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EAST RIDING OF YORKSHIRE, CHALK LOWLAND AND THE HULL VALLEY NMP

AERIAL INVESTIGATION AND MAPPING REPORT

Sally Evans, Yvonne Boutwood, David Knight and Matthew Oakey

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Research Report Series 39-2012

EAST RIDING OF YORKSHIRE

CHALK LOWLANDS AND THE HULL VALLEY NMP AERIAL INVESTIGATION AND MAPPING REPORT

Sally Evans, Yvonne Boutwood, David Knight and Matthew Oakey

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SUMMARY

This report describes the results of a survey interpreting, mapping and recording archaeological features visible on aerial photographs and lidar within the Yorkshire Wolds chalk lowland and the Hull Valley, providing a synthesis of the archaeology, analysing its character, diversity, distribution and associations in the landscape. It also describes the specification, methodology and scope of the project.

This study forms part of the National Mapping Programme (NMP) and comprises eight whole and six part Ordnance Survey 1:10,000 scale quarter sheets totalling 300sq km. The aerial survey and mapping ran from 5 October 2011 to 3 October 2012. Digital maps and supporting records were created by English Heritage's Aerial Investigation & Mapping team based in York.

The project identified and mapped sites ranging from the Neolithic to the 21st century. New records were made for 794 sites and a further 135 existing records were enhanced.

CONTRIBUTORS

Mapping and recording was carried out by Yvonne Boutwood, Sally Evans, David Knight and Matthew Oakey of English Heritage's Aerial Investigation & Mapping team.

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English Heritage
Archive Services
The Engine House
Fire Fly Avenue
Swindon
SN2 2EH

Tel: 01793 414600
Fax: 01793 414606

archive@english-heritage.org.uk

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6438

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CONTACT DETAILS

Aerial Investigation and Mapping, English Heritage, 37 Tanner Row, York, YO1 6WP
Sally Evans; 01904 601940; sally.evans@english-heritage.org.uk
Yvonne Boutwood; 01904 601944; yvonne.boutwood@english-heritage.org.uk
David Knight; 01904 601952; david.knight@english-heritage.org.uk
Matthew Oakey; 01904 601920; matthew.oakey@english-heritage.org.uk

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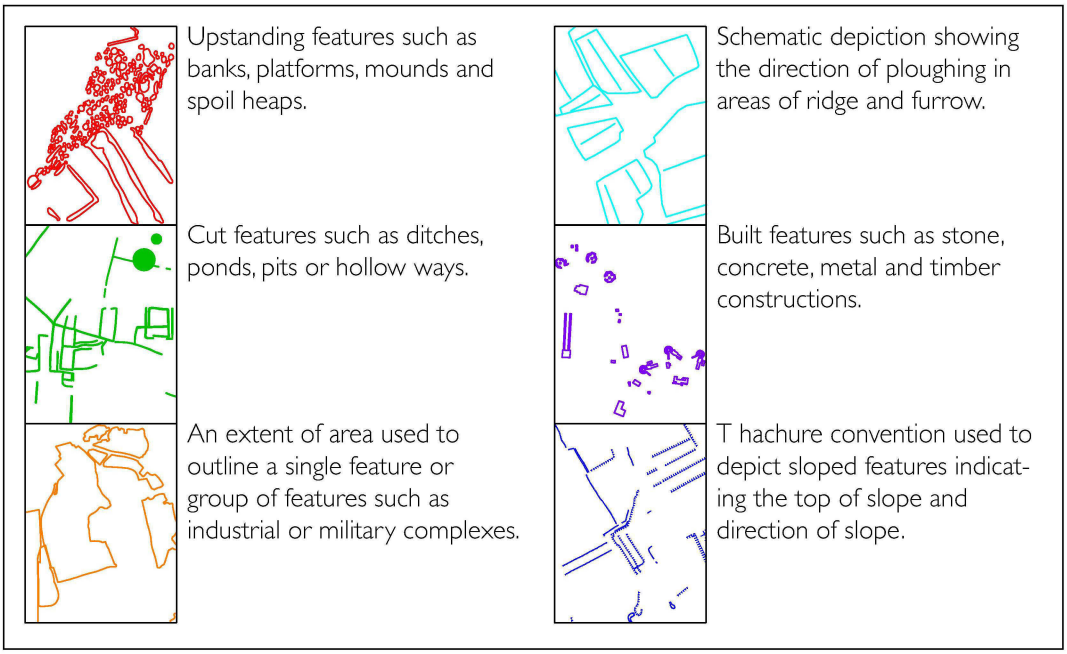

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INTRODUCTION

Background

The Chalk Lowland and the Hull Valley NMP is an air photograph interpretation and mapping project in the East Riding of Yorkshire (Fig 1), covering the valley of the River Hull and the Yorkshire Wolds chalk edge. The Yorkshire Wolds chalk was mapped by the RCHME (Stoertz 1997) but the lower-lying eastern edge was not included in that survey. This project examines that lower fringe of the chalk, providing a natural extension to the research carried out by the RCHME. It builds upon the small amount of mapping and recording done in the area by English Heritage's Reconnaissance Recording project. The project also complements the study done in the Hull Valley by the Humber Wetlands Survey project (Van de Noort and Ellis 2000), which integrated archaeological and palaeoenvironmental surveys, by examining the interface between these two very different landscapes.

The English Heritage at Risk Register for 2009 noted that the Yorkshire and Humber Region had the highest proportion of monuments at risk of any region in the country. The 2010 register reiterates that fact, stating 'Approximately 1 in 6 (17.2%) of England's 19,731 scheduled monuments are at risk, compared with 28% (734 sites) in Yorkshire and the Humber'. The project area contains 48 scheduled monuments and 16 (33%) of those are classed as at risk.

Nationally the commonest threat to scheduled monuments is from agricultural practices, and in the region it is the intensively farmed landscapes of the Yorkshire Wolds that hold the greatest concentration of scheduled monuments at risk. The majority of the monuments at risk within the project area are medieval earthworks and are categorised as at risk from arable ploughing, drainage and dewatering problems and encroachment of trees and shrubs. None of the monuments at risk and few of the scheduled monuments have survey data available, except Ordnance Survey antiquity models. A few medieval sites have higher level surveys at a scale of 1:2500 undertaken by the RCHME in the 1980s and 1990s (Eske and Rotsea settlements and Watton Priory).

Large parts of the project area have been evaluated by Natural England (2008), identifying areas eligible for Environmental Stewardship Agreement grants, under Entry Level Stewardship (ELS) and Higher Level Stewardship (HLS) Schemes. The River Hull Headwaters, which overlaps with the northern extent of the project area, is a priority target area for Higher Level Stewardship. Environmental Stewardship Agreements informed by NMP data can aid the management of visible and below ground archaeological and historic features. This protects the most vulnerable archaeological sites that are currently in arable areas, for example by reducing the depth of damaging cultivations through minimum tillage or direct drilling where this offers a suitable level of protection.

Project area

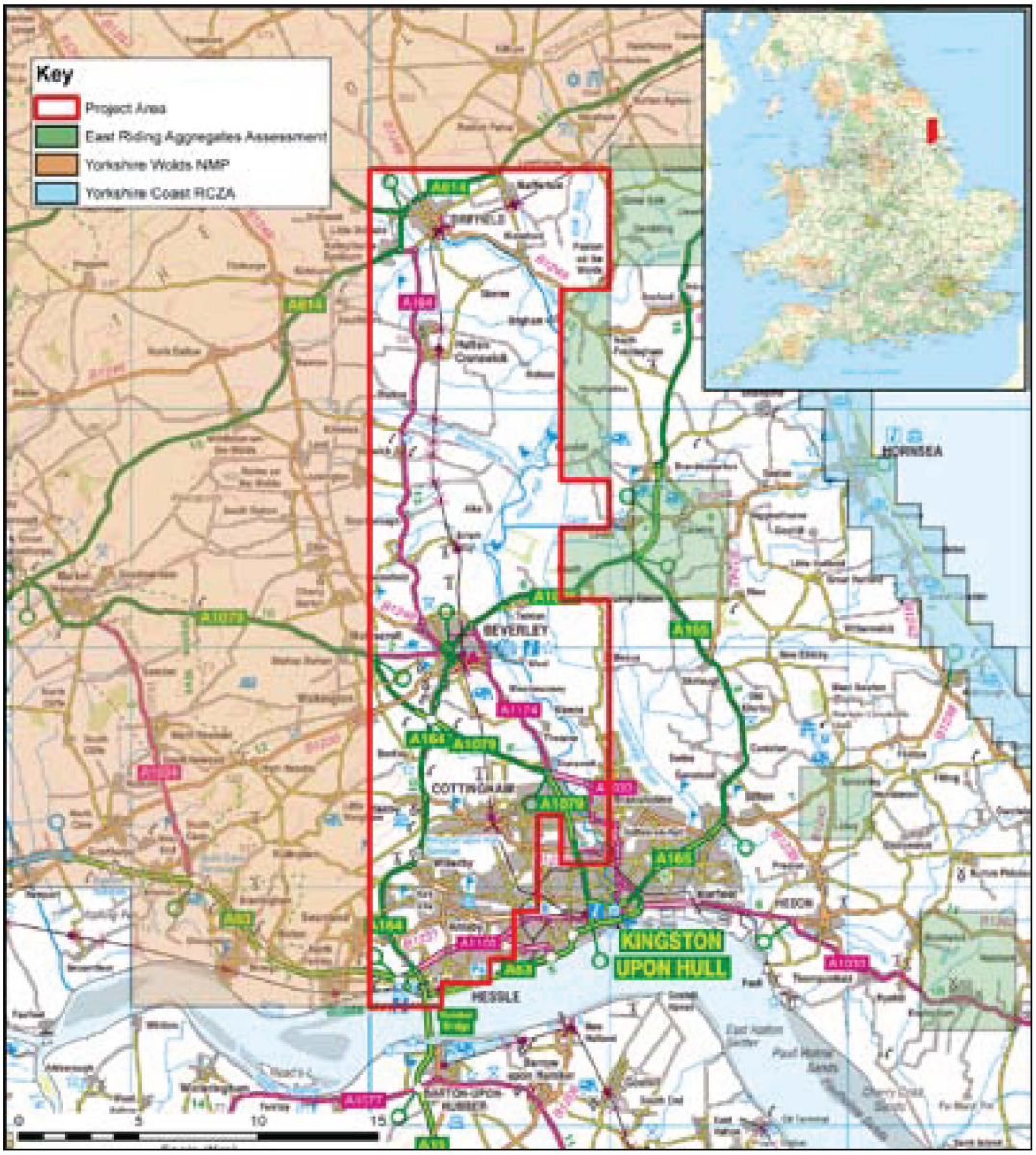

Fig 1: The Hull Valley and chalk lowland NMP project area. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088.

The project covers a north–south corridor, up to 10km wide, from Driffield in the north to Kingston upon Hull in the south (Fig 1). It comprises eight full and six part 1:10,000 scale Ordnance Survey quarter sheets totalling 300sq km (APPENDIX 1). The project abuts the Yorkshire Wolds air photo mapping project (NRHE Event UID 1073872; Stoertz 1997) and three of the sample mapping areas of the East Riding of Yorkshire ALSF NMP (NRHE Event UID 1459306; Deegan 2008). The project area encompasses the valley of the River Hull, from its source to the west of Driffield into Kingston upon Hull, and the fringes of the Yorkshire Wolds to the north and west. The suburban areas of Hull were included where pre-development aerial coverage was available but the

project excludes older, core areas of the city.

Geology, topography and modern land use

The major part of the project area falls within Natural England's Landscape Character Area 40: Holderness, with small areas around Driffield and Skidby falling within the Yorkshire Wolds Character Area 27 (Natural England 2012a; 2012b). The terrain contrasts between the dip slope of the Wolds edge and the low-lying, broad, flat floodplain of the Hull Valley. The geology is Cretaceous chalk bedrock overlain by Quaternary drift and post-glacial alluvial deposits (Ellis 2000, 7–9).

The soils are mainly influenced by the geology and superficial till deposits, where glacial clays are inter-bedded with sands and gravels. The flanks of the chalk Wolds have well drained loamy soils. In contrast the flat, poorly drained valley areas are mainly characterised by gley soils, with some areas of freely drained brown earths. The varied depositional history means that the character of the overlying deposits changes across the area, revealing small pockets and islands. This, in turn, impacts on the location and visibility of sites, the better drained soils being more conducive to cropmark formation compared to the heavier soils where cropmarks tend not to form except in exceptionally dry years.

Continued drainage within the valley from the medieval period onwards has reduced the once extensive salt marsh and wetland carr areas (Sheppard 1976). These improvements combined with rich soils of glacial till and alluvium have meant the modern landscape is dominated by intensive agriculture, primarily arable cultivation. Grassland pasture is evident on the poorly drained areas or on poorer clay soils. Field boundaries on the lower-lying areas are usually ditched for increased drainage, while on the higher ground hedged boundaries are more common. Woodland is very sparse, either present in small copses or beside water courses.

Water transport was once of vital importance to the lowland areas and the River Hull played a central part in the transport network. Many of the earliest 'drains' in the area were intended primarily for water transport (Middleton 2000, 15; fig 3.1b). The pattern of roads in the region has been dictated by the settlements of Kingston upon Hull and Beverley and the availability of river crossings.

Present-day settlement is largely determined by topography, with most villages centred on higher ground away from the river. The settlement pattern that we see today was broadly established by the medieval period, and reflects limited availability of dry areas prior to the effective drainage schemes of the 18th or 19th centuries (Fenwick *et al* 2000, 90; Aalen and Muir 2006, 209). Hamlets and villages are widely dispersed, with Kingston upon Hull, Driffield and Beverley forming the major urban settlements in the area.

Summary of methodology

The air photograph mapping of the chalk lowland and the Hull Valley was undertaken by the Aerial Investigation & Mapping team (formerly Aerial Survey & Investigation team)

in York (see APPENDIX 2 for project roles). The project adhered to National Mapping Programme (NMP) standards and methodology (Winton 2012). A summary of the scope of the project is described in APPENDIX 3 and a list of the consulted sources can be found in APPENDIX 4.

Methods involved the systematic examination of all aerial photographs available from the English Heritage Archives, formerly the National Monuments Record (NMR), the Cambridge University Collection of Aerial Photography (CUCAP) and those held at Humber Archaeology Partnership (Humber SMR). Additional oblique photographs from a local flyer, Anthony Crawshaw, were also consulted. Orthorectified vertical photographs supplied by Next Perspectives™ through the Pan Government Agreement (PGA) as 1sq km tiles in TIFF format were used in the project.

The project also assessed the suitability of using 2D lidar tiles (in TIFF/JPEG format) as opposed to raster surface data, in mapping archaeological features across a 9km by 2 km transect between Beverley and Hull. Two image visualisation techniques were trialled; 16 direction hillshade images and Principal Component Analysis (PCA).

Oblique and vertical photographs were scanned and then rectified using the specialist AERIAL 5.29 software and control was derived from 25cm resolution PGA orthophotography or Ordnance Survey 1:2,500 scale MasterMap® vector mapping. Features were interpreted and mapped in AutoCAD Map 3D. Georeferenced orthophotography, rectified images and lidar were directly inserted into AutoCAD where archaeological features were mapped. Full details of the methodology for mapping and monument recording carried out during the project are contained in APPENDIX 5. The mapping conventions and the layer structure used in AutoCAD drawing files are summarised in APPENDIX 6. Monument data were also recorded in an object data table (see APPENDIX 7). The monument types conformed to the English Heritage Thesaurus and are listed in APPENDIX 8. All mapped features were recorded in the National Record of the Historic Environment (NRHE) database, where new records were created or existing monument records were amended.

Copies of the digital drawing files are deposited in the English Heritage Archive in Swindon. NHRE monument data is available on the PastScape website (http://www.pastscape.org.uk/). Data is also shared with Humber Sites and Monuments Record. Full details relating to archive and dissemination can be found in APPENDIX 9.

HIGHLIGHTS OF THE PROJECT

The accurate digital mapping and recording of archaeological features, created by this NMP project, produced high-quality baseline data, for the management of change in the historic environment through planning and other statutory systems. The data and synthesis provide a substantial contribution to the archaeological knowledge of the Hull Valley and the chalk lowland fringes. The project has created 794 new monument records in the NRHE and amended 135 existing records. This represents a 198% increase in the number of new archaeological records, greatly enhancing the National Record of the Historic Environment (NRHE) database.

Of these newly identified sites the most significant were the widespread Iron Age/Roman remains found throughout the Hull Valley (see THE IRON AGE AND ROMANO-BRITISH LANDSCAPE). The identification of a coaxial field system to the south-west of Woodmansey was of particular interest as this form of land division was previously unrecognised in the Hull Valley and does not occur on the Yorkshire Wolds. Conversely, other forms of land division, such as linear boundaries previously recorded on the Yorkshire Wolds (Stoertz 1997) have been identified continuing into the Hull Valley (see Later prehistoric). The landscape scale of the NMP survey partially redresses the urban bias for these later prehistoric sites as a consequence of pre-development archaeological investigations.

Archaeological monuments are vulnerable to a wide range of human activities and natural processes. During the course of the project it became apparent that the rates of earthwork survival post-war were low, largely as a consequence of ploughing. An assessment comparing the condition of the archaeology on historic air photographs (1940s onwards), to recent air photographs revealed that 70% of archaeological features have been levelled or destroyed in that time (see LEVELLING AND SURVIVAL).

Against such a history of loss, maximising the use of the project data in assessing and protecting archaeological monuments is essential. A flow-line model, interacting with other teams involved in heritage protection, was developed to maximise the use of the project data in assessing and protecting archaeological monuments. This process was facilitated by the systematic photographing of the 48 scheduled monuments within the project area at the start of the project. This allowed a re-evaluation of all the scheduled monuments from up-to-date air photographs. Newly discovered significant archaeological remains have also been highlighted as priorities for further investigation (see Scheduled monuments).

In some circumstances scheduling might not be the most appropriate mechanism to secure a monument's long term preservation. The role of NMP data in informing the protection of non-designated archaeological assets via Environmental Stewardship Agreements was also investigated (see Environmental Stewardship Agreements). For both scheduling and Environmental Stewardship Agreements the dissemination of the NMP data to internal and external partners ensures increased protection outcomes.

In addition to archaeological highlights new methodologies were trialled in order to

enhance the results of NMP mapping. This project aimed to assess the suitability of using 2D lidar tiles (in TIFF/JPEG format) as opposed to raster surface data, in terms of the detail visible and a reduction in time taken for interpretation and mapping. Two techniques were trialled, evaluating 16 direction hillshade and Principal Component Analysis (PCA). This increased our understanding of the methodologies required for working efficiently and effectively with lidar and led to recommendations for future work (see LIDAR VISUALISATION TECHNIQUES).

Finally an attempt was made to assess the benefits of combining NMP and non-NMP datasets, specifically NMP and Agricultural Land Classification as a means of estimating the potential for archaeological survival. This is the first time this type of analysis has been undertaken as part of an NMP project and the results demonstrate the value of incorporating non-archaeological datasets with NMP data to understand the wider landscape (see AGRICULTURAL LAND CLASSIFICATION). The data also have implications for the future strategy for NMP, particularly in targeting new project locations and predicting output from those projects, given the finite resource available to NMP.

How the project fulfilled corporate aims and objectives is addressed in APPENDIX 10.

SUMMARY OF RESULTS

Introduction

This report provides an overview of the archaeological features on a broad period-by-period basis. The Iron Age/Roman landscape is discussed in more detail later in this report (see THE IRON AGE AND ROMANO-BRITISH LANDSCAPE) because of the impact of new discoveries and understanding made by the NMP mapping. The majority of archaeological remains seen from the air are cropmarks or earthworks that have since been ploughed level in the post-war period. The issues of levelling in the Hull Valley are also discussed in detail later in this report (see LEVELLING AND SURVIVAL). Where references are made to specific sites these are referred to by a locational name or are followed by their NRHE numbers.

The archaeological features recorded range in date from the Neolithic to the 21st century. New records were made for 794 sites and a further 135 existing records were enhanced.

Later prehistoric

The archaeology of the Hull Valley has been under-studied until relatively recently, when the Humber Wetlands Survey correlated archaeological and palaeoenvironmental data (Van de Noort and Ellis 2000). The study suggests that the evidence for the Neolithic is largely from stray lithic finds (ibid, 89), but excavations of barrows and radiocarbon dates from other sites also attest Neolithic activity (D Evans pers comm). Bronze Age activity is similarly revealed by lithic and metal finds, but is primarily represented by funerary monuments. The aerial survey data from the Hull Valley project thus makes a significant contribution to the understanding of the later prehistoric period by mapping and recording known and new archaeological features.

The later prehistoric features recorded by the project are primarily round barrows, dated mainly to the Bronze Age, but some potentially with Neolithic origins. Two pit alignment groups are attributed a Neolithic/Bronze Age date. Other features include a curvilinear enclosure and multiple ditch systems, with potential use from the Bronze Age through to the Iron Age, or even into the Roman period. Features dated to Iron Age only or Iron Age/Roman are discussed elsewhere (see below and THE IRON AGE AND ROMANO-BRITISH LANDSCAPE).

Ritual and funerary monuments

The project recorded 50 round barrows, visible as earthworks, cropmarks and occasionally as soilmarks. The round barrows are distributed across the project area sited along the valley of the River Hull and its tributaries, occurring singly or grouped forming cemeteries. The largest group at Old Hall, Woodmansey contains 14, but has no distinctive pattern, whilst other round barrow groups display a linear pattern (1551156).

The form of the barrows is varied and they were sometimes seen as mounds, sometimes

with an accompanying ditch, or, where the mound is not visible, as circular to sub-circular ditched enclosures, ranging in diameter from 6m to 32m. The ditches define single or double concentric circuits and some barrows have internal pits, probably indicative of either cremation or inhumation pits. The term 'ring ditch' and 'bowl barrow' is sometimes applied, but round barrow was preferentially used in this project. None of the barrows had a distinctive oval shape that may suggest a Neolithic long barrow form (Jones 1998, fig 2).

In one instance (1550101) the form of the circular ditched enclosure may suggest a possible hengiform monument with opposing entrance gaps, one of which may have swollen terminals, but the clarity of the cropmarks is confused by background geological marks. Another circular feature, described as a causewayed ring ditch (1566980), has three possible circuits (see below). These poorly understood monument forms were also recorded in the adjacent East Riding of Yorkshire NMP project, extending into Holderness and also noted in Northamptonshire (Deegan 2008, 7–8).

Fig 2: A Bronze Age barrow with a Second World War pillbox sited on top. NMR 28227/17 19-OCT-2011 ©English Heritage. NMR.

Only eight of the round barrow mounds recorded by the project are still extant earthworks, and some are protected by scheduling. Many of the earthwork barrows were known through antiquarian studies and depicted as 'tumuli' on historic Ordnance Survey maps. The original distribution of round barrows within the project area was much wider than that mapped, as some tumuli depicted on historic maps, for example south-west of Driffield, have already been lost through urban development.

Dating of most barrows relies on morphological comparison with excavated sites. A

Bronze Age date was assigned to the many circular features interpreted as barrows within the Hull Valley project. However, excavations of a round barrow south-west of Driffield (79308) produced evidence of Neolithic burial (Mortimer 1905, 262), mirroring a pattern noted by Stoertz (1997, fig 32) on the Yorkshire Wolds. Iron Age burials display a mix of square and round barrow forms and can coincide with Bronze Age burials, as seen at Westwood Common (79109), respecting the earlier ritual landscape. A survey of Westwood suggested that a larger size and rounder plan distinguished Bronze Age barrows from Iron Age ones (Pearson and Pollington 2004, 13). There is also evidence of the re-use of round barrow mounds for cremations in the early medieval period south-west of Driffield (79322). Excavations in the nineteenth century revealed at least 46 inhumations within the barrows were secondary burials from the early medieval period (Mortimer 1905, 271–83). Other re-use of barrows includes siting of a post medieval windmill at Westwood Common and a Second World War pillbox at Howe Hill (79286; Fig 2).

On the Yorkshire Wolds the positions of round barrows are respected by later features such as linear boundaries and trackways (Stoertz 1997, fig 14). This relationship can also be observed in the Hull Valley and is discussed in more detail below (see THE IRON AGE AND ROMANO-BRITISH LANDSCAPE).

Fig 3: A ritual complex of unusual pit defined features and enclosures, the colours in the photograph have been enhanced.
NMR TA 0131/8 NMR 28081/31 21-JUL-2010 ©English Heritage. NMR.

At Eppleworth (1566980; Fig 3) there is a spatial association of barrows with a group of pits, potentially dated Neolithic/Bronze Age. This complex has a round barrow and another circular enclosure, described as a 'causewayed ring ditch'. The form of the latter is unusual with an outer ditch with at least two, but potentially more, gaps in the circuit.

