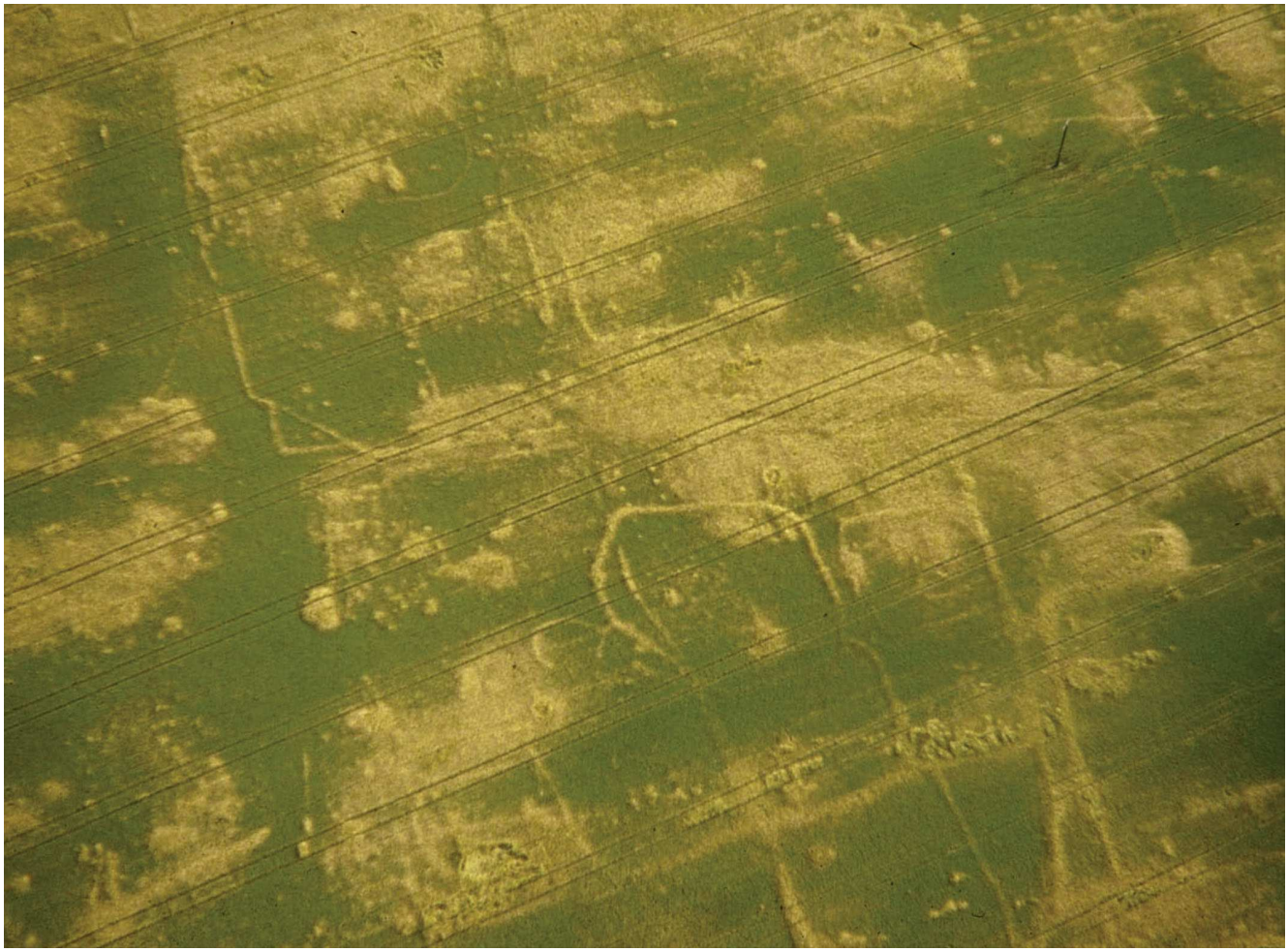
Historic England

Breckland
Aerial Investigation and Mapping of part of the Norfolk and Suffolk Breckland Region (Stage 1)

Sarah Horlock and Sophie Tremlett, Norfolk County Council

Discovery, Innovation and Science in the Historic Environment



Research Report Series no. 66-2018

Research Report Series 66-2018

BRECKLAND

Aerial Investigation and Mapping Survey of part of the Norfolk and Suffolk Breckland Region (Stage 1)

Sarah Horlock and Sophie Tremlett
Norfolk County Council

© Historic England

ISSN 2059-4453 (Online)

The Research Report Series incorporates reports by the expert teams within the Investigation & Analysis Division of the Heritage Protection Department of Historic England, alongside contributions from other parts of the organisation. It replaces the former Centre for Archaeology Reports Series, the Archaeological Investigation Report Series, the Architectural Investigation Report Series, and the Research Department Report Series.

Many of the Research Reports are of an interim nature and serve to make available the results of specialist investigations in advance of full publication. They are not usually subject to external refereeing, and their conclusions may sometimes have to be modified in the light of information not available at the time of the investigation. Where no final project report is available, readers must consult the author before citing these reports in any publication. Opinions expressed in Research Reports are those of the author(s) and are not necessarily those of Historic England.

For more information write to Res.reports@HistoricEngland.org.uk
or mail: Historic England, Fort Cumberland, Fort Cumberland Road, Eastney, Portsmouth PO4 9LD

Opinions expressed in Research Reports are those of the author(s) and are not necessarily those of Historic England.

SUMMARY
Breckland is a distinctive region of East Anglia straddling the Norfolk and Suffolk border. It has long been known as an area of high archaeological potential in terms of the survival of earthwork sites, in an area of the country where such remains are rare. This report collates and synthesises the results from Stage 1 of an Aerial Investigation and Mapping (AIM; formerly National Mapping Programme [NMP]) project, which investigated 96 sq km of central Breckland. It used aerial photographs and, crucially, data from a new lidar survey, to discover, interpret, map and record archaeological sites across the project area, ranging in date from the Neolithic to the Cold War. It covered an area (of 75 sq km) for which an interpretative survey of aerial photographs and lidar – 'Brecks from Above' – was already taking place, as part of the Heritage Lottery Fund (HLF) Landscape Partnership Project 'Breaking New Ground'. The project brought the survey up to Historic England's AIM standards, by facilitating and funding the loan and survey of aerial photographs held by the Historic England Archive (HEA). It also funded the completion of an additional 21 sq km. The resulting datasets will be an important resource for those researching, managing and making decisions about the historic environment of the Breckland region.

CONTRIBUTORS
Survey, research and report by Sarah Horlock and Sophie Tremlett, Norfolk County Council (NCC)

ACKNOWLEDGEMENTS
The majority of the work was completed as part of 'Brecks from Above', which was a 'Breaking New Ground' Landscape Partnership Scheme Project, supported by the HLF. Additional funding was provided by Heritage Protection Commissions (HPC).

The project was undertaken and managed by Norfolk Historic Environment Service (NHES), part of NCC. The principal staff were Sarah Horlock and Sophie Tremlett, with David Gurney and subsequently Martin Horlock acting as Project Manager and Executive; Alison Yardy was Project Manager for the 'Brecks from Above' project. Heather Hamilton provided support in relation to the Norfolk Historic Environment Record (NHER). Pete Watkins helped to summarise information relating to the Palaeolithic and Mesolithic in Breckland.

The project was undertaken in partnership with SCCAS, and the authors would like to thank Dr Richard Hoggett (formerly SCCAS), James Rolfe, and Grace Campbell for their help and advice. At Historic England, advice and support was provided by Helen Winton (Project Assurance Officer and Quality Assurance Officer), Simon Crutchley (Aerial Survey), Dr Will Fletcher (Inspector of Ancient Monuments) and Caroline Skinner (Senior Designation Adviser). Rachel Riley (Forest Research) was an invaluable source of help and advice throughout the project. Tim Holt-Wilson (Norfolk Geo-Diversity Partnership) kindly provided advice regarding geological and topographic features. Dr Jon Gregory (University of East Anglia), Professor Tom Williamson (University of East Anglia), Edward Martin (formerly SCCAS) and Anne Mason (Friends of Thetford Forest) all provided advice and information

regarding different aspects of Breckland's archaeology and landscape history. The team would also like to acknowledge the help and support of the BNG team.

The mapping was undertaken using aerial photographic material from the HEA at Swindon, Historic England Aerial Survey (images supplied to Historic England through the APGB Agreement by Next Perspectives), Suffolk Record Office, SCCAS, and the Forestry Commission. Thanks are extended to all those who kindly provided access to the photographs and supplied loans of material, in particular Luke Griffin (HEA), Rachel Riley (Forest Research), Dr Richard Hoggett (formerly SCCAS) and James Rolfe (SCCAS), and to Simon Crutchley (Historic England) who converted the BNG lidar to a suitable format. Lidar imagery was created using Relief Visualisation Toolbox (Kokalj *et al* 2011).

The maps in this report are reproduced from or based on Ordnance Survey mapping, with the permission of the Controller of Her Majesty's Stationery Office © Crown Copyright, Suffolk County Council licence number 100023395 2018, and NCC licence number 100019340. Unauthorised reproduction infringes Crown Copyright and may lead to prosecution or civil proceedings. The archaeological mapping is copyright Historic England, licensed to NCC and Suffolk County Council.

ARCHIVE LOCATION

Norfolk Historic Environment Record
Community and Environmental Services
Norfolk County Council
Union House, Gressenhall
East Dereham, Norfolk
NR20 4DR

Suffolk Historic Environment Record
Bury Resource Centre
Hollow Road
Bury St Edmunds
IP32 7AY

DATE OF SURVEY

Survey, mapping and recording were carried out between June 2016 and March 2018

CONTACT DETAILS

Community and Environmental Services
Norfolk County Council
Union House, Gressenhall
East Dereham, Norfolk
NR20 4DR
Sophie Tremlett; 01362 869382; sophie.tremlett@norfolk.gov.uk

CONTENTS

LIST OF FIGURES

Front cover: part of the Romano-British settlement at Hockwold/Weeting; photograph by Derek Edwards, Norfolk Historic Environment Record TL7587AQ 13-JUL-1989 (NLA 239/SLIDE) © Norfolk County Council

Abbreviations

AIM	Aerial Investigation and Mapping (formerly NMP)
BNG	Breaking New Ground
CUCAP	Cambridge University Collection for Aerial Photography
HEA	Historic England Archive
HER	Historic Environment Record
HLF	Heritage Lottery Fund
HPC	Heritage Protection Commissions
NCA	National Character Area
NCC	Norfolk County Council
NHER	Norfolk Historic Environment Record
NHES	Norfolk Historic Environment Service
NHLE	National Heritage List for England
NMP	National Mapping Programme (now renamed AIM)
NRHE	National Record of the Historic Environment
SCCAS	Suffolk County Council Archaeological Service Conservation Team
SHER	Suffolk Historic Environment Record

INTRODUCTION

The Breckland Aerial Investigation and Mapping (AIM) project (Historic England Project 7014) comprises a survey of 190 sq km of Breckland, a distinctive region of East Anglia which straddles the Norfolk, Suffolk and (to a lesser extent) Cambridgeshire border (Fig 1). This report collates and synthesises the results from Stage 1, which covered 96 sq km of central Breckland; Stage 2, which is now in progress, will cover an additional 94 sq km in two blocks located to the north and south of Stage 1. Stage 1 largely comprised an area (of 75 sq km) where an interpretative survey of aerial photographs and lidar – 'Brecks from Above' – was already taking place, as part of the HLF Landscape Partnership Project 'Breaking New Ground' (BNG; http://www.breakingnewground.org.uk/). The Stage 1 project brought the planned survey up to Historic England's AIM standards, by facilitating and funding the loan and survey of aerial photographs held by the HEA. In addition, it funded the completion of an additional 21 sq km.

AIM projects comprise large area archaeological surveys, which map and record archaeological features using aerial photographs and airborne laser scanning (lidar) as the main sources. The principal products are typically a digital map of the archaeological features, new and updated records for Historic Environment Record (HER) databases and the National Record of the Historic Environment (NRHE), a report, recommendations for heritage protection, including potential designation candidates, and suggested updates to the National Heritage List for England (NHLE).

Breckland was already known to be an area of high archaeological potential in terms of the survival of earthwork sites, in an area of the country where such remains are rare. The project addressed a key heritage risk in the Breckland region, by enhancing baseline knowledge of heritage assets within areas of forestry and heathland, where earthworks were known or thought likely to survive, but where vegetation cover made them difficult to identify or locate, and ground disturbance relating to forestry practices and heathland restoration placed their survival in jeopardy.

The project has contributed to the identification and protection of England's most important heritage, by discovering and enhancing understanding of the hidden heritage of Breckland. This unique and fragile environment is subject to intrusive changes in land use and management, which pose a threat to its historic environment. The impact of the project has been significantly enhanced by being co-located and run concurrently with the HLF BNG Landscape Partnership: BNG, which concluded in 2017, encompassed multiple projects focussed around, or with an impact upon, the historic environment. In particular, the project benefitted significantly from the availability of data from a new lidar survey, flown as part of 'Breaking New Ground', as part of a separate

project managed by the Forestry Commission. This new survey, of the Public Forest Estate holdings in Breckland, was undertaken with the specific aim of providing a resource from which to identify and accurately record archaeological sites surviving as extant earthworks or structures below tree cover.

Stage 1 of the Breckland AIM Project has made a very significant contribution to baseline knowledge of the heritage of the Brecks. It has identified, and enhanced our understanding of, a wide variety of sites ranging in date from the Neolithic to the Cold War. It has identified 470 new records for the Norfolk and Suffolk HERs, representing an increase of 57 per cent within the area surveyed; it has also identified amendments for a further 305 entries. This equates to an average density of 8 records per sq km, many of which encompass large groups of features within forestry plantations, often extending for a kilometre or more. The project has also created a digital archaeological map covering *circa* 96 sq km, bringing NMP/AIM coverage in Norfolk up to 41 per cent (from 40 per cent) and in Suffolk up to 22 per cent (from 20 per cent). The work has provided locational and interpretative data that will facilitate planning, management, preservation and research decisions concerning the historic environment of the project area at every level, from strategic planning and national designation to local interventions, site visits and research. This report provides a summary of the Stage 1 results, highlighting significant discoveries, identifying important research themes and assessing the potential for further work.

Aims and Objectives of the Survey

The principal aims of the project were:

- To contribute to the identification and protection of England's most important heritage, by discovering and enhancing understanding of the hidden heritage of Breckland.
- To make recommendations for sites where further protection, including designation, might be appropriate.
- To contribute to ongoing research, both academic and developer-led, into the historic environment of eastern England; the substantial contribution to ongoing research made by interpretative surveys such as the NMP (now AIM) was recognised in the last review of the Regional Research Frameworks (Medlycott 2011), and in the current review (which is still ongoing; http://eaareports.org.uk/algao-east/regional-research-framework-review/).
- To provide baseline locational and interpretative data that will facilitate planning, management, preservation and research decisions concerning the historic environment of the project area, particularly within areas of forestry and heathland restoration where heritage is most at risk.

- To provide accessible data that will inform, facilitate and encourage the study and preservation of the historic environment of the project area, and promote it as a valuable resource, particularly within the timescale and context of the 'Breaking New Ground' Landscape Partnership Project.

The project's main objectives could be summarised as:

- The identification, mapping, interpretation and recording to NMP (now AIM) standards of archaeological sites within the project area, augmenting work done as part of the 'Breaking New Ground' project by enabling aerial photographs held by HEA to be utilised.
- The integration of this data into the Norfolk and Suffolk HERs and the NRHE, through the provision of a GIS-compatible digital map layer linked to database records (data to be transferred once an appropriate transfer mechanism is in place).
- The analysis and dissemination of the results of the project, through the production of an internal summary report, and 'signposting' on Historic England websites.
- Liaison with external bodies to promote the use of NMP/AIM data as a tool for informing and facilitating future management decisions, in particular with partners in the 'Breaking New Ground' project.
- As part of the 'Breaking New Ground' project, to encourage the use of NMP/AIM data for community heritage projects, including training and education, community engagement, and community-led heritage research and conservation projects.

Project Area

The Stage 1 project area encompassed approximately 96 sq km of the Breckland landscape. The area was selected not only to coincide with the 'Breaking New Ground' core area, but also to cover a significant proportion of the central, forested area of Breckland, for which data from the new BNG lidar survey would be available. It was also selected in order to include parts of both Norfolk and Suffolk, and to cover areas that are a priority for heathland restoration; the latter meant that the results of the AIM project could feed into the historic environment assessment and mapping undertaken for another BNG project relating to ground disturbance. The Stage 1 area covered key known sites, including Grimes Graves, Weeting Castle, and Thetford Warren, and also bordered an area previously surveyed as part of the Norwich-Thetford-A11 Corridor NMP project (Historic England project 5313).

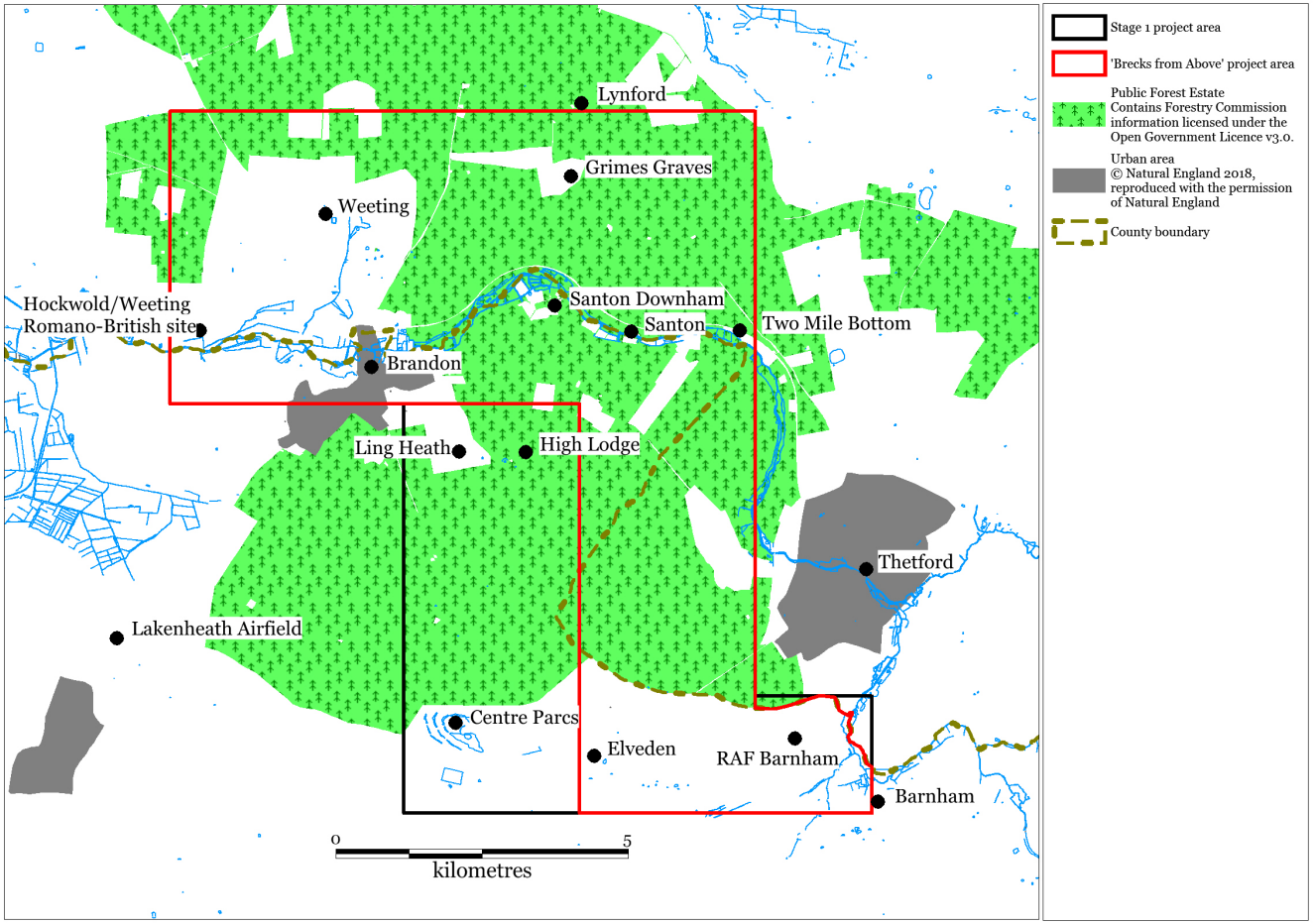


Figure 1 Locations mentioned in the text. The Breckland AIM Stage 1 area is shown in black, and the 'Brecks from Above' project area in red. Base mapping derived from Ordnance Survey MasterMap © Crown copyright and database rights 2018 Ordnance Survey 100019340.

