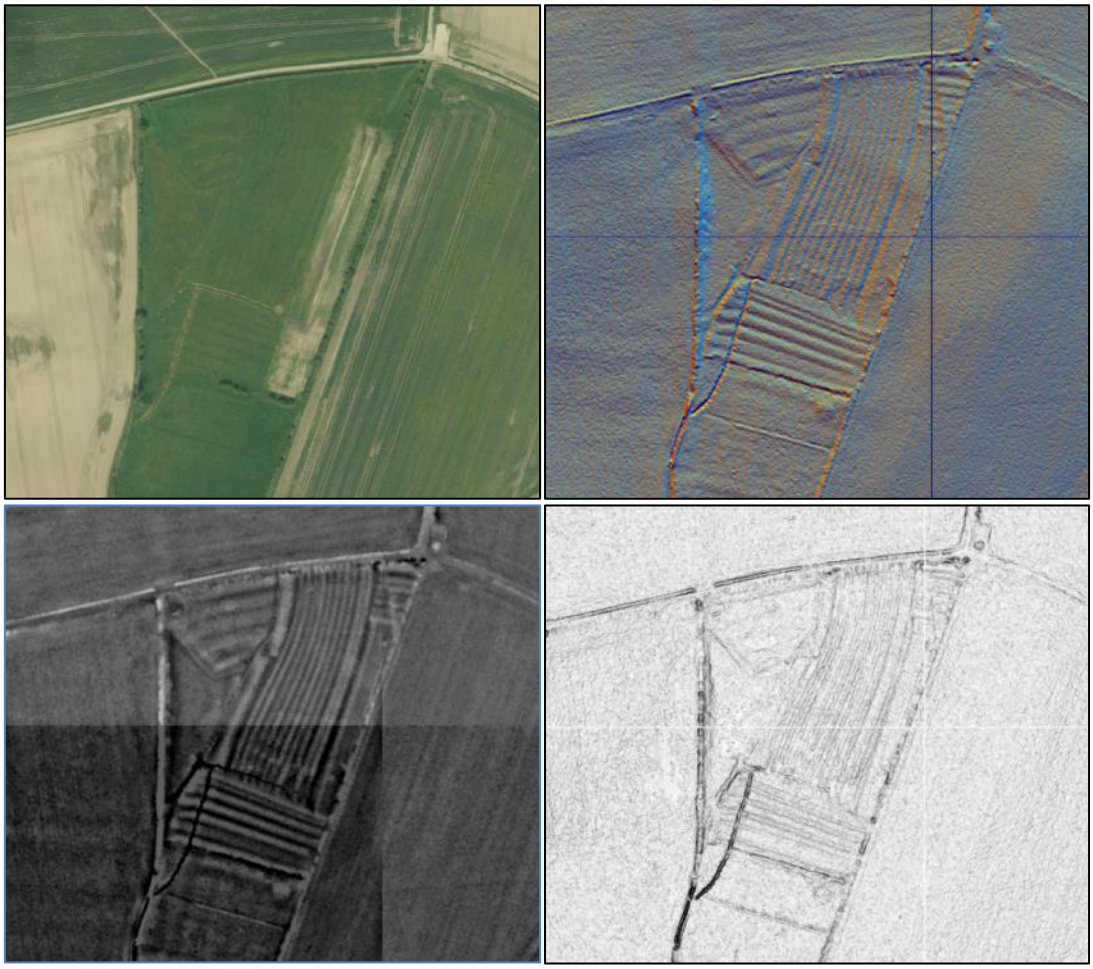


Figure 11 Medieval ridge and furrow at Whitton.

MLS20697. Aerial photograph (top left), multi-directional hill shade (top right), LRM bottom left and slope gradient (bottom right).

There was blanket cover of the 1m lidar tiles for the entire project area with more limited cover of the higher resolution 25cm and 50cm surveys (Figure 11).

There is 25cm cover for two small areas: 9km sq to the southwest of Elloughton were surveyed in 2012 and in 2015 a survey covering approximately 8km sq was carried out at the confluence of the Rivers Humber and Trent west of Alkborough (see Fig 12). Approximately 80% of the project area is covered by 50cm resolution lidar surveys. Those areas not covered lie along the periphery of the area, particularly to the east of a line drawn between Hessle and Barrow upon Humber.

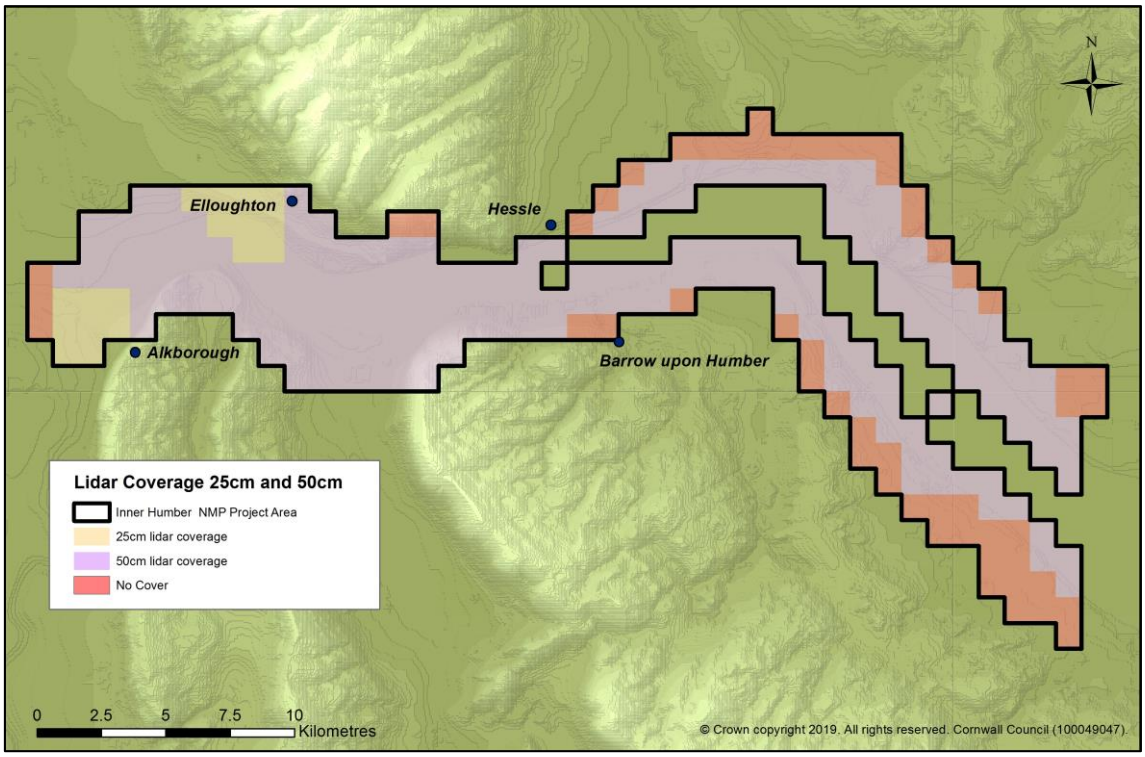


Figure 12 Distribution of geomatics lidar tiles available at 25cm and 50cm resolutions.

4. HUMBER ESTUARY: OVERVIEW OF RESULTS

4.1 Summary Results of the AI&M

The following is a brief illustrated summary of the overall results of the project. It discusses the project's findings in terms of overall numbers of sites recorded (including numbers of new sites) as well as their form, survival and distribution. Sites have been broken down broadly by period and each section is illustrated with a limited selection of new sites, previously unrecorded in either the county HBSMR databases or in the national NRHE curated by HE. The thematic section that follows (Section 5) gives a more in-depth discussion of the principal themes identified.

4.2 Overview of the AI&M

The AI&M methodology entails the interpretation, mapping and recording of all archaeological sites from the Neolithic to the 20th century from all readily available aerial photographic sources and lidar imagery (Fig 13). Features visible on aerial photographs include ditched or banked features either surviving above ground as earthworks, or as cropmarks of sub-surface features. Relatively slight earthworks surviving under tree cover or in open ground can be identified from lidar imagery. Historic aerial photography provides details of earthworks and structures which have subsequently been denuded or levelled by ploughing, or otherwise destroyed or removed.

All sites mapped within North Lincolnshire were recorded remotely into the North Lincolnshire HBSMR database. As the project team did not have direct access to the HER databases for North East Lincolnshire or Hull CC, sites mapped in these areas were recorded in the Cornwall AI&M HBSMR database. These records will be appended to the relevant database at the end of the DBA element of the Inner Humber RCZAS project. All four HBSMR databases (Cornwall AI&M, Hull CC, North Lincolnshire and North East Lincolnshire) generate unique project record numbers. These are prefixed MCX for Cornwall, MLS for North Lincolnshire, MHU for Hull CC and MNL for North East Lincolnshire. All sites discussed will be referenced using these prefixes.

Numbers of sites in the project area

The project created 2105 monument records. The general locations of these sites are displayed as dot-data on the distribution map (Fig 14). The map shows that in terms of overall distribution, sites were identified right across the study area. On average the project recorded 8.23 sites for each km^2. Of the 2105 monuments recorded, 1828 (87%) were new sites and only 278 (13%) were sites already recorded in the county and national databases.

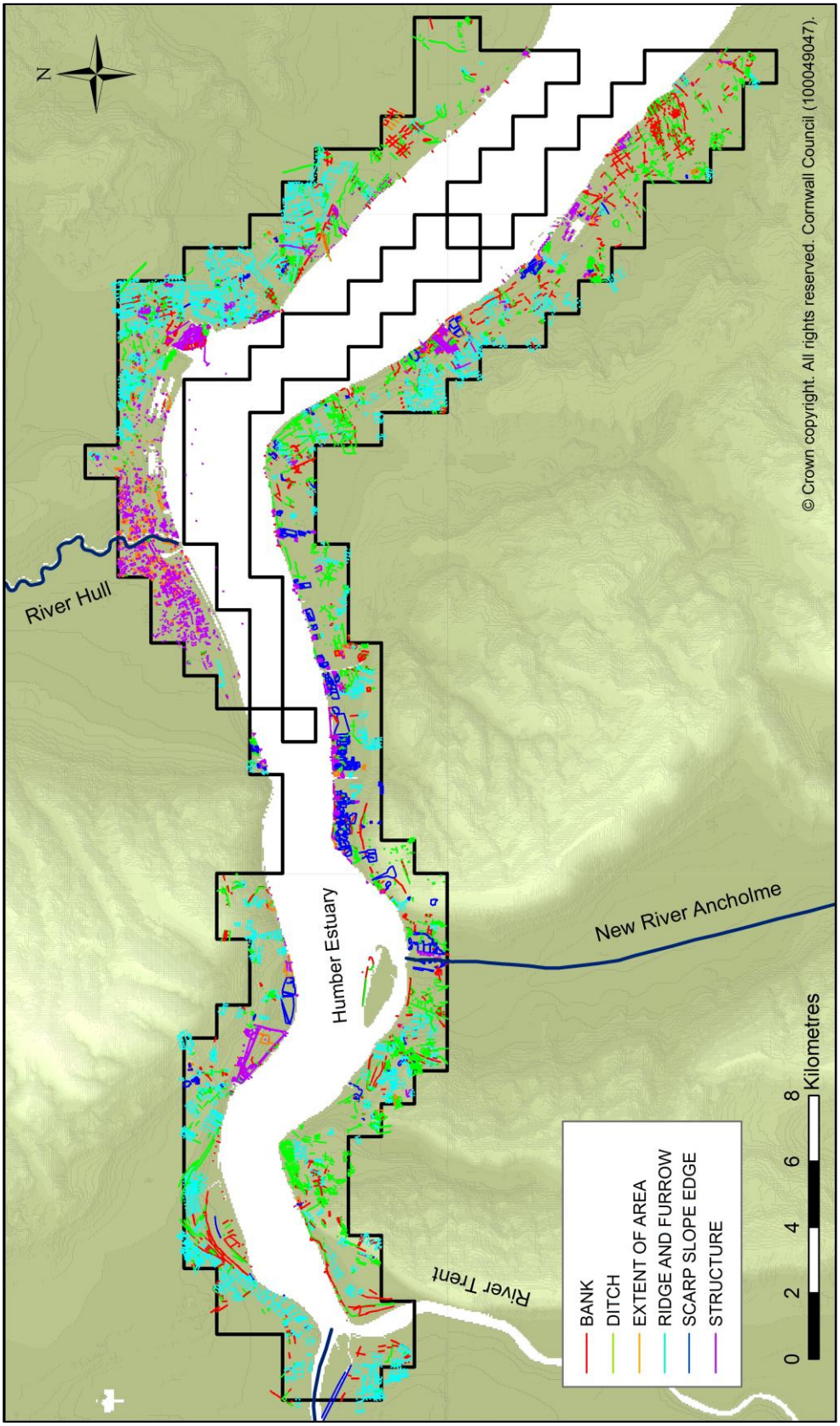


Figure 13 Map of the project area showing all the aerial mapping.

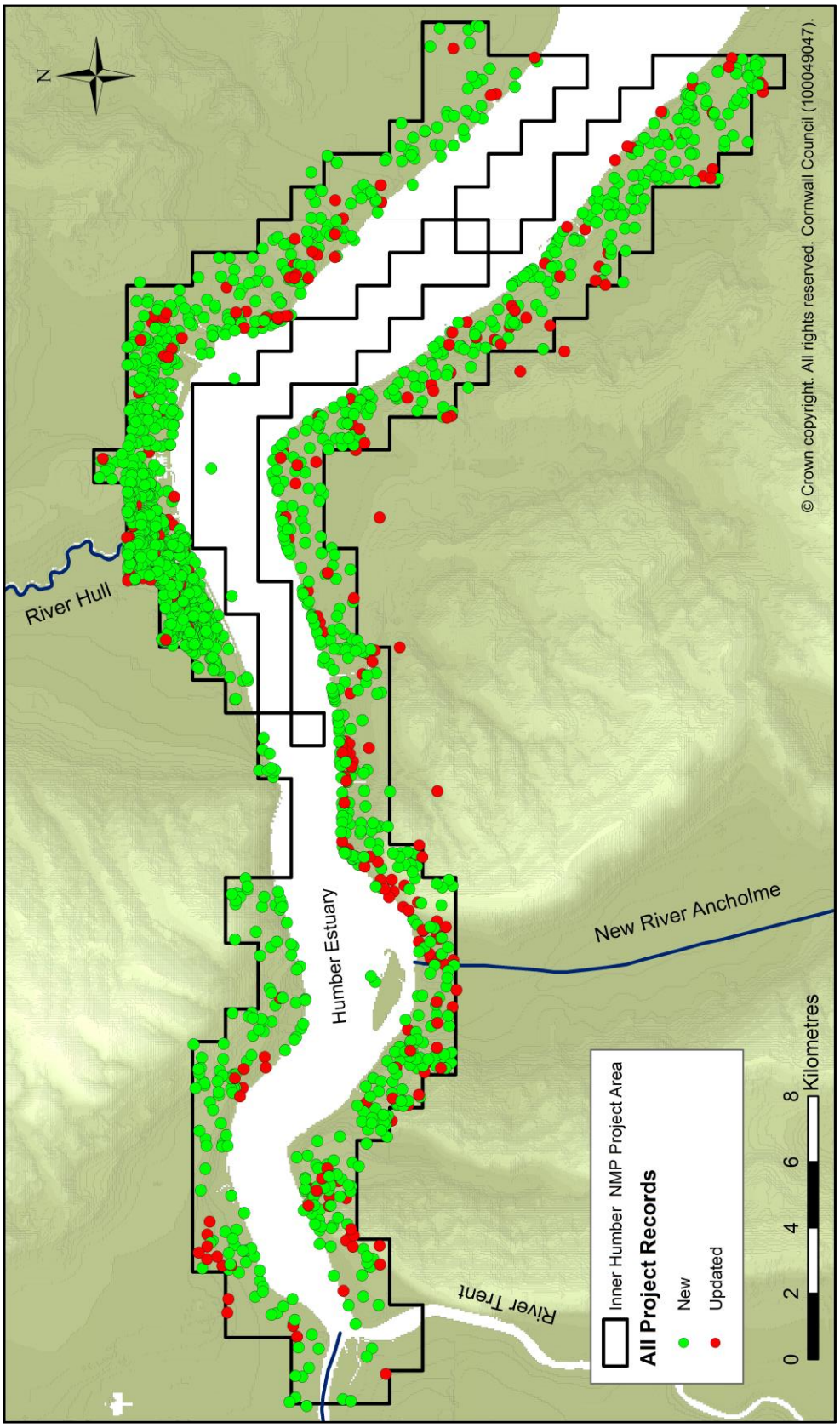


Figure 14 Distribution of all monuments mapped and recorded during the project.

Sites previously recorded within the various county and national databases were distributed right across the study area; the largest concentrations being sites associated with the post medieval brick and tile industries on the southern bank between Goxhill and South Ferriby and historic buildings within Hull which were recorded during the project as Second World War bomb sites. Many of the other previously recorded sites were military installations dating from the late 19th century to the Second World War, as well as prehistoric or Roman cropmark sites.

Form and survival of sites

The form and survival of each site was recorded in the project database. At the direction of the HEA, only the last known form of the site was recorded (e.g. as visible on the latest Google Earth images or on the lidar) and not necessarily the form of the site on the photographs from which it was plotted.

For example, if a site was visible as an earthwork on early 1940s RAF photographs but was later plough-levelled and consequently only visible as a cropmark on the latest photography, then the site was recorded in the database as a cropmark.

Similarly, if a site was not visible at all (neither as earthworks nor cropmarks) on the latest imagery but had been plotted as an earthwork from early photographs, it would be recorded in the database as Levelled Earthwork (unless no assessment of the current state of the monument could be made, for example if the site was obscured by vegetation [tree-cover or scrub], in which case it was recorded as earthwork).

A summary of the form and survival of sites recorded is set out in Table 1 and illustrated in Fig 15. Of the 2105 sites recorded during the mapping project the largest numbers were for demolished structures, 878 (42%). The vast majority of these were Second World War sites within the city of Hull; either the sites of bombed buildings or domestic defence structures such as air raid shelters and water tanks.

Table 1 Form and survival of sites recorded in the HER databases

Form	**No: Sites**	**% of total**
Extant earthwork	230	10.91
Extant structure/extant building	64	3.04
Vessel structure	33	1.57
Partially levelled earthwork	77	3.65
Partially demolished structure or ruined structure	60	2.84
Cropmark/soilmark/levelled earthwork	717	34.12
Completely demolished structure	878	41.67
Demolished structure with extant earthworks	24	1.14
Destroyed monument	22	1.04
Total	**2105**	

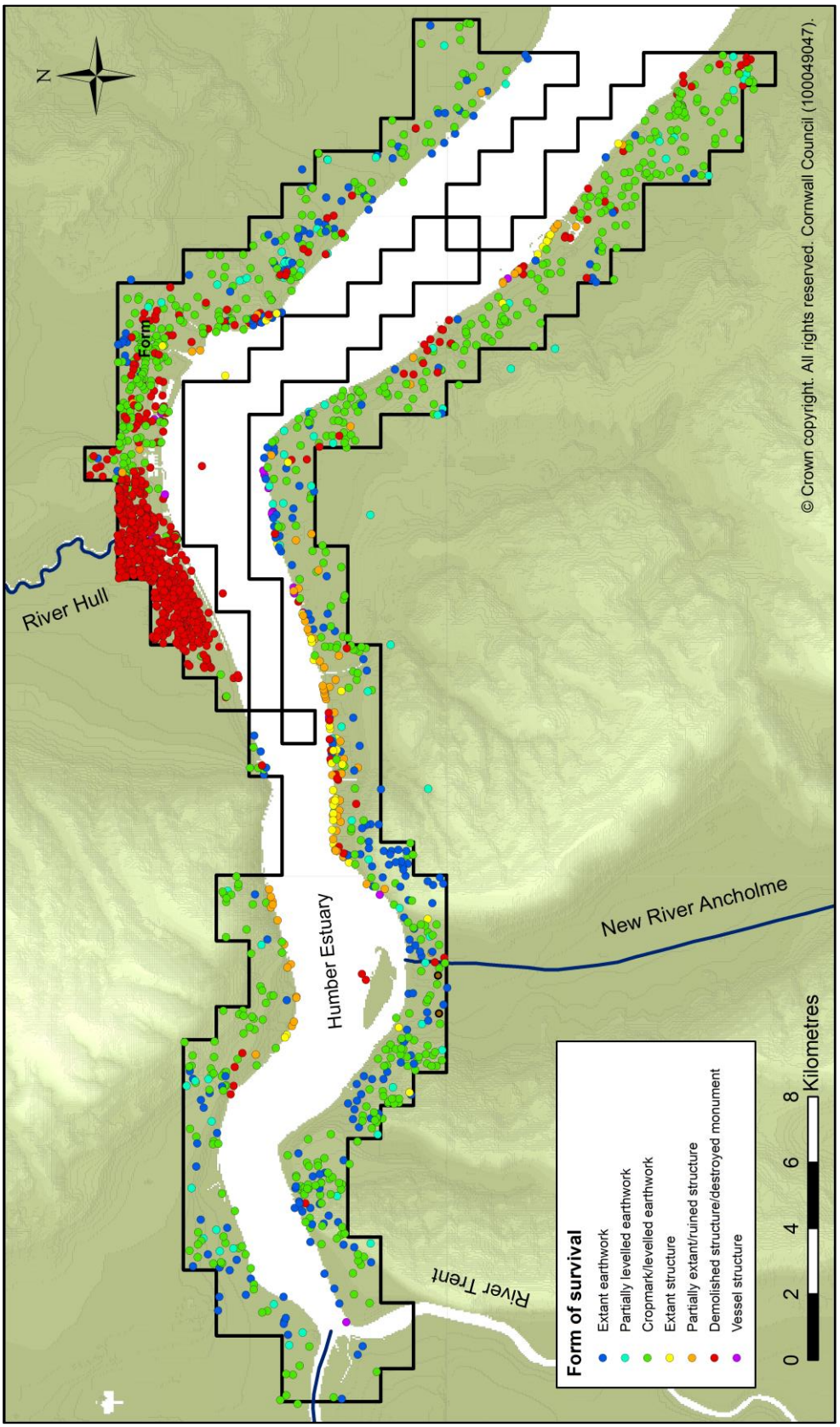


Figure 15 Survival of monuments mapped and recorded during the project.

Three hundred and seven sites (14%) were still extant or partially extant earthworks and 124 (6%) were extant or partially extant structures. Upstanding remains were not visible on the latest aerial photographs or lidar imagery for 401 sites (24%).

Summary of sites recorded by period

Table 2 Numbers of sites recorded in the HER databases during the project

Period	**Updated Sites**	**New Sites**	**Total**
Bronze Age	3	12	15
Prehistoric	4	17	21
Iron Age/Romano British	29	6	35
Roman	4	15	19
Medieval	35	117	152
Historic (Medieval/Post Med)	6	143	149
Post Medieval	62	364	426
19th/early 20th century	20	89	109
WWI	4	2	6
WWII	98	984	1082
Undated	13	78	91
Total	**278**	**1827**	**2105**

The numbers of sites recorded by period are listed in Table 2. The date ranges used in this report conform to national standards (e.g. FISH website 2017) and are those used in the HBSMR databases. With the exception of the early medieval period, archaeological sites were recorded for all periods from the Bronze Age to the mid-20th century. It should be noted that the nature of aerial photographic evidence means that morphologically undiagnostic sites can only be assigned to broad archaeological periods unless there is independent dating evidence from fieldwork, artefact scatters or excavation.

In this section, sites have been assigned broad archaeological periods based on the evidence from morphology, context and association with other securely dated sites. Some generalisations have been made: for example, ring ditches which were considered to relate to funerary practices have been assigned to the Bronze Age despite their potential for being of Late Neolithic/Early Bronze Age origin. This broad approach reflects the indexing of the database entries within the HERs.

The three maps in Figures 16 to 18 show the general distributions of sites by broad period across the project area. Figure 16 demonstrates the scarcity of monuments of Roman or earlier date.

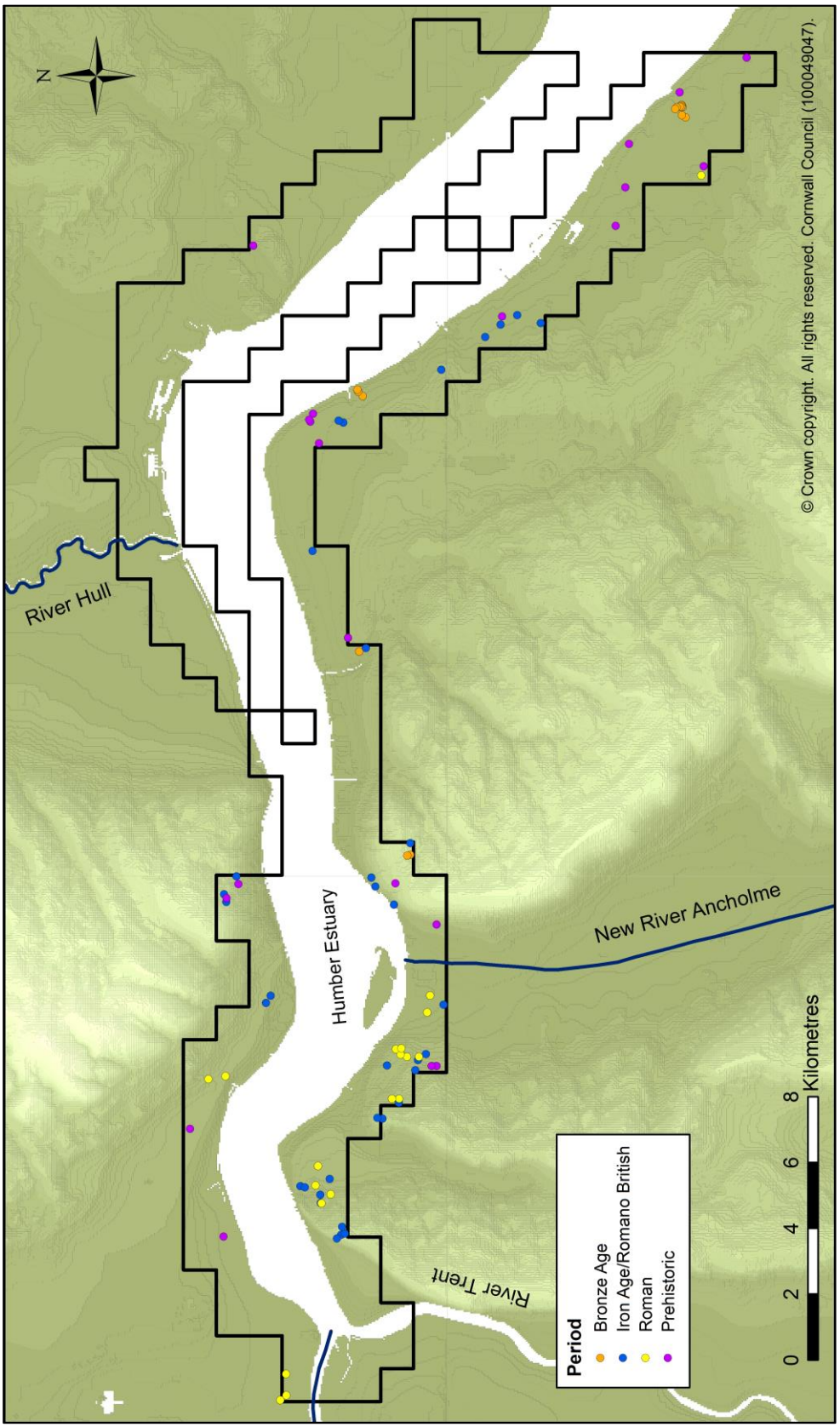


Figure 16 Distribution of all prehistoric and Roman monuments.

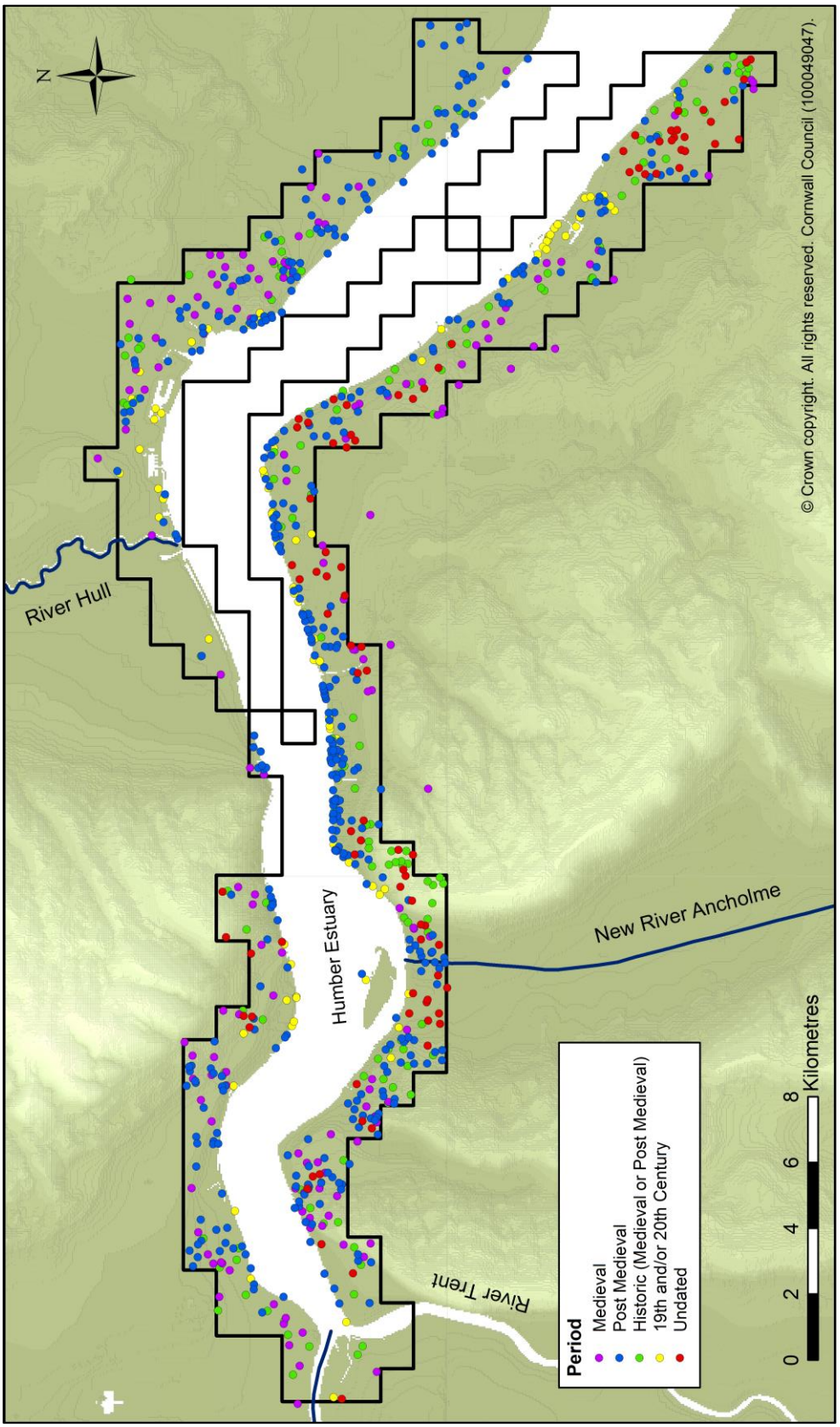


Figure 17 Distribution of all post-Roman and undated monuments.

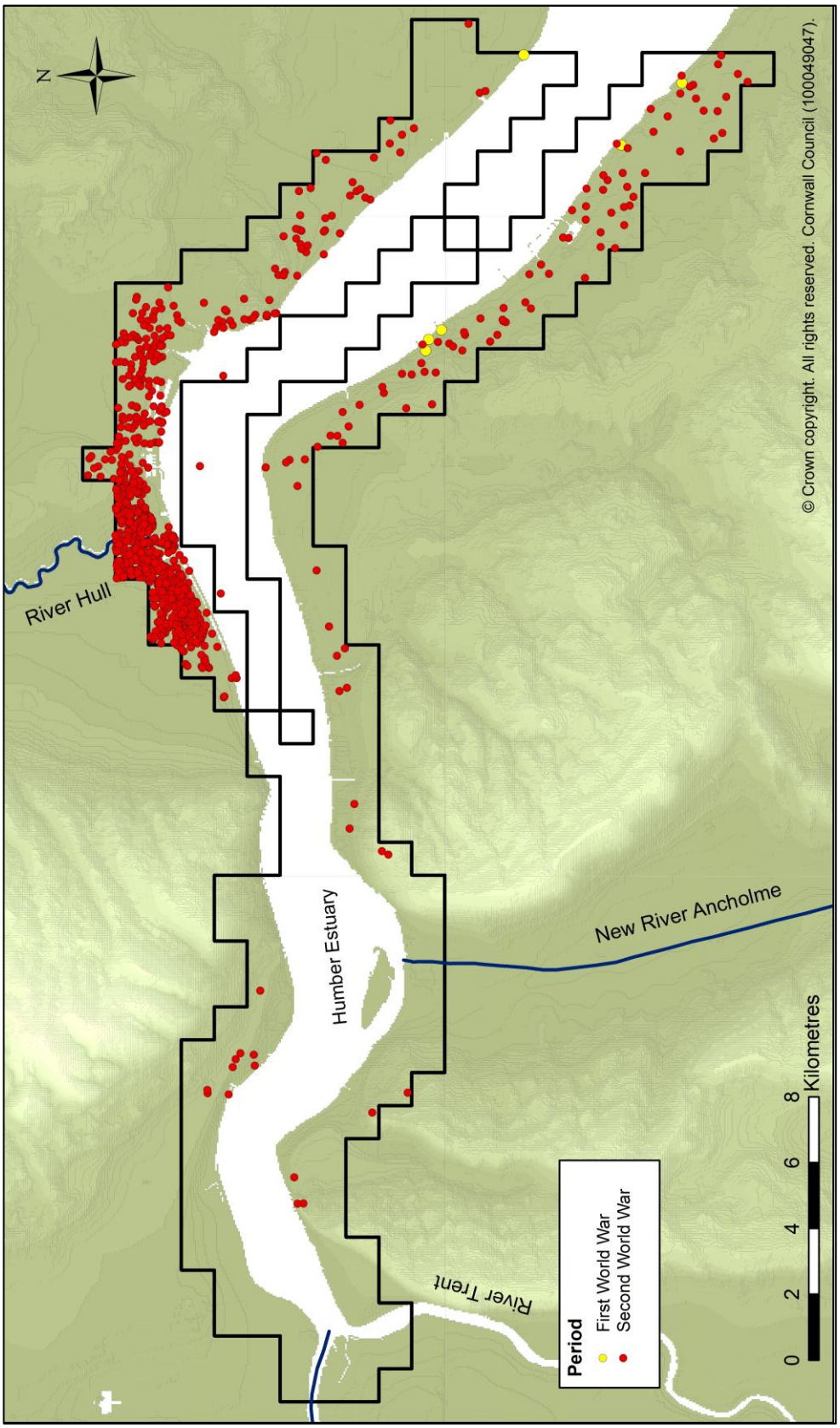


Figure 18 Distribution of all First and Second World War sites.

4.3 AI&M results: Bronze Age sites (2200-800BC)

Fifteen monuments were assigned a Bronze Age date, all of which were for possible Early Bronze Age round barrows (Fig 19). All but three were newly recorded during the project. Eight were round mounds visible as earthworks on historic RAF photographs taken in the 1940s, all have since been levelled; the others were cropmark ring ditches.

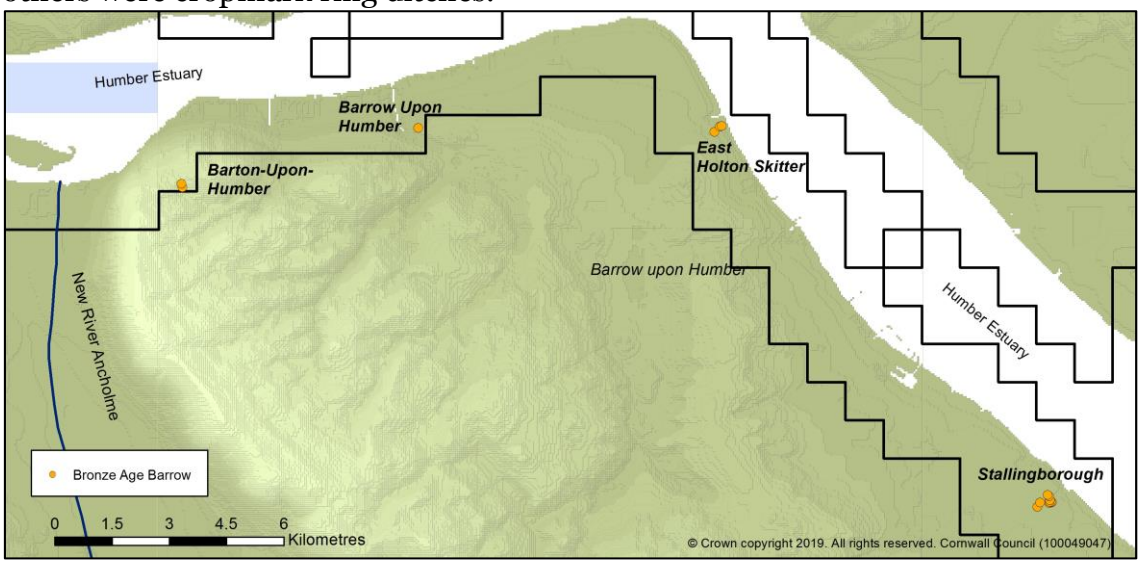
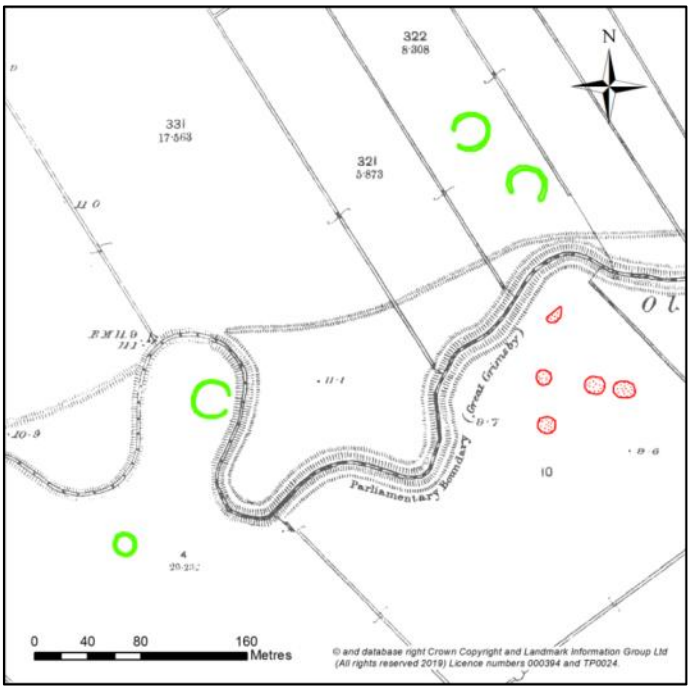


Figure 19 Distribution of Bronze Age monuments.



The largest group was recorded near Oldfleet Drain, Stallingborough (Fig 20, MCX192-200). Four ring ditches were identified on RAF photographs taken in 1941. They were considered to be of prehistoric origin on morphological grounds. Five small mounds, since levelled, were mapped in the vicinity of the ring ditches, their close proximity to the potentially prehistoric sites may be indicative of a Bronze Age funerary origin.

Figure 20 Potential Bronze Age barrows at Stallingborough.

MCX192-200. Background map OS 1st Edition 1:2500, c1880.

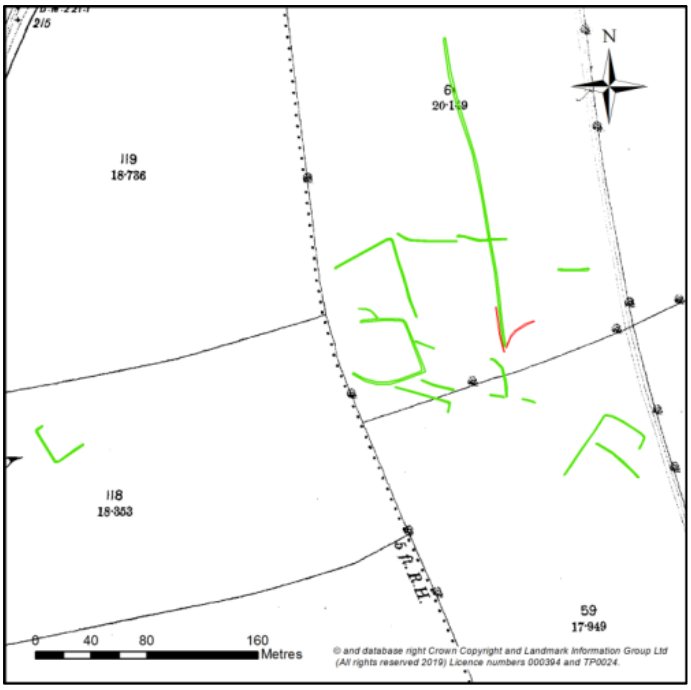
4.4 AI&M results: Iron Age/Romano-British sites (800BC-AD410)

Thirty five sites of Iron Age or Iron Age/Romano-British date were mapped and recorded during the project, of which six were new sites, previously unrecorded in the HERs and NRHE. All are cropmarks except one, (MLS11230) and the majority are situated to the south of the estuary (see Fig 22). The one site surviving as extant earthworks was identified by the North Lincolnshire Museum as a possible Iron Age or Romano British settlement and salt making site as a result of an earthwork survey carried out in 2006/7 although this was not confirmed during test pitting (Hemblade 2007).

As the distribution map (Fig 22) shows, the majority of sites dating to this period are located on the southern bank of the estuary. Those on the north bank are restricted to the area around North Ferriby. Read's Island was known to have been a crossing point in the later Roman period and the small number of Iron Age/RB sites immediately to the north may indicate an earlier origin for this routeway.

Table 3 Iron Age/Romano-British Site Types

Site Type	**No: Sites**
Enclosure	15
Field boundary/field system	3
Settlement	14
Settlement/Field system	3
Total	**35**



One newly recorded cropmark site lies to the north-east of North Ferriby at Grange Farm (MCX1464 and MCX1465) and appears to comprise a loose collection of rectilinear enclosures associated with other linears; probably the remains of a contemporary field system (Fig 21).

Figure 21 Iron Age or Romano British cropmarks at North Ferriby.

MCX1464, MCX1465. Background map OS 1st Edition 1:2500, c1880.

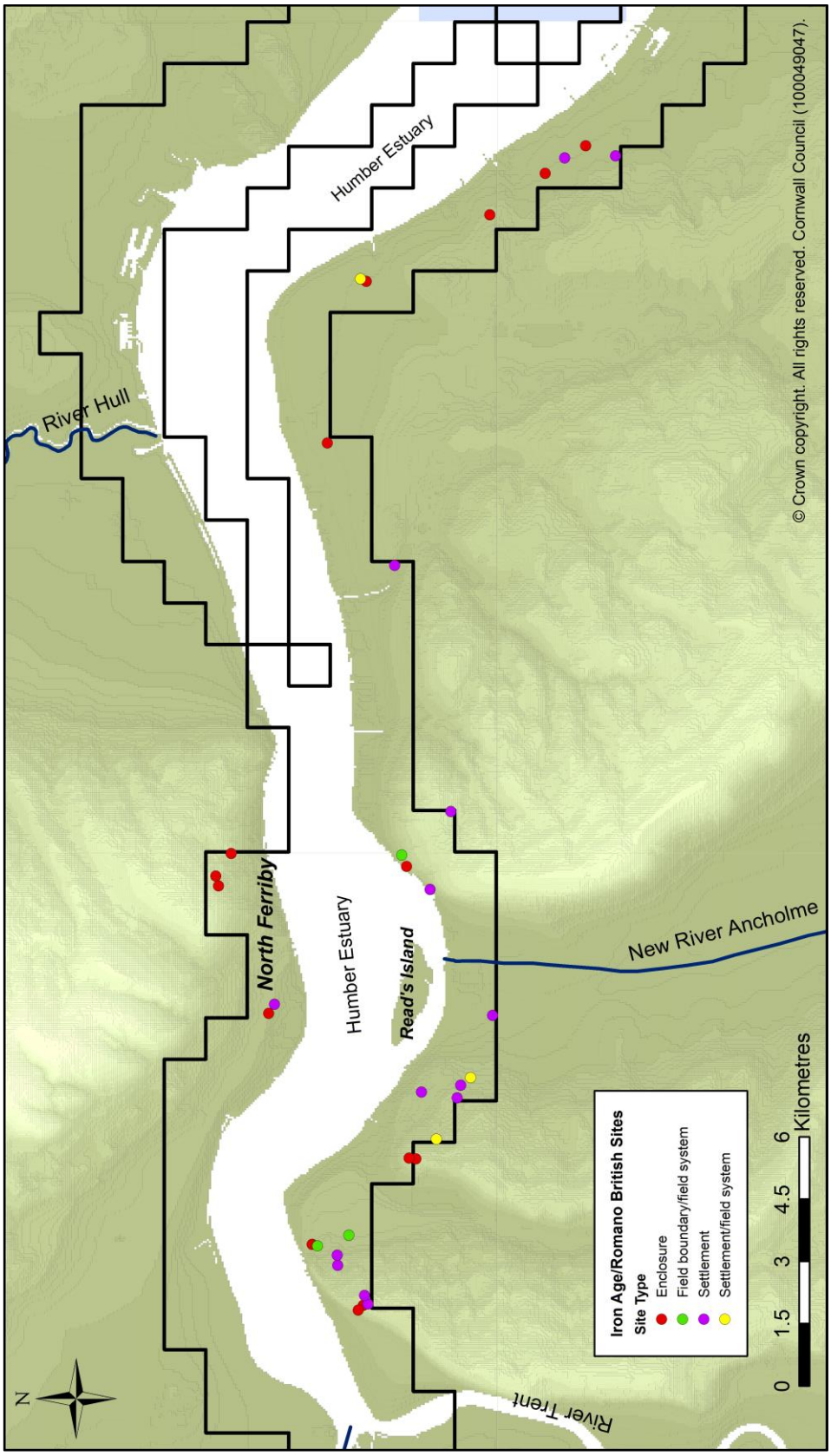


Figure 22 Distribution of Iron Age/Romano-British sites.

The site of a Roman settlement at Winteringham (where Ermine Street meets the south bank of the Humber) has long been known (Bennet 2006; Chapman et al 1998) and extensive cropmark complexes dating to this period have been recorded by aerial reconnaissance (see Section 5.2: Roman Winteringham: military base and small town). A group of field boundaries and pits were recorded at Eastfield to the SE of the later Roman settlement. The possible round house showing as a cropmark ring ditch may indicate that the site predates the main phase of Roman occupation (see Fig 23).