Internally there may be a further two interrupted concentric ditches, or arrangement of pits, but the diffuse cropmarks are difficult to interpret. The group of 11 pits, recorded as a double 'pit alignment', consists of a row of five pairs of pits, extending for 27m, with a single pit to the west. The pits, range between 2m and 4m in diameter, and the pairs are spaced between 6.5m and 9.5m apart. At Beverley there is another group of pits, with a similar pattern and association with round barrows (1566066) but the pits are smaller.

A similar pattern of pits with associated barrows was recorded at Hambleton Down on the North York Moors (Sutcliffe 2011). Sutcliffe compared these examples to earthworks of segmented embanked pit alignments on the Moors as described by Lofthouse (1993, 392). However, there is no evidence of flanking banks at Hambleton Down or the Hull Valley cropmark examples. Further reconnaissance and/or geophysical survey may reveal if flanking banks were originally part of their construction. Lofthouse (ibid) believed that the segmented embanked pit alignment were a distinctive form, localised to the North York Moors. However, other examples of short lengths of double pit alignments do occur elsewhere, for example in the Yorkshire Wolds (Dent 1983), Barrow in Furness, Cumbria and Catterick (D MacLeod, pers comm). These distinctive groups of pits, which often occur in contexts with burials, are likely to be parts of ritual complexes such as those associated with Neolithic long barrows in Lincolnshire (Jones 1998, 100).

The form of these short groups of paired pit alignments differs from the long lengths of double and single pit alignments that form linear land divisions found more widely across Britain, for example in the National Forest (MacLeod 1995, fig 28) and the Yorkshire Wolds (Stoertz 1997, fig 6.13). Indeed, there is no evidence of long linear pit alignments recorded from air photography within the Hull Valley project area, in contrast to the numerous examples on the adjacent Wolds landscape.

Other curvilinear enclosures

A curvilinear enclosure with two internal pits, south-west of Driffield (1547977) has been attributed a later prehistoric/Roman date on the basis of its morphology and its apparent relationship to rectilinear enclosures dated Iron Age/Roman, which are the more common form of enclosure across the Hull Valley project area. Although unusual in the context of the Hull Valley project, in a wider context, similar curvilinear enclosure forms were recorded west of the project area by the Yorkshire Wolds mapping project.

Multiple ditch systems

Several sections of linear boundaries form multiple ditch systems in the Hull Valley project area. The term 'dyke' or 'entrenchment' is used for similar features on the Yorkshire Wolds, where they form extensive networks. They have a potential period of use from the Bronze Age through to the Roman period. Similar examples in Lincolnshire produced late Bronze Age to mid/late Iron Age radiocarbon dates with evidence of Roman re-use of some elements (Boutwood 1998, 37–39).

The fragmentary multiple ditch systems have a distinctive form (Fig 4). Earthwork examples have parallel ditches with alternating banks, whereas when seen as cropmarks,

Fig 4: Multiple ditched systems and potential associated rectilinear enclosure. NMR TA 0137/39 NMR 12890/5 02-AUG-1996 ©Crown copyright. NMR.

usually only the ditches are evident. Typically there are between three and four broadly parallel ditches, but the individual ditches can be quite sinuous. The ditches often have small breaks, which may indicate entrances as excavations in Lincolnshire found termini forming entrance gaps (Boutwood 1998, 29). The sections of multiple ditch system take a straight or slightly sinuous course, or change direction via doglegs. Their fragmentary nature and discontinuity could be a reflection of poor cropmark formation, but some gaps are probably original features, as such systems could have used natural features, such as woodland, since removed, as part of their layout and arrangement in the landscape.

Nine sections of multiple ditch system were recorded, mainly distributed along the chalk Wolds edge, with three examples in the lower lying Hull Valley context (Fig 5). Those located on the western edge of the project area continue the pattern of linears on the Wolds (Stoertz 1997, fig 33; Fig 5). Double and single linear boundaries within the Hull Valley project area are discussed in more detail below (see THE IRON AGE AND ROMANO-BRITISH LANDSCAPE), but multiple ditch systems should be viewed alongside these features. The shared alignment, north-west to south-east, of the multiple linear boundaries with some double-ditched linears, interpreted as trackways, as seen around Driffield, suggests they may be contemporary. It is also possible that the potentially earlier multiple linear systems influenced later trackways and land division, emphasising controlled access between upland and lowland resources. Further investigations southwest of Driffield, near Highgate Wood (79423) may help elucidate the chronology of associated features. Here field boundaries run perpendicular to the multiple ditch system and the outer ditch is broken and splays outwards at the

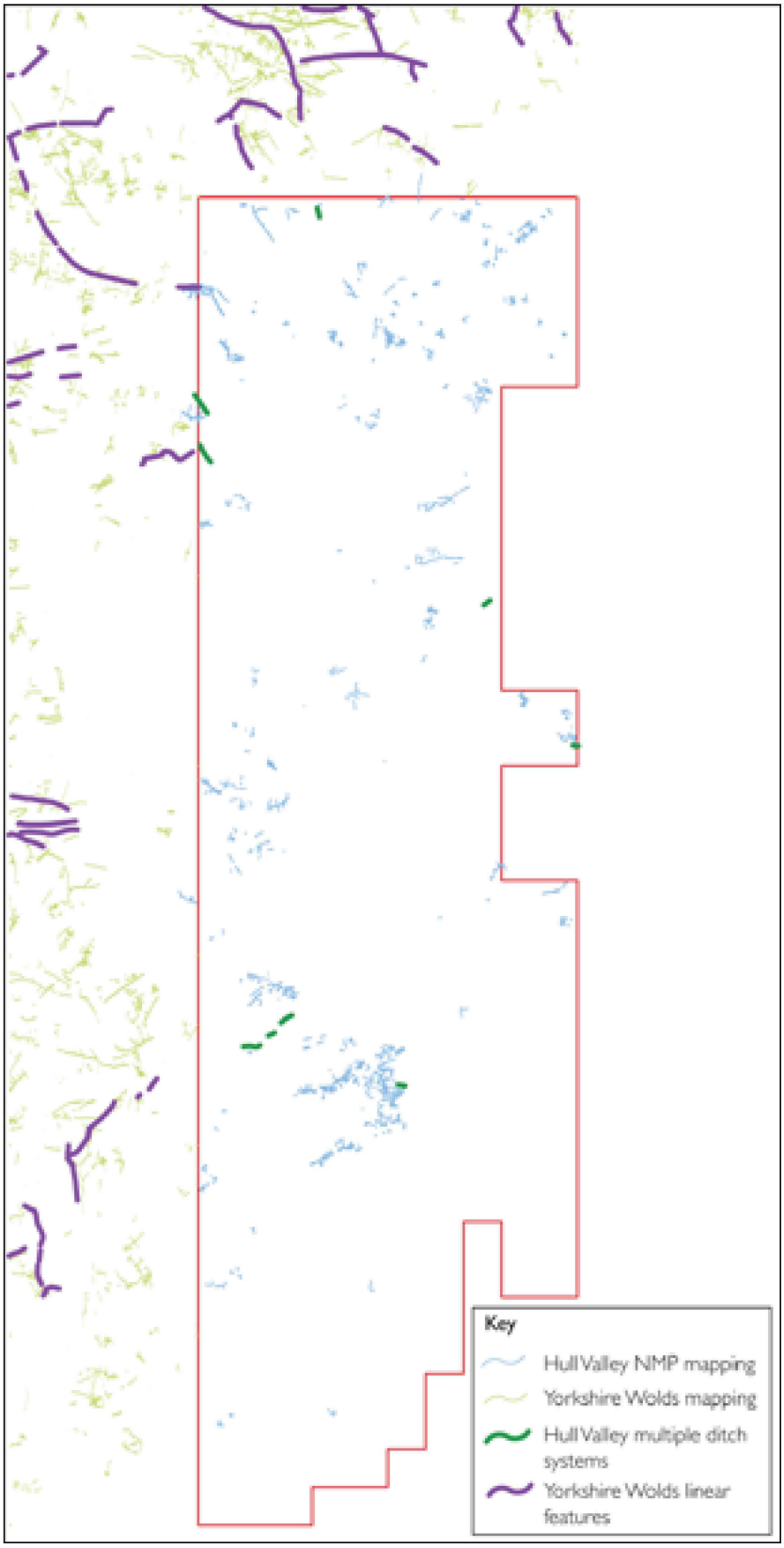

Fig 5: The distribution of multiple ditched systems and other linear features across the project area and beyond.

intersection with one of the single boundaries.

In the Hull Valley a multiple ditched system, with three ditches and two banks, was originally recorded as an earthwork (1551185) but is now destroyed by a reservoir at Tophill Low pumping station. Two others are visible as cropmarks with Iron Age/Roman enclosures and trackways. Here interpretation is difficult as double-ditched trackways may have been re-cut or 'braided', displaying a triple-ditched effect in the cropmark evidence. On the eastern edge of the project at Routh Carrs linear features were interpreted as trackways rather than multiple ditched boundaries, since they display both double-ditched and triple-ditched elements (1463587 and 1463587).

One of the more extensive sections of linear ditched system south-west of Beverley (Fig 6; 1087954) has three discontinuous sections extending for approximately 1.6km. One earthwork section was depicted on the first edition maps, labelled 'intrenchments' indicating that they survived as earthworks in 1854, whilst other parts have only been seen as cropmarks. A small section of this system, adjacent to an active quarry, survives as an earthwork and is recommended for further research (see PROTECTING ARCHAEOLOGICAL MONUMENTS). The quarrying has already destroyed part of the linear boundary. The system appears to continue an alignment found 2.4km to the west at Walkington on the Wolds (Stoertz 1997, fig 33). Aerial reconnaissance carried out after the Yorkshire Wolds mapping project has revealed more detail of attached enclosures and parallel linear alignments at Walkington. At Beverley, it is possible that a seemingly isolated enclosure, 115m to the south, may be associated with the multiple ditched system (1087966). Further reconnaissance has the potential to reveal additional elements and sections of boundary between the two locations.

Fig 6: A multiple ditched system adjacent to and partially destroyed by an active quarry. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088.

The chronology and function of the multiple ditched systems on the edge of the Wolds and in the Hull Valley was probably complex. Excavations in Lincolnshire revealed complex phasing, re-cutting and remodelling of the multiple ditch systems. As summarised by Boutwood (1998, 39) 'The simplicity or complexity of linear boundary construction may reflect their intended function, relationship to topography, symbolic and prestige value, or it may embody a chronological dimension'. The function of linear boundaries, is also discussed in the context of the Lincolnshire Limestone and the Witham Valley (ibid, 39–41) and some aspects such as access to resources and movement of people and livestock, may be relevant to the Wolds edge and Hull Valley.

Iron Age and Romano-British

In the Hull Valley, features dating to the Iron Age and Romano-British landscape mainly relate to enclosure and land division, movement through the landscape and funerary monuments. Although several features survive as earthworks, or were extant until the 1950s, most were seen as cropmarks. Mapping and recording the cropmarks was particularly valuable in enhancing understanding of settlement and land division in this period. A more detailed discussion on the Iron Age and Romano-British landscape can be found in the IRON AGE AND ROMANO-BRITISH LANDSCAPE chapter.

Many of the Iron Age funerary monuments mapped by the project survive, or survived until relatively recently, as earthworks. The most extensive single group is the Scorborough Iron Age square barrow cemetery and there are a number of barrows on Westwood Common, Beverley. A potential addition to the Westwood group (1566172) was identified on historic RAF photographs and other isolated examples were seen as cropmarks elsewhere.

Enclosures were the most numerous site type and are found throughout the project area. These were commonly rectilinear in plan and usually defined by a single ditch, although examples of multiple ditched enclosures were identified. Most enclosures appear isolated but there were a number of enclosure groups, sometimes flanking trackways, a pattern that is also seen on the Yorkshire Wolds. Internal features such as round houses were rarely recorded but this is likely to be due in part to the difficulty of cropmark formation over such ephemeral features.

Several fragments of double-ditched trackway suggest that movement through the landscape was managed. On the periphery of the Wolds most trackways are aligned as to indicate passage down into the Hull Valley. A trackway between Beverley Parks and Old Hall is the most extensive example and terminated on a dry valley that would have provided a natural route up onto the Wolds.

Some elements of field systems survive as earthworks, the most extensive of which are located on Westwood Common, Beverley, and others were identified as cropmarks. It remains unclear how, if at all, the landscape was divided and managed in much of the project area. One exception is a complex of features visible, to the south-west of Woodmansey, as an extensive and articulated series of cropmarks in an area of sands and gravels. Here the remains of a coaxial field system with embedded enclosures was

mapped; this is of particular significance because coaxial systems are not found on the Wolds but are common in the Vale of York and in South and West Yorkshire.

Although some areas may have been seasonally or permanently waterlogged, the distribution of archaeological sites demonstrates that land at elevations at least as low as 3m OD was dry enough to be habitable and farmed by the Roman period.

Medieval

Research relating to the medieval period in the Hull Valley has largely been confined to the previous four decades, with an emphasis on settlement and moated sites. Jean Le Patourel's seminal study of the 'Moated Sites of Yorkshire' (1973), underpins much of the later studies of Fenwick in the 'Wetland Heritage of The Hull Valley' volume (2000). Numerous excavations from the 1930s onwards have further enhanced our knowledge, providing detailed evidence for the use of sites, as at North Grange (see below). The medieval settlements of Eske and Rotsea have undergone analytical field survey at a scale of 1:2,500 and 1:1,000 respectively (English and Miller 1991; Cocroft *et al* 1989), adding detailed interpretation of the earthworks. Studying the aerial photography for this area has not only increased the number of known medieval sites, but as enhanced our understanding of the layout and complexity of settlement, monastic activity and associated land management.

The survey recorded aspects of medieval agriculture, ecclesiastical activity and settlement, including defended and moated sites. These features provide a framework for future fieldwork and documentary research.

The only feature tentatively identified as belonging to the early medieval period is an irregular curvilinear enclosure (1549650), underlying medieval ridge and furrow on Warren Hill. This is west of Little Kelk and lay adjacent to a complex of activity attributed to the Iron Age or Roman period. Similar examples on the Yorkshire Wolds were identified as being of possible early medieval date through their morphological characteristics and potential identification of Grubenhäuser (Stoertz 1997, fig 30).

Most of the medieval features recorded in the project probably post-date the Norman conquest. The exact interpretation of some features can be problematic, for example granges can be difficult to distinguish from secular settlement without documentary evidence.

Moated and defended sites

There are numerous moats in and around the Hull Valley. Of the 29 sites recorded during the project, four were previously unknown, and six were thought to indicate the location of monastic granges. Most of the moated sites are located along the west of the study area, on the lower slopes of the Wolds, between 10m and 25m OD (Fig 7). A handful of isolated examples are situated on the river plain. Of note is the possible monastic fishery of Fish Holm Barn, as it is located below 5m OD at the confluence of the River Hull and Frodingham Beck. The moated site in Risby Park is also an exception

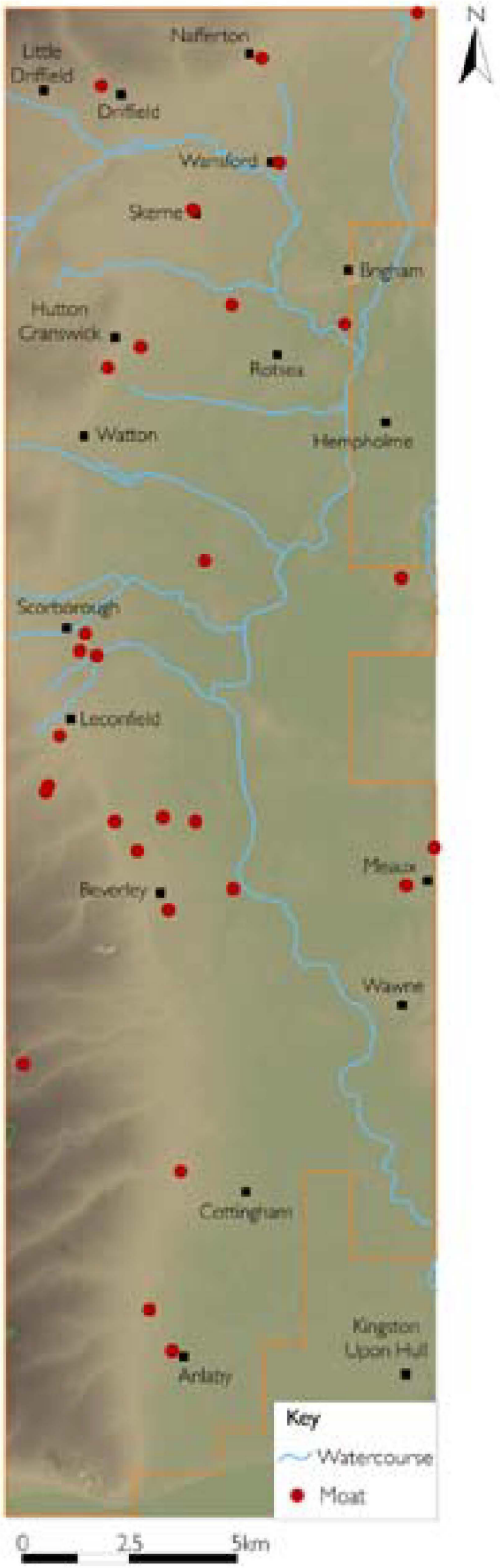

Fig 7: The distribution of moated sites across the project area.
Height Data: Licensed to English Heritage for PGA, through Next Perspectives™.

being located on much higher ground to the west.

Taylor defines a moated site as being 'an area of ground, often occupied by a dwelling or associated structure, bounded or partly bounded by a wide ditch' (1978, 5). No attempt has been made here to group the moats into Jean Le Patourel's forms (1973, fig 1), though it is noted that most are rectilinear, with only a handful displaying internal divisions or other anomalous features, which are mentioned below (Fig 8). These moated enclosures performed a variety of functions in a range of contexts such as a settlement, a monastery, a grange, or parkland (Fenwick 2000, 183–184).

A defensive role was identified at a few sites. Baynard Castle in Cottingham, now surrounded by urban development, saw a crenellation licence granted in the early 14th century (Jean Le Patourel 1973, 111) and Leconfield became the principle seat of the Percy family from the 14th to 16th centuries (Fenwick *et al* 2000, 96). The site of Moot Hill in Driffield remains the only true castle, being a Norman motte in origin, though now only visible as much denuded earthworks. Another potential motte, north of Little Kelk, named Nunnery Hill, has a mound with a diameter of over 40m surrounded by a 5.4m wide ditch.

A number of moated monastic sites belonging to Meaux Abbey are already known such as North Grange, north of the abbey, which underwent excavation in the 1930s and 1950s. This is where tiles were produced for the abbey, and it is the only moated site in East Yorkshire associated with industrial activity (Williams 1996, 32). The moated site of Fish Holm Barn, south of Brigham, is also thought to have belonged to Meaux Abbey and may have been a fish house. Barf Hill may have been the site of Mauley Manor, a vaccary attributed to Meaux (Jean Le Patourel 1973, 109), though it is uncertain whether the moat is associated with earlier, contemporary or later use. A small moat at Heigholme Hall was granted to Meaux in the late 12th century, and was the site of a manor house until the mid-19th century (Kent *et al* 2002, 295–306). A fifth moated grange (79426) potentially belonging to Meaux is located on the eastern border of Hutton Cranswick, though attempting to differentiate this from another documented grange, belonging to Watton Priory and also in Hutton Cranswick, is difficult (Stephenson 2009, 16).

Most of the moated sites in the project area were associated with nucleated settlement. A substantial moat (79252) at Nether Hall in Nafferton, was the site of the manor house of the Constable family from the 16th century. The 'moat of the manor of Grovall', was documented in the 15th century (Miller *et al* 1982, 34) but most of the manor is now covered by Grovehill industrial estate to the east of Beverley. The moat associated with the manor was identified as a cropmark to the south of Grovehill Bridge (79067). There are further manorial moats at Wansford, Driffield and Moat Hill, Anlaby, the latter being excavated in 1954 prior to development, exposing remnants of 13th-century tiled surfaces (Thompson 1956, 75). The moat at Driffield (79339) may have been part of Driffield Castle. The moat lay immediately to the west of Moot Hill, and was identified as earthworks on historic photography but has since been levelled.

At South Hall, on the southern edge of Cranswick, there were earthwork remains of a moat, a dovecote, hollow way and fishponds, all of which have been levelled. This site,

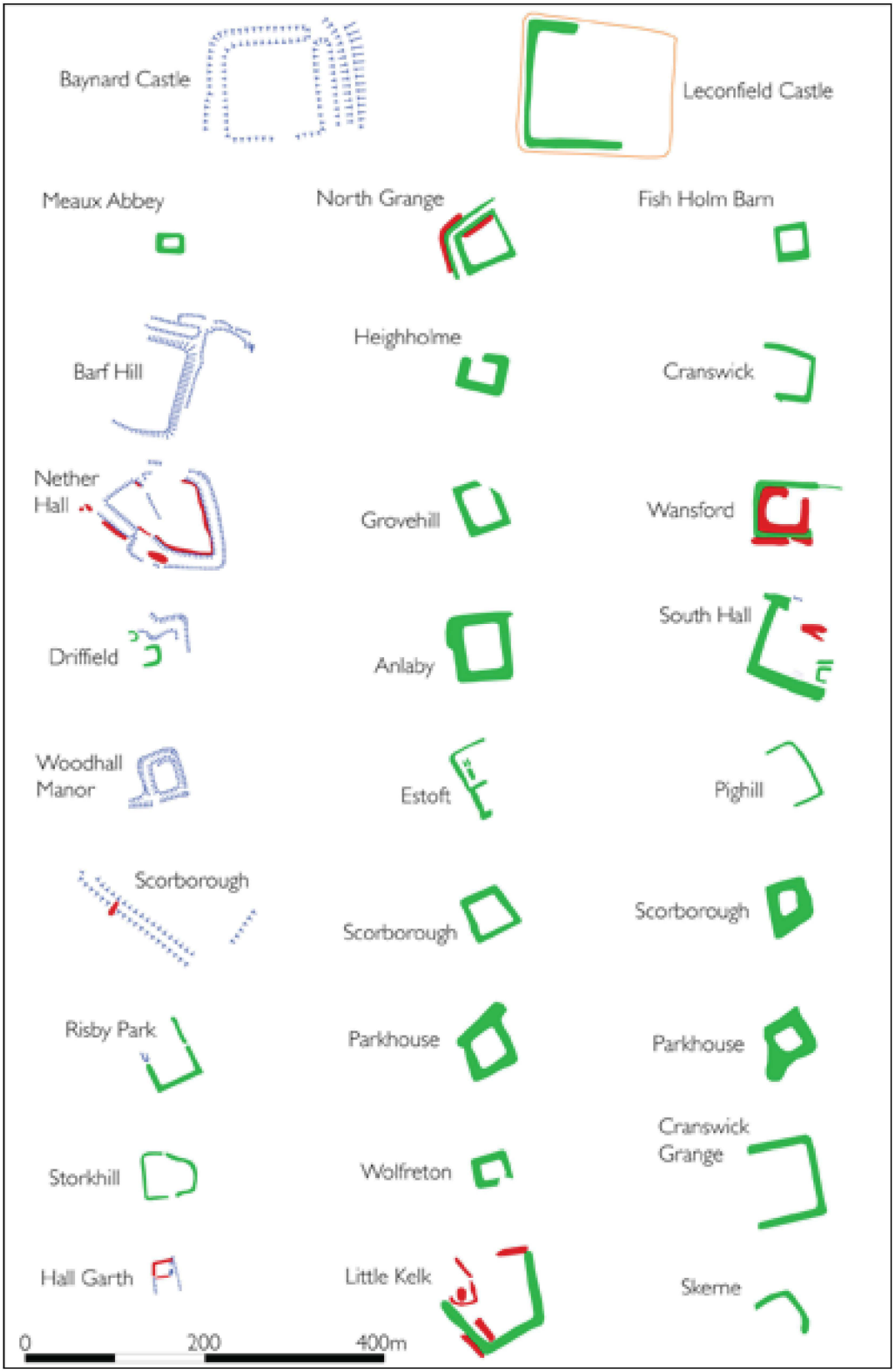

Fig 8: The forms of the moats recorded during the project.

being more complex than usual and in close proximity to the village, may suggest it to be a manorial seat, or possibly even associated with Watton Priory to the south.

A moated site east of the historic manor of Molescroft in the north of Beverley (910622), is now under a housing estate. It was excavated between 1965 and 1970 and included a barn and a roadway (Miller *et al* 1982, 34). This site, with a complex array of associated fishponds connected to the moat by a series of water channels, may be Woodhall Manor. A little to the east the possible site of John Bedford's 15th-century house of Estoft is indicated by a moat (1550441). This was heavily truncated by the railway and its eastern-most extent was tentatively identified by the location of a field boundary on the first edition Ordnance Survey map (1854, 1:10,560). This moat appears to have had an internal division and cropmarks indicate the sites of possible buildings or small internal fish ponds.

Pighill moat, also situated in the north half of Beverley and now under housing, is partly visible as earthworks on air photographs, and is thought to have belonged to the Copandales in the 14th century (ibid, 34).