Summary of Project Methodology

The general methodology and scope of the project was based, as far as possible, upon what was then the most recent revision *of Standards for National Mapping Programme Projects* (Winton 2015), and continued that used for the Suffolk Coast and Heaths AONB NMP project (Historic England Project 7085). The approach was also informed by the experience gained by the Air Photo Interpretation Team of previous NMP/AIM projects in Norfolk (Historic England Projects 2913, 5241 and 5313) and Suffolk (Historic England Projects 6642 and 7085).

The only significant change in methodology from previous NMP/AIM projects in Norfolk and Suffolk is the fact that the project area extended across the county boundary. In practice, this had little impact upon the methodology used by the Air Photo Interpretation Team, as the processes and requirements are similar in both counties. The main difference was that records were input directly into the Norfolk HER, whereas records for Suffolk were initially created as Word documents, and the data transferred to the Suffolk HER in batches, members of the Air Photo Interpretation Team travelling to SCCAS offices to do this on a periodic basis. For sites overlapping the county boundary, duplicate maps and records for each site were supplied to both HERs (the mapping will not be replicated in versions supplied to Historic England); this means that any such sites have two HER numbers and Monument UIDs, one for each county. Further use of the Suffolk HER at SCCAS offices was required for querying the data to inform this report.

The project looked at all available aerial photographs, held in national and local archives, which spanned 90 years of photography, and included vertical photographs taken for non-archaeological purposes and specialist archaeological oblique photograph collections. Of fundamental importance was the new 'Breaking New Ground' lidar survey data, for which several different visualisations were checked for each grid square. Online photo mosaics such as Google Earth were also reviewed. Environment Agency lidar data, downloaded from the Survey Open Data website, was used where there was no coverage by the 'Breaking New Ground' survey. Additional standard sources were also used, for example, historic mapping, HER monument records, published and unpublished excavation results and archaeological syntheses; however, the constraints of time meant that the use of such material was by necessity limited.

All archaeological sites and landscapes were analysed, with dates ranging from the Neolithic period to the Cold War. The scope of AIM projects includes recording buried sites, usually visible as cropmarks, features seen as earthworks and stonework, and some structures and buildings. Standard mapping and recording techniques were used to produce an archaeological map of features

visible on the aerial photographs with linked archaeological site descriptions. The site descriptions include references to the source aerial photographs and/or lidar, to inform any re-evaluation of a site, for example for development or research purposes.

The archaeological map was created in AutoCAD, either from sources that were already geo-referenced (such as the lidar and Google Earth extracts), or from aerial photographs rectified and geo-referenced using Ordnance Survey MasterMap mapping (usually 1:1250 scale). Standard layers such as 'BANK' and 'DITCH' were used to record the form of the archaeological remains, and these were then exported and formatted in MapInfo. Polygons indicating the limits of each site were linked to associated HBSMR database records. Descriptive records with associated indexing were added directly to the Norfolk HER (sometimes a temporary Word file was used); for Suffolk, records were initially created as Word documents, the information being transferred to a live copy of the Suffolk HER in batches. The records include a descriptive account and an index of the interpretation, form (cropmark, earthwork, etc) and date of the features. The archaeological interpretations were based on evidence from aerial photographs or lidar, together with any contextual or supplementary sources used. Attribute data, comprising the Monument UID and Parish Code (Suffolk) or Pref Ref (Norfolk) was attached to each object, to ensure full linkage between the mapping and the records.

Two reports have been produced during the lifetime of the project. The first, funded by the HLF, was produced at the conclusion of the 'Brecks from Above' project in March 2017. This covered the results from Mapping Block 1 and the portion (54 per cent) of Block 2, which corresponded to the 'Brecks from Above' project area. The second is this Stage 1 report, funded by HPC and produced following the completion of Mapping Block 1 and the whole of Block 2 (96 sq km in total). It draws upon the 'Brecks from Above' report, but has been updated to incorporate the results from the remainder of Block 2, and to meet AIM standards. Now that funding for Stage 2 has been agreed, a third report, also funded by HPC, will be produced at the conclusion of Stage 2 and the completion of the full 190 sq km project area. It will report on the results from Mapping Blocks 3 and 4, but also provide an overview and assessment of the results from the project area as a whole. As for this report, it will include a brief chronological summary of the results for the area it covers, followed by one or more thematic discussions of key aspects or highlights.

An important impetus for the project was the need for baseline data to facilitate better heritage protection, for example by informing responses to planning issues, or providing precise information regarding the location and extent of features at risk from habitat management and forestry. The Air Photo Interpretation Team will continue to liaise with NCC, SCC and Historic England to highlight any significant discoveries. Following the final submission of this

report, a list of potential candidates for designation or other forms of management or heritage protection will be submitted to SCC, NCC, and the Historic England Listing Group (East), who will then judge what further action to take. A list of updates to the Old County Number schedulings will also be submitted. A version of both lists is included as appendices to this report (Appendix 3 and 4).

The project's mapping and records can be accessed through the Norfolk and Suffolk HERs; the database records are available on their respective Heritage Explorer websites (www.heritage.norfolk.gov.uk; heritage.suffolk.gov.uk) and the Heritage Gateway. Data will be supplied to the NRHE upon request, once a suitable migration mechanism is in place.

The methodology of the project is described in more detail in Appendix 1.

THE CHARACTER OF THE PROJECT AREA

Breckland is an area that is unique both in terms of its environment and its landscape history. Its geology consists of chalk, overlain, predominantly along its eastern side, by till and glacial sands and gravels, and on all sides cut through by river valleys containing river terrace gravels, alluvium and peat. The region is known for its light soils, which retain few nutrients – typically a free-draining mixture of chalk, sand, silt, clay and flints – and its dryness (its climate is classified as semi-continental). The name Breckland derives from the historic practice of cultivating areas of land or *brecks* for just a few years, before the soils became exhausted. The Breckland National Character Area (NCA) covers some 1019 sq km of forestry (including Thetford Forest), heathland (much lying within the Ministry of Defence's Stanford Training Area, known as STANTA), and agricultural land. Prior to the start of the project, AIM-standard mapping had already been completed for 134 sq km (13 per cent) of the Breckland NCA. This covered the historic town of Thetford and its environs, including the A11 corridor within Norfolk (Historic England Project 5313).

An important facet of Breckland's historic environment is the hugely significant Palaeolithic and Mesolithic resource. The region's Lower Palaeolithic sites have proven to be amongst the country's most productive, with hundreds of handaxes recovered at a number of locations. Significantly these productive sites are likely to represent both pre-Anglian and post-Anglian phases of occupation. Work at Beeches Pit, Icklingham (SHER WSW 009) has also revealed what appears to be evidence for the earliest use of fire in Britain. Breckland sites have also produced important evidence for several subsequent phases of hominin occupation, the most notable being the gravel quarry at Lynford (NHER 37095) where between 2000 and 2002 a Middle Palaeolithic site of national (and arguably international) significance was excavated. Here large numbers of distinctive stone tools were found in close association with an extensive faunal assemblage, including the remains of at least 11 woolly mammoths. Scattered lithic implements demonstrate that the region saw at least an intermittent human presence during the earlier phases of the Upper Palaeolithic. There is now clear evidence for much sustained activity in the region by around 10,000 BC, with distinctive Final Upper Palaeolithic long blades assemblages now recovered at a number of Breckland sites. There is also important evidence for Mesolithic activity in the area, for example at Two Mile Bottom, Thetford (NHER 5719, 5738), and West Stow (SHER WSW 002), as well as numerous findings of stray artefacts and flint scatters. As with the evidence for later prehistoric activity, the quantity and distribution of Upper Palaeolithic and Mesolithic artefacts recovered in Breckland reflects not just the intensity of past activity but the extent to which its open heaths and warrens have facilitated the collection of lithic assemblages.

The Breckland region is also notable for its earthwork sites, which are relatively numerous and well preserved in comparison to other part of East Anglia. This is due in large measure to the great tracts of heathland that once existed here, which to some extent still survive, and to the requisitioning of the STANTA training area by the Ministry of Defence in 1940, affording a substantial level of protection to archaeological sites within its bounds. The light soils of the region make Breckland's earthwork sites especially vulnerable to ground disturbance. At the same time, the forestry plantations and heathland vegetation that have to some extent protected them, also limit their visibility and the ability to locate them accurately, making them hard to find and to manage, and thus more vulnerable to land management changes.

Earthwork sites recorded within the Stage 1 area prior to the project starting included the Neolithic flint mine of Grimes Graves (NHLE 1003619) as well as other (some much later) flint mines, numerous round barrows, the Icknield Way (a possible prehistoric trackway and Roman road), the Late Roman or Saxon Fossditch linear earthwork (NHLE 1004040), and various banks and undated earthworks identified within woodland. Cropmark sites were relatively scarce – unsurprisingly, given the large areas covered by forestry – but included a substantial Roman settlement and religious site at Leylands Farm, Weeting/Hockwold (NHLE 1003621). Twentieth-century military defences were recorded widely across the area; they included the First and Second World War military camp at Barnham, together with its Cold War atomic bomb store (NHLE 1020781). The area was also home to a very extensive First World War tank training area, part of which was the 'Elveden Explosives Area' (SHER WSW 101).

With the award of Growth Point status to Thetford in 2006, and the dualling and diversion of the A11 around Elveden, the heritage assets of the area are at risk from related development. This is most likely to take place in surrounding towns and villages, but there are also risks from diversification in the use of agricultural land (solar farms, for example). However, within the forestry and heathland areas that dominate the Stage 1 area, threats from changes in forest management and heathland restoration (which often includes ground disturbance) were the principal focus of the project. Sixty-one per cent (58.2 sq km) of the Stage 1 area is within the Public Forest Estate. It also contains several areas that are known or potential targets for heathland restoration. The latter is a particular issue in the Brecks: the region's unique geology, soils, environment and landscape history have produced landscapes that are an important target for conservation and regeneration of the natural environment, but its light soils mean that archaeological sites are especially vulnerable to disturbance.

FACTORS AFFECTING THE RESULTS OF THE SURVEY

As is the case with any archaeological survey, the results of the Breckland AIM project have been influenced by a number of different factors. Some of these factors are inherent in the methodology used for AIM projects, or in the nature of aerial photographic (or lidar) evidence and its interpretation. Others relate to archaeological work undertaken both before and during the project's lifespan. The effects are evident in both the number and nature of sites recorded in different environments and under different conditions and these factors need to be borne in mind when interpreting the project results.

Methodology

The comprehensive analytical and interpretative aerial photographic survey provided by the methodology used by AIM projects makes an essential contribution to the understanding and protection of the historic environment of any area it covers. It advocates the systematic use of all available aerial photographs – and lidar – to map and record all visible new and previously known sites, irrespective of their present-day survival and encompassing every period from the Neolithic to the Cold War. While some aerial photographic transcription of specific sites had been undertaken prior to the start of the project, for the most part such work had not made use of the full range of sources typically consulted for projects using AIM standards. This means that new sites, and new information about previously recorded sites, were recorded even in parts of the project area that had already been subject to archaeological investigation. In addition, for most of the project area, the survey was the first time that much of the historic, non-specialist aerial photography had been consulted for archaeological purposes. Even specialist archaeological photographs, from which heritage sites had already been recorded, benefitted from re-examination, with new features and sites being recognised, and existing interpretations reappraised.

Perhaps more significantly, the survey represented the first time that high resolution lidar data had been available, and utilised systematically, for much of the project area. Given the difficulty of using aerial photographs and conventional ground-based survey techniques in wooded environments, the project provided an important opportunity to discover new earthwork features within the extensive forestry plantations that characterise so much of Breckland, and to produce a coherent and accurate map of those features (or fragments of features) that had been recorded previously.

One of the key strengths of the methodology used by AIM projects, as opposed to more piecemeal or site-oriented aerial photographic surveys, is the large size of the areas investigated. This landscape-scale approach allows sites to be

studied and understood within their wider context. The production of synthetic and thematic accounts to accompany the mapping adds value to the process and allows newly created data to be more easily understood and disseminated. Through the identification of dominant themes and characteristics within the data, and more specifically through the recognition of significance and survival, the approach allows the results to feed into and inform strategies and decisions regarding heritage protection, relating to designation, planning or landscape management, for example.

The project encountered relatively few methodological issues during its lifetime. Most frequent were difficulties in producing accurate rectifications of aerial photographs. This was particularly the case in heathland areas, where there were few control points available. However, it was also frequently a problem in areas of forestry plantation as well; this perhaps reflects inaccuracies in the Ordnance Survey mapping of such areas.

Further details of the project methodology are given Appendix 1.

Geology and Soils

The geology, soils and topographic formation of any geographical area all have a direct impact on the efficacy of using aerial photographs, and to a lesser extent lidar, to record the historic environment. This is especially the case in arable areas, where sites predominantly consist of sub-surface remains. The complex and varied processes and conditions which lead to differential crop growth are described in detail elsewhere (for example, Wilson 2000, 67–86). However, the Stage 1 project area was unusual for Norfolk and Suffolk, due to the high incidence of earthwork remains – which are generally scarce in a region dominated by arable agriculture – and the extensive areas of land covered by forestry plantation (61 per cent of the Stage 1 area). This has meant that topography, land use and coverage by the aerial sources – whether aerial photographs or lidar – has had a far clearer impact on the results of the project. These factors are discussed in further detail below.

There were many instances where it was difficult to distinguish archaeological features from those relating to geo-morphology. The Brecks have long been noted as an area where the physical traces of earlier, pre-Holocene landscapes are clearly evident. Features such as ‘patterned ground’ – where periglacial freezing and thawing has caused the underlying chalk to be pushed up through a shallow covering of sand – were extremely common, both as cropmarks and as low earthworks. Where there was some uncertainty as to the archaeological nature of some of the mapped features, this was noted in the relevant HER record. However, it is possible that not only have some features of natural origin been recorded as archaeology, but that archaeological features have been

misinterpreted as features of natural origin and excluded from the record. Such uncertainties are not uncommon in interpretative surveys using aerial sources, but they have perhaps been more prevalent in Breckland, where the landscape bears so many traces of its geological past.

Topography and Land Use

The topography of an area and its land use (which are often related) can both have a significant impact upon the existence, survival and visibility of archaeological sites. Some topographic and/or land use settings will have been preferred or avoided in the past, for settlement, industry, burial or land division, for example. Alluvial deposits within valleys, and undisturbed heathland vegetation, pasture or parkland can favour the survival of sites, while sites on light arable soils and exposed hilltops and ridges may be more affected by ploughing. In terms of visibility, the alluvial deposits protecting valley sites may also mask them, making them impossible to detect using conventional aerial photography, while ploughing may make sites visible as cropmarks or soilmarks, under the right conditions.

As with all surveys utilising aerial sources, these processes are likely to have affected the results of the project, but in Breckland they appear to be of particular significance. Topographically, the Stage 1 area consists of two areas of higher ground, bisected east to west by the valley of the Little Ouse. The 'uplands' are dominated by the free-draining, sandy soils typical of the Brecks. These are areas of former heathland and warrens, and are now where forestry plantations dominate. These are where extensive earthworks were found to survive. The western 'arm' of the Stage 1 area is lower lying, better irrigated, and, in places, has better soils. The landscape is more open, with less forestry and more arable. Here cropmarks were more common, and in some areas were extremely dense and complex, as at the Hockwold Roman settlement site (Fig 9). The southern fringe of the project area, where the forestry gives way to arable again, also contained cropmarks. The river valley contained a mixture of earthwork and soilmark sites, with the former dominating.

This variation in survival and visibility has significant consequences for the results of the project and their interpretation. In the open, arable areas, and particularly in the western arm of the Stage 1 area, around Hockwold and Weeting, dense cropmarks attest to settlement and agriculture from at least the Roman period – and in all probability from the Bronze Age and Iron Age – onwards. Sites excavated at Brandon, such as Game Farm and Chequer/Staunch Meadow, and further afield (the A11 Improvement excavations, Two Mile Bottom) reinforce this picture of a densely utilised landscape, with all periods from the Bronze Age onwards represented. However, within the forested areas, where the survey almost exclusively recorded earthworks, the mapping is

dominated by mounds – many probably Bronze Age round barrows – and medieval to post-medieval boundaries and enclosures, the latter often associated with warrens. The pre-medieval landscape is almost invisible. Finds and small-scale excavations demonstrate that evidence of earlier activity does survive, but has been levelled or otherwise rendered invisible by tree and vegetation cover. This discrepancy presents a challenge to both the analysis and interpretation of Breckland's archaeological record, and to the protection and management of its heritage sites. It should be presumed, until disproved, that the intense activity from the Roman period (or earlier) onwards, evidenced (largely) by cropmarks to the west of Brandon, and by excavated evidence within the town itself, once continued eastwards along the Little Ouse, but has been rendered largely invisible are far as the aerial sources are concerned.

Aerial Reconnaissance, Photo and Lidar Coverage, and Previous Archaeological Work

The date, distribution and density of aerial photographs and lidar sources has a significant impact upon the results of any project utilising aerial sources. The project consulted several photographic collections in order to ensure the best possible photographic coverage, but this was not even across the project area. It was not always certain that all available coverage had been viewed: as some of the SCCAS collection is unaccessioned, there was no locational information for many of the Forestry Commission photographs, and the CUCAP library is closed, making it impossible to view any photographs not held as copies elsewhere.

The new lidar survey, flown as part of the 'Breaking New Ground' Landscape Partnership project, was probably the single most important source for much of the project area, in particular for those areas under forestry plantation. The lidar survey covered most of the Stage 1 area, but in general data was only available for those parts that form part of the Public Forest Estate. Outside these areas Environment Agency data was used instead, but was not always available at an equivalent resolution.

Most of the photographs consulted were vertical photographs, and included, amongst others, surveys by the RAF and OS, and the photo mosaics on Google Earth and Bing Maps. These sources provide large area cover but most were taken for non-archaeological purposes and so were not always taken in optimal conditions for the study of the historic environment. Probably the most significant factor was the availability – or otherwise – of photographs pre-dating the end of the Second World War. For many areas there was no coverage pre-dating 1945 or 1946, and this limited the opportunity to record 20th century military sites dating to the First World War, or to the earlier British Expeditionary Force manoeuvres of the 1900s and 1910s. Often, it was difficult

to be certain which phase of military activity a particular site or feature might date to.