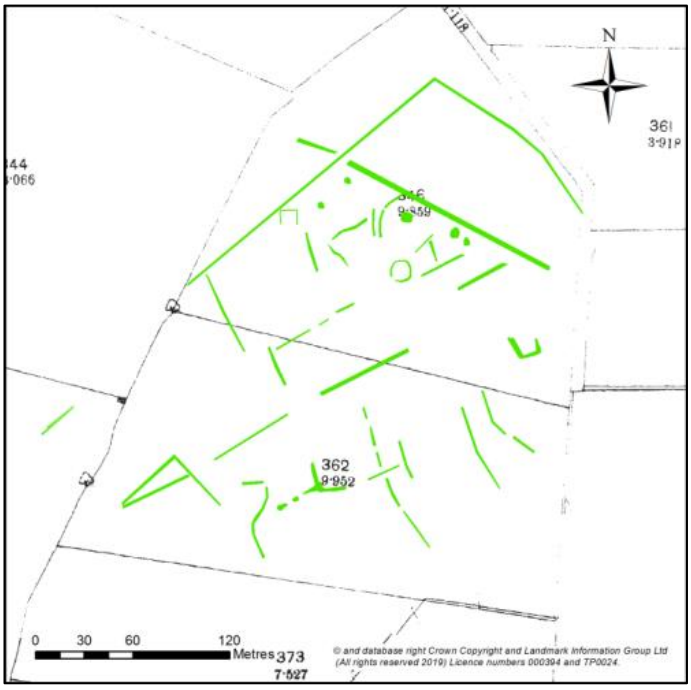


Figure 23 Iron Age or Romano-British cropmarks at Eastfield Winteringham.

MLS26587. Background map OS 1st Edition 1:2500, c1880.

4.5 AI&M results: Prehistoric or Romano-British sites (2200BC-AD410)

It was not possible to attribute a specific period to 21 sites considered to be of Roman or earlier date; of these, 17 (81%) were new to the record. All 21 sites have been levelled and were only visible as cropmarks. The sites include generic monument types of non-specific origin, such as field systems, trackways and enclosures that morphologically are not diagnostic of a particular period. For the purposes of this report, these sites are referred to as 'prehistoric' although some may have been in use into the Roman period.

The pattern of distribution of prehistoric sites is generally along the southern bank of the estuary with some sites on the northern bank west of Brough (Fig 24). Only one possible site lies east of Brough, a curvilinear ditch in a field to the northeast of Intack Plantation, Paull (MCX24) which was interpreted as a section of boundary or enclosure ditch, possibly of late prehistoric date; an Iron Age occupation site being recorded to the North of Boreas Hill, 210m to the northwest (MHU8764).

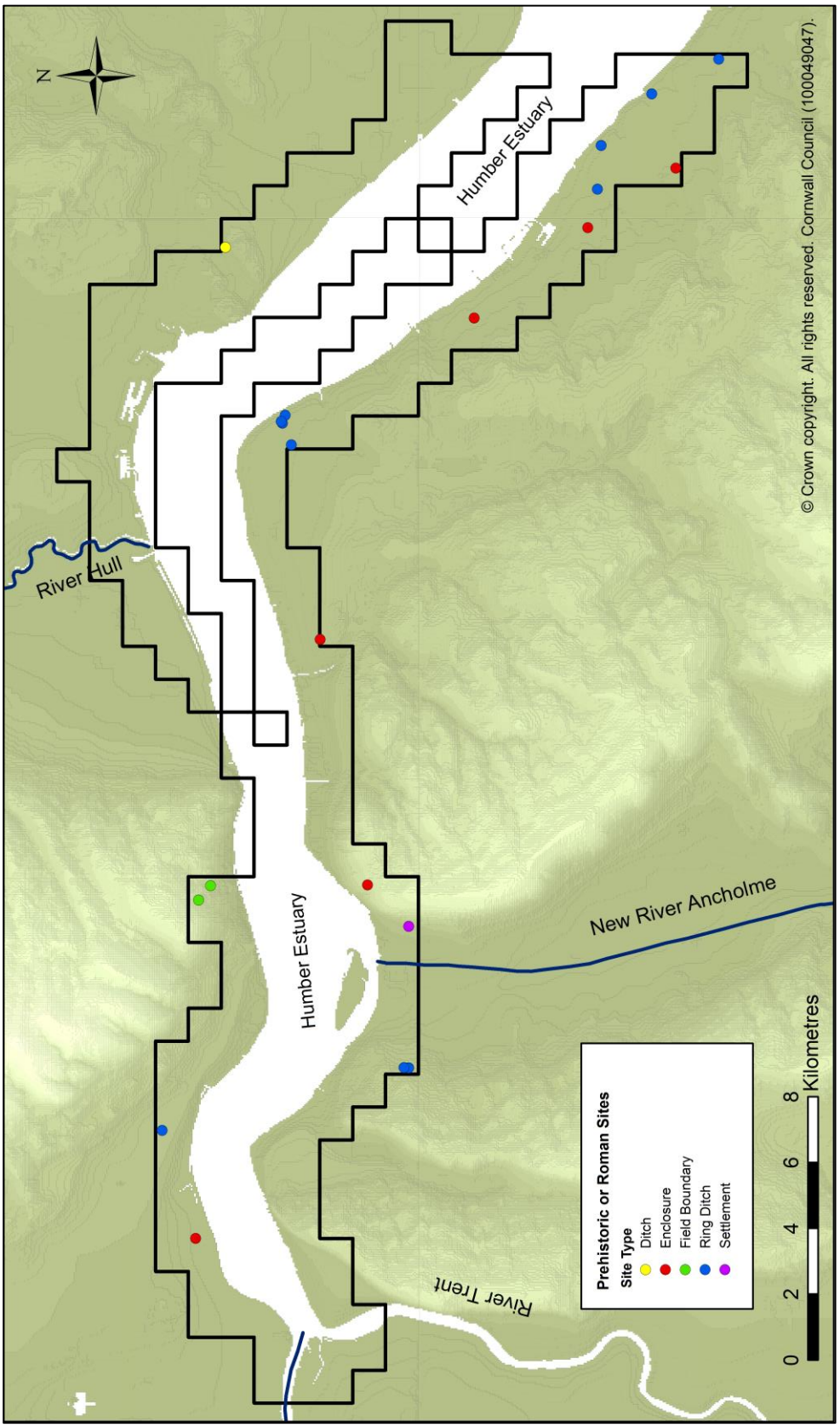


Figure 24 Distribution of Prehistoric or Romano-British sites.

Table 4 Prehistoric or Roman Site Types

Site Type	No: Sites
Ditch	1
Enclosure	6
Field Boundary	2
Ring Ditch	11
Settlement	1
Total	**21**

Two large ring ditches (MLS26227-8), were identified on aerial photographs taken in the 1940s on East Marsh, Goxhill (Fig 25). They may be Bronze Age round barrows or later prehistoric round houses associated with the adjacent, undated (possibly prehistoric), field system (MLS26224).

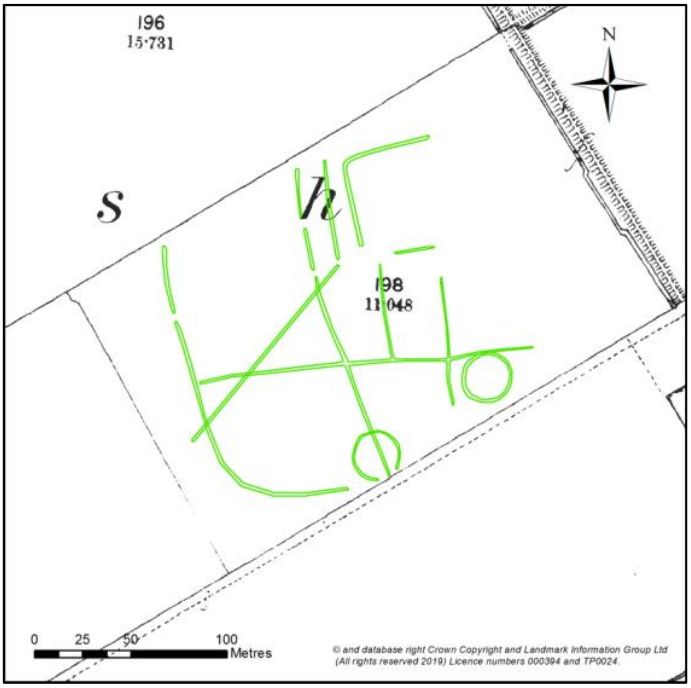


Figure 25 Prehistoric ring ditches at East Marsh, Goxhill.

MLS26227-8. Background map OS 1st Edition 1:2500, c1880.

4.6 AI&M results: Roman sites (AD 43-410)

The longevity of many of the features that might otherwise have been assigned to the Roman period, for example field systems and trackways, means that only 19 sites within the project area have been attributed a specifically Roman date. Of these, 15 are new to the record and all bar two are levelled earthworks or cropmarks. As the distribution map (Fig 26) shows, all bar one lie in the west of the project area.

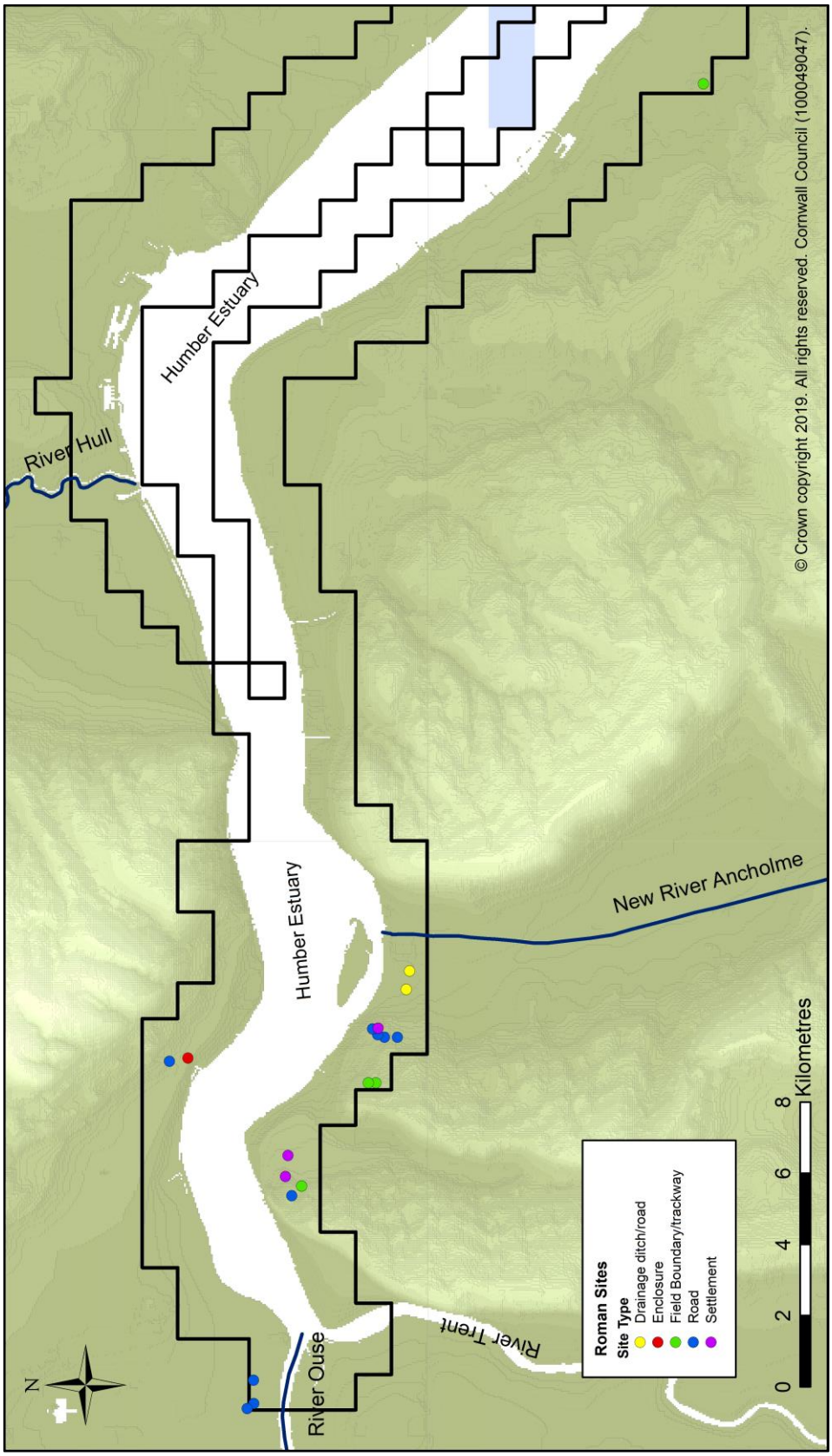


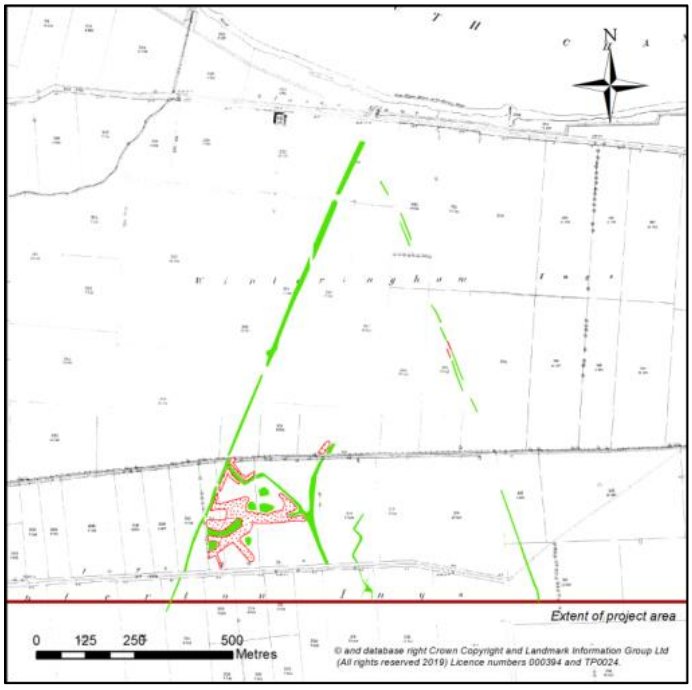
Figure 26 Distribution of Roman sites.

Table 5 Roman Site Types

Site Type	No: Sites
Drainage Ditch/Road	2
Enclosure	1
Field Boundary/Trackway	4
Road	9
Settlement	3
Total	**19**

Of the sites attributed specifically to the Roman period, roads were the most frequent.

A section of Roman road had previously been recorded at South Ferriby, close to the eastern end of present-day Read's Island (Chapman *et al* 1998; Van de Noort 2004) (see Section 5.2: Roman Roads). The road headed across the Ancholme floodplain towards Old Winteringham. Two other potential Roman roads were newly identified during the project cutting across Winteringham Ings, west of Ferriby Sluice (Fig 27, MLS26430-1). They run northwards for over a kilometre on a converging course, meeting at the water's edge to the south of Read's Island which may be the site of a Roman river crossing. These features may alternatively be drainage ditches or associated with land reclamation.



A Roman settlement and possible saltern site (MLS11230) is documented just to the south between the two potential Roman roads and just outside of the project area. Irregular cropmarks abutting the eastern side of the westernmost 'road' may be an extension of the Roman saltern site (Fig 27).

Figure 27 Potential Roman roads and saltern site at Winteringham Ings.

MLS26430-1 and MLS26433. Background map OS 1st Edition 1:2500, c1880.

4.7 AI&M results: Medieval sites (AD1066-1540)

One hundred and fifty two monuments identified during the project were assigned to the medieval period (Fig 28); of these, 117 (77%) were new sites. The majority (78 (51%)) were visible as earthworks on historic photographs but have since been levelled. Sixty two sites (40.5%) are still visible or partially visible as upstanding earthworks or structures.

The results are spread across a wide variety of site types (Table 6), but might in general be described as relating to settlement and agriculture (see Fig 28). The vast majority of the newly recorded sites were medieval ridge and furrow cultivation marks. Some of the most extensive ridge and furrow field systems were recorded in the north east of the project area in the parishes of Preston and Paull. The broad and sometimes curvilinear morphology of the ridge and furrow indicates a likely medieval origin. In places the earlier cultivation ridges appear to be overlain by straight regular field boundaries that are probably the result of later Parliamentary enclosure (Fig 29).

Table 6 Medieval Site Types

Site Type	**No: Sites**
Enclosure/ Bailey/Motte and Bailey/Moated Site	9
Drainage Ditch/Drainage System	3
Sea Defence/Flood Defence/Causeway	5
Field Boundary/Field System	8
Hermitage	1
Mound/Saltern	5
Ridge and Furrow	115
Shrunken medieval village	1
Trackway	2
Windmill Mound	2
Wreck	1
Total	**152**

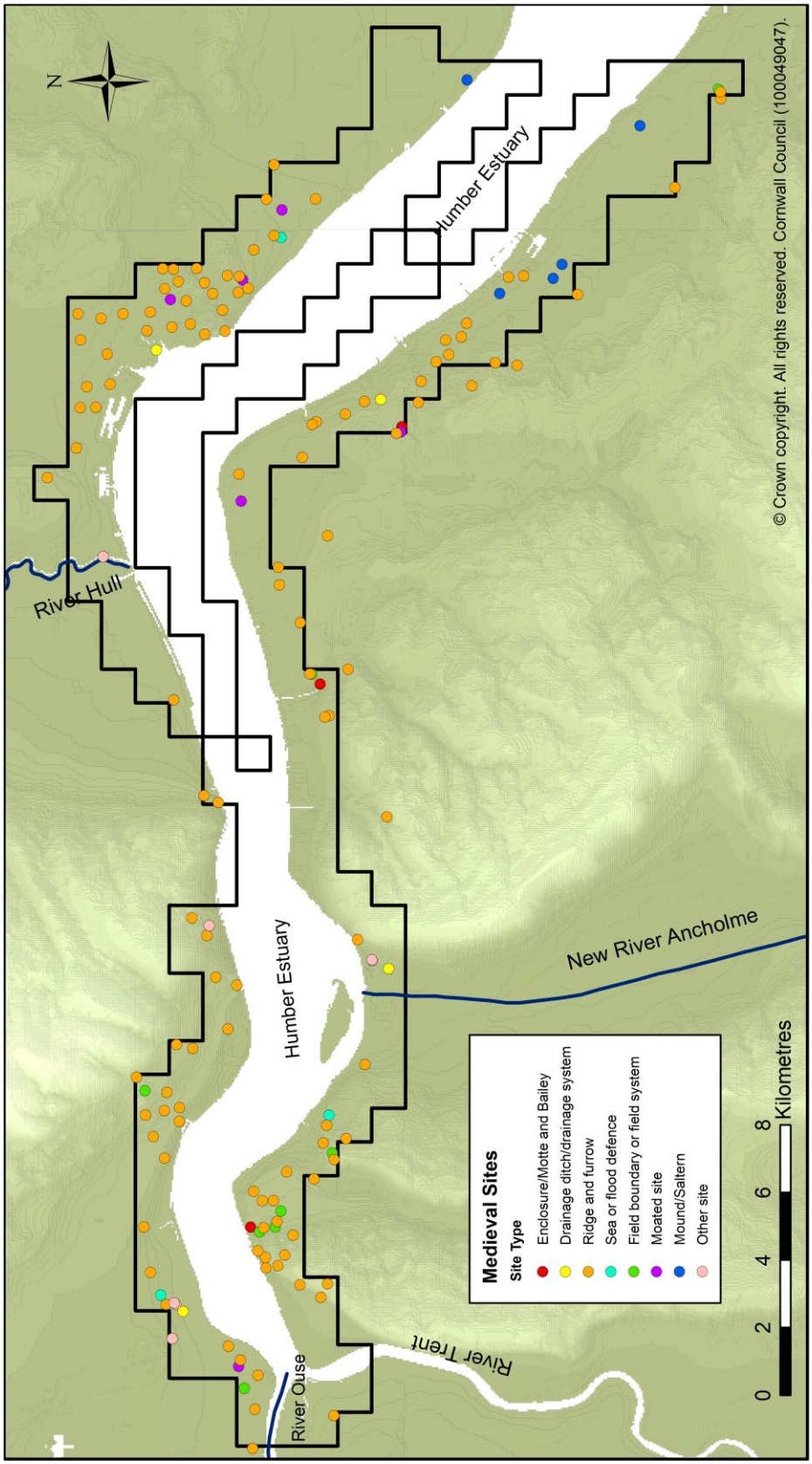


Figure 28 Distribution of Medieval sites.

Figure 29 Medieval ridge and furrow between Marfleet and Hedon.

The straighter edges are probably the result of later Parliamentary enclosure forming straight regular lines that overlie and divide the areas of earlier medieval cultivation. Background map OS 1st Edition 1:2500, c1880.

The site of a possible medieval trackway was identified to the east of North Ferriby (MCX1470). The linear trackway is visible as a low earthwork on lidar imagery and appears to fork south eastwards from Ferriby High Road at Tithe Farm. It runs for 550m to Blasket Pond before turning southward for 180m (Fig 30).

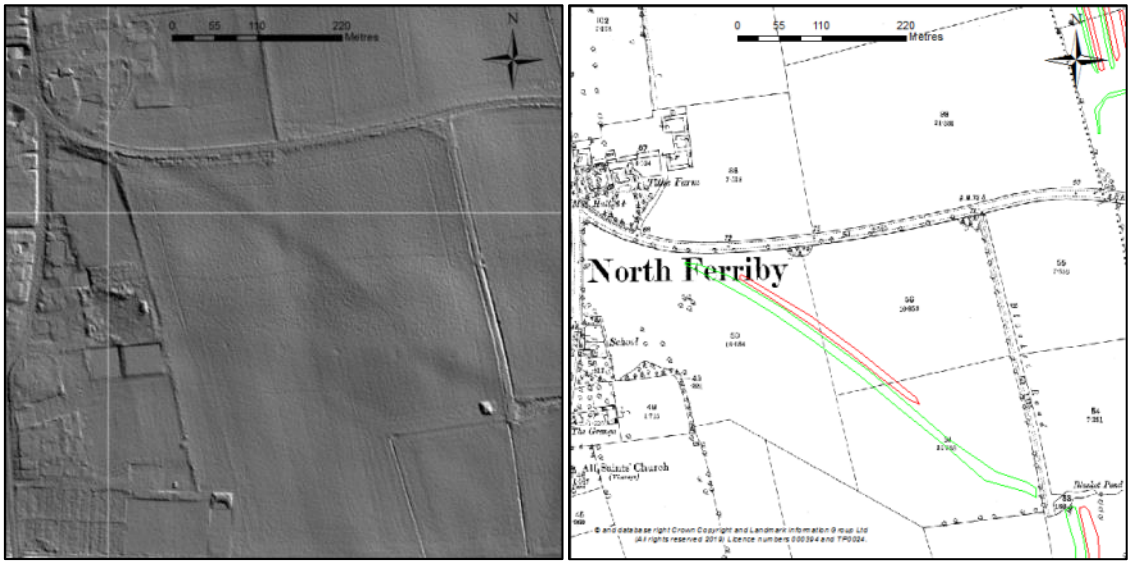


Figure 30 Possible medieval trackway North Ferriby.

MCX1470. Lidar image © Historic England; source Environment Agency. Background map OS 1st Edition 1:2500, c1880.

4.8 AI&M results: Post medieval sites (AD1540-1900)

During the mapping project 20% (426) of sites identified were attributed a post medieval date (Fig 31; Table 7). Of these monuments, 202 (47%) survive as extant or partially extant earthworks and structures; and 179 (42%) as cropmarks and levelled earthworks. Of the remaining sites recorded, 44 (10%) have since been completely demolished or destroyed.

Table 7 Post medieval site types

Site Type	**No: Sites**
Beacon	9
Breakwater/Groyne	32
Brickworks/Brick Drying Shed/Tile Kiln	47
Building	3
Cement Works	1
Clay Mill	1
Coastal Battery	2
Cultivation Marks/Ridge and Furrow	11
Dewpond/Pond	30
Ditch/Drainage Ditch/Drainage System/ Flood Defences /Leat	63
Enclosure	4
Extractive Pit/Quarry/Shaft (Clay, Gravel and Sand)	78
Farmstead/Small Holding	2
Fertilizer Works	1
Fish Pond	1
Fish Trap/Oyster Beds	3
Field Boundary/Field System/Orchard	58
Folly	1
Fort	1
Jetty/Pier/Landing Point/Quay/Slipway	36
Malt House	1
Railway Embankment/Railway Station	2
Road/Trackway	28
Shipyard	1
Spoil heap	1
Stack Stand	5
Windmill Mound	3
Wreck	1
Total	**426**

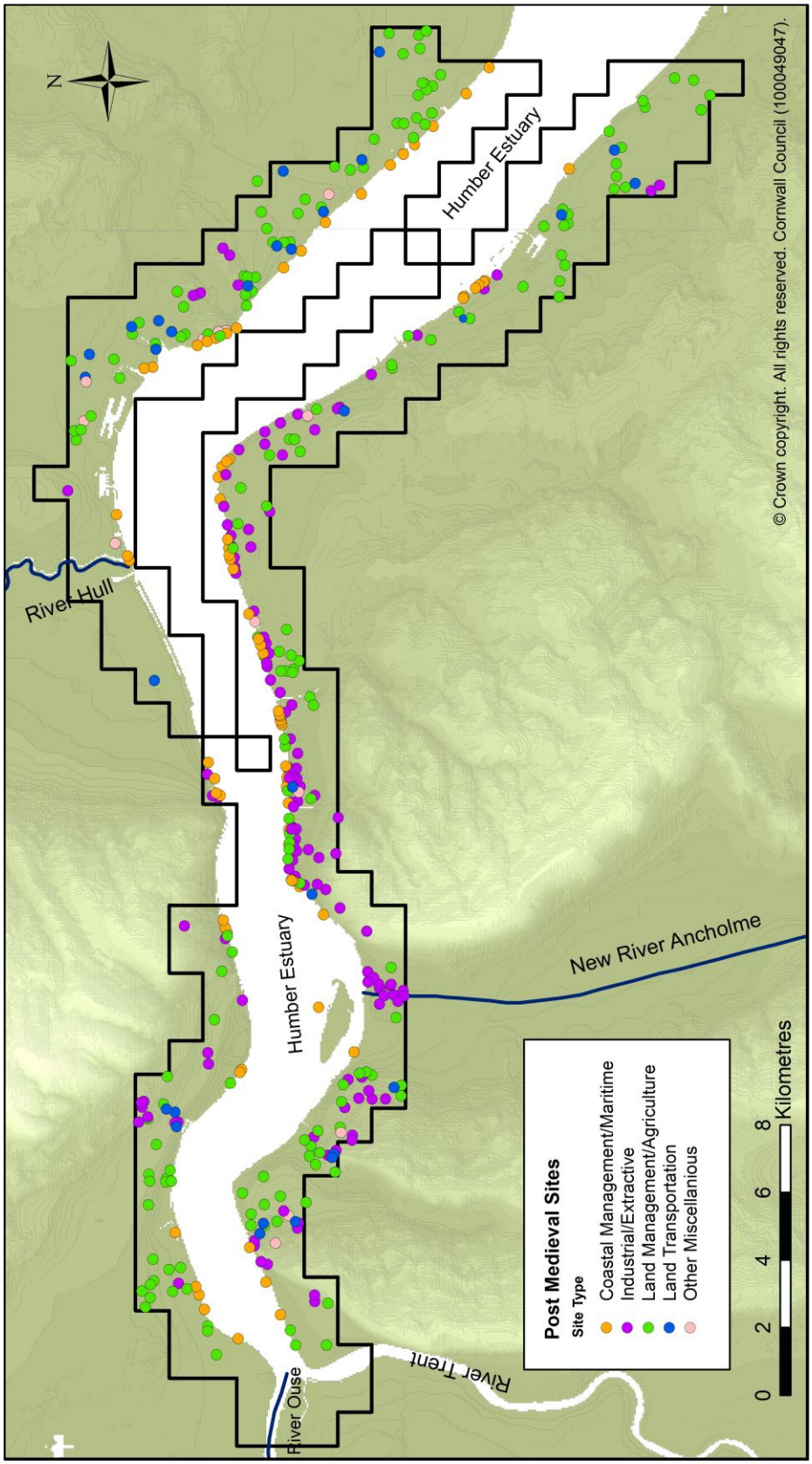


Figure 31 Distribution of Post Medieval sites.

Eighteen percent of sites given a post medieval date are related to extraction of clay, sand and gravel. This included large scale extraction associated with the brick and tile industry (Fig 32) (and see Section 5.4: Post medieval extraction). Smaller pits were also found across the project area, excavated for a number of purposes including aggregate pits for road construction or as a local source of stone for building. On the chalk and limestone areas, the pits may relate to farms and local communities extracting chalk and limestone for use as a soil improver and for the manufacture of lime for the local building industry.

Figure 32 Large-scale clay extraction associated with the post medieval brick and tile industry between Barton Waterside and Chowder Ness.

Background map OS 1st Edition 1:2500, c1880.

In the parish of Goxhill, a number of linear groups of small rectilinear pits were identified running adjacent to the shore-line (Fig 33). They ranged from 2m to 100m in size (the large pits probably being aggregates of a number of smaller ones) and ran in total for a distance of over 4km around the curve of the shore-line. The pits appear to be shallow and are possibly the result of local peat extraction; they are unique to Goxhill and were not encountered anywhere else in the project area.

A number of linear mounds were identified jutting out into the estuary in various places along the shore-line including the parishes of Goxhill and Paull, and on Broomfleet Island. Some were marked on the 1st edition OS mapping although many were not. Some may have been groynes constructed to limit erosion of the estuary bank however several are marked as 'Beacon' on the historic mapping. These beacons would have aided the navigation of the difficult waters of the estuary with its shifting sandbanks. Examples of these features are illustrated in Figure 33 (MLS26187 and MLS26274-5).

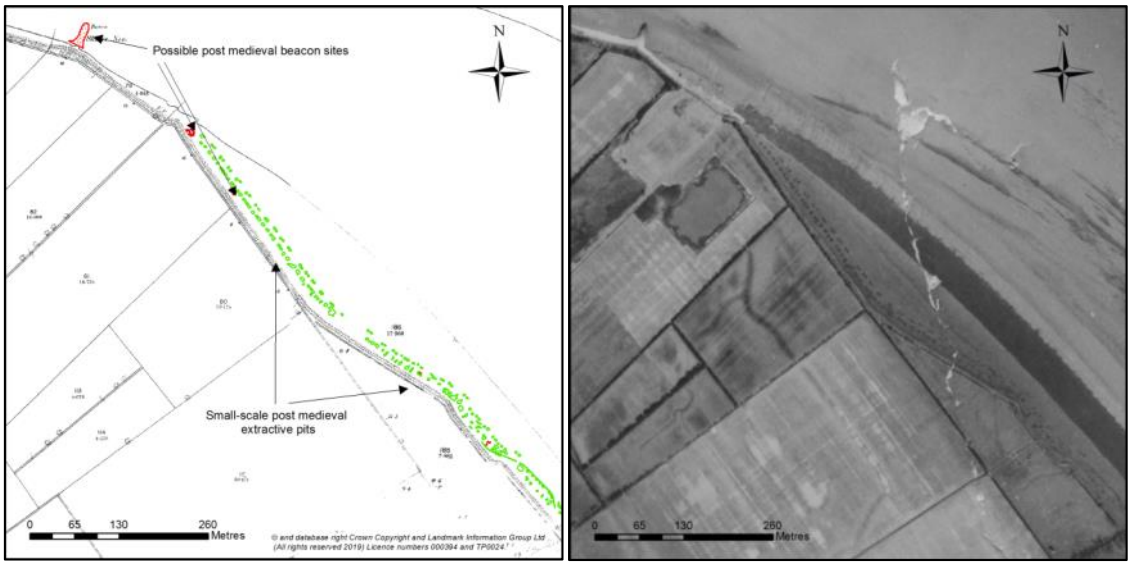


Figure 33 Post medieval peat extraction pits at Goxhill.

MLS26180. Photograph: RAF 613D/BR52 VB 1 13th March 1941 Historic England RAF Photography. Background map OS 1st Edition 1:2500, c1880.

Two oval banked mounds, 10m by 7m across, were identified on aerial photographs taken in 1948 lying on top of medieval ridge and furrow to the south west of Broomfleet village (Fig 34). Each is surrounded by a narrow ring-ditch. They are considered to be post medieval haystack stands. Three similar features had previously been recorded in the same parish 2km south of Prospect Farm (Loughlin and Miller 1979, 41) two of which also overlay extant ridge and furrow.

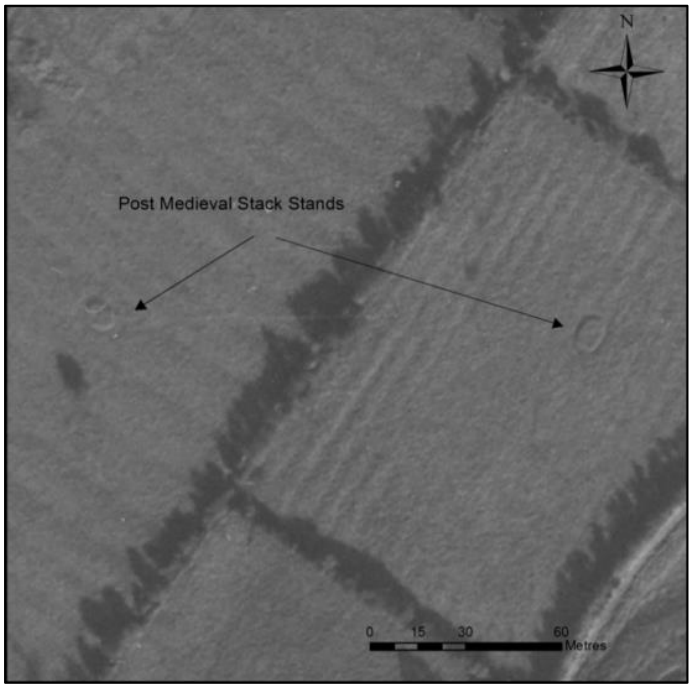


Figure 34 Post medieval stack stands, Broomfleet.

MCX1488-9. Photograph: RAF 541/189 RS 4123 26th October 1948 Historic England RAF Photography.

Twenty-four percent of monuments (101 sites) dated to the post medieval period were for field boundaries and systems and drainage ditches and systems and of these all but four were new sites not previously recorded. One such site was an extensive system to the east of Whitton (Fig 35). Many of the recorded boundaries respect and sometimes align with historic boundaries recorded on the 1st Edition OS map and they were therefore considered to be part of a much wider post medieval system.

Figure 35 Post medieval field boundaries and drainage features east of Whitton.

MLS26506 and MLS26523. Background map OS 1st Edition 1:2500, c1880.

4.9 AI&M results: Historic (early medieval or later) sites (AD410-1900)

The nature of the evidence of aerial photographic and lidar surveys means that there are certain categories of site, mainly agricultural, which could have been medieval or post medieval in date; features such as field boundaries, wood banks, trackways and extractive pits, for example. For the purposes of this summary, these sites have been given a general Historic date (Fig 37; Table 8).

Table 8 Historic site types

Site Type	**No: Sites**
Boundary Bank	1
Cultivation Marks/Ridge and Furrow	27
Ditch/Drainage Ditch/Drainage System	36
Enclosure	9
Extractive Pit/Chalk Pit	18
Field Boundary/Field System	36
Flood Defence/Sea Defence	11
Mound/Saltern	1
Pond	1

Settlement/Village	2
Trackway	7
Total	**149**

A series of mounds had previously been recorded in the North Lincolnshire HER north of Immingham village (MCX439 (MNL4105)); these are recorded in blue in Figure 36. Further mounds and enclosures were identified during the project immediately to the south-west (MCX433-6). Overall, the features cover an area of 1.5ha; they are considered to be of medieval or later date, possibly associated with the salt-making industry (See Section 5.4: Salt production).

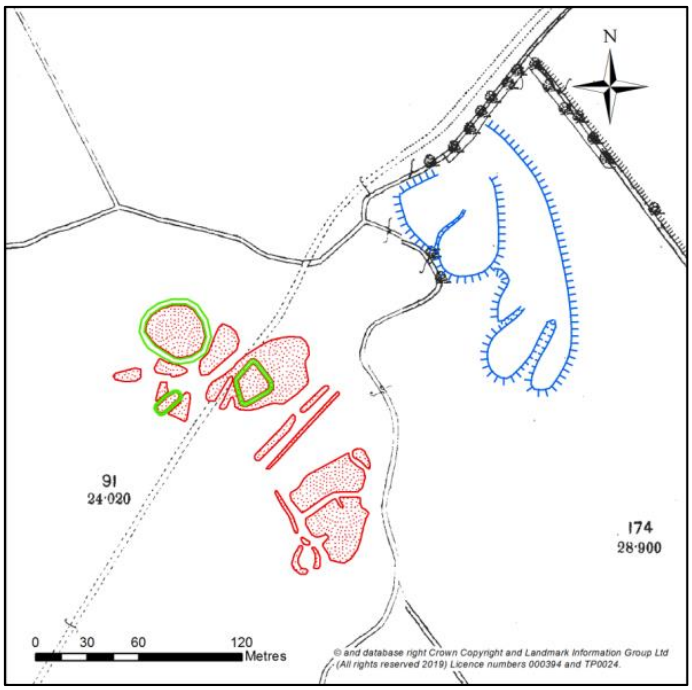


Figure 36 Possible historic salterns, Immingham.

MCX436 and MNL4105. Background map OS 1st Edition 1:2500, c1880.

Of the 149 sites given a general historic date, the majority (96%) were previously unrecorded in the HERs or NRHE. Examples of these new sites include possible salterns to the north of Immingham (Fig 36) and the site of a possible medieval or post medieval settlement to the west of Ferriby Hall, South Ferriby (MLS26449); rectilinear features to the west of Ferriby Hall are clearly visible on lidar imagery and cover an area of 15 hectares (Fig 38).

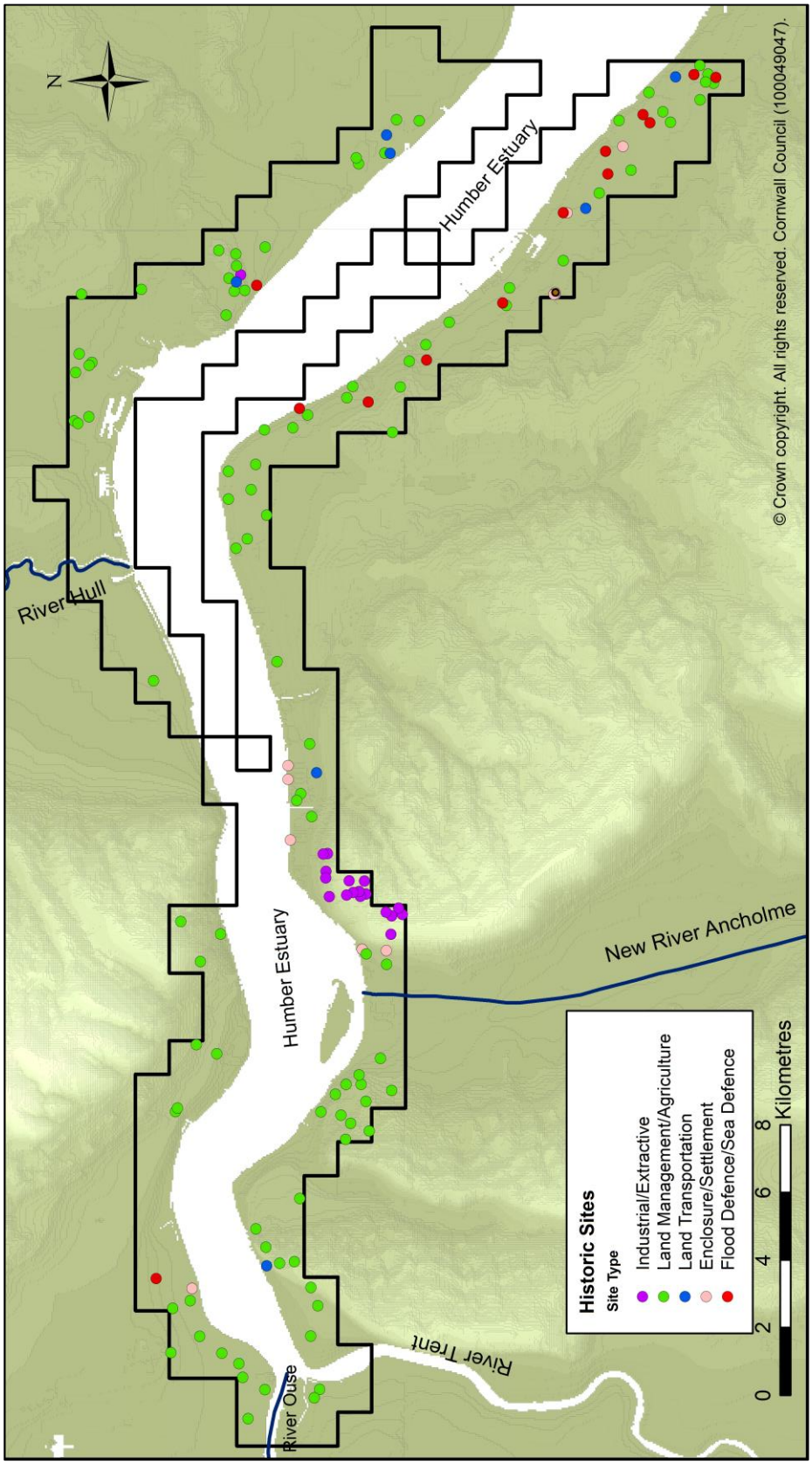


Figure 37 Distribution of Historic sites.

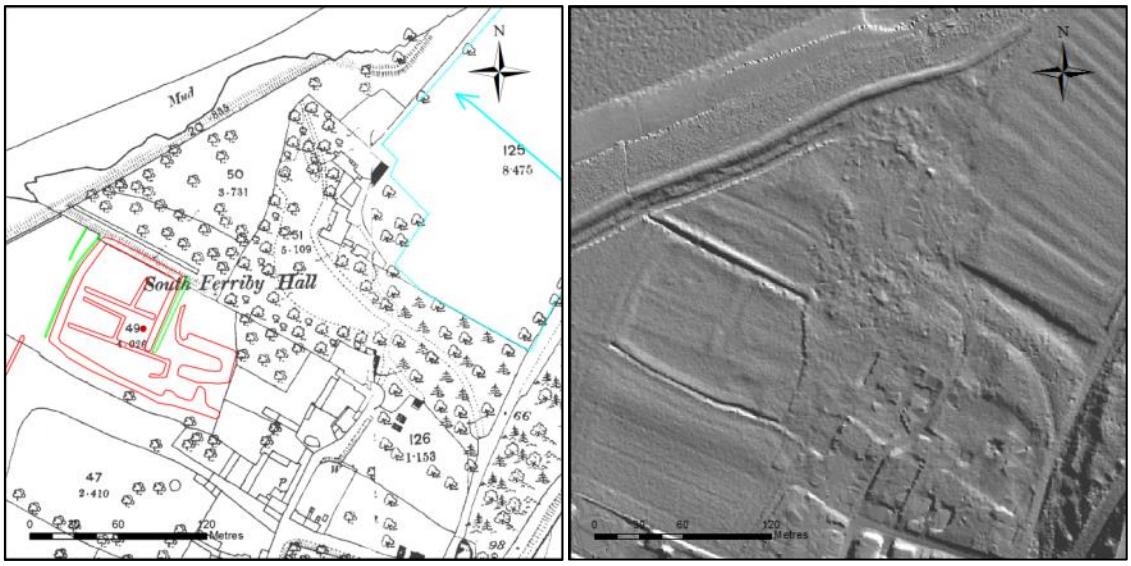


Figure 35 Possible deserted settlement to the west of Ferriby Hall.

MLS26449. Lidar images © Historic England; source Environment Agency. Background map OS 1st Edition 1:2500, c1880.

An intriguing site lies to the west of East Marsh Road, Goxhill (Fig 39). Here a series of massive bank and ditched features are visible as cropmarks running north-westwards towards the peripheral earthworks associated with the known medieval moated site of Hogcote Close (MLS1583) (Discussed in Section 5.4). They are clearly man-made running near ruler-straight for over a kilometre. It is possible that the features relate to medieval or post medieval drainage or land reclamation which is discussed in detail in Section 5.1.

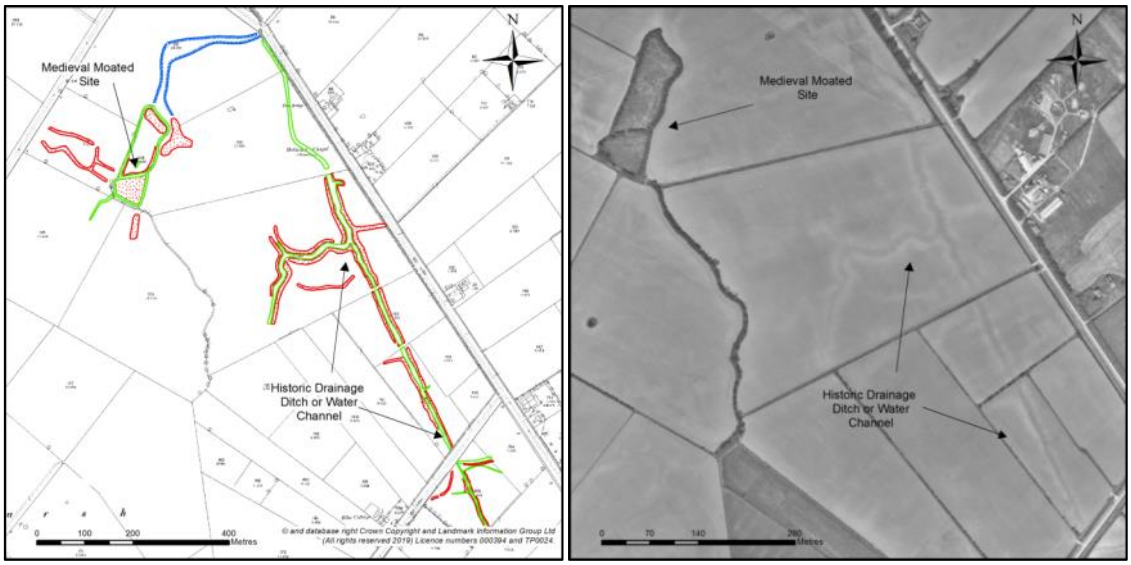


Figure 39 Historic drainage ditch or water channel, Goxhill.

MLS26240. Photograph: OS/67036 V 504 12th April 1967 © Crown Copyright Ordnance Survey. Background map OS 1st Edition 1:2500, c1880.

4.10 AI&M results: Late 19th to early 20th century sites (AD1850-1945)

All late 19th and early 20th century sites predating the end of the Second World War (1945) were mapped and recorded during the project including military features relating to the War itself (Fig 41; Table 9). Features post-dating 1945 were not generally plotted unless they were abandoned military features associated with the Cold War. Structures that are still in use or preserved in later structures that are still in use were not mapped, this included extant field boundaries, roofed buildings, canals, railways and 20th century drainage features. Of the total number of sites identified during the project, 58 (78%) had not previously been recorded in the NMR or HERs.