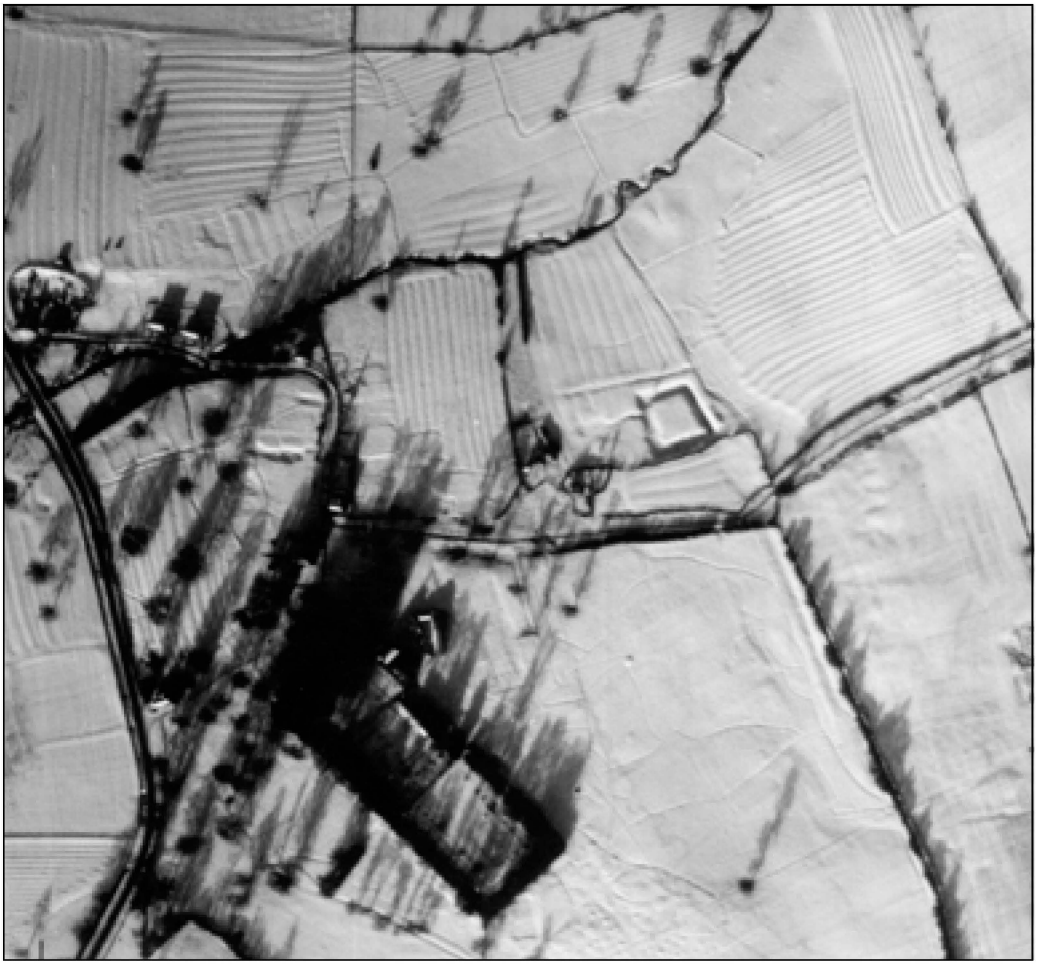

Fig 9: Medieval earthworks at Scorborough, including two moats, settlement and ridge and furrow.
NMR RAF/540/1750 0007 21-DEC-1955 English Heritage (NMR) RAF Photography.

The group of moats at Scorborough indicate a complex story (Fig 9). They all lie on the south-eastern periphery of the settlement. The largest moat adjacent to Scorborough Hall was manorial in origin and is now largely obscured by dense tree cover. Of the two smaller moats, one sits within the boundary of Scorborough Park, with which it may be associated. The area is thought to have been emparked in the late 14th century and may have continued in this use until the 1700s. This moat may have been the site of a hunting lodge, such as at Parkhouse to the south of Leconfield Castle, where two adjacent moats survive as earthworks within the area of the 'New Park', with the southern-most considered to be the site of a 'fair tower of brick for a lodge in the park' and the north moat being next to an area once known as 'Stable Close' (Jean Le Patourel 1973, 114). In contrast, the small moat in Risby Park, in the area known as Cellar Heads, is thought to be the site of a park lodge associated with the manor house (E Dennison pers comm).

A small number of isolated moated sites were identified during the project, such as west of Storkhill where an earthwork D-shaped moat (1551517) was recorded with adjacent field boundaries and a possible hollow way passing through the centre. Similarly a small moat mapped to the north of Wolfreton (1555976), sits in an area with no known settlement and was previously unrecorded. A possible further example was mapped from cropmarks to the north of Corpslanding Road, near Cranswick Grange, being of considerable size with internal dimensions measuring at least 64m by 74m and with a ditch nearly 10m wide.

The moated site of Hall Garth, on the outskirts of Beverley, is anomalous being neither manorial, a farmstead or park related. This monument, which is visible as the earthwork remnants of part of the moat and a building, is the much truncated remnants of the Archbishop of York's house dating to approximately the 13th or 14th century (Miller *et al* 1982, 11).

Another anomaly is the moat north-west of Little Kelk, which is the only three-sided example mapped in the project (Fig 8; see Fig 33; 79613). This sits adjacent to the possible motte of Nunnery Hill. The moat and the surrounding earthworks could be the remains of a shrunken settlement or a grange documented as belonging to Bridlington Priory (Allison 1974, 245).

Monastic sites

The Hull Valley was dominated by monastic influence in the medieval period, primarily from Watton and Haltemprice Priories and Meaux Abbey. Founded in the late 12th century, the Cistercian monastery of Meaux is still visible as extensive earthworks in the east of the study area, with a complex of fishponds, enclosures and a moat lying within the precinct (Fig 10). Up to seven granges, vaccaries or fisheries belonging to the abbey were identified on air photographs. A number of these sites were moated and have been mentioned above, such as the tile making site of North Grange and the fish house at Fish Holm Barn. The possible site of Belagh Grange comprises a complex array of rectilinear enclosures and boundaries, all of which are now levelled (see Fig 34).

Excavations at the now-demolished Gibraltar Farm, on the outskirts of Hull, produced

evidence for a medieval fishery associated with Meaux, which continued in use into the post-dissolution period as illustrated on Osborne's 1668 map by the place-name 'Fish Houses' (Fenwick *et al* 2000, 93). Earthworks, probably relating to water management associated with the fishery, were identified to the immediate south of the farm.

Fig 10: The earthworks of Meaux Abbey.
NMR 28225/34 19-OCT-2011 ©English Heritage. NMR.

A nunnery may have existed at Watton as early as the 7th century, though the complex earthworks which survive today are attributed to Watton Priory, a Gilbertine monastery dedicated to St Mary founded in about 1150 (Fenwick 2000, 188). This site, as described above, has extensive earthwork remains of fishponds and buildings. The priory is known to have had a number of granges in the area, but it was only possible to tentatively identify one from air photographs. The site of Cherry Garth (79205), a little under 1km to the east of the priory, consisted of a number of rectilinear enclosures with embanked building foundations clustered to the south. The regularity in the layout is reminiscent of other grange sites, and its proximity to Watton makes it a good candidate. Watton also had a grange in Hutton Cranswick to the north, though with numerous earthworks mapped around Cranswick (including a possible grange belonging to Meaux) it is not possible to positively identify the site (Stephenson 2009, 16).

Haltemprice Priory, located in the south of the study area, between Cottingham and Wolfreton, is considerably smaller than its counterparts. Some of the earthwork remains mapped from 1950s air photography were levelled. The precinct boundary survives, though much of it has been recut for modern drainage. Founded initially in Cottingham by the Augustinian order under Lord Thomas Wake in 1320, the site was later moved to the village of Newton (Gaze Pace 2011, 15), elements of which survive as earthworks to

the immediate west of the priory.

Watton Priory, Haltemprice Priory and Meaux Abbey, are designated, and the aerial survey produced evidence for activity extending beyond the scheduled area at Watton and Haltemprice.

Settlement

Medieval settlement remains in the Hull Valley are well illustrated on early air photographs, taken prior to subsequent ploughing and levelling of many sites. Excluding manorial moated sites, a total of 22 areas of settlement were identified as either earthworks or cropmarks. Most appear to be the shrunken remnants of settlement, often centred on a remaining farm or property. Wawne (Fig 11) and Skerne are still substantial villages, but are surrounded by complex settlement earthworks, including crofts and tofts with associated field boundaries, suggesting population shrinkage or shift.

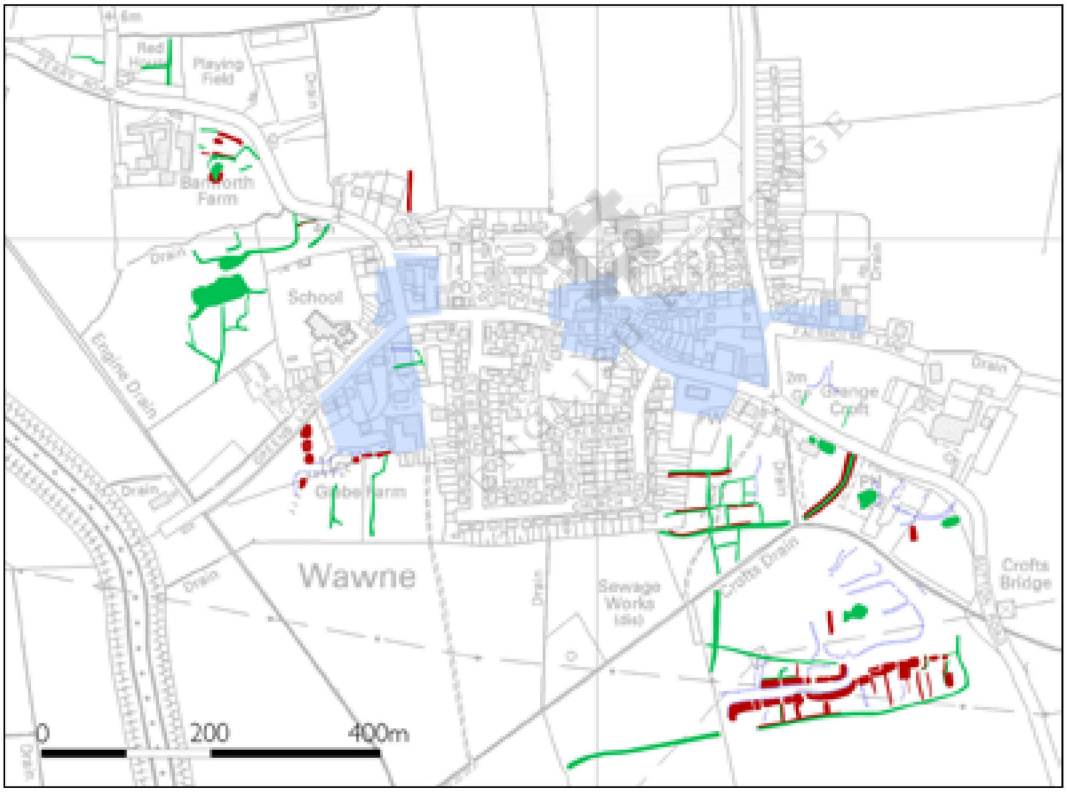

Fig 11: The remains of tofts, crofts and hollow ways surrounding the present day village of Wawne. The extent of the village as recorded on first edition Ordnance Survey mapping is highlighted in blue.
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At Sunderlandwick and Eske, there is evidence of the ordered layout of a planned settlement. Eske is thought to have continued as a sizable village into the 18th century, but now only consists of Eske Manor and High Eske, the settlement having migrated away

from the riverside (Fenwick *et al* 2000, 99). Most of the villages in the valley were located on raised ground, surrounded by their associated enclosed and open field systems.

Only a few villages were completely abandoned: Winthorpe Manor, west of Scorborough being one example. Another example is indicated by the complex earthwork remains at Rotsea, located some 300m away from the modern hamlet. This scheduled site is the most extensive in the project area, with a complex array of hollow ways, building foundations and platforms with associated field boundaries (Fig 12; also see Fig 38). It is unclear whether the village was abandoned or whether it simply migrated uphill to the present site, though 'old foundations' are labelled on the 1848 Ordnance Survey map on the site of the earthworks (Cocroft *et al* 1989, 14–15), suggesting that final abandonment

Fig 12: The medieval settlement of Rotsea.
NMR TA 0651/26 NMR 17183/26 26-OCT-1998 ©Crown copyright. NMR

occurred in the post medieval period.

Another possible abandoned medieval settlement lies adjacent to Park Grange Farm (1375141), south of Beverley. Consisting of rectilinear enclosures and ditches, this site is morphologically unusual with two sinuous boundary ditches defining a broad open space. It is however possible that this site may in fact be a much earlier settlement as it seems to show a relationship with an Iron Age/Roman field system to the south. The site has been levelled and was largely mapped from cropmarks but it survived as earthworks in the 1940s and is recorded on historic RAF vertical photographs.

Survival of medieval settlement earthworks is unfortunately rare, with most sites being ploughed level or developed in the previous 50 years. Raventhorpe, for example, which stands on the western border of the Leconfield parks was, for the most part, well preserved as earthworks until the 1970s, and is still illustrated as such on modern Ordnance Survey maps. Most of the site is, however, now completely levelled.

The project illustrated the changing settlement patterns in the Hull Valley. The possible population decrease, indicated by earthworks of abandoned medieval settlement areas, reversed in the 20th century and modern housing has engulfed some of the medieval sites, such as at Molescroft on the outskirts of Beverley.

Agriculture and landscape management

Medieval ridge and furrow in the Hull Valley is defined by open fields. The densest concentrations lie along the west edge of the project area, predominantly on the foot slopes of the Wolds and on the upper reaches of the Hull Valley. Another cluster centres on the rising ground to the east, around Meaux Abbey (Fig 13) and Wawne. Smaller isolated pockets exist throughout the valley bottom, almost exclusively on raised areas, such as north-east of Eske.

Ridge and furrow can only be given an approximate date by its morphological characteristics. Taylor states that open fields became the norm after the Norman Conquest (1975, 71), but where documentary sources exist they can sometimes be used to help date ridge and furrow more precisely. Areas of cultivation were mapped within Leconfield and Risby Parks, and considering that the approximate dates of these parks is known through documentary evidence (Leconfield from the 14th to 16th century, and Risby from the 16th to 18th century), it may be reasonable to assume that the ridge and furrow either pre-dates or postdates them. In the case of Risby it will almost certainly pre-date the park, as it was not disused until at least 1787 (Neave 1991, 46).

Different phases of medieval land use are illustrated to the west of Molescroft where a linear boundary bank (1552238) with a length of 1.5km, is visible as denuded earthworks beneath the medieval ridge and furrow. This boundary is also considered medieval in origin, possibly a redundant intake boundary or a northern boundary to Westwood Common.

Most open fields were enclosed in the post medieval period, though some enclosure may

Fig 13: Medieval ridge and furrow north of Meaux Abbey.
NMR TA 0940/11 NMR 12974/15 06-MAR-1997 ©Crown copyright. NMR

have begun earlier, with arable areas being turned over to pasture (Fenwick *et al* 2000, 93). Physical evidence of pastoral activity was limited, but a number of stock enclosures were recorded throughout the project area, often closely associated with settlement, as in Little Driffield. An isolated ditched enclosure at Feather Holm, by the River Hull, may be associated with an adjacent farmstead seen as foundations and mentioned on the first edition Ordnance Survey map (1854, 1:10,560), and annotated as 'Fetherholme' on Osborne's 1668 map (ibid, fig 6.1). Most of these stock enclosures are considered to be medieval or post medieval in origin.

A number of stack stands recorded throughout the project are generally considered post medieval in nature as they sit on top of medieval ridge and furrow, though two examples abutting the rectilinear enclosures of the possible grange of Cherry Garth may be medieval by association.

As well as the boundary bank north of Westwood Common, mentioned above, further boundary banks were mapped (1550513), most notably on the northern and eastern limits of Swine Moor, east of Beverley, where they appear to have acted as a flood defence for the lower-lying pastures of the Moor. These banks are probably medieval in origin, though elements were maintained into the post medieval period until they became redundant with the cutting of the Beverley and Barmston Drain in the early 19th century (Allison *et al* 1989, 161–169). Unusually broad boundary banks (1566927), centred on Eppleworth Head are more irregularly spaced and their function remains uncertain, though they appear to form an integral part of the medieval or earlier landscape, being abutted or part-levelled by medieval ridge and furrow.

Water management played an integral role in the medieval landscape, most notably in terms of drainage. Drains were, as a rule, not recorded unless they formed a part of a mapped field system, such as west of Sunderlandwick. Many of the medieval sites mentioned above were associated with complex arrangements of water features, such as fish ponds or moats. The array of fishponds and water channels around the settlement of Storkhill is a good example of the complexity at some sites. It is documented that some of the granges of Meaux, such as at Skerne, had water channels allowing access to the River Hull (Knowles 1990, 366), though none could be positively identified during this survey, possibly having been re-used to form modern drains.

Other forms of water management were also evident. The mill race at Bridge Farm (1549024), on Watton Beck, with associated leats and ponds is associated with a bleach mill labelled on the 1857 Ordnance Survey map, though the subsequent over-ploughing of some features in the post medieval period may suggest earlier origins. Earthworks, leats and other water management features, associated with Watton Mill further upstream, may also be medieval in origin.

Causeways sometimes formed routeways across the lower-lying areas of the Hull Valley. A number were identified during the survey, especially in those areas near the river where drainage was difficult. Documentary sources record the existence of a ferry crossing the Hull River between the settlements of Rotsea and Hempholme in the 14th century (Fenwick *et al* 2000, 90). A 180m length of causeway on the west bank of the river, near Rotsea, may have provided access to the ferry and is probably an indication of the location of the crossing point.

Post medieval

The landscape of the Hull Valley went though a massive transformation over the course of the post medieval period, largely as a result of extensive drainage schemes gradually reducing the impact and frequency of flooding in the lower lying carrs. Where previously these carrs had been underwater for much of the year, by the mid-19th century they were largely dry (Crowther, 1983, 115). The move to enclosure also effected a substantial change in the Hull Valley. It signified a shift away from the communal, open field methods of the medieval period and reflects an intensification of agriculture during this period. Most of the settlements in the Hull Valley had seen at least partial enclosure of their open fields by the 18th century (Fenwick *et al* 2000, 101; Crowther 1996, 66) achieved through agreement between major landowners. This piecemeal process was gradually replaced by the parliamentary enclosure acts of the late 18th and early 19th centuries (Neave 1971, i).

Arable and pastoral farming continued to be practised throughout this period, as evidenced by numerous post medieval remains, including stock enclosures, stack stands (for the storage of winter fodder) and narrow ridge and furrow. Prior to the drainage schemes, implemented during the 18th and 19th centuries, arable farming was largely limited to the lower slopes of the Wolds or on areas of higher ground in the valley bottom. This distribution is seen in the pattern of surviving medieval ridge and furrow. The drainage schemes allowed effective arable cultivation of areas that had previously

Fig 14: Post medieval duck decoys at Meaux, Scorborough and Watton.
NMR TA 0345/1 NMR 817/377 07-MAY-1975 ©Crown copyright. NMR
NMR TA 0840/13 NMR 12974/18 06-MAR-1997 ©English Heritage. NMR.
LIDAR TA04NE DTM 21-OCT-2010 ©Environment Agency copyright 2012. All rights reserved.

been waterlogged and provided the impetus for an increasingly arable landscape. Post medieval narrow ridge and furrow was largely located in the lower lying areas adjacent to the River Hull, benefiting from the fertile alluvial deposits found on the floodplain. The resulting field patterns are of note with irregular field boundaries visible on areas that were subject to pre-parliamentary enclosure largely located on the higher ground. The field systems lying in the former carrs were some of the last areas of the Hull Valley to be enclosed and as such are notably more regular in plan (Crowther 1983, 109).

The post medieval period saw the introduction of a number of innovative husbandry techniques. In the 17th century a new method of trapping ducks was imported from the Netherlands (English Heritage 2012a, 6) known as a duck decoy or decoy pond. Duck decoys were artificial or modified ponds with a number of curving ditches leading off, known as pipes (ibid, 2). The unfortunate waterfowl were encouraged onto the pond and lured up the netted pipes to be trapped. There are duck decoys at Meaux (a scheduled monument), Scorborough and Watton (Fig 14). The decoys at Meaux and Watton are largely rectangular with four pipes extending at each corner. The decoy at Scorborough is slightly more complex with five pipes. All three are located in low-lying wetland marsh areas, known locally as ings or carrs. These locations are ideal, given that decoys are best placed in open land away from human habitation and that the marginal land was of limited value for other agricultural practises; being underwater for much of the year. Historical sources suggest Meaux, Scorborough and anecdotally Watton were rendered useless in the late 18th century when various acts, in particular the 'Beverley and Barmston drainage act 1798' were passed (Payne-Gallwey 1886, 182). These acts led to the draining of the carrs, eventually denying the ducks a suitable habitat. The decoy ponds survive as earthworks, but Watton is in very poor condition. The decoys at Scorborough and Meaux both survive well, although Scorborough is covered by dense woodland.

The 18th century saw rabbit warrens reach their greatest extent in Yorkshire (Harris 1970, 429). The two rabbit warrens located during the course of the survey, were of an unusual form. Pillow mounds (1549637) at Warren Hills, just west of Great Kelk, were constructed on top of the ridges of medieval ridge and furrow ploughing. Presumably this limited the amount of construction required and allowed for good drainage along the existing furrows. As a rabbit warren precludes the use of an area for arable farming (the rabbits eating all the crops) the ridge and furrow was obviously redundant by this point. Another warren, at Low Carr, south of Driffield, comprised two embanked crosses each surrounded by a narrow ditch (Fig 15; 79304). The embankment cross is a variation on the traditional rectangular pillow mound, having a cruciform arrangement (Williamson 2006, 38–39). A total of only 14 embankment crosses are known in England, and of these 13 are located in North or East Yorkshire, making them an infrequent variation of a common site type (Horne 2001). These embankment crosses are the only surviving elements of the once extensive Eastburn Warren, reported to have been reclaimed for arable farming in 1849 to 1850 (Harris 1970, 432–433). Although both warrens were surviving as earthworks post-war, neither are upstanding presently; Warren Hills is under arable agriculture, whilst Low Carr has undergone land improvements resulting in the levelling of much of the area.

Fig 15: RAF vertical photography revealing an embankment cross at Low Carr. NMR RAF/CPE/UK/1911 4164 27-DEC-1946 English Heritage (NMR) RAF Photography.

Industry was also playing an increasing economic role during the post medieval period. Small-scale aggregate extraction was fairly widespread throughout the Hull Valley during this period. Chalk pits were commonplace along the foothills of the Wolds, the rock either spread on the fields, or converted to lime for soil improvement. Larger scale chalk pits continued in use from the post medieval into the 20th century periods and their expansion can be traced on Ordnance Survey mapping. On-site processing of chalk at some of the pits is evidenced by associated lime kilns or whiting works. Whiting is formed by crushing chalk and has a number of industrial applications (British Geological Society 2004, 1). Of the three whiting works recorded by the project only the mill at Hessle survives, just a small fragment of the former works. Brick and tile making was established in Hull and Beverley since the medieval period, as locally produced bricks were used for the town walls (Los and Los, 1996, 82). A number of post medieval and 20th-century brick and tile making sites and clay pits were located at Hull, Beverley and Driffield, situated on suitable alluvial clays. Over the last 50 years most of these industrial remains have been levelled, largely as a consequence of the expansion of urban areas or increased ploughing within the Hull Valley. The small-scale post medieval chalk pits largely remain extant, perhaps due to less pressure on the lower slopes of the Wolds.

Only one post medieval military feature, a possible Civil War redoubt (79260), was recorded by the project. This earthwork was recorded on first edition Ordnance Survey mapping (1854, 1:10,560) as an 'Ancient Inclosure'. The feature sits on medieval ridge and furrow and is therefore medieval or later in date. The form, a crudely constructed polygonal enclosure with an internal ditch and external bank, is considered fairly typical, given the inexperience of the Civil War armies (Harrington 1992, 6). Although further research is needed to confirm the civil war interpretation, skirmishes are recorded in the neighbouring parishes of Driffield, Cowlam and Helperthorpe (Neave 1996, fig 1).

During the post medieval period gardens of the upper classes become larger and more substantially constructed (English Heritage 2012, 5). Isolated examples of features within landscape parks were recorded by the project and include post medieval tree enclosure rings at Tickton Grange and Hull Bank Hall. The most significant remains of post medieval formal gardens belong to Risby Hall (Fig 16). Here the extensive earthworks represent a rare survival of a post medieval garden design, as many gardens belonging to this period were later radically altered to suit changing fashions. Their survival is a direct consequence of the poor fortune of the owners of the hall. The hall was constructed in approximately 1680, replacing a medieval house nearby. Unfortunately the post medieval hall was twice destroyed by fire, first in 1770 and again in the early 1780s. The location of the house is marked by a depression formed by the remains of the cellars. The earthworks relating to the formal gardens are particularly impressive and include numerous terraces, avenues and ornamental water features.