The area has seen a considerable amount of earlier work, although little in terms of air photo or lidar interpretation. Substantial areas of forestry plantation have been investigated on the ground, through Rapid Earthwork Identification Surveys or similar. Often these surveys identified parts of much larger earthwork features, which the project has now been able to map in their entirety. Unsurprisingly, given the difficulties of locating sites on the ground in areas of woodland – especially before the widespread availability of GPS – existing records were often inaccurate. More detailed surveys, and in some cases excavations, had been carried out at a number of sites, such as Grimes Graves. At the latter, the sheer size of the record, and the variation between the information held by different sources (such as the Norfolk HER and the NRHE) made correlation between the results of the mapping and existing records problematic. More extensive and recent commercial excavations in Brandon (Game Farm, Chequer/Staunch Meadow), and further afield (the A11 Improvements, Two Mile Bottom) provided an opportunity to date parts of the mapping but again, correlation was not always easy and was, in many cases, beyond the scope of the survey. Perhaps most significant in terms of the project's results was the two Breckland Society warren surveys (2010; 2017). The resulting reports provided crucial baseline information which helped in the identification, interpretation and recording of the warrens within the survey area.

SUMMARY OF ARCHAEOLOGICAL RESULTS

Overall Results

The project identified 470 new records for the Norfolk and Suffolk HERs, and amendments for a further 305 entries; in total, the records relating to 775 individual 'sites' were created or enhanced. Although the 'new' records include a small proportion (29, or 6 per cent) of previously recorded sites that were split into separate elements and renumbered, or included in the recording for a more extensive new site, this still represents a very significant number of archaeological sites and landscapes recorded for the first time. Prior to the project starting the HERs had mapped 825 sites within the project area (grouped by Monument UID rather than Pref Ref/Parish Number). The project results therefore represent a 57 per cent increase to this record.

As described above, the extent of the two mapping blocks did not reflect differences in the character of the project area. Therefore, while figures are given below for each individual block, these are largely a construct of the mapping process; they do not reflect significant differences in the archaeology across the project area. (Compare, for example, the results for the three mapping blocks for the Suffolk Coast and Heaths AONB NMP project, where the blocks did reflect real differences in soils, topography and land use, and in the archaeological sites encountered; Horlock *et al* 2016). The very extensive nature of many of the sites also means that their ascription to a specific block is at least partially nominal, again based on the processes of mapping and recording. As has already been described, far more real differences were apparent between the 'upland' areas of the project area and the lower lying – and, importantly, wetter – areas of the Little Ouse valley, the area around Weeting, and the arable and parkland landscape around Elveden.

Mapping Block	*Area (sq km)*	*Existing HER Records (mapped)*	*Total 'Sites' Recorded by Project*	*Records Created by Project*	*Records Amended by Project*	*Increase to HERs*	*Density of Sites Recorded by Project*
Block 1	50	569	404	251	153	44%	8.1
Block 2	46	263	371	219	152	83%	8.1
Stage 1 Overall	96	825	775	470	305	57%	8.1

For sites recorded within the NRHE (formerly the National Monument Record) the increase is even more striking. At the start of the project, the Stage 1 area contained 213 NRHE monument records, of which 64 correlate with a site (or sites) recorded by the project, whether new or amended. Across the project area, therefore, a total of 711 new NRHE sites have been recorded, equivalent to a 334 per cent increase in the number of records for the area.

Unless otherwise stated, the sites referred to in the text relate to parish codes in the Suffolk HER (prefixed SHER, eg SHER STN 122), or HER numbers ('Pref Ref's) in the Norfolk HER (prefixed NHER, eg NHER 5640).

Geological Features

The geology of Breckland is of considerable interest. It is particularly noteworthy for the many traces of the last glaciation still evident in its landscape; this includes the 'patterned ground' – a result of periglacial conditions – for which, from an aerial archaeology perspective, the area has long been known.

In common with other AIM/NMP projects, the identification and recording of geological or, more broadly, geomorphological features was not within the scope of the survey. In general, geomorphological features were not plotted unless their presence helped to define the limits of an archaeological site or feature, or, more commonly, there was uncertainty as to the archaeological or non-archaeological origin of the feature. Geological and geomorphological features may have been noted in site records, as their presence in some instances could assist with the interpretation of a site or landscape.

However, in appraising the aerial sources for the area, it is clear that there is potential to record such features. The lidar was particularly useful in showing landforms, such as dry valleys, possible dunes, periglacial mounds and areas of possible scouring. 'Patterned ground' was clearest on the aerial photographs, but was also evident on the lidar as faint earthworks at some sites (such as the environs of Grimes Graves). Some work using the lidar has taken place (for example Holt-Wilson 2017, 4), but there is clearly potential for a more intensive survey, using a wider range of sources.

Palaeolithic and Mesolithic

As has already been described, Breckland has long been notable for its extensive evidence for both the Palaeolithic and Mesolithic periods. However, as has been found by other surveys using a similar methodology, sites of this date are for the most part not visible on the aerial sources. Even if traces are evident, they may not be recognised as being of this date. As a consequence, no sites or features were identified which were thought to date to any earlier than the Neolithic.

Neolithic

The earliest site with a confirmed date recorded by the project is the Neolithic flint mine complex at Grimes Graves, Weeting-with-Broomhill (NHER 5640). It

is also one of the best known archaeological sites in Breckland. The main part of the site consists of a cluster of several hundred hollows, each of which marks the mouth of a mine shaft or pit. Some were excavated 10 to 12m through the chalk to access the layers of flint below, and were linked by numerous galleries. The miners used antler or bone picks to dig out whole nodules of flint, which were then broken down into smaller pieces at the site; tool manufacture seems to have taken place elsewhere.

The mines at Grimes Graves have seen many years of excavation and other forms of investigation, including a recent dating programme (Healy *et al* 2014). For this reason, and due to the baseline nature of the survey, analysis of the lidar and aerial photographs has added relatively little to our knowledge of the earthwork remains; the detailed plans compiled by earlier surveys (such as Barber *et al* 2000) must be preferred over the highly schematic mapping produced by the project. The project's main contribution has been to record details of the later landscape for the first time on the Norfolk HER, but there remains considerable work to do in terms of updating and synthesising the information for the site in both the HER and the HEA. The Grimshoe mound – an irregular mound, its upper part at least seemingly constructed of mining debris and spoil – which lies on the eastern edge of the main group of shafts, is discussed in the Anglo-Saxon section below.

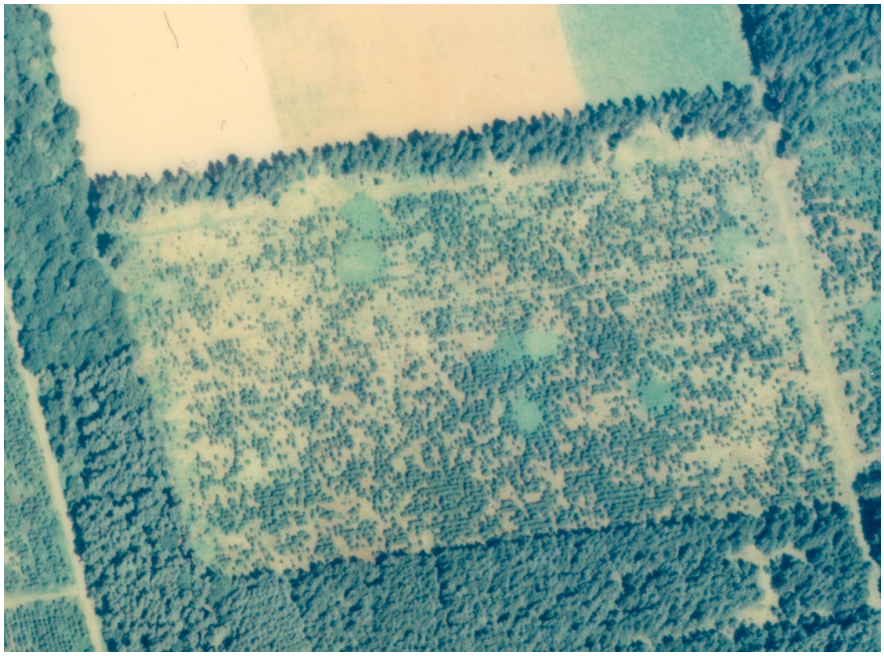


Figure 2 Aerial photograph taken in 1988, showing the location of possible flint mining pits or shafts to the east of Grimes Graves, visible as broadly circular patches of bright green vegetation (NHER 62019). Photograph © Norfolk County Council BKS 8359 06-AUG-1988 (NCC 1568).

The survey has also been able to tentatively identify some new areas of possible additional pits to the south, east and west of the main area of earthworks (NHER 61536, 62051, 62052, 62057, 62031, 61523, 62019, 61522, 62095). The identification of these features as Neolithic flint mines, or in some cases even as pits, is extremely uncertain. Most of the recorded examples are visible principally as vegetation marks in areas of heath or clear-felled woodland, rather than earthworks (Fig 2). However, most are broadly similar in size and shape to the shafts at Grimes Graves. Work by the Grimes Graves Environs Project has identified probable mine shafts in the forested area to the south of the site, using Ground Penetrating Radar and excavation (NHER 55660; Bishop 2012). So while the nature of the additional features mapped from the aerial photographs and lidar remains uncertain, there is supporting evidence for Neolithic flint mining taking place beyond the limits of Grimes Graves itself.

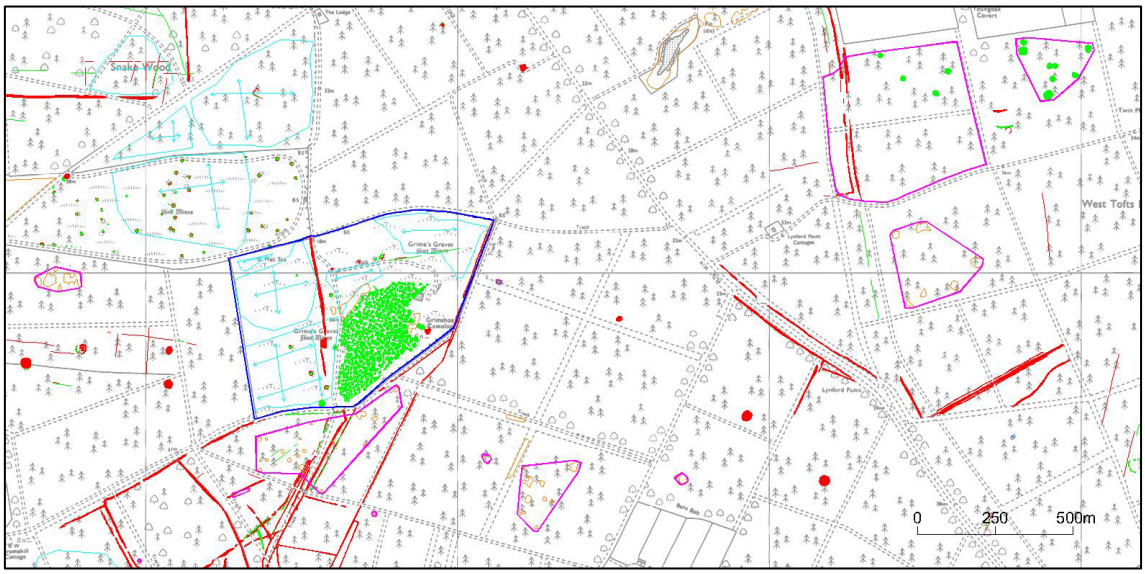


Figure 3 The site of Grimes Graves (outlined in blue), with the location of possible additional areas of Neolithic flint mine shafts (outlined in magenta). Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

Other possibly Neolithic features recorded during the survey were confined almost entirely to possible funerary monuments. Several of the barrow mounds recorded (see below) were distinctly oval in shape and could feasibly represent Neolithic barrows. A possible low oval mound (NHER 61985) was tentatively identified on the lidar within plantation to the north of Crescent Wood, Weeting. It appears to have a circular mound located on top of it, and could feasibly represent a Neolithic barrow that has been augmented with a further barrow mound during the Bronze Age. One group of three plough-levelled round barrows (NHER 62082) to the south of Pepper Clump, Weeting-with-Broomhill, were recorded in close association with a substantial group of Neolithic finds (NHER 12854), which could suggest a Neolithic origin for at

least one of the barrows. However the location of the site – overlooking the valley of the Little Ouse to the south – may have led to it being utilised for Neolithic settlement or hunting activity, and then later chosen for the site of the Bronze Age barrow cemetery. A number of elongated mounds had also been recorded by earlier surveys (for example, SHER BRD 082 and 196 in Brandon, STN 152 in Santon Downham), but none were particularly convincing as Neolithic long barrows, and a post-medieval, modern or natural origin to the features seemed most likely.

A small number of additional records – for example, the trackway known as East Harling Drove (NHER 5435) – have been assigned a possible prehistoric date, but there is no evidence that they date specifically to the Neolithic.

Bronze Age

The record of Bronze Age sites created by the project was dominated to a great extent by funerary sites; no enclosures, settlements or field systems of definite Bronze Age date were identified. At the same time, a Bronze Age origin for some of the complex, multi-period cropmarks and earthworks mapped at Hockwold and Weeting, for example (see below), cannot be ruled out. In this area, surface material dating to the early Bronze Age and Iron Age (NHER 5595) was found in association with earthworks of fragmentary enclosures and field boundaries on the side of the Little Ouse Valley (NHER 62016 and 62084). However, a significant number of Roman and medieval to post-medieval sites are also recorded in this area and therefore a Roman or later date may be more likely. At Thetford, the cropmarks of a curvilinear enclosure (NHER 5938) could feasibly relate to prehistoric – perhaps Bronze Age – settlement. Middle and Late Bronze Age enclosures and fields have been excavated at Game Farm, Brandon (SHER BRD 154; Gibson 2004). This evidence, along with prehistoric finds from the area, has led to the suggestion that at least some of the enclosures and boundaries identified by the project in the Little Ouse Valley could have originated in the Bronze Age (NHER 61284, for example).

At Game Farm, an area of fragmentary cropmarks, vegetation marks and soilmarks was visible on historical aerial photographs at the site of the excavated settlement (SHER BRD 280). Comparatively little was apparent in the southern part of the site, where the prehistoric settlement was located. The evaluation excavations demonstrated that these earlier deposits were covered by windblown sand and buried topsoil (Gibson 2004, 5). While some of the features mapped may relate to elements of the excavated Middle to Late Bronze age phase, the majority are located in the northern part of the site and potentially date to the later ditches cutting through this sand (ibid).

The project created or amended 181 records relating to known, probable or possible Bronze Age round barrows and round barrow cemeteries. At previously recorded sites, the project usually mapped the feature(s), updated the record, and, where necessary, corrected the HER Monument Record mapping of the location and extent of the site. Where the site is designated as a Scheduled Monument, any suggested updates to the existing mapping was added to the list included as Appendix 4. At some sites, this work has been fundamental. At one site, in Weeting-with-Broomhill, a group of four probable Bronze Age round barrows was surveyed by the Ordnance Survey in 1973 (NHER 5649). The fact that they were not seen during either earlier or later site visits, led to them being all but dismissed in the HER record. However, all four barrows are clearly visible on the lidar, at the approximate locations recorded by the Ordnance Survey. A possible fifth barrow (NHER 62020) has been added to the group, which almost certainly represents a small barrow cemetery (NHER 61502; Fig 4). Their existence has also been confirmed by a recent site visit by David Robertson, former Historic Environment Team Leader (Strategy and Advice), NHES.

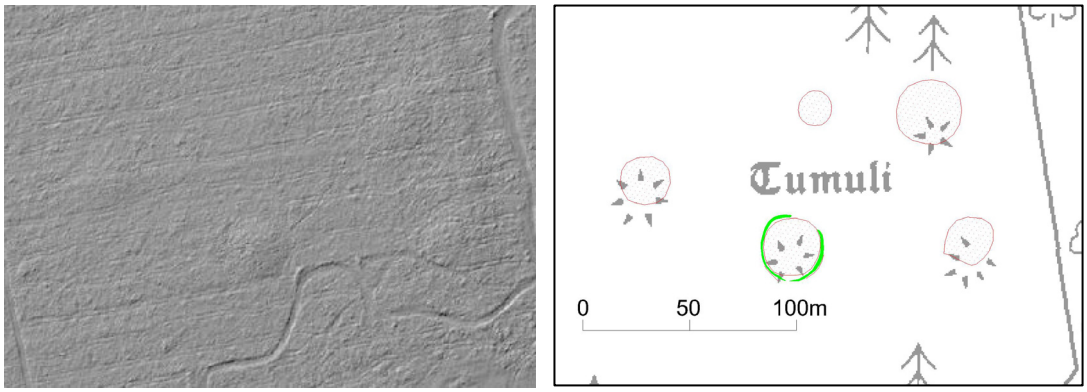


Figure 4 Lidar extract (left) and mapping extract (right) of the 'lost' barrow cemetery recorded at Weeting-with-Broomhill (NHER 61502); banks and mounds shown in red, ditches in green. Lidar © Crown Copyright. Forest Research. Based upon BNG LPS Project, FC England and Fugro Geospatial Data. Supported by the Heritage Lottery Fund. Visualisation created by Historic England. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

Most of the known or putative barrows that the project identified were relatively substantial in size, often measuring 25m—30m in diameter. It was not uncommon for evidence of an outer ditch or bank to be present. However some of the mounds recorded were of much smaller proportions, perhaps representing a distinct phase within the development of a wider funerary landscape. One such possible cemetery group, recorded within Nelson's Plantation, Weeting (NHER 61498), consisted of a nucleated cluster of up to ten small mounds, ranging in diameter from 10m—17m in diameter. Two of the mounds (NHER 33623—4) had been identified during an earlier ground survey,

but the remainder were newly identified by the survey. The construction of small barrows or mounds during the Bronze Age is recorded elsewhere in Norfolk and Suffolk. At Salthouse Heath, in North Norfolk, a group of late Bronze Age cremations were covered by at least thirty small, closely spaced barrows measuring approximately 0.3m high and 3–5m in diameter (Albone *et al* 2007, 55). At the same time, the small size of the Weeting examples could instead indicate a much later, possibly Saxon date for their construction.

The plantations to the west and north of Weeting produced quite spectacular results. Numerous round barrows were visible, which together appear to form a substantial funerary landscape on the higher ground alongside the fen edge. Within this wider landscape, distinct cemetery groups can be identified. Many of these had been recorded by earlier ground-based surveys, but use of the aerial sources meant that it was often possible to identify additional mounds. Some groups appeared to be respected by the Fossditch, a substantial linear earthwork thought to be of Early Anglo-Saxon date, which crosses the area north-south (see below). Differences in the character of the various barrow groups – for example, in the size of the mounds – may reflect barrow construction in the area developing over a considerable period of time, possibly from the late Neolithic to the late Bronze Age. It is likely to have encompassed a variety of ways in which such monuments may have been constructed and used. The extent of the barrows, their number, and the variation in their form bears comparison with other large dispersed cemetery landscapes, such as that preserved on Salthouse Heath on the North Norfolk Coast (Albone *et al* 2007, 53-55).