Table 9 Late 19th or early 20th century site types

Site Type	**No: Sites**
Boat Yard/Shipyard	2
Brickworks/Tile Works	6
Building/Military Building	8
Chemical Works	1
Chimney	1
Coast Artillery Searchlight Battery	2
Ditch/ Water Channel	2
Dock	2
Enclosure	4
Extractive Pit/ Quarry/Spoil Heap	5
Firing Range	1
Fish Trap	13
Flood Defences/Sea Defences	6
Groyne	2
Jetty	10
Observation Post	1
Railway Embankment	1
Refinery	1
Sports Pavilion	1
Submarine Mine Depot	1
Trackway	3

Tram Depot	1
Water Tower	1
Wreck/Ship Graveyard	34
Total	**109**

The majority of sites attributed a 20th century date relate to the First and Second World Wars and these are described separately in Section 4.11. Figure 41 shows the distribution of all non-world-war sites, which clearly cluster along the estuary shoreline. Perhaps not surprisingly therefore, the most common site types are of a maritime function such as fish traps, jetties and ship wrecks.

The majority of late 19th and early 20th century fish traps that were identified were partially buried in the mud between South Killingholme Haven and Immingham Haven. They were up to 80m long and traces of nets were visible on photographs taken in 1970 (Fig 40). It is uncertain as to whether these features still survive in the tidal muds, the area having since been partially enclosed by the Coal and Ore Conveyor Jetty of Immingham Ore Terminal. Two other possible fish traps were identified on the northern bank at Welton Bank Clough (MCX1430-1) (for discussion of fish traps see Section 5.4: Fish Traps).

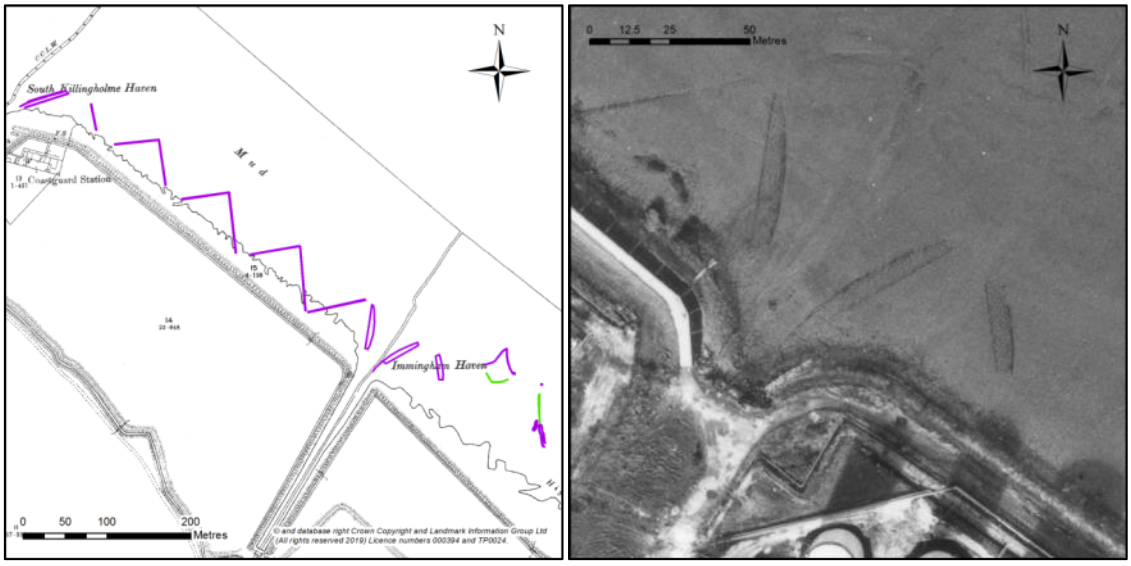


Figure 40 Fish traps in the muds west of South Killingholme.

MCX473-8. Photograph: MAL/7084 V 051-2 28th October 1970 © Historic England. Background map OS 1st Edition 1:2500, c1880.

Several long 'strings' of conjoined rectilinear structures were identified in the intertidal region on the southern bank of the estuary between Chowder Ness and Barrow Haven (Fig 42). It is uncertain whether these were associated with mariculture or the eroded out remains of late 19th/20th century sea defences.

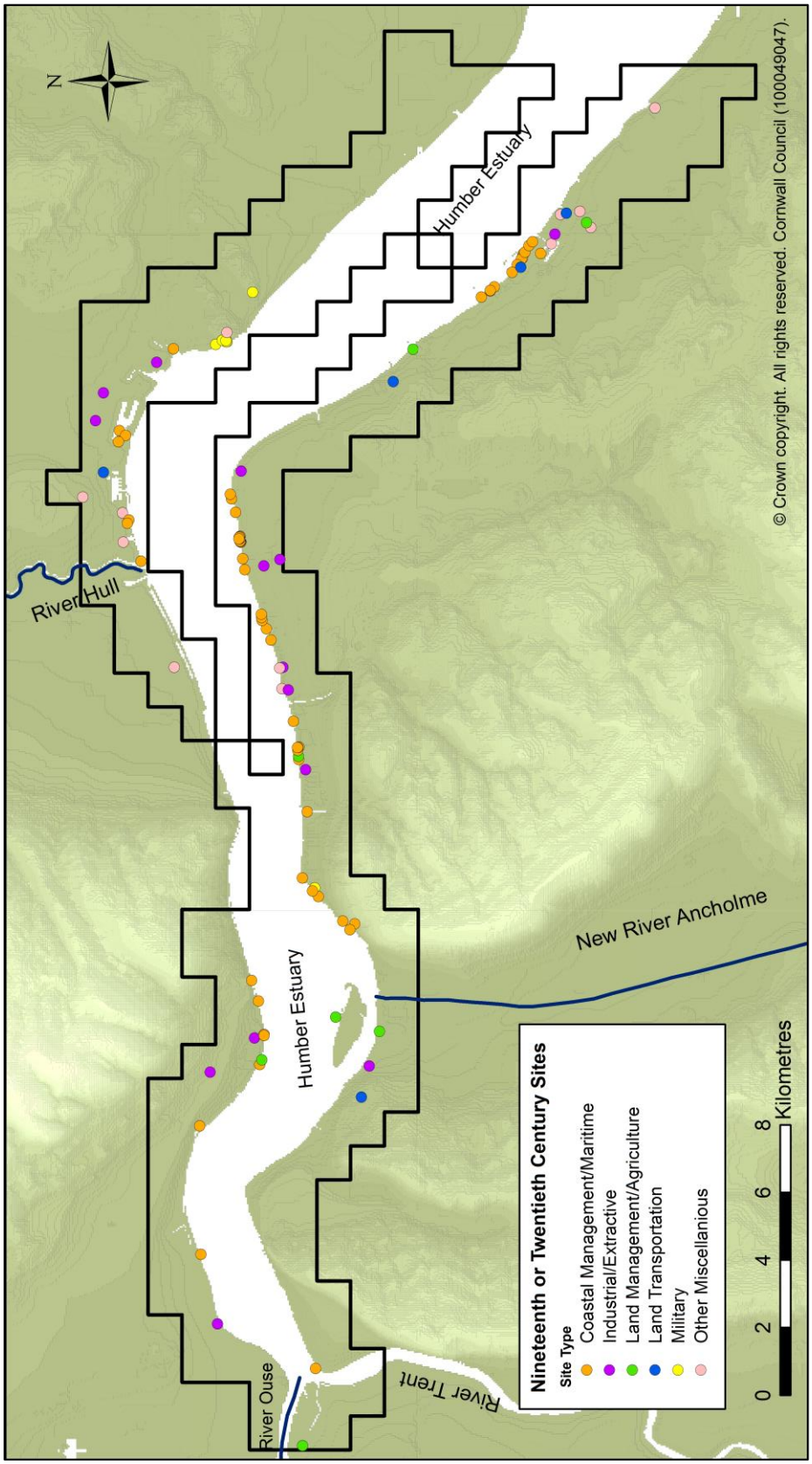


Figure 41 Distribution of late 19th and/or early 20th century sites.

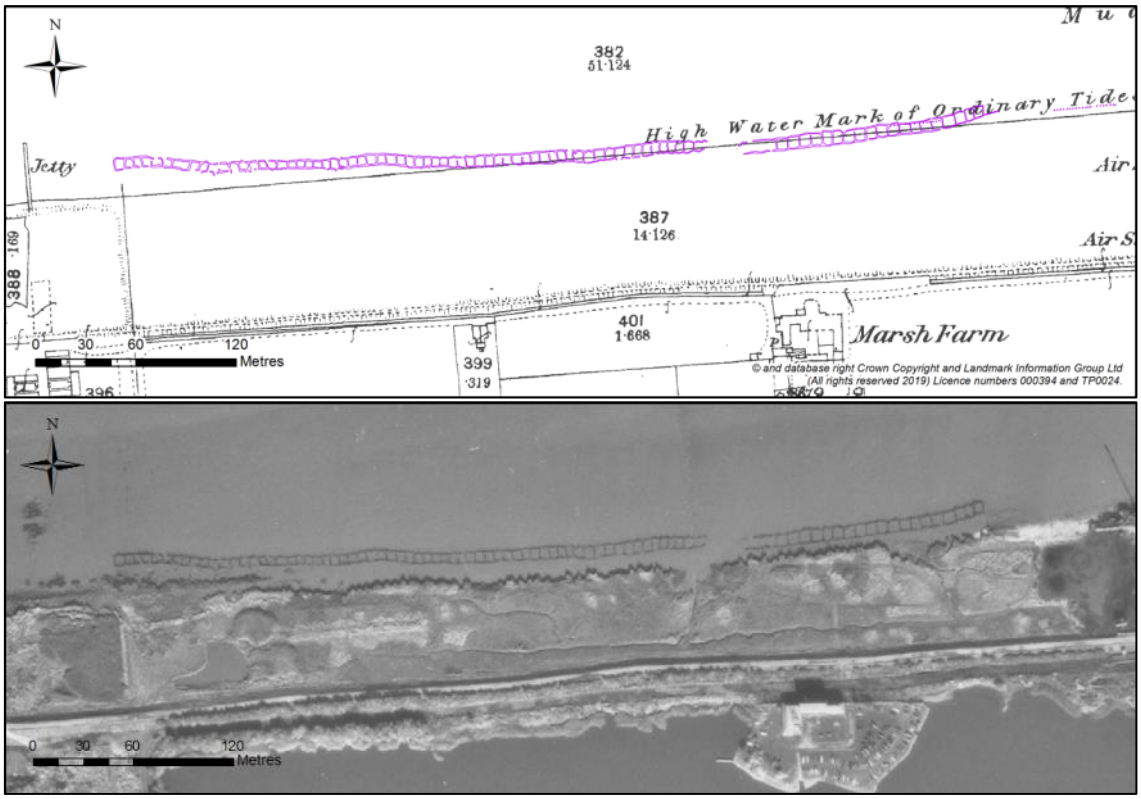


Figure 42 Fish Traps or sea defences, Marsh Farm, Barton-upon-Humber.

MLS26366. Photograph: OS/87199 V 649 23rd October 1987 © Crown Copyright Ordnance Survey. Background map OS 1st Edition 1:2500, c1880.

Ship wrecks and ship graveyards were the most common site type recorded dating to the late 19th or 20th century. One example is located northeast of Goxhill Tileries, north of Neatgangs Lane. Here eighteen wrecks were mapped during the project although more than these were visible on the aerial photographs (the others having been assessed as having been floated off or scrapped when looking at later photographs). The wrecks appear to be in the vicinity of a late 19th or early 20th century shipyard which was later used as a 20th century scrap yard with buildings and a slipway visible (Fig 43).

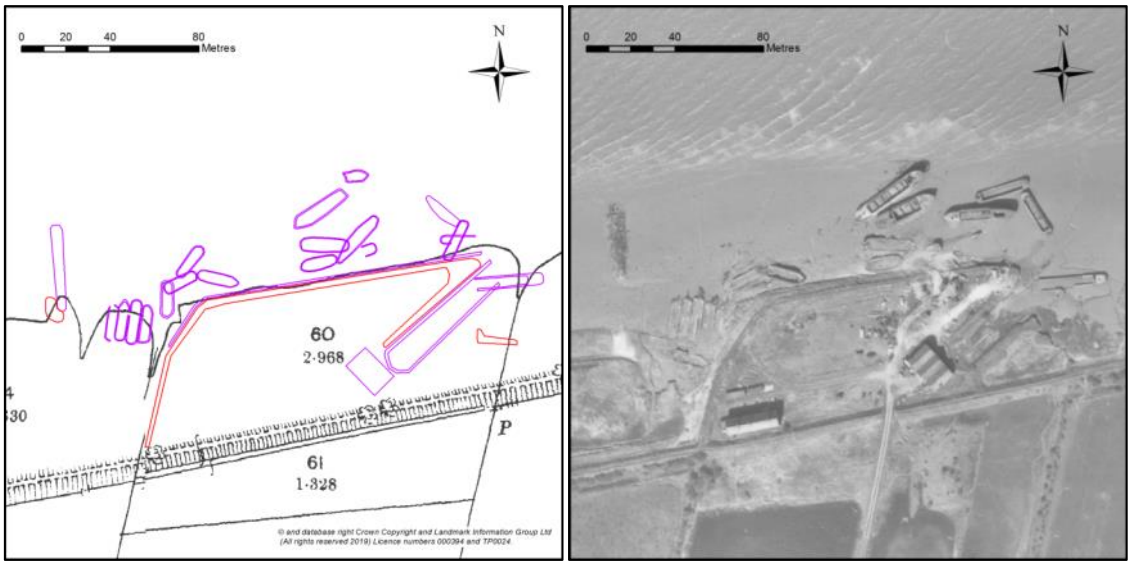


Figure 43 Ship graveyard and scrap yard north of Neatgangs Lane, Goxhill.

MLS26190-7. Photograph: OS67036 V 523 17th April 1967 © Crown Copyright Ordnance Survey. Background map OS 1st Edition 1:2500, c1880.

A straight channel, 100m wide and nearly 2km long is visible as earthworks on aerial photographs taken in 1947 running along the southern edge of Blacktoft Sand, Twin Rivers (Fig 44). It follows the line of the high water marked on the Ordnance Survey 1st edition map and a channel is marked on the 2nd and 3rd Edition maps running eastwards to the main river channel. The feature is therefore considered to be a late 19th and early 20th century attempt to open a navigable channel on the landward side of the sands. The feature has since completely silted up and is no longer visible on more recent imagery.

Figure 44 Water Channel, Blacktoft Sand.

MCX1514. Photograph: RAF CPE/UK/2013 RS 4175 29th April 1947 Historic England RAF Photography.

4.11 AI&M results: Sites dating to the First and Second World Wars (AD1913-1945)

All 20th century military sites relating to the First and Second World Wars were mapped and recorded during the project (and see Section 5.5 for discussion).

First World War military features

Table 10 First World War Site Types

Site Type	No: Sites
Coastal Artillery Searchlight	1
Coastal Battery	3
Firing Range	1
Military Camp/Installation	1
Total	**6**

As the distribution map (Fig 45) shows, all six sites dating to the First World War lie towards to the mouth of the estuary east of Goxhill.

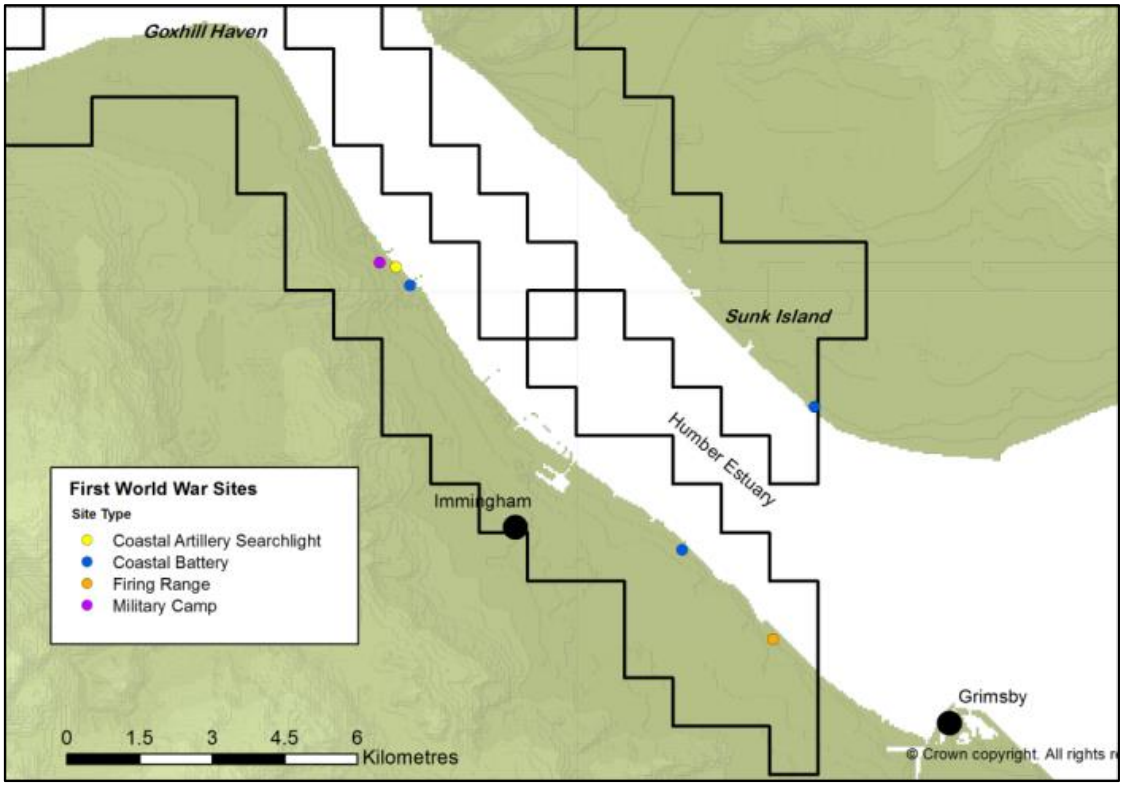


Figure 45 Distribution of First World War sites.

Sunk Island Battery (MCX255) formed and important part of the Humber estuary's First World War coastal defence system and was one of two batteries on opposite banks of the Humber Estuary close to its opening to The North Sea; the second being at Stallingborough. It was built between 1914 and 1915 and later reused during the Second World War. Structures including gun emplacements, buildings and to the east of the site, defensive linear trenches are clearly visible on photographs taken in 1947. The site is now overgrown but some structures still remain and are visible on lidar (Fig 46).

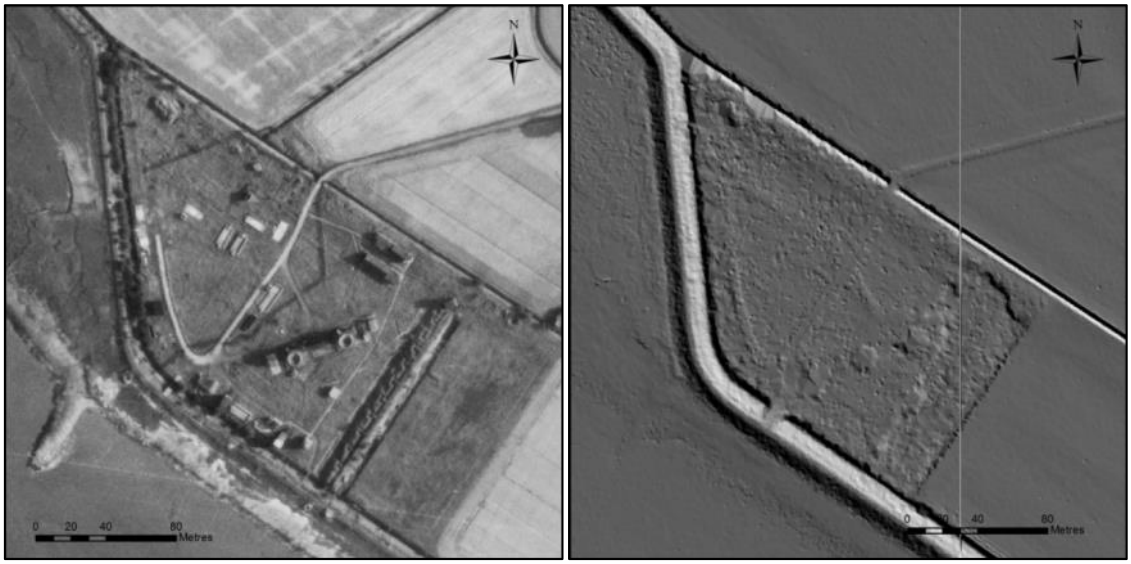


Figure 46 Sunk Island WWI Coastal Battery.

MCX255/MHU9587. Photograph: RAF CPE/UK/2043 RP 3071 29th April 1947, Historic England RAF. Lidar image: © Historic England; source Environment Agency.

Second World War military features

Whilst sites dating to the Second World War were found right across the project area, the majority are located to the east of the River Humber towards the mouth of the estuary (Fig 47). The highest concentrations of sites are located within the city of Hull itself where an average of 80 sites per kilometre square was recorded (Figs 48 and 49). These were mainly bomb sites and air-raid shelters with a lesser number of water tanks and barrage balloon sites.

Table 11 Second World War Site Types

Site Type	**No: Sites**
Air Raid Shelter	388
Airfield	2
Ammunitions Depot/Ordnance Depot	2
Anti-landing Obstacle	43
Barrage Balloon Site	42
Bomb Site/Bomb Crater	451
Bombing Decoy	13
Degaussing Station	1
Firing Range	1
Gun Emplacement/Pillbox	16
Gun-laying Radar Platform	2
Heavy Anti-aircraft Battery	9
Light Anti-aircraft Battery	1
Military Building/Military Camp/Barracks/ Military Headquarters	22
Military Installation	4
Oil Works	1
Practice Trench	1
Radar Station	1
Road Block	1
Rocket Projector Battery	3
Coast Artillery Searchlight/Searchlight Battery	17
Water Tank	60
Wreck	1
Total	**1082**

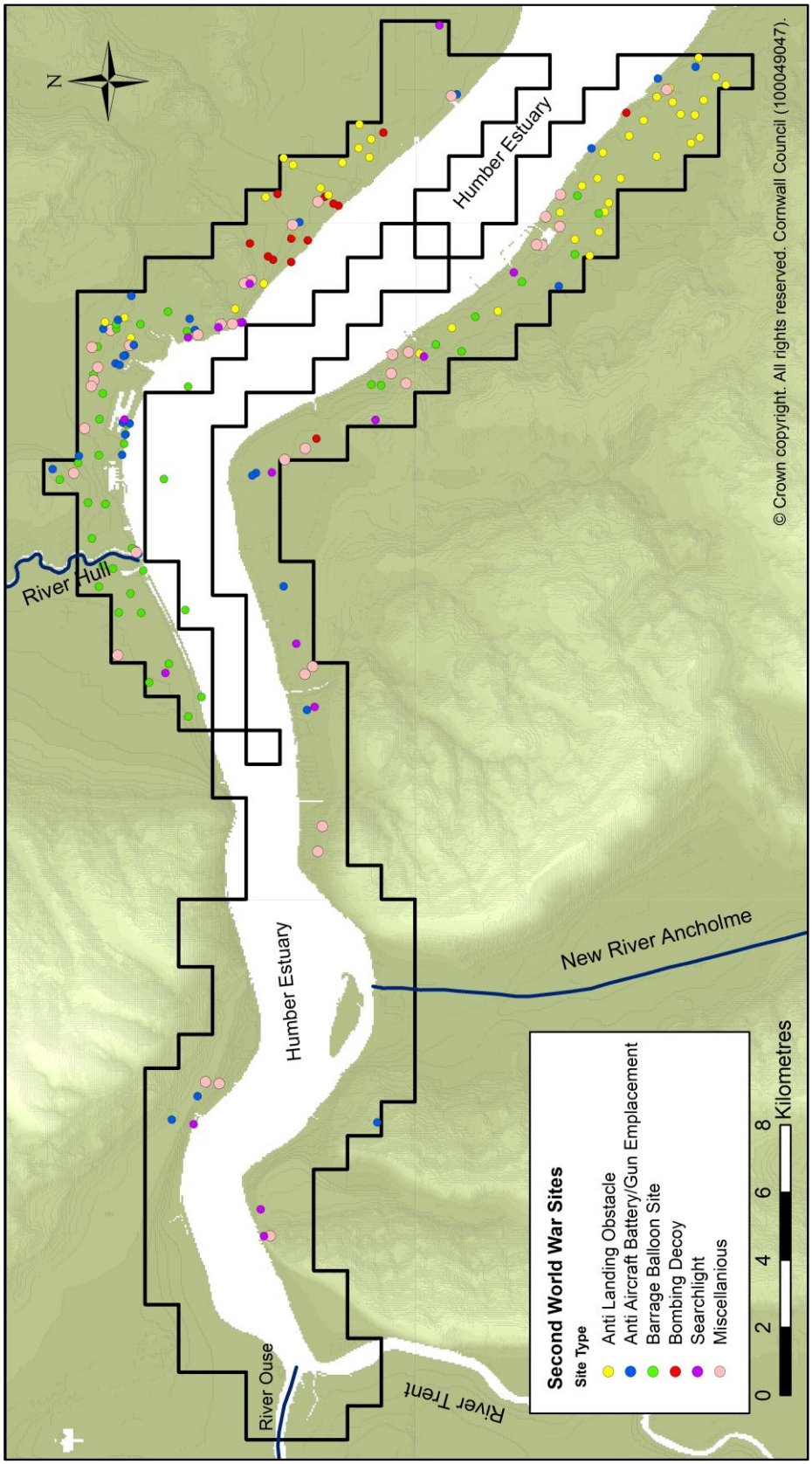


Figure 47 Distribution of Second World War sites.

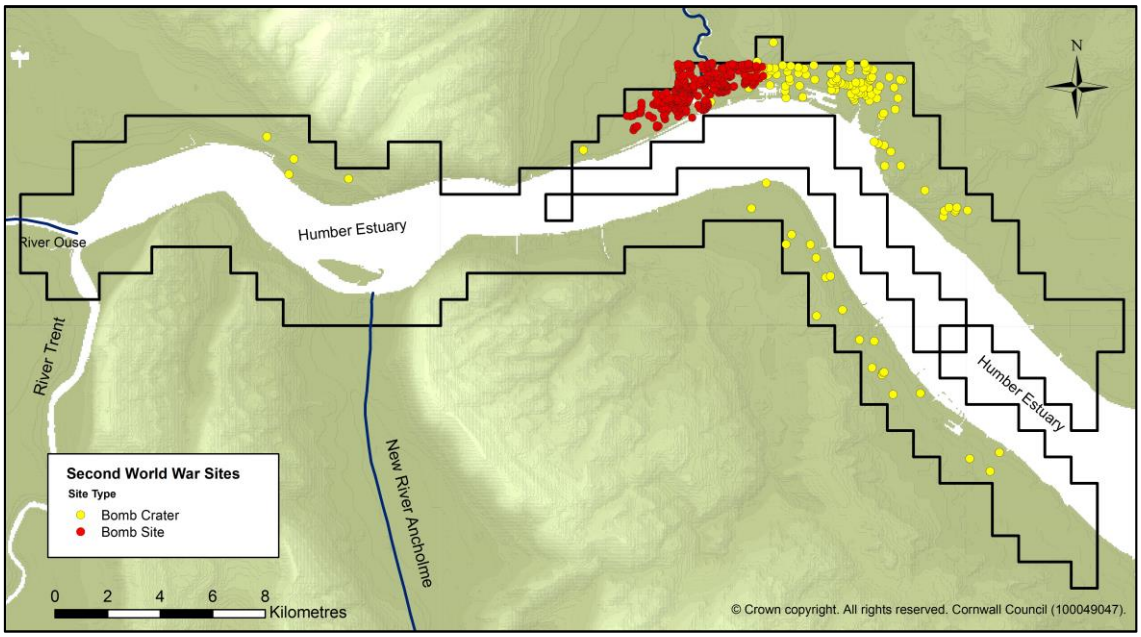


Figure 48 Distribution of Second World War bomb sites and craters.

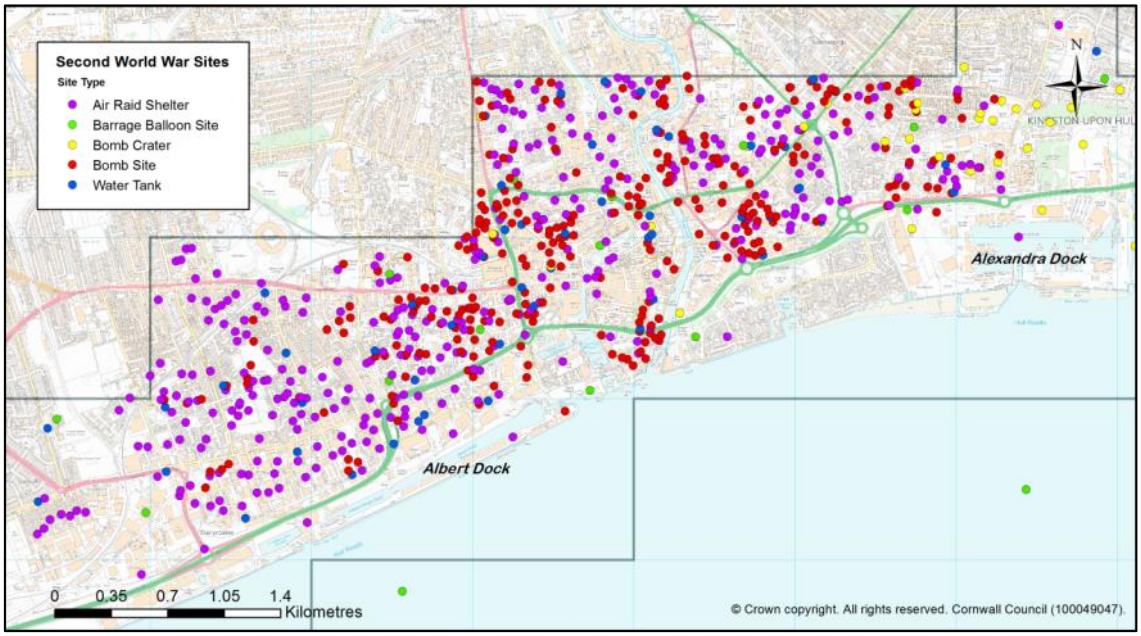


Figure 49 Distribution of Second World War sites, Kingston upon Hull.

Examples of new Second World War sites not previously recorded include a probable gun and searchlight battery at Ellerker (Fig 50). Here a group of structures including emplacements and buildings all protected by two lines of barbed wire were plotted from aerial photographs taken between 1940 and 1946. The site lies on the west side of Brough and Ellerker Havens and opposite Brough Airfield; it was presumably constructed in this location to provide protection for the airfield. For discussion of light anti-aircraft and searchlight batteries see Section 5.5.

An extensive area of Second World War anti-landing obstacles were recorded at Cherry Cobb Sands (Fig 51) (For discussion of anti-landing obstacles see Section 5.5). The regular chequerboard patterns of earthworks made this area unfit for the landing of enemy troop-carrying aircraft and were the approved method issued by the War Office in 1940 (Dobinson 1996a).

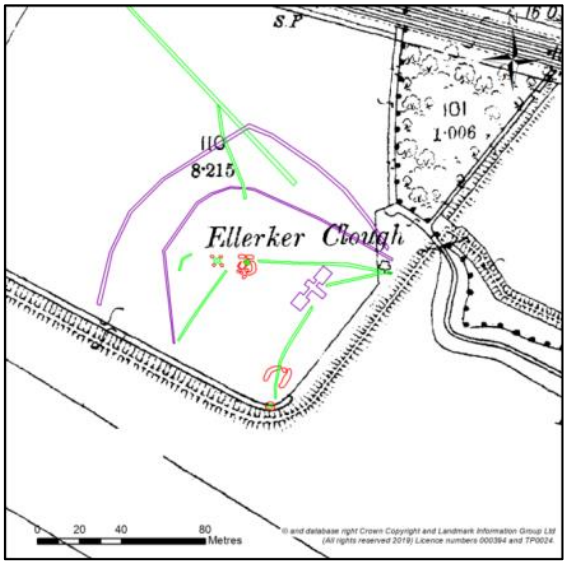


Figure 50 Second World War searchlight battery at Ellerker Clough.

MCX1385. Background map OS 1st Edition 1:2500, c1880.

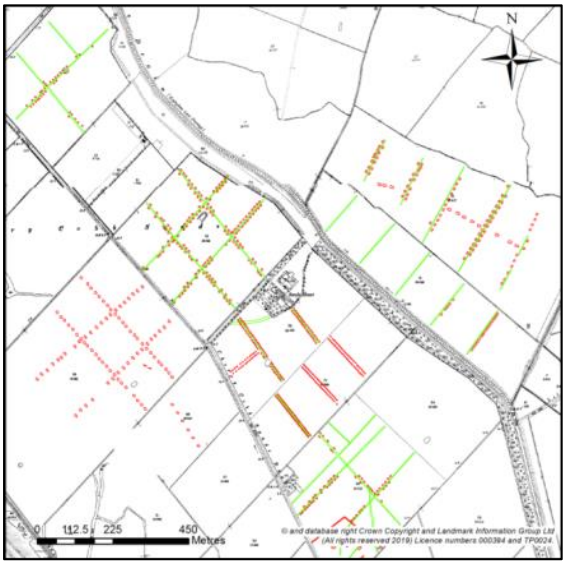


Figure 51 Second World War anti-landing obstacles at Cherry Cobb Sands.

MCX37-8 and MCX40-1. Background map OS 1st Edition 1:2500, c1880.

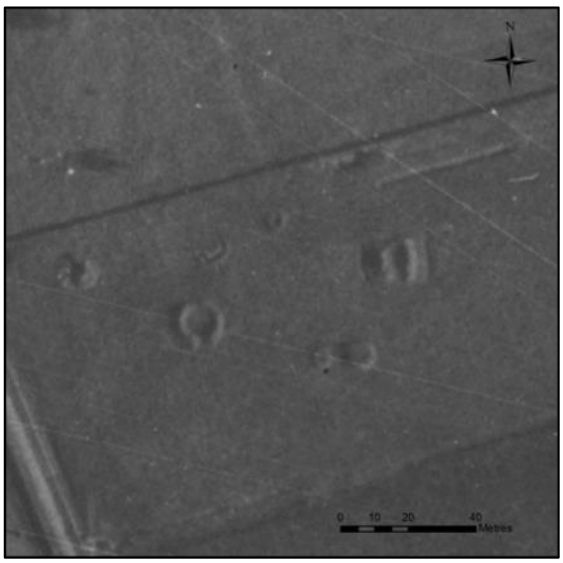


Figure 52 Second World War searchlight emplacement, West Farm, Sunk Island.

MCX266. Photograph: RAF CPE/UK/1748 RS 4026-7 21st September 1946 Historic England RAF Photography. Background map OS 1st Edition 1:2500, c1880.

The probable site of an early Second World War searchlight battery was recorded for the first time at West Farm, Sunk Island (Fig 52). It comprises a

small group of curvilinear earthworks which range in size from 7m to 14m across. The larger earthworks were considered to be the locations of the searchlights whilst the smaller features may be anti-aircraft Bren gun posts; it is one of several similar sites found right across the project area.

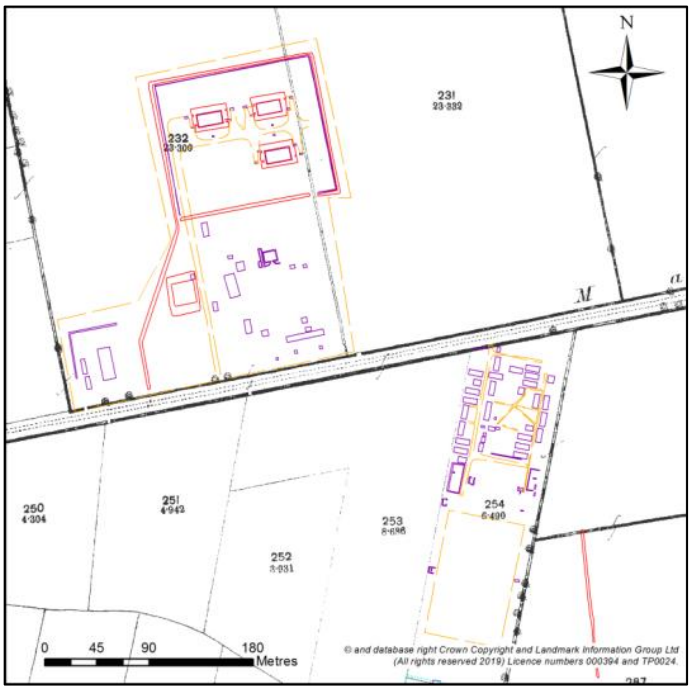


Figure 53 Second World War ammunitions store and barracks, Barrow upon Humber.

MLS26329-30. Background map OS 1st Edition 1:2500, c1880.

Two previously unrecorded Second World War sites were mapped during the project to the southeast of Barrow Haven (Fig 53). To the north of the road there is an ammunitions store with three large storage buildings each surrounded with protective blast walls and the whole with a barbed wire and earthen banked enclosure (MLS26329). To the south of the road is what appears to be a barracks (MLS26330). The site is located 850m from a searchlight battery (MLS26315) and 1km to the west of a heavy anti-aircraft battery (MLS9649).

4.12 AI&M results: Undated sites

It was not possible to assign a specific date to 91 sites recorded during the survey. These are sites to which a more specific prehistoric or historic date could not be assigned with confidence. They include sites of ambiguous functions such as mounds and ditches as well as site types that could date to any period such as field boundaries and field systems, trackways and enclosures (Table 12). Many of these sites could well be of prehistoric origin. Of the total number of sites, the majority (86%) were new to the HERs and NRHE.

As the distribution map (Fig 54) shows, the vast majority of the undated sites are situated on the southern bank of the estuary. It is uncertain as to why this may be; potentially through differences of recording between the team members or a difference in site types and ambiguity of period in the two areas.

Routeways are likely to remain in use for long periods of time. Unless there was a clearly apparent relationship with other dated monuments or historic features in the landscape it was difficult to assign them a definite date; for example ten trackways recorded during the project had no period allocated.

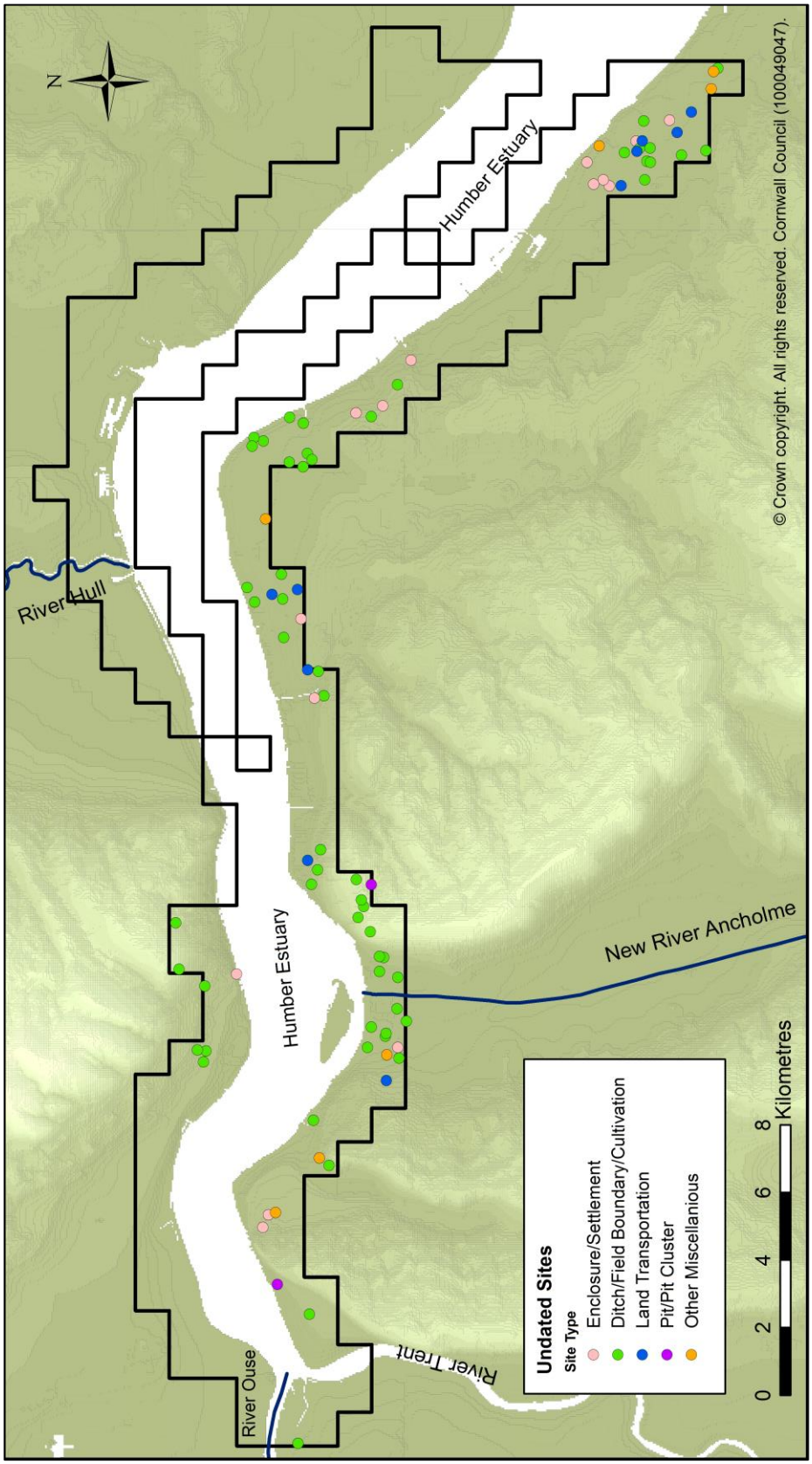


Figure 54 Distribution of undated sites.

Table 12 Undated site types

Site Type	No: Sites
Boundary Bank	1
Cultivation Marks	2
Ditch/Drainage Ditch/ Palaeochannel	25
Enclosure	14
Field Boundary/Field System	30
Mound	6
Pit/Pit Cluster	2
Settlement/Saltern	1
Trackway	10
Total	**91**

A long linear boundary is visible as low earthworks on lidar imagery to the west of Barton-upon-Humber (Fig 55). It runs for over 2km to the west of the village and at its east end it continues the line of West Acridge lane. The feature clearly predates Barton Cliff Quarry and is likely to be a medieval or earlier prehistoric boundary or routeway. (MLS26360).

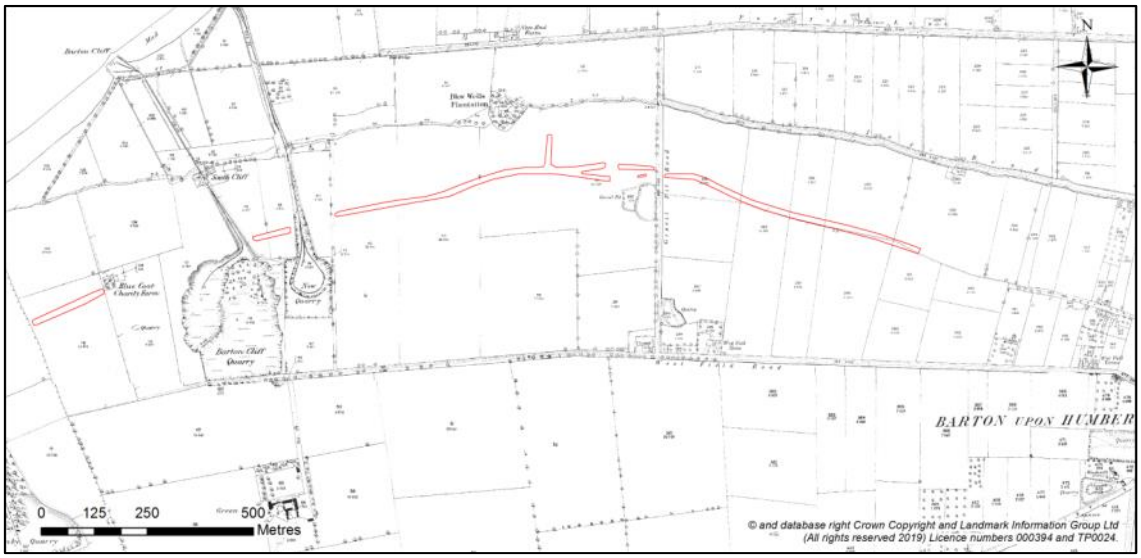
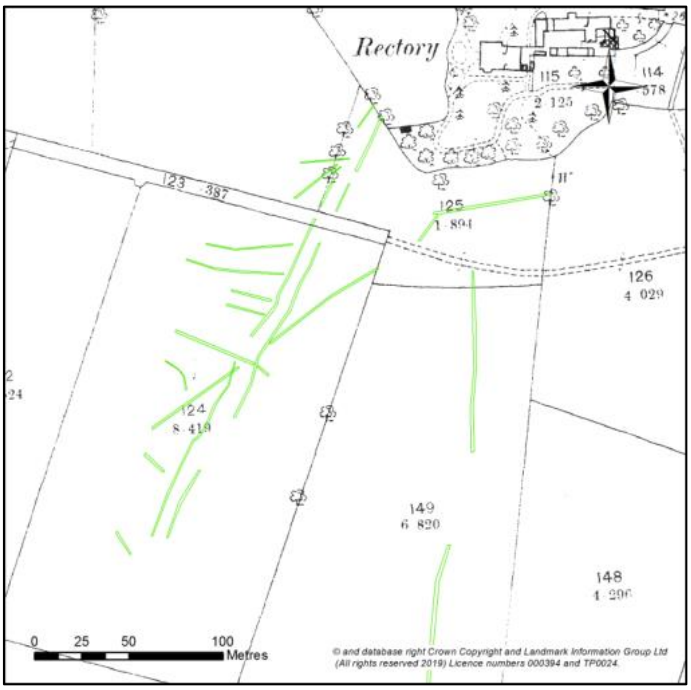


Figure 55 Medieval or prehistoric linear earthwork, Barton-upon-Humber.

MLS26360. Background map OS 1st Edition 1:2500, c1880.



Undated linear features were recorded to the southwest of Winteringham (Fig 56). They appear to be the remains of a double-ditched trackway with associated field boundaries and were recorded as possibly late prehistoric or historic in origin (MLS26577).

Figure 56 Undated linear ditches southwest of Winteringham.

MLS26577. Background map OS 1st Edition 1:2500, c1880.

A scatter of elongated pits is visible on 1991 aerial photographs immediately to the south of the Whitton Channel, Alkborough (MLS26477, Fig 57). The pits are 10-16m long, orientated northwest to southeast, and are of uncertain date and function. The linear to the north is part of the post medieval flood defences known as the Devil's Causeway but was previously recorded in the HER as an Iron Age or Roman ditch (MLS21595).