Fig 16: The earthwork remains of Risby Hall and gardens. NMR 28224/25 19-OCT-2011 ©English Heritage. NMR.

20th century

As noted above, the extractive industries in the Hull Valley continued beyond the post medieval period into the 20th century, albeit less widespread. A number of chalk quarries continued in use and were seen to be still active on the historic RAF photography; the Queensgate chalk quarry near Beverley remains in use to this day. Most 20th-century features recorded in the survey related to military activity, in particular to the Second World War.

Fig 17: First and Second World War practice trenches on Westwood Common, Beverley. NMR RAF/3G/TUD/UK/1 PART II 5006 14-DEC-1945 English Heritage (NMR) RAF Photography.

Beverley's Westwood Common was utilised for military training during the First World War, as were many urban commons in England (Bowden *et al* 2009, 51). An area of First World War practice trenches are visible in the south of the common on historic photography (Fig 17) and several other trenches of probable Second World War date can also be seen. The common was also the location of an airfield established on Beverley racecourse in 1916 in response to the threat of Zeppelin air raids on Hull (Bowden *et al* 2009, 51). The earthwork remains relating to the airfield buildings were recorded on 1945 RAF photographs but one building and its associated water tower are all that remain of the airfield buildings today (Fig 18). RAF Driffield also had its origins under the Royal Flying Corps (RFC) during the First World War, becoming a permanent airfield in 1918 (Halpenny 1990, 64).

Fig 18: A First World War airfield building and water tower at Beverley Racecourse in use as part of an Army camp in 1941. The rectilinear plan of the old airfield buildings is visible in the background.
NMR TA 0139/5 MSO 31050/PO-02084 20-JUL-1941 English Heritage (NMR) RAF Photography.

The east of England was the location for the majority of military airfields during the Second World War and three of these, RAF Driffield, Leconfield and Hutton Cranswick, lay within the project area. RAF Leconfield and Hutton Cranswick were established in 1936 and 1942 respectively and, after a brief hiatus in the 1920s, Driffield was reactivated in the early 1930s (Halpenny 1990, 64). As well as the airfields themselves, related infrastructure was also recorded by the project. This included airfield defences such as pill boxes, numerous dispersed camps and an aviation fuel distribution depot at Watton which supplied several of the local RAF airfields (R Thomas, pers comm).

Hull was the most bombed northern city in Britain during the Second World War (Neave and Neave 2010, 29). Evidence for this can be seen in the numerous bomb craters visible on 1940s vertical photography; this historic imagery also shows large

swathes of bomb damage in urban areas (Fig 19). Over 470 civilian air raid shelters and just under 50 emergency water supplies were mapped in Hull and Beverley although the original number was certainly considerably higher. The project specification was restricted to public shelters and did not include the smaller domestic shelters because they were so numerous. Air raid shelters were most commonly of the concrete surface type although some semi-sunken shelters were seen.

Fig 19: Bomb damage in the Newland area of Kingston upon Hull.
NMR RAF/3G/TUD/UK/87 PART IV 5302 27-MAR-1946 English Heritage (NMR) RAF Photography.

The anti-aircraft defences designed to combat the aerial threat included barrage balloon sites, searchlight batteries and Heavy Anti-Aircraft (HAA) batteries. Barrage balloon sites were restricted to the urban areas of Hull but searchlight and anti-aircraft batteries were more widespread. Advances in technology, particularly the introduction and development of radar, are reflected at these sites. Examples of radar directed searchlight sites such as that near Meaux Abbey Farm (Fig 20) were recorded and traces of radar gun laying (GL) mats were visible at all three HAA batteries. A Ground Controlled Interception station was also recorded at Hampston Hill which was used to detect and track enemy aircraft.

The HAA batteries at Butt Farm (Humber H31) and Costello playing fields (Humber

Fig 20: A radar directed searchlight battery near Meaux Abbey Farm.
NMR RAF/106G/LA/212 4152 13-APR-1945
English Heritage (NMR) RAF Photography.

H28) were both retained after the war as part of the Nucleus Force, a small network of HAA sites that were selected to remain operational post-1945 (Dobinson 1996, 231). At both sites the GL mats had already been superseded by more advanced radar systems and H28 was upgraded in 1945 to four 5.25in guns which were sited to the north-east of the original emplacements. H28 acted as an 'Off site' position with its guns stored locally but H31 was a permanently armed 'BHQ site' (Dobinson 1996, table LXXVII) and the guns and other equipment are clearly visible on large-scale 1945 vertical photography (Fig 21).

Few examples of anti-invasion defences were recorded but included barbed wire obstructions, trenches, pill boxes and tank traps. One prolific form, however, was the aircraft obstruction of which numerous and extensive examples can be seen in and around Hull. These were typically defined by earthwork ditches flanked by mounds of earth and sometimes utilised existing systems of drains.

Two decoys were recorded, both 'Q' type which were designed to operate at night using lights to mimic airfields and draw enemy fire (Dobinson 2000, 43–45). Q12A was located at Skerne Grange and acted as a decoy for RAF Driffield while Q13A, north-east of Tickton Grange, was a decoy for RAF Leconfield. At both sites only the control post was visible and although this was seen to be extant at Skerne Grange on 2008 photography, the Tickton Grange control post was obscured by trees on the latest 2011 photography so its state of preservation could not be determined.

The threat of nuclear war in the Cold War period meant East Yorkshire remained militarily significant. Two Royal Observer Corps underground monitoring posts were recorded during the survey (1415829 and 1415720). These formed part of a nationwide network designed to observe explosions from nuclear bombs and monitor the subsequent fallout (Lowry 1996, 127). At Wawne there was a 1950s semi-sunken Anti-Aircraft Operations Room which would have been the base to command the Hull Gun Defended Area, one of 33 such regions in the United Kingdom (Cocroft *et al* 2005, 148).

Although flying ceased at Hutton Cranswick after the war, both RAF Leconfield and Driffield continued as operational stations and the changes in the airfield layouts and infrastructure can be traced on the post-war vertical photography. Amongst other

Fig 21: HAA battery Humber H31 showing the remains of the redundant GL mat and later radar infrastructure (top). The enlarged image (below) shows the battery with the guns and other equipment in situ.
NMR RAF/3G/TUD/UK/1 PART 1 5061 14-DEC-1945 English Heritage (NMR) RAF Photography.

roles, RAF Leconfield housed a succession of jet fighter squadrons until the early 1960s, requiring lengthening of its north–south runway. The biggest change was at RAF Driffield which in 1958 became one of the four principal Thor nuclear missile sites (Cocroft *et al* 2005, 38). Although short-lived, the airfield was adapted to host the missiles and the distinctive cruciform concrete launch emplacements are clearly visible on 1958 and later vertical photography (Fig 22).

Fig 22: The Thor missile site at RAF Driffield photographed while operational in 1962. The site has been superimposed on the Second World War runways.
NMR RAF/543/2003 0035 18-DEC-1962 ©Crown copyright. MOD.

Fig 23: A probable military site on Swine Moor Beverley. Its function remains uncertain.
NMR RAF/3G/TUD/UK/1 5060 14-DEC-1945 English Heritage (NMR) RAF Photography.

While military features are often easily identifiable due to their standardised plan, interpretation of some features remains elusive. On Swine Moor to the east of Beverley are a series of features defined by a mound with a structure on top flanked by two depressions (Fig 23). The regular pattern and apparent freshness on these features on 1945 photography has led to the conclusion that they are military in origin but as yet their exact function is uncertain.

THE IRON AGE AND ROMANO-BRITISH LANDSCAPE

Introduction

Until the 1930s, knowledge of the Iron Age and Roman settlement of the Hull Valley was largely restricted to small finds evidence and a handful of sites, commonly square barrows, which were visible as upstanding monuments. Early investigations also focussed on these sites with Mortimer and Greenwell excavating numerous barrows in the latter part of the 19th century. The most significant of these is perhaps the chariot burial from Westwood Common.

In the 1930s excavation began at the site of RAF Driffield, prompted by the imminent construction of new aircraft hangars. This uncovered an Early Iron Age barrow cemetery but also finds of Iron Age and Roman pottery suggestive of settlement (Sheppard 1939). Further work was carried out in the early 1950s close to the location of Sheppard's excavations after the discovery of skeletal remains and Roman pottery during drainage works for the new married quarters at RAF Driffield. Several cut features and pottery sherds were identified, indicating a Late Iron Age occupation site (Philips 1960). These excavations and subsequent work nearby at Auchinleck Close (Walsh *et al* 2012) are some of the few examples which coincided with features identified through aerial survey and will be discussed in more detail below.

From the 1970s the identification and recording of Iron Age and Romano-British sites as cropmarks through aerial photography began to broaden the range and distribution of known archaeological features. Excavation, particularly numerous small-scale excavations and watching briefs in advance of development in the urban areas of Driffield, Beverley and Kingston upon Hull, also produced an ever increasing body of evidence for settlement and farming.

The nature of the evidence

The Hull Valley NMP project expanded considerably our understanding of the Iron Age and Romano-British landscape. As well as increasing the number of sites, the mapping also revealed areas of contiguous and articulated features that were previously not fully recognised. The ad hoc and cumulative nature of the previous record meant that while some sites had been noted, their spatial and chronological relationships to one another were often not fully appreciated or understood.

The coincidence of excavations with features mapped from air photographs is rare within the survey area meaning that interpretation and dating of cropmark and earthwork features is primarily based on morphology. The difficulties of distinguishing between Iron Age and Roman period settlements, enclosures and field systems from morphology alone are widely acknowledged and have been noted in this region (Chapman 2000, 177) so features have generally been recorded as Iron Age/Roman unless explicit dating exists. Furthermore, there can often be a continuity of settlement from the Iron Age into the Roman period.

Cropmark evidence for settlement and land division is often fragmentary, especially compared with the extensive and contiguous archaeological landscapes of the Wolds, Vale of York and Magnesian Limestone belt. To what extent this fragmentary nature reflects a true distribution of archaeological features or the relative responsiveness of different soils and geologies is a well-rehearsed debate but it is certainly the case that the 'gaps' in the cropmark record of the Hull Valley are often a result of the latter (see Chapman 2000, 179–81). Earthwork survival is even rarer but instances of features still visible on historic photography as earthworks into the 1950s have been noted.

Enclosures

There were enclosures throughout the project area in a number of contexts – as part of enclosure groups, aligned on trackways, embedded within field systems and as isolated features. The enclosures are almost exclusively rectilinear in plan and most are apparently simple in form, defined by a single ditch with little or no evidence of internal features or division. This pattern has been observed on the Wolds to the north and west (Stoertz 1997, 49–51) and in adjacent areas of Holderness (Deegan 2008, 7).

Single

Although many enclosures appear to be isolated, it is common for them to have associations with small fragments of ditch which indicate that they must once have been aligned on boundaries or sat within a wider field system. It is possible that the insubstantial construction of these field boundaries means that they only form cropmarks in exceptionally dry conditions, or alternatively they may have been partially destroyed by ploughing. In some places, such as the area to the west of Wansford (Fig 24), a shared alignment of fragmentary ditches and isolated enclosures suggests they once formed a broader system of land division.

Enclosure groups

Instances of enclosure groups are less common and where these do occur there is often evidence of phasing suggesting a gradual development of the complex or a redundancy of some elements when others were constructed. The group to the west of Wansford (1088033) is potentially the only one that bears a close morphological similarity to the linear enclosure complexes or 'ladder settlements' identified on the Yorkshire Wolds (Stoertz 1997, 51–5). Here a series of conjoined enclosures is largely confined within a strip of land approximately 120m wide. Elements of the complex appear to be appended onto two ditches that partially define the strip, suggesting that the enclosures were infilling an existing block of enclosed land (Fig 24). Although the establishment of these linear complexes may have begun in the Late Iron Age (Stoertz 1997, 53), excavations of 'ladder' type settlements in Hull have invariably produced Roman dates (Evans 2000, 197) so it may well be that this site originated in the post-Iron Age period. The location on the bank of the river is also a characteristic that is shared with the excavated Hull examples and might indicate that a second enclosure group 1.5km to the west (1547927) is of a similar date.

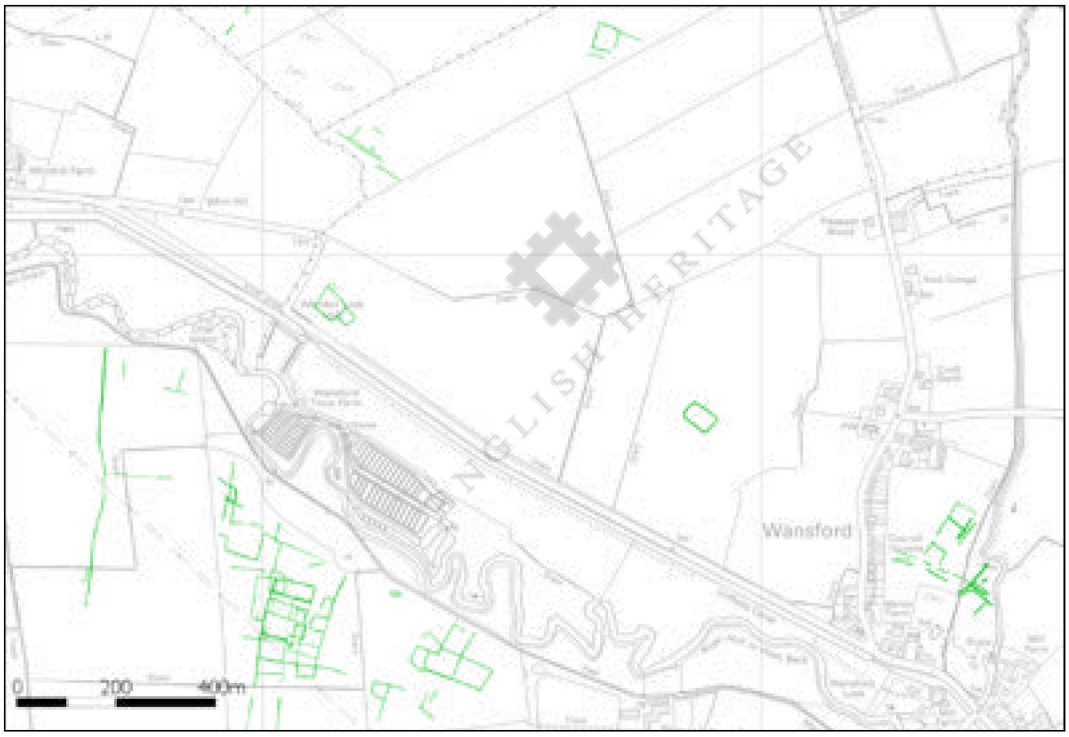

Fig 24: A 'ladder' type settlement near Wansford (bottom left). Also note the common alignment of the enclosures to the north.
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At Little Driffield is a complex (64488), partially mapped by Stoertz and re-mapped by this project, which is morphologically very different in nature to that at Wansford. It comprised a series of rectilinear enclosures or small fields aligned on a network of trackways. A long double-ditched trackway continues south-eastwards from the complex and various excavations close to the Kellythorpe industrial estate have recorded ditches and round houses dating to the Iron Age and Roman periods as well as dating the trackway itself. It is reasonable to extrapolate similar dates for the cropmarks to the north.

An enclosure complex seen as cropmarks at Cottingham Parks (910624) was aligned on what is probably a former meandering watercourse. A high concentration of prehistoric and Roman pottery was identified during field walking at this location (Didsbury 1988, 25) and the complex sits close to the site of a multi-phase Late Iron Age settlement identified through excavation (interim report in *CBA Forum* (1998): 42–4). The proximity of the cropmarks and excavated features suggests they may be part of the same settlement. Immediately to the west of the cropmark enclosures are a series of low banks that were visible as earthworks on historic RAF photography but have now been levelled. These continue the sinuous linear alignment of the cropmarks to the east and have therefore been interpreted as potentially contemporary field boundaries or enclosures.

Multiple ditched

Five examples of enclosures with multiple circuits of ditch were identified within the project area (Fig 25). Enclosures with ditches running parallel to parts of their circuit were also found but in these instances they were considered likely to represent trackways running alongside enclosures. It is often only possible to demonstrate whether multiple ditches represent contemporary or separate phases of construction through excavation but the parallel nature of the circuits in many instances suggests some degree of contemporaneity. At Hall Ings (1566009) a double-ditched trackway, appears to curve to avoid the north-eastern corner of a double-ditched enclosure (Fig 25). A third outer circuit of ditch intersects the trackway so it is possible the trackway was out of use by the time this was constructed. These multiple-ditched enclosures perhaps had a particular function or status within the landscape.

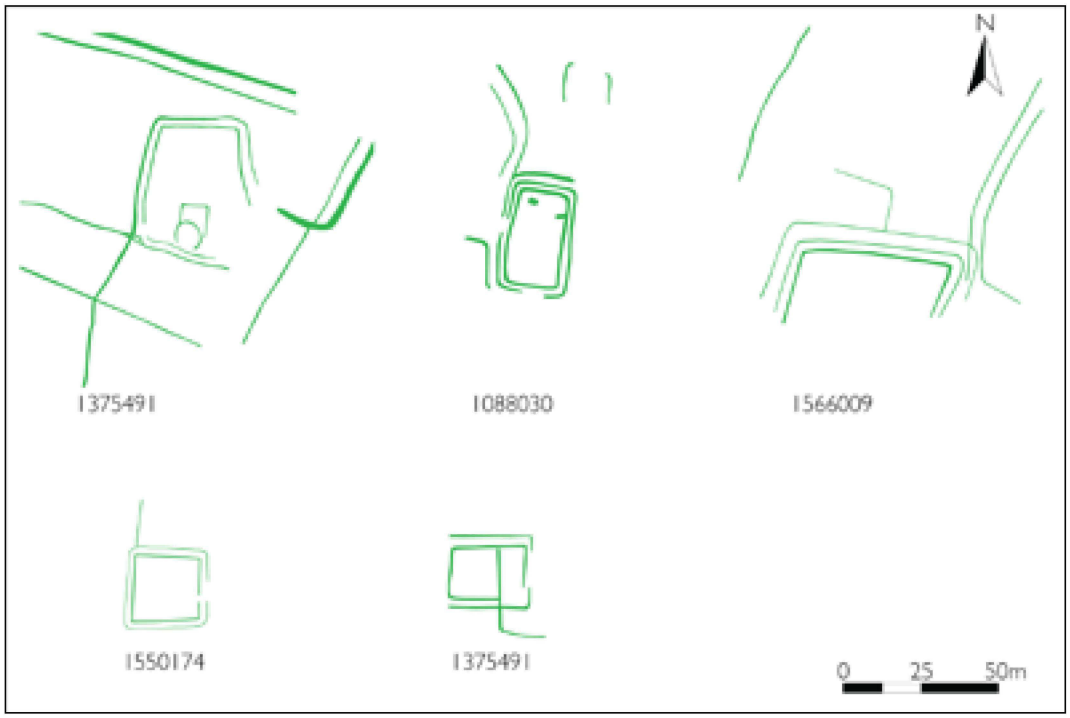

Fig 25: Iron Age/Romano-British multiple ditched enclosures.

The multiple ditched enclosure at Rotsea (1550174) is morphologically distinct, being formed by a fine ditched sub-square enclosure with an outer circuit of ditch with distinctly rounded corners. With internal dimensions of approximately 41m, the enclosure is of similar size to many others within the project area but the outer circuit of ditch makes it unusual. The site is superficially similar a site at Bramham Moor, West Yorkshire. Here too the site was identified as unusual in the context of the wider archaeological landscape seen as cropmarks and it was tentatively interpreted as a possible Romano-Celtic shrine or temple (Roberts *et al* 2010, 35).

Curvilinear

Few examples of curvilinear enclosures were considered to be of Iron Age or Romano-

British date. One previously known site (1039041; List Entry Number 1013999) survives as an earthwork on Westwood Common, Beverley. Although scheduled as a defended enclosure, recent analytical field survey suggested it is probably a livestock enclosure and may be post-Roman in date (Pearson and Pollington 2004, 19–23).

At Boggle Hills (Fig 26; 1551177) a curvilinear enclosure was identified as a cropmark on 2008 PGA imagery, although recent Environment Agency lidar data suggests that it may survive as a slight earthwork. The enclosure sits on a natural knoll and appears to be defined by a broad ditch but subtleties in the cropmark suggest traces of a possible palisade trench in parts of the circuit. Additional rectilinear enclosures appear to abut the enclosure to the north. It is unique to the project area and perhaps served a particular function. Although the cropmarks to the north seem to abut the enclosure this does not necessarily mean that they were constructed at the same time. It is possible that the enclosure may date from, or at least originate in, an earlier period. This may be as far back as the Bronze Age as at other palisaded sites on the Wolds (Stoertz 1997, 46–49).

Fig 26: An unusual circular enclosure with potential palisade and further abutting cropmark features
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Aerial Photography: Licensed to English Heritage for PGA, through Next Perspectives™.

Enclosures with round houses

Seven enclosures contained round houses but this cannot be taken as a reliable indicator that other enclosures were not settlements. Modern arable ploughing is likely to have had a more severe impact on slight internal features than on the deeper and more substantial

enclosure ditches. It is also probable that at some locations soil conditions prohibit fine resolution in cropmark development and that traces of round houses and other settlement features will only be revealed through the application of other investigative techniques such as geophysical survey or excavation.

Due to the presence of a number of known Bronze Age round barrows within the project area, circular ditched features with no obvious association with enclosures were commonly attributed this interpretation. Although in many cases this is likely to be a correct assumption, the possibility that some of the smaller features in fact represent unenclosed settlement must be considered. The example at Burn Park Farm (1566824), for instance, is of identical size to round houses that have been excavated immediately to the east.

Associations with trackways

Enclosures flanking trackways are a common feature of the cropmark landscapes of the Yorkshire Wolds and this pattern can be observed in a number of locations within the current survey area. A good example of this can be seen near Southburn (1479337) on the high ground of the Wolds chalk where a multiple-phase arrangement of enclosures lies to the south of a double-ditched trackway which itself shows evidence of re-cutting. At Auchinleck Close (Walsh *et al* 2012) geophysics and subsequent excavation between 2003 and 2008 revealed a Late Iron Age/Romano-British enclosure complex close to the site of similar date excavated in the 1950s (Philips 1960). Both of these excavations lie within a series of cropmarks revealing enclosures flanking a trackway and can therefore be used to provide a good indication of the date range of the wider complex.

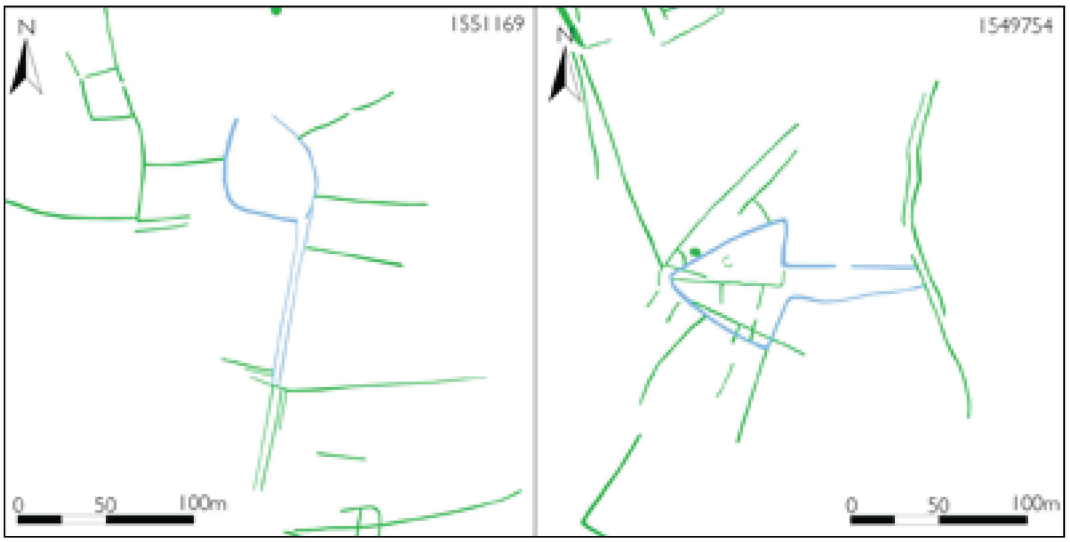

Fig 27: Enclosures with trackway entrances (in blue) sitting within broader systems of field boundaries.