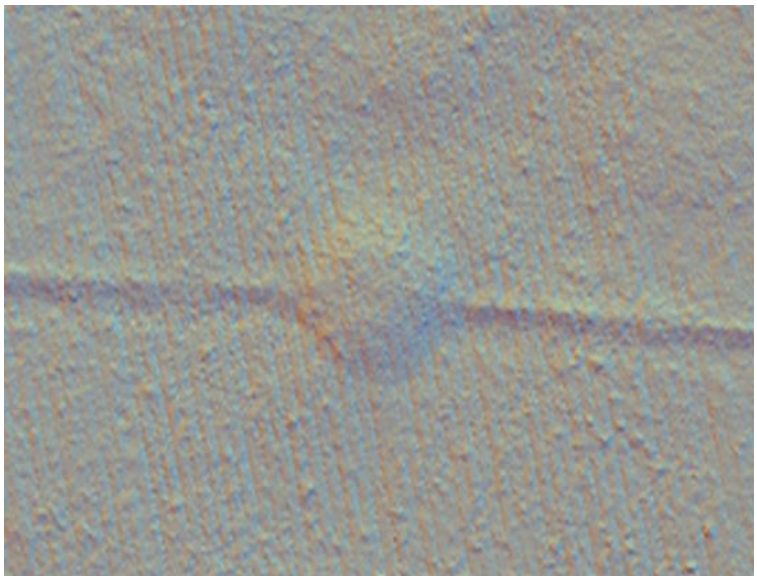


Figure 5 Lidar imagery of a newly recorded barrow at Weeting-with-Broomhill (NHER 61510). Measuring circa *34m in diameter, and incorporated into a later boundary bank, it is likely to have formed part of a cemetery with other nearby barrows (NHER 61509). Lidar © Crown Copyright. Forest Research. Based upon BNG LPS Project, FC England and Fugro Geospatial*

Data. Supported by the Heritage Lottery Fund. Visualisation created by Historic England.

As described above, at some sites the survey has been able to expand the number of barrows identified within a previously recorded group or cemetery. In other cases, the features identified are entirely new to the record (Fig 5). At Thetford, what appears to have been a large, dispersed, round barrow cemetery was identified from the lidar imagery (NHER 62464; Fig 6). The possible cemetery comprises up to 20 mounds, only one of which (SHER STN 089) – and the only part of the site falling within Suffolk – had been identified previously. A proportion of the mounds could instead be of natural origin (perhaps being sand dunes, or periglacial features), or be dense vegetation that the lidar could not penetrate. Others could instead be enclosures related to Thetford warren. Many, however, appear convincing as barrows on the lidar imagery. Further investigation on the ground, to better establish the existence, form and condition of the mounds, would be beneficial.

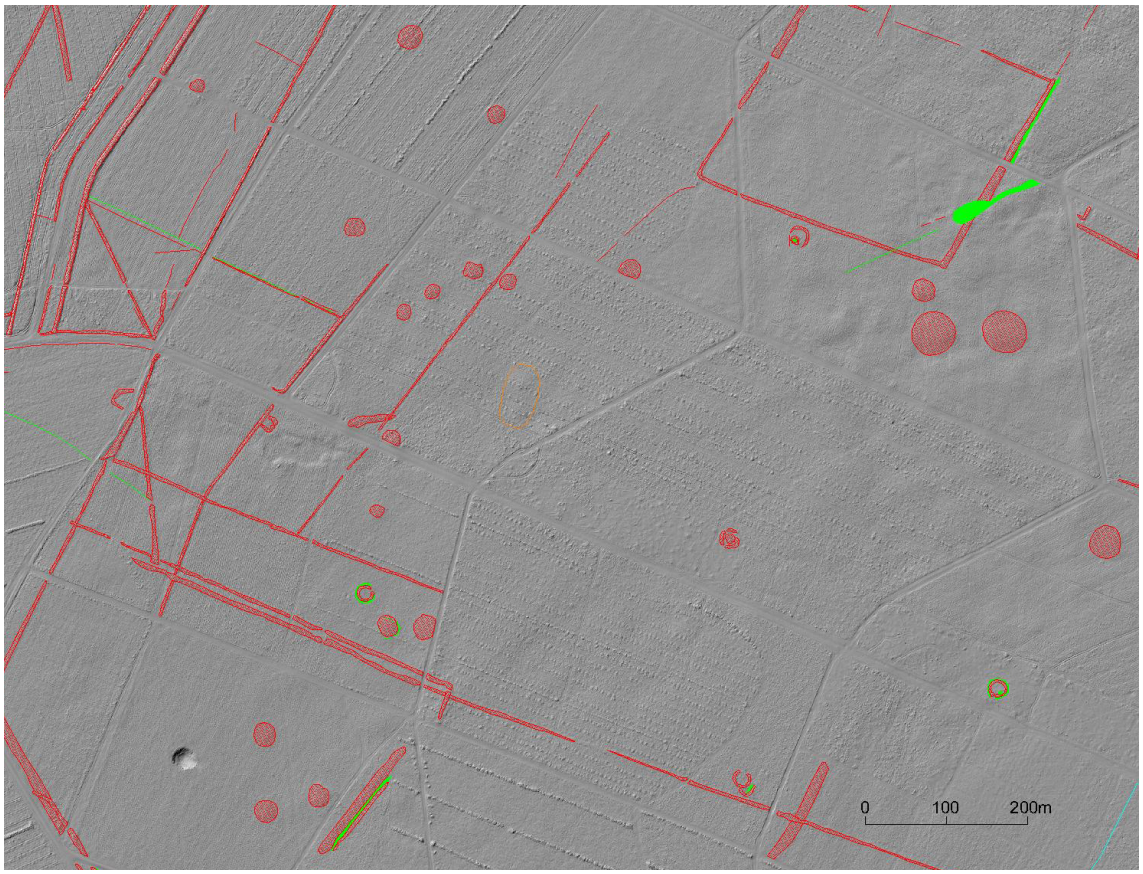


Figure 6 The newly identified possible barrow cemetery in Thetford Forest (NHER 62464), overlain on the lidar imagery. All of the mounds require further investigation, and it is possible that many are of natural or recent origin; the circular enclosures may relate to warrening. Banks and mounds shown in red, ditches in green. Lidar © Crown Copyright. Forest Research. Based upon BNG LPS Project, FC England and Fugro Geospatial Data.

Supported by the Heritage Lottery Fund. Visualisation created by Historic England.

Of the new records added to the Norfolk and Suffolk HERs, 119 (25%) relate to probable or possible round barrow sites, or round barrow cemeteries. Of these, only eight are noted as being a renumbering of previously recorded features, meaning the vast majority are entirely new discoveries. Overall, while Breckland has long been known to be an area with a relatively high density of round barrows (for example, Ashwin 1996, 50; Martin 1999, 38), the survey has demonstrated that, if anything, the number of surviving mounds has been under-represented in previous surveys. It has also highlighted the need for further work to further investigate not only sites newly identified by the survey, but also those previously recorded sites that might require reassessment. For sites newly identified from the lidar imagery, for example, a simple check on the ground for the existence of an earthwork would be beneficial, as it is possible that at least some of the sites recorded by the survey are the product of the laser re-bounding from dense vegetation, rather than the presence of an earthwork.

Iron Age

When compared with the comparatively numerous Bronze Age funerary sites, and discounting those sites associated with the A11 easement excavations discussed below, few sites of known or likely Iron Age date were identified. It is clear, however, from the A11 excavations (Watkins 2006; Lees 2013) and sites such as Fison Way (NHER 5853) and Two Mile Bottom (NHER 5738), Thetford, High Lodge, Santon Downham (SHER STN 008 for example), and Staunch/Chequer Meadow, Brandon (SHER BRD 018) that there was certainly activity in the area during this period. It may be that this central area of the Brecks was less conducive to settlement than more fertile, and less arid, areas such as the fen-edge. It is also likely that the activity that was taking place here in the Iron Age was of a type that has not left traces that have survived in the landscape, or, at least, that are not readily identifiable on aerial sources, or distinguishable from activity dating to other periods. As discussed above, within the forestry plantations that cover a large proportion (61 per cent) of the project area, the mapping is dominated by earthworks of probable medieval to post-medieval date. Evidence of Iron Age settlement or activity may be 'hidden' within this mass of largely undated features, or may have been obliterated by natural processes and subsequent human activity. Outside of the forestry plantations, it is also likely, as for the Bronze Age, that elements of the complex, multi-phase landscapes recorded in Hockwold and Weeting (see below) may date from the Iron Age.

As mentioned above, there are a number of sites in the Breckland region where Iron Age activity had been recorded prior to the survey. Fison Way (NHER

5853), a large Iron Age to Roman site, thought to be a religious complex, lies a short distance (7km) to the east of the project area, and was covered by an earlier survey (Bales *et al* 2011). At High Lodge, Santon Downham, nothing was identified that could be associated with the Iron Age features and finds previously identified at the site (SHER STN 008, for example). This was also the case at Two Mile Bottom, Thetford (NHER 5738), and Staunch/Chequer Meadows, Brandon (SHER BRD 018).

The excavations in advance of the A11 easement route on the Elveden estate (Watkins 2006; Lees 2013) provided vital information concerning the Iron Age landscape of parts of the project area. The excavations revealed that the site was intermittently occupied during the earlier Iron Age, but the bulk of the evidence dated to the later Iron Age. During this phase the domestic settlement, consisting of roundhouses, enclosures and pit groups, was enclosed by boundary ditches, and a broader system of land division was established (Lees 2013, 294). Phases of reorganisation, and possible expansion, of these boundaries during the later Iron Age, is thought to have related to a move towards increased arable cultivation, instead of a previously more mixed economy with a focus on animal husbandry and stock enclosures (ibid 295). The development of a planned layout of fields and boundaries imposed on this site during the early to mid-Roman period is discussed below.

In terms of the project, the results for the area of the excavation were comparatively poor, with cropmarks relating to patterned ground dominating. However some traces of the excavated Iron Age landscape were visible as faint cropmarks (SHER ELV 120; relating to Area 11/SHER ELV 086 of the road scheme). Additional faint cropmarks were mapped in the area of the later Iron Age fields and may relate to this phase of activity, although this is uncertain due to the similar alignment of features across different phases. Excavation to the north of the main area, in advance of the creation of a new access road for Centre Parcs, also revealed evidence of Iron Age and Roman ditches (SHER ELV 093), suggesting that the settlement and fields were more extensive. Faint vegetation marks were tentatively identified within rough ground in this area, suggesting the possible presence of an enclosure and further ditches. These fragmentary linear marks appear to correspond to the alignment and pattern of the excavated later Iron Age and Roman ditches to the south, and therefore to represent further components of this landscape.

To the east of the excavated Iron Age settlement and fields, the cropmarks of a possible polygonal enclosure and associated tracks and boundaries (SHER ELV 121) were tentatively identified on the aerial photographs (Fig 7). The enclosure is 'D'-shaped, measures approximately 52m by 48m and has a trackway along one side. It is feasible that the enclosure could be later Iron Age in date and contemporary with some of the excavated cropmarks to the west. Morphologically the enclosure is comparable with later Iron Age excavated

examples from outside East Anglia (for example, Winton 1998, 51). However the trackways and more rectilinear elements of the site have the same orientation as the early and mid-Roman tracks and boundaries, so a Roman date is also possible.

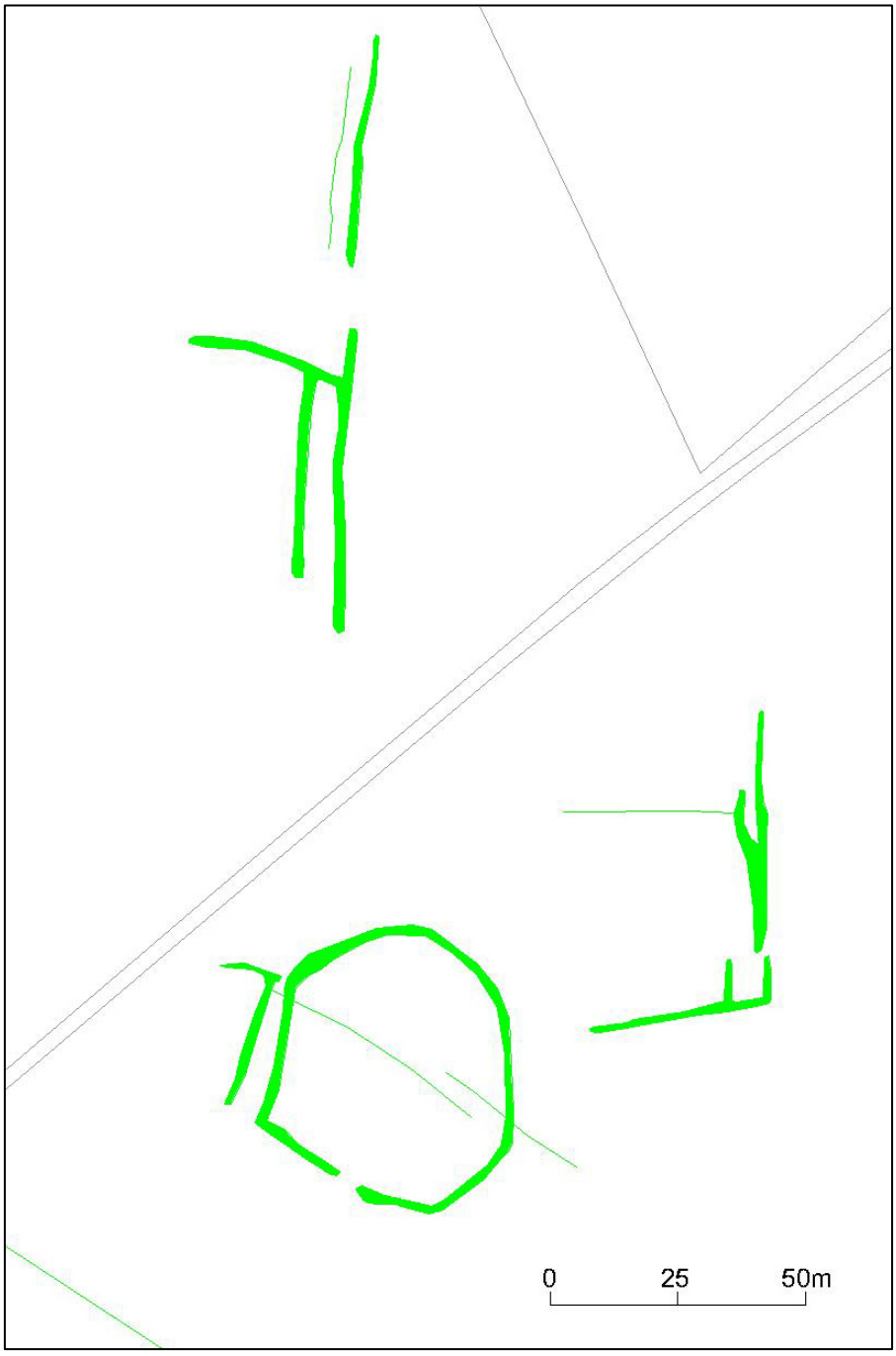


Figure 7 The possibly Iron Age enclosure at Elveden (SHER ELV 121); ditches shown in green. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

Amongst the earthworks mapped by the project, it is possible that an incomplete rectilinear enclosure (SHER ELV 111) identified on the BNG lidar imagery could also represent a later prehistoric and/or Iron Age enclosure, as it seems to be bisected by the boundary bank of Elveden Warren. However, further inspection of these features on the ground is required to better understand the archaeological significance of the features visible on the lidar imagery. It is also the case that Elveden Warren appears to have been established comparatively late, in the early 17th century (Breckland Society 2010, 20), and that while perimeter banks and ditches surrounding warrens were constructed in the medieval period, they seem to have become more common in the post-medieval period, when stocking levels increased (Williamson 2006a, 178). Therefore the Elveden enclosure could equally be of medieval date, overlain by a post-medieval boundary. Others of the many, mostly undated enclosures mapped within the Breckland warrens could pre-date the establishment of the warrens, and perhaps be of prehistoric, Roman or even Anglo-Saxon date. In the absence of further evidence, however, they have for the most part been assumed to be of medieval to post-medieval date.

Also worthy of mention is the possible course of the Icknield Way, a supposed prehistoric trackway and Roman Road. This route has been recorded by the project across Barnham Heath to the south of Thetford (SHER ELV 016, NHER 61561), but the origin and date of the trackway/road – both as a whole and its constituent sections – is not certain; some parts, at least, may date back only to the medieval period, or even later (NHER 1398; Harrison 2003).

Roman

A significant number of sites of probable Roman date were identified, particularly along either side of the Little Ouse. It is already well-established that the fen-edge to the west of the Brecks was occupied in the Roman period by an extensive spread of settlement and land division (for example Sussams 1996, 74; Plouviez 1999, 43; Gurney 2005, 29). The results of the survey, in conjunction with other evidence recorded in the HERs, confirms that this continues into the northwestern 'arm' of the project area, and extends along the Little Ouse into Brandon.

The Roman sites recorded by the project include one of the densest, most complex areas of archaeology encountered by the project. The existence of an important Roman site at Hockwold/Weeting has been known for many years, through the recovery of numerous finds, excavation, and aerial photographs (NHER 5587; Gurney 1986; Wade-Martins *et al* 1999, image 31). It has been interpreted as both a settlement and as a religious or cult centre. The detailed mapping of the site and its surroundings by the project has highlighted the internal organisation of the site, and the exceptionally high number of timber

buildings present. These buildings may represent barns, and could feasibly reflect a centralised agricultural role, perhaps focussed on grain storage.

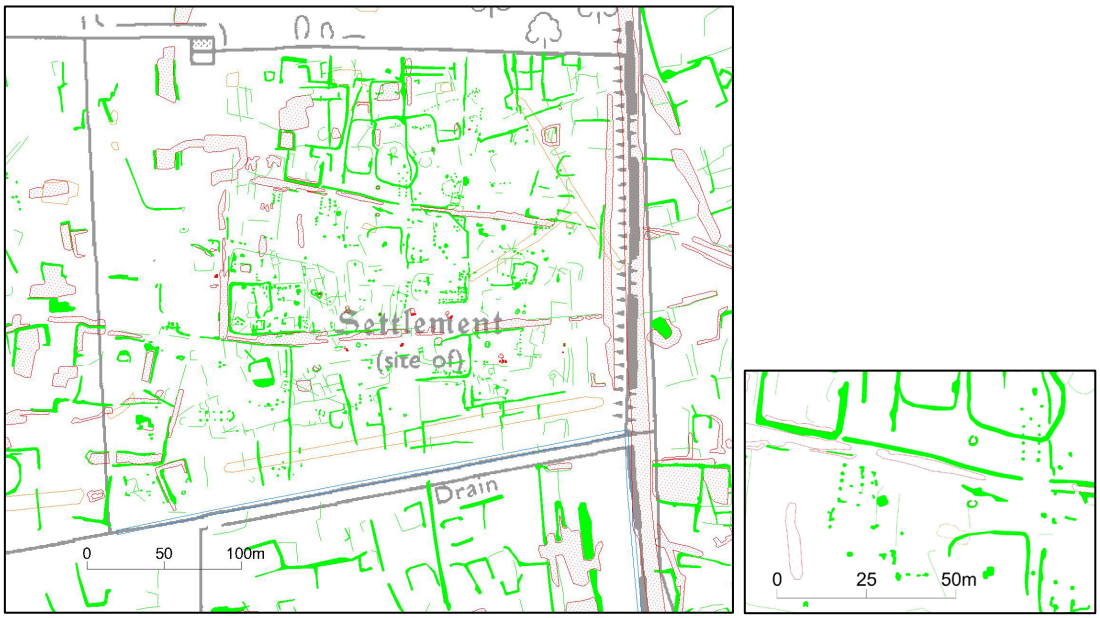


Figure 8 Mapping extract showing the Roman settlement at Hockwold/Weeting (NHER 5587), with detail (to right) of some of the timber buildings; banks and mounds shown in red, ditches and pits in green. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

Figure 9 Mapping extract showing the Hockwold/Weeting site (NHER 5587, just left of centre) within its wider landscape; banks and mounds shown in red, ditches and pits in green. Note the Fossditch (NHER 1089, see below) running

through the middle of the site. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

The aerial photographs and lidar have revealed extensive new evidence of roads, enclosures and boundaries in the area surrounding the site, indicating a substantial settlement and associated landscape. Furthermore, while parts of the site have been levelled by ploughing, others appear to still survive as earthworks. This is potentially a significant survival, in a part of England where earthworks of any date are comparatively rare, although it must be noted that some of these remains may relate to the medieval or later use of the Little Ouse Valley, rather than being of Roman (or earlier) date. As is frequently the case with archaeological surveys using airborne sources, it is extremely difficult to be certain of the date of different elements of palimpsest landscapes such as this.