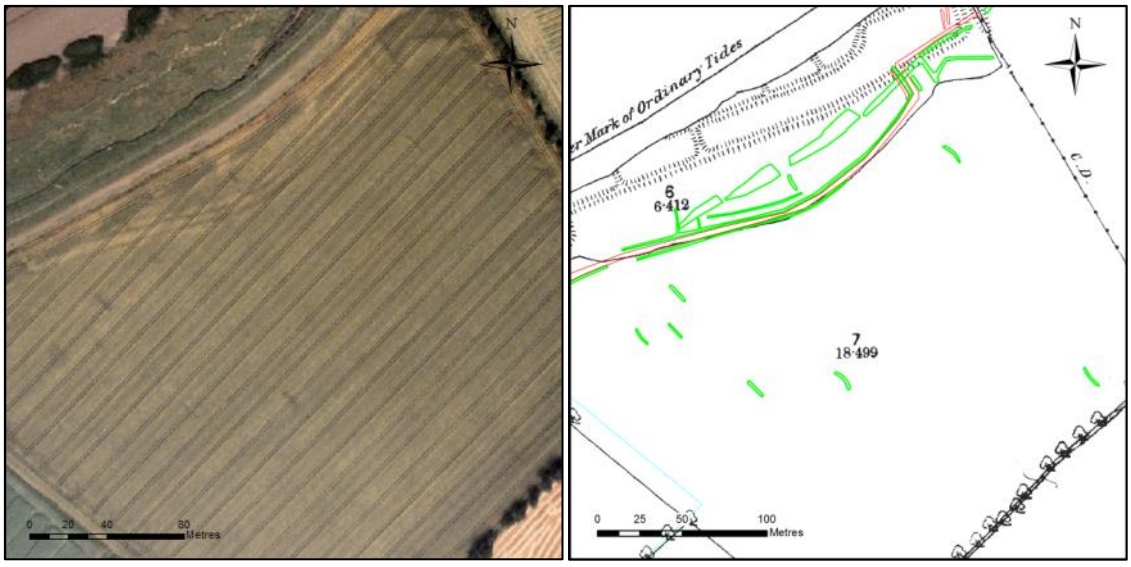


Figure 57 Undated pits, Alkborough.

MLS26477. Photograph: NMR12095/06 24th July 1991 © Crown copyright Historic England. Background map OS 1st Edition 1:2500, c1880.

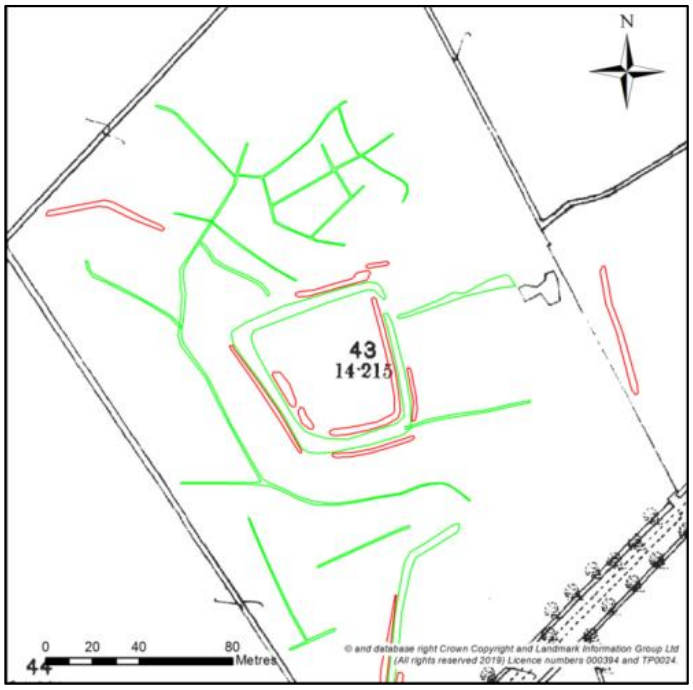


Figure 58 Undated enclosure at North Killingholme.

MLS26169. Background map OS 1st Edition 1:2500, c1880.

An intriguing site was recorded at North Killingholme (Fig 58, MLS26169). Here a rectilinear enclosure was visible as earthworks on aerial photographs taken in 1947, 500m inland from North Killingholme Haven. It is 58m wide by 68m and flanked by an internal and external bank. It was in good earthwork survival in 1940s perhaps indicative of a medieval or later date, however, a prehistoric origin cannot be ruled out. The site has unfortunately since been completely levelled by modern development.

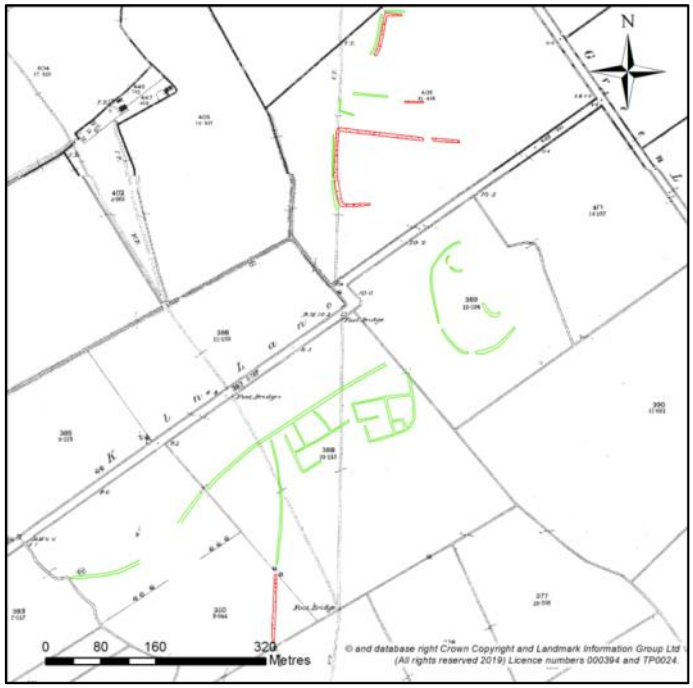
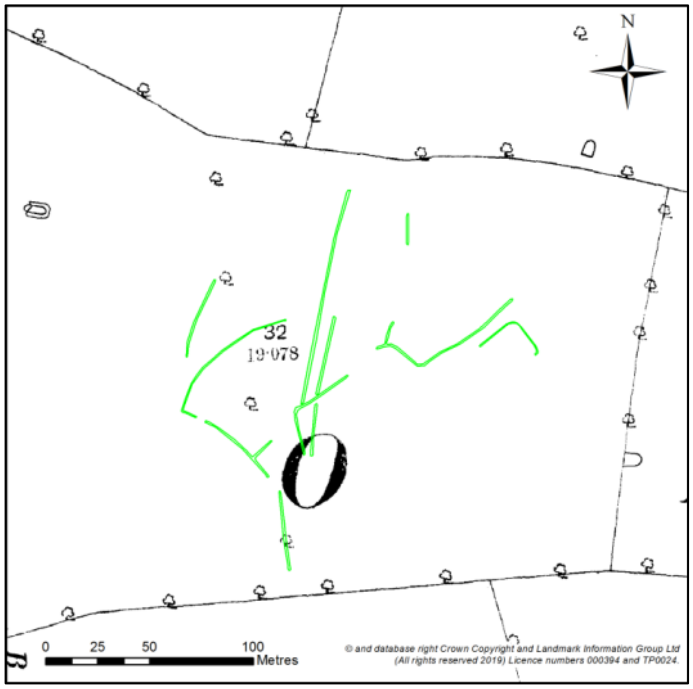


Figure 56 Undated enclosures and linear features at Kiln Lane, Stallingborough.

MCX220 and MCX231-2. Background map OS 1st Edition 1:2500, c1880.

A series of undated enclosures and linear features were recorded at Kiln Lane, Stallingborough (MCX220, MCX231 and MCX232). The complex of enclosures towards the south of Kiln Lane was visible as earthworks in the 1940s but has since been destroyed by modern development (Fig 59).

The large oval ditched enclosure in the centre-right of Figure 59 is 166m across and visible as cropmarks on aerial photographs taken in 2005, it is possibly prehistoric in date although a natural origin (drainage channel) cannot be ruled out. The rectilinear bank and ditched features towards the top of the image are visible as cropmarks on aerial photographs taken in 1941 and appear to form parts of an undated field system which does not align with the modern boundaries and may therefore be of some antiquity.



A group of undated linear ditches are visible as cropmarks on aerial photographs taken in 1991 to the west of Long Plantation, Melton, Welton (Fig 60). The features are considered to be field boundaries, a possible trackway and part of a rectilinear enclosure; they may be prehistoric or later in origin.

Figure 60 Undated features at Melton, Welton.

MCX1460. Background map OS 1st Edition 1:2500, c1880.

5. THEMATIC OVERVIEW

The following section introduces the principal themes identified for this region based on the types of sites mapped by this project and the ways in which these inform and expand on current understanding. The full range of sites recorded by the project can be accessed respective of site type and period in the relevant HERs for heritage assessment and period-based research. The themes presented below are intended to provide a contextual discussion of the main results and their significance using selected case studies as illustration. Some sites and period topics are therefore excluded from this section. Historic landscape change is a particularly significant theme, as is military defence; particularly that of the two World Wars. The Roman and medieval settlement landscapes are also of note as is medieval/post medieval resource exploitation and industry. Only a very small number of Bronze Age sites were mapped and recorded and therefore the pre-Iron Age landscape is not explicitly discussed here.

5.1 Historic landscape change; loss, reclamation and management

The low-lying coastal wetlands along the Humber Estuary have provided a wide range of natural resources for local communities since early prehistory. For prehistoric hunter gathering communities these areas would have been used for hunting, fowling and fishing to provide food as part of a wider subsistence strategy. A degree of pastoral farming within cleared areas of wetlands may have occurred during the Neolithic and the Bronze Age, although arable farming was probably still reserved for areas of lighter free draining soils. Arable farming appears to have intensified alongside seasonal grazing during the later Bronze Age and into the Iron Age, when there is some evidence for more permanent settlement and organisation of wetland areas; at Goldcliff on the Caldicot Level of the Severn Estuary, for example, where evidence for middle Iron Age occupation and drainage systems were identified (Bell and Neumann 1997; Locock and Walker 1998). During the late 1st millennium BC marine transgressions had returned most coastal wetlands to saltmarsh and mudflat conditions; as evidenced on the Ancholme Levels, for example, during the Humber Wetlands Project (Van de Noort 2000, 167). These were followed by a subsequent regression of sea levels by around the 1st century AD (Rippon 2000a, 32-33).

From the Roman period onwards there was more intensive exploitation and settlement of wetland areas in England generally. Small-scale industrial and agricultural activity included the use of the salt marshes for salt production or seasonal grazing with additional resources such as reed, sedge and willow beds used for thatching, flooring and basket-making, for example (e.g. Clarke 2016). Some active management of wetlands in England is known to have occurred from as early as the 1st century AD (East Riding of Yorkshire Council 2018; Historic England 2018a; Van de Noort 2004). Wentlooge Level in the Severn Estuary is the only known example of large-scale systematic reclamation in North East Europe during the Roman period and was probably carried out under the control of the military base at Caerleon (Rippon 2000b). Rippon

argues, however, that intentional transformation of wetland areas during the Roman period is generally more localised and piecemeal and largely coincides with villa or estate structures (*ibid*, 56). Around the Humber Estuary the known Roman villas are situated on areas of higher ground and it is not certain how far these estates extended or to what degree any active reclamation of the Humber wetlands during the Roman period occurred (Van de Noort 2004).

The end of the Roman period in Britain saw a further marine transgression which majorly impacted on coastal wetlands, covering much of the evidence for Roman activity in these areas with alluvial deposits (Rippon 2000a; Van de Noort 2004). Studies show that the population of the Humber wetlands reduced in numbers during the post-Roman and early medieval periods; the evidence for settlement of this area during the 5th to 9th centuries is scarce but indicates this was predominantly situated on islands of glacial till forming higher ground from where access to the resources of both the drier ground and the wetlands could be maximised (Van de Noort 2004).

The recolonisation of the Humber wetlands probably occurred alongside an intensification of agricultural activities in the area, coinciding with greater political and economic stability and periods of marine regression. Studies show that between the 11th and 14th centuries the Humber wetlands were increasingly settled and transformed through drainage and embankment schemes (Thirsk 1988; Van de Noort 2004). Clarke (2016) suggests that active management of the North Lincolnshire wetlands is implied by the etymology of Scandinavian place-names; for example, 'ings' (low lying pasture or meadow), 'marsh' (meadowland near water) and 'neatgangs' (cow pasture), indicating an early medieval economic function for these areas. This is borne out by Rex Russell's studies (Russell 1995; Russell and Russell 1987), which record the distribution of these enclosure names along the wetlands of each parish (Fig 61).

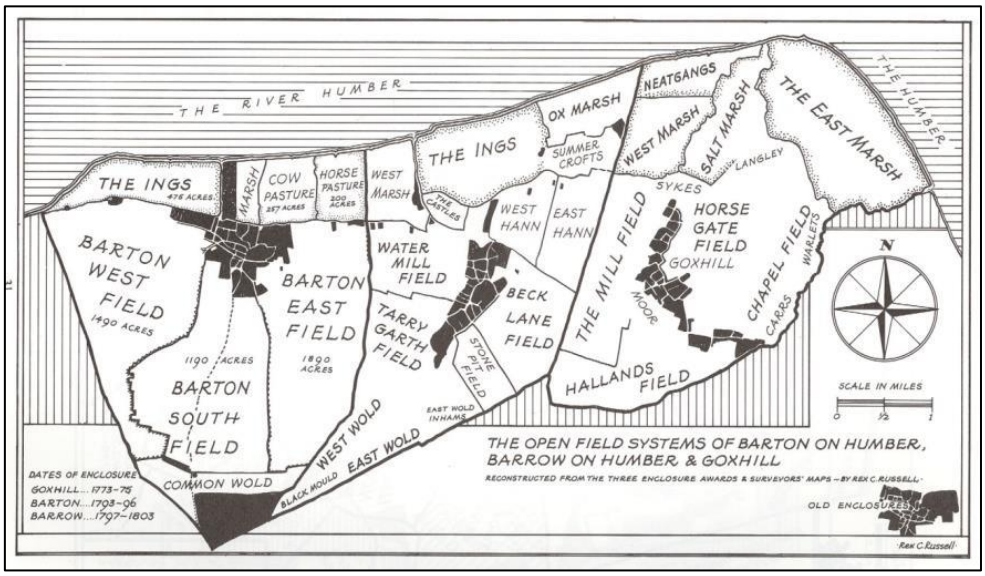


Figure 61 Distribution of 'ing', 'marsh' and 'neatgangs' place-names along the wetlands of Barton-on-Humber, Barrow-on-Humber and Goxhill parishes.

(Russell and Russell 1987, 31).

Changes to the Humber wetlands during the medieval period were typically carried out by the large landowners of the time, with subsequent changes made by the smaller manors and villages that were established as improved land was divided up under grant (Sheppard 1966, 15). Many of the larger manors were under monastic ownership; the Abbeys of Meaux and Thornton, for example. The manor of Faxfleet was owned by the Knights Templar. During the 11th to 12th centuries small hamlets were established on the newly reclaimed salt marshes as well as large farmsteads, or granges; such as those at Ottringham (owned by Meaux Abbey) and Little Humber (owned by the Earl of Albermarle).

Drainage channels were cut through the reclaimed land and the wetter carrs at their back to manage drainage and to provide access by boat between these areas and the main river network; in the Hull valley, for example, monks at the Abbey of Meaux cut new channels or enlarged existing streams to link the Abbey with the River Hull. The most important of these being the Eschedike (built 116-82 (Sheppard 1958 3).

Sluices, known locally in East Yorkshire as 'clows', were constructed along some of these channels to prevent tidal waters from entering upstream. At Wallingfen in the Humberhead Levels, for example, long linear drainage channels were cut by local lords of the manor; the function of these may have been to drive water mills at their southern end, which probably made use of the fall from the channels to the Humber at low tide (around 2.5-3m). Hamlets sprung up along these drains, followed by roads, and the old drainage pattern remains preserved in the present-day road system (Sheppard 1966, 16).

In some areas of the Humber wetlands the transformation of the historic landscape has developed as a result of specific industrial processes. Parts of the east Lincolnshire Marshes, for example, were colonised by daughter settlements of the Domesday parishes situated along the higher ground. This movement seawards was due to the need to be closer to the sea for salt production. The features relating to salt production are collectively known as salterns and a large number of these historic sites are visible along the coastal marshlands.

Part of the salt-making process involved sand washing or 'sleeching', which was the most widely-used method of extracting salt from seawater during the medieval period. The bi-product of this process was large waste mounds which are often the most identifiable features of historic salterns. Although typically of varying shape and size, these mounds are characteristically similar, with distinctive bulbous outlines (which show up as lighter marks where exposed by ploughing) and darker, possibly wetter, centres. Sometimes the footprints of the small rectangular buildings used for boiling the salt (known as saltcotes) are visible around the edges of the mounds (Grady 1998, 84).

As old waste mounds were abandoned then new salterns were established on the seaward side and the disused mounds became 'new' land that was taken into pasture or arable land or as the site of new settlements. The resulting field pattern evolved to take on an irregular accretive appearance as the old mounds become absorbed through later medieval enclosure (Ellis *et al* 2001). New sea

banks were often constructed on the seaward side of the newly created land; assumed to post-date the abandonment of the former salterns (Grady 1998, 86).

Between the 13th and 15th centuries further major inundations occurred around the Humber Estuary, probably due to a wider frequency of storm surges in the North Sea during this period (see Galloway 2009, for example). A great storm in 1256 is documented and this may have been responsible for breaches in Spurn Head (Sheppard 1966, 6). The medieval port of Ravenserodd originally stood at the tip of Spurn Head and is referred to in the Meux Chronicle. The name is Danish and refers to the Danish standard, a raven, and *eyr* or *ore*, which means 'a narrow strip of land between two waters' (Sheppard 1912, 49). By 1275 the site was an island, indicating the loss of land at Spurn Head. This would have left the Hull Estuary vulnerable to the effects of further storm surges which were probably responsible for significant loss of previously reclaimed areas of saltmarsh. As early as 1285 reports were made to King Edward I on the violence of the River Humber which had caused breaches in the flood banks causing the land in South Holderness to become often 'drowned' (Sheppard 1912, 60). Sheppard (1966, 6) documents that in the 14th century nearly all the fields at Tharlesthorpe and other granges and hamlets along South Holderness disappeared or moved inland. The poor condition of the medieval flood banks and drainage ditches of South Holderness during the 13th and 14th centuries was clearly an ongoing concern and repeated Royal orders for their upkeep are documented (Sheppard 1912, 60).

The medieval coastline at Sunk Island in South Holderness may have extended to close to that of the present day but by 1650 this area was reduced to sand banks (including Sunk Island and Cherry Cobb Sands) with a navigable channel (North Channel) around their north side (Sheppard 1966, 6). There was minimal intervention within Holderness over the course of the 16th and 17th centuries and some silting occurred along the edges of Sunk Island and within Hedon and Patrington Havens during this time (*ibid, 7*). There was a slightly different picture within the Hull Valley and the Vale of York, where some degree of maintenance of existing drains did occur during the 14th to 17th centuries (Sheppard 1958; 1966).

Greater technology by the 17th century saw more concerted efforts at drainage management and land reclamation from this period forwards. Cherry Cobb Sands in Holderness was embanked in 1769-70. Two large land drains, the Thorngumbald Drain and the Keyingham Drain, were constructed during the early 19th century and the Hedon fleet enlarged to restore waters to Hedon Haven. The construction of new drains had adverse effects on other areas of land, however; the North Channel around Sunk Island became more choked by silt and Patrington Haven fell out of use by this time (Sheppard 1966, 9-11). Sunk Island and Cherry Cobb Sands were fully reclaimed again by the 19th century but the present-day pattern of fields and lanes still define the probable coastline along this part of South Holderness as it was by the 17th century. The accretive reclamation of Sunk Island and the subsequent enclosure of the North Channel are also evidenced in the present-day field pattern (Fig 62).

Figure 62 The present-day field pattern at Sunk Island visible on current Google Earth imagery fossilises the 17th century coastline and illustrates accretive reclamation and enclosure of Sunk Island and the North Channel.

Within the Vale of York silt accumulation along the Humber edges was also increasing by the late 17th century. This resulted in some of the larger drains, such as the Temple, Hansard and Thornton Dams, becoming less efficient and the mills to fall out of use. Drainage improvements in this area continued to be relatively small-scale and large areas of seasonally waterlogged salt marsh and common land remained unimproved pasture used for livestock grazing. In the mid-18th century changes in this area took place with the construction of the Market Weighton and Pocklington Canals. Some of the carr on either side of the canals was drained and enclosed to improve agricultural productivity (Sheppard 1966, 13-26).

The drainage history of the coastal margins on the Yorkshire side of the estuary was largely complete by the late 19th century; although that has not been the end of landscape change within the estuary itself and modern flood defence schemes continue in the light of improvements to counter the impacts of ongoing climate change. Broomfleet Island, for example, is recorded as an island on the OS 1st Edition map, with an open channel (Broomfleet Hope) to the north and salt marsh on its east side. The island was largely absorbed into the mainland by the early 19th century, although its outline can be identified in the current field pattern. Other sandbanks, such as Whitton Island, Read's Island and Brough and Pudding Pie Sands also variously show gain and loss over several phases of OS historic mapping. The historic landscape may have been defined by artificial and natural changes over the course of the last 2000 years but the estuarine landscape remains fluid and change is a continuing and measureable process within which modern flood defence schemes continue in the light of improvements to counter the impacts of ongoing climate change.

Features associated with medieval or early post medieval wetlands management mapped by the project include banked and ditched flood defences along vulnerable areas of coastline. Also included are extensive networks of linear banks and ditches a short distance inland from the coast, which may indicate earlier foreshore lines which were advanced through the building of new sea banks on the seaward side as part of progressive land reclamation in order to convert additional saltmarsh into agricultural land. This is particularly evident at Goxhill and Winteringham, for example, where the sea banks have become incorporated into the historic field pattern (see Fig 63).

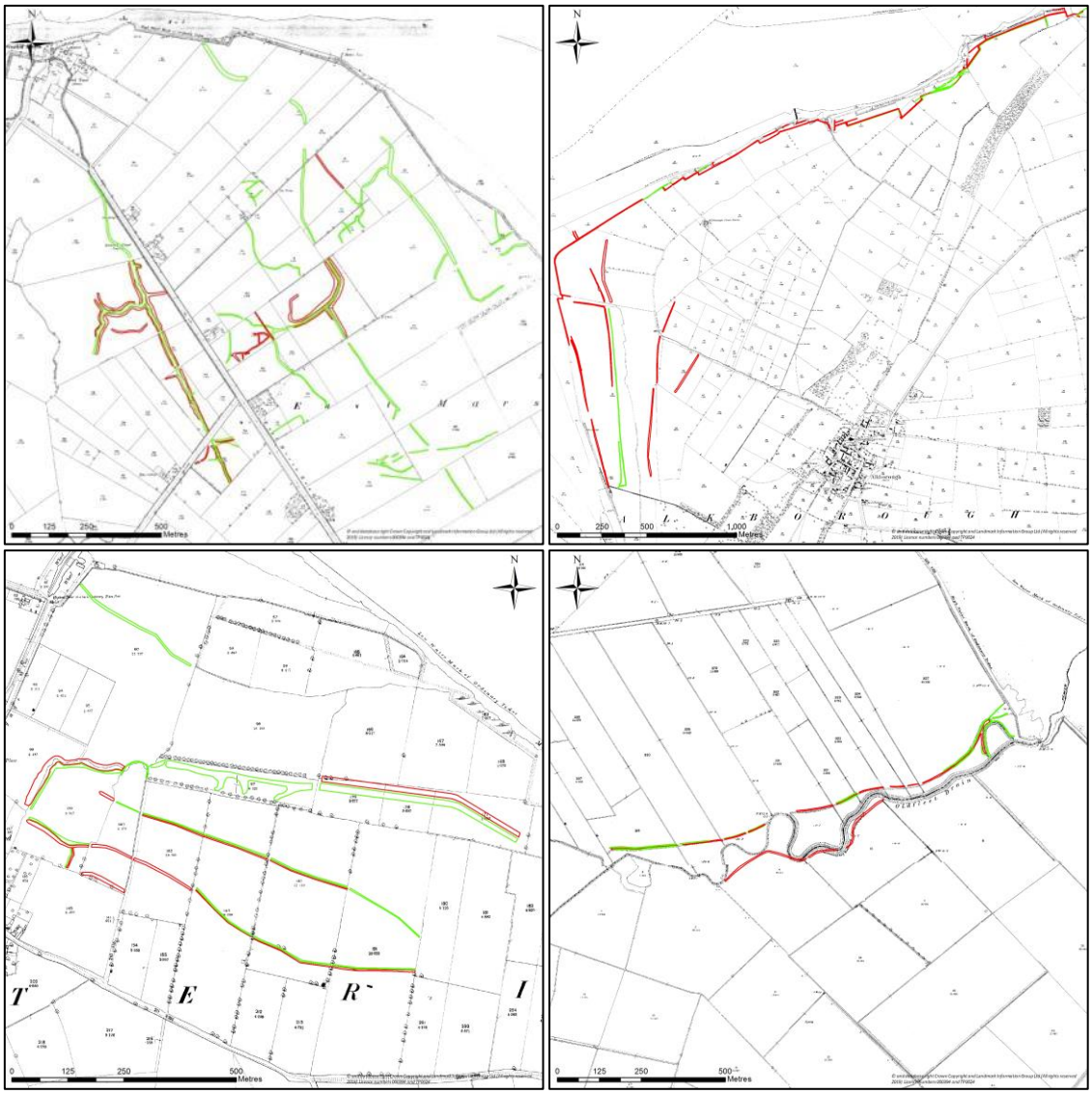


Figure 63 Examples of flood defence banks and drainage ditches of medieval to post medieval date within the project area.

Clockwise from top left: Goxhill; Alkborough; Winteringham; Oldfleet, Stallingborough. Background map OS 1st Edition 1:2500, c1880.

The depth of historic landscape change through the medieval and post medieval periods is legible at a number of sites within the Inner Humber Estuary project area. This is particularly apparent at Broomfleet, a small linear village situated towards the western end of the project area in the Vale of York. The village is situated within the Humberhead Levels (NCA 39) and is located just over 1km inland from the present-day coastline. Medieval flood defences are documented at Broomfleet by 1304 (Sheppard 1966). By 1820 a sandbank had grown off the southeast side of the foreshore at Broomfleet, disappearing again between 1846 and 1853 when it began to accumulate again. Reclamation and embankment of Broomfleet Island had extended to 60 acres by 1870. By 1866 six acres of the newly reclaimed land had been taken into enclosure (Sheppard 1912, 47). The OS 1st Edition map shows Broomfleet Island, separated from the mainland by an open channel; Broomfleet Hope (Fig 64). By 1900 this channel had completely silted up (*ibid*).

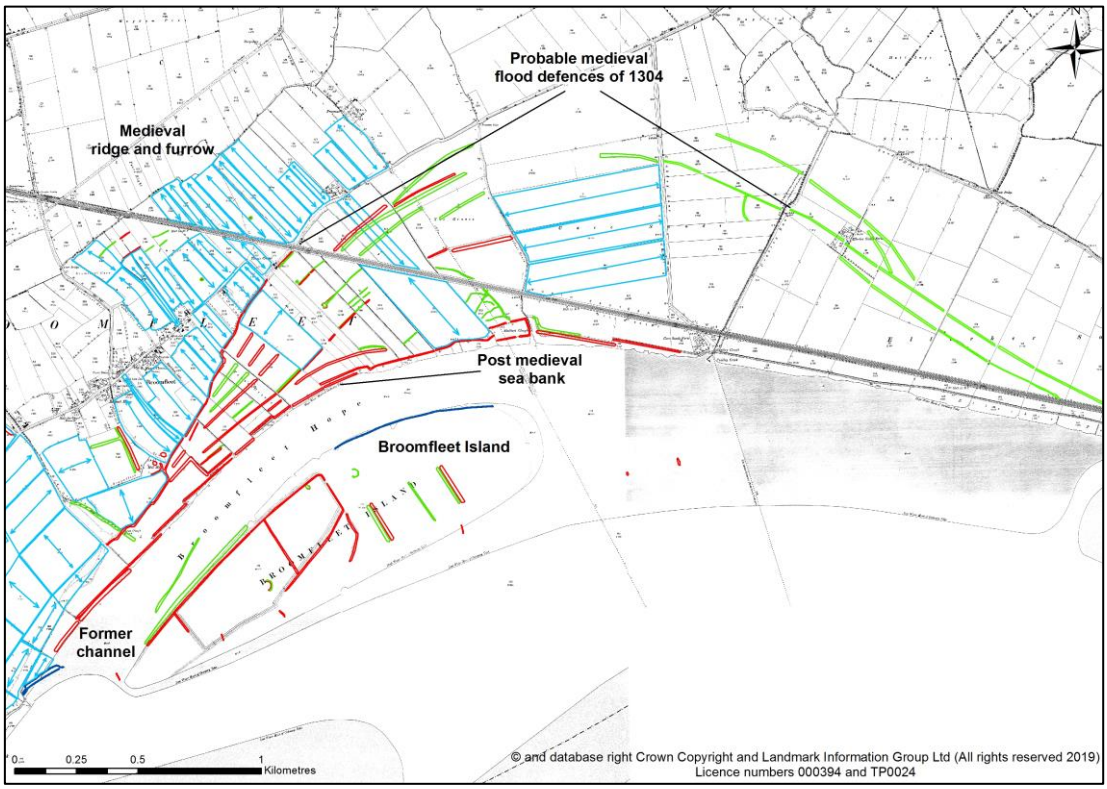


Figure 64 Ridge and furrow at Broomfleet respecting a medieval sea bank marking the earlier coastline.

The flood defences may have continued northeast to Ellerker Sands. Linear banks and ditches on the seaward side of the flood defences may indicate progressive land reclamation between the medieval sea bank and the 19th century shoreline. Background map OS 1st Edition 1:2500, c1880.

Aerial photographs of the 1940s record extensive areas of medieval ridge and furrow cultivation to the northeast and southwest of Broomfleet. The historic field pattern recorded on the OS 1st Edition map suggests these were probably part of a medieval open field system at Broomfleet; possibly of the two-field

type. Many of the historic boundary lines are still fossilised in the present-day field pattern. The name Broomfleet Carr is also recorded on the OS 1st Edition map, suggesting that the medieval open field on the east side of Broomfleet Beck may have been partly created from the drainage of the carr which was then converted to productive farmland (Fig 64).

The south-eastern boundary of the medieval ridge and furrow is defined by a well-defined banked earthwork (MCX1498) on a southwest to northeast axis. The earthwork is recorded on the OS 1st Edition map and is still extant and in use as a public footpath. The eastern end of the bank is around half a metre high and the ground level on its north side is lower than that on the south (Fig 65). The bank is probably the remains of a medieval sea bank marking the former coastline; presumed to be part of the flood defences documented in 1304 (see Figs 64 and 66). The landward side of the bank would be protected from tidal flooding and so starved of new silt, whilst ground level to seaward rises as successive high tides deposit fresh silt. Over time the land on the seaward side exceeds that of the landward side; the greater the elevational difference the earlier the reclamation (Historic England 2018a, 6).

The medieval sea bank (MCX1498) is also visible on lidar imagery along with additional curvilinear features (MCX1403) to the northeast at Ellerker Sands. Along with part of the current line of Ings Lane these sets of features describe a wide arcing line that may indicate the extent of the medieval coastline between Broomfleet and Ellerker Sands, marking the edge of the higher ground. The crescent of land on the seaward side of the medieval flood defences is illustrative of the extent of early land reclamation in this area (Fig 64).

Figure 65 Medieval sea bank at Broomfleet, currently a public footpath, looking southwest.

MCX1498. Photograph: P Dudley.

There may have been some progressive land reclamation on the seaward side of the medieval sea bank during the later medieval or post medieval periods. A series of linear banks and ditches are visible on lidar imagery (Fig 66). The features are situated within narrow linear fields which may be later medieval or post medieval in origin (although a later date is possible) and run counter to the historic field boundaries on a broadly southwest to northeast axis (see Figs 64 and 66). The features may be historic drainage features indicating incremental reclamation of strips of ground; possibly evidence for the process of 'warping'.

The OS 1st Edition map also shows the 19th century foreshore to the southeast of the medieval sea bank, curving round on a southwest to northeast axis along the northern edge of Broomfleet Hope (Fig 64). Also recorded is a stepped line of banked earthworks along the line of this former foreshore and these are still visible on current lidar imagery (Fig 66). Part of the mainland is documented as having disappeared in 1846, at the same time as the recently formed Broomfleet Island (Sheppard 1912, 47). The earthworks are likely to be flood defence banks, possibly dating to the re-accumulation of the foreshore by the 1860s-70s and closely contemporary with the embankment of Broomfleet Island.

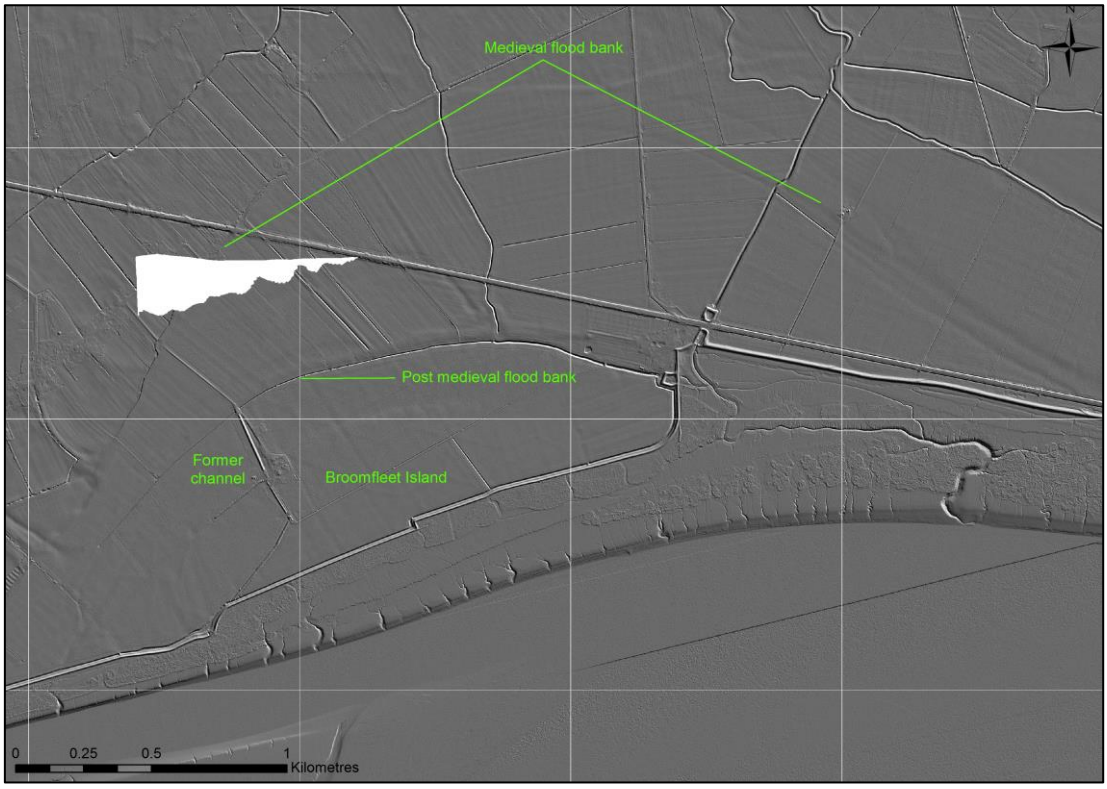


Figure 66 Linear banks and ditches at Broomfleet associated with medieval and post medieval flood banks and land reclamation.

Lidar images © Historic England; source Environment Agency.

The former Broomfleet Island and Broomfleet Hope are still clearly visible on lidar imagery, defined by the linear earthworks of the defensive banks and drainage ditches marking their perimeters (Fig 66). Today these form part of the present-day field pattern. From the medieval sea bank Broomfleet Island is

visible to the southwest as a rise of higher ground above the low-lying fields, with the present-day Hope Farm situated close to its northern edge where it met the former Broomfleet Hope (Fig 67).

Figure 67 Aerial view of Broomfleet on current Google Earth imagery.

Read's Island

Read's Island lies approximately 400m from the south bank of the Humber Estuary between South Ferriby and Winteringham and is divided from the mainland by an open channel recorded as South Channel on current OS mapping; Sheppard (1912) records it as Ancholme Channel. This channel didn't always exist as the shoreline at South Ferriby is documented as having been near coincident with the northern edge of Read's Island in 1603 (Barton-upon-Humber 2014). Palaeoenvironmental studies of the area during the Humber Wetlands Project suggested that the coastal wetland at South Ferriby would have extended much further northwards during prehistory when sea levels were lower. Fluctuations in sea levels continued to periodically alter the line of the Humber Bank and during the Roman period the shoreline was several metres inland from its present-day line (Chapman *et al* 1998, 233, 237). This changed again with the late to post-Roman marine transgression, which caused the shoreline to recede inland once more. The present-day shoreline is the result of land drainage and reclamation from at least the 10th century combined with natural sedimentation processes (*ibid*).

A large sandbank known as Ferriby Sands or 'Old Warp' may fossilise part of this former shoreline. The 'Old Warp' name may indicate that by the 17th century this part of the shoreline had once again been consolidated from an intertidal landscape through historic land reclamation. Carey (1997) documents a 1719 estate map of Winteringham showing land extending out across most of

the South Channel at that time. Contemporary place-name evidence for the low-lying meadows ('Groves' or 'Growes') along the foreshore at Winteringham also suggests these were the result of land reclamation prior to this date (*ibid*). The sandbank was recorded on a 1734 Customs map of the Humber Estuary and is shown as partly surviving on the OS 1st Edition map, although not named (Barton-upon-Humber 2014; Carey 2010).

Post medieval changes to this part of the shoreline and the intertidal mudflats and sandbanks may in part be attributed to alterations to the course of the River Ancholme at South Ferriby in 1636, when the New River Ancholme was cut. The old river course and the medieval haven at its mouth had silted up and the new cut was sited to the west of the town, out-falling on the south side of the Ferriby Sands (Carey 2010; Lincolnshire Wildlife Trust 2010). Read's Island may have started off as a consolidation of the former sandbank; grass is reported as growing on top of most parts of Ferriby Sands by 1840 (Wilkinson *et al* 1973). By the mid-1800s permanent flood banks had been built at South Ferriby and this would no doubt have further impacted on the inter-tidal areas of the estuary in this area. The deep-water channel in the River Humber constantly changes position. In 1861 it was lying on the south side. In 1893 North Read Channel appeared. Dominance between these two channels has continued to shift, with the North Channel resuming dominance since the 1950s (Barton-upon-Humber 2014; Carey 1997; Wilkinson *et al* 1973).

The Read brothers owned Read's Island in the early 19th century and gave the island its name. They are documented as having reclaimed more of the island through warping to build up the silt deposits. Read's Island is recorded on the OS 1st Edition map by which time it had grown to nearly 500 acres, 450 acres of which were enclosed compared to the 75 acres enclosed by 1840 (Sheppard 1912). Flood defence banks enclosing the island are also recorded on the OS 1st Edition map, indicating the extent of useable land being protected at that time (Fig 68). Aerial photographs of Read's Island from the 1940s show flood defence banks and ditches along the north side of the island and these were mapped by the project (Fig 68). The western section of these earthworks is first recorded on the OS 4th Edition map, indicating an early 20th century date. These defences suggest that by the early 20th century the north side of Read's Island had already starting eroding and the defence line was retreating southwards.

Read's Island was inhabited on a semi-permanent basis by tenant farmers up until 1989. It is currently used for grazing deer and as a nature reserve. There has been substantial loss to the north side of the island in recent years and changes to the South Channel, which began to silt up but is now growing again (Barton-upon-Humber 2014; Lincolnshire Wildlife Trust 2010). Erosion from the west side of the island has been ameliorated by accumulation on the east side but there is an overall reduction in size, with a gradual movement of the solid landmass downstream (Wilkinson *et al* 1973). These changes are illustrated on current Google Earth imagery (Fig 69).

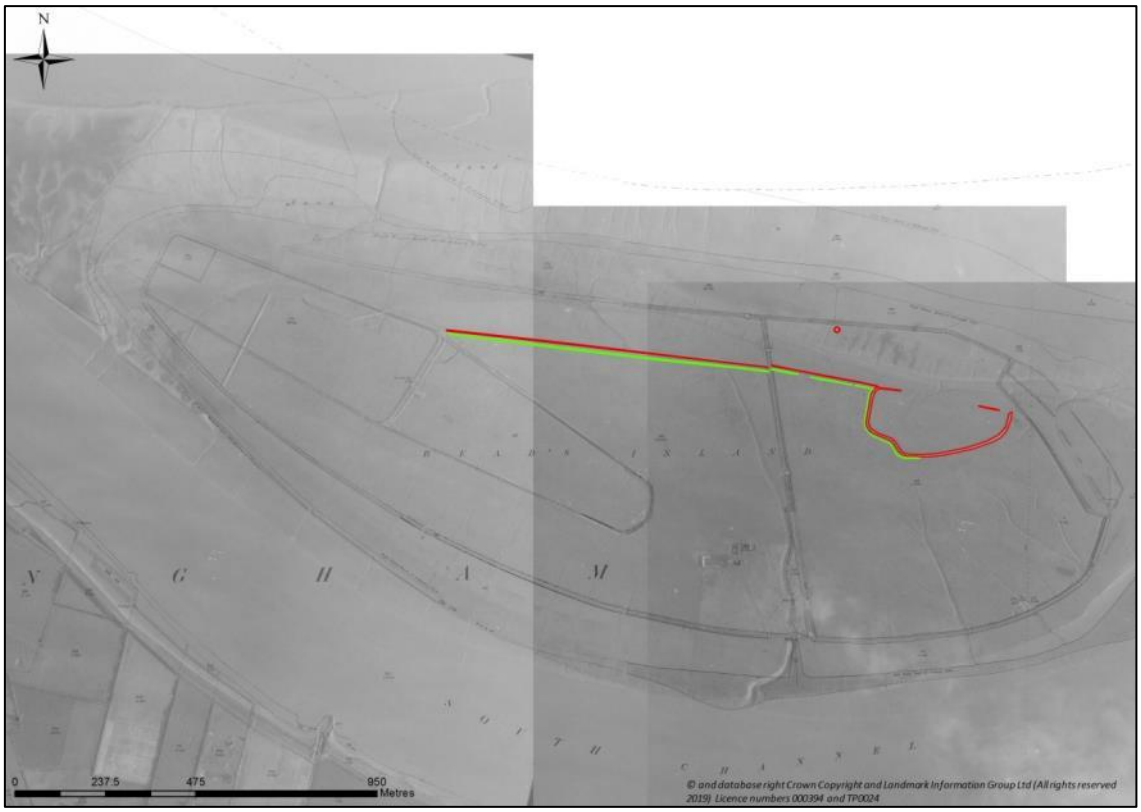


Figure 68 1940s aerial image of Read's Island overlain by the OS 1st Edition map.

Early 20th century sea defences on the north side of the island are visible in 1946 (MLS26421). Photograph: RAF/CPE/UK/1748 RV 6066-70 21-SEP-1946 Historic England RAF Photography.

Figure 69 Aerial view of Read's Island on current Google Earth imagery.

5.2 Iron Age and Roman settlement, land use and routeways

Settlement along the edges of the Humber Estuary during the Iron Age and Roman periods is evidenced by cropmarks and earthworks visible on aerial photographs. A number of enclosures, field systems and trackways for these periods were mapped by the project. Although the morphology of some of the larger settlements mapped is more evidently Roman, with occupation of this period demonstrated by excavation of some of these sites, it is also clear that some investigations indicate Iron Age origins. For some of the smaller settlements mapped, however, the character is more suggestive of an Iron Age date, although that is not to say that there was not a continuity of occupation into the Roman period. Van de Noort (2004) proposes a Late Iron Age/Romano-British settlement hierarchy for the Humber Wetlands that is borne out by the morphological evidence mapped by the Inner Humber AI&M.

For the purposes of this report it is possible to distinguish between smaller native settlements that are more likely to be small Iron Age and Romano-British farmsteads or specialist production sites and larger complex settlements, often linear in form and positioned along major roads or trackways and probably more inter-linked to wider trading and communication networks. Above these are larger settlements and/or small towns that are more likely to have a particular administrative function or military purpose.

Farmsteads and specialist production sites

A number of smaller settlements were mapped by the Inner Humber AI&M. These are relatively compact in character and are predominantly situated in a wide distribution pattern along the marshy fringes of north and northeast Lincolnshire. One site on the northern side of the Humber Estuary, on the low-lying ground of Welton Ings near North Ferriby (MCX1456), also falls into this group. These settlements typically comprise one or more small sub-circular or sub-rectilinear enclosures associated with relatively localised field systems and short sections of trackways; as at Barrow on Humber (MLS17956), Immingham (MLS21567) and Killingholme Marshes (MLS19771), for example (Fig 70).

These settlements may be examples of individual or polyfocal farmsteads, comprising one or more small farmsteads grouped together. Both unenclosed and enclosed examples of these types of farming settlements are known from sites elsewhere, with the latter either individually enclosed or grouped together within a larger compound (e.g. Historic England 2018b; Hingley 1989; Stoertz 1997). The sites at Barrow upon Humber (MLS17956) and Welton Ings (MCX1456), for example, may be examples of enclosed settlement. Cropmarks visible on aerial photographs suggest these sites may have comprised several smaller enclosures within a larger sub-rectilinear enclosure (Fig 70). The settlements at Immingham (MLS21567) and East Halton, Killingholme Marshes (MLS19771) potentially suggest a more open character, although there are

multiple enclosures present within these sites and a degree of internal division is indicated (Fig 71).