Two enclosures can be described as having 'trackway entrances' (Fig 27), that is to say an arrangement of double ditches leading directly to the entrance. This is a site type seen in West and South Yorkshire where they often appear to pre-date other field boundaries

that later become associated with them, although no excavation has taken place to prove this or provide dating evidence (Roberts *et al* 2010, 30). At Warren Hill (1549754) the enclosure is abutted by field boundaries indicating that it was constructed first and also had a very unusual triangular or 'arrow head' form. Another example (1551169) lies to the south and is curvilinear in form – again unusual within the context of the present study – and is approached by a double-ditched trackway from the south. Although the chronology of construction of these features is difficult to establish it is possible that they date to the Early Iron Age or the Late Bronze Age.

Trackways

Evidence for movement through the landscape was seen in the form of fragments of double-ditched trackways. Their alignment often indicates passage between the high ground of the Wolds and the lower ground of the Hull Valley and into Holderness. Enclosures and field boundaries flanking these trackways are common (eg 1479337 and 1430033) and provide a physical continuation of the Wolds landscape towards the Hull Valley. The presence of ditched trackways demonstrates that movement of people and livestock was to some extent restricted and suggests a managed landscape that was in places enclosed by field boundaries. Their often sinuous nature is likely to reflect the fact that these trackways respected existing features such as fields or areas of woodland as well as the natural topography. They may also represent a formalisation of existing routes.

The most extensive trackway was traced intermittently for a distance of around 1.8km from Beverley Parks to Old Hall (see Fig 30). The ditches defining the route are usually 30m apart and were flanked by field boundaries and enclosures for much of its length. The easternmost limit of the trackway lies at an elevation of just 6.5m OD and appears to terminate just short of a natural dry valley which would provide an obvious route up onto the chalk of the Wolds. The presence of this trackway provides the most compelling evidence for a strong link between the Hull Valley and the Wolds in the Iron Age and Romano-British periods.

Field systems

The fragmentary nature of the cropmarks in much of the Hull Valley means that it is often very difficult to evaluate how, if at all, the landscape was divided up. As noted above, the alignment of some enclosures and their association with fragmentary ditches often suggests that they must once have sat on boundaries or formed part of a field system. In other areas the presence of trackways and fragmentary linear cropmarks, possibly functioning as field boundaries, may be seen as an indicator of wider enclosure.

In addition to those field systems identified as cropmarks, a limited number were also seen as earthworks, some of which are still extant. These earthwork boundaries probably indicate the original form of other field systems within the survey area; the embanked and scarped elements having long been levelled leaving only the remains of the ditches to produce the cropmark signature of what we would commonly refer to as 'ditched' field systems.

Fig 28: Earthwork field systems on Westwood Common.
NMR RAF/3G/TUD/UK/1 PART 1 5107 14-DEC-1945 English Heritage (NMR) RAF Photography.

Elements of surviving field systems (1039041 and 1566089) were already known on Westwood Common, Beverley and had been photographed from the air and subject to analytical field survey by English Heritage (Pearson and Pollington 2004). The systems (Fig 28) are rectilinear in form and defined by a combination of banks, ditches and scarps. To the east there were low banks running east–west which were only identifiable on the air photographs and lidar data and are thought to represent another area of field system. Some of the banks abut a ditch, thought to represent an associated boundary and/or hollow way. This ditch was originally recorded from air photographs as potentially prehistoric or Roman in date and subsequent field survey confirmed that a pre-medieval date was possible. If this is true then, by association, the banks are likely to be contemporary field boundaries. The relationship of the banks to the ditch, abutting it at the doglegs in its course, is also a pattern seen at sites visible as cropmarks such as the trackway to the west of Leconfield Grange (1551527).

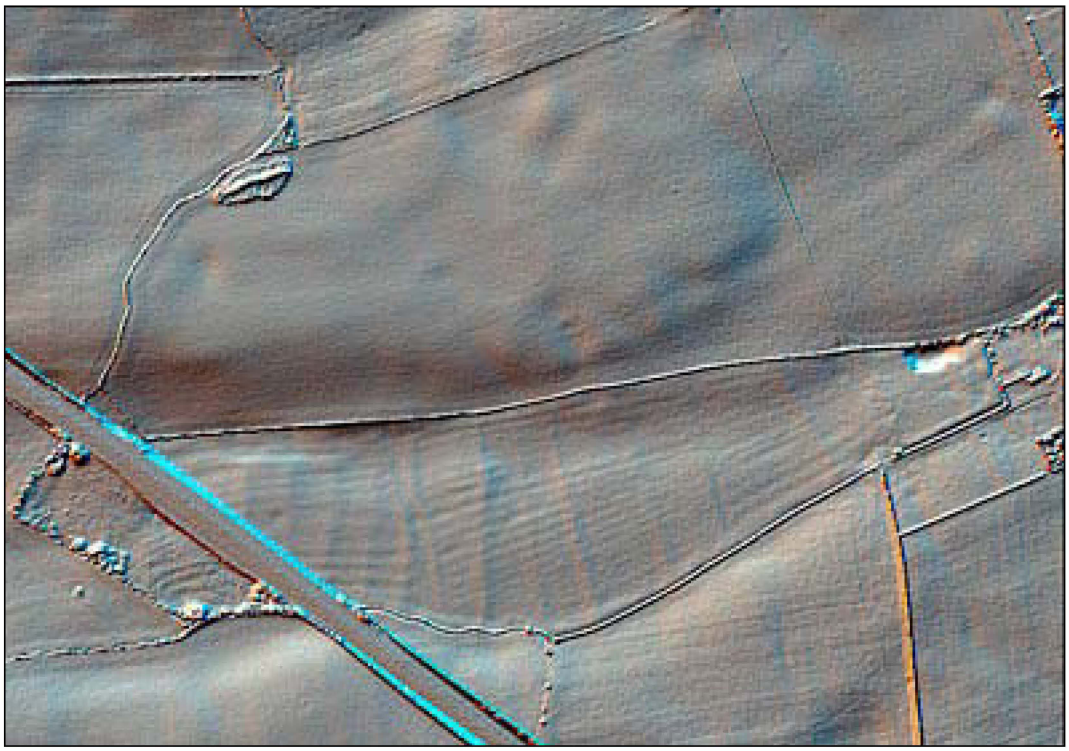

Fig 29: A 16-direction hillshaded lidar image of probable Iron Age/Roman field boundaries underlying medieval ridge and furrow.
LIDAR TA0336 Environment Agency 15-FEB-2012 ©English Heritage; source Environment Agency.

Several broad banks were identified on Environment Agency lidar at Beverley Parks (Fig 29). Clearly underlying medieval ridge and furrow, the banks lie perpendicular to the Iron Age or Roman trackway noted above so it is likely that they are broadly contemporary. Traces of another bank are aligned on the course of the trackway so it is possible that this represents the earthwork remains of the trackway that is only seen as a cropmark feature elsewhere. Approximately 1.2km to the north-west of the trackway are further fragmentary linear features again seen as earthworks on historic photographs. These

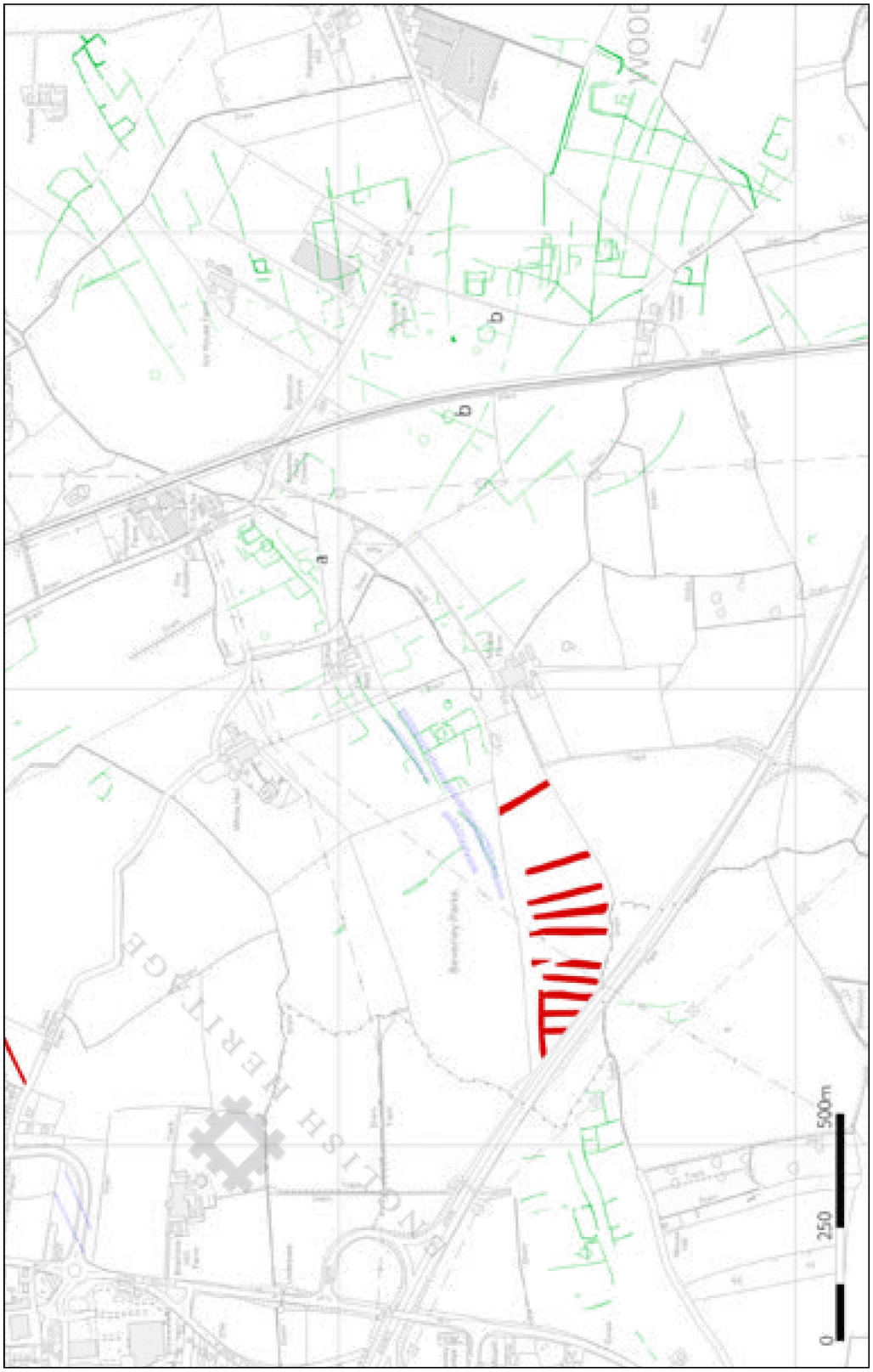

Fig 30: The Iron Age/Roman trackway and coaxial field system to the south-west of Woodmansey. A number of Bronze Age barrows are also visible, one of which (a) has been incorporated into the later trackway while others (b) appear to have been slighted by field boundaries. ©Crown Copyright and database right 2011. All rights reserved. Ordnance Survey Licence number 100019088.

have been more tentatively recorded as potential Iron Age or Roman field boundaries based on a shared alignment with the trackway and the fact that they underlie medieval and post medieval ridge and furrow.

Perhaps one of the most significant findings of the project has been the identification of a coaxial field system to the south-west of Woodmansey (Fig 30). Immediately to the east, an archaeological evaluation of fields to the north of Low Farm identified several fragments of ditch dating to the Iron Age or Roman period (Tibbles 2002). Interpreted as enclosures and field boundaries by Tibbles, these features may represent a continuation of the field system but at the very least indicate that land division was in place at this location in the Iron Age and Romano-British periods. A concentration of metal finds including 15 Roman coins was also recorded by the Portable Antiquities Scheme in the vicinity.

The area covered by the coaxial system corresponds closely with a region of Quaternary sands and gravels located between glacial tills to the west and alluvium, clays and silts to the east. The nature of this geology is conducive to the formation of cropmarks which goes some way to explaining why such an extensive area of articulated landscape is visible. To the north, the long axis of the system shares a north-east south-west alignment with the trackway described above although no clear relationship can be seen between these features. Moving southwards, the alignment changes to north-west south-east, most probably dictated by the topography (see below). Several enclosures are embedded within the system and some elements of these survived as earthworks into the 1950s.

Possible coaxial systems were identified at two further locations to the north of the Woodmansey group. Fragments of three linear ditches were mapped to the north-west of Barf Hill (1549001) and a more extensive group are located to the east of Copper Hall Farm (1550229). While the cropmarks at these sites are not extensive enough to interpret the features as coaxial systems with a great degree of certainty, their pattern and spacing are sufficiently similar to the field system at Woodmansey to suggest that they may be analogous. A characteristic of these particular systems is a fanned appearance, with the width of the fields gradually increasing, which can also be observed in the coaxial systems in the Vale of York (Jones 2001).

The identification of coaxial field systems is significant because this method of land division is commonplace in the Vale of York and on the Magnesian Limestone in South and West Yorkshire, but is not found on the neighbouring Yorkshire Wolds. This broadens the extent of known coaxial field systems eastwards from the Vale of York and further indicates that the Wolds has a system of land division different to the surrounding lower-lying areas.

It is possible that different farming regimes dictated the layout and form of land division and these regimes may partly be influenced by topography. Conclusions from the work on the Magnesian Limestone suggest that the primary factors influencing the pattern and morphology of field systems in South and West Yorkshire are topography and the openness of the landscape (Roberts *et al* 2010, 96). The low-lying and comparatively well

drained location is similar to areas with coaxial systems found elsewhere in Yorkshire.

The possibility that we are also seeing evidence of chronological phasing in relation to the Wolds cannot be ruled out. Forest clearance in the Iron Age in Holderness is attested by the pollen record (Flenley 1990, 51) so it may be that the coaxial fields represent a relatively late phase of land division. This division would be morphologically distinct from that on the Wolds which was adapting and reusing a pattern that had already been established in the Bronze Age. A broad Iron Age or Roman date for these coaxial systems would fit in with dated field systems of this form elsewhere in the region.

Relationships to existing features

Evidence for pre-Iron Age use of the landscape is largely restricted to funerary or ritual monuments, primarily Bronze Age round barrows; the relationship of features to the later prehistoric multiple ditch systems is considered elsewhere in this report (see Later prehistoric). As noted above, it is possible that some of the features interpreted as barrows may actually represent round houses but most are too large for this to be a possibility. Due to the often fragmentary nature of survival and visibility it is usually difficult to establish what relationship the Iron Age and Romano-British landscape features had with these existing burial monuments but where they do occur in close proximity some interesting observations can be made.

Fig 31: Air photograph of a Bronze Age round barrow cemetery, to the south-west of Woodmansey.
NMR 28166/10 20-JUN-2011 ©English Heritage. NMR.

One of the largest barrow groups is at Woodmansey (Figs 30 and 31) where up to 14 barrows are visible as cropmarks within the area covered extensively by enclosures and field systems. Most of the barrows have no obvious association with the later boundaries which might indicate that a conscious decision was made to avoid the barrow remains but might equally be coincidental. Three instances of barrow ditches being slighted by probable field boundaries can be observed and although slighting of a ditch cannot necessarily be interpreted as slighting of the entire barrow – field boundaries may have been placed over silted up ditches but still avoided an extant mound – in at least one instance the boundary goes through the centre of the barrow.

More interesting is the incorporation of a large barrow to the east of Old Hall (1375100) which sits on the course of the flanking ditch of a trackway (see Fig 30). In this case it appears that there has been a deliberate alignment of the trackway on the barrow, a relationship that can be observed elsewhere (Stoertz 1997, fig 14), which has resulted in the barrow restricting passage along the trackway. This relationship suggests that its incorporation into the Iron Age or Roman landscape was based on a continued ritual significance of the barrow rather than it simply forming a convenient marker in the landscape. Juxtaposed with this is another potential barrow of similar size, situated on the opposite ditch of the same trackway 96m to the north-east, which is slighted by both the trackway ditch and an enclosure.

Soils, geology and topography

A detailed analysis of cropmarks with reference to soils and geology is beyond the scope of this project and has already been attempted elsewhere (Chapman 2000, 180) but there is unsurprisingly often a correlation of cropmarks and areas of better drained sands and gravels. However, fragmentary cropmarks have been noted on less well drained geologies such as the tills, suggesting that further reconnaissance under optimum conditions will undoubtedly continue to reveal new sites.

Topographically, evidence for settlement and land division can be seen ranging from elevations of up to 80m OD on the Wold edge down to approximately 2m in the Hull Valley itself, although most sites are above 3m OD. Fragments of archaeological features were mapped below the 2m contour which indicates that the absence of cropmarks may sometimes be a factor of visibility rather than a genuine indication of original extent of the archaeological features. This lower limit comfortably concurs with Didsbury's findings in the lower Hull Valley (Didsbury 1988; 1990) where he surmised that alluvial areas over till at elevations over -3.8m OD were dry enough by the Roman period to be settled and farmed.

Examples of enclosures are recorded at elevations as low as approximately 3m OD but most lie above approximately 5m OD. Although enclosures occur across a broad elevation range, their positions relative to the surrounding landscape appear to be carefully chosen. Commonly they are located on slightly higher ground which presumably would have ensured that they remained relatively dry, a trend that continued for settlements into the medieval period and beyond. These later settlements are also likely to obscure earlier remains in many cases. Geographically, there is a concentration

of enclosures in the northern part of the project area around Driffield and Nafferton although this may be partly influenced by the presence of sands and gravels which are conducive to cropmark formation.

The topography of the Wolds edge had a visible influence on the pattern of settlement, notably in the south where the chalk protrudes up to 3km into the project area. The linear arrangements of cropmarks at Beverley Parks and Cottingham Parks are both situated with reference to dry valleys on the chalk, suggesting that they developed along natural route ways leading to and from the Wolds. It is probable that this was a pattern replicated elsewhere in the south of the project area but the masking effect of the urban areas of Beverley, Cottingham and Kingston upon Hull means that this cannot be proved by aerial survey.

LEVELLING AND SURVIVAL

English Heritage highlights the issues of plough damage on archaeology in leaflets for farmers and land managers (English Heritage 2003). The Monuments at Risk Survey (Darvill and Fulton 1998), demonstrated that 40% of damage and destruction to archaeological monuments in the last half-century is attributable to agriculture largely as a result of the mechanisation of arable agriculture. The Heritage at Risk Register 2011(English Heritage 2011b) is limited to scheduled monuments at risk but provides an indication of what may be expected in the wider archaeological landscape. In the Yorkshire and Humber region 26.7% of scheduled monuments are at risk, this compares unfavourably with the national picture where 16.9% are at risk, largely as a result of arable agriculture and unrestricted plant, shrub or tree growth. Limiting the data set to the project area, there are 48 scheduled monuments and 16 (33%) of those are classed as at risk; comparable with the regional picture.

It is very important to note that levelling does not always signify the total loss of an archaeological monument, often though a feature may be totally levelled above ground, sub-surface features may survive. In certain circumstances arable agriculture can aid identification of below ground archaeology by revealing monuments as cropmarks. A total of 232 archaeological monuments were revealed in this way. Frequently there are layers in the landscape, with early archaeological monuments masked by later features. For example at Warren Hills medieval ridge and furrow and a rabbit warren were visible as earthworks on 1945 RAF photography. It was only after the levelling of these features by ploughing and the planting of a crop that a complex Iron Age/Roman settlement was revealed by cropmark development.

However, during the course of the project it became apparent that the rates of earthwork survival post-war were low. It was decided to attempt to quantify the amount of levelling within the project area, for those features recorded from air photographs. To clarify, a feature will only have been recorded as a levelled earthwork if it was originally surviving as an earthwork on an earlier photograph (this tends to be RAF vertical photography taken from 1938 onwards) and on the latest available photography appeared to be totally flat. Where a feature had been built over it was counted as a levelled earthwork as there is the potential for sub-surface survival.

Features recorded as cropmarks were excluded from the quantification as they were levelled in the distant past, not as a consequence of modern agriculture. On a very limited number of occasions a site that was visible as an earthwork on air photographs, but that later showed more clearly as a cropmark may have only been mapped from the cropmark evidence. However, this amounts to a statistically insignificant sample of the results. Demolished buildings and demolished structures were excluded from this appraisal. Occasionally the latest condition of a monument is uncertain, due to tree cover on the available photography; these features too were excluded. Additionally, as ridge and furrow is widespread throughout the project area it was studied separately.

Evaluating the evidence or condition of a monument from aerial photography is limited and relies on good quality photography. Occasionally a feature recorded as levelled may

actually still survive as a slight earthwork. This is particularly likely to happen if the latest photograph was taken in poor light conditions, unsuitable for highlighting earthworks. PGA orthophotography, which is often the latest available source, is not available as stereo pairs and can also be quite tonally flat making earthwork identification difficult. Additionally, the latest photography is often a number of years old, in the instance of the PGA orthophotography used in the project it dates to 2008 (ie four years before this project began) which could mean further destruction has occurred since then. Even with these difficulties most monument survival can be correctly identified and the overall trends correct.

Using the air photo mapping as a baseline for the quantification of levelling is problematic. One approach is to calculate the number of objects within the AutoCAD drawing recorded as either surviving as an earthwork or having been levelled or destroyed. An 'object' in AutoCAD is a single entity within the drawing such as a polyline or polygon. Using this methodology 57.9% of features are levelled, 0.7% destroyed and only 41.2% survive as earthworks. This method is however unreliable as a Bronze Age round barrow is likely to be drawn from a single polyline, whereas a medieval settlement will consist of multiple objects biasing the sample.

The more reliable approach is to calculate the number of unique NRHE entires, as each monument would have been given the same NRHE number irrespective of the number of elements that make up that monument. In this instance a Bronze Age barrow would be counted once, as would a medieval settlement. Some overlap will occur where a monument has been partially levelled resulting in a double count in the earthwork and levelled dataset. Via this methodology 68.4% of archaeological monuments are levelled earthworks, 1.7% are destroyed and only 29.9% survive as earthworks. In other words less than a third of the monuments originally recorded from historic air photographs as earthworks survive in that condition to the present day. This approach to analysing the data provides a more reliable way of presenting the data.

Medieval and post medieval ridge and furrow were present across much of the project area on the earliest available photography, a picture not reflected on the latest available coverage. An attempt was made to analyse the levelling and destruction of this site type. Unlike the previous example, the best way of analysing the level of survival of ridge and furrow is to count the number of objects. This is ideal as each block of ridge and furrow is drawn in the same way, with a polygon enclosing its extent. Direction arrows, revealing the alignment of the ridge and furrow are also recorded, but for the purposes of this analysis were considered superfluous and so were discarded. The results of the survival rates of ridge and furrow are poor. Levelled or destroyed ridge and furrow account for 83.5% of features, with a meagre 16.5% visible as earthworks.

Figure 32 demonstrates the low number of monuments surviving as earthworks compared with the large number that have been levelled or destroyed.

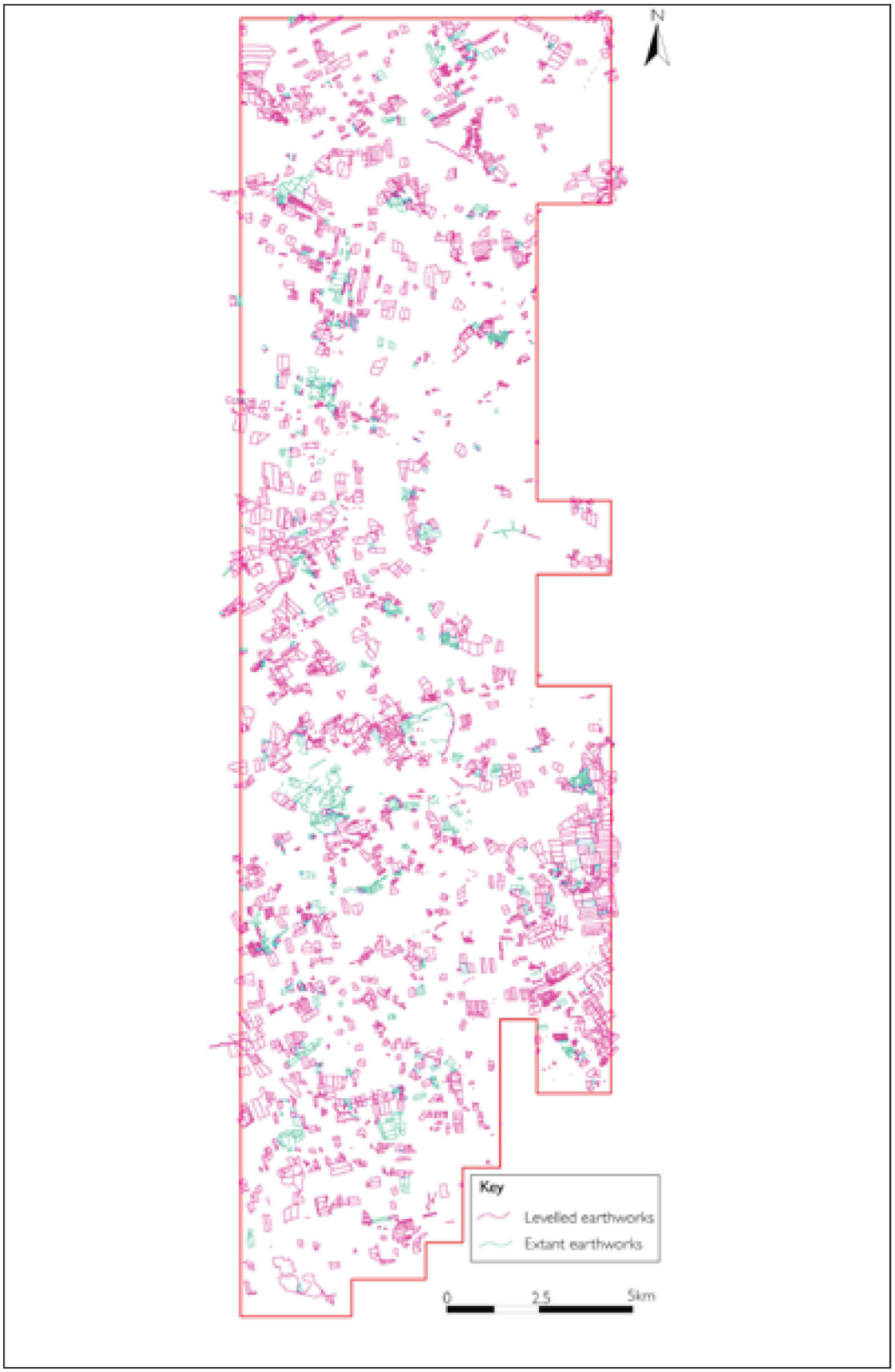

Fig 32: Levelled and extant archaeology as recorded by the project from the latest available photography.