Just to the south of Weeting village is the site of an excavated Roman building, which is also the location of a late Roman pewter and bronze hoard (NHER 5636). The building is thought to have been built in the 4th century AD, probably as the barn of a Romano-British farming complex. Elements of this complex are visible amongst the cropmarks and earthworks recorded around the site. However, the identification of possible Roman features within the medieval and later elements of the landscape is again difficult. At the same time, Bronze Age and Iron Age finds in the area, as well as nearby excavations such as Game Farm, Brandon, are a reminder that some of the settlement and field boundaries may in fact be of prehistoric origin.

Fragmentary areas of earthwork enclosures and boundaries have been identified on the corresponding Suffolk side of this section of the Little Ouse, to the west of Brandon. Some of these newly identified sites are associated with previously recorded Roman building material and finds. This suggests that many of them may relate to Roman settlement and/or land use, and that they are contemporary with other previously recorded Roman settlement and field systems at Fenhouse Farm, just outside the western limit of the project area (SHER BRD 007, BRD 008).

In contrast to this extensive evidence of the intensive use of the Little Ouse Valley to the west of Brandon, there is very little comparable evidence to the east of the town, and, indeed, throughout much of the project area. As for sites of Iron Age date, there is non-aerial evidence of Roman activity at sites such as High Lodge (SHER STN 008, possibly STN 009), Two Mile Bottom (NHER 5730 and 5738), and Lynford (NHER 5659), but this could not be associated with any certainty with features visible on the aerial photographs and lidar imagery. Those features that were mapped in these areas were generally thought to be of later date.

An exception was the excavations along the A11 improvements at Elveden. Here the aerial photographs clearly revealed evidence of broad bank-like features, predominantly showing as soilmarks, that appear to run alongside some of the excavated Roman boundaries and trackways. The banks appear to perhaps be located on top of and/or immediately adjacent to the excavated boundary ditches. Although no definite evidence of accompanying banks or hedge lines was identified by the excavations, it was surmised that due to the fragile, dry and sandy nature of the Breckland soils, which are particularly susceptible to wind erosion, a hedge line would have been required, to reduce the rate at which the ditches were infilled with windblown material once the land was cleared for agriculture (Lees 2013, 99). The presence of these hedgerows was also inferred from the fact that some boundaries continued to be respected by later features long after the boundary ditches had filled with sediment. It is likely that the features visible as soilmarks on the aerial photographs represent the remains of these hedgerows.

A broad, sub-rectangular ditch, identified as a low earthwork at Weeting (NHER 62086), could potentially be of Roman date. It is poorly defined, and may be of natural origin, or related to drainage, as it lies less than 250m to the northwest of the Little Ouse. However, it could instead represent part of a broadly rectilinear enclosure, its southeastern side truncated by the Thetford-Brandon railway line, and perhaps by the changing course of the river. Its location, plan and substantial ditch could indicate the site of a Roman camp, or a settlement site. However, there is no other evidence, as yet, to confirm this, and the significance and nature of the site are still uncertain.

Anglo-Saxon

Although the project recorded archaeological features at sites with known Saxon settlement – for example the middle Anglo-Saxon site at Chequer Meadow, Brandon (SHER BRD 018, discussed below) – in most cases it was hard to distinguish this phase of occupation from earlier and later activity. Sites of this period are typically difficult to identify from aerial sources, in the absence of features with readily identifiable characteristics, such as sunken featured buildings.

Amongst the many boundary banks recorded by the project, at least one is thought to date to the Anglo-Saxon period. The Fossditch (NHER 1089) is a substantial linear earthwork that runs for approximately 10km between the River Wissey and the Little Ouse. It is thought to be an early Anglo-Saxon territorial boundary; excavation of a section close to its southern end, where it overlaps with the Hockwold Roman settlement (described above), indicated a post-Roman date for this segment of the boundary at least (Wade-Martins 2016, 331). The project has mapped its course across the western reaches of the

project area, from the Little Ouse at Brandon as far as the Hockwold/Feltwell parish boundary.

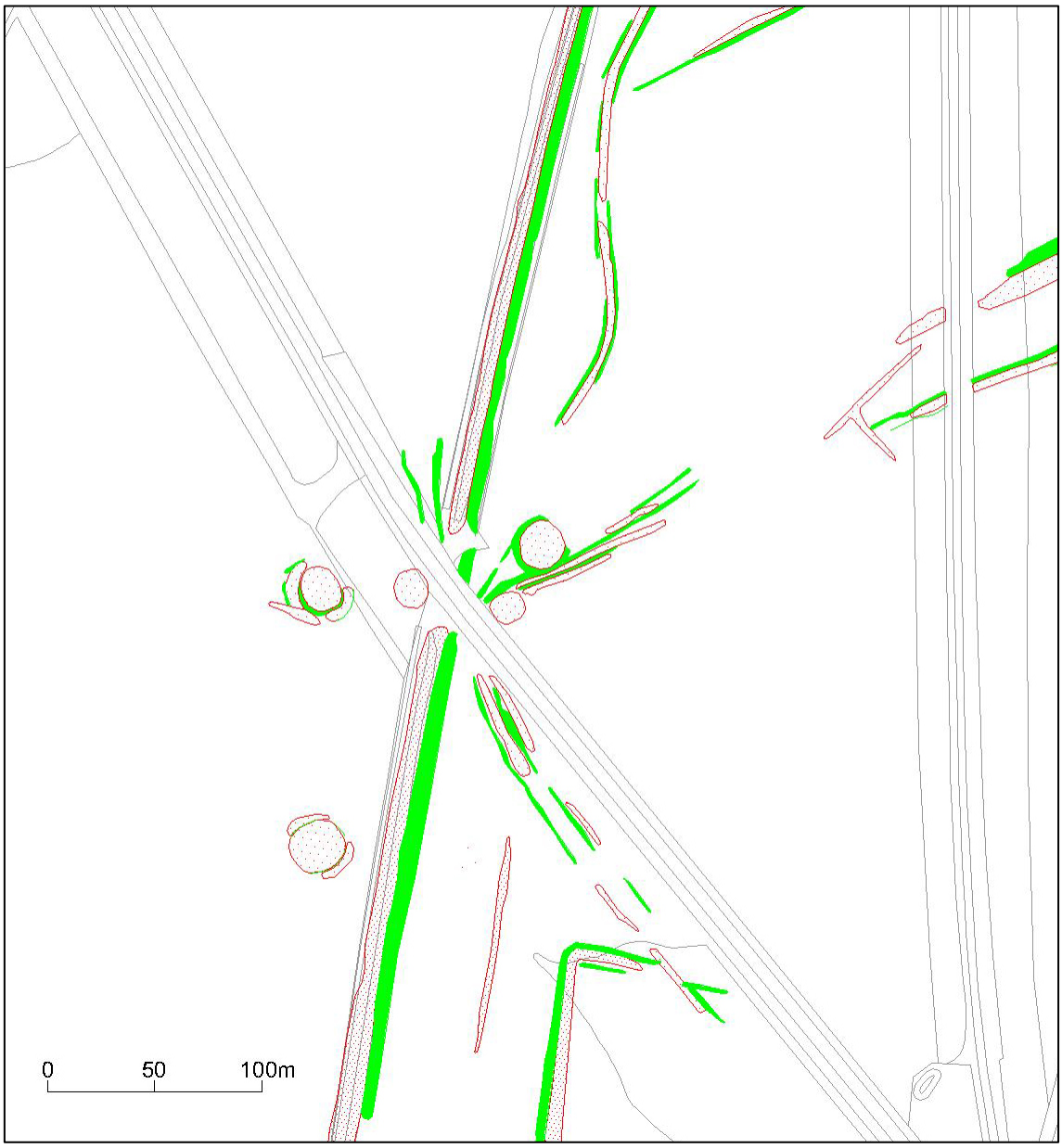


Figure 10 Detail of the Fossditch (NHER 1089), where it bisects a round barrow cemetery (NHER 61515); banks and mounds shown in red, ditches in green. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

Along the Weeting and Hockwold parish boundary, the line of the Fossditch bisects an extant Bronze Age round barrow cemetery (NHER 61515; Fig 10). The appropriation of prehistoric barrows by Saxon communities is a well-documented phenomenon. It may be that the relationship drawn between the barrows and this presumed territorial boundary added to the legitimacy of the

claim to this landscape. Two newly identified mounds (NHER 61513–4) within this barrow group are noticeably smaller in size (measuring 14–18m across), and are located either side of the linear earthwork. It is feasible that these are also Saxon in date. However, it is also possible that they are later spoil heaps associated with the cutting of the B1106 road through the Fossditch during the post-medieval period.

The most significant site of Anglo-Saxon date excavated within the project area is arguably the high status middle Anglo-Saxon settlement, spanning the mid-7th to the late 9th century, at Staunch/Chequer Meadow, Brandon (SHER BRD 018). The site is partially designated (NHLE 1005971) and was excavated between 1980 and 1988 (Tester *et al* 2014). It occupies a slight island of windblown sand, located within the floodplain of the Little Ouse. The excavations and subsequent geophysical surveys revealed a dense concentration of middle Anglo-Saxon timber buildings, settlement and industrial remains, two churches and two cemeteries. During the medieval period the island was enclosed and a religious building and/or chapel was established, accessed by a causeway. Of potential significance for the interpretation of other areas of undated, but possibly Roman and later earthworks on the floodplain of the Little Ouse (for example SHER BRD 257, BRD 260; NHER 5587, 62016, 62022) was the discovery of extensive industrial activity and structures, including some relating to the manufacture and preparation of cloth, taking place alongside the waterfront of the settlement.

The aerial photographs allowed the main components of the Middle Anglo-Saxon settlement and later medieval enclosure and causeway to be recorded by the survey (Fig 11). The aerial photographs from the 1940s reveal faint surface traces of the plan of some of the buildings subsequently recorded by excavation, including the Middle Saxon church, but also indicated additional structures and areas of activity. Other areas of structures, in particular within the northern parts of the enclosures, were visible as building platforms and/or areas of raised ground or accumulated material.

The mapping also enables the wider extent of the settlement, compared to the excavated component, to be better understood. In particular, the mapping points to a substantial area of enclosures and buildings existing to the east and north of the excavations and geophysical survey areas. Within the wider landscape, a swathe of former settlement and fields is visible to the west of the site, much of which is likely to be medieval in date. However, finds from the area also suggest settlement and buildings dating to the Roman period. This could mean that some of the features are likely to be pre-medieval, which is interesting given the lack of excavated Roman features on the adjacent Staunch Meadow site.

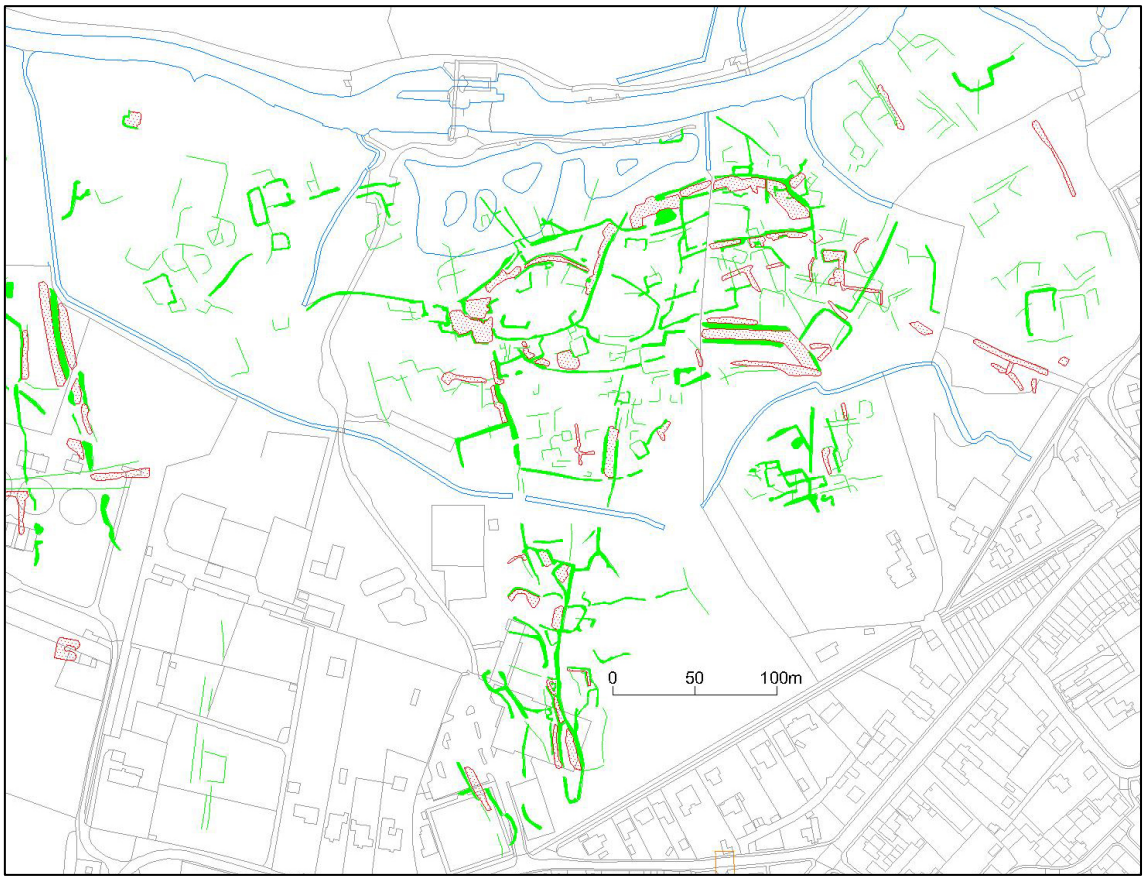


Figure 11 Archaeological mapping in the environs of Staunch/Chequer Meadow, Brandon (SHER BRD 267); banks, platforms and mounds shown in red, ditches, pits and hollows in green. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

Features of early Anglo-Saxon date, including ditches, pits and a possible sunken featured building, were identified during excavations at Two Mile Bottom, Thetford (NHER 5738; Bates 2003). Ditches visible in this area on 1940s aerial photographs, which may extend for some distance northwestwards along the river valley (NHER 54503), may be the same features as those encountered during the excavation. The imagery derived from the lidar survey indicates that some of these ditches may still survive as earthworks.

Amongst the many known and possible round barrows mapped by the project, it is possible that some are of Anglo-Saxon origin, or are Bronze Age barrows re-used during this period. Little in the way of indisputable evidence of either scenario was identified during the survey, but a more in depth and focussed review of the evidence for such practices (for example, of metalwork dating to this period recovered from the area) might allow potential candidates to be put forward. There is some indirect evidence, including the relationship between the Fossditch and the barrow cemetery (NHER 61515) described above. A newly recorded mound, which potentially represents the remains of a round barrow,

within woodland to the west of the Fossditch at Hockwold (NHER 62017), is located in close proximity to finds suggesting the location of a possible early Anglo-Saxon cemetery (NHER 19576). This could suggest a Saxon date for the mound or the appropriation of an existing – possibly Bronze Age – mound during that period. Another group of smaller mounds, identified on the lidar within a plantation belt in Brandon (SHER BRD 276), were located close to Saxon material (SHER BRD 146); however the mounds were felt to be of uncertain archaeological date and significance.

Also of note is the Grimshoe mound at Grimes Graves (NHER 5640). This rather irregularly shaped mound had been identified as a possible Bronze Age round barrow. There is, however, little evidence to support this, and limited excavated suggests that its upper portion at least was seemingly constructed of mining debris and spoil, and covered a knapping floor and unurned cremation (Healy *et al* 2014, 2). It was named Grims Howe by the Anglo-Saxons (Grim's, or Woden's, burial mound; http://www.pastscape.org.uk/hob.aspx?hob_id=1076402). By the medieval period it is recorded as the meeting place of the Grimshoe Hundred. It was presumably a prominent feature in the Late Anglo-Saxon and medieval periods, and may have been specially constructed or enhanced to act as a focal point. There is, however, little evidence of its significance in the mapping produced by the survey. There is no obvious relationship between the mound and the boundaries (such as warren banks) mapped in the vicinity of Grimes Graves; this is perhaps because the boundaries visible on the aerial sources are probably of relatively late, post medieval, date, by which time the significance of the mound had presumably waned.

Medieval

Medieval sites mapped by the project relate to settlement, rabbit warrens, trackways and boundaries and, possibly, agriculture. For the latter categories of site, it has rarely been possible to distinguish medieval activity from post-medieval. At many sites, the weight of evidence suggests a later date is most likely. Features relating to cultivation and land division, therefore, are discussed below, with the evidence for post-medieval sites. The medieval to modern rabbit warrens, which are one of the most distinctive and dominant elements of the mapping, are discussed separately below, in their own 'Research Theme' chapter. The settlement evidence, which is easier to characterise as medieval, is discussed here, and ranges from high status sites such as Weeting Castle (NHER 5626) and Santon moated site (NHER 5688), to deserted medieval villages, at Santon (NHER 5688) and Otterynghythe (NHER 32589), for example.