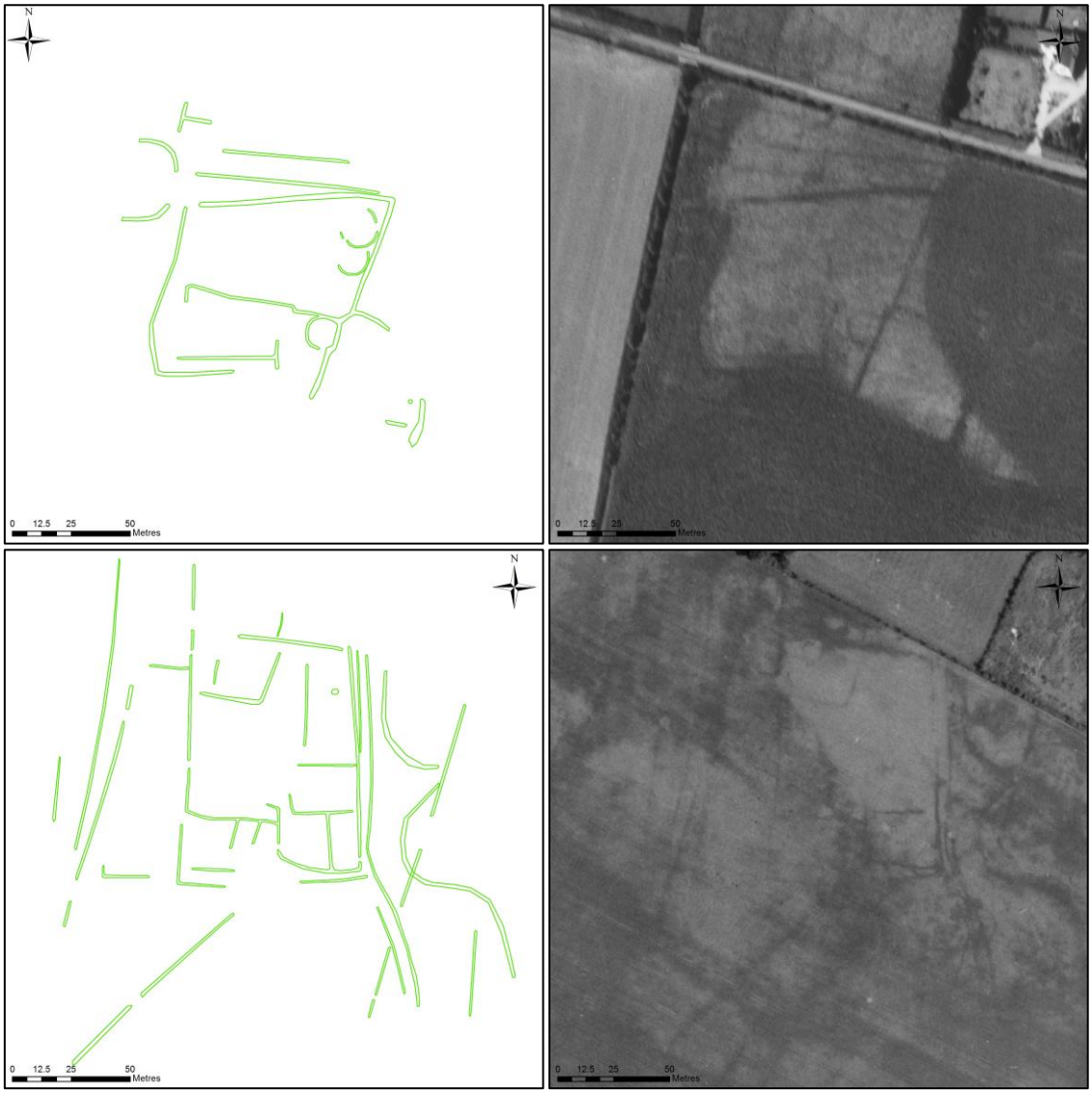


Figure 70 Iron Age/Romano-British settlements at Barrow-on Humber and Welton Ings; possibly examples of enclosed farmsteads.

MLS17956; MCX1456. Photographs: NMR/12172/78 06-SEP-1991 © Historic England NMR; OS 91135 V 163 03-AUG-1991 © Crown Copyright Ordnance Survey.

These farmsteads may represent a single or extended family unit who would probably have had a subsistence-led economy, perhaps trading agricultural surplus with the larger settlement centres in the area. There may also have been some small-scale industry carried out to supplement their agrarian lifestyle. The evidence for small-scale industries from sites along the Humber Estuary includes pottery or salt production (e.g. Ellis *et al* 2001; Rippon 2000a, 79-82; Van de Noort 2004, 123). The farmsteads may have been subsidiary settlements within a wider estate structure, with the controlling centres (e.g. villas) situated inland on the higher ground (e.g. Rippon 2000a, 50-52). Situated on the lower

lying wetlands, it is possible that some of these settlements may have been occupied on a seasonal basis; for example, by fishermen, salt makers or by shepherds as part of a transhumant-type economy. On areas of higher ground, however, these settlements may have developed independently of the larger estates, perhaps gaining social and economic independence over a period of time or being newly established on previously unoccupied areas of wetland (*ibid*).

Figure 71 Iron Age/Romano-British settlements at Immingham and East Halton, Killingholme Marsh; possibly examples of open settlements.

MLS21567; 19771. Photographs: NMR17473/01 26 JUN-2000; NMR/28707/51 04-JUN-2015 © Historic England NMR.

Late Iron Age/Romano-British settlement near Winteringham

An area of Late Iron Age/early Romano-British settlement (MLS2224) is visible as cropmarks to the southeast of Winteringham. The features comprise a number of sub-circular and sub-rectilinear enclosures associated with a series of linear ditches and two sections of double-ditched trackways. One of the trackways runs on a northwest to southeast alignment towards a section of Roman road (MLS26583) which is an arm of Ermine Street running north out of the Roman settlement (MLS2068) of Old Winteringham (see below). The results of field walking and excavation of the site suggests it may have been focussed along its west side (Rowe 2008).

A shorter section of trackway runs south off the main track into the settlement site (Fig 72). The settlement appears to be open in character and excavations by Pre-Construct Archaeology (Rowe 2008) demonstrated a small complex of Late Iron Age to early Romano-British settlement situated on relatively high ground sloping to the north and east towards the estuary edge and within 100m of the probable Roman shoreline (Tann 2010). The evidence suggested the site was located within an arable landscape with spelt wheat and barley amongst the main crops. Some of the enclosures were used as stock pens and the trackways may have been used for animal transportation. There is slight evidence from the recovery of possible briquetage sherds to indicate salt transportation or salt processing but no clearly identified industrial areas (*ibid*).

The site is thought to have been a small trading post and may have been one of the earliest sites to demonstrate Roman activity in the area. It appears to have gone out of use by the 2nd century AD (Rowe 2008; Tann 2010). This may have coincided with the disuse of the Roman road (MLS26583) to the east.

Figure 72 Late Iron Age to early Romano-British settlement to the southeast of Winteringham.

MLS2224. Photograph: DNR/1032/03 28-JUN-78 © Historic England NMR. Background map OS 1st Edition 1:2500, c1880.

Complex enclosure settlements

Larger, more complex, settlements of probable Late Iron Age to Romano-British date were mapped in a fairly close concentration along the higher ground at the northern end of the Lincolnshire Edge (NCA45), in the vicinity of Whitton and Winteringham, for example, and along the estuary edge of the more low-lying Central Lincolnshire Vale (NCA44) to the east, at South Ferriby. The evidence was predominantly from cropmarks, which demonstrated the larger size and character of these settlements as well as their proximity to each other and to the major trackways and roads also mapped in this area. These types of sites are often linear in form and typically comprise multiple contiguous rectilinear enclosures tightly positioned along a linear trackway or droveway. Often referred to as 'ladder settlements' (although terminology surrounding these forms of settlement demonstrates some disparity), they are larger and more complex than the smaller farmsteads exampled above and are typically situated closer to other settlements of similar morphology; as at Whitton (MLS4150 and 4192), for example (see Fig 73).

Studies of these complex forms of settlement on the Yorkshire Wolds indicate that these forms of settlement typically had late Iron Age origins dating towards the end of the 1st Millenium BC, with continued construction extending into the Roman period and occasionally beyond (Derych 2012, 33; Stoertz 1997, 53). Excavations of a complex linear settlement at Wetwang Slack indicate that the development of these linear forms of enclosure may have replaced earlier forms of open settlement (Giles 2007, 236). Furthermore, whilst some sites appear to have been established in a single phase, others were more likely to have experienced multiple stages of development as well as successive episodes of expansion, contraction and reconstruction (Derych 2012, 36; Giles 2007, 239; Stoertz 1997, 53). The range of enclosures present within these settlements may have been used for a range of domestic and agricultural purposes; excavations at Wetwang Slack and Garton Slack, for example, suggest evidence of stock rearing. Smaller plots may have been gardens (Derych 2012, 36; Giles 2007, 244; Stoertz 1997, 51). The locations of these types of settlement suggest they were more clearly associated with lines of communication and inter-connectivity between neighbouring settlements, perhaps related to a higher degree of agricultural intensification and/or landscape management.

At both Garton Slack and Wetwang Slack there is evidence for a continuity of occupation throughout the Roman period with a marked elaboration and reorganisation of both settlements during the 3rd and 4th centuries AD. This has been taken to indicate that a substantial reorganisation of these linear settlements typically occurred during this later Roman period, possibly incorporating changes of function and status (Giles 2007, 239). This suggests a phasing of settlement development within these more complex sites, possibly incorporating changes of function and status. The evolution of these linear settlement types may reflect changes in socio-economic organisation, bringing with them new expressions of social identity, community, lineage and place within the landscape (Derych 2012, 37; Giles 2007).

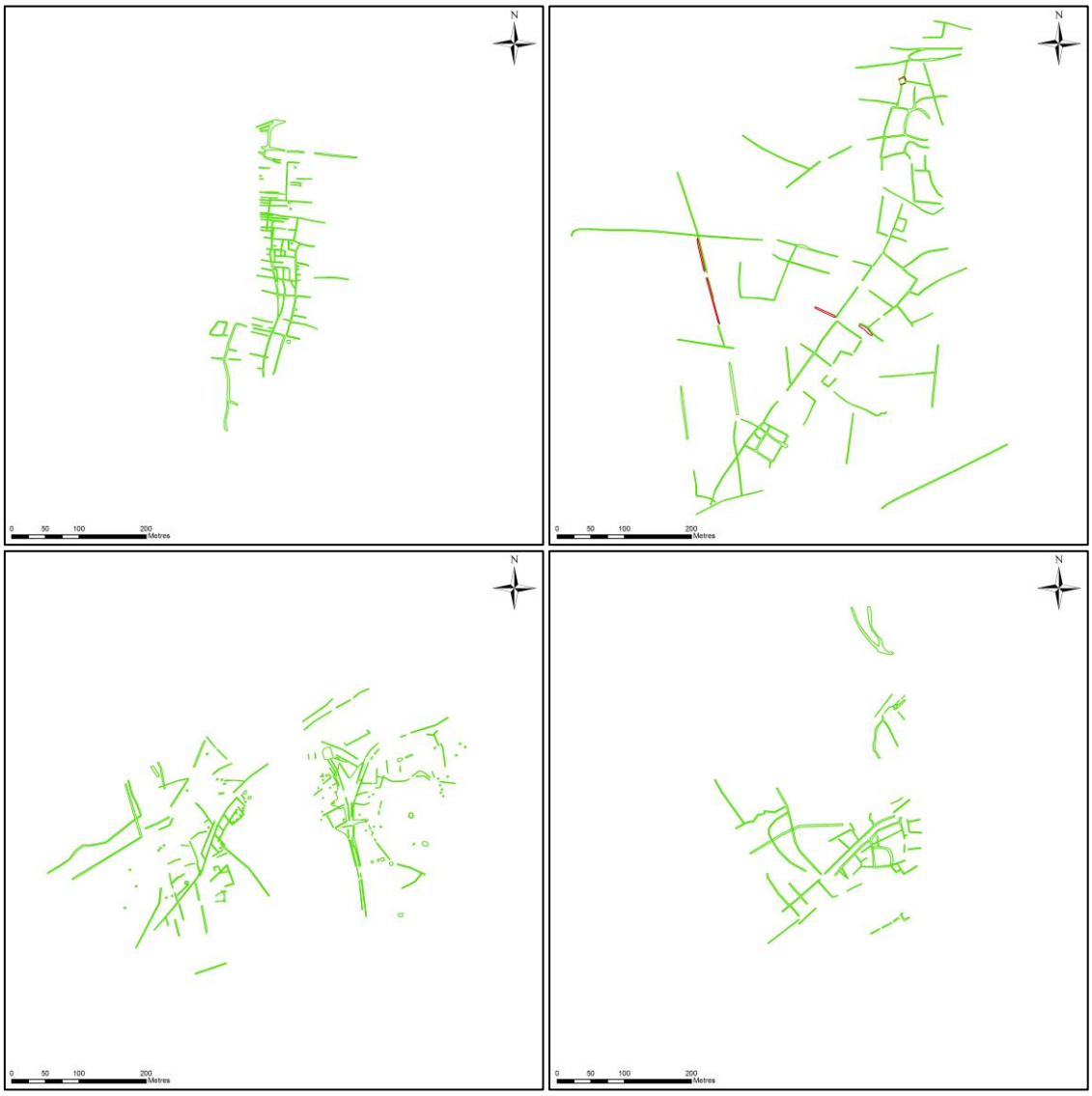


Figure 73 Examples of complex Roman settlements mapped by the project in North Lincolnshire.

Clockwise from left: South Ferriby (MLS19434), East Halton (MLS8777), Whitton (MLS4150; 4192) and Winteringham (MLS10362).

It has been shown that at some of these complex linear sites a single, large, double or broad-ditched enclosure was constructed within the settlement, apparently late in their occupation (Stoertz 1997, 53). Where evaluation has been carried out it has demonstrated that these enclosures often had a higher status or specialised purpose; as at Wharram le Street, for example, where a double-ditched enclosure contained a 3rd to 4th century Roman villa (*ibid*). Although no certain examples of this type of specialised enclosure are recorded from the sites mapped by the project it is possible that some may be present; at Whitton (MLS19413), for example, discussed below.

Complex linear settlement at Whitton (MLS19413)

A complex linear settlement to the east of Whitton (MLS19413) is clearly visible as cropmarks on aerial photographs (Fig 74). The cropmarks curve round from northwest to southwest following the base of a gentle southeast-facing slope marking the probable edge of valley alluvium (Fenwick *et al* 1998, 193). The southern section of the settlement comprises a southwest to northeast aligned trackway bordered on both sides by small contiguous, and occasionally overlapping, rectilinear enclosures.

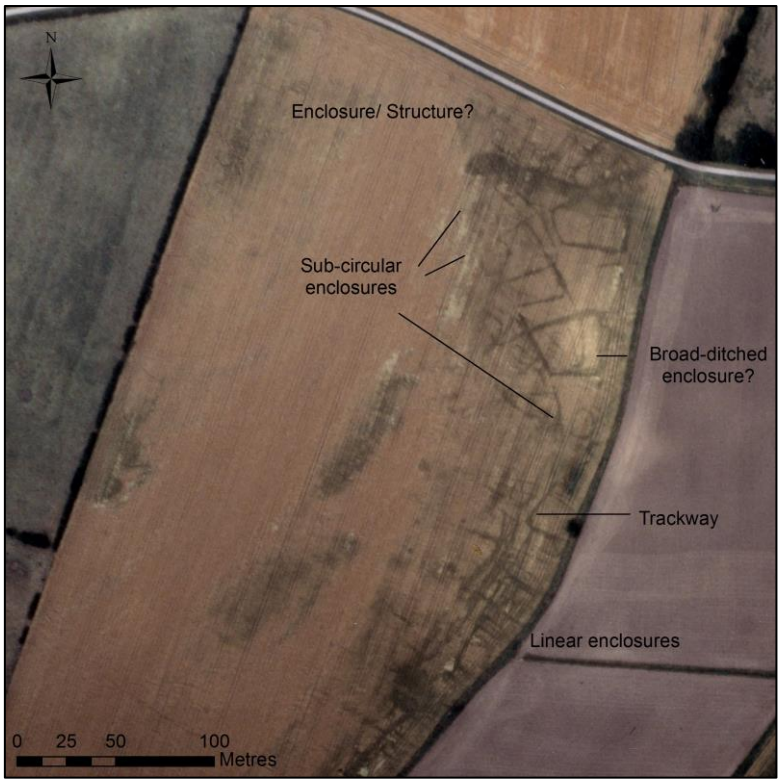


Figure 74 Complex linear Roman settlement at Whitton with possible broad-ditched enclosure at its northern end; potentially a later phase of settlement development.

MLS19413. Photograph: NMR/12883/24 31-JUL-96 © Historic England NMR.

At the north eastern end of the trackway is a possible example of a broad-ditched sub-rectilinear enclosure. Approximately 31m by 38m in size, this enclosure is located at the south eastern end of a group of enclosures on a different (southeast to northwest) alignment from those to the south. Some of these enclosures are also comparatively large and rectilinear in form, some smaller and sub-circular in character. A further section of possible trackway runs northwest from the broad-ditched enclosure through this northern complex towards a large sub-oval 20m by 11m ditched feature of uncertain origin at the northwest end (possibly a later extractive feature).

These larger enclosures at the northern end of the settlement are more strongly defined and of a different morphology and layout to the area of settlement to the south. It is possible that this part of the settlement represents a different phase

of construction. Based on current understanding this may be later in date then the more linear settlement to the south, and potentially of higher status or specialised function (e.g. Stoertz 1997; Giles 2007). The smaller enclosures at the southern end of the settlement are not so clearly defined but potentially indicate a degree of overlapping or sub-division, suggesting that some phased development also occurred in this area. Pottery scatters recovered from the site predominantly constituted Roman period grey wares with one sherd of Samian ware, indicating a broadly Roman date for the settlement overall. Situated on the edge of the alluvium, the settlement probably had a mixed economy based around the wetland resources to the east and the higher ground to the west (Fenwick *et al* 1998, 193).

Small towns

Van de Noort (2004) suggests that some of the larger Roman settlements recorded around the edges of the Humber Estuary may have had the status of small towns. Within the project area, sites at Hull, Adlingfleet, South Ferriby and possibly Faxfleet are postulated as having been of a size to qualify for this status (*ibid*, 123). There was no evidence for these sites visible on aerial sources available to the project and nothing was mapped for these. The Roman towns of Brough and Winteringham, which both had an early military function, are discussed below.

Roman military sites

The earliest Roman presence in the Humber Estuary was undoubtedly military in character. As the Romans pushed the military frontier northwards they established the usual system of frontier vexillation forts and military camps as they went. The Roman army, spearheaded by the Ninth Legion, had advanced as far as the south bank of the Humber Estuary by *c* AD 47. The main road northwards, Ermine Street, ran from Lincoln northwards to Winteringham, where a 1st century military base was established from which to cross the estuary. On the opposite side of the Humber, at Brough, was the Iron Age tribal capital of the local Parisi. The Parisi appear to have accepted the Roman advance without too much resistance and before long a military installation had been established on the site of the native settlement, becoming a Roman town (Petuaria) by the early 2nd century (Bennet 2006; Norman 1960; Chapman *et al* 1999). Winteringham, too, developed as a small town once the military advance had passed through, continuing in use into the 4th century (Bennet 2006; Chapman *et al* 1998).

There was no certain evidence for the Roman town at Brough on aerial photographs available to the project. A possible U-shaped banked linear feature (MCX1402) is faintly visible on the south side of the Burrs on current lidar imagery. The feature may be part of an enclosure and is approximately 91m long on its east side, 56m long on its west side and 41m wide. It is open ended to the

northwest. The feature is very tenuous and confidence is low but it may be a feature of late prehistoric or Roman date.

Roman roads

A number of linear features visible as cropmarks and earthworks on aerial photographs were mapped as trackways of probable late prehistoric or Roman date. The majority of these were associated with areas of settlement and field systems. Linear features identified specifically as sections of Roman road were limited but included a possible Roman road at Blacktoft (MCX1415). This possible road section runs southwest from Staddlethorpe for just over 800m on a northeast-southwest alignment towards the estuary edge west of Blacktoft (Fig 75a). Linear parallel ditches (MCX1416; 1417) to the east of this feature and running perpendicular to it may be further sections of Roman road or trackway or alternatively drainage ditches of Roman or later origin.

The line of Roman Ermine Street (MLS100) remains fossilised in parts of the modern road system but where it diverges from this some sections are visible on aerial photographs and current lidar imagery as cropmarks and/or earthworks. At Winteringham several sections of Roman roads are identifiable. Ermine Street appears to follow part of present-day Cockthorne Lane before veering off northeast (road section MLS26582) towards Eastfield Farm and then through the Roman settlement of 'Old Winteringham' (MLS2068), heading towards the estuary foreshore. Shorter sections of probable road (MLS26583-26585) are visible running parallel and perpendicular to this main road (Fig 75b). One of these (MLS26583) forms an offshoot of Ermine Street which continues broadly northwards towards the coast near Winteringham Haven (and see Chapman *et al* 1998, fig 10.19).

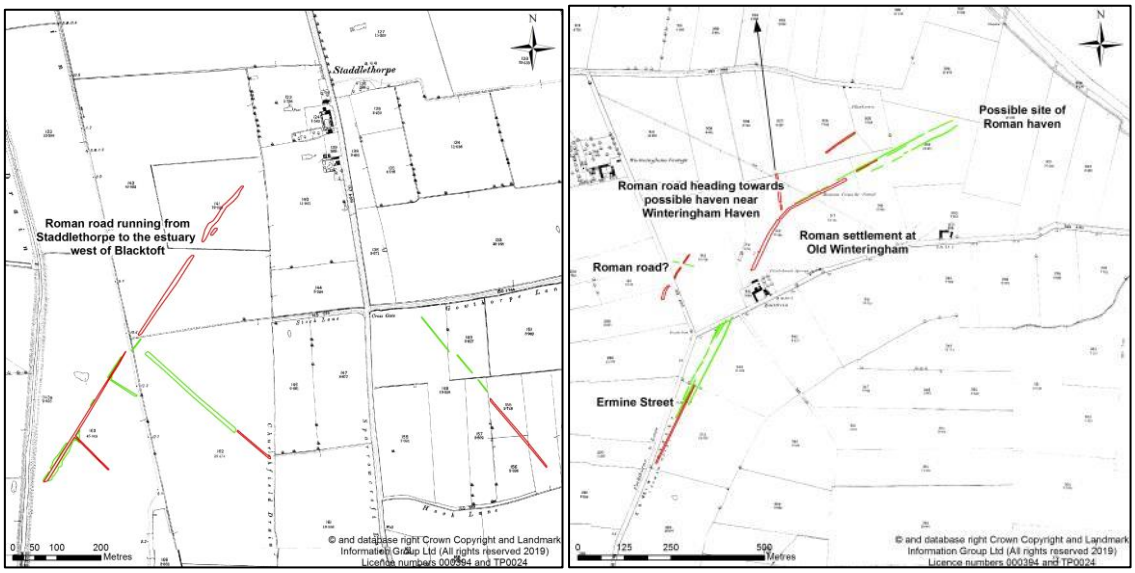


Figure 75 Roman roads at Blacktoft and Winteringham.

Left: Blacktoft (MCX1415). Right: Winteringham (MLS26582-26584 and MLS26586). Background map OS 1st Edition 1:2500, c1880.

Two linear banked features (MCX1389) visible on Brough golf course on 1940s aerial photographs may also be part of a Roman road at this location; the features potentially branch off from the Roman road (MHU63) between Brough and York, heading northeast. These features may alternatively, however, be historic field boundaries; the southernmost linear curves round slightly to the northeast towards the end of a broad historic field boundary recorded on the OS 1st Edition map (Fig 76).

Figure 76 Possible Roman road on Brough golf course.

MCX1389. Photograph: RAF/CPE/UK/1748 V 5138 21-SEP-46 Historic England RAF Photography.

A section of Roman road (MLS16777) was also discovered in 1994 eroding out of the foreshore at South Ferriby, approximately 400m west of South Ferriby Sluice and close to the eastern end of present-day Read's Island (Carey 1997). The road was excavated in 1996 during the Humber Wetlands project, which showed that it was constructed as a raised causeway just over 0.5m above the level of the salt marsh in the early 1st Century AD (Chapman *et al* 1998; Van de Noort 2004). The road headed on a southeast-northwest alignment across the Ancholme floodplain towards Old Winteringham, where it may have linked with the north eastern offshoot of Ermine Street (MLS26582). Alluvial deposits overlying the Roman road at South Ferriby indicate a marine transgression in this area *c* 70-260 CAL AD (Chapman *et al* 1998). Part of the road was detected on a geophysical survey prior to tidal defence works (Lindsey Archaeological Services 1999; Oxford Archaeotechnics Ltd 1997). The road is not visible on available aerial sources, however, and was not mapped by the project.

Roman Winteringham: military base and small town

The Roman settlement (MLS2068) of 'Old Winteringham', to the east of Eastfield Farm is well-documented and stone buildings of Roman date have been disturbed by ploughing on this site from as early as the 17th century (Chapman *et al* 1998, 236). The site lies close to the south bank of the Humber Estuary where it occupies a spur of land around 12m OD at its highest point. The land to the east is markedly lower and until modern drainage was tidal marshland as far as the mouth of the River Ancholme, some 2km to the east (*ibid*). Although Late Iron Age finds are recorded from the site there is no certain evidence for a settlement at this point prior to the establishment of a military base here in the mid-1st century AD (*ibid*).

The military base at Old Winteringham was established at the northern end of Roman Ermine Street and the earliest evidence for a possible military site here suggests it was located around a junction along this road (MLS26582), at the point where another spur of road (MLS26583) branches off to the north. Sections of both these roads are visible on aerial photographs. No certain evidence for a Roman fort was found but the remains of 1st century timber buildings at this location are thought likely to be part of the early military installation (Chapman *et al* 1998, 236).

Excavation evidence indicates that both of the roads at Old Winteringham were contemporary in date. They probably continued on to points along the Roman foreshore where small havens or crossing points across the estuary were sited. A Roman haven and ferry point is documented to the northeast of Old Winteringham. This may have been situated at Flashmire to the northeast of Eastfield Farm. Other sources (see NHRE Hob UID 64015), however, place the site of a Roman harbour closer towards Winteringham Haven. The line of the former Roman foreshore ran to the south of the present-day Humber bank prior to late medieval and post medieval sedimentary accumulation along that section of the estuary edge (Chapman *et al* 1998; Van de Noort 2004). Given the presence of two roads heading towards separate points along the foreshore, it seems probable that more than one site existed. To date, there is no certain evidence for the site of a Roman harbour at either location; this may be due in part to the erosion of unstable wetland deposits along this part of the Humber coast (Chapman *et al* 1998). The probable line of the Roman riverbank has, however, been detected in places through recent geomorphological work and archaeological interventions (*ibid*).

The Roman invasion forces left Old Winteringham *c* AD 70 and after a short period of decline the site developed into a small town and trading post (Chapman *et al* 1998, 236-242). The northern branch of Ermine Street (MLS26583) appears to have gone out of use around this time, suggesting a reduced need for two crossing points over the estuary by this time. Cropmark evidence shows linear ditched features potentially overlying part of the road, possibly indicating settlement development post-dating its use (Fig 77).

A wider area of settlement (MLS2063; 17636) became established along the main arm of Ermine Street to the south of Eastfield Farm; excavations within this area over the years have produced evidence for settlement dating between the late 2nd and 4th centuries as well as a small contemporary cemetery (MLS20324) on the northern outskirts of the settlement area. Roman settlement at Old Winteringham appears to have declined during the later 4th century and into the early 5th century AD and there is no evidence to date of any specifically Anglo-Saxon occupation of the site (Chapman *et al* 1998, 238).

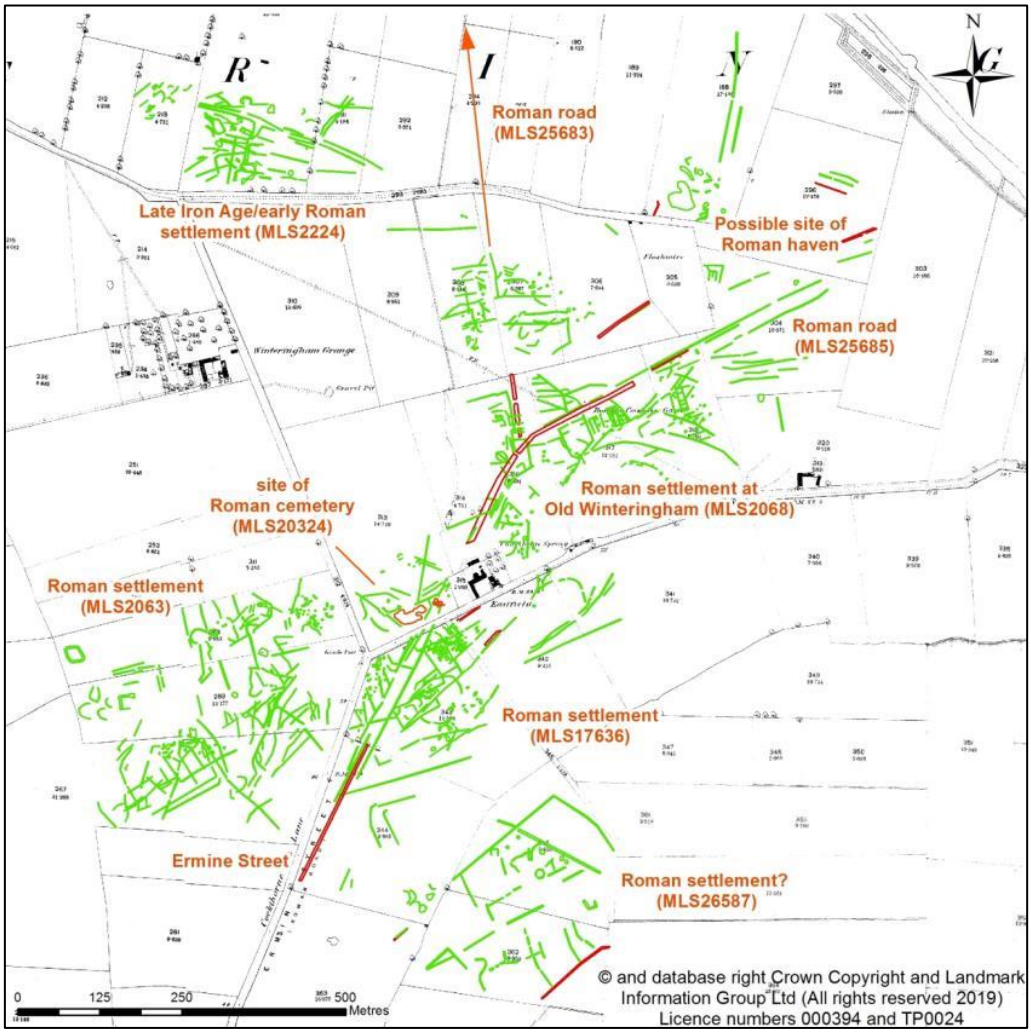


Figure 77 Roman settlements along Ermine Street to the southeast of Winteringham.

Background map OS 1st Edition 1:2500, c1880.

Extensive areas of cropmarks in the vicinity of Eastfield Farm, to the south of Winteringham, are visible on aerial photographs and these were mapped by the project (Fig 77). In addition to the sections of Roman road discussed above, the cropmarks comprise a range of enclosures, pits, field boundaries and trackways extending both sides of Roman Ermine Street and across the site of Old Winteringham. Enclosures include both rectilinear and sub-circular types. Linear features suggest no clear alignment but broadly extend off Ermine Street at acute angles to the northwest and northeast rather than run parallel to it.

5.3 The medieval landscape; settlement, land use and control

The marine transgression that occurred across Western Europe during the late to post-Roman period resulted in a contraction of settlement away from low-lying wetland areas and the fringes of the Humber Estuary were no different in this regard. As a result, where continuity of occupation occurred within the project area between the end of the Roman period and into the early medieval period this was typically on the higher ground. Likewise, the foundation of new sites between the 5th and 11th centuries also occurred predominantly on higher areas of ground along the estuary edges, or on islands of higher till within the lower lying wetland areas (e.g. Van de Noort 2004, 131). During this period the land around the Humber Estuary was under the control of large manorial estates. During the 11th century many of these manors were granted to new Norman lords under William the Conqueror and as part of these changes new sites emerged, such as the defensive motte and bailey castles constructed around the estuary to control access and trade along the major waterways. One of these castles (MLS374) at Barrow upon Humber lies within the project area.

The medieval motte and bailey castle (MLS374) at Barrow upon Humber occupies a small island of boulder clay and is thought to have been built by the Norman baron Drogo de la Beuvriere who was granted the land in 1071. The castle may have replaced an earlier manorial centre held by the Saxon Earl Morcar. One of the castle baileys may have been formed from a ringwork associated with this earlier manor (Fenwick *et al* 2001, 69). In 1087 the manor passed to Count Odo of Champagne. A charter of 1189 records the castle as belonging to Thornton Abbey by this time (*ibid*, 69-70).

Barrow Castle occupies a strategic position beside the Barrow Beck, which was once tidal up to this point. The Beck served as a moat on the south side of the castle and filled additional moats through a series of channels. The medieval coastline was further to the south than its present line and the castle would have controlled the medieval haven, also the landing point of a Humber ferry operated by Count Odo to link his estates on both sides of the estuary. Excavations of the site have produced pottery dating from the 11th to 14th centuries (Fenwick *et al* 2001, 70).

The earthworks of Barrow Castle are visible as linear banks and ditches on aerial photographs and current lidar imagery and were mapped by the project. The earthworks comprise a low motte and a series of baileys; a small oval one to the northeast, a triangular one to the southeast and a larger oval one to the north. An outer circular bank is also visible on the north side, cut by the later road. This may be an outer earthwork or annexed enclosure. Additional linear banks are also visible to the east (Fig 78).

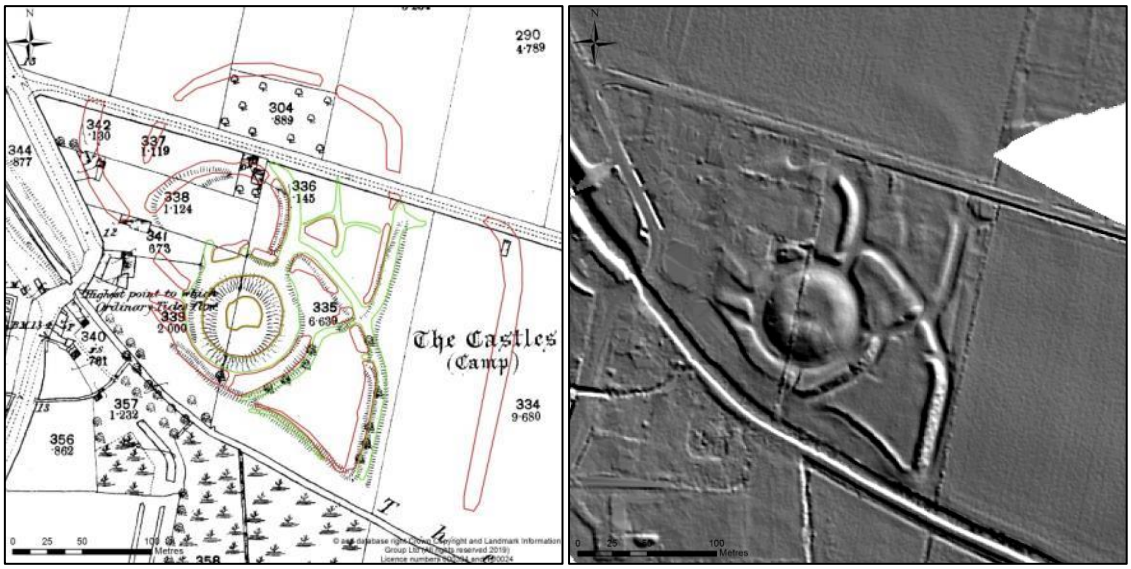


Figure 78 Motte and Bailey castle at Barrow upon Humber.

MLS374. Lidar images © Historic England; source Environment Agency. Background map OS 1st Edition 1:2500, c1880.

Medieval settlement character

The present-day settlement character on the higher ground around the estuary edges is dominated by large nucleated villages that were largely in place by the 11th century. Although some of these larger settlements, such as Barrow and Barton-upon-Humber, for example, demonstrate probable 5th to 8th century origins, their development into a more structured form of settlement was in line with a wider restructuring of the landscape in England that occurred somewhere between the 8th and 11th centuries; a phenomenon termed 'the village moment' by Lewis *et al* (1997, 191-2). The project area falls within the central belt of England (termed the 'Central Province' by Roberts and Wrathmell 2000), where this restructuring typically resulted in large nucleated villages associated with a two or three field open field, or 'townfield', farming system, which would have been shared by the community (Rippon 2009, 6).

Outside of this central belt there was much regional variation in settlement development between the 5th to 11th centuries, as well as a less certain chronology of events (e.g. Rippon 2009 and Roberts and Wrathmell 2000; 2002 for further discussion on this topic). A more dispersed settlement pattern of hamlets and farmsteads was typical, occasionally with smaller nucleated villages within this; these more typically located in areas closer to the fringes of the Central Province. Associated field systems were also smaller in scale in these peripheral regions and demonstrated greater variation in the way they were farmed; with examples of small commonly farmed fields as well as land farmed in severalty by a single landowner or tenant farmer (e.g. Rippon 2009). The factors underlying the range in regional settlement development during the early medieval period (5th to 11th centuries) are many and varied, with geographical and social influences both playing their part. Certainly the changes

appear to have coincided with, and were probably shaped by, a reorganisation of large estates and the ways in which land was managed.

Up until the 11th century the lower lying wetland areas bordering the Humber Estuary were largely used as a resource base by the settlement centres on the higher ground, complementing the subsistence economy through the supply of summer pasture, fishing and fowling grounds. Settlement of these areas prior to the 11th century was largely confined to isolated sites, such as religious houses, a number of which were established on higher islands of glacial till; such as the 8th century Saxon monastery of *Donaemuthe* (Donmouth), for example, thought to lie near Adlingfleet (Van de Noort 2004; Van de Noort *et al* 1998).

By the 11th century, however, some wetland areas were starting to become recolonised. Settlements such as Tharlesthorpe and Paull Holme in Holderness, for example, were mentioned in the Domesday Book as were the hamlets of Drypool, Marfleet and Southcoates within the Hull River valley (Sheppard 1958; 1966). Some settlements established on the higher ground of the Humber Estuary between the 9th and 11th centuries have place-name elements that indicate a probable Viking origin; the *–by* element of South Ferriby and Grimsby, for example.

As mentioned above, a number of large farms or granges were also established on areas of former salt marsh during the 11th and 12th centuries, often under monastic ownership (and see Sheppard 1966). Into the 12th and 13th centuries there was a continuing spread of settlement across the wetland areas of the project area, with new hamlets and smaller villages becoming established during this time; Blacktoft, Faxfleet and Broomfleet in the Vale of York, for example, established during the 12th century (Van de Noort 2004). Settlements in the wetland areas are characteristically smaller than the larger nucleated villages on the higher ground, more typically those of dispersed smaller hamlets and farmsteads; some of these larger granges. Field systems associated with these may still conform to the two-three field system of farming; as on the heavier soils of Holderness, for example (see Harris 1959, 4), although probably on a smaller scale than the larger villages inland.

One of the site types common to most wetland areas within the Inner Humber Estuary project area is the moated manor. These began to establish on the marginal wetlands from around the 12th century and may be associated, at least in part, with a wider gradual break-up of manorial lands; a process known as subinfeudation that saw smaller manors develop out of larger ones through inheritance and the transfer of land into private ownership (Bailey 2002, 12). The date range of this site type varies from the late 12th century to the post medieval period but is more concentrated between the late 13th to 14th centuries (Fenwick 1995; 1997). Moated sites also varied in size and shape, typically having one or more islands enclosed within a u-shaped ditch, generally filled with water. The island (or islands) might hold buildings such as a farm, manor house or grange and/or be used for a variety of agricultural activities (Fenwick 1997). The moats may have been used as fishponds and there is also

evidence at some sites for small-scale industries such as pottery production and rope-making (Fenwick 1997; Van de Noort 2004).

Much of the evidence for medieval settlement underlying existing villages is generally invisible to aerial mapping projects and within the project area nothing was mapped in these areas. Within the smaller villages and hamlets established across the project area by the 11th century there was, however, some evidence for medieval settlement; as shrunken or deserted villages showing as earthworks and/or cropmarks on aerial photographs and current lidar imagery. These were largely confined to moated sites but alongside some of these, such as Paull Holme (MHU8515), Newton Garth (MHU2671) and Faxfleet (MCX1422), for example, there was evidence for a wider area of associated settlement of probable medieval to early post medieval origin.

Paull Holme medieval manor and shrunken village

The settlement of Paull Holme (MHU8515), on the north bank of the River Humber just south of Hedon, is first recorded in the Domesday Book as 'Holme' when it was part of the manor of Burstwick. The manor had originally been held by Earl Tosti and by Domesday he had given the manor, along with the rest of Holderness, to Drogo de Beuvriere. Paull Holme is located on an island of glacial till; one of several in the vicinity which are situated within a low-lying alluvial plain that had probably developed a salt-marsh environment by the early centuries AD (Head *et al* 1995). Curvilinear enclosure boundaries are recorded at Paull Holme on the OS 1st Edition map. The boundaries closely correspond with the island of glacial till, as represented by the 5m contour line and may fossilise part of the settlement's former arable open field (Fig 79).

The settlement at Paull Holme may have been impacted by the stormy period of the 13th to 15th centuries (see Sheppard 1966) and the surrounding salt marsh may have been lost for a time under these conditions (Head *et al* 1995). By the late 15th century Paull Holme was owned by the Holme family who had a moated manor built on the site, complete with a manor house; the north tower of which is still standing (MHU2660).

The moated manor site at Paull Holme is visible as earthworks and structures on 1940s aerial photographs and these were mapped by the project (Fig 79). These features comprise the still extant tower, along with the east and part of the north side of the moat, which enclosed a rectilinear island approximately 130m by 95m. The moat on the south side of the island may have been incorporated into a post medieval drainage ditch (MCX112) which is recorded on the OS 1st Edition map (Fig 79). The ditch curves round from the west to the northeast along the southern edge of the island of glacial till. Additional linear features are visible as earthworks to the east and south of the moated site and these may be areas of further medieval to post medieval settlement, although some features may alternatively be drainage features of corresponding date (MCX110; MCX113; MCX116). It is possible that a curvilinear east to west

aligned ditch (MCX116) within this southern area may be part of a former sea defence line.

Associated with the settlement of Paull Holme are areas of ridge and furrow cultivation (MCX106; MCX107; MCX110; MCX300). In the main these are broad with the characteristic reverse S-shaped rows of medieval ridge and furrow (e.g. Hall 1982). The features are located within the curvilinear boundary lines indicating the area of possible medieval open field (see above), which is likely to be contemporary with the earliest medieval settlement at Paull Holme. The medieval open field pattern in south Holderness was almost exclusively of the two-field variety (Harris 1959, 4). This may have been the case at Paull Holme with a possible dividing line between two areas of open field on Cow Hill and Holme Hill (see Fig 79).

Further areas of ridge and furrow (MCX107) are visible to the south of Paull Holme, outside of the suggested Domesday extent. Although straighter in form than the ridge and furrow to the north, these features are still relatively broad in character, suggesting a probable medieval date; possibly contemporary with the construction of the moated manor in the 15th century and the recovery of land after the storms of the previous centuries. It is possible that the ridge and furrow cultivation in this area reflects arable intake of previously uncultivated areas of salt marsh during this time; these may previously have been used solely as pasture. Alternatively, it is possible that a further area of open field existed to the south of Paull Holme and that subsequent changes in this seaward area has altered older boundary lines.

Figure 79 Paull Holme medieval moated manor and shrunken settlement with associated medieval ridge and furrow cultivation.

MHU8515; 2660; MCX105-113; 300. Photographs: RAF/CPE/UK/1748 RP 3100-1 21-SEP-46; RAF/CPE/UK/1911 RS 4023-4 27-DEC-46 Historic England RAF Photography. Background map OS 1st Edition 1:2500, c1880.

Newton Garth medieval settlement, moated site and leper hospital

Newton Garth is situated to the northeast of Paull, just under 1.5km inland from the current Humber bank. A settlement (MHU2671) here is recorded in the Domesday Book where it is named as Newton in Paull. By 1179 a hospital (MHU2672) was founded on the site by William le Gros, Earl of Albermarle and shortly after this date King Henry II granted the hospital a yearly fair on the feast of St Mary Magdalene to whom the hospital was dedicated (British History Online 2017).

The OS 1st Edition map (*c*1880s) records two settlements at Newton Garth (Fig 80). The Domesday record would have referred to a *vill* or land unit, which can be assumed to have been equivalent to a manor or tithing in existence by the 11th century. As such this may have consisted of single or multiple settlements, dependent on the organisation of land ownership and tenure (e.g. Bailey 2002; Fleming 2016; Rippon 2008). Both of these settlements may therefore have been part of the medieval manor; or the result of a dividing up of the manor during the later medieval period. Where Newton Garth is mentioned in the text this refers to the northernmost settlement, which is probably the site of the 12th century hospital; a field to the west of the northernmost settlement is recorded as 'hospital garth' on the OS 1st Edition 10560 series map, suggesting this was the site of the hospital or part of the arable land associated with it. The second settlement is located just over 500m to the south. By the time of the OS 2nd Edition map (*c*1904-8) the name of this settlement had become Rose Hill Farm.

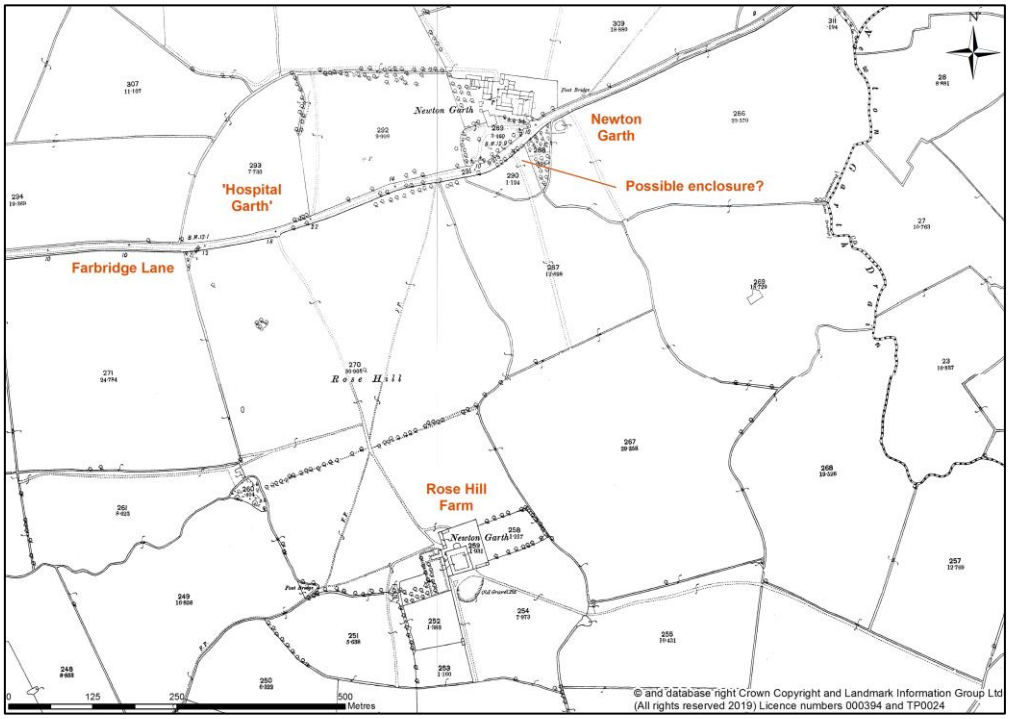


Figure 80 Newton Garth medieval settlement; the 12th century leper hospital was probably located in the vicinity of the present-day Newton Garth.

MHU2671; 2672. Background map OS 1st Edition 1:2500, c1880.

Earthworks to the west of Newton Garth are visible on 1940s aerial photographs (Fig 81). The earthworks comprise a rhomboid island of raised ground up to 114m by 144m at its widest points. The island has low scarped slopes on its south, east and north sides with traces of a narrow outer ditch. On the west side of the island is a linear scarped hollow up to 20m at its widest point. The features may be that of a small medieval moated site; possibly that of the medieval hospital. Within the moated site on its south side, is an irregular square ditched feature approximately 21m by 26m with linear offshoots to the south, east and west (Fig 81). It is possibly a drainage feature but could potentially indicate the site of underlying structures; an area of disturbed ground is also visible at this location on lidar imagery (Fig 82). Additional linear scarps and banks are visible to the west of the moated site; these are quite well-defined and may be part of the wider hospital enclosure; possibly historic field boundaries or part of a hollow way. The curvilinear character of the historic field boundaries on the north and west sides of the fields containing the earthworks suggest a probable medieval origin and may form part of an outer enclosure around the hospital site.