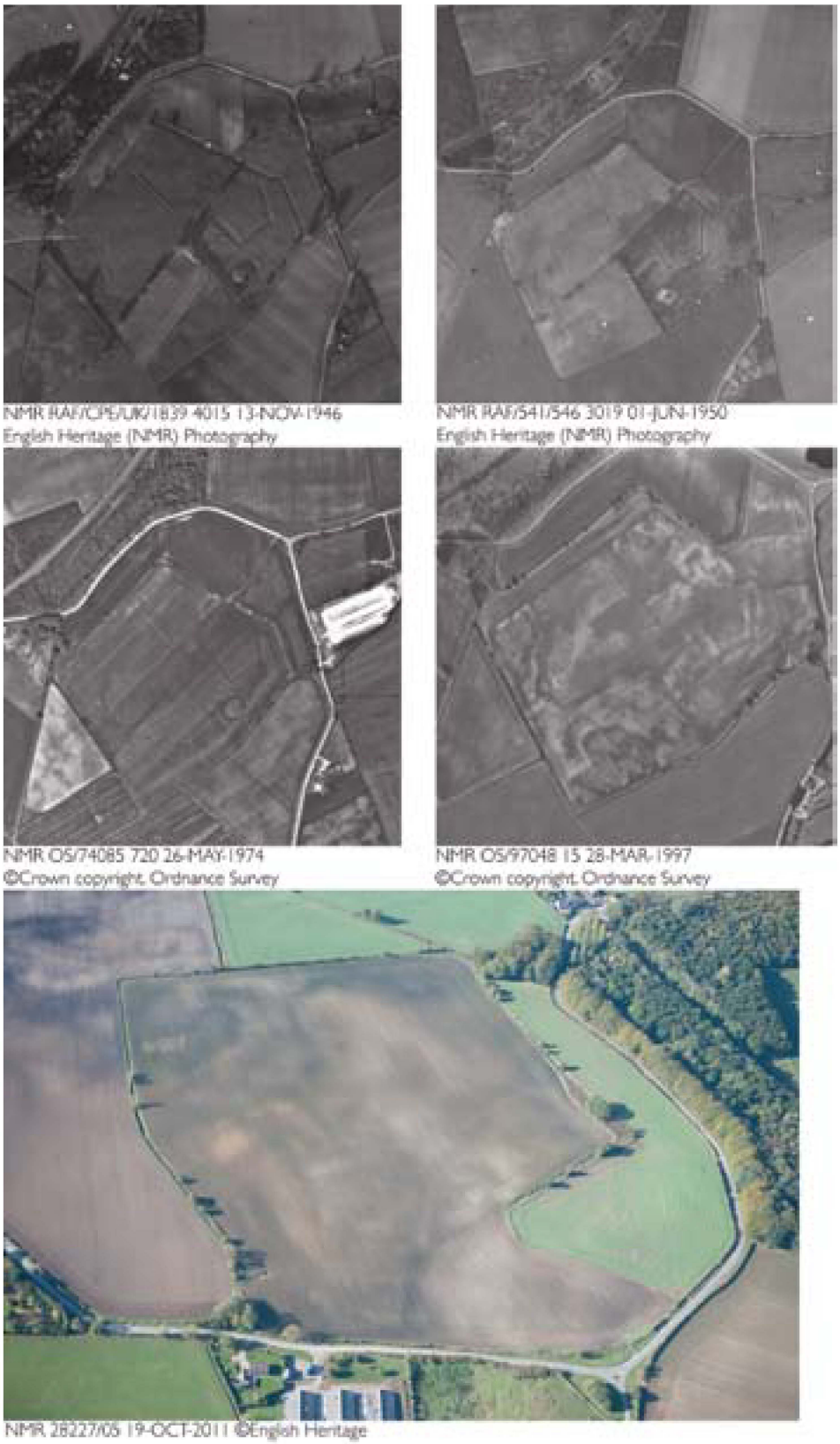

Fig 33: A case study on the levelling of Nunnery Hill.

Case studies

The following photographic case studies are intended to demonstrate the rates of levelling over the period covered by the historic air photographs, in order to provide an insight into the effects of arable agriculture on the historic resource.

Nunnery Hill – 79613; Fig 33

The medieval site at Nunnery Hill is a scheduled monument,. This comprises numerous features including those associated with a medieval settlement, a moat and a large mound. Interpretations for the mound have varied but suggestions include a small motte or Bronze Age barrow. The small motte appears more likely given the size and form of the mound.

The NRHE monument record describes Ordnance Survey Field Investigators visiting the site in 1974. They say 'Nunnery Hill is a ploughed-down mound 42m diameter and 1.7m high. According to the farmer, prior to being bulldozed during the war it was about 15ft high and ditched suggesting the destruction occurred during the Second World War'.

An assessment of historic imagery shows the site as good quality earthworks on vertical photographs dating to 1946 ie post war. By June of 1950 levelling of the features had begun to the west of the road, affecting the motte, moat and parts of the medieval settlement. This record of loss continues on the 1974 and 1997 imagery, which show the earthworks gradually reducing in height. The specialist oblique photographs taken in 2011 at the start of this project reveal that all the earthworks to the west of the road have been totally levelled by ploughing.

Belagh Grange – 910694; Fig 34

The site of a medieval grange associated with Meaux Abbey and first documented in 1151 as 'Byley' (Donkin 1960, 165). The feature is largely made up of rectilinear banks and ditches, with associated medieval ridge and furrow.

Air photographs taken between 1945 and 1948 record the grange site as good quality earthworks. The shadows thrown by the earthworks on the photographs taken in December 1946 make the site particularly identifiable. Unfortunately between 1948 and 1971 there is a gap in photographic coverage, but by 1971 the earthworks had been totally levelled. An oblique photograph, taken in 1994 showed the medieval features as soil marks. The latest photography available for the site is 2008 PGA orthophotography, which shows some elements as cropmarks, proving that there are still sub-surface elements of the grange surviving.

NMR RAF/106G/LA/215 4026 13-APR-1945
English Heritage (NMR) Photography

NMR RAF/CPE/UK/1879 3264 06-DEC-1946
English Heritage (NMR) Photography

NMR RAF/541/184 4008 19-OCT-1948
English Heritage (NMR) Photography

NMR OS/71137 13 02-MAY-1971
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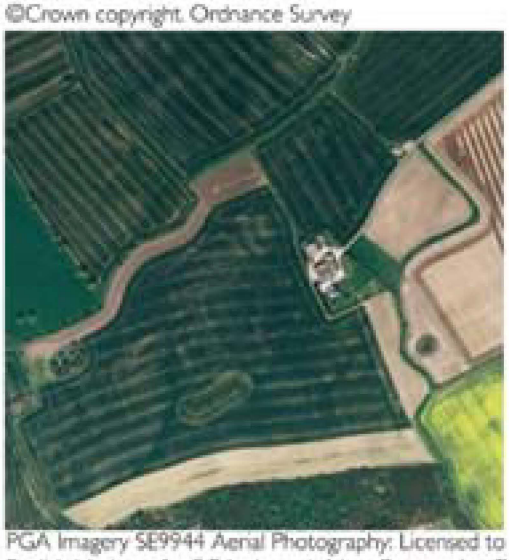
NMR SE 9944/2 NMR 12466/36 06-APR-1994
©English Heritage



PGA Imagery SE9944 Aerial Photography. Licensed to English Heritage for PGA, through Next Perspectives™

Fig 34: A case study on the levelling of Belagh Grange.

AGRICULTURAL LAND CLASSIFICATION

It is hoped that the Agricultural Land Classification (ALC) may help target future NMP project areas or provide a usable dataset to estimate the potential for archaeological survival. ALC provides a method for assessing the quality of farmland and was largely developed as a means to protect high quality agricultural land from inappropriate development (Natural England 2009). Land quality varies across the country, but the ALC classifies farming land into five grades. The best agricultural land is defined as Grades 1–3, being flexible, productive and efficient:

- Grade 1 excellent
- Grade 2 very good
- Grade 3 a) good; b) moderate
- Grade 4 poor
- Grade 5 very poor

Distinctions are also made for non agricultural land as follows:

- Non-agricultural land
- Urban

The ALC system was introduced in 1966 and was mapped from reconnaissance field surveys onto Ordnance Survey base mapping at a scale of one inch to one mile from 1967 to 1974. The resulting maps are therefore not sufficiently accurate for assessment of individual fields. Additionally, they show only five grades, as their preparation preceded the subdivision of Grade 3 (shown above), which occurred after 1976 (ibid). The data have been digitised and are available as a download at a scale of 1:250,000 from the Magic website http://magic.defra.gov.uk/, all assessments were made using this information.

A significant problem when using this data for assessing archaeological potential is that the classification is concerned with the inherent potential of land; the current use does not affect the ALC grade. However, broad trends are visible with higher ALC grades dominated by arable agriculture and lower grades dominated by pastoral agriculture. To confirm these trends were true for the Hull Valley project area an assessment of land use was made in Google Earth, importing the ALC grades as a .kmz file. The highest quality agricultural land Grade 1 and the lowest quality Grade 5 are not represented in the Hull Valley project area. The assessment revealed Grade 4 land is focussed on the low-lying land adjacent to smaller tributaries of the River Hull, and is used exclusively for pastoral farming. ALC Grades 2 and 3 are primarily used for arable agriculture, though Grade 2 is largely focussed on the Wolds edge and Grade 3 land is located on the valley floor of the River Hull. Non-agricultural land relates to the extant airfields at Driffield and Leconfield

and the racecourse at Beverley. The Urban areas are Kingston upon Hull, Driffield and Beverley.

Assessing monument numbers on each ALC grade

As we already have seen the Hull Valley is predominantly made up of high quality agricultural land, this is borne out by the ALC data where Grades 2 and 3 equate to nearly 80% of the land coverage (97.6sq km for Grade 2, 138.3sq km for Grade 3). The other significant classification is the urban areas which cover 15% of the project area (Fig 35).

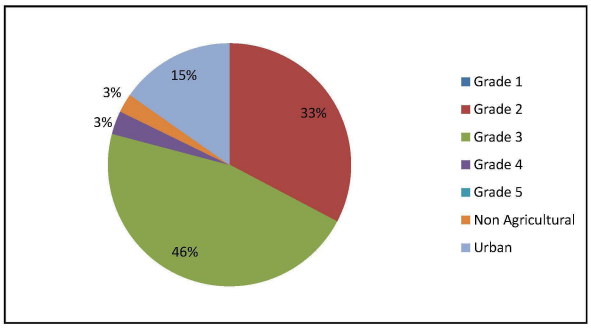


Fig 35: The proportions of Agricultural Land Classification grade within the Hull Valley project area.

The number of monuments located on a particular ALC grade of farming land is of interest as it may help make informed decisions for future projects based on expected numbers of archaeological discoveries. The number of archaeological monuments was calculated using the NMP data, all additional SMR data or NRHE monuments not visible on air photographs were excluded from this assessment. Individual monuments, discovered by NMP were defined by their unique NRHE number, though ridge and furrow which is recorded on a parish basis, was excluded from these calculations. Larger monuments may overlie multiple ALC land grades, in this instance the monuments will be counted twice; therefore the total numbers of monuments described below do not match the overall project totals. The square kilometre coverage of each grade of land varies, for example Grade 3 land covers 138.3sq km, compared with only 7.5sq km for non-agricultural land, so in order to remove this bias the totals were calculated as follows:

(Number of NMP archaeological monuments/Number of sq km of ALC Grade land)

The results are interesting and can be most readily understood in Figure 36. It clearly shows that many more monuments per square kilometre of land grade were found on Grade 4 land than any other ALC grade, nearly nine archaeological monuments per square kilometre. Grade 4 land forms only a tiny proportion of the project area, a mere 9.3sq km, but 82 archaeological monuments were recorded on it. This contrasts with ALC Grade 2 where 3.4

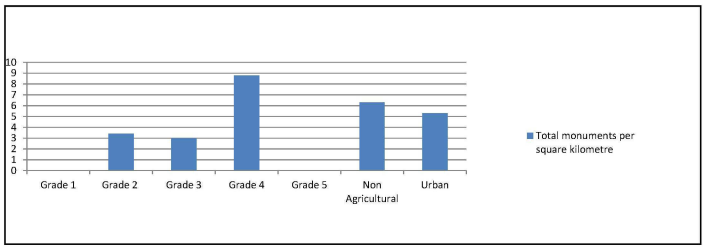


Fig 36: The number of archaeological monuments per sq km of ALC grade.

monuments were located per square kilometre or ALC Grade 3 where only three monuments per square kilometre were discovered.

This is an unexpected result as it was previously felt that high quality agricultural land, generally used for arable has the highest potential for revealing archaeological sites because of visibility of cropmarks on these areas. Indeed, this previously has affected aerial reconnaissance patterns for discovering archaeological sites and influenced prioritising areas for NMP projects (Horne 2009, 21). Perhaps it is the survival of archaeology on this grade of land that has increased monument visibility, an assessment follows.

Assessing monument survival on individual ALC grade

Monument survival was plotted for each ALC grade to ascertain whether there were any significant differences. As discussed above, the numbers of archaeological monuments on each grade of land varies considerably; therefore the frequency is irrelevant. It is the proportions of archaeological monument survival (in this instance EVIDENCE 2) per ALC grade that are of interest. The relative proportions of evidence type for each grade of farming land can be seen in Figure 37.

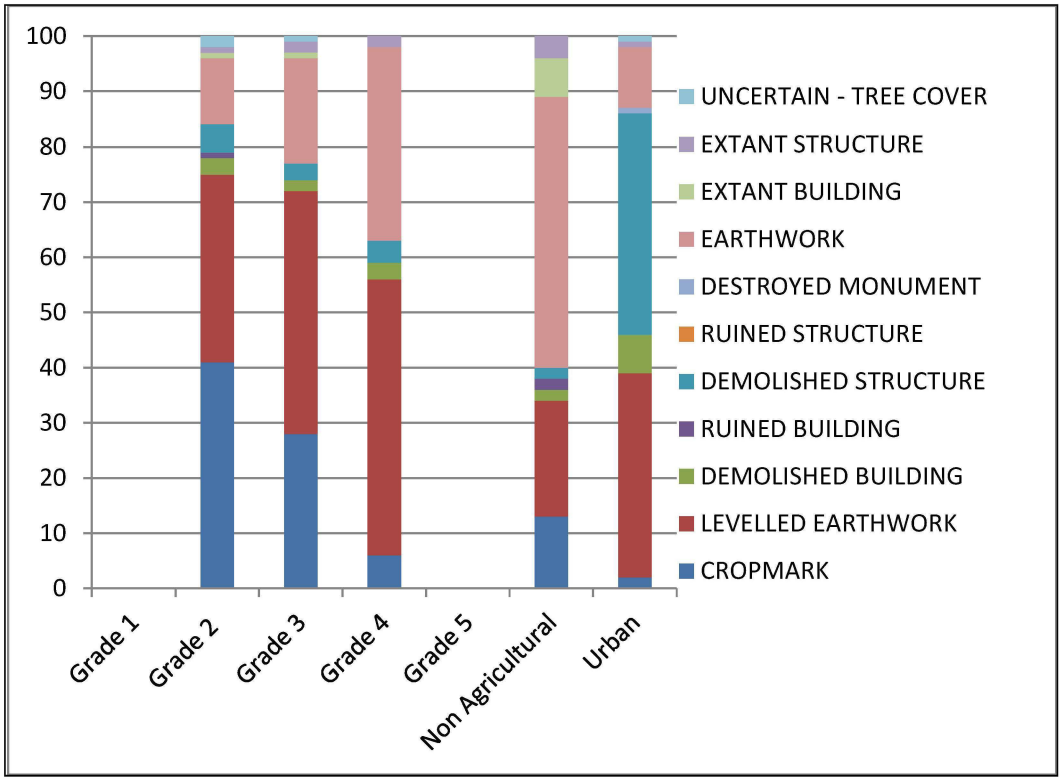


Fig 37: The relative proportions of latest evidence for each ALC grade.

Some clear conclusions are evident. As expected the majority of levelled and cropmark sites are located on Grade 2 and Grade 3 land. The proportion of earthwork sites increases steadily as the grade of farming land worsens, with non-agricultural land and

Grade 4 land boasting excellent earthwork survival, presumably as it is under no threat from the plough. The proportion of demolished structures is vastly higher on urban land character, largely as a consequence of the large proportion of military sites during the Second World War and their subsequent removal.

Future work

This is the first time this type of analysis has been undertaken as part of an NMP project and the results demonstrate the value of incorporating non-archaeological datasets with NMP data in understanding the wider landscape. The accuracy of these statistics could be greatly improved by retrospectively applying these analyses to include previous NMP project areas. This could reveal whether these results apply to other areas or whether they are the result of regional variation or topographical variation given the wetland nature of this project area. The analyses could also be extended further to assess whether period or type of monument is affected by ALC grade.

The data also have implications for the future strategy for NMP, particularly in pinpointing new project locations and predicting output from those projects, given the finite resource available to NMP. For example, we could develop a project based on ALC grade 1–3 land, where threat from agricultural intensification upon archaeological monuments is greatest. Alternatively, the focus could be a lower ALC grade where there are fewer threats to archaeological survival and where we may anticipate larger numbers of archaeological discoveries per square kilometre of survey area.

PROTECTING ARCHAEOLOGICAL MONUMENTS

As we have seen in the previous section (see LEVELLING AND SURVIVAL) our archaeological resource is fragile and finite and vulnerable to a wide range of human activities and natural processes. NMP projects have a history of protecting monuments simply by identifying new sites, by recording monuments on NRHE and by depositing data in local HERs, where it is used for heritage management. However with the implementation of the NHPP the focus of NMP projects has shifted. One aim of the project was to maximise the use of the project data in assessing and protecting archaeological monuments. There are a number of ways to protect significant archaeological monuments; most commonly by scheduling or by entry into a stewardship agreement with Natural England.

Scheduled monuments

The UK has had legislation in place to protect heritage assets with archaeological interest since 1882. In England, English Heritage takes the lead in identifying sites to place on the list or 'schedule'. A representative sample of nationally important sites are thus afforded legal protection, meaning that it becomes a criminal offence to destroy or damage a scheduled monument, though consent can be granted for some works. Additionally, some categories of works such as agricultural works do not require consent. However, given the evidence of damage that can be caused by modern farming practices this consent will be progressively revoked (Department for Culture, Media and Sport 2010).

A total of 48 monuments are scheduled within the project area. One outcome of this project was to develop a model for recording aspects of the scheduled monuments most useful for heritage protection. In liaison with English Heritage's Designation team a spreadsheet was developed, avoiding the need for a long report on each monument and improving clarity. This spreadsheet covered aspects useful to both the Designation and the Heritage at Risk teams; the former are responsible for scheduling monuments and amending existing schedulings and the latter are responsible for the care of existing scheduled monuments.

Perhaps the most valuable aspects recorded by the NMP authors on the spreadsheet included:

- The latest condition of the scheduled monument.
- Any specific risks to the monument.
- The suitability of the scheduled area ie is the entirety of the monument protected.
- Discrepancies in archaeological interpretation or date.

The recommendations and flowline of data from NMP projects will enable the Designation team and Heritage at Risk team to reassess threats, review existing

scheduling and add new ones, maximising the use of the project data in managing and protecting archaeological monuments. This type of analysis could easily be incorporated into future NMP projects. Although the spreadsheet worked well for this project, with relatively few scheduled monuments, it may not be a suitable for other NMP project areas. Collating the data on very high numbers of scheduled monuments would have a significant impact on a project timetable. The flowline model developed at this regional level needs to be tested in other projects and regions to develop a national strategy.

A number of archaeological priorities for further investigation perhaps leading to scheduling were identified by the project and are discussed below:

1551177 – A large Iron Age/Roman circular enclosure and palisade, with appended rectilinear enclosures to the north (see Fig 26).

The feature is unique within the project area and although largely visible as cropmarks the main enclosure appears to be surviving as a slight earthwork on Environment Agency lidar. The circular enclosure sits upon a natural knoll and its construction appears to have taken advantage of the natural topography. As the appended rectilinear enclosures were only visible on poor quality oblique photographs further reconnaissance or geophysics is likely to reveal additional features. This monument type, recorded in other NMP projects in similar Iron Age/Roman contexts, is poorly understood and would benefit from further research on the ground.

1548714 – A post medieval duck decoy pond (see Fig 14).

The feature is a rare earthwork survival of a duck decoy. The other earthwork decoy in the area, at Meaux, is already scheduled. An analytical field survey could reveal more on the level of preservation as the feature is partially obscured by tree cover.

1087954 – A later prehistoric/Roman multiple ditch system (see Fig 6).

This linear boundary is visible in three sections taking a sinuous course on an approximately south-west north-east alignment. The feature is partially depicted on the Ordnance Survey first edition mapping as an 'Intrenchment' with additional sections identified on air photographs. The earthwork section, partially destroyed by quarrying, is at further risk from an active chalk pit and therefore is priority for further assessment. The linear boundary appears to be a continuation of a Wolds boundary lying beyond the Hull Valley project area near Walkington. Geophysical investigation, between the two locations and flanking the linear boundaries could confirm the course of the linear boundary and any associated features. Further reconnaissance has already revealed additional features at Walkington and has the potential to reveal more.

1550174 – An Iron Age/Roman square double-ditched enclosure; 1550290 – Four parallel ditches of possible medieval/post medieval date; 1550255 – Sinuous, ditch-defined trackway, possibly medieval in date; and 1550185 – Sinuous, ditch-defined trackway, possibly Iron Age/Roman in date (Fig 38).

The enclosure (see THE IRON AGE AND ROMANO-BRITISH LANDSCAPE), ditches and trackways described above are located just north-west of the scheduled medieval settlements of Rotsea. Some elements survive as earthworks though the majority have been levelled or are cropmarks. The features are morphologically difficult to attribute to any particular period. Excavations on these features could provide definitive dating evidence.

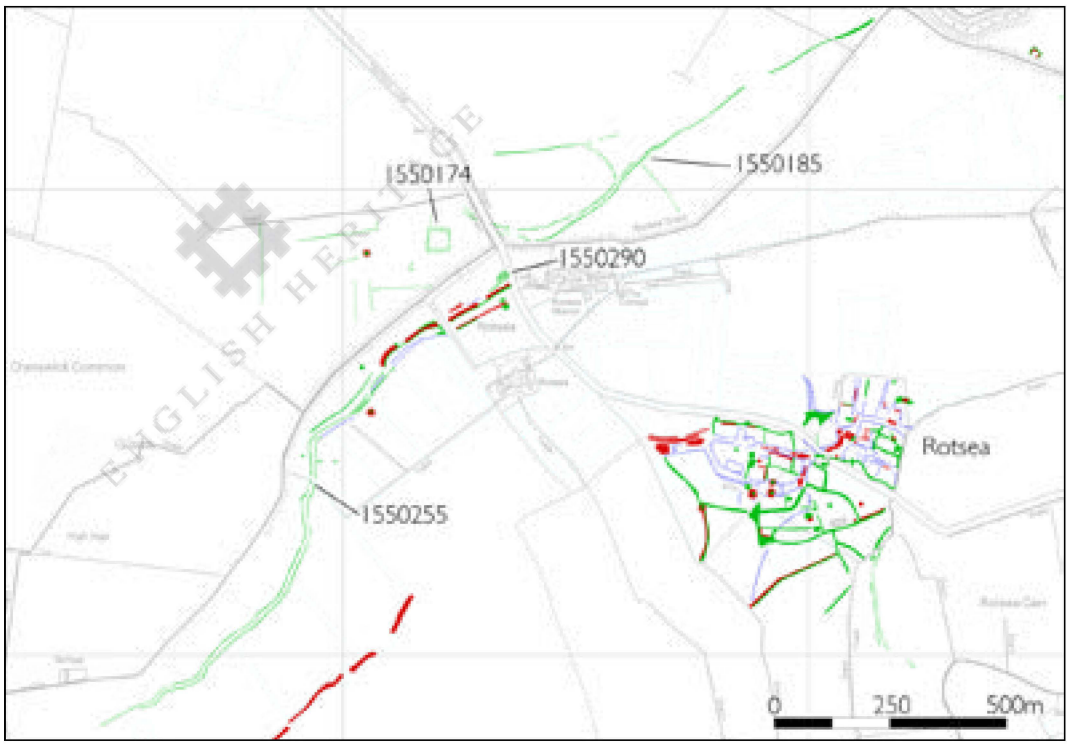


Fig 38: A multi-phased landscape to the north-west of Rotsea.
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1566980 – Neolithic or Bronze Age causewayed ring ditch, round barrow and pit alignment (see Fig 3).