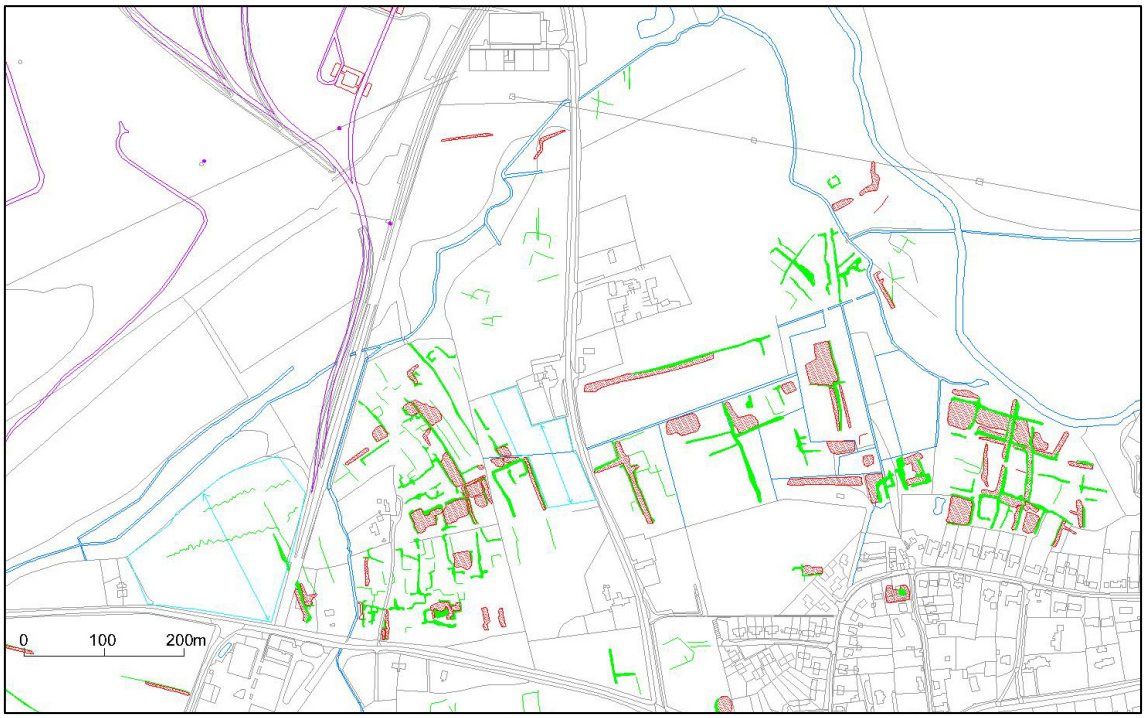


Figure 12 The probable medieval settlement earthworks identified at Barnham (BNH 114); banks, platforms and mounds shown in red, ditches in green, structures relating to RAF Barnham in purple. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

In terms of newly-identified sites, an extensive area of medieval settlement to the north of Barnham was recorded from the aerial photographs (SHER BNH 114). The evidence suggests that that the village of Barnham contracted in size considerably in the later medieval and post-medieval period. These newly identified earthworks – which are still extant – appear to be associated with a nearby moated site (SHER BNH 022; outside the project area). The identification of such an extensive area of probable medieval settlement earthworks, at least some of which survive, is of considerable importance. It also continues the pattern of identifying medieval settlement remains along the Breckland river valleys, noted in the previous survey of Thetford and its environs (Bales *et al* 2011, 48–51).

Another newly identified area of probable medieval settlement earthworks (NHER 61993; Fig 13), with a similar river valley location, was recorded to the southeast of Broomhill Priory (NHER 5627). The possible location of 'Otterynghythe' deserted medieval settlement and a possible church (NHER 32589) are recorded as having been located on the eastern margins of this area of earthworks. Medieval finds have also been recorded at the site, but no earthworks previously noted. However it must also be noted that Iron Age, Roman and Saxon finds have been found in the vicinity of this site (NHER 5618, 32589, 5642, 5651), and prehistoric and Roman finds have been recovered from

the adjacent Broomhill Ballast Pit (NHER 61098). While a medieval date for these earthworks still seems most likely, given the previously identified location of medieval settlement at this site, a Roman date for some or all of the features cannot be ruled out. Roman settlement in the general area has already been suggested (NHER 35352). The enclosures and tracks are broadly comparable with those mapped at the nearby Hockwold Roman settlement (NHER 5587). This site and the earthworks would benefit considerably from further investigation on the ground.

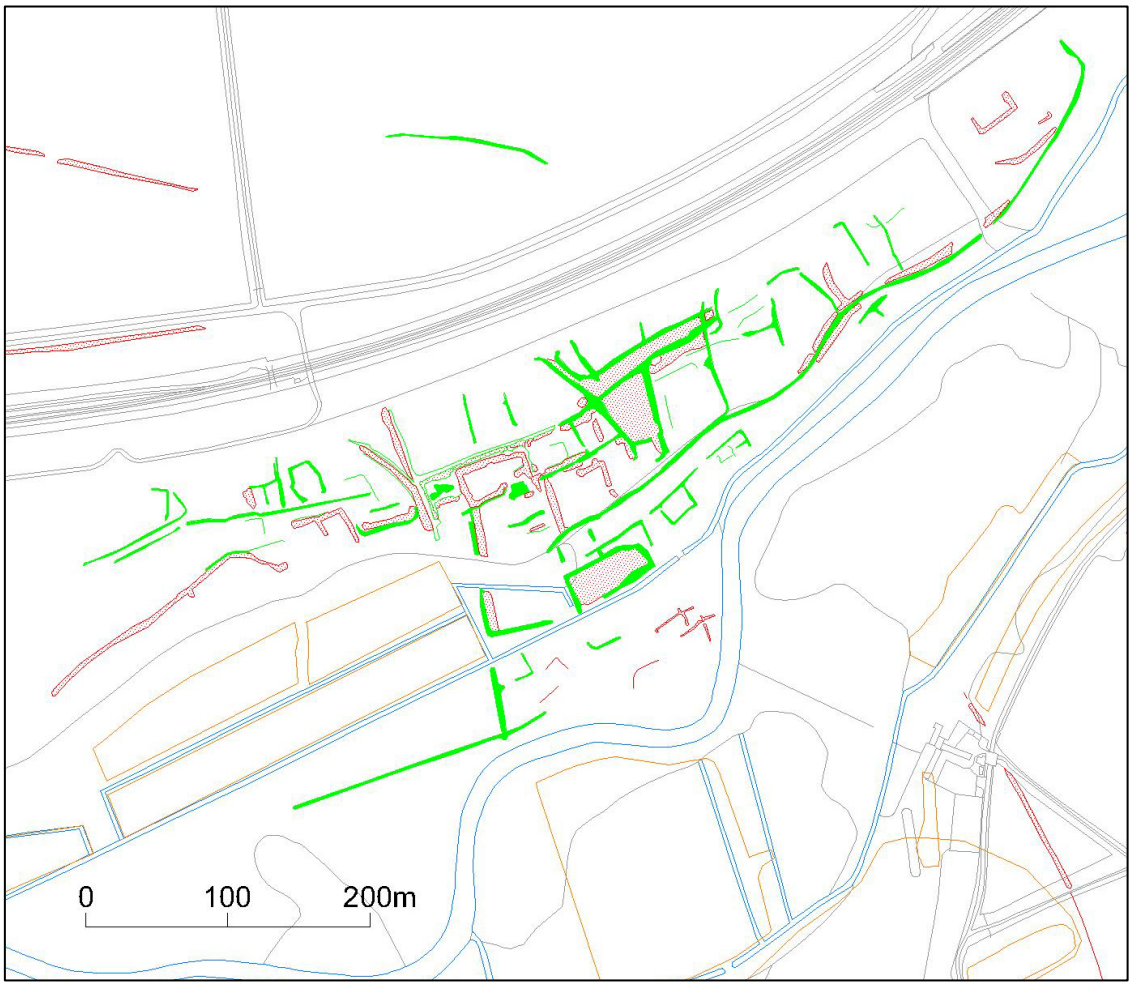


Figure 13 The probable medieval settlement earthworks identified at Weeting (NHER 61993); banks, platforms and mounds shown in red, ditches in green. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

Another significant area of probably medieval settlement (SHER ELV 099) was newly identified as earthworks and vegetation marks within the grounds of Elveden Hall (SHER ELV 009). At this site, it must be borne in mind that the features may relate to structures and formal gardens associated with previous layouts of the park. The main part of the site consists of a group of possible

former structures, building platforms, and embankments, with narrow strip fields and/or land divisions to the north (Fig 14). A curving trackway running to the northwest is depicted on the draft Ordnance Survey map 1816–1820 (Edwards 2009) and may relate to an earlier layout of the park, rather than pre-dating it. It is worth noting that the earthworks – other than those to the south of the church – are located to the east of the area previously defined as the historic settlement core of Elveden (SHER ELV 080) based on historic maps, and Late Saxon and medieval finds distributions. Another area of earthwork enclosures was identified within the western part of the park (SHER ELV 095), which may be contemporary.

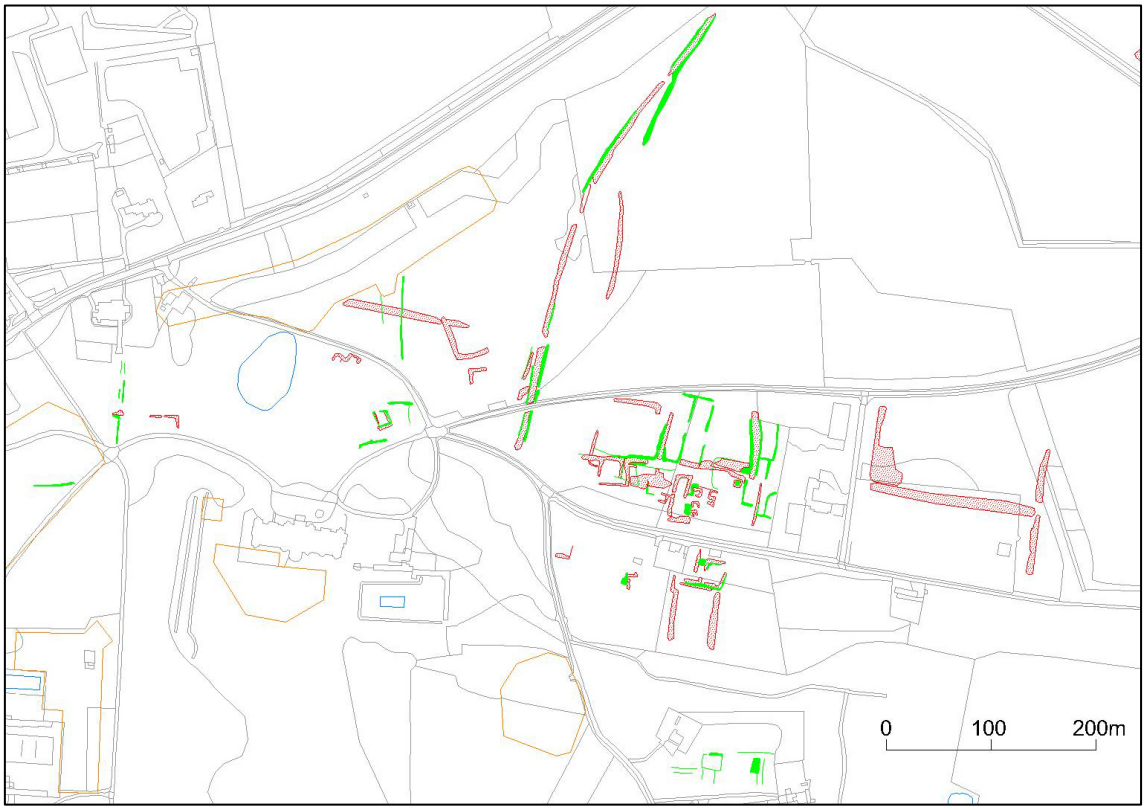


Figure 14 Features relating to probable medieval settlement (SHER ELV 099) within the grounds of Elveden Hall; banks, platforms and mounds shown in red, ditches in green. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

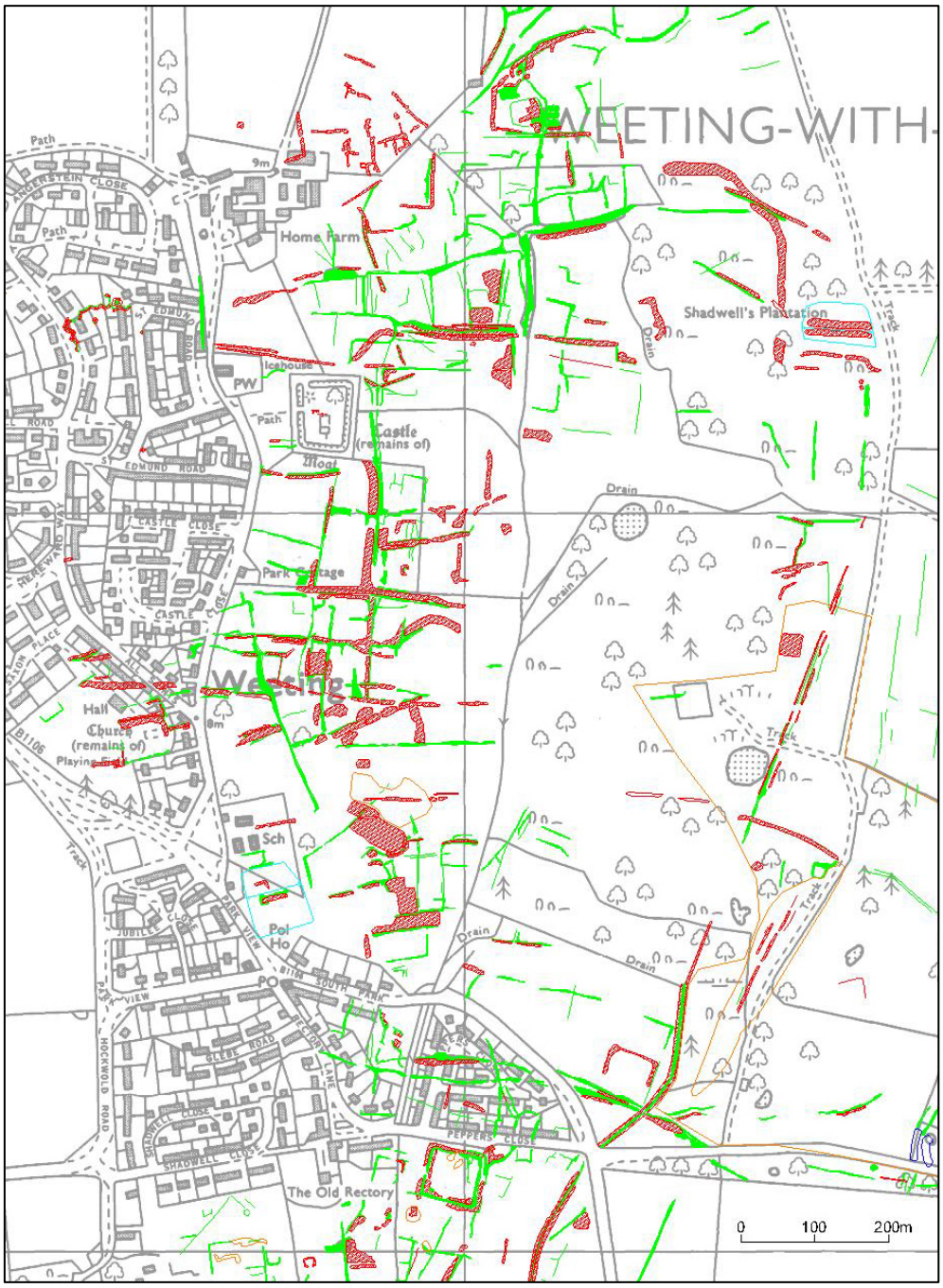


Figure 15 Extract of the mapping for the area to the east of Weeting village; banks and mounds shown in red, ditches and pits in green. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

To the east of Weeting village, an extensive spread of earthworks and soilmarks was recorded (NHER 5633). In their midst is Weeting Castle (NHER 5626), a medieval manorial site surrounded by a moat. Around this lies a complex system of hollows and boundaries, some of which may have had a drainage function, while others defined enclosures and platforms, including probable building platforms. At the northern end of the site is a group of oblong fish

ponds. Beyond the southern end of the site is a large, broad-ditched enclosure (NHER 29701), assumed to be another medieval moated site. While several of the major features within the complex had been identified previously, the survey has been able to create a more detailed and comprehensive plan of the features, allowing the inter-relationships between different features to be seen with greater clarity. However, as with the largely Roman sites at Hockwold and Weeting, the dating of these features is potentially complicated. Although the majority of those identified on the aerial sources are likely to be medieval in date, some could date to the Roman period or relate to even earlier activity in the area, while others could date to the post-medieval period, when the area was enclosed as a park.

Santon moat and deserted medieval village (NHER 5688) were also recorded previously, and have been the subject of a ground survey (Cushion 1995). The moat still survives as a substantial earthwork, and traces of possible internal features, including a possible building platform, were noted by the earlier survey and identified from the aerial photographs and lidar imagery. Evidence for the surrounding village, however, is slight; the survey recorded only a series of parallel banks, which perhaps post-date the settlement. In the adjacent field to the west, however, a group of bank-defined boundaries and enclosures was mapped from earthworks and, subsequently, soilmarks visible on 1940s and 1950s aerial photographs (NHER 62113). These could represent an extension of the medieval settlement at Santon, and surface finds from the area, which included a scatter of late Anglo-Saxon Thetford-type ware, medieval pottery and tile (NHER 31637), would support this interpretation. However, a gravel pit is shown in this field on the Ordnance Survey 1st edition 6 inch map, and it is possible that the features are of more recent origin, associated with gravel extraction, or even more recent agricultural or 20th century military activity. Further investigation of this site would be of benefit.

Figure 16 The site of Santon deserted medieval village (NHER 5688), in 1955. The moat, which still survives as an earthwork, is visible towards the bottom right corner. Newly identified soilmarks (NHER 62113), possibly relating to part of the medieval settlement, are visible towards the top left. Photograph RAF/82/1204 F22 0054 02-JUN-1955 Historic England Archive (RAF Photography).

A little over 1km to the east along the Little Ouse valley lies the site of St Helen's Church or Oratory, Santon (NHER 5684). The remains of the church, and its associated earthworks, date to at least the early 12th century; the church, which contains reused Roman material, may be earlier, and a 10th or 11th century grave marker has been found nearby. Excavations took place at the site in the 1920s and 1960s, and it is designated as a Scheduled Monument (NHLE 1015257). As visible on the aerial photographs and lidar imagery, the earthworks are rather confused, and difficult to correlate with the descriptions of them in the written records. As mapped they comprise an irregular, sub-rectangular mound measuring approximately 60m by 20m, with a pair of ditches to its north. The ditches lie within a larger network of broadly east-west oriented braided trackways and boundaries (recorded as part of NHER 62066). Further correlation of the archaeological mapping and the aerial sources with existing records for this site – beyond what was achievable within the scope and timescale the survey – would be of benefit. This would facilitate a better understanding – and an improved record – of the surviving earthworks, and how these relate to written accounts and the earlier excavations. Geophysical survey might also be of benefit, to better establish the location of buried masonry or other features. The associated site of St Helen's Well (NHER 5685),

a spring and pool lying 70m to the east, is included within the designated area, but no new information about this site was recorded from the aerial sources.

Figure 17 Earthworks at the site of St Helen's Church, Santon (NHER 5684), in 1946. Note to the north (top of photo) the continuation of a bank and the 'patterned ground' typical of the Brecks. The oval area of trees to the east (right) of the site obscures St Helen's Well (NHER 5685); the Little Ouse is visible to the south. Photograph RAF/3G/TUD/UK/59 V 5149 05-FEB-1946 Historic England Archive (RAF Photography).