Figure 81 Medieval moated site at Newton Garth with adjacent fields of ridge and furrow cultivation.

The moated site may be the site of the medieval leper hospital (MHU2671; 2672; ridge and furrow: MCX302-310; 312; 424; 425). Photograph: RAF/CPE/UK/1748 FS 2092 21-SEP-46 Historic England RAF Photography.

The historic fields around both Newton Garth and Rose Hill Farm are formed of well-defined curvilinear boundaries that are probably medieval in origin and define part of the arable open field at Newton Garth. The distinctive reverse S-shaped features of broad ridge and furrow cultivation are visible within the

majority of these fields on 1940s aerial photographs (Fig 81). Some peripheral areas of more regular ridge and furrow within straighter rectilinear fields are likely to be later in date, although these may still be later medieval or early post medieval in origin. Traces of ridge and furrow are visible overlying the site of the 12th century hospital on 1940s aerial photographs, suggesting the hospital went out of use later into the medieval period at which time the site was taken into arable cultivation.

The well-defined ditched linear features to the west of the moated site are clearly visible on lidar imagery, as are two additional broad linear ditches to the southeast that correspond with historic field boundaries recorded on the OS 1st Edition map and still extant in the 1940s (see Figs 80 - 82). The form of these latter features shares similar characteristics to the linears associated with the moated site. It is clear they functioned as drainage features and possible that they fossilise older features of potentially medieval date. One of the linear ditches immediately southwest of Newton Garth curves southeast and then northeast to form what appears to be part of a sub-rectilinear enclosure, now cut by Farbridge Lane (Fig 82). The west side of this possible enclosure may be defined by a slightly curvilinear field boundary on the north side of Farbridge Lane, recorded on the OS 1st Edition map and visible on 1940s aerial photograph (see Figs 80 and 81). If it is an enclosure it pre-dates the road and is potentially of medieval date; assumed to be part of the medieval settlement at Newton Garth, possibly an additional moated enclosure.

Figure 82 Newton Garth medieval settlement and moated site, documented to have been a medieval leper hospital.

MHU2672. Lidar images © Historic England; source Environment Agency.

Faxfleet medieval settlement

A Knight's Templar preceptory existed at Faxfleet, on the north bank of the Humber, close to the confluence of the Rivers Ouse and Trent. In the 12th century a medieval grange farm, or *camera*, associated with this was located in the vicinity of Faxfleet Hall. The full extent of the area occupied by the *camera* is not known but in 1322 the site passed into the hands of King Edward II and a moated site (MCX1424) was constructed at some point after this date. The moated site is situated to the northwest of the present-day Faxfleet Hall and is thought to occupy part of the medieval *camera* and may have re-used some of the existing grange buildings (see Scheduled List Entry 1007737). The west and south sides of the moat are still visible on aerial photographs and these were mapped by the project, along with a linear pond (MCX1425) on the east side of the moat, and possibly contemporary with it (Fig 83).

Further earthworks (MCX1426; 1422; 1423) are visible on aerial photographs and current lidar imagery to the southeast of the moated site and on the west side of the modern road (Fig 83). The earthworks comprise linear banks and ditches on the same alignment as the historic field pattern, which may be associated with a wider area of medieval settlement at Faxfleet.

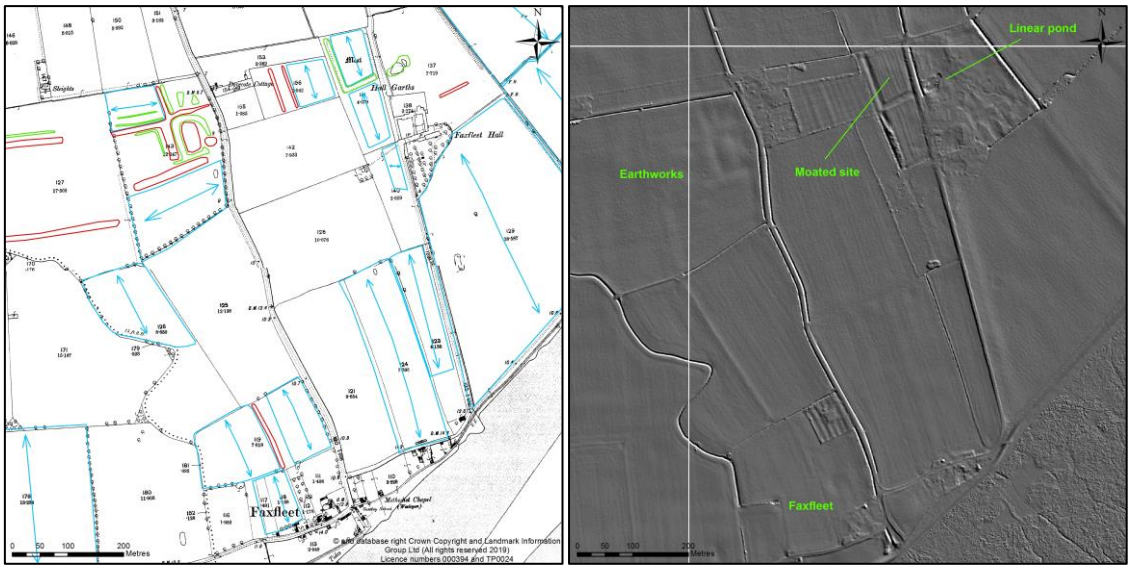


Figure 83 Medieval settlement and moated site at Faxfleet.

MCX1422; 1423; 1424; 1426. Lidar images © Historic England; source Environment Agency. Background map OS 1st Edition 1:2500, c1880.

Moated sites

In addition to those at Paull Holme, Newton Garth and Faxfleet, above, only three certain moated sites were mapped by the project; at Manor Farm, East Halton (MLS1595), Old Little Humber, Paull (MHU2669) and Goxhill (MLS1583).

The large moated site at East Halton (MLS1595) is recorded on the OS 1st Edition map which describes a large banked and ditched earthwork enclosure around the manor complex (Fig 84). The southwest corner of the enclosure is truncated by later fields but may originally have extended further to the southeast to complete a more rectilinear shape. The Scheduled Monument description for the site documents this large enclosing moat as being 10m wide and 3m deep with an internal bank between 1m and 1.5m in height and between 5m and 7m wide around almost the entire circuit (See List Entry description NHLE 1007816).

Earthworks within this large moated enclosure, on the north side of Manor Farm, were mapped by the project from 1940s aerial photographs. The features comprise a series of broad linear ditches flanked by sections of narrow banks that appear to form the northern part of an internal 'island' enclosure up to 130m long by 110 m wide, with the manor house at its southern end (Fig 84). Additional narrow linear banks and ditches within the enclosure include a bifurcation of the broad drainage ditch on its west side to form a small internal moat and island approximately 20m long by 7m wide. These internal features may be historic field or garden boundaries.

On the east side of the larger enclosure is a lobed enclosure bounded by banks and ditches to form two compartments. These may have been historic fields, or possibly stock enclosures, although they are not recorded on the OS 1st Edition map (Fig 84). The moated site is bordered to the east by an extensive area of medieval broad ridge and furrow cultivation (MLS10746). The site survives as low earthworks and is visible on current Google Earth imagery (Fig 85).

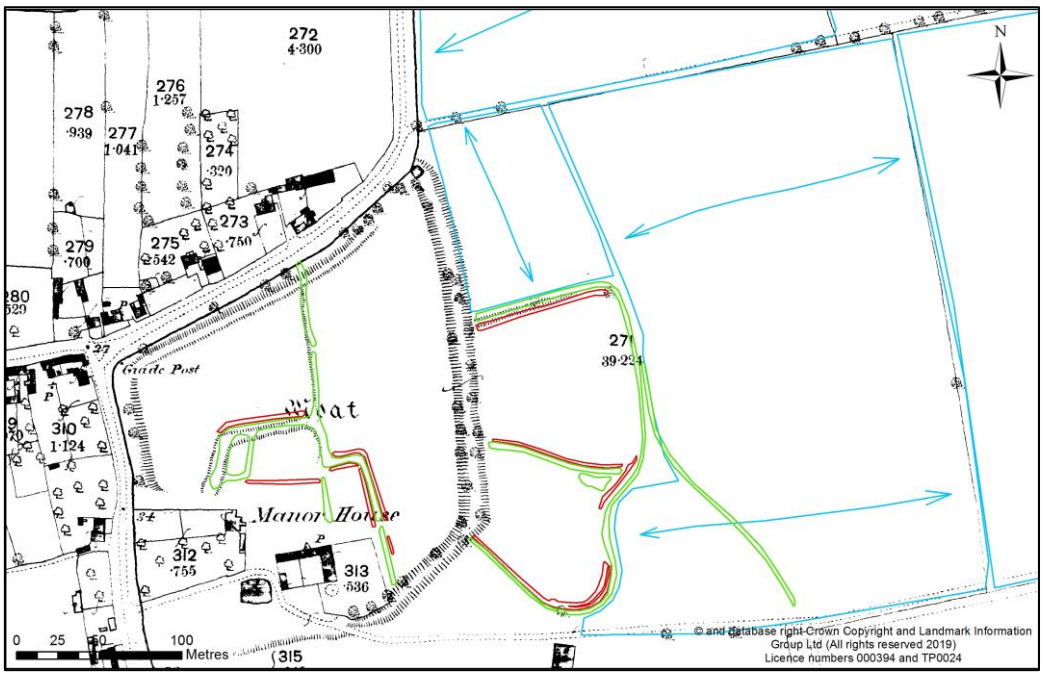


Figure 84 The medieval moated site at Manor Farm, East Halton.

Additional earthworks to those recorded on the OS 1st Edition map were digitally plotted from 1940s aerial photographs (MLS1595). Background map OS 1st Edition 1:2500, c1880.

Figure 85 The earthworks of the medieval moated site at Manor Farm, East Halton are still visible on current Google Earth imagery (MLS1595).

The moated site (MLS1583) at Hogcote Close, Goxhill, is visible on 1940s aerial photographs as an elongated rectilinear double island enclosure approximately 195m by 65m overall, with an internal ditch separating off the lower third (Fig 85 and see Fig 39). It is situated just over 450m to the southwest of Goxhill Haven in an area of large regular historic fields of uncertain origin; the straight regular boundary form suggests a post medieval date and they may be enclosures created from former saltmarsh as part of a reclamation scheme.

Extending from the north side of the moated site is an irregular linear ditch, visible as a shallow hollow on aerial photographs. This feature extends north and then east to join with a banked and ditched north to south aligned linear feature (MLS26240), which links into a historic drainage channel at its north end; probably a drainage ditch of medieval or post medieval origin and possibly part of a former flood defence line; possibly indicating a former shoreline or part of the former extent of Goxhill Haven. Additional banked linear earthworks to the east, south and west of the moated enclosure are visible as cropmarks on 1940s aerial photographs, possibly part of an associated field system.

Artefactual evidence from the site includes 13th to 16th century pottery wares and architectural remains such as brick, tile, stone and window tracery. Some sections of walls and corner stones have also been uncovered (see MLS1583 HER record). The main area of occupation appears to have been at the southern end of the site, within the third divided off by the internal ditch (see Fig 86).

The moated site at Hogcote Close is now largely unidentifiable on current Google Earth imagery, save for a curvilinear field boundary that appears to respect its east side. It is still visible as a low earthwork on current Lidar imagery. Interestingly, Rex Russell in his book on the open field systems of

North Lincolnshire records the name Langley on the edge of the salt marsh to the southwest of Goxhill Haven (Russell 1995, map 12). The name translates as ‘long clearing’, from the Old English elements *lang* and *leah* (Gelling 2000, 205). It is possible the name Langley refers to an early settlement at this location, possibly corresponding with the site at Hogcote Close.

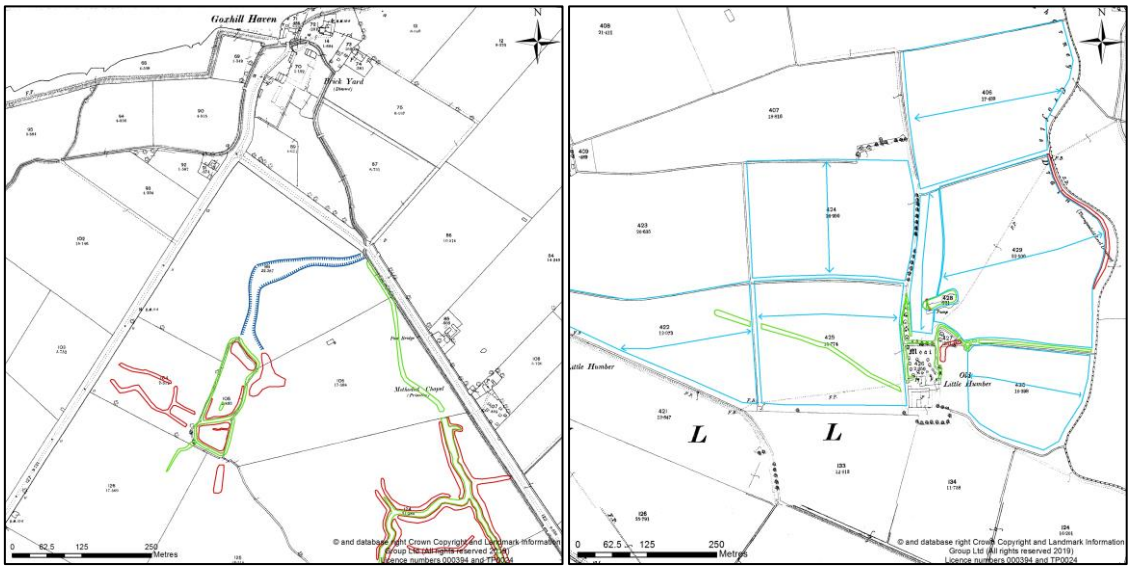


Figure 86 Medieval moated sites at Hogcote Close, Goxhill and Old Little Humber.

MHU2669; MLS1583. Background map OS 1st Edition 1:2500, c1880.

The moated site at Old Little Humber (MHU2669) is visible to the north of the modern farmstead on current lidar imagery. The site comprises a ditched moated enclosure approximately 63m by 61m, open on its south side. Arms of the moat extend from the northwest and northeast corners, continuing as drainage channels north and east respectively (Fig 86). The site is visible within areas of broad ridge and furrow cultivation on 1940s aerial photographs; these and the curvilinear historic field boundaries adjacent to the site suggest two open fields, one running north-south with the moated site at its southwest corner, one running east-west from the west side of the site.

5.4 Medieval/ Post medieval resource exploitation and industry

The Humber Estuary's natural wetlands resource has a long history of exploitation, from the opportunism of passing hunter-gatherer communities through to the more organised regimes of the large landowning estates during the Roman and medieval periods. Alongside fishing, fowling and hunting pursuits there would also latterly have been the gathering of materials for fuel and activities such as basket making and thatching. The salt marshes were used as summer pasture and the salt-rich seawater itself used in the production of salt. The archaeological record has a wealth of artefactual evidence for the range of early resource exploitation but there is also some physical evidence for small-scale industry such as salt making: the waste mounds of historic salterns are visible as earthworks and cropmarks on aerial photographs and lidar imagery.

As technologies advanced into the post medieval period larger industries developed along the estuary margins. Post medieval sites mapped by the project include extractive pits, brick and tile yards, shipyards and fish traps. Historic windmills of medieval to post medieval date are also a common feature of the wider Humber wetlands and five sites were mapped by the project, three with only the base mounds surviving and two with partial structures still extant on top of their base mounds. These larger industrial sites have a much more visible presence in the archaeological record, with distinctive site types and surviving earthworks and structures that are more easily identifiable on aerial photographs and lidar imagery.

Salt production

Salt was an important commodity to early communities, for preserving food and in certain processing industries. Organised salt production in Britain began as early as the Bronze Age and developed through the Iron Age and into the Romano-British period, increasing in scale and geographical distribution. A change in technology during the medieval and post medieval periods took salt making to a more factory-like production level, although the basic processes remained largely the same (Historic England 2018c).

The processes underlying salt production involve the drying and crystallisation of salt rich seawater or inland brine and artefactual evidence associated with these processes have left their trace in the archaeological record. Typical of the majority of salterns are the waste layers and mounds which, where they survive, are distinctive landscape features visible on aerial photographs and lidar imagery. Given their often coastal locations, these sites have suffered from coastal erosion and flooding and their preservation is under threat. Modern ploughing in places has also had an impact (Historic England 2018c).

Along the Humber Estuary there is some evidence for Romano-British salt production, although much of the evidence for this is likely to have been lost as

a result of marine transgression at the end of the Roman period. Along with other wetland industries in this area, salt making did not properly re-establish until well into the 11th century, alongside the gradual recolonisation of the wetland areas (Van de Noort 2004). The Lincolnshire coast was a particularly rich salt-producing area during the medieval period, although it was severely decimated by a great flood in 1571 (Historic England 2018c).

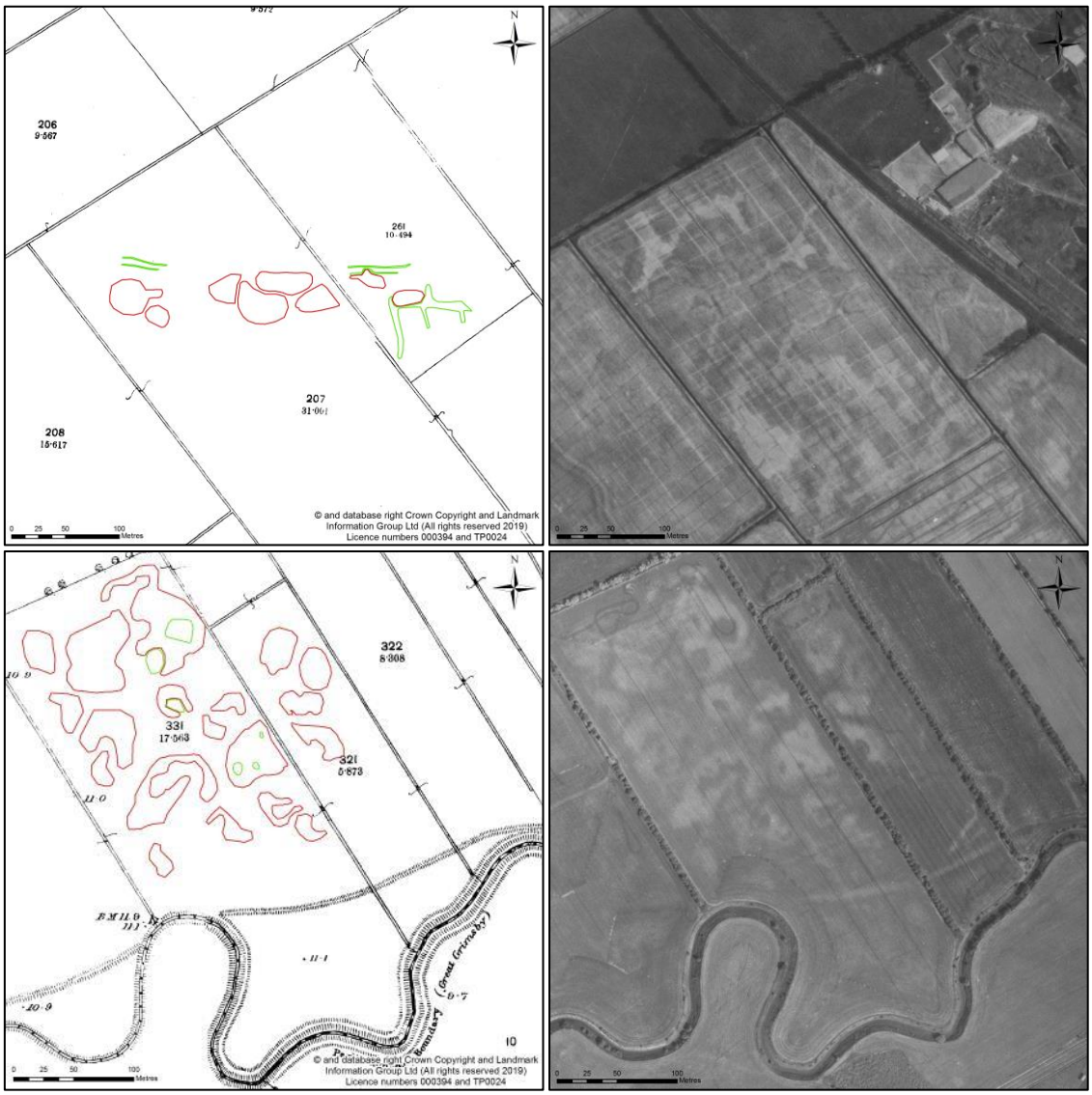


Figure 87 Examples of possible medieval to post medieval salterns at Immingham and Stallingborough.

MLS26145; MCX333. Photographs: RAF/CPE/UK/2043 RP 308229-APR-47 Historic England RAF Photography; MAL 65051 V 161 20-MAY-65 © Historic England Photography. Background map OS 1st Edition 1:2500, c1880.

There is evidence for one possible Romano-British saltern (MLS26433) within the project area; at South Ferriby. Banked and ditched features are visible on current lidar imagery to the southwest of South Ferriby Sluice (see Section 4.6, Fig 27). The site is associated with two linear ditched features (MLS26430;

26431), possibly Romano-British trackways, and is also located within 200m of a probable Late Iron Age to Romano-British settlement (MLS11230).
Six possible salterns of between medieval and post medieval date were recorded by the project (see Sections 4.7 and 4.9, tables 6 and 8). Five of these sites were situated along the south side of the estuary between Stallingborough and South Killingholme (MLS 26145; MCX 333; 436; 439; 444), with one on the north side of the estuary at Sunk Island (MCX263). They were typically located on the coastal salt marsh and were visible as a series of irregular linear banks and ditches forming amorphous mounds and linear spoil heaps; as at Immingham MLS26145) and Stallingborough (MCX333), for example (see Fig 87).

Salterns were often part of a wider historically dynamic landscape and may be found alongside associated features such as trackways and sea walls. Links with neighbouring settlements may be observed and, in some cases, as discussed in Section 5.1, the progressive construction and abandonment of the salterns has determined new settlement lines and historic boundary patterns.

Fish traps

The use of stationary traps or weirs to catch fish is an activity reaching back over 8000 years in some parts of Britain, and still practiced in a few parts of Britain into the present day. The word 'weir' comes from the Anglo-Saxon *wer*, one meaning of which is a device to trap fish; two types of fish weir are documented in Saxon land charters and Domesday Book is just one of the medieval documents to record weirs and fisheries (Historic England 2018d).

The classic form of fish weir is a v-shaped barrier with a net or basket at its apex to catch the fish. Timber posts are often used to support barriers made of wattle or brushwood or rubble. Some more recent examples may use nets only. Coastal fish weirs always point out to sea in order to trap the fish behind the barriers on an ebb tide. Various shapes can be found; L- shapes, crescents or bows, long linear barriers or rectangles. W shapes and zig-zags can occur, where two or more V-shaped weirs are placed together and sometimes parallel rows of traps are laid to maximise the catch (Historic England 2018d).

The most certain archaeological evidence for fish traps and weirs typically dates from the early medieval period forwards, although some earlier examples are known. The remains of a probable Bronze Age timber fish trap were uncovered on the foreshore north of New Holland (Barrow 8 in Fenwick *et al* 2001). Amongst several examples of probable fish traps uncovered at Melton, near North Ferriby, were at least two sites that were also of Bronze Age date (Melton 12 and 13 in Fletcher *et al* 1999).

In total 16 sites identified as fish traps or possible fish traps were mapped by the project. The majority of these were considered likely to be late 19th or early 20th century in date (Section 4.10, table 9) and were positioned along the estuary foreshore between Immingham and Barton-upon-Humber. Three sites located on the foreshore at Elloughton and Welton Ings (MCX 1430; 1431; 1434) may be

post medieval to early 20th century in date (Section 4.7, table 7). One of the sites at Welton Ings (MCX1430) is typically v-shaped. Two linear features to the east of this (MCX 1431) may also be the remains of fish traps (Fig 88).

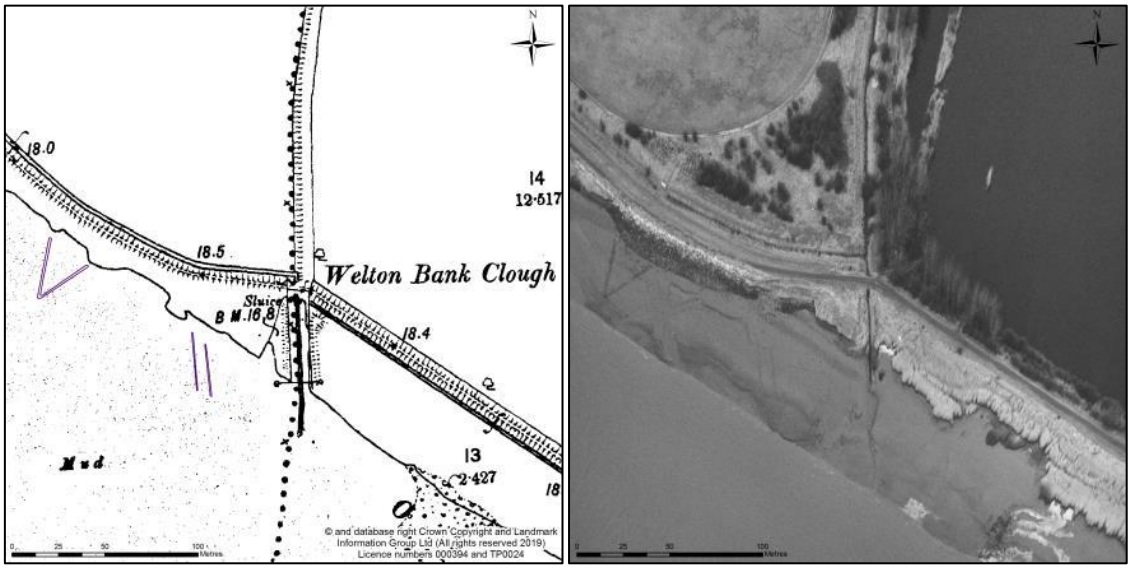


Figure 88 Post medieval fish traps at Welton Ings.

MCX 1430; 1431. Photograph: NMR 17452/29 25-FEB-00 © Historic England NMR. Background map OS 1st Edition 1:2500, c1880.

Several sites along the estuary foreshore between Goxhill and Barton-upon-Humber (MLS 26266; 26290; 26366; 26364; 26365) comprised long linear structures containing single or double rows of rectangular compartments (Fig 89). In certain cases, as at Barrow upon Humber (MLS26290), for example, these particular features were associated with additional structures, such as jetties. These sites are thought to probably be fish weirs or possibly some form of oyster beds.

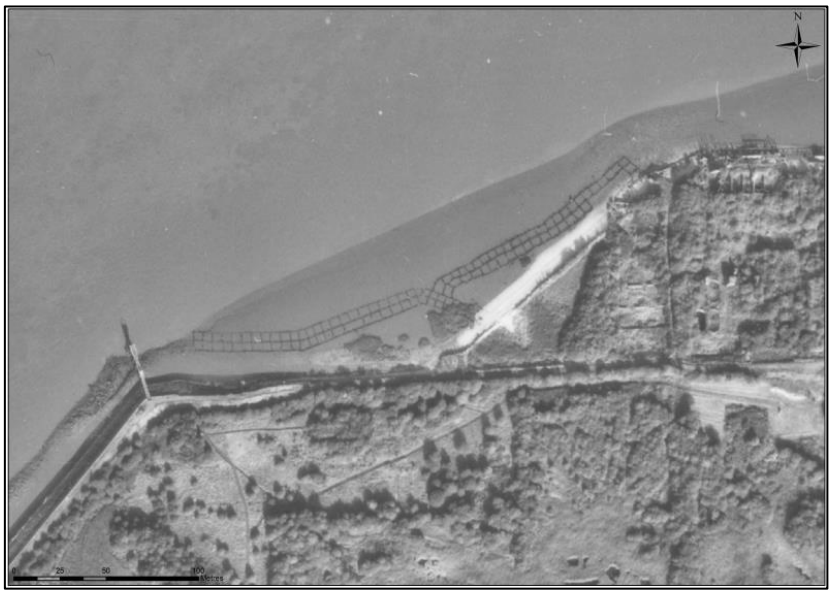


Figure 89 Possible 19th century fish traps along the foreshore at Barton-upon-Humber.

MLS 26365. Photograph: NMR 17126/25 22-JUL-1980 © Historic England NMR.

Shipyards

Two shipyards were mapped by the project (Section 4.8, table 7); both on the north side of the Humber Estuary at Hessle Haven, to the west of Hull (MCX1360), and at the southwest corner of Victoria Dock, Hull (MCX699).

A boat building yard is recorded on the west side of Hessle Haven on the OS 2nd Edition map. The boatyard is documented as having been initially operated by the Cooper family, becoming the partnership Livingstone and Cooper *c*1910. Up until the First World War the yard built coasters and naval tugs but then went on to construct a range of boats from trawlers to hospital ships. The yard closed in 1926 due to depleted resources (Grace's Guide 2019a; Hessle Local History Society 2019). The site is recorded on the OS 3rd Edition map as 'shipyard disused' (Fig 90). Features associated with the disused shipyard are visible as earthworks and structures on 1940s aerial photographs. By this time the majority of shipyard buildings have been demolished but some of the slips and jetties are still visible, extending out onto the foreshore (Fig 90).

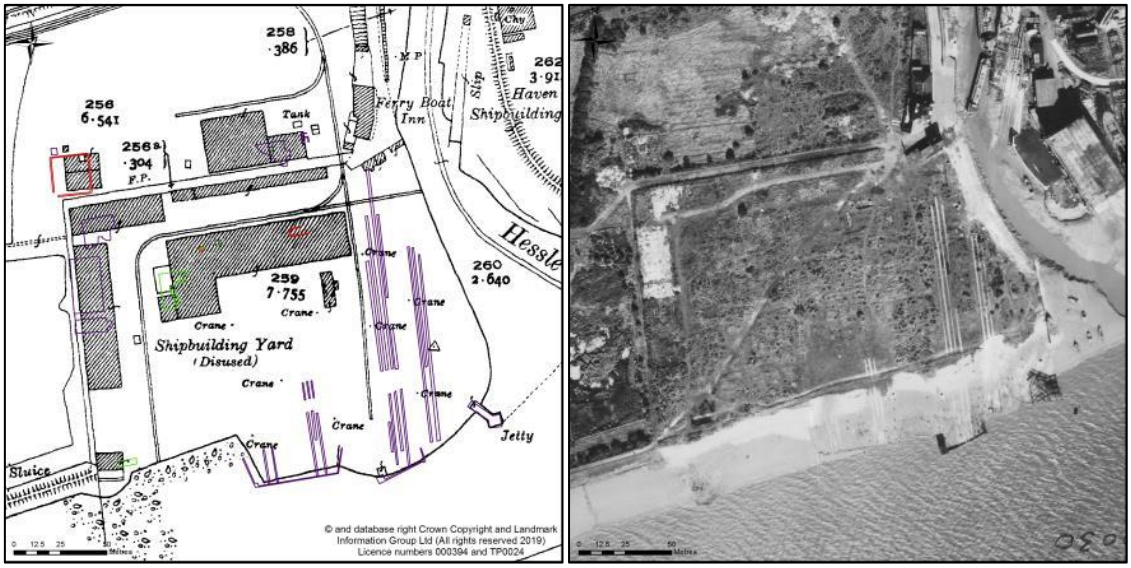


Figure 90 Livingstone and Cooper's shipyard at Hessle Cliff.

MCX1360. Photograph: RAF/106G/UK/805 RV 6030 17-SEP-45 Historic England RAF Photography. Background map OS 1st Edition 1:2500, c1880.

The shipyard near Victoria Dock, Hull, is documented as Earle's Shipbuilding and Engineering Yard on the OS 4th Edition map. The Earle's Shipbuilding and Engineering Co was one of the largest yards on the Humber. Originating in 1853 as C. and W. Earle, the yard moved to its location on Victoria Dock in 1861 following a fire at its former premises. The yard was taken over by Earle's Shipbuilding and Engineering Co in 1871 and went on to build a range of large ships including steamers, ferries and cargo ships. They also had a running Admiralty contract. In 1901 the yard was acquired by a local ship owner C H Wilson who had the yard modernised. Contracts included ships for the Wilson Line and the Admiralty again. The yard was finally dismantled in 1932 after being acquired by National Shipbuilders Security once work ran out (Grace's

Guide 2019b). The remains of some of the slips belonging to Earle's Yard are visible as ruined structures on 1940s aerial photographs. Also visible on the west side of these is a partial row of structures, possibly boat building bays. These do not appear to correspond with structures recorded on the OS 4th Edition map, suggesting they may be later in date (Fig 91).

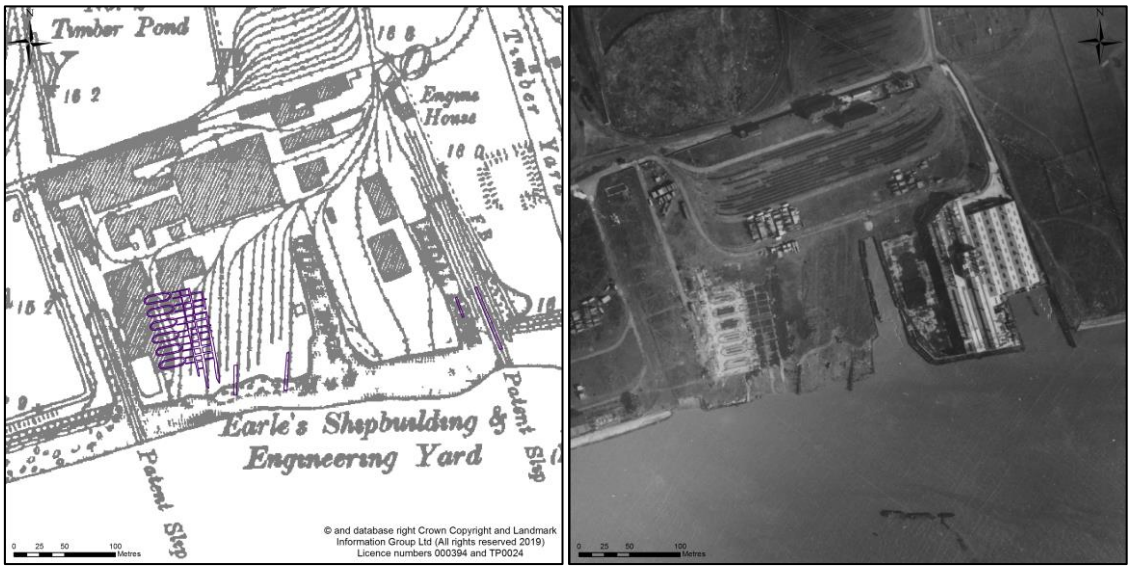


Figure 91 Structures associated with the former Earle's Yard, Drypool.

MCX699. Photograph: RAF/106G/LA/253 FS 2233 28-APR-45 Historic England RAF Photography. Background map OS 1st Edition 1:2500, c1880.

Post medieval extraction

Within the Inner Humber Estuary project area there is much evidence for post medieval extraction of the alluvial and estuarine clays, sands and gravels, with some lesser evidence for small-scale extraction across the limestone and chalk areas further inland (see Section 4.8). Seventy eight extractive pits (including quarries and shafts) were mapped by the project along with 48 sites associated with brick and tile works (Section 4.8, table 7). Sites ranged in scale from small discrete extractive pits up to the extensive runs of clay pits along the estuary edges that were cut to provide the raw materials for brick and tile production.

Barton-upon-Humber brick and tile works

Whilst a small number of large clay pits and/or brick works are recorded on the north side of the estuary; at Hessle (MCX1440) and Welton Ings (MCX1355), for example, these site types are more prevalent along the south side of the estuary between Immingham and Barton-upon-Humber. The brick and tile-making industry at Barton-upon-Humber can be traced back as far as the 17th century and, due to the rich alluvial deposits along the Humber foreshore in this area, was a major centre for brick and tile production in Britain by the 19th century (Barton-upon-Humber 2009; William Blyth 2019). The scale of historic brick and tile production in this part of North Lincolnshire is evident from the large

numbers of sites recorded on Ordnance Survey historic mapping and visible as large-scale earthworks and structures on 1940s aerial photographs; in the vicinity of Barton and Barrow-upon-Humber, for example (Fig 92).

The process of making clay tiles is described by William Blyth tile works: based at the Hoe Hill tile yard and Far Ings tile works this is the last of its kind at Barton-upon-Humber. The best quality clays used in the production of the tiles come from six feet below the surface and are rich in iron. Once formed, the tiles are spread to dry in long open-sided drying sheds with vented roofs to allow year-round drying to take place (William Blyth 2019).

Figure 92 Brick yards at Barrow Haven recorded on the OS 1st Edition map and still visible on 1940s aerial photographs.

MLS 26326; 26327; 26328. Photograph: RAF/3G/TUD/UK2 Vp1 5012 14-DEC-1945 Historic England RAF Photography. Background map OS 1st Edition 1:2500, c1880.

These large-scale industrial brick and tile works were, and in many cases remain, distinctive landmarks of the Humber Estuary; often recorded on Ordnance Survey historic mapping and clearly visible as large-scale earthworks and structures on 1940s aerial photographs. As the brick and tile industry has declined into the 20th century, however, many of these sites have gone out of

use. With a rise in dock construction along the North Lincolnshire coast, many of the sites in this area have been re-developed; at North and South Killingholme (MLS 20136; 22004; 26116), for example. Where these sites survive into the present day they have typically been re-purposed as nature reserves or leisure facilities, as at Far Ings and Hoe Hill, Barton-upon-Humber, for example.

Ferriby Cliff chalk quarries

Three large chalk quarries are recorded within the project area at Ferriby Cliff on the OS 1st Edition map; New Cliff, Barton Cliff and Ferriby (or Leggott's) Quarries (Fig 93). These quarries supplied materials to local cement works via jetties and wharves along the foreshore, linked to the quarries by sections of narrow gauge railway lines. New Cliff Quarry also had a short narrow gauge railway line linking with the port Adamant Cement Works (MLS21964) at Ness End, Barton-upon-Humber (Barton-upon-Humber 2009).

The quarry earthworks (MLS 22097; 22101; 22108) are visible on 1940s aerial photographs, along with an additional quarry (Leggott's Quarry -MLS22095) to the southwest, first recorded on the OS 4th Edition map. Additionally, there are a number of small sub-circular ditched features in the near vicinity of the larger quarries that are visible as earthworks or cropmarks on aerial photographs. These are likely to be small chalk pits, possibly cut to provide chalk for improving the heavy clay soils (Fig 93). The quarries appear to be largely disused on current Google Earth imagery and are partially re-vegetated. The lines of the former railways linking the quarries to the foreshore are still identifiable and there may still be some physical evidence for the former jetties and wharves along the estuary edge.

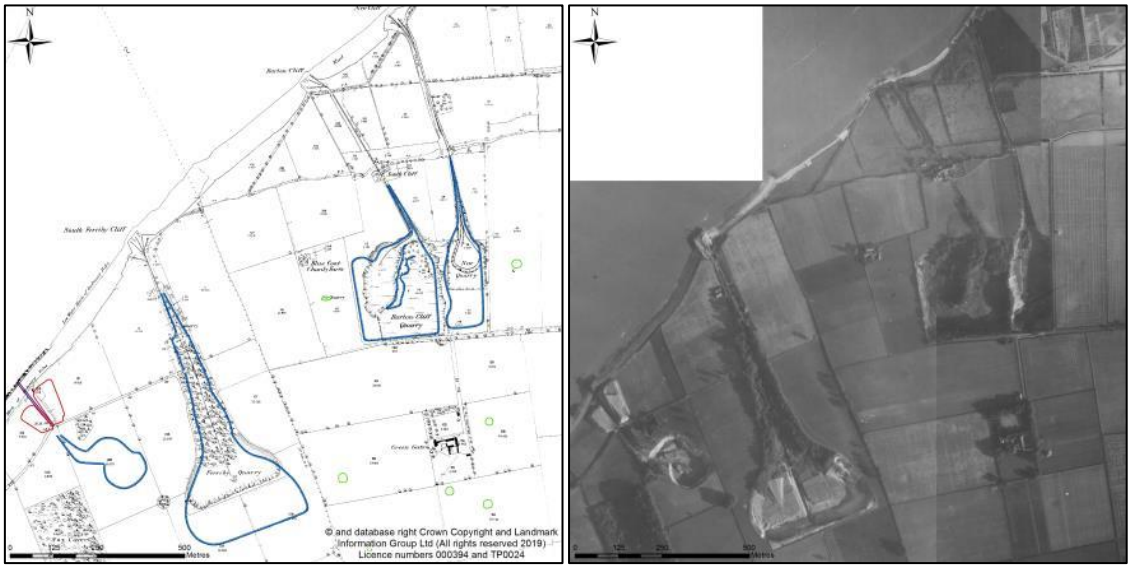


Figure 93 19th and early 20th century chalk quarries at Ferriby Cliff.

MLS22095; 22097; 22101; 22108. Photographs: RAF/CPE/UK/1748 RV 6063 21-SEP-46; RAF/CPE/UK/1748 FB 1128 21-SEP-46; RAF/CPE/UK/1 Pt1 5045 14-DEC-1945 Historic England RAF Photography. Background map OS 1st Edition 1:2500, c1880.

5.5 In defence of the Realm; civilian and military defensive sites

The Humber Estuary has frequently been a major focus of attack during times of conflict and the physical evidence for sites associated with the historic defence of the estuary bears a deep and tangible imprint. The predominant features mapped by the project date from the Second World War, with just six sites of certain First World War origin (Section 4.11, table 10), although some sites may have features of both dates. Only two military sites of pre-20th century date were mapped, both on the north side of the estuary; the remains of Hull Citadel (MHU713) and Paull Point Battery (MHU2663), which saw subsequent use during both World Wars.

Hull Citadel

In 1541, hot on the heels of the religious uprising known as the Pilgrimage of Grace, King Henry VIII ordered the construction of Hull Castle (MHU11690) on the east bank of the River Hull, complete with two blockhouses which were linked to the castle by a wide curtain wall (Gurnham 2011). Hull Castle served the town during the Civil War, suffering substantial damage. In the 1680s work began on remodelling the castle and one of the blockhouses to create the Citadel, a triangular artillery fort. The Citadel continued in use until 1859 and the buildings were levelled in 1864 (NHRE Hob UID 80543). Excavations in the late 1980s exposed some of the surviving below ground structures, and these were mapped by the project from aerial photographs taken at the time.

Paull Point Battery

Paull Point Battery was constructed *c*1856, probably on the site of earlier gun batteries dating back to 1542 and 1807 (NHRE Hob UID 80540). A 19th century practice battery (MHU 18807) is recorded to the south of the main fort and possible earthworks and structures associated with this were mapped by the project. Concrete holdfasts for gun emplacements and a range finder recorded as part of this group of features may be First World War in date. Three coast artillery searchlights (MHU 19732; 19733; 18804) were constructed to the northwest and south of the battery *c*1907. These were mapped by the project along with a further earthwork to the south of the battery, also recorded as a coast artillery searchlight (MHU20489), date unknown. Alterations to buildings on the landward side of Paull Battery were also carried out during the First World War although the battery itself was disarmed during this time.

During the Second World War the battery was used as a submarine base and armament store (MHU 19802; 18800). The battery was mapped by the project from aerial photographs. Additional features are visible on 1940s aerial photographs and these were also mapped: including buildings associated with the submarine mining establishment and domestic officers' quarters (MHU 18801; 18802). A possible searchlight emplacement (MCX 84) was mapped to the north of the battery; this was a 16m wide sub-circular banked earthwork with a hollow centre located within a barbed wire fenced enclosure. The feature appeared degraded and crossed by a footpath on a 1945 aerial photograph, possibly indicating a pre-Second World War

origin. A rectilinear structure on the south side of the main battery was identified as a Second World War degaussing station (MHU18806). Three Second World War air raid shelters (MHU 18803; 18805; 22215) were also identified; one in the corner of a field to the north of the battery, two on the south side, one of which was set into the outer earthwork bank (Fig 94).

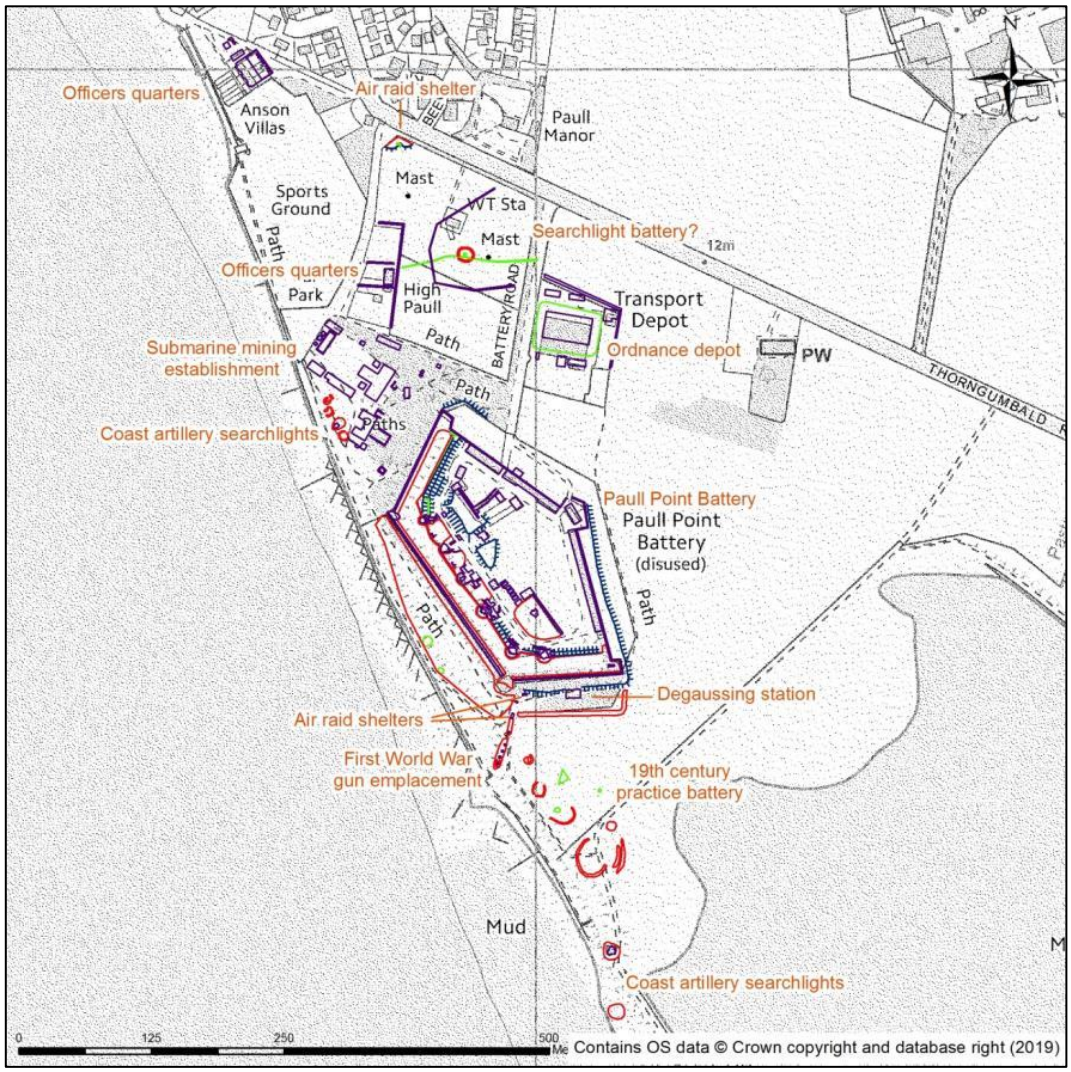


Figure 94 Structures and earthworks at Paull Point Battery mapped by the Inner Humber AI&M project. Background map OS 1st Edition 1:2500, c1880.