The pit alignment consists of two parallel rows, totalling 10 pits with a single pit set apart. Its form is one recognised elsewhere on the Yorkshire Wolds and North York Moors as a segmented embanked pit alignment, though in this cropmark context there is no evidence of the flanking banks. Their association with round barrows is also noted in other areas. Their position on the footslopes of the Wolds is noteworthy given other Neolithic monuments nearby. All the features would benefit from further reconnaissance or geophysical survey, particularly as the form of the pit alignment and the causewayed enclosure is not fully understood. Excavation could help pinpoint a definitive date.

1566066 – Neolithic or Bronze Age pit alignment.

Two pairs of pits and a fifth single pit form a double pit alignment on a north-west south-

east axis. The feature was recorded from small-scale vertical photography and could benefit from specialist oblique photographs of the site. Additionally fieldwork, either excavation or geophysics could confirm its date and form.

1565996 – An Iron Age/Roman field system (see Figure 29).

The features represent a rare earthwork survival of embanked Iron Age/Roman field boundaries. Further investigations, such as geophysical survey or excavation could be used to pin point its date and investigate any possible relationships to the cropmark coaxial field system to the east.

79202 – Scheduled medieval moated site; 1548862 – Medieval grange site; 1548877 – Medieval/post medieval rectilinear enclosure and platform; 1548882 – Medieval/post medieval boundary bank (Fig 39).

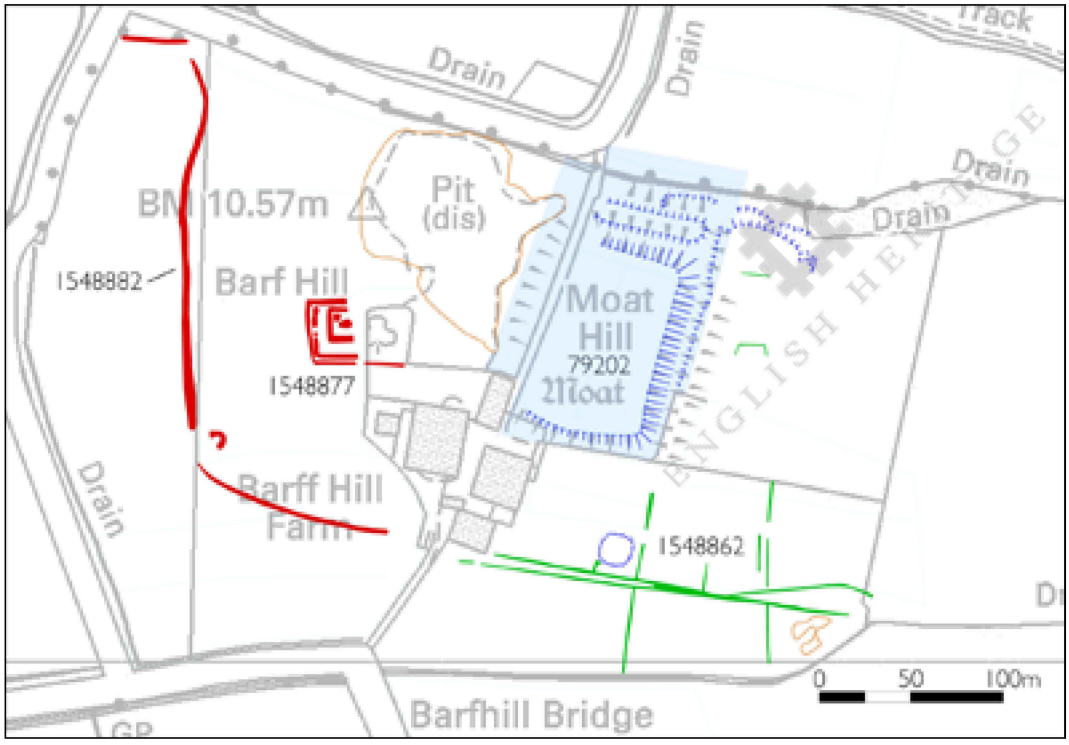

Fig 39: The medieval site of Barf Hill, with the designated area highlighted in blue. Additional features falling outside the existing scheduling may warrant further investigation.
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The moated site at Barf Hill is already protected by designation. Further newly identified features in the immediate vicinity, particulary the rectilinear enclosure and platform, warrant further investigation to confirm its interpretation and whether it is associated with the vaccary or grange site at Barf Hill associated with Meux Abbey. This would

broaden the understanding of the landscape context surrounding the scheduled site

Environmental Stewardship Agreements

In some circumstances scheduling might not be the most appropriate mechanism to secure a monument's long term preservation. Environmental Stewardship Agreements (ESA), managed by Natural England, support farmers and land managers in managing the ecology and archaeology of their land by providing financial incentives (Natural England and English Heritage 2009). Large parts of the Hull Valley project area have been evaluated by Natural England identifying areas eligible for Environmental Stewardship schemes grants, under Entry Level Stewardship (ELS) and Higher Level Stewardship (HLS) Schemes. ELS provides a straightforward approach to supporting the good stewardship of the countryside, whilst HLS involves more complex types of management and agreements are tailored to local circumstances. The River Hull Headwaters, which overlaps with the northern extent of the project area, is a priority target area for HLS, though large areas outside this target area also qualify under high quality/multi-objective agreements (Natural England 2008a; 2008b). Target areas are where Natural England are seeking the most environmental benefits from HLS agreements for wildlife, landscape, the historic environment and resource protection. HLS agreements can be applied for by those engaged in the positive management of visible and below ground archaeological and historic features that are assessed as a priority in the region as advised by, among others, English Heritage. The aim is to ensure positive management of visible features such as earthworks, standing stones and structures, and action for the most vulnerable archaeological sites that are currently in cultivation, for example by reducing the depth of damaging cultivations through minimum tillage or direct drilling where this offers a suitable level of protection.

There are a number of existing HLS and ELS schemes in place for the Hull Valley area, covering approximately one third of the project area (80.3sq km for ELS and 14.2sq km for HLS, note that most HLS areas are also accounted for in ELS). A proportion of the archaeological monuments discovered by the project are located on farms with an existing stewardship agreement (Fig 40). Excluding ridge and furrow, 45 monuments fall within a HLS agreement and 226 monuments fall within an ELS agreement. A total of 598 monuments discovered by the project are currently in areas not subject to any stewardship agreement and could provide new opportunities for farms to be accepted onto the scheme.

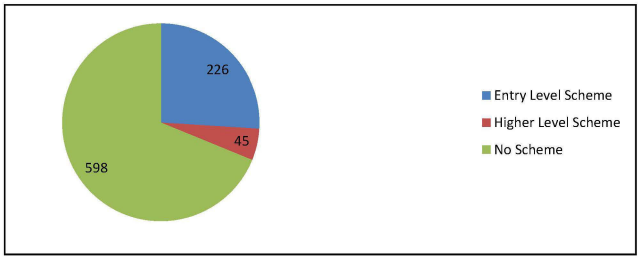

Fig 40: Numbers of archaeological monuments currently falling within an Environmental Stewardship Agreement.

Of those monuments located within a HLS agreement, 33% are sites previously recorded on the NRHE, whilst 67% are newly discovered by NMP mapping and interpretation. A similar picture applies for the ELS schemes where 23%

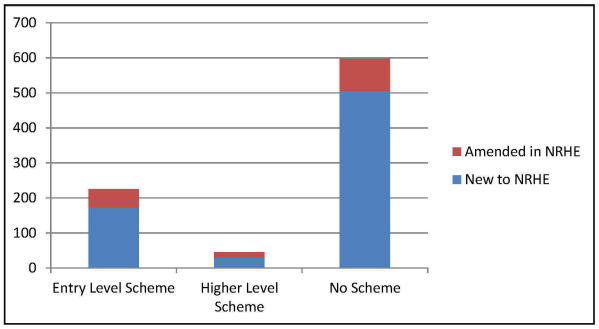

Fig 41: A comparison of the proportions of newly discovered archaeology for each category of Environmental Stewardship Agreement.

were previously recorded sites and 77% new discoveries (Fig 41). As two-thirds of the archaeological features were not recorded when the agreement was put in place then there is no provision for the active management of these new archaeological discoveries, unless the agreement is renewed and they are placed on the Selected Heritage Inventory for Natural England (SHINE), which provides information on undesignated heritage assets. In other words only a third of the archaeological monuments currently within an ELS or HLS agreement have the opportunity for active management. However, NMP data will enhance the SMR, which can feed into the SHINE database, hence there is an increased potential for protection of some new discoveries.

A distinction is made between upstanding archaeology and below ground archaeology for ESAs as management options differ according to each form. Using the NMP data analysis revealed the disparity between the two categories as distributed across the two agreement types. A monument was counted as below ground archaeology if the condition of the archaeological monument was seen as any of the following on the latest available photography: cropmark, demolished building, demolished structure or levelled earthwork. Alternatively the archaeological monument is counted as an upstanding monument if the condition was any of the following on the latest photography: earthwork, extant building, extant structure or ruined building.

As we already have seen (see LEVELLING AND SURVIVAL) the rate of levelling in the Hull Valley is high and this picture remains true for all below ground archaeology (Fig 42). Of the archaeological monuments falling outside an Environmental Stewardship Agreement 20% are upstanding monuments, whilst 80% are below ground. Of those archaeological monuments in ELS only 11% are upstanding, whilst 89% are below ground. However, for those monuments within a HLS scheme this picture is reversed, 43% are below ground whilst 57% are upstanding. As this scheme has only been in operation since 2005,

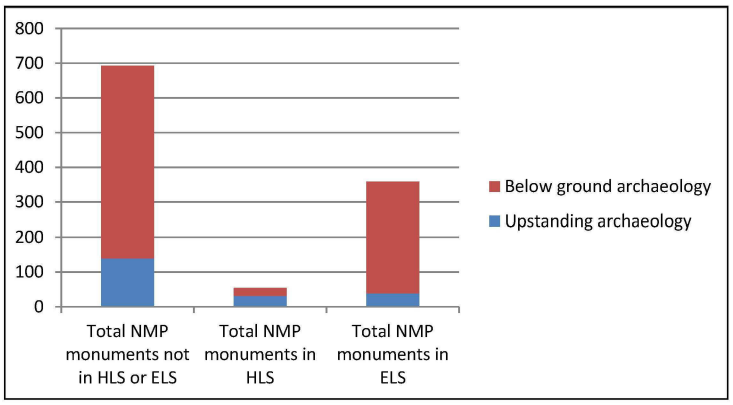

Fig 42: A comparison of below ground and upstanding archaeology for each category of Environmental Stewardship Agreement.

it is unlikely that inclusion into the scheme has benefitted archaeological survival to this extent. The more likely explanation is that the visibility of upstanding archaeological monuments is aiding the selection of areas for inclusion into a HLS scheme. However inclusion into an ALC scheme is likely to benefit archaeological survival in the longer term

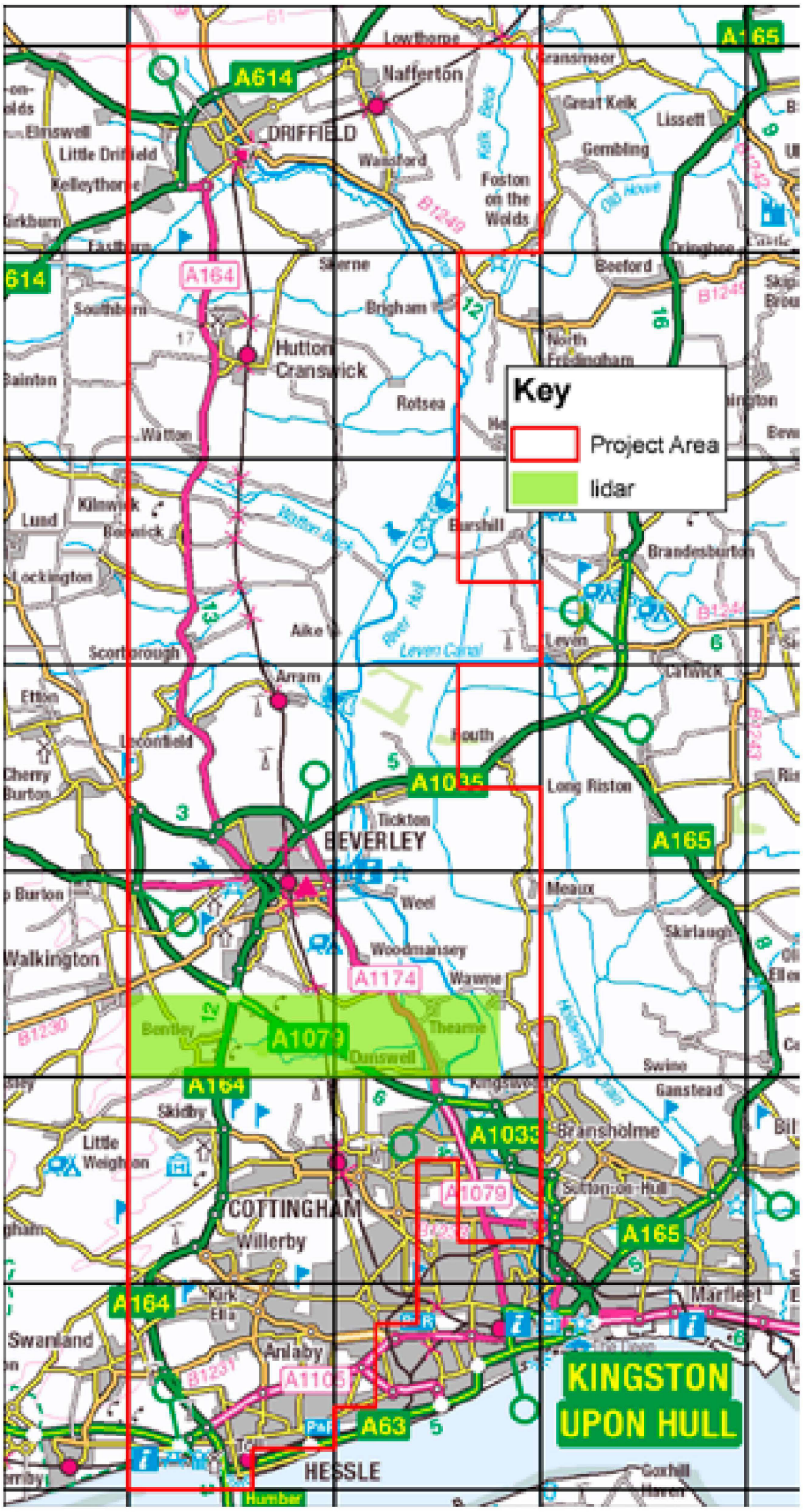

Fig 43: Location of the purchased 1m resolution lidar tiles, note the careful avoidance the urban areas of Kingston upon Hull and Beverley.
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LIDAR VISUALISATION TECHNIQUES

Lidar

This project aimed to assess the suitability of using 2D lidar tiles (in TIFF/JPEG format) as opposed to raster surface data, in terms of the detail visible and a reduction in time taken for interpretation and mapping.

A number of NMP projects (Marden Henge, Beachy Head etc) have used lidar supplied as Environment Agency jpeg images. These are hillshade models lit from a single source and the data within them cannot be manipulated. As with regular photo interpretation, if an archaeological feature is aligned parallel to the sun's illumination, it will not cast a shadow and will therefore be difficult to see. Likewise, if a single illumination angle is used for a lidar Digital Elevation Model (DEM) then it is likely that features will be missed (Devereux *et al* 2008, 471). This combined with a low, 2m resolution means that they are not ideal for archaeological interpretation.

The North Pennines NMP was the first English Heritage project to systematically use raster surface data over a reasonably large area which provided the ability to alter lighting angle and exaggerate heights. The results from that project were outstanding, with numerous archaeological discoveries being mapped from the lidar; however this was offset by cost implications both in the initial outlay of commissioning bespoke lidar data and also as a consequence of the time invested in the manipulation of the raster surfaces. A number of recommendations were made following the conclusion of that project to increase efficiency in lidar use and directly led to the methodologies described here (Oakey *et al* 2011, 74–75).

The compromise between these techniques is to produce a single image that reveals the archaeological features from multiple directions; there are numerous visualisation techniques that can achieve this. To keep costs low a trial area of lidar was purchased from the Environment Agency's existing datasets. One metre (or higher) resolution lidar is preferred for archaeological interpretation. An assessment of the Environment Agency coverage revealed that they only held 1m resolution lidar data for the southern portion of the Hull Valley project. Unfortunately this coincided with the urban and peri-urban landscapes of Beverley and Kingston upon Hull. The best compromise was a 9km by 2 km transect between Beverley and Hull, across TA03NW and TA03NE (Fig 43). Using this data it was agreed that two image visualisation techniques be trialled; 16 direction hillshade images and Principal Component Analysis (PCA).

The processing for both the 16 direction hillshade and the PCA was carried out in-house using a toolbox extension in ArcGIS. The toolbox was written by Ziga Kokalj and colleagues at the Institute of Anthropological and Spatial Studies at the Research Centre of the Slovenian Academy of Sciences and Arts and has a number of potential visualisation techniques including hillshading and PCA. These make use of the basic commands within ArcGIS, but are combined within the model structure to make a simple process for the end user. The processed tiles were then provided as georeferenced TIFF images that could be imported directly into AutoCAD Map 3D

and fully integrated with the air photographs at the analysis, interpretation and mapping stages.

16 direction hillshade

The 16 direction hillshade image is generated automatically from any GeoTIFF or surface model. It uses the 16 compass points or azimuths to create 16 individually lit images, before merging them into one. The merged image reduces the problems associated with single source hillshade imagery and is intuitive to interpret, with positive and negative features readily distinguished.

Principal Component Analysis

PCA is a statistical method to examine multiple hill-shaded images and compile a composite image that shows the main features from each image (Devereaux *et al* 2008). The PCA then takes the images used from the 16 direction hillshade and instead of merging them it does the analysis to select which features occur most often and which images are effectively just replicating the same information. Component images present new, summary views of the data with redundancy removed. Principal component analysis of multiple azimuth illumination enhances visibility of subtle features and overcomes some of the azimuth-related difficulties (Challis *et al* 2011, 279). However, the technique has inherent problems. The images are highly and brightly coloured and this combined with a conflicting shadow and highlight pattern makes interpreting positive and negative features very difficult (Crutchley and Crow 2009, 23–24)

Findings in the Hull Valley

Within the context of the Hull Valley project area the lidar data has provided benefits beyond the use of air photographic evidence alone. A limited number of archaeological features were visible on the lidar that were not clearly visible on other photographic sources; these included a Bronze Age round barrow (UID 79068) and Iron Age/Roman field boundaries (UID 1565996). The lidar also provided a better understanding of the micro-topography of the area when compared with the 2m interval height data supplied through the PGA.

In terms of usability the difference between the PCA and the 16 direction hillshade is marked. The 16 direction hillshade became the preferred visualisation technique for mapping as it is far easier to interpret. However, PCA has advantages; with at least one field of ridge and furrow visible on the PCA being obscured on the 16 directions image, proving that both techniques have a place in archaeological interpretation.

One of the main issues for testing lidar methodologies in the Hull Valley has been the poor earthwork survival of archaeological features across vast areas. As Crutchley and Crow (2009, 17) so eloquently state 'The bottom line, however, is that lidar does not penetrate the ground. If the archaeological features of interest are not represented on the ground surface then lidar will not be able to record anything except the general topography of the survey area'. Both visualisation techniques have been proven as useful

tools, but results could have been more impressive where archaeological earthwork survival was greater. Conversely, lidar has been of particular value in providing a more confident and definitive statement of archaeological earthwork survival than that provided by air photographs alone.

Future recommendations:

- The decision on whether or not lidar will be an effective resource can be informed by initial assessment of the likelihood of earthwork survival in the project area. Information on topography, soil types and the past and present agricultural regime should be considered. 2m resolution Environment Agency single source hillshade imagery may be a suitable resource for this purpose or alternatively an assessment of the air photographs could be made.

- A resolution of at least 1m is necessary for archaeological interpretation, though a higher resolution would enable an understanding of finer details.

- PCA and 16 direction hillshade have proven to be effective for archaeological interpretation, further visualisation techniques could also be trialled, as recommended by Kincey *et al* (2010, 21-28), Crutchley and Crow (2009, 38).

- Trial the use of multiple visualisation techniques in a single project.

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APPENDIX 1. QUARTER SHEETS

Map	NMR Collection Number	Author(s)	Date of completion
TA 02 NW	MD003135	Sally Evans	1 June 2012
TA 02 NE	MD003134	Sally Evans	25 June 2012
TA 03 NW	MD003137	Matt Oakey	3 October 2012
TA 03 NE	MD003136	Sally Evans	20 July 2012
TA 03 SW	MD003139	Yvonne Boutwood	21 August 2012
TA 03 SE	MD003138	David Knight	28 June 2012
TA 04 NW	MD003141	Yvonne Boutwood	17 April 2012
TA 04 NE	MD003140	Sally Evans	17 August 2012
TA 04 SW	MD003143	David Knight	13 July 2012
TA 04 SE	MD003142	Matt Oakey	13 April 2012
TA 05 NW	MD003145	Sally Evans	25 November 2011
TA 05 NE	MD003144	Sally Evans	12 July 2012
TA 05 SW	MD003147	Matt Oakey	7 February 2012
TA 05 SE	MD003146	Matt Oakey	9 August 2012

APPENDIX 2. PROJECT ROLES

The Project Roles adopted were in accordance with MoRPHE principles (English Heritage 2006, 16–19).

Project Executive:

Pete Horne, Head of Remote Sensing, English Heritage

Project Manager:

Dave MacLeod, Aerial Investigation & Mapping Operational Manager, English Heritage

Project Experts:

Simon Crutchley, Development & Strategy Manager, English Heritage

Yvonne Boutwood, Aerial Investigation & Mapping Senior Investigator, English Heritage

Sally Evans, Aerial Investigation & Mapping Investigator, English Heritage

Dave Knight, Aerial Investigation & Mapping Investigator, English Heritage

Matthew Oakey, Aerial Investigation & Mapping Investigator, English Heritage

Project Assurance:

Pete Horne, Head of Remote Sensing, English Heritage

Petra Wade, Heritage Data Coordinator North, English Heritage

Stakeholders (named representatives formed part of the project liaison group):

English Heritage Archive

Eric Branse-Instone, Designation Advisor, English Heritage

Keith Miller, Inspector of Ancient Monuments, English Heritage

Dave Evans, Archaeology Manager, Humber Archaeology Partnership

Margaret Nieke, Historic Environment Lead Advisor, Natural England

APPENDIX 3. ARCHAEOLOGICAL SCOPE OF THE PROJECT

The aim of the NMP is to increase our understanding of the historic environment. It achieves this by identifying, interpreting, mapping and recording all probable and possible archaeological features visible on aerial photographs as cropmarks, soilmarks, parchmarks and earthworks. The main aspects of the archaeological scope relevant to this project are summarised below.

Earthwork archaeology

All extant earthworks identified as archaeological in origin were mapped and recorded, including those since levelled.

Levelled archaeology

All cropmark, parchmark and soilmark features identified as archaeological in origin were mapped and recorded.

Post medieval and modern field boundaries

Post medieval or later field boundaries (upstanding or levelled) that are visible on air photographs or lidar but are also depicted on Ordnance Survey first edition or later edition maps were not generally mapped. The exception to this was where they formed part of a more extensive field system that was not depicted, and potentially had earlier origins.

Ridge and furrow

All ridge and furrow visible on air photographs or lidar was mapped and recorded. Using a simplified depiction, the extent of the blocks of ridge and furrow and the direction of ploughing were delineated. Remains were characterised as medieval or post medieval in date. When the form was not diagnostic as to an explicit date it was identified as medieval/post medieval.