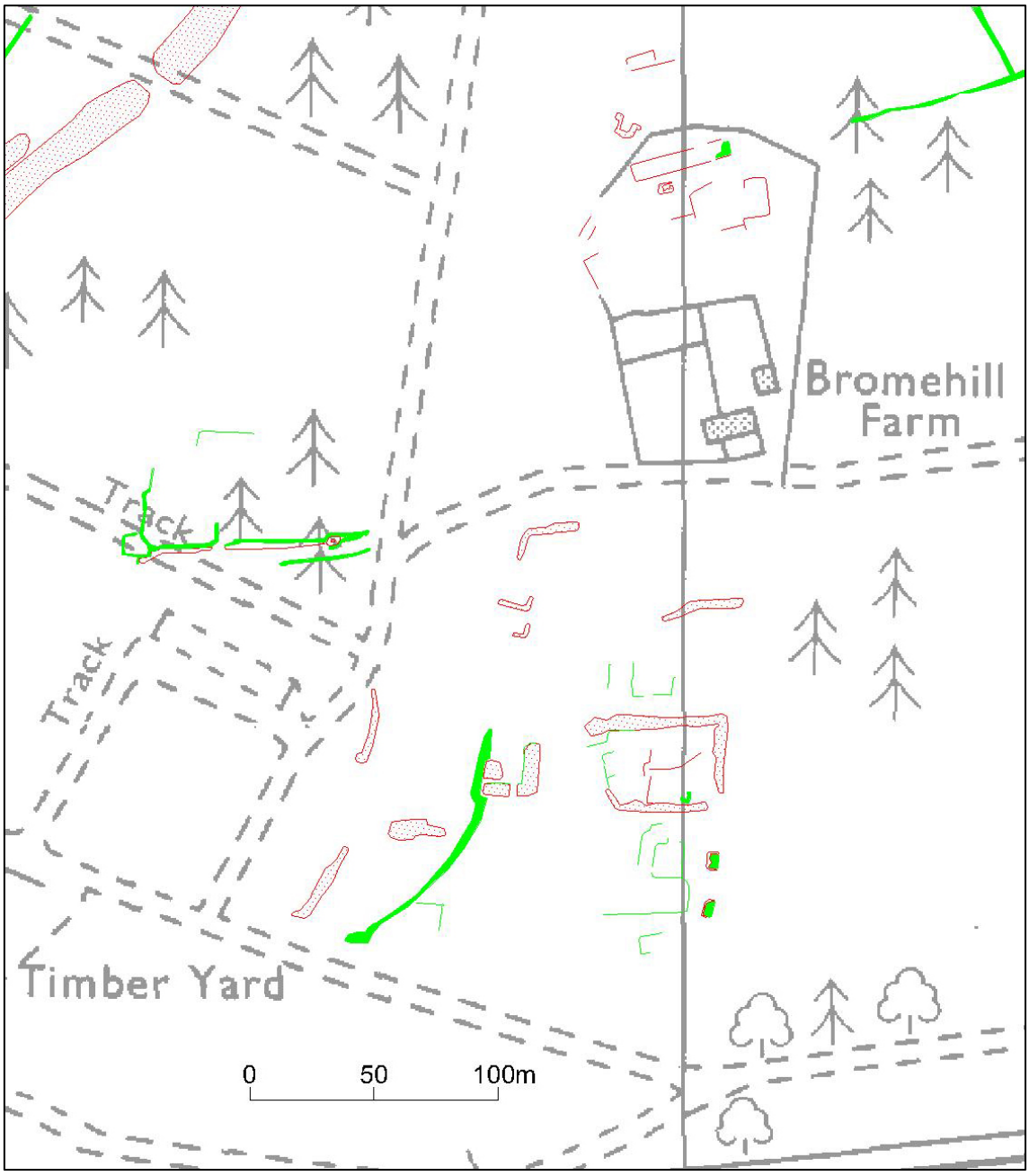


Figure 18 Earthworks mapped at the site of Bromehill Priory (NHER 61992); some may be associated with Broomhill/Weeting Warren. Banks, mounds and platforms shown in red, ditches in green. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

The site of Broomhill (or Bromehill) Augustinian Priory (NHER 5627) is known to have been located on the western edge of Broomhill parish. The Priory, which is thought to have been built around 1220 by Sir Hugh De Plaiz, the Lord of Weeting Manor, and largely demolished in the 16th century, has no structural remains recorded as surviving at the site, which is now the site of Bromehill Farm. However an area of earthworks of probable medieval to post-medieval

date are visible on historical aerial photographs within the area of this site (NHER 61992; Fig 18). The southern part of the site consists of a series of rectangular banked enclosures and bank and ditch boundaries. It seems likely that at least some of these enclosures and boundaries relate to the monastic site. However the Broomhill/Weeting rabbit warren (NHER 54063), which was owned by the Priory, may also have extended into this area and it is therefore feasible that some of these earthworks relate to the warren. It is also possible that the embanked enclosures relate to the former site of the warren lodge. It has previously been suggested that the warren lodge may have been at the Priory site (see NHER 31601), despite map evidence suggesting it was located elsewhere; it is of course possible that there was more than one lodge and/or lodge site. A substantial bank (NHER 55578 and 61991), marking the former edge of Weeting and Broomhill parishes, and perhaps defining the western edge of Broomhill warren (NHER 54063), could also have formed a monastic boundary for Broomhill Priory (NHER 5627).

Post-Medieval

As described above, in many cases it has been difficult to distinguish sites of medieval date from those dating to the post-medieval period. Many of the sites described below, could feasibly have origins in the medieval period, or represent a continuation of land-use – or, where relevant, land division – from the medieval period. Similarly, several of the sites described below may have continued in use into the 20th century.

The medieval to modern rabbit warrens, which are one of the most distinctive and dominant elements of the mapping, are discussed separately below, in their own 'Research Theme' chapter.

Ridging

Contrary to expectations, the project has encountered extensive evidence of the division, enclosure and, possibly, cultivation of the Breckland heaths and warrens. This most probably took place in the post-medieval period. At various locations, but first noted on former West Tofts Heath (NHER 61521), blocks of narrow, parallel ridges, reminiscent of ridge and furrow have been identified. At this site, and some others, there is a clear relationship with the earthworks of tracks and boundaries which are post-medieval in character, but appear to have been removed prior to the surveying of the Ordnance Survey 1st edition 6 inch map (published 1880s), and in some cases the Tithe Map (*circa* 1840s).

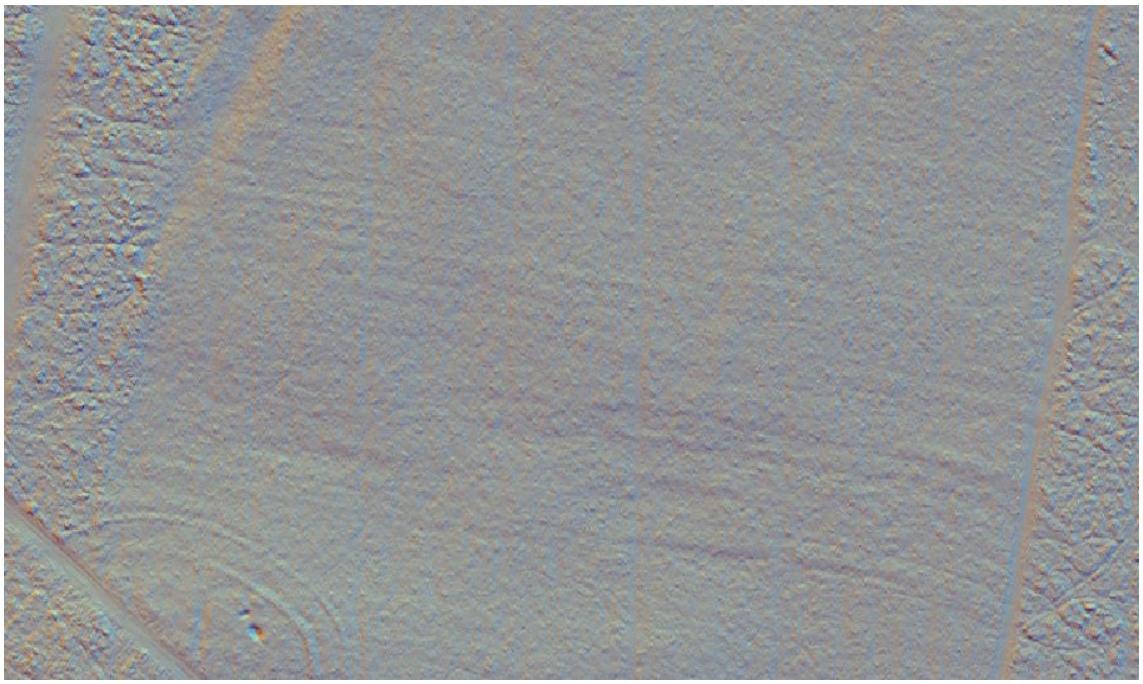


Figure 19 Possible cultivation ridges, for agriculture or plantations, visible on lidar imagery of Santon Downham (SHER STN 121). The double-banked curvilinear enclosure partially visible in the bottom left-hand corner of the image relates to a plantation depicted on historical Ordnance Survey maps. Two undated boundary banks (part of SHER STN 185) can be seen underlying the ridges. Lidar © Crown Copyright. Forest Research. Based upon BNG LPS Project, FC England and Fugro Geospatial Data. Supported by the Heritage Lottery Fund. Visualisation created by Historic England.

Some parts of the warrens may have been used for arable agriculture on a temporary basis, alongside their primary purpose of breeding and raising rabbits (Williamson 2006b, 48—9). It is also plausible that – in some cases at least – the features mapped by the project reflect an expansion of agriculture onto Breckland's heaths, most probably during the 17th to 19th centuries, as part of the drive towards 'Improvement'. The ridges may be remains of low ridge and furrow, of the kind created by 'stetch' ploughing, thought to have once been extensive in the East Anglian landscape (Martin and Satchell 2008, 30–33). Arthur Young, in his *General View of the Agriculture of Suffolk*, published in 1813, wrote about Downham that 'the whole some years ago was warren but now a large quantity is under the plough'. More generally he stated that 'within the last twenty years, great tracts of them [the warrens] have been ploughed up and converted to the much better use of yielding corn, mutton and wool' (information from Anne Mason, Friends of Thetford Forest). Any expansion of arable farming appears to have been relatively short-lived. This was probably due to the difficulty of farming such poor soils, combined with the onset of the agricultural depression in the 1880s. The boundaries, trackways and ridges have

survived as earthworks, first as areas reverted back to heath, and then below the plantations that took its place.

Another possibility is that some of these blocks of ridges were created for the cultivation of fodder crops for rabbits. During the post-medieval period, stocking levels on the warrens were increased, and it was therefore necessary to provide extra food for the greater number of rabbits. Ridges identified within large, rectangular enclosures at Lakenheath Warren have been interpreted as resulting from the cultivation of fodder crops (Williamson 2006b, 49, fig. 32).

A third alternative is that some of the ridges were created by the land being ploughed to break it up and/or create ridges to aid the establishment of plantations. This practice certainly took place, although it is unclear how widespread it was. In October 1778, John Andrews wrote to Thomas de Grey that '…the plowing foer planting began at the Right of the Thetford Road with two plows the first with a pair of horses and My Masters Grate Plow with Four Horses following in the same Furrow' (Norfolk Record Office WLS XXIX/1/20 416x4; information from Dr Jon Gregory, University of East Anglia). Again, this practice is likely to have taken place in the later post-medieval period, once attempts at arable cultivation of the Brecks had been abandoned, and the Breckland landscape was deemed suitable for little other than rabbits and pine plantations. Tree-planting was also popular as a means of alleviating sand-blows (Breckland Society 2010, 51). In Downham High Warren, it is likely that many of the areas of ridge and furrow, and some of the enclosures, were created for the purposes of planting trees. In the late 18th century, the estate was purchased by Charles Sloane Cadogan, Surveyor of the King's Gardens, who began to establish plantations on the warren. These were destroyed in the First World War, when the Board of Timber Supply requisitioned the trees (Breckland Society 2010, 19).

Water Meadows

Another aspect of the post-medieval 'Improvement' of the landscape which has been particularly evident, are the traces of what appear to be floated water meadows along the Little Ouse. Breckland was already notable for possessing well-preserved water meadows at Lynford and Stanford (Sussams 1996, 110–113, fig. 29), but most of the sites encountered by the project are new discoveries; albeit ones that in some cases have been made simultaneously by Professor Tom Williamson of University of East Anglia, who has also been undertaking research into this aspect of the Brecks landscape.

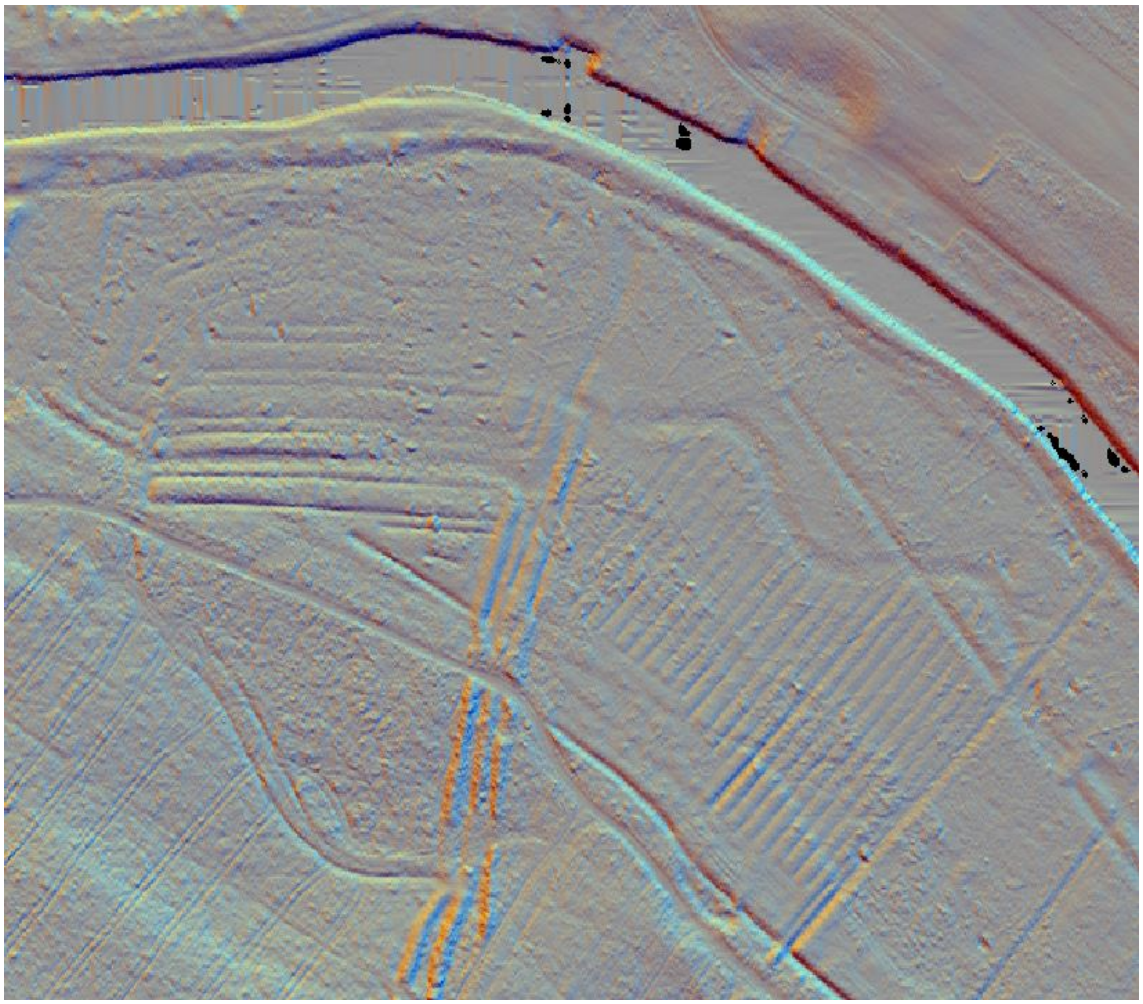


Figure 20 Lidar imagery of earthworks possibly relating to post-medieval water meadows or to osier beds, on the county boundary between the parishes of Santon Downham and Thetford (SHER STN 116, NHER 61566). Lidar © Crown Copyright. Forest Research. Based upon BNG LPS Project, FC England and Fugro Geospatial Data. Supported by the Heritage Lottery Fund. Visualisation created by Historic England.

Several of the possible water meadows identified by the project (and by Professor Tom Williamson, pers comm) don't conform to the conventional herringbone plan usually thought to be typical of water meadows. Some have a more rectilinear arrangement, others have channels spaced more widely or more narrowly than might be expected. It is possible that at least some of these sites are in fact osier beds, rather than water meadows. Information from Anne Mason, Friends of Thetford Forest, indicates that in the 19th century consideration was given to converting 6 acres at Thetford Warren into an osier bed. It is not known whether this conversion took place, but it is possible that the rather unusual layout of some of the supposed water meadows mapped along the Little Ouse are osier beds instead. It includes two blocks mapped at

the northern end of Thetford Warren, either side of the county boundary (NHER 61566, SHER STN 116; Fig 20).

There seems to have been a particular concentration of water meadows around the former site of Santon Downham Hall (NHER 62011 and SHER STN 122, for example), perhaps in order for the owners of the hall to show off their 'improvements' to visitors and guests. Another area of possible floated water meadows has been tentatively identified on Hunwell Lows (SHER BNH 115), associated with Hunwell Spring and a former tributary of the Little Ouse to the east of Brandon (shown on Hodkinson's map of 1783). The site is located to the immediate southeast of Elveden Hall and Park and these are potentially the result of land 'Improvement' associated with the Elveden Estate.

Flint Mining

Although best known for the Neolithic flint mines of Grimes Graves, it is probable that the rich flint resources of the Brecks were exploited from the Palaeolithic through to the 20th century; the significance of flint as a building material in the medieval and post medieval period, for example, is clearly evident in the area's surviving buildings. During the post-medieval period Brandon, on the western edge of the project area, became an important centre for the production of gun flints. The remains of post-medieval flint mines thought to be associated with the gun-flint industry have been recorded at several locations around the town, most notably at Ling Heath (Sussams 1996, 119–128; The Breckland Society 2016a, 20–24). The lidar in particular was invaluable in enabling the project to better locate these sites and define their extent, as well as offering an opportunity to identify possible evidence of flint mining at new sites.

The earthworks typically associated with Breckland's post-medieval gun flint mines tend to be circular pits or shafts, surrounded by a 'horseshoe' of spoil (Sussams 1996, fig 35). However, while such features can be identified on the aerial sources at most sites, it is apparent that many also possessed areas of gullies or ridges, which in some cases are now more extensive than the 'classic' pits (at Bromehill, NHER 31296, for example). On close inspection, the gullies appear to be formed of linked chains of pits, an impression reinforced by the appearance of some of these earthworks when inspected during a site visit. While gullies or ridges had been noted previously at some of the sites, the work done by the project has drawn attention to their number and extent. It has highlighted a need for them to be recognised as a distinct type of flint-mining feature in their own right, not simply an adjunct to the better known pits and horseshoe-shaped spoil heaps.