A site visit was made to Paull Point battery in July 2019. Investigation revealed the remains of brick surfaces and partial structures within the woods to the north of the battery; thought to be the remains of structures associated with the former submarine mining establishment. Large bramble and scrub-covered mounds to the northwest of the battery may conceal the partial remains of searchlight batteries MHU 18733 and 19733. On the south side of the battery the Second World War air raid shelter (MHU 18805) set into the outer bank survives in fair condition, with steps down into the shelter via a narrow opening that then turns left into the shelter proper (Fig 95). The concrete slab roof was overgrown and the structure was set into the bank and partially below ground level. The remains of a second concrete structure were observed to the south of the air raid shelter, possibly part of a second shelter (MHU 22215). Part of a circular granite setting for a gun emplacement was

also identified; believed to be part of the 19th century practice battery (MHU 18804) (Fig 95).

Figure 95 The remains of brick surfaces in the woods at Paull battery; one of the coast artillery searchlights; air raid shelter set into the battery earthworks; remains of a possible air raid shelter; currently overgrown.

MHU 19802; 18804; 18805; 22215. Photograph: F Fleming.

First World War sites

Only six sites mapped by the project were identified as specifically First World War in date (Section 4.11, table 10), although a number of military sites were visible as degraded or overgrown earthworks in 1940s aerial photographs and these may have been very early Second World War or First World War in origin. The six First World War sites comprised a rifle range (MNL 4132) at Great Coates, Healing; two coastal batteries at Stallingborough and Sunk Island (MNL 1534; MHU 9587); Killingholme Battery (MLS 26130) and a military base (MLS26126) and coastal artillery searchlight (MLS26128) at North Killingholme. Stallingborough and Sunk Island batteries were both re-used during the Second World War.

North Killingholme and Immingham Dock

Prior to the outbreak of the First World War the Admiralty had oil tanks built at Immingham and an oil storage depot established at North Killingholme. When war broke out Immingham was established as a base for the Naval Wing of the Royal Flying Corps (RFC). First named Royal Naval Air Station (RNAS) Immingham it later became RNAS Killingholme and its duties expanded to carrying out coastal

patrols (Crossland and Turner 2012). A battery of two quick-firing 12 pounder guns at North Killingholme was established to protect the oil storage depot, along with an adjoining barracks block. Additional machine guns were emplaced around the site in open weapons pits and three coastal artillery searchlights were positioned along the riverbank and at the end of Killingholme jetty (Fenwick *et al* 2001, 94).

A seaplane base was established at North Killingholme, to the north of the fuel depot there. Immingham Dock became the site of a submarine base with an Admiralty shore base attached. The base became the centre of East Coast Command and this led to a need for more administrative staff. As a result a number of women became employed and this initiative led to the formation of the Women's Royal Naval Service (WRNS). Initially coastal patrols and U-boat operations were undertaken from RNAS Killingholme but ultimately its main function became a training station for sea-plane and flying boat crews. In 1917 a balloon base for U-boat spotting was established in the southwest corner of Immingham Dock (Crossland and Turner 2012).

Naval activity resumed at Immingham with the outbreak of the Second World War. New buildings, jetties and mooring dolphins were built and a vehicle depot established. Defensive features included a security perimeter fence and blast walls to protect important infrastructure. A complex of gun batteries, pillboxes and barrage balloon sites were set up along the coastal fringes and around the dock areas and a torpedo net located across the dock entrance (Crossland and Turner 2012). Probable Second World War military structures within Immingham Dock are visible on 1940s aerial photographs and these were mapped by the project.

Structures associated with Killingholme Battery (MLS26130) and one of the coast artillery searchlights (MLS26128) on the estuary side northwest of the battery were also mapped by the project, as was a possible coast artillery searchlight (part of MLS26130) visible on 1945 aerial photographs just north of Killingholme Battery at TA 16578 20159 (Fig 96).

At North Killingholme the fuel depot (MLS15395) and adjacent military base (MLS26126) are visible on early 1940s aerial photographs, by which time the military base appears disused. A wooden jetty extending from the northeast side of the estuary is believed to be associated with the seaplane base. Between the two main areas of fuel tanks is a domestic military camp (MLS26123) which was also out of use by 1945 and is assumed to also be First World War in date; possibly associated with the seaplane training base. A section of railway line is visible on 1945 aerial photographs, leading into the base from the west. To the west of the base at TA 15566 20711 is a sub-rectilinear banked feature (MLS26117), possibly a building contained by earth banks and likely to be military in origin although its function is unknown (Fig 96). These features were also mapped by the project.

Figure 96 Military complex at North Killingholme, including a fuel depot and military base.

Killingholme Battery is near bottom right of shot (MLS15395; 26117 and 26123-26130). Photographs: RAF/3G/TUD/UK/3 Vp4 5041-2 and 5050-2 14-DEC-45 Historic England RAF Photography.

Second World War sites

The predominant threat during the Second World War was attack from the air. As might be expected for such an important waterway with major urban centres, docks and industrial complexes, the majority of Second World War sites mapped by the project were associated with active defence against this form of attack but also included a range of sites designed to confuse and disorientate enemy aircraft in order to steer them away from their intended targets. These included decoys such as Starfish and QF (dummy fire) sites designed to use fire-fuelled decoys to imitate the impacts of bombing on smaller industrial complexes and strategic sites as well as larger sites intended to simulate a similar impact on the docks at Hull; even including dammed up drainage channels to mimic the mouth of the Hull River.

An early line of defence also included the construction of anti-landing obstacles along the flat land of the estuary edges. The instruction coming down from the Ministry of Defence was to use whatever materials came to hand. Mainly this was earth banks, ditches and wooden posts but on Hedon Airfield a more unusual approach used ranks of old cars set out in a wide grid (see Fig 109). Many of these sites are visible only on the earliest 1940s aerial photographs and by 1945 were almost lost to the visual record altogether.

Also visible on some of the earliest 1940s aerial photographs are large numbers of barrage balloon sites. These ranged in size and were strategically positioned around the perimeter of vulnerable areas and on areas of open ground; fields in the more rural areas and within public gardens, docksides and even bomb sites in Hull city centre. Barges were also moored along the estuary to create a line of balloon defences along strategic parts of the waterside.

By far the largest group of Second World War sites were those aimed at identifying and counter attacking enemy aircraft raids. Along both sides of the estuary there were significant numbers of heavy anti-aircraft batteries as well as smaller sites made up of searchlight batteries and smaller gun emplacements. Many of these sites still partially survive as degraded earthworks and structures, testament to the pounding this area received during both World Wars. A chain home station (MCX422) on the north side of Hedon Road, Hull, was also mapped by the project; part of the early warning system of radar developed during the early 1930s to aid the detection of enemy aircraft.

Two airfields within the project area saw military re-use during the Second World War; Brough and Hedon. Although Hedon never saw active flying during the war it was the site of a number of air defence sites. Brough was used for flying and is seen to be in active use on 1940s aerial photographs. Part of its remit was as a fighter pilot training school.

The extent of the Second World War bombing raids on the Humber Estuary is demonstrated by the large numbers of bomb craters visible on 1940s aerial photographs; particularly focussed within dockyard areas, railway sidings and airfields but also evident along the more open ground of the estuary edges and within more rural areas. Nowhere was the damage quite so heavily inflicted as on Hull. Aerial photographs reveal the scale of the bombing raids on the city centre and dock areas. Large swathes of the city were completely obliterated and buildings flattened. Even before the Second World War began in earnest the city responded to the threat of attack by constructing thousands of public air raid shelters; on every street and terrace within a radius of the city centre and docks, within schoolyards, industrial premises, churchyards and public parks. A total of over 40,000 public air raid shelters were installed in central Hull by the end of the war (Geraghty 1978; Bilton and Mann 2019).

Second World War bombing decoys

From the outbreak of the Second World War in 1939 Britain began to develop a decoy programme under the overall control of Colonel J F Turner (Dobinson 1996b; Dobinson 2000). This comprised a complex and varied deception strategy using dummy installations, diversionary fires and simulated urban lighting. Some of the earliest Second World War sites identified and mapped by the project were bombing decoys, the majority of which were located on the north side of the estuary at Paull Holme and Cherry Cobb Sands (Fig 97).

Paull Holme and Cherry Cobb Sands, to the southeast of Hull, were the sites of a series of decoys intended to simulate the docks at Hull. These used light systems, or QL (dummy urban lighting) sites, positioned along the estuary side to mimic the wartime lighting permitted during night-time blackouts (e.g. Council for British Archaeology 1996; Dobinson 1996b; Dobinson 2000). These are visible on 1940s aerial photographs as a series of triangular and rectilinear tanks interspersed between rows of linear ditches flanked by small raised mounds of earth. These latter features may have been part of the decoy system but could alternatively have been anti-landing obstacles, of which there were numerous examples along this part of the estuary (see below). The decoy docks were positioned either side of post

medieval drains leading towards the estuary from Pant Drain to the north, which were dammed and flooded to simulate the mouth of the River Hull.

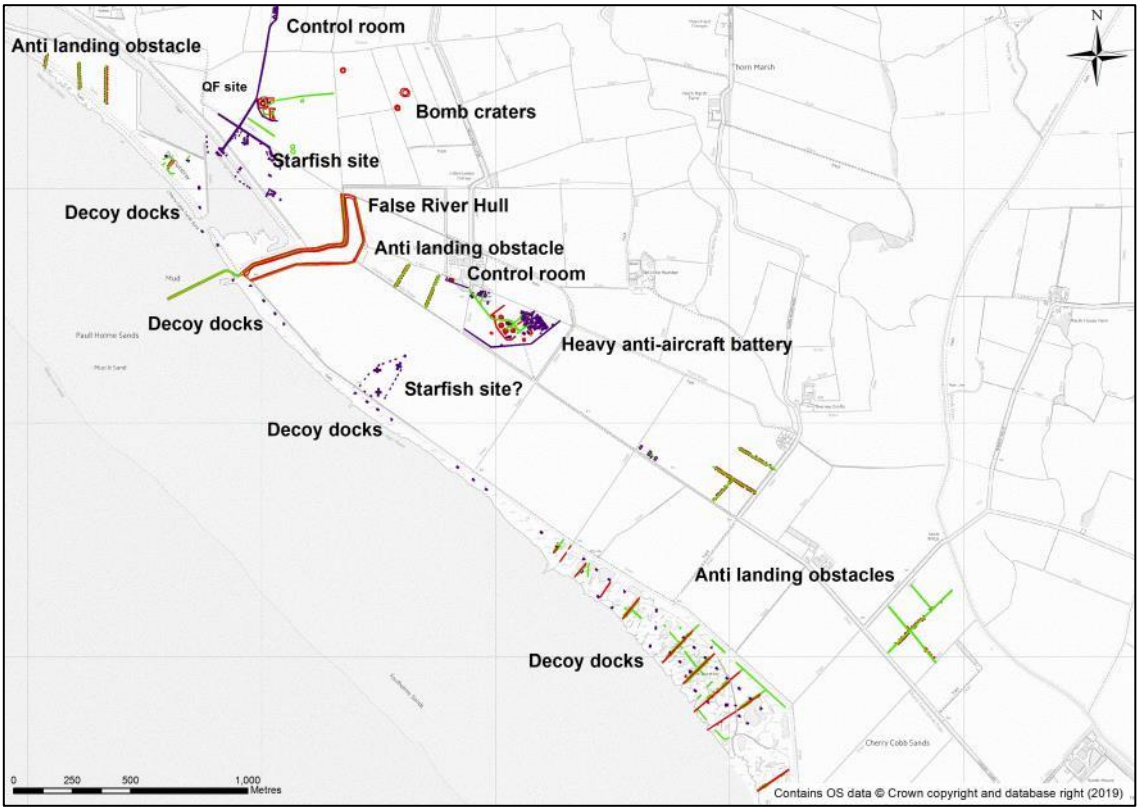


Figure 97 Second World War sites on Paull Holme and Cherry Cobb Sands.

To the northeast of the false River Hull there were additional decoy sites, comprising a permanent Starfish site (MHU18426) and a QF site (MHU 2670; 19147); both using oil fired systems to simulate successful bombing raids on the city docklands and therefore encourage enemy aircraft to drop their bombs away from the intended target zone (e.g. Council for British Archaeology 1996; Dobinson 1996b; Dobinson 2000). The QF and Starfish sites were linked by a roadway leading south off Dark Lane: a group of structures are visible partway along this road on 1940s aerial photographs, one of which was a control room for these sites (Fig 97 and see Fig 98 for detail of these two sites). A smaller possible bombing decoy (MCX450) is also visible on 1940s aerial photographs to the southeast of the artificial reservoir; the character of the features indicates a possible Starfish site but this is not certain (Fig 97).

Closely associated with this cluster of Second World War sites at Paull Holme and Chery Cobbb Sands was a heavy anti-aircraft battery (MHU18843) at Little Humber. A rectilinear structure to the northwest of the battery on a 1948 aerial photograph is a control room (MHU18428) for the decoy docks to the southwest. The structure appears to comprise a 13m by 8.5m rectilinear building contained on three sides by an earthen bank (Fig 97). The relative success of this group of bombing decoys might be demonstrated by the cluster of bomb craters visible on 1940s aerial photographs to the northeast (Fig 97).

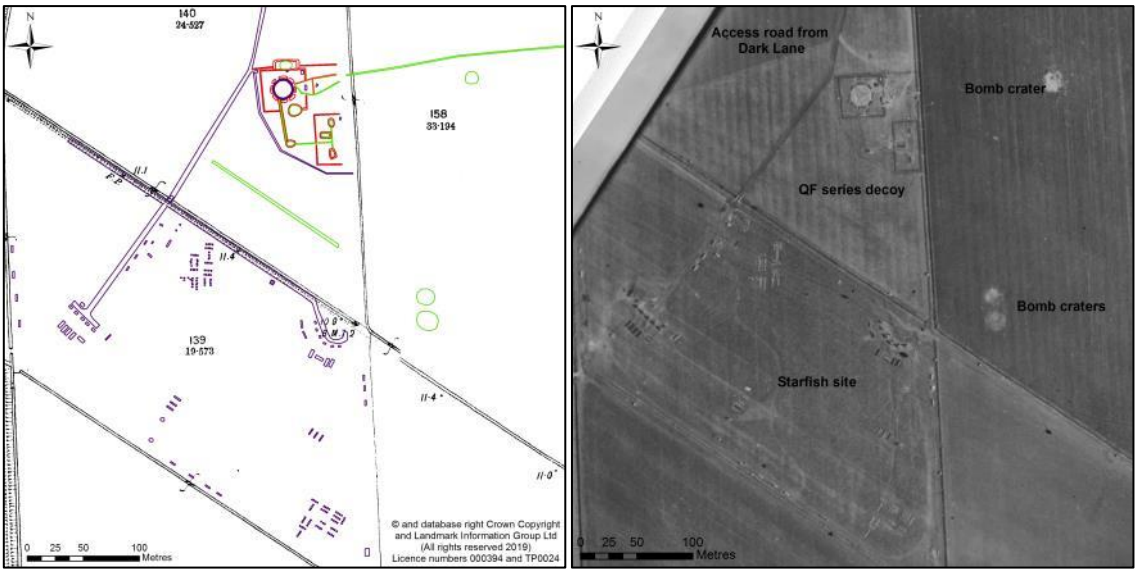


Figure 98 Starfish site at Paull Holme, with a QF oil series site to the north.

MHU18426; 2670. Photograph: RAF/HLA/550 V 5125 27-MAY-1942 Historic England RAF Photography. Background map OS 1st Edition 1:2500, c1880.

Anti-landing obstacles

Extensive areas of Second World War anti-landing obstacles are visible on the earliest 1940s aerial photographs; predominantly along both sides of the estuary mouth between Grimsby and Immingham on the south side and Cherry Cobb Sands and Hedon on the north side (Fig 99). The features typically comprise grids of narrow ditches and/or banks extending across whole fields and flanked on both sides by small earth mounds. Some of these features are also located along parts of the foreshore, within the extent of the decoy docks discussed above. Often the anti-landing obstacles are situated together across large areas, although smaller discrete sites are also evident. This suite of sites is only visible on aerial photographs for a short period of time and the majority have disappeared by 1945. On some later 1940s aerial photographs the linear ditches or banks partially survive but are easily mistaken for field boundaries or drainage ditches without knowledge of the earlier features.

At Hedon Airfield a grid of used cars was constructed to deter enemy use of the site during the Second World War. The cars are visible on 1942 aerial photographs (see Fig 109).

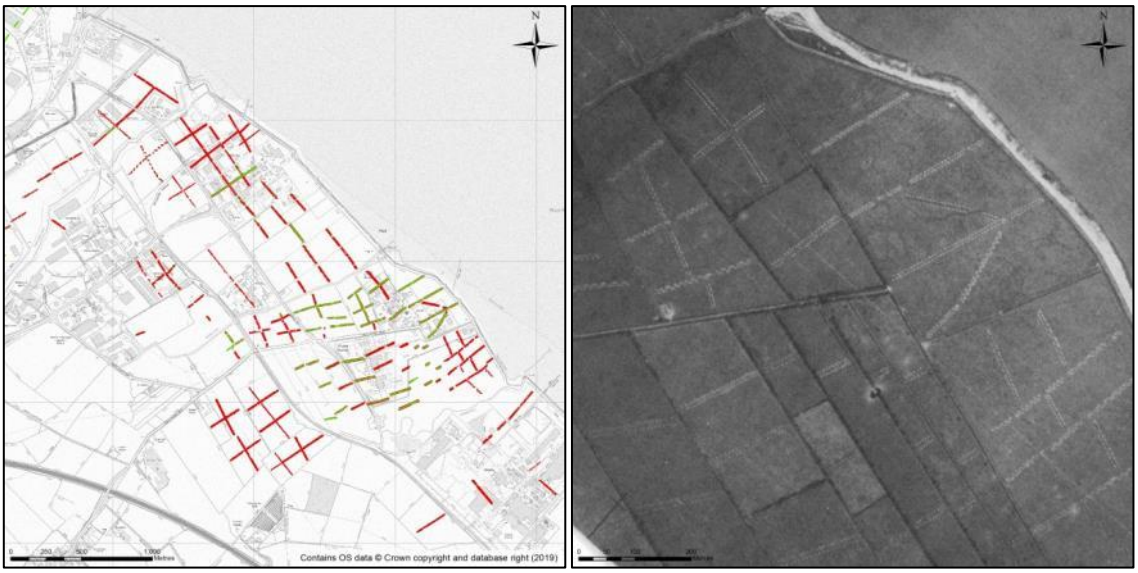


Figure 99 Anti-landing obstacles along the coast to the northwest of Grimsby.

MCX 243; 245-250. Photograph: RAF/613A/BR19/3 VK 10 02-SEP-1940 Historic England RAF Photography.

Barrage balloon sites

The concept of using barrage balloons in air defence originated during the First World War and was used by all sides to deter enemy aircraft. Due to their effectiveness plans were already in hand to re-deploy them as a line of defence in future conflict. Hull was amongst the first cities to be chosen for a barrage balloon unit at the start of the Second World War and the balloons here were under the operation and management of the 17th Balloon Centre at RAF Sutton on Hull, which opened in 1939 (Bacon 2002; The War Office 1943).

Barrage balloon sites were positioned at strategic points along both sides of the Humber Estuary during the early 1940s. As with both types of sites above, these are also only visible on the earliest 1940s aerial photographs, although the level of detail that can be identified from these is often remarkable. More than 24 waterborne and 24 land-based balloon sites are recorded as being positioned around Hull and along the Humber Estuary (Bilton and Mann 2019).

The Inner Humber AI&M project mapped 41 barrage balloon sites in total, comprising permanent land-based sites as well as a number of waterborne sites stationed on barges along the centre of the estuary. The barrage balloon sites are located within and around the Hull docks and across the southern part of the city centre along the docksides. Several sites were additionally positioned around the Saltend Chemical works, on the outskirts of Immingham Dock and in the vicinity of North Killingholme Haven (Fig 100).

The earliest deployments of barrage balloons were flown directly off motorised winches which needed reset every time the wind changed direction. This resulted in a high balloon casualty rate so a more complex system was developed which comprised an all-directional bed on which the balloon was tethered. A later addition

was a wire circle around 180 feet (approximately 55m) in diameter around which a tail-guy could be tethered according to wind direction (The War Office 1943).

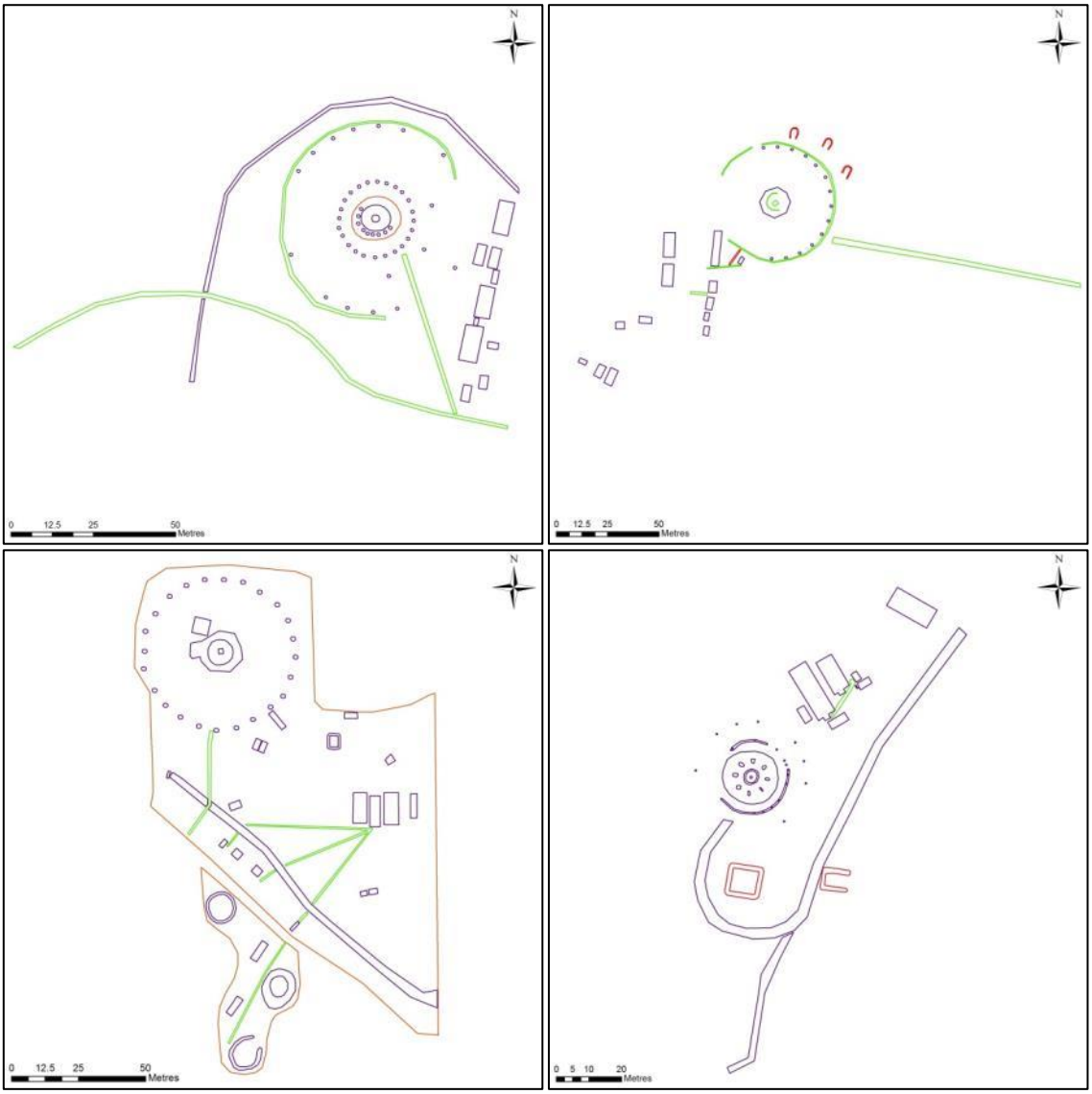


Figure 100 Examples of Second World War barrage balloon sites.

Clockwise from top left: Saltend, Hedon and Dairycoates; (MCX337; 399; 420 and 874).

In some of the largest and clearest examples of barrage balloon sites mapped by the project a central circular mooring base is visible, with one or more outer rings of tethering points. The overall diameter of these outer rings can vary between 50m and 60m across and are thought likely to be outer wire circles constructed for the tail-guy. A number of smaller balloon sites were also mapped by the project where there appeared to be single tethering circles of smaller diameter, varying between 12m and 25m across. These sites were typically within the Hull docks and in the vicinity of Immingham and North Killingholme and may have been some of the earliest balloon sites to be established. The larger sites, which were more common on the outskirts of Hull, near Saltend and Hedon, to the east, and near Dairycoates to the west, may have been later additions, but this is speculative based on the presence of the outer wire circles.

Additional features associated with the barrage balloon sites usually include small groups of buildings adjacent to the balloon mooring and an access road into the site. Occasionally the site is contained within a fenced compound. In some of the earliest 1940s aerial photographs the truck carrying the balloon is present, along with a number of additional vehicles, and the barrage balloons are visible in suspension. For the waterborne sites along the estuary this was the only way to identify the location of the barges.

Heavy anti-aircraft batteries

Air defence during the Second World War used a combination of visual observation and radar to guide anti-aircraft artillery, which was divided between light (LAA) and heavy (HAA), dependent on the calibre and ballistic properties of the weapons used (Council for British Archaeology 1996; Dobinson 1996c). The type of weapon also dictated the operational facilities that were needed; HAA batteries were the more of these complex sites, with a number of concrete-built gun pits positioned around a central command post (Council for British Archaeology 1996).

It is not uncommon for Second World War HAA batteries to have a combination of gun emplacement types; however, there is some degree of dateable morphology (Dobinson 1996c). The first gun emplacement design of 1938 consisted of an octagonal shuttered concrete gun pit with twin axial entrances enclosed by steel gates. Inside were up to six internal ammunition recesses and a central concrete gun holdfast (see Fig 101). By 1942 the design had been modified to comprise an octagonal gun emplacement with a single entrance and a number of external ammunition recesses and one or two rectilinear shelters, external to the structure but internally accessed; one for gun maintenance, the limber gunner's shelter, and one for the gun crews to take rest in (Council for British Archaeology 1996; Dobinson 1996c; The War Office 1943) (and see Mere Farm, Winteringham, for example, Fig 102).

The command post was typically a rectangular brick or concrete structure, often semi-sunken or protected by earth banks. Plotting, telephone and rest rooms would be under cover of a concrete roof, with detection and range finding equipment sited in an open enclosure within the perimeter of the command post. Ammunition magazines were sited closely adjacent to or inside the arc of gun emplacements. Usually these comprised simple hard standings or Nissan huts contained by a brick or concrete blast wall with earth banks; sometimes more substantial semi-sunken concrete structures were constructed (Council for British Archaeology 1996).

A concrete service road would lead from the main gate to a loop around the command post, taking in the ammunition magazine and with an offshoot to each gun emplacement. An ancillary domestic site of Nissen and timber huts would provide billeting for the battery detachment and any necessary washing and cooking facilities and smaller maintenance buildings (Council for British Archaeology 1996; Dobinson 1996c). Sometimes abandoned domestic sites were reused as prisoner of war camps or occupied by families made homeless: this was known to be the case for a HAA battery at Winteringham (MLS21368), for example.

The use of radar as a detection and early warning system was under development from the early 1930s and HAA batteries were one of the first sites to put this equipment to good use (see Fig 102). Gun laying radar was introduced from September 1939, originally comprising a simple range and spot-bearing finder which could be wheeled into position. By late 1940 improvements to this included a radar platform consisting of a raised octagonal post and wire ground mat intended to create a level artificial horizon and eliminate interference (Council for British Archaeology 1996; Dobinson 1996c). A concrete ramp provided to access the platform.

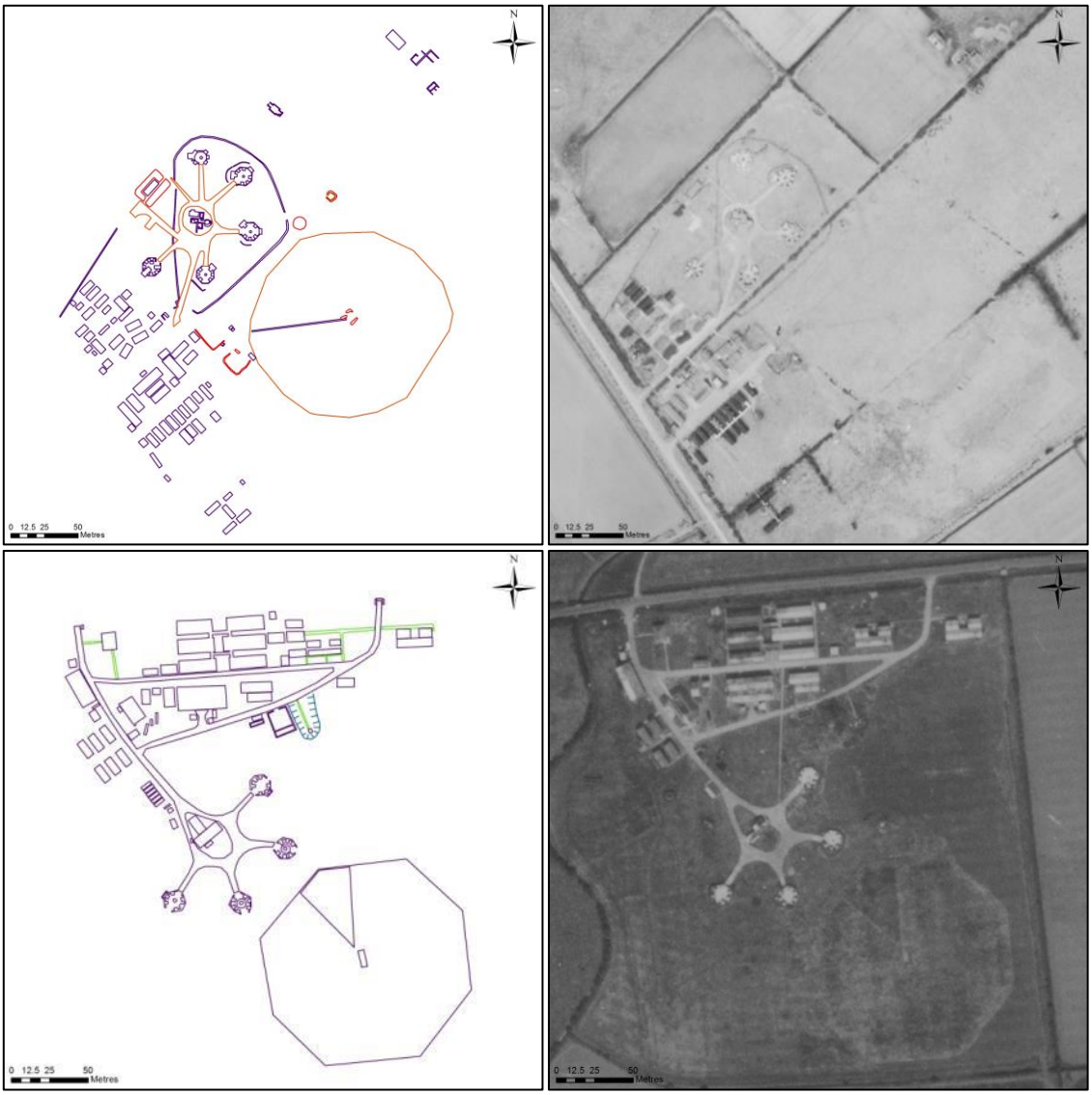


Figure 101 HAA batteries at East Marsh and Paull; both with gun laying radar platforms visible on 1940s aerial photographs.

MLS21427 & 26241; MHU18841. Photographs: RAF/3G/TUD/95 Vp1 5056 26-MAR-1946; RAF/FNO/109 FS 2033 20-AUG-42 Historic England RAF Photography.

Ten HAA batteries were mapped by the Inner Humber AI&M project. Of these, one at Great Coates (MNL1526) is visible as earthworks by 1941 and is recorded as unarmed by this time. Eight have octagonal gun pits with internal ammunition recesses. One (MLS19692), near Mere Farm, to the south of Winteringham, has

octagonal gun pits with external ammunition recesses and two attached shelters, possibly indicating a later date for this site (see Fig 102). Two sites, one at East Marsh, North Lincs, (MLS21427) and one at Paull (MHU18841), have octagonal gun laying radar platforms visible on 1940s aerial photographs (Fig 98). Whether coincidental or not is not known but these two sites are directly opposite each other on either side of the neck of the estuary just before the point where the Humber River turns west past Hull.

Six of the HAA batteries have some structures still extant. The three most well preserved, at Stone Creek (MHU4258), Mere Farm (MLS19692) and West Marsh Creek (MLS9649), are Scheduled Monuments.

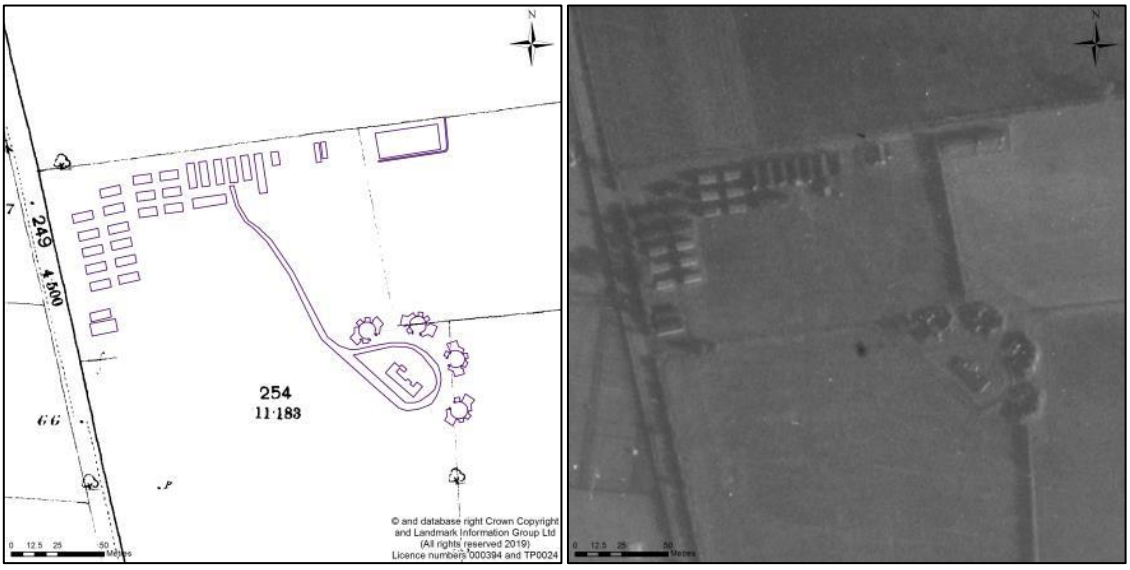


Figure 102 HAA battery at Mere Farm, Winteringham, with octagonal gun pits with external ammunition recesses and two attached shelters; possibly a later design.

Photograph: RAF/CPE/UK/1748 RV 6072 21-SEP-46 Historic England RAF Photography. Background map OS 1st Edition 1:2500, c1880.

Chain Home Station, Hedon Road

The Chain Home radar system was developed from 1935 onwards by scientists at Orfordness and then at Bawdsey Research Station in Suffolk. The research continued throughout the war as technology progressed. Two main types of Chain Home installations were built; East Coast and West Coast stations. The East Coast stations followed the pattern of the experimental station set up at Bawdsey, with a protected main building for housing the equipment, transmitter aerials on 107m high steel towers and receiver aerials mounted on 73m high timber towers (Council for British Archaeology 1996).

A radar station (MCX422), possibly a Chain Home station, is visible on 1940s aerial photographs on the north side of Hedon Road to the east of Hull. The site comprises a central building, which in 1946 still had a camouflaged roof. Positioned around the building are five tall pyramidal masts with 4.5m wide square bases. In between these are a number of smaller square structures of uncertain function. An access road leads into the site from Somerden Road to the west (Fig 103).

Figure 103 Possible Chain Home station off Somerden Road, Hull.

MCX422. Photograph: RAF/3G/TUD/UK/217 V 5021 23-MAY-46 Historic England RAF Photography. Background map OS 4th Edition 10560 series, 1:2500, c1938-1946.

Light anti-aircraft batteries, pillboxes and searchlight batteries

A wide range of light anti-aircraft (LAA) guns were used during the Second World War. They were intended to be light and mobile and artillery sites often consisted of little more than a small square earth-banked enclosure revetted with sandbags, blockwork or timber. There was a single entrance into the enclosure with room for a single mounted tripod and a number of integral ammunition lockers (Council for British Archaeology 1996; Dobinson 1996c).

Concrete pillboxes were also used as defensive posts associated with beach defences, stop-lines and nodal points, as well as being used to defend coastal batteries, airfields and important facilities such as radar stations and factories. More than 18,000 were built during 1940, typically comprising flat-roofed squat buildings with one or two entrances and a series of open slits or firing loops designed to provide interlocking fields of fire with neighbouring pillboxes over anticipated directions of attack (Council for British Archaeology 1996).

During the Second World War almost the entire country was covered with a grid layout of searchlight batteries which were used to identify and intercept enemy aircraft at night and direct anti-aircraft fire. They also forced enemy aircraft to fly high, decreasing their bombing accuracy. A typical searchlight site would comprise a circular earthwork approximately 9m in diameter for a 0.9m light, a predictor emplacement, at least one LAA machine gun pit and a number of huts for the battery detachment (Council for British Archaeology 1996).

There were 12 searchlight batteries mapped by the Inner Humber AI&M project and 17 gun emplacements, pillboxes or LAA batteries (Section 4.11, table 11). In addition there were a number of undated enclosures and/or earthworks that were of

uncertain origin but which may also be of Second World War date. These features were typically small sub-circular 'doughnut' or crescentic banked earthworks, which were identified both as individual sites and as part of a group of features; generally searchlight batteries, as at Whitton (MLS21961) and Holme Hill (MHU19145), for example (Fig 104). Many of these earthwork features were poorly defined on aerial photographs and therefore difficult to accurately identify but were assumed on balance to be individual LAA gun posts, probably for smaller bore machine guns such as Browning or Bren guns, for example.

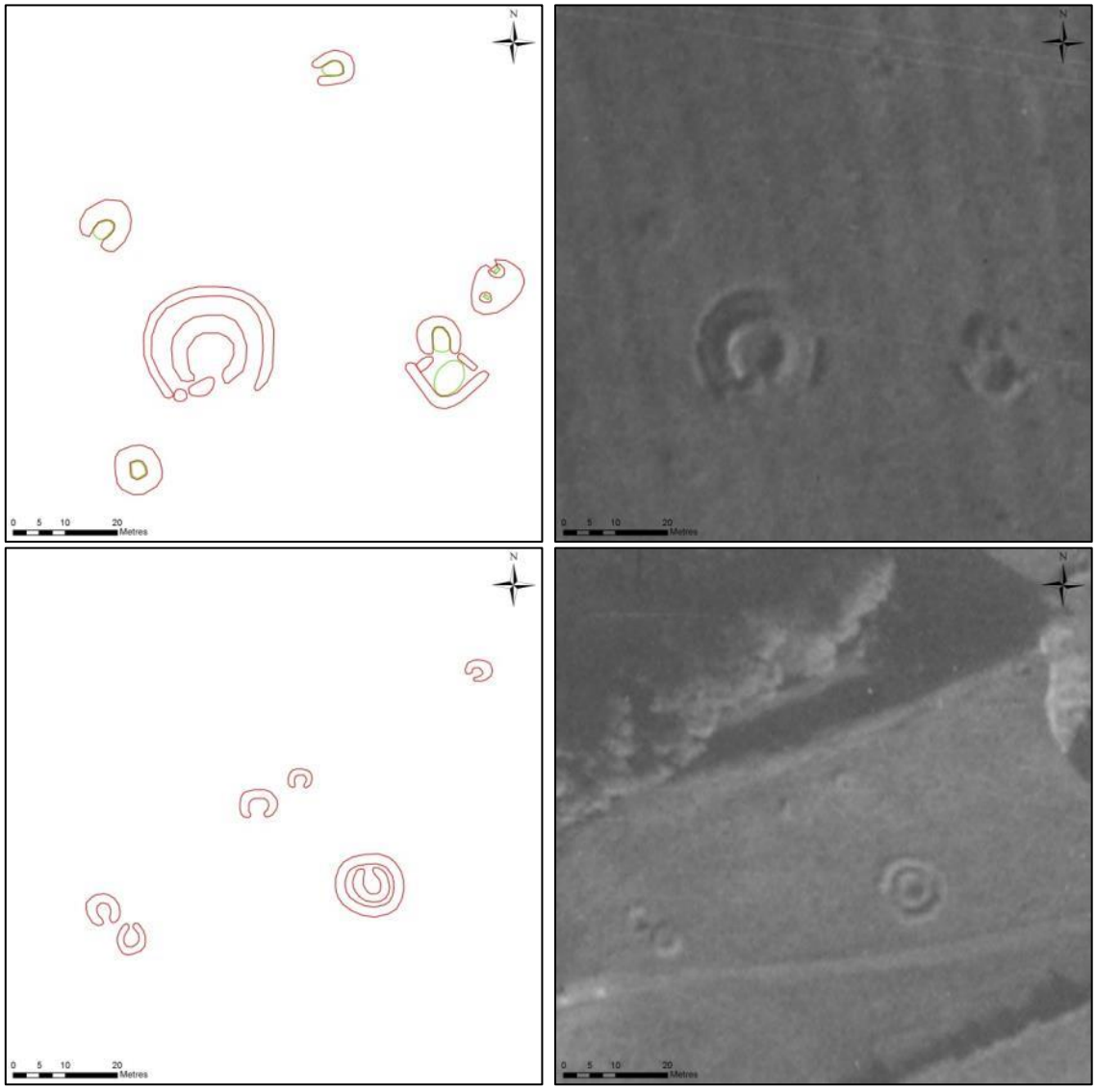


Figure 104 Searchlight batteries at Holme Hill and Whitton, both with probable LAA gun emplacements.

MHU19145; MLS21961. Photographs: RAF/CPE/UK/1748 RP 3101 21-SEP-46; RAF/541/189 RS 4052 26-OCT-48 Historic England RAF Photography.

At East Marsh Farm, Goxhill, a searchlight battery (MLS25936) is visible on a 1945 aerial photograph, accompanied by a group of ancillary buildings and several smaller banked earthworks also thought to be forms of LAA gun emplacements, although some of the features are poorly defined by this time (Fig 105).

Few of the features mapped as part of this group of sites survive extant but a site visit to the searchlight battery at Whitton (MLS21961) in July 2019 revealed that the earthworks there do survive in fair to poor condition. Although low to the ground the features remain distinct; particularly the largest of the circular earthworks. Currently in a field but on a public footpath, these features may be at medium risk of damage or loss due to lack of awareness or understanding. An archaeological survey and assessment would be recommended for this site, which has also been added to the Scheduling candidate list for this project (See Appendix 3).

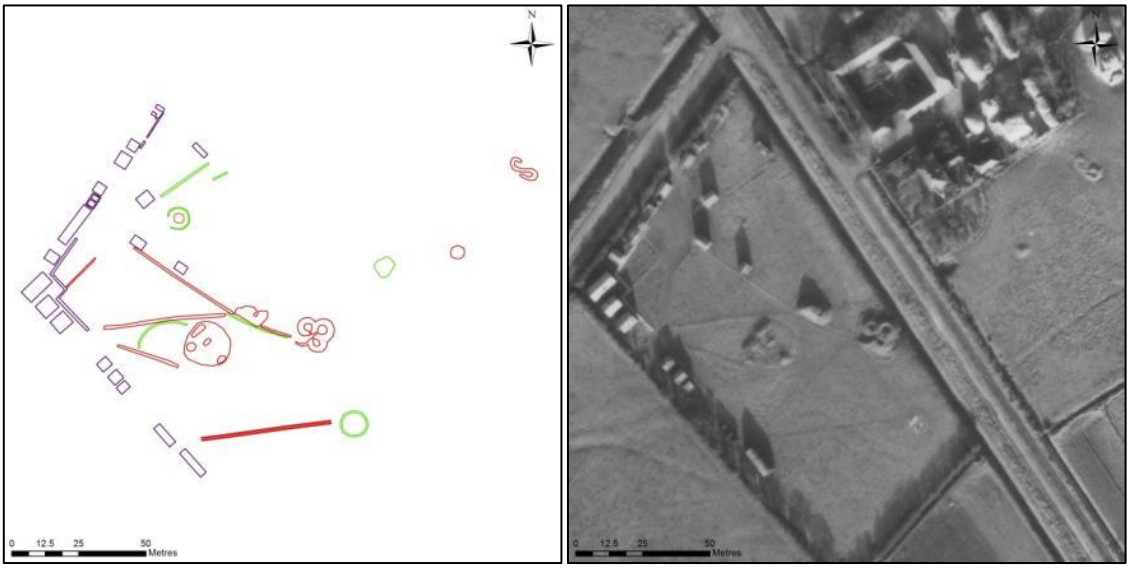


Figure 105 Searchlight battery at East Marsh Farm, Goxhill, with ancillary buildings and additional earthworks thought to be LAA gun emplacements.

MLS25936. Photograph: RAF/33G/TUD/UK/3 Pt1 5054 14-DEC-1945 Historic England RAF Photography.

Just four pillboxes were mapped by the project; near Stallingborough Fort (MCX240), Brough Airfield (MCX1381) and at Salt End, Preston (MCX370 and 376). To the west of Hedon a site (MCX383) comprising two squat structures within barbed wire enclosures is visible on 1940s aerial photographs. The site is located close to the main approach into Hedon from the west and just south of Hedon Airfield. It may be some form of defensive position, possibly pillboxes and barbed wire entanglements. An access track leading off the main road is also visible on 1940s aerial photographs, along with two parallel lines of possible barbed wire located 200m east of the site and possibly associated with it (Fig 106).

Figure 106 Possible pillboxes within barbed wire entanglements to the west of Hedon.

MCX383. Photograph: RAF/HLA/550 V 5172 27-MAY-1942 Historic England RAF Photography.