Industrial features and extraction

Widespread and common small-scale extraction measuring smaller than 1ha was not mapped, unless it directly impinged on other archaeological features. Larger areas of extraction were usually defined by an extent of area, but included scarp slopes defining areas of peat cutting or clay pits. Industrial complexes, such as brick and tile works, were also defined by an extent of area. Transport features such as main railway lines and side branches already depicted on the OS base were not mapped.

20th-century military remains

Military features up to and including the Cold War period were generally mapped as an extent of area, though further detail was recorded for some military sites. Military

airfields were outlined as an extent of area and the plan of the runways was depicted.

Buildings and structures

The foundations of buildings visible as earthworks and ruined stonework were mapped and recorded. Standing roofed or unroofed buildings or structures and those that were depicted on the Ordnance Survey first edition or later edition maps were generally not recorded unless they fell within the NMP Sphere of Interest (see Winton 2012), such as military or industrial sites.

Parkland, landscaped parks, gardens and country houses

Elements of earthwork and levelled parkland, landscape park and garden features were mapped and recorded. Urban and 20th-century parks and gardens were not recorded.

Urban areas

Archaeological features of the pre-urban landscape meeting the previous criteria, when identified either as islands of survival or from historic photography, were mapped.

Geological features

Geological features were generally not mapped or recorded but may be mentioned in the monument record when they occurred in close proximity to archaeological features and there was a risk of confusion with archaeological features.

APPENDIX 4. SOURCES

Air photographs

All air photographs held by the English Heritage Archives, formerly the National Monuments Record (NMR), were consulted; the coversearch was carried out on 14 March 2011(loan refs 63015 and 63016). A total of 3,545 specialist obliques and 7,074 vertical prints were examined. The vertical photography ranged in date from 1938 to 1999 and the obliques from 1935 to 2010. Additional oblique photographs included recent English Heritage reconnaissance from 2011, totalling 717 images. Although not currently accessioned into the English Heritage Archives, they were made available to the project locally as digital files. These latter photographs focus on the scheduled monuments within the project area and provide up-to-date imagery.

Orthorectified vertical photographs were supplied to English Heritage by Next Perspectives™ through the Pan Government Agreement (PGA) as 1sq km tiles in TIFF format, covering the entire project area.

Additional prints were loaned to the project by the Cambridge University Collection of Aerial Photography (CUCAP) administered by the Department of Geography.

Anthony Crawshaw, a local flyer, made his photographs available to the project. These totalled 64 oblique photographs ranging in date from 1988 to 1996.

The photographic collection of the Humber Archaeology Partnership (Humber SMR) was accessed at the county offices in Kingston upon Hull in July 2012. The majority of the quarter sheets for the project had been mapped by this point so where additional details were visible, photographs were scanned for rectification and mapping.

Lidar

The project piloted the use of TIFF files derived from composite images of the lidar surface models providing 16 direction hillshade images and those processed using Principal Component Analysis (PCA). The resolution of the lidar examined was limited to 1m. The lidar data was purchased from the Environment Agency and processed in-house to produce the appropriate formats. The pilot area covered a 9km by 2km east–west transect, across TA03NW and TA03NE (see Fig 43).

Initially using Environment Agency lidar JPEG tiles was outside the scope of the project and these were not examined. However, this was reviewed during the project and lidar was used for scheduled monuments, or sometimes other earthwork features, when tree cover restricted their visibility on all other sources.

Monument data

The English Heritage monument database, the National Record of the Historic Environment (NRHE) (formerly known as AMIE - Archives Monuments Information

England), was consulted as was the Humber Archaeology Partnership (Humber SMR).

Additional sources

Other sources used to aid interpretation were available via English Heritage's WebGIS datasets, including historic Ordnance Survey maps. British Geological Survey 1:50,000 scale geology maps were also consulted using the Geology of Britain viewer online at http://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html.

A few medieval sites have higher level surveys at a scale of 1:2,500 undertaken by the Royal Commission on the Historical Monuments of England (RCHME) in the 1980s and 1990s (Watton Priory and Eske and Rotsea settlements). These plans were used to aid mapping and interpretation.

In 2002 English Heritage embarked upon a project to study town commons in England (Bowden *et al* 2009). Three of those commons fall within the area; namely Swinemoor, Figham and Westwood and Hurn where level 3 archaeological surveys were undertaken at a scale of 1:2,500 or 1:1,000 for key areas. The resulting archaeological survey reports were used to inform interpretation and mapping (Pollington and Pearson 2004; Pearson and Pollington 2005).

There were a number of archaeological surveys which overlapped with the project area and provided useful background information. Some produced gazetteers collating a wide range of sources, including air photographs (Loughlin and Miller 1979; Brigham *et al* 2008). The 'Wetland Heritage of the Hull Valley' (Van de Noort and Ellis 2000) included integrated archaeological and palaeoenvironmental surveys and is complimented by this study which examines the interface between the wetland areas of the Hull Valley and the chalk fringes.

APPENDIX 5. MAPPING AND RECORDING METHODOLOGY

Mapping methods

The mapping conventions broadly adhered to NMP methodology (Winton 2012).

Evaluation

- Where possible, air photographs were viewed stereoscopically and under magnification. There were no prints of the PGA orthophotography so this was viewed digitally on screen. The interpreter could alter the colour balance of the PGA orthophotography in Adobe Photoshop to enhance the appearance of some archaeological features.

Rectification

- Oblique and vertical photographs were scanned and then rectified using the specialist AERIAL 5.29 software. Control was derived from 25cm resolution PGA orthophotography or Ordnance Survey 1:2,500 scale MasterMap® vector mapping.

- Topographic information derived from the 5m interval contour data supplied to English Heritage by Next Perspectives™ through the PGA was used in AERIAL to improve the accuracy of rectification.

- Rectification of photographs is normally within ±2m of the source used for control but in areas with large topographic variation this may be higher.

Mapping

- Features were mapped in AutoCAD Map 3D. The mapping conventions and the layer structure used are summarised in APPENDIX 6.

- Georeferenced orthophotography and rectified images were inserted into AutoCAD where archaeological features were mapped.

- Lidar data were added as georeferenced images in AutoCAD where archaeological features were mapped.

Recording

- All mapped features were recorded in the NRHE database. New records were created or existing monument records were amended, following NMR Heritage Datasets: Monument Recording Guidelines.

- Where possible, concordance between the SMR data and NRHE records was made; this is identified as an SMR number in the Other Identifiers field. However, no facility exists to comment on records that exist within the SMR that were not verified by

the project.

- Within the AutoCAD drawing files monument data were also recorded in an object data table (see APPENDIX 7).

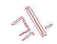
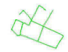
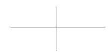
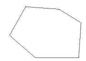
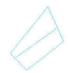
- The latest known condition of the monuments was assessed from the lidar or latest available photography. This was recorded in the EVIDENCE_2 field in the object data table in AutoCAD (see APPENDIX 7) and in the NRHE.

Quality Assurance

- Discussion during the life of the project ensured consistency in dating and interpretation.

- Quality assurance was maintained by peer-to-peer cross-checking of both mapping and recording content and style.

APPENDIX 6. AUTOCAD MAP LAYER CONTENT AND DRAWING CONVENTIONS

Layer Name	Layer content	Attached data table	Layer colour	Linetype	
0	None	NONE	7 (white)	CONTINUOUS	
BANK	Closed polygons for features such as banks, platforms, mounds and spoil heaps	MONARCH	1 (red)	CONTINUOUS	
DITCH	Closed polygons for cut features such as ditches, ponds, pits or hollow ways	MONARCH	3 (green)	CONTINUOUS	
EXTENT_OF_FEATURE	Closed polygons outlining a feature or a group of features such as an industrial complex	MONARCH	30 (orange)	CONTINUOUS	
GRID	Grid lines at 1km intervals	NONE	7 (white)	CONTINUOUS	
MONUMENT _POLYGON	Closed polygon encompassing features recorded within a single NRHE record	MONARCH	7 (white)	CONTINUOUS	
RIG_AND_FURROW_ALIGNMENT	Polyline showing the direction of ploughing in areas of ridge and furrow	MONARCH	4 (cyan)	CONTINUOUS	
RIG_AND _FURROW_AREA	Closed polygon defining the extent of ridge and furrow	MONARCH	4 (cyan)	CONTINUOUS	
STRUCTURE	Closed polygon for built features including stone, concrete, metal and timber constructions	MONARCH	190 (purple)	CONTINUOUS	
THACHURE	Polyline t-hachure convention to schematise sloped features indicating the top of slope and direction of slope	MONARCH	5 (blue)	CONTINUOUS	

APPENDIX 7. AUTOCAD MAP ATTACHED DATA TABLE

The attached object data table MONARCH* consists of eight fields that were input directly through AutoCAD Map. The object data were exported with the shapefiles as attribute data. The content of these fields broadly duplicates those that are entered in the National Monuments database, NRHE.

Attribute	Description	Sample data
MONARCH*	NRHE Unique Identifier (UID)	79060
PERIOD	Date of feature (EH Thesaurus). Single or dual indexed terms	MEDIEVAL
NARROW_TYPE	Monument Type (EH Thesaurus). Specific monument type for individual features	FISHPOND
BROAD_TYPE	Monument Type (EH Thesaurus). Broader monument type to enable grouping of individual features	CISTERCIAN MONASTERY
EVIDENCE_1	Form of remains (EH Thesaurus) as seen on PHOTO_1	EARTHWORK
PHOTO_1	Source feature was mapped from (air photograph or lidar)	NMR RAF/3G/TUD/UK/3 PART 1 5097 14-DEC-1945
EVIDENCE_2	Form of remains (EH Thesaurus) as seen on PHOTO_2	LEVELLED EARTHWORK
PHOTO_2	Latest available source (air photograph or lidar)	NMR 28225/36 19-OCT-2011

*MONARCH is a former name of the National Monuments database re-named NRHE. The table retains the former name to facilitate download into the English Heritage GIS.

APPENDIX 8. MONUMENT TYPES

ABBEY
AIR RAID SHELTER
AIRCRAFT OBSTRUCTION
ANTI AIRCRAFT BATTERY
ANTI AIRCRAFT GUN EMPLACEMENT
ANTI AIRCRAFT OPERATIONS ROOM
AVENUE (LANDSCAPE FEATURE)
BANK (EARTHWORK)
BARBED WIRE OBSTRUCTION
BARRACKS
BARRAGE BALLOON SITE
BARROW CEMETERY
BOMB CRATER
BOMBING DECOY SITE
BOUNDARY BANK
BOUNDARY DITCH
BOUNDARY DITCH/HOLLOW WAY
BRICK AND TILEMAKING SITE
BRICKWORKS
BUILDING
BUILDING PLATFORM
CANAL
CARRIAGEWAY
CASTLE
CAUSEWAY
CAUSEWAYED RING DITCH
CHALK PIT
CIRCULAR ENCLOSURE
CISTERCIAN MONASTERY
CLAY PIT
CLAY PIT/CHALK PIT
COAXIAL FIELD SYSTEM
COMMAND POST
CORN MILL
COUNTRY HOUSE
CREW YARD
CROFT
CURVILINEAR ENCLOSURE
DAM
DECOY POND
DEER PARK
DITCH
DOUBLE DITCHED ENCLOSURE
DOVECOTE
DRAIN
EMBANKMENT CROSS
EMERGENCY WATER SUPPLY
ENCLOSURE
EXTRACTIVE PIT
FIELD BOUNDARY
FIELD SYSTEM
FIRING RANGE
FISHPOND
FLOOD DEFENCES
FOLLY
FORMAL GARDEN
GARDEN FEATURE
GARDEN TERRACE
GRANGE
GRAVEL PIT
GUNPOST
HA HA
HEAVY ANTI AIRCRAFT BATTERY
HENGIFORM ENCLOSURE
HOLLOW
HOLLOW WAY
LEAT
LIME KILN
LYNCHET
MAGAZINE
MILITARY AIRFIELD
MILITARY BUILDING
MILITARY CAMP
MILITARY DEPOT
MILITARY INSTALLATION
MILITARY ROAD
MILL
MILL POND
MILL RACE
MINERAL EXTRACTION SITE
MOAT
MONASTIC PRECINCT
MOTTE
MOTTE AND BAILEY
MOUND
MULTIPLE DITCH SYSTEM
NARROW RIDGE AND FURROW
OBSERVATION POST
ORDNANCE STORE
ORLIT POST
ORNAMENTAL CANAL
ORNAMENTAL POND

PARK PALE
PEAT CUTTING
PILLBOX
PILLOW MOUND
PIT
PIT ALIGNMENT
PLATFORM
PLOUGH HEADLAND
POND
PRACTICE TRENCH
PRECINCT
PRIORY
QUARRY
RADAR STATION
RAMPART
RECTANGULAR ENCLOSURE
RECTILINEAR ENCLOSURE
REDOUBT
RIDGE AND FURROW
ROAD
ROADBLOCK
ROUND BARROW
ROUND HOUSE (DOMESTIC)
SAND AND GRAVEL EXTRACTION SITE
SAND PIT
SCARP
SEARCHLIGHT BATTERY
SETTLEMENT
SPOIL HEAP
SQUARE BARROW
STACK STAND
STOCK ENCLOSURE
TANK TRAP
TERRACED GROUND
TOFT
TOWER MILL
TRACKWAY
TRAMWAY
TREE ENCLOSURE RING
TREE MOUND
TRENCH
UNDERGROUND MONITORING POST
WATER CHANNEL
WATER MEADOW
WATERMILL
WEAPONS PIT
WHITING WORKS
WINDMILL MOUND

APPENDIX 9. DATA ARCHIVE AND DISSEMINATION

Copyright

The copyright of the aerial survey mapping and associated records produced by this project lies with English Heritage. Permission to reproduce and publish any of this material must be sought from English Heritage, Archive Services, The Engine House, Fire Fly Avenue, Swindon, SN2 2EH. Licence to use the data extends to project stakeholders under the ALGAO agreement or by agreement with the English Heritage Archive.

Project archive

This project produced 14 AutoCAD Map drawing files, one for each Ordnance Survey 1:10,000 quarter sheet (see APPENDIX 1). Copies of the digital drawing files are deposited in the English Heritage Archive in Swindon. Aerial Investigation & Mapping, York also retain copies of the digital files for day-to-day access.

Project dissemination

Progress and selected results of the project were disseminated during the project via quarterly reports and presentations to the liaison group.

Some of the NMP project highlights and the Summary Report can be found at http://www.english-heritage.org.uk/professional/research/landscapes-and-areas/national-mapping-programme/hull_nmp/.

The data have been supplied to project stakeholders, Humberside Archaeology Partnership. The digital mapping was exported from AutoCAD Map in ESRI Shapefile format. The monument records created and amended in the NRHE database were output as PDFs. The NRHE records created by the project will be available to professionals and the public via PastScape http://www.pastscape.org.uk/ and signposted via Heritage Gateway http://www.heritagegateway.org.uk/gateway/.

The digital mapping, monument records and polygons will also be imported into English Heritage's corporate GIS, where they will be displayed against other archaeological datasets, facilitating research for internal English Heritage teams.

APPENDIX 10. AIMS AND OBJECTIVES ACHIEVED BY THE AIR SURVEY MAPPING

The aims and objectives of the project were defined and set out in the project design (Boutwood & Macleod 2011). The completed products of mapping, recording, project report and activities undertaken during the project have enabled the aims and objectives to be met. The project has also contributed to fulfilling aspects of English Heritage's Strategy, Strategic Framework for Historic Environment Activities & Programmes in English Heritage (SHAPE), National Heritage Protection Plan (NHPP) and Strategy for the National Mapping Programme.

Aim 1 To contribute to the National Mapping Programme in mapping and recording archaeological landscapes.

Objective 1.1 To map and record the equivalent of up to twelve 1:10,000 quarter sheets to NMP standard.

- *Archaeology within 300 sq km, equivalent to twelve Ordnance Survey quarter sheets, was mapped and recorded from aerial photographs and lidar*
- *Contributed to meeting the NMP target for 2011-12*

Aim 2 To evaluate and interpret monuments to provide baseline archaeological information to enhance the national monuments record and local Historic Environment Record (HER/ SMR).

Objective 2.1 To examine existing aerial photographs in accessible archives.

- *3,545 specialist obliques and 7,074 vertical prints were examined*
- *PGA orthophotography examined for the entire project area*
- *CUCAP, SMR and Anthony Crawshaw photographs used*

Objective 2.2 To examine other remote sensing data e.g. lidar derived images.

- *Lidar TIFF files were examined for a 18 sq km transect across the project*
- *Project piloted the use of 16 direction hillshade and PCA lidar TIFF files*
- *Low resolution LIDAR was examined for scheduled monuments obscured by tree cover on aerial photographs*

Objective 2.3 To identify and accurately map known and previously unrecognised archaeological monuments.

- *Archaeology ranging from the Neolithic to the 21st century was mapped and recorded*

- *Interpretation, mapping, analysis and research places sites in their landscape setting*
- *Products adhere to NMP specification and standards*
- *Control for rectification in AERIAL5.29 derived from PGA orthophotography improved location accuracy for mapping*

Objective 2.4 To create a geo-referenced digital map of archaeological features visible on air photographs.

- *Georeferenced digital maps were created using AutoCAD Map 3D*
- *File formats facilitate import into English Heritage webGIS and other GIS*
- *Autocad object data table facilitates analysis*

Objective 2.5 To update and create monument records in the National Record of the Historic Environment (NRHE) database

- *794 new records were created and a further 135 existing records were enhanced*
- *Data conforms to NRHE data standards*

Aim 3 To assess the impact of erosion on archaeological sites through agricultural ploughing of the chalk landscape of the Wold hinterland.

Objective 3.1 To look for evidence of monument loss or degradation due to agricultural activities by examining photography taken over a seventy year period.

- *Historic photographs from 1938 to 2011 were consulted*

Objective 3.2 To examine the latest available photographs images to assess the latest known condition of each monument.

- *The latest monument evidence was recorded from the latest photography or lidar*
- *Recent reconnaissance provided up to date photography for all scheduled monuments to assess their condition*
- *68.4% of recorded monuments are levelled on the latest photography, 1.7% destroyed and 29.9% survive as earthworks*

Aim 4 To develop a flow-line model, interacting with other teams involved in the NHPP, to maximise the use of the project data in assessing and protecting archaeological monuments.

- *Consulted Designation and Heritage at Risk Teams*

- *When integrated with HER/ SMR datasets, NMP data are a key tool for heritage management*

Objective 4.1 To liaise with and ensure that EH Designation team are included as Stakeholders.

- *Designation team member assigned to project and attended liaison and team meetings*

Objective 4.2 To document opportunities and threats for heritage protection in compiling statistics data on:

a. New sites identified and percentage falling within ELS and HLS and other designated areas

- *Statistics compiled in project report*

b. Known sites where enhanced knowledge will assist assessment and protection

- *135 existing NRHE records were enhanced providing accurate mapping and up to date information on sites*

c. Designated sites where enhanced knowledge will assist assessment and protection

- *Devised methodology for collating data on scheduled sites*
- *Data on scheduled sites readily available to Designation, Heritage at Risk Teams*
- *Assessment of damage noted from latest photography eg from animals*
- *Identified and recommend sites for further archaeological investigation and candidates for scheduling*

Aim 5 To disseminate products and results to inform national and local management strategies and Natural England's Environmental Stewardship Schemes.

- *Textual records accessible to professionals and public via PastScape and signposted via Heritage Gateway*
- *Data accessible in national and local archives*
- *Project report and highlights available via English Heritage web page*
- *Data provides a tool for heritage management and can aid development control decision making*

- *Data available to Natural England for inclusion in their Selected Heritage Inventory for Natural England (SHINE) informing management of Environmental Stewardship Schemes*

- *Poster presentation delivered to an international audience eg Aerial Archaeology Research Group.*

Objective 5.1 To keep stakeholders informed of project progress and results, through liaison meetings.

- *Liaison meetings attended by team members with internal and external stakeholders*

- *Project progress disseminated via quarterly reports*

Objective 5.2 To deposit the project's products in the national monuments archive in Swindon and local HER/ SMR office.

- *Products deposited in English Heritage Archive*

- *Products delivered to Humberside SMR*

Aim 6 To analyse the results of the project to inform future strategies for mapping and recording archaeological landscapes, particularly in alluvial valleys.

Objective 6.1 To examine the effectiveness of using traditional aerial photographs and lidar in the Hull Valley and make recommendations in the Summary Report.

- *Evaluation of the use of 16 direction hillshade and PCA lidar TIFF files for archaeological mapping*

- *Increased understanding of methodologies required for working with lidar and its efficient use; contributing towards standard setting for the professional sector*

The project fulfils the aims of the English Heritage Strategy:

Aim 1: Identify and protect our most important Heritage (Understanding)

The project aligns with the recommendations made in the Strategy for the National Mapping Programme (Horne 2009):

5.2.3 "Encourage NMP projects in those areas where arable farming is most intense or the buried archaeology is most under threat, in particular the Grade 1 and 2 farming land and those areas …….. that have not already been targeted by NMP."

The project addresses the Strategic Framework for Historic Environment Activities & Programmes in English Heritage (SHAPE):

Corporate Objective 1A: Ensure that our research addresses the most important and urgent needs of the historic environment

Sub-programme 11111.110: Understanding Place: New historic assets discovered from remote sensing surveys

The project also serves the aims of the National Heritage Protection Plan (NHPP):

Measure 3 Understanding: Recognition and Identification of the Resource

Activity Plan 3A4 Identification of terrestrial assets via non-intrusive survey

Activity Programme 3A4.3 Integrated survey of target historic landscapes and assets

The project can contribute to other NHPP targets:

Measure 6 Responses: Managing Change in the Historic Environment

Activity Plan 6A3 Management of Scheduled Monuments

The project aligns with the priorities in the English Heritage Research Agenda:

Theme A Discovering, studying and defining historic assets and their significance.

A1 What's out there? Defining characterising and analysing the historic environment

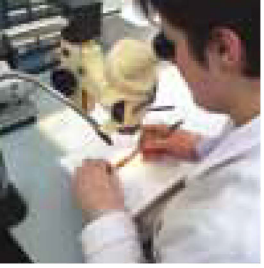
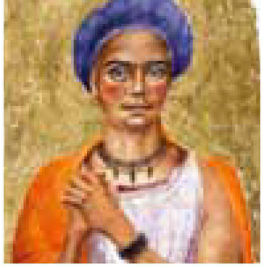
A2 Spotting the gaps: Analysing poorly understood landscapes, areas and monuments.

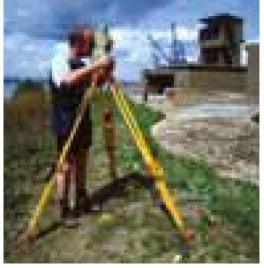
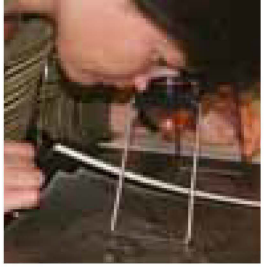
Theme D Studying and assessing the risks to historic assets and devising responses

D1 Heritage at risk: Quantifying and analysing the condition of the historic environment.

Theme G Studying and devising ways of making English Heritage and the "Sector" more effective

G1 Sharpening the tools: Developing new techniques of analysis and understanding


ENGLISH HERITAGE RESEARCH AND THE HISTORIC ENVIRONMENT

English Heritage undertakes and commissions research into the historic environment, and the issues that affect its condition and survival, in order to provide the understanding necessary for informed policy and decision making, for the protection and sustainable management of the resource, and to promote the widest access, appreciation and enjoyment of our heritage. Much of this work is conceived and implemented in the context of the National Heritage Protection Plan. For more information on the NHPP please go to http://www.english-heritage.org.uk/professional/protection/national-heritage-protection-plan/.

The Heritage Protection Department provides English Heritage with this capacity in the fields of building history, archaeology, archaeological science, imaging and visualisation, landscape history, and remote sensing. It brings together four teams with complementary investigative, analytical and technical skills to provide integrated applied research expertise across the range of the historic environment. These are:

* Intervention and Analysis (including Archaeology Projects, Archives, Environmental Studies, Archaeological Conservation and Technology, and Scientific Dating)
* Assessment (including Archaeological and Architectural Investigation, the Blue Plaques Team and the Survey of London)
* Imaging and Visualisation (including Technical Survey, Graphics and Photography)
* Remote Sensing (including Mapping, Photogrammetry and Geophysics)

The Heritage Protection Department undertakes a wide range of investigative and analytical projects, and provides quality assurance and management support for externally-commissioned research. We aim for innovative work of the highest quality which will set agendas and standards for the historic environment sector. In support of this, and to build capacity and promote best practice in the sector, we also publish guidance and provide advice and training. We support community engagement and build this in to our projects and programmes wherever possible.

We make the results of our work available through the Research Report Series, and through journal publications and monographs. Our newsletter *Research News*, which appears twice a year, aims to keep our partners within and outside English Heritage up-to-date with our projects and activities.

A full list of Research Reports, with abstracts and information on how to obtain copies, may be found on www.english-heritage.org.uk/researchreports

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