Road Block, Saltend

Between 1940 and 1942 a system of anti-invasion defences were developed, originating in plans put in place by General Edmund Ironside. As part of the defensive works major anti-tank stop-lines were established; the principal inland barrier being the General Headquarters (GHQ) Stop-Line which ran from southwest England through London and onwards into Scotland and Wales (Council for British Archaeology 1996; Dobinson 1996a). Forward divisions to the south and east of this line were also established, intended to disrupt and delay any breakthrough advances. One of these forward divisions ran north from the northern side of the Humber in the vicinity of Hull and Saltend (Dobinson 1996a Fig 3). The stop-lines frequently improvised from existing features such as waterways, embankments, railway lines and bridges, for example. New features were also constructed to create anti-tank obstacles. Accompanying features might include pillboxes, weapons pits and gun emplacements, barbed wire and minefields (Council for British Archaeology 1996; Dobinson 1996a).

A Second World War road block (MCX375) is visible on a 1942 aerial photograph to the east of Saltend. The feature comprises two semi-circles of barbed wire fence either side of Saltend Lane to the north of the Saltend Chemical Works. Within the semi-circles there are grids of small structures, possibly post or concrete blocks. A road block comprising gates and a small command building bars the road at this point. To the east is a long line of barbed wire fencing extending southeast to the edge of Hedon Haven, possibly flanked by a ditch on its northeast side. This fenced line extends across fields occupied by anti-landing obstacles (MCX380), which the

fenced line appears to respect, suggesting it was a later introduction. To the southeast of the semi-circular enclosure is a pillbox (MHU19126). Closely adjacent features include a possible searchlight battery (MCX378), possibly re-used as a barrage balloon site, to the east and gun emplacements (MCX369) to the west, positioned at the corners of a chemical works or fuel storage depot on the north side of the main Saltend complex (MCX343) (Fig 107). The features are thought to form part of a defensive stop-line and may be part of the forward defences ahead of the main GHQ stop-line; possibly that referred to in Dobinson (1996a, Fig 3).

Figure 107 A road block and defensive line to the north of Saltend extends northeast from Hedon Haven. MCX375. Photograph: RAF/HLA/550 V 5170 27-MAY-42 Historic England RAF Photography.

Brough and Hedon Airfields

Two military airfields within the project area were used in some form during the Second World War and features associated with these used were mapped by the project (Section 4.11, table 11). Brough started out in the early 1916 as an aircraft factory and test facility for military seaplanes. During the inter-war years the range of aircraft being produced extended to include both military and civil aircraft. The site also became a training school and in 1937 a bespoke flying school building was constructed, designed by Hull architects Williams and Jopling. During the Second World War the school trained RAF fighter pilots (BAE Systems 2019).

Aerial photographs of the early to mid-1940s show some of the developing structures and changes to the airfield runways and hangars. The runways are first visible on 1946 aerial photographs, as are hangars and aircraft hard standings on the east side of the airfield. Also visible by this time are two areas of Nissan type huts in the west of the site; presumed to be ancillary domestic camps (Fig 108).

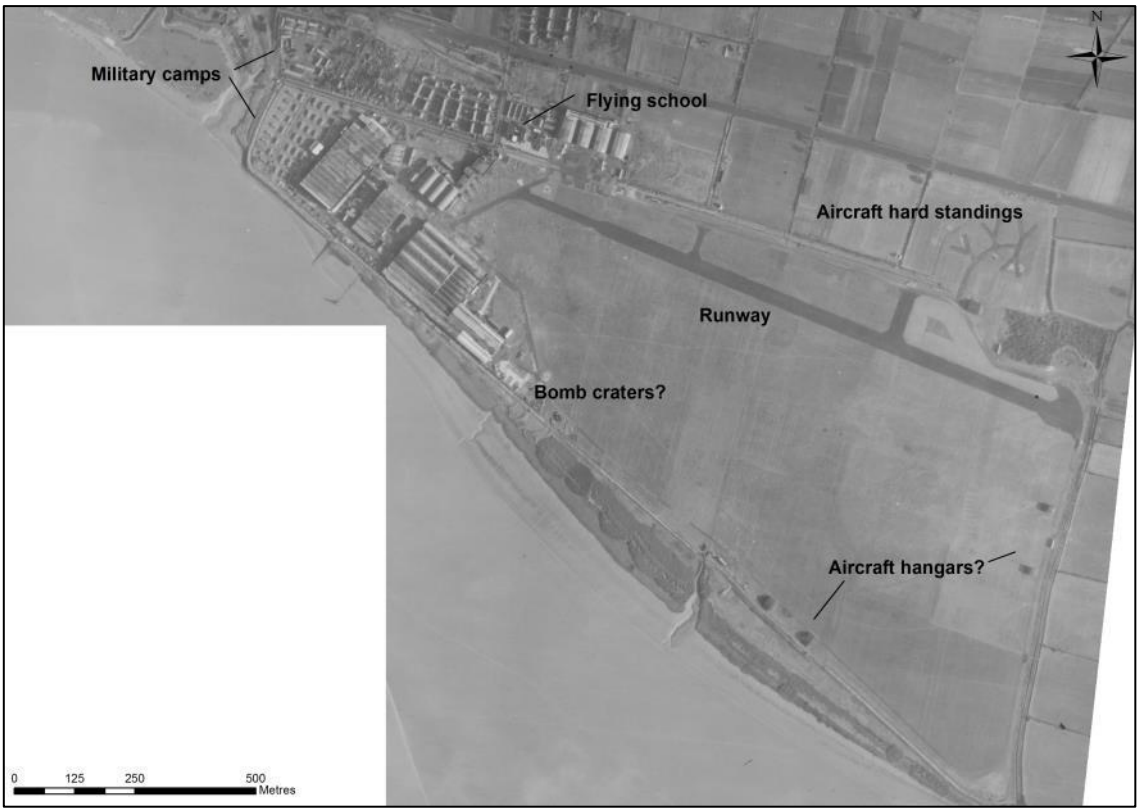


Figure 108 Brough airfield as it looked in 1946.

MCX1382. Photograph: RAF/CPE/UK/1748 FS 2125-6 21-SEP-46 Historic England RAF Photography.

Hedon airfield was not actively use for flying during the Second World War but a number of military sites were established there during this time and features associated with these are visible on 1940s aerial photographs and were mapped by the project. These sites include a ZAA rocket battery (MHU20208) in the northeast corner of the airfield and a light anti-aircraft (LAA) battery (MHU19124) on the south side. To the west of the LAA battery, also on the south side of the airfield was a barrage balloon site (MCX385). An anti-landing obstacle (MCX389) formed of a grid of old cars is visible on early 1940s aerial photographs in the northeast corner of the airfield. Additional to these are numerous bomb craters (MCX364) (Fig 109).

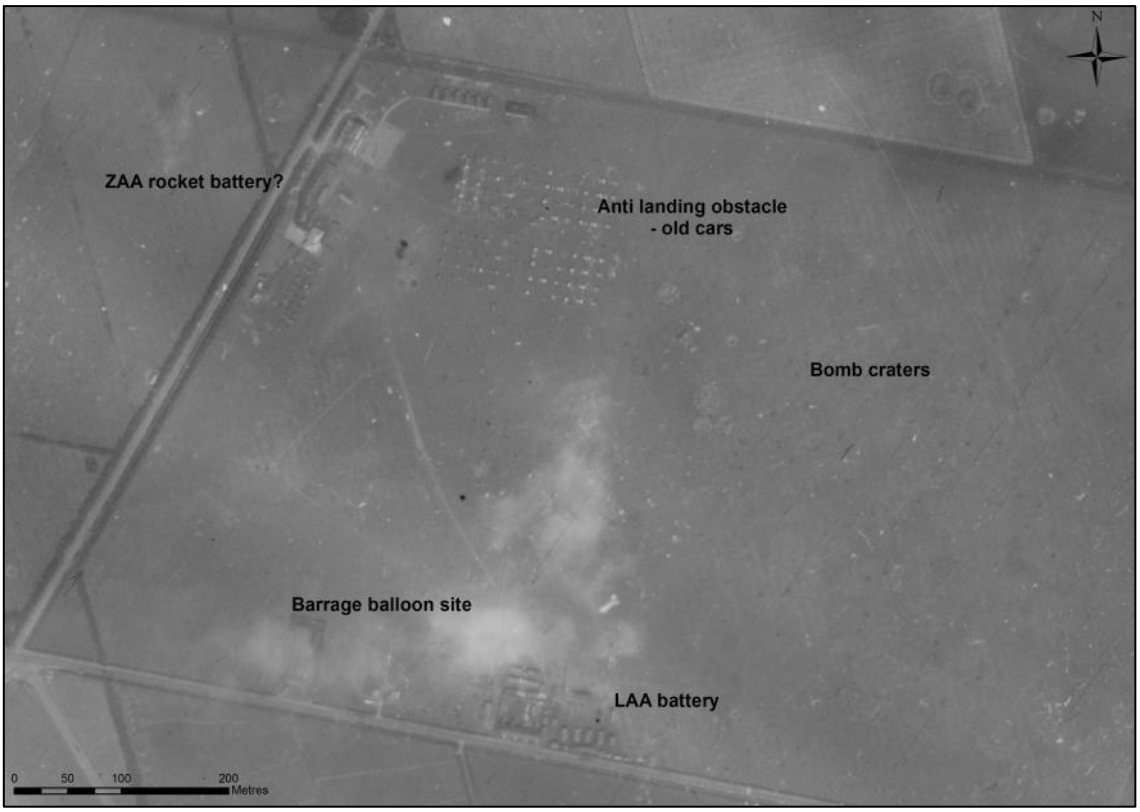


Figure 109 Second World War sites on Hedon Airfield.

Photograph: RAF/FNO/109 FP 1027 20-AUG-42 Historic England RAF Photography.

Hull: bomb sites and air raid shelters

Outside of London, Hull suffered the most frequent and prolonged bombing raids of the Second World War. The first raid on the city was on the 19th June 1940 and the raids continued until March 1945, with an official death toll of 1200 and the number of people injured as a result of enemy action more than twice that. The city was particularly badly hit throughout 1941, with consecutive raids on the 7th and 8th of May exacting the highest death toll so far, with over 400 lives lost (Bilton and Mann 2019; Geraghty 1978).

Hull suffered 82 bombing raids in total over the span of the Second World War and the scale of the bomb damage around Hull City Centre and the docks is evident from 1940s aerial photographs. These show the destruction of bombed and burnt out buildings and also the relative speed at which these sites were cleared to leave large empty gaps within the streets and terraces. Numerous bomb craters are also visible, spread out across the docks and railway sidings and within the surrounding fields. Typically bomb craters are not identifiable within Hull itself although they are occasionally visible as distinct features. The project mapped all bomb sites, bomb craters and ruined structures within the project area (see Section 4.11, table 11); where the earliest aerial photographs showed ruined buildings these were mapped rather than the subsequently cleared sites (Fig 110).

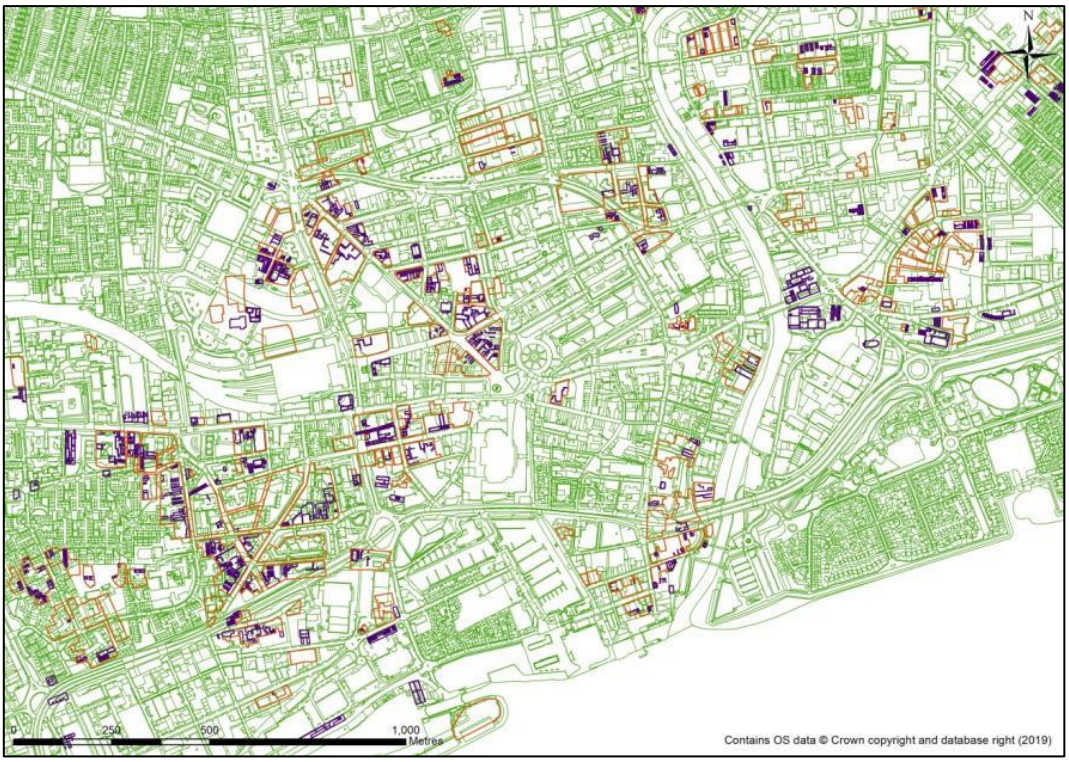


Figure 110 Bomb sites in Hull City Centre.

The construction of air raid shelters in Hull began following the Munich Crisis of 1938. By the end of the war over 40,000 communal and domestic air raid shelters had been built at a cost of £1,500,000 (Bilton and Mann 2019; Geraghty 1978). Shelters were typically of brick or concrete construction with reinforced concrete roofs. The style of shelter ranged from simple rectangular structures with one or two entrances, to more complex structures with two or more entrances protected by external blast walls.

Aerial photographs of the 1940s reveal the high number of communal air raid shelters lining the main streets of Hull around the city centre. In addition there were smaller shelters within each terrace of houses and groups of shelters within industrial complexes and public institutions such as churches, school and hospitals, also within some public parks. A number of air raid shelters are also distinguishable from other dockyard buildings within the dock areas. All these types of communal shelters were mapped by the project where identifiable (Fig 111). Private domestic air raid shelters were not mapped, however.

Figure 111 Communal air raid shelters within the streets and terraces north of Albert Dock, Hull.

Groups of shelters were positioned within industrial and public complexes, such as mills, schools and churches, for example.

Queens Gardens air raid shelters and underground bunker

Early 1940s aerial photographs of Queen's Gardens, Hull, show a range of linear earthworks along the north side of the gardens, with construction of a large rectilinear structure underway in the centre of these (Fig 112).

Figure 112 Air raid shelters, an underground bunker and a barrage balloon site in Queen's Gardens.

MHU19614; MCX 889, 1139 and 1140. Photograph: RAF/613E/UK/558 V 2262 04-SEP-40 Historic England RAF Photography.

The structure (MHU19614) was originally intended as part of a new police headquarters but was instead used to house a bomb-proof underground control centre with a reinforced concrete basement. The earthworks either side may also be part of the shelter system. Although the details on aerial photographs are not clear there appears to be multiple entrances into the structures and small raised square features along the centre line may be air vents (Fig 112). A barrage balloon site (MCX889) is visible adjacent to the underground bunker in 1940, with a barrage balloon flying aloft. Along the south side of Queen's Gardens is a further row of rectilinear air raid shelters (MCX1139). By 1942 a rectangular water tank (MCX1140) had also been positioned here.

The northern strip of Queen's Gardens is still raised although currently under planting with provision for stepped entrances into the gardens from Dock Street. A café occupies a modern concrete building approximately halfway along the strip. Older brickwork faces the central section of the raised area and this possibly relates to some of the Second World War structures formerly on this site (Fig 113).

Figure 113 Older brickwork facing the raised strip of ground along the north side of Queen's Gardens may be associated with the former Second World War air raid shelters and underground bunker.

MHU19614; MCX889. Photograph: F Fleming.

6. CONCLUSIONS

The mapping of the Inner Humber Estuary has identified 2105 monuments of which 1827 (87%) were previously unrecognised or unrecorded in the county and national historic environment databases. The project mapped a wide range of sites from the Bronze Age through to the early 20th century, although pre-Iron Age sites were relatively few in number.

Of the 2105 sites recorded, 291 (14%) were still extant or partially extant earthworks and 82 (4%) were extant buildings or structures. A total of 1528 (72.5%) sites were completely or partially levelled and destroyed. The remaining 204 (9.5%) sites were visible as cropmarks or soilmarks on aerial photographs, some 32 (16%) of these also having some surviving earthworks. In this respect the project fulfilled its aim of improving knowledge of the archaeological resource, by providing fuller awareness of the range and extent of archaeological remains within the project area.

6.1 Outcomes

The results of the mapping project have improved our understanding of human activity around the Inner Humber Estuary and its adjacent high ground. Sites of prehistoric date included a small number of Bronze Age barrows and ring ditches of possible Bronze Age or later date. The predominant evidence for prehistoric activity within the project area, however, was for Iron Age or Roman settlement, field systems, roads and trackways. A number of these sites related to small individual settlements located on the lower lying ground; most likely to have been native farmsteads and industrial sites which were probably abandoned ahead of rising sea levels at the end of the Roman period. On the higher ground settlement sites are typically larger and often positioned along major roads or trackways. Some, such as Old Winteringham, would probably have had a military origin but may have continued as civilian settlements once the Roman army had passed through. These larger settlements were more complex in form and probably functioned as administrative and trade centres serving the wider area. These settlements may have better survived the threat of sea level rise, potentially determining the focus for developing settlement in the area into the medieval period.

A significant number of sites of medieval and post medieval date were recorded, testifying to the scale of historic settlement, agriculture and industry along the estuary sides during these periods. Included in this date range were sites illustrating aspects of land management and landscape change; particularly earthworks associated with drainage and flood defences and historic boundary definition arising from these. Of particular note were a number of medieval moated sites, probably small manors or manor granges that signify how the spread of settlement back onto the low-lying wetlands during the early medieval period was probably largely under the control of the large local estates and land owners. Post medieval sites within the project area are heavily weighted towards the large-scale extraction industries that developed along the estuary margins during this period, many of which remain prominent landmarks where not lost to modern redevelopment.

A very large number of sites mapped by the project were early to mid-20th century in date, predominantly associated with the defence of the estuary during the two World Wars. The sites included both military and civilian types, with a large percentage returned by the air raid shelters constructed around Hull city centre and the docks at the start of the Second World War. Alongside these were large numbers of bomb sites and bomb craters; particularly within Hull and along the north side of the estuary close to the dockland areas. Strategically positioned military gun and searchlight batteries were recorded along the greater extent of the estuary within the project area, along with bombing decoys, anti-landing obstacles and barrage balloons intended to draw enemy air attacks away from key target areas and deter any attempts at invasion.

Overall, the results have greatly added to our understanding of the character and extent of human activity along the Humber Estuary from prehistory onwards. In particular they have significantly contributed to the understanding of key themes within the estuary's history; as an area of large-scale landscape change and land management, as a Roman military frontier and latterly, as an area of strategic wartime military defence. Woven through these larger themes is a rich tapestry of evidence for settlement, agriculture and industry that demonstrates the particular character of the human landscape of the Humber Estuary and the importance of its resources in sustaining the communities who have lived within its extent.

The distinctive historic character of the Humber Estuary resides in the sites and monuments of all periods that are to be found within it; both known and unknown. Qualities found within these sites can be measured against defined values that communicate certain aspects of heritage and community in a way that allows the richness of our past to colour and shape our present and future. Historic England's *Conservation Principles* (English Heritage 2008) defines four values that can be used to describe the significance of a place:

- **Evidential value**: the potential of a place to yield evidence about the past
- **Historical value**: the ways in which past people, events and aspects of life can be connected through a place to the present
- **Aesthetic value**: the ways in which people draw sensory and intellectual stimulation from a place
- **Communal value**: the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory

Evidential value

The Inner Humber Estuary has clear evidential value along its entire extent, with a time-depth of archaeological survival extending back into prehistory. The physical remains of past human activity are a record of historic substance and evolution of places and the people and cultures that shaped these (English Heritage 2008).

Within the Inner Humber Estuary project area there were a few sites that increase the evidence for prehistoric activity along the estuary sides. Fifteen monuments of potential Early Bronze Age date were mapped by the project, all of which were possible round barrows and all but three newly recorded sites.

There is wide-scale evidence for Iron Age and Roman activity within the project area, predominantly in the form of cropmarks, which are visible at optimum times of climate and cultivation. A large number of Iron Age and Roman sites were already known but 21 new sites were recorded by the project. The evidence increases our understanding of settlement form, hierarchy and distribution and demonstrates that the principal focus for complex settlement sites was along the higher ground, close to the route of Roman roads. These roads were part of the military frontier and illustrate the importance of the crossing points over the estuary during the period of Roman advance northwards. The more evidence that becomes available, the greater understanding there is of the extent to which the military presence deployed existing systems of settlement and communications and to what extent it determined future patterns of settlement development. Excavation from sites such as Old Winteringham has also demonstrated the potential yield of artefactual evidence to enrich the material record and inform on aspects of status, hierarchy, trade, consumption and cultural practices for these periods.

The evidential value of medieval period sites includes a large number that survive as earthworks, partial earthworks or cropmarks. Some structures, or partial structures of medieval date were also recorded within the project area; Paull Holme Tower (MHU2660), for example. With almost 80% of medieval sites within the project area new to the record and just over 40% still visible or partially visible, there is a significant increase in information on medieval settlement and settlement hierarchy, land use and industry as well as enduring patterns of land loss, land reclamation and historic boundary definition. The evidence within the project area for this period has therefore amplified our understanding of its historic character during that time but also how that related to the wider local, regional and national processes that were taking place.

The evidential value of the post medieval and early 20th century sites contrasts with those from the previous periods, being more widely visible as earthworks and structures and more firmly rooted in industry and defence. Of 426 sites attributed a post medieval date 364 (85%) were new sites, demonstrating significant enhancement of the archaeological record.

Moving away from the evidence for subsistence-based living, the post medieval sites recorded within the project area demonstrate the increase in industrial activity and scale and the growing trade and export infrastructure associated with these. Large post medieval quarries and clay pits are recorded across the project area but are particularly prevalent along the north Lincolnshire coast. Many of these sites are still distinctive landscape features, often re-purposed to create nature reserves or leisure facilities. Others are now amalgamated into or subsumed by modern dock complexes and industrial parks near Hull and Immingham.

The project has been particularly useful in enhancing understanding of the nature and scale of wartime defences around the Humber Estuary. There is significant evidential value in the number of sites identified through contemporary aerial photography, particularly as the majority of these sites were ephemeral or short-lived in nature. Without the results of the project the context of wartime defence along the estuary sides would be much harder to read as many of these short-lived sites leave no physical trace. A significant number of wartime sites do still survive as whole or partial earthworks and structures but the project results provide a more

thorough contextual analysis for these and the distinct period of social history to which they pertain.

Historical value

The historical value of the Inner Humber Estuary resides in the relationship and interplay between local communities and their landscape over centuries of habitation, subsistence and adaptation. Of the two types of historical value, illustrative and associative, the sites mapped by the project are predominantly illustrative, having the ability to link past people or events to the present. The mapped sites comprise features from a wide range of periods, relating to a scope of human activities, including monument building, settlement, land use, land organisation, land management, resource exploitation and industry, and military offence and defence. Through all these facets of social history the inter-relationship between the low-lying wetlands and the adjacent high ground weaves like a thread, illustrating the importance of each to the other.

As well as being illustrative, there are a number of sites with associative value; linking the present to particular people, events or circumstances in the past. Some sections of present-day roads fossilise the lines of earlier Roman roads; Roman Road, Cockthorne Lane and Ermine Street to the southeast of Winteringham, for example. These roads were constructed to facilitate the advance of the Roman army northwards from Lincoln in the years following the Roman invasion. The patterns of boundaries, lanes and drainage ditches across parts of the lower lying wetlands have associative value in relation to historic drainage, management and control of the wetland areas and patterns of land loss and reclamation, preserving earlier features in the modern-day landscape. Some surviving post medieval industrial sites preserve the names of former owners; Leggott's Quarry (MLS22095) and Adamant Cement Works (MLS21964) at Barton-upon-Humber, for example, or Earle's shipyard (MHU17210) and Livingstone and Cooper's shipyard (MCX1360) at Victoria Dock, Hull and Hessle Cliff, respectively.

Not least amongst sites with associative value are those relating to the defence of the estuary during times of conflict. The mottes and baileys of Barrow Castle (MLS374) stand testament to the need for a defensive capacity as far back as the 11th century; directly relatable to grants of land made to his Norman lords by William the Conqueror and thereby tied in with aspects of lordship, status and control. Paull Fort (MHU2663), constructed in the 16th century, had many roles over its centuries of use, with features from all the major periods of conflict still surviving. Of the range of First and Second World War sites that were established around the estuary during these periods, the larger artillery batteries best survive, often now within fields returned to agriculture or alongside the expanding ports of Hull and Immingham. These sites are directly associated with wartime air defence and, particularly in the latter years of the war, were often manned by crews which included members of the local Home Guard (Bilton and Mann 2019, 29). More generally, sites from this period have high associative value through their links with the local communities who lived through the war, through those that contributed to the war effort in some measure and through those that were physically affected by injury or loss; the scale of the bomb sites mapped in Hull are a stark visual reminder of the scale of suffering endured by the people of Hull during the war

years. Books that capture the story of Hull during the Second World War link the associative value and communal value of sites that form part of this story.

Aesthetic value

The landscape of the Inner Humber Estuary is one of contrasts; wide open views across endless fields and salt marsh, fringed by rolling hills and steeper scarps of higher ground. The wide quiet flat of the upstream estuary turns into a wide rolling waterway that gets progressively darker and silt-laden towards the estuary mouth. Expansive agricultural landscapes juxtapose with the concrete towers of power stations and the infrastructure of modern dock complexes. The present-day estuarine landscape is the result of natural processes and human intervention over centuries of habitation and exploitation and the combined aesthetic has intrinsic value to the communities who have helped shape it and who continue to live within it. The estuary has inspired generations of local artists and writers and there are a number of well-known poets whose works capture the changing moods of the river and its setting; Andrew Marvell, Stevie Smith and Philip Larkin to name just three. In this respect aesthetic value and communal value are intertwined; as a landscape that provides meaning of a place for those who draw part of their identity from it or have emotional links to it (English Heritage 2008).

Communal value

The Inner Humber Estuary extends across two counties, both with strong senses of identity and distinctive social histories. In addition, the contrasting landscape character areas within the project extent all exhibit particular aspects of physical and social character deriving from specific natural processes combined with human intervention. The Humber Estuary is like the glue that binds all these separate elements together, being the common factor underlying historic change and adaptation; the route between places, the provider of resources, the catalyst for physical landscape change. The communal value of the area as a whole is therefore enriched by a range of different elements that come together to express its distinctive character and the meaning of the place in local consciousness. This association and sense of connection is illustrated through a wide range of literature and online resources that cover aspects of local history and past ways of life, communicated by the people who still live and work here.

6.2 Recommendations

This report represents the results of the first stage aerial mapping component of the Inner Humber Estuary RCZAS. The mapping has demonstrated an enhanced level of information on the form and extent of archaeological features within the project area and this can be used to inform future planning and historic environment management decision-making. The following recommendations arise from these results but should be reviewed alongside any recommendations emerging from the desk based assessment and considered in the light of the project as a whole.

- Continuing aerial reconnaissance. Specialist aerial reconnaissance has been undertaken over the project area in recent decades and a number of important new sites have been identified from this photography. In addition, a large number of remains were identified from vertical photographs taken by the OS and by the RAF in the 1940s. There consequently remains considerable potential for the discovery of archaeological sites through a continuing programme of aerial reconnaissance, particularly during the summer months. The use of AI&M mapping during future aerial reconnaissance will also allow much greater efficiency by facilitating better targeting in areas of very dense archaeological remains.

- Further AI&M projects. The significant numbers of important new sites recorded during the project demonstrate the effectiveness of aerial mapping within North Lincolnshire and the East Riding of Yorkshire. This is despite a long history of aerial reconnaissance over these counties since the 1920s. Further AI&M projects for all parts of either county as yet unmapped would be of enormous value, especially in areas subject to continued ploughing.

- Further investigation of sites recorded from aerial photographs. Although a large number of sites have been recorded from aerial photographs, a relative lack of field work and excavation in many areas means that little is known about them. In particular the date and function of certain features remains unclear. A programme of ground-based investigation of a representative sample of the sites recorded by AI&M, involving field walking, geophysical survey and targeted 'ground-truthing' excavation, would significantly enhance current knowledge of prehistoric, Roman and early medieval rural settlement, land management and industry. There is potential public benefit to be had in this area too, providing opportunities for communities to engage in fieldwork projects.

  A selection of sites which would benefit from further ground-based investigation is included in Appendix 2. Of notable interest are the possible historic salterns near Immingham (MCX436); the earthworks at Faxfleet, documented as the site of a 12th century Knights Templar preceptory (MCX1422) and the medieval moated site and settlement at Paull Holme (MHU8515). The late 19th century Adamant Cement Works (MLS21964) near Barton-upon-Humber, the First World War battery at Sunk Island (MHU9587) and the complex of military earthworks and structures adjacent to Paull Fort (various, see Appendix 3) would also merit further assessment.

- Enhanced Designations. The aerial investigation and mapping has added to the interpretation of a number of important archaeological monuments within the project area. In some cases the extent of previously known sites is suggested to be greater than that included in the current designation and ground-based survey of the site is recommended to assess extent and condition of the relevant sites. One site at Whitton, probably a Second World War searchlight battery (MLS26494), survives in good condition and is suggested as a candidate for designation. A survey and assessment of this site is recommended at the earliest opportunity. A list of potentially national and regionally important sites is included in Appendix 3.

This report has aimed to set out the results of the aerial mapping with a view to communicating the significance of the archaeological sites to be found along the Inner Humber Estuary. These results will feed into the RCZAS desk-based assessment, alongside which they will promote better understanding of the historic environment of this distinctive landscape and help inform its future management.

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APPENDIX 1 - METHODS

The project followed current AI&M standards and methodology.

Sources

Photographs

All readily available aerial photographs were consulted during the project.

The Historic England Archive (HEA) formerly part of the National Monuments Record (NMR) in Swindon holds large numbers of aerial photographs of the project area. These include vertical prints taken by the Royal Air Force (RAF), Meridian Airmaps (MAL) and the Ordnance Survey (OS) ranging in date from the 1930s onwards.

The HEA also holds a large collection of oblique prints; including military obliques taken by the Ministry of Defence (MOD) in the 1940's and 50's and a collection of specialist oblique prints, slides and digital images which were taken for archaeological purposes and range in date from the 1950's to the present day. In addition early oblique images taken in the 1920s and 30s by OGS Crawford and others are held in the HEA collection.

In all 9419 photographs were consulted from the HEA collection. These included 6965 vertical prints, 2093 specialist oblique prints and 361 military oblique prints. A loan arrangement was put in place enabling the consultation of these photographs at the office of Cornwall Council in Truro.

Cambridge University Committee for Aerial Photography (CUCAP) holds an important national collection containing a number of vertical photographs taken for a range of non-archaeological purposes as well as specialist oblique photography resulting from archaeological reconnaissance. This important collection was not accessible during the lifetime of the project.

North East Lincolnshire provided the project team with census vertical photographs in digital format for 2002 and 2006. The oblique photographic collections held by North Lincolnshire and Hull City Council were consulted at their various offices.

Additional digital photographs available to the project included photographic tiles provided by HE from the Pan Government Agreement (PGA). Online photographic images from Google Earth were also accessed via the internet.

Lidar Tiles

Lidar tiles were provided by the Environment Agency (Geomatics) as .asc files. These were converted into hillshades, gradient slope and LRM tiles by HE using RVT. The available lidar included blanket 1m resolution cover as well as 80% cover (of the river and immediate river bank) at 50cm resolution.

Monument datasets

Data from the three HERs was provided to the project team as a series of Arcview shape files with attached object data.

Monument data from the National Record of the Historic Environment (NRHE) AMIE database was provided to the project team for the study area by HE at the start of the project as was data from the from the National Heritage List for England (NHLE - scheduled monuments). This data was provided digitally in a series of pdf files and Arcview shapefiles.

Map Sources

In addition to the current OS MasterMap data which was used as the primary source of control for the rectification and mapping. The Historic Ordnance Survey mapping dating from the late 19th century and early 20th century (1st, 2nd, 3rd and 4th editions) was consulted to further understand the archaeology of the project area and to aid interpretation of specific sites.

Archaeological Scope

The AI&M Sphere of Interest is defined as all archaeological features visible on aerial photographs as cropmarks, soilmarks, parchmarks or earthworks and some structures. The earliest sites recognised on aerial photographs usually date from the Neolithic onwards. AI&M projects therefore record all archaeological features visible on aerial photographs with a date range from the Neolithic to the 20th century.

The AI&M mapping is designed to be viewed against an OS base map and therefore AI&M projects do not usually record non-archaeological features visible on aerial photographs and depicted on the modern base map and still in use, such as buildings, field walls, hedges, canals and railways. In some contexts, however, it may have been appropriate to map structures visible on historic maps - the archaeological context or importance determined whether features such as field boundaries, shooting butts, sheepfolds, relict quarries, canals, railways, tracks etc. were mapped.

Cropmarks, parchmarks, soilmarks

All sub-surface archaeological remains visible as cropmarks, parchmarks or soilmarks were recorded.

Earthworks

All archaeological earthworks visible on aerial photographs were mapped and recorded. This included features visible as earthworks on early photographs, which had subsequently been levelled and archaeological features marked on the OS maps.

Ridge and furrow

All areas of medieval and post medieval ridge and furrow were mapped using a standard convention to indicate the extent and direction of the furrows.

Post medieval field boundaries

All removed field boundaries and field systems were plotted where they were considered to pre-date the OS 1st Edition map (c1880) and were not already recorded on any other OS map. Where post medieval field boundaries mapped by the OS may be misinterpreted (e.g. within complex areas of archaeological features), these may have been plotted or mentioned in the text record.

Buildings and Structures

All foundations of buildings visible as cropmarks, soilmarks, parchmarks, earthworks or ruined stonework were mapped and recorded. Standing roofed or unroofed buildings are usually more appropriately recorded by other methods, so were not generally be mapped. However, buildings were recorded and mapped in specific archaeological contexts (e.g. industrial and military complexes and Second World War bomb sites within the city of Hull). Other stone, concrete, metal and timber structures that were of archaeological relevance (e.g. fish traps, timber circles) were mapped.

Twentieth Century Military Features

The AI&M standard includes First and Second World War remains and Cold War features visible on aerial photographs or lidar. The project mapping of military sites aimed to be a 'snapshot' of the main features of the site at a relevant date, such as the latest development of the site in, for example 1945. Military structures recorded included outlines of extensive features such as airfield perimeter and runways, camp perimeters as well as buildings and earthwork structures, and all ephemeral features such as barbed wire, lines of tank cubes, etc. The main built up area included in the project was Hull. The project stakeholder (HCC) was consulted to agree a strategy for recording the very large numbers of Second World War features (bomb sites, air-raid shelters and water tanks) encountered.

Industrial Features and Extraction

Areas of industrial archaeology were recorded using the appropriate conventions where they were recognised as pre-dating 1945. Depiction was using the 'extent-of-area' symbol and mapping the main features within the complex. Features mapped included buildings (roofed or unroofed), structures, spoil heaps, and transport features associated with industrial processes. All extractive features believed to pre-date 1945 were mapped. These included large-scale quarries and industrial clay pits as well as small-scale extraction of resources for immediately local use (chalk pits, marl pits, stone quarries, gravel pits and peat workings).

Transport

Major transport features (i.e. disused canals and main railways) were not mapped unless considered to be archaeologically significant in the context of the project. Smaller features (e.g. local tramways associated with industrial sites and docks) were mapped and recorded, especially in the context of other associated features.

Natural features

Natural features which are geological or geomorphological in origin (such as the extensive reclaimed creek systems within the Humber Estuary) were excluded. If there was a risk of confusion in contexts with other archaeological features, then natural features were mentioned in the text record. In a few areas, particularly between Grimsby and Goxhill, some natural features may have been mapped to fully understand the archaeology.

Mapping and recording

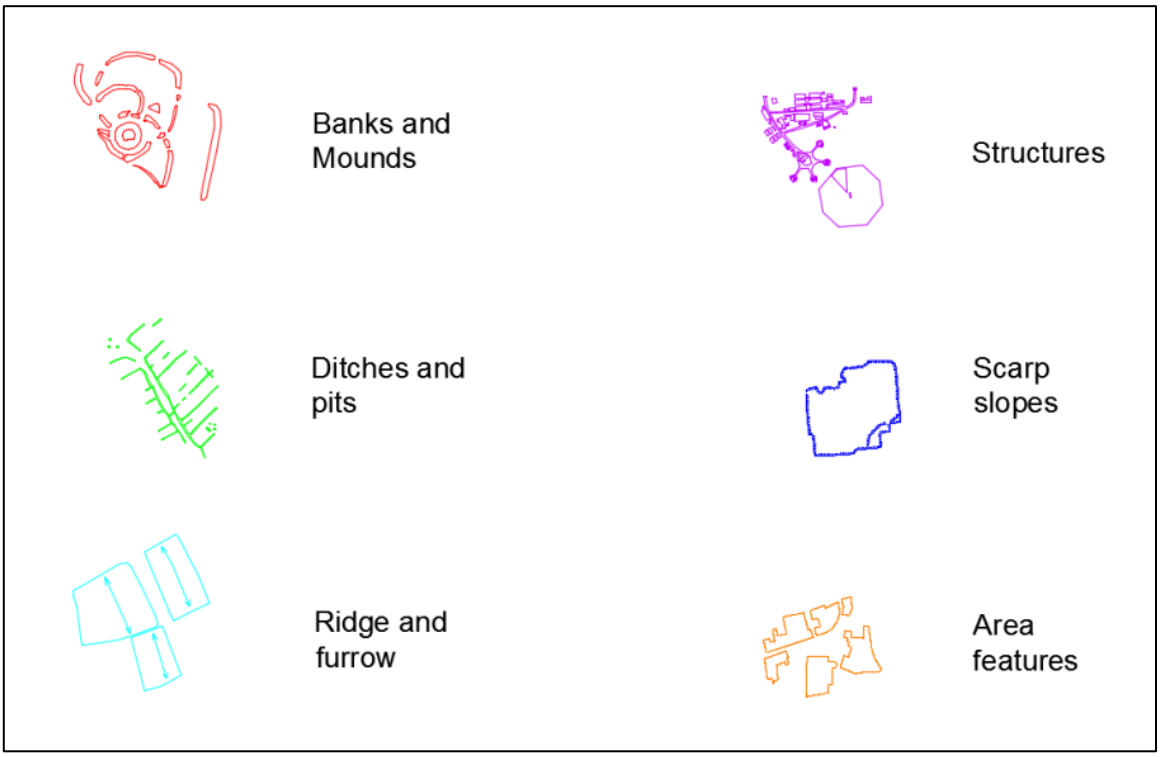
Transcription

The results of the mapping were produced entirely in digital format. Archaeological features were digitally transcribed according to a nationally agreed layer structure and using agreed line and colour conventions as specified by Historic England (Winton 2015).

A combination of aerial photographs and lidar were used to map archaeological features and interpretations were based on morphological comparison to well know site types, topographical location and other published evidence.

Oblique or vertical photographs were scanned and then rectified using AERIAL 5.36 software. Control was derived from the Ordnance Survey 1:2,500 scale MasterMap® vector data. Digital terrain models derived from 5m interval contour data supplied by Next Perspectives were used to improve the accuracy of the

rectification. Archaeological features were traced off geo-referenced and rectified aerial photographs or lidar visualisations using AutoCAD Map 3D 2015.



Conventions used for Inner Humber RCZAS AI&M mapping.

Table showing AI&M standard layers used in the project

LAYER NAME	COLOUR	DESCRIPTION
BANK	Red	Used to outline banks, platforms, mounds and spoil heaps
DITCH	Green	Used to outline cut features such as ditches, ponds, pits or hollow ways.
EXTENT _OF_FEATURE	Orange	Used to depict the extent of large area features such as airfields, military camps, or major extraction.
MONUMENT _POLYGON	White	Used to indicate the extent of the monument record as defined in the NRHE or HER database.
RIDGE_ AND_FURROW_ALIGNMENT	Cyan	Used to outline a block of ridge and furrow.
RIDGE_FURROW_AREA	Cyan	Line or arrow(s) (hand drawn not a symbol) depicting the direction of the rigs in a block of ridge and furrow.

SCARP_SLOPE_ EDGE	Blue	The top of the 'T'indicates the top of slope and the body indicates the length and direction of the slope. Used to depict scarps, edges of platforms and other large earthworks.
STRUCTURE	Purple	Used to outline structures including stone, concrete, metal and timber constructions e.g. buildings, Nissen huts, tents, radio masts, camouflaged airfields, wrecks, fish traps, etc.

Map Note Sheets (MNS) were maintained for each OS quarter sheet within the survey area. MNS record the progress of each sheet and the sources used.

Quality assurance checks were carried out on selected map sheets to ensure that all sheets were completed to AI&M standards.

Project database

Data for all features mapped during the prioject was either input into the Cornwall AI&M HBSMR v5 database or the North Lincolnshire HBSMR v5 database via a remote link. These databases automatically generated unique Project UID numbers (Prefixed MCX for Cornwall and MLS for North Lincolshire) and contained fields enabling monument indexing to be carried out to Historic England Archive (HE and Association of Local Government Archaeological Officers (ALGAO) standards. Appropriate data was entered into these databases for each archaeological site mapped (data recorded included summary, description, photographic references, site type and period, locational information and details of the interpreter). The level of survival of each archaeological site (surviving, levelled, partially levelled, or destroyed) was also recorded within the various project databases.

Data exchange

The mapped data was provided to the HE as AutoCAD drawings as well as GIS data in a format suitable for incorporation in to the HE Corporate GIS. All data supplied was to AI&M monument recording standards and in line with HE minimum standards for monument recording.

Copies of the Project Design, Final Report and all other relevant project documentation will be deposited with HE. The pdf version of the report will be deposited with Archaeology Data Service (ADS).

APPENDIX 2: LIST OF SIGNIFICANT SITES

List of sites that would benefit from further work – recommendations to include what kind of work – for example, analytical earthwork survey, documentary research, excavation, geophysics, more aerial work, etc.

Description	Place	HER and/or NRHE Monument No.	NGR	Assessment of significance/reason for further work/nature of further work
Enclosures and mounds on lidar, potential salterns	Immingham	MCX436	TA 1815 1555	Possible example of rare monument type. Analytical ground based survey (field walking, geophysics, GPR, trial trenching) to confirm interpretation.
WWI Coastal Battery	Sunk Island	MHU9587, MCX255, AMIE914236	TA 2493 1759	Highly significant site. Ground based survey to assess survival. Tree and scrub clearance. Assess potential for consolidation and scheduling.
Ruins of late 19th century cement works	Adamant, Barton-upon-Humber	MLS21964	TA 0109 2344	Recent imagery suggests significant survival. Ground based survey to assess level of survival and potential for consolidation. Tree and scrub clearance.
Ploughed earthworks associated with medieval preceptory of Flaxfleet	Blacktoft	MCX1422 AMIE61229	SE 8603 2482	Reputed site of a 12th century establishment of Knights Templars. Documentary research, geophysical survey and field walking.

Potential prehistoric ring-ditches	Oldfleet Drain, Stallingborough	MCX199-200	TA 232 130	Two prehistoric ring ditches, possibly Bronze Age barrows. Few sites of this type in the area, suggest field walking and geophysical survey.
Potential prehistoric ring-ditches	East Marsh, Goxhill	MLS26227-8	TA138 241	Two prehistoric ring ditches and field boundaries. Uncertain date and functions, suggest field walking and geophysical survey.
Historic earthworks, possible settlement	South Ferriby	MLS26449	SE 9870 2128	Rectilinear earthworks visible on lidar to the north of a known moated site. Suggest further work including walk-over survey and then possibly geophysical survey.
Historic earthworks, possible medieval settlement	Paull Holme	MHU8515	TA 1867 2483	Earthworks to south and east of Paull Holme tower and moated site. Recent imagery suggests good survival of moated site and adjacent earthworks, possibly settlement-related. Suggest analytical ground based survey to assess nature and extent.
Civil defence building, air raid shelter	Hull	MHU19614	TA 0982 2896	Possible survival of some of the external structure under modern café. Underground survival unknown. Site potentially a rare surviving example of a WWII control centre/air raid shelter. Suggest historic building survey and record, possibly including underground areas if these survive.

Possible Roman road	Brough	MCX1389	SE 9381 2724	Linear earthworks visible on aerial imagery suggest good survival of feature. Suggest site walkover and geophysical survey to assess identification and potential. Possible trial evaluation.
Rectangular enclosure and earthworks	S of Ings Lane, Whitton	MLS20696	SE 9085 2406	Good survival of earthworks on aerial and lidar imagery indicated. Uncertain dating of enclosure and relationship to adjacent earthworks and medieval field system is not known. Suggest analytical ground based survey of earthworks to assess nature and extent. Also suggest evaluation to determine form, relationship and possible dating.

APPENDIX 3: REVIEW AND RECOMMENDATIONS FOR DESIGNATED SITES

List of scheduled monuments in the area where the survey could improve the location, extent and interpretation. This will also include any new sites of potential regional or national importance that might merit designation.

Description	Place	List No.	NGR	Recommendation
WWII Heavy Anti-aircraft battery.	West Marsh Farm, Barrow Upon Humber	1020024	TA 056 232	Review scheduled area; possibly extend to include associated structure to SE. Current polygon too small and clips four of the emplacements and the ammunitions store.
Moated site	Old Little Humber, Paull	1008048	TA 20613 23663	Review scheduled area; possibly extend to east to include banked enclosure on this side. Suggest site walkover and/or geophysical survey to identify extent and nature of the site and associated features. Suggest digital survey of earthworks.
Paull Point Battery	Paull	1020425	TA 16934 25539	Site visit confirmed upstanding evidence associated with the submarine mine depot (brick remains in wooded area), coastal artillery searchlight MHU 19732 (under bramble and scrub), Air raid shelters MHU 18805 and MHU 22215 and concrete holdfasts associated with battery MHU18807 - all within area of paths and some tree cover. Potential threat to survival. Suggest ground based survey to assess level of survival

				and potential for consolidation and interpretation. Tree and scrub clearance.
Old Winteringham	Winteringham	1005343	SE 9474 2149	Review scheduled area. Cropmark evidence suggests site may extend NE and SW. Consider extending to include settlement areas and Roman road to SW (MLS17636; 26582; 2063; 26582).
HAA battery	Mere Farm, Winteringham	1020549	SE 9340 2113	Review scheduled area. Area clips gun emplacements and control room on SW side. Suggest historic building record. Also, possible geophysical survey and/or field walking of field to NW, site of WWII camp.
WWII Searchlight battery	Whitton		SE 9002 4245	Aerial imagery and site visit confirm good survival of earthworks. Good surviving example of WWII searchlight battery and gun emplacements of regional significance. Suggest ground based survey to confirm identification and potential candidacy for scheduling. Suggest historic building record and digital survey of earthworks as record.

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