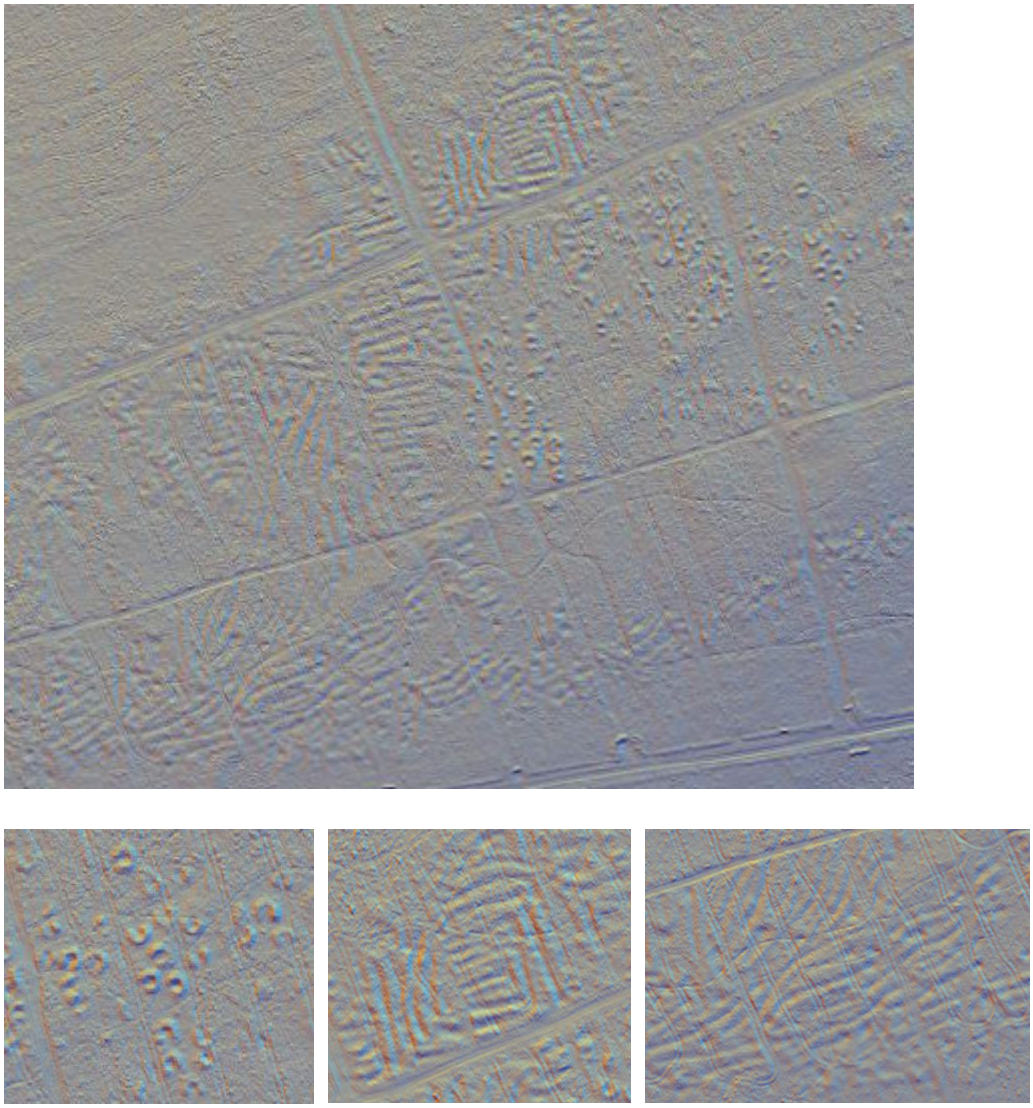


Figure 21 Lidar imagery of part of the complex of post-medieval flint mines at Bromehill (NHER 31296). The smaller extracts show (from left to right) horseshoe-shaped spoil heaps surrounding mining shafts or pits, and varying arrangements of linear gullies. The earthwork of an earlier bank is clearly visible below the mining remains. Lidar © Crown Copyright. Forest Research. Based upon BNG LPS Project, FC England and Fugro Geospatial Data. Supported by the Heritage Lottery Fund. Visualisation created by Historic England.

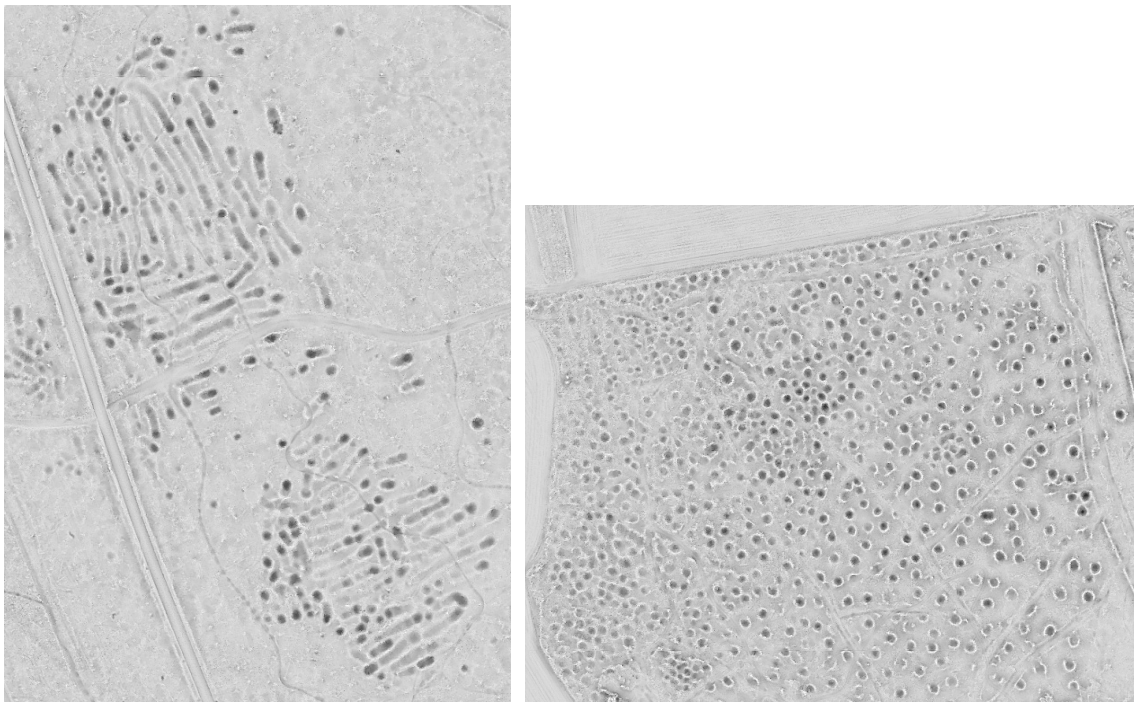


Figure 22 'Positive openness' lidar imagery of gully-type flint extraction features at Mount Plantation, Brandon (left; SHER BRD 136), and the more typical (or better known) circular pits with surrounding spoil heap at Ling Heath, Brandon (right; SHER BRD 066). The segmented appearance of the gullies indicates that they may have been dug as a line of conjoined pits. Lidar © Crown Copyright. Forest Research. Based upon BNG LPS Project, FC England and Fugro Geospatial Data. Supported by the Heritage Lottery Fund. Visualisation created by Historic England.

The origin and function of the linear features is still uncertain; they perhaps reflect an alternative method of extracting flint, or a method of prospection. One site where they are particularly dominant (albeit outside of the project area) is Elms Plantation (SHER BRD 067), 2km to the southwest of Ling Heath. Skertchley, who documented Brandon's flint mining industry in the late 19th century, stated that the workings at Elms Plantation preceded the beginning of mining at Ling Heath (which he dated to *circa* 1720). He also speculated that the Elms Plantation workings were perhaps excavated before the gun-flint trade arose (Pearson 1996, 3; Lang *et al* undated). Gun flint waste has been found at the Elms Plantation site (Lang *et al* undated), however the possibility that this is a relatively early site could be an explanation for the form of its earthworks.

Figure 23 Linear gullies, presumed to relate to flint extraction, visible as cropmarks at Ling Heath, Brandon (SHER BRD 066). Photograph TL7985 06-JUL-2013 RGB Aerial Photography – ©Bluesky International/Getmapping PLC.

It is interesting to note that linear features are also visible at Ling Heath (SHER BRD 066), albeit in the form of cropmarks. They are visible in the northwestern part of the site, in an area where relatively few circular shafts are evident, although there is some overlap with the area of 'dense shallow pitting' identified by an earlier field survey (Pearson 1996, fig 3). In broad terms, the survey identified two contrasting forms of earthwork – shallow, closely spaced pits with poorly defined spreads of spoil, and larger, better defined, circular pits with a

clear 'horseshoe' of spoil (Pearson 1996, 16-17). These two 'types' are also evident on the lidar, and their differences may represent further phasing in the chronology of the site, and/or differences in the method of extraction or the material extracted. Amongst the more typical (and more numerous and widespread) larger pits, Pearson also identified linear arrangements, with the pits being arranged in rows. This patterning may reflect greater degrees of organisation and control being exercised over the process of extraction at various times during the lifetime of the site (Pearson 1996, 17). Rows of pits can also be seen on the 1940s aerial photographs of the site. Unfortunately, as stated above, no linear gullies survive as earthworks at the site, and none were identified by the field survey. However, it is possible to speculate that the linear cropmarks seen on the aerial photographs may represent the earliest phase of flint extraction at Ling Heath.

For many of the post-medieval flint mining sites recorded in Breckland, including those recorded by the project, the possibility of an earlier, pre 18th century date, should be considered. Between the exploitation of Grimes Graves in the Neolithic and early Bronze Age, and the height of the gun flint industry at Brandon in the 19th to 20th centuries, it is probable that Breckland's extensive resources of flint were exploited in some way in all periods. In the East of England, there is widespread evidence for the working of flint into the Early Iron Age (Brudenell 2017, 13), while Breckland's surviving medieval and post medieval buildings demonstrate that flint was the most common – and is now the most archetypal – building material in the area (Breckland Society 2016a, 10). There is therefore a gap in knowledge: was Breckland flint exploited during the later prehistoric period, after mining ceased at Grimes Graves, and where and how was it extracted and worked? Similarly, where were the sources of flint used for building stone in the medieval and post medieval periods? Documentary research to better understand Breckland's (presumed) post medieval flint mining sites might help identify those that are 'unusual' or undocumented, and might therefore have a different – potentially earlier – history of use. Small scale excavation at selected sites might also recover material that would help elucidate the dating and character of these sites.

Twentieth Century Military Sites

As with all similar projects undertaken in Norfolk and Suffolk, evidence of 20th century military activity forms a significant component of the mapping. This is in part due to the use of historical aerial photographs, a few taken during the First World War or between the wars, but many thousands taken during or shortly after the end of the Second World War, and then throughout the 20th century. These sources allow modern sites to be mapped while they are in use, or shortly after they have gone out of use, and sometimes as they are being constructed. It is also the case that Breckland was a particular focus for military

sites during the 20th century, in part due to its low population density, large landed estates, and extensive areas of what was perceived to be unproductive land.

Large scale manoeuvres were taking place within Breckland prior to the First World War, after the British Expeditionary Force was established in 1906. Large scale training exercises took place in the Brecks in 1906, 1911 and 1912 (Breckland Society 2016b, 9). It is therefore possible that some of the sites recorded by the survey as being of First or even Second World War date, could instead relate to this earlier phase of military activity. Without further investigation of contemporary records or photographs, it is difficult to differentiate features relating to these early 20th century training exercises from those dating specifically to the First World War or later.

A map showing the location of the 1912 Territorial Manoeuvres indicates that they took place in an area between Thetford, Brandon and Elveden (ibid). A rifle range located on Parsonage Heath in Elveden Warren has previously been recorded as dating to the Second World War (NRHE 1412140). The aerial photographs do indicate that it was in active use in the 1940s, but it is depicted on a 1928 Ordnance Survey map, as noted by the HER record (SHER ELV 041). The rifle range therefore clearly pre-dates the Second World War, and could relate to training activities during the First World War. However, it is also possible that it dates to the earlier British Expeditionary Force manoeuvres, in particular those known to have taken place in this area in 1912. It is feasible that this is also the case for another rifle range located to the southwest of Thetford (NHER 54560, NRHE 1412278), which is visible on aerial photographs and depicted on a 1929 Ordnance Survey map. However this is located in close proximity to a First World War training camp, and therefore is perhaps more likely to date to this period and not the earlier, pre-1914, exercises.

First World War

The Brecks was an important area for the accommodation of troops during the First World War (Breckland Society 2016b, 13), and, as already described, the rifle ranges recorded at both Thetford and Elveden may have been used (if not necessarily constructed) in this period. In 1916 part of the Elveden Estate was requisitioned by the War Office to be the location of a highly secret and nationally important training area (ibid, 19). Officially known as the Elveden Explosives Area and utilised by the Heavy Section, Machine Gun Corps, in reality parts of the estate were used to develop and test new tank technologies, specifically the Mark I tank (ibid, 19—22).

Although much of this activity took place on parts of the Elveden Estate, outside the project area, the estate village and possibly the hall appear to have been used by the military. Located within the northern part of Elveden village is a group of huts (SHER ELV 102) that from the aerial photographic evidence look like they may be part of the Second World War camp located here (SHER ELV 098). However, the Elveden Conservation Character Area report (Edwards 2009) indicates that some of these buildings are clad in green painted corrugated iron, and map evidence suggests they were built before 1925 (ibid). This suggests they may be of First World War date. One of the buildings has timber and weather board additions that are thought to be a Second World War alteration (ibid), indicating that the structures were incorporated into the Second World War military camp.

On the western edge of Thetford, and overlapping the eastern edge of the project area, were a series of First World War training camps (NHER 54560). Barnham Heath, to the southwest of these camps, was also used as a temporary camp and as a training ground during the First World War (SHER BNH 054). The evidence from aerial sources for this site is limited, due to the heath being used more extensively in the Second World War (as a major munitions store), and subsequently during the Cold War as an atomic bomb storage facility. Nevertheless, some information regarding the First World War phase of the site could be identified on the aerial photographs. Barnham Heath may have been associated with another First World War site to the south, at Little Heath (SHER BRD 063), which is thought to have been associated with tank training and development, and which also functioned as a chemical/mustard gas works. There is also a possible reference to workshops at the site being used to fabricate parts for First World War tanks (Breckland society 2016b, 46); although the reference states that the workshops were at Barnham Broom, the context (its location in Breckland, its later use as a nuclear bomb store) suggests that it is in fact Barnham Heath that is being referred to.

An undated, possibly 1920s, Crawford Collection aerial photograph shows the remains of tracks and the former location of temporary structures in the northern part of the site and around Aughton Spinney. Some huts visible in the eastern part of site during the 1940s also appear to be of First World War date. To the northwest of Aughton Spinney, a possible bunker or defensive position (SHER BNH 113) can be seen dug into an earlier, post-medieval bank. Like those at Thetford and Elveden, a small rifle range to the south may also have originated during the First World War, but continued in use during the Second World War. The most significant evidence for activity during the First World War is a large area of practice trenches, identified from faint traces visible on the 1940s and 1950s aerial photographs. These lie largely to the west of Aughton Spinney and a central plantation belt, and to a lesser extent to the east. They form a system of front line, support and communication trenches, with a number of defensive positions. Other First World War trenches may exist within

the rough ground, or the wooded areas but may be obscured by vegetation. Fragments of these trenches only showed on a relatively small number of the aerial photographs due to the differing levels of vegetation cover, and it is likely that they are more extensive than the assessment of the aerial photographs indicates.

Another, more extensive area of First World War trenches was recorded at Brandon (SHER BRD 201), within plantation near Spinks Lodge. A small part of these trenches was identified on the ground during a rapid earthwork identification survey in 2001 (Bales and Pendleton 2001, 25, fig 22). The lidar imagery clearly shows a much more extensive network of these trenches, covering an area measuring approximately 400m by 300m, surviving within the forest plantation (Fig 24).

Figure 24 'Positive openness' lidar imagery of probable First World War practice trenches at Brandon (SHER BRD 201). Lidar © Crown Copyright. Forest Research. Based upon BNG LPS Project, FC England and Fugro Geospatial Data. Supported by the Heritage Lottery Fund. Visualisation created by Historic England.

Second World War

Evidence for Second World War activity within the Stage 1 area was far more plentiful, and (generally) more conclusive than that for the First World War and

pre-1914 periods. Within the town of Brandon itself, there was evidence for roadblocks (SHER BRD 293 and 295) and multiple pillboxes (for example SHER BRD 240, 279, 300—1, 303), located in particular on the approach roads to the town and alongside the railway line. The site of a probable Second World War gun battery is visible on aerial photographs to the east of Brandon (SHER BRD 302). The site appears to have consisted of two or three gun emplacements or similar building platforms, with some associated operational buildings and defences. The 55th Heavy Regiment (using 7.2 inch guns) were at Brandon (www.bbc.co.uk/history/ww2peopleswar) and this may be the battery. However as the structural components cannot be clearly distinguished on the historic aerial photographs – in part due to the semi-demolition of the site – it remains a possibility that it is a searchlight battery and not a gun battery.

Extensive areas of military training were evident on many of the heathland areas. This included areas of pitting on and around the site of Grimes Graves (NHER 61549, 61500, 61524). Several large Second World War military camps were also recorded; two of these – Elveden Hall and Park (SHER ELV 098) and Weeting Hall and Park (NHER 61476) – were on requisitioned estates. Weeting Hall and Park were used extensively both during and after the Second World War, and had multiple functions. A militia camp was established there in 1939, and it became a holding camp for the 1st Battalion of the Rifle Brigade of the 7th Armoured Division in the lead-up to the Normandy landings in 1944. The site was also used as a hospital for wounded Indian and Gurkha soldiers. Post-war the camp was used to house displaced Polish soldiers – from the 1st Medical Company (1st Komp. Sanitarna) and the Polish People's Army (Karp. Polska Armia Ludowa; www.polishresettlementcampsintheuk.co.uk) – and their families from 1949 to 1955 (www.lostheritage.org.uk; Breckland Society 2016b). The site consisted of several groups of large operational buildings and huts, mainly clustered around Weeting Hall itself. The remainder of the buildings were located within parkland to the west of the hall. To the north of the hall lay a Type 22 pillbox, set within an area of slit trenches, weapons pits and emplacements. Other small defensive earthworks were located elsewhere in the park. Another large military camp was identified alongside London Road at Brandon (SHER BRD 270; just outside the project area). After the war, this too was used as a Polish resettlement camp, for the 3 Karp. Baon Saperów. Another Karp. Polska Armia Ludowa camp is listed as existing at Dixon West Camp, Brandon (www.polishresettlementcampsintheuk.co.uk). Other sites documented in the Brandon area, such as an Auxiliary Unit base on the edge of Ling Heath (www.coleshillhouse.com/brandon-auxiliary-unit; ww2.brandonatwar.co.uk) could not be identified on the aerial sources.

There was limited evidence of Second World War activity within Thetford Forest. Most obvious were lines of huts (or the bases and earthworks left after the removal of huts) visible alongside parts of the Little Ouse (NHER 62112), around Santon Downham village (SHER STN 151), and extending along roads

and forest rides between Thetford Warren, High Lodge and Little Lodge Farm, Santon Downham (SHER STN 165/NHER 62121). It is not clear whether these huts were used by military personnel, or by forestry workers. At High Lodge itself (SHER STN 029), there is evidence of activity in the vicinity of the 1920s labour camp, and the buildings appear to have been in use. A group of huts and tents is visible 385m to the south of the camp on aerial photographs taken in June 1945 (SHER STN 157); they had been removed by April 1947. Again, however, at High Lodge as elsewhere, much of the evidence visible on the aerial sources is not overtly military in character, and the function of the site – on this evidence at least – is not entirely clear. Further work to link what is visible on the aerial photographs with information in documentary and oral history sources would be extremely beneficial.

Figure 25 High Lodge labour camp (top right) in June 1945; a group of temporary huts and tents is visible to its south (bottom left). This was the only photograph consulted by the project on which the tents are visible. Photograph RAF/106G/UK/369 RP 3073 08-JUN-1945 Historic England Archive (RAF Photography).

Figure 26 The eastern half of RAF Barnham, as visible on an RAF aerial photograph taken in October 1946. The three Second World War compounds are visible towards the right of the image. Photograph Norfolk County Council RAF/CPE/UK/1801 RS 4288 25-OCT-1946 (NHER TL8580A).

Probably the most significant 20th century military site to be mapped was Barnham Camp (SHER BNH 054), which lies on heathland to the south of Thetford. As discussed above, the site was utilised during the First World War and subsequently during the Cold War (see below). During the Second World War the site was a major munitions store, including for chemical weapons, and a filling station for mustard gas bombs. This latter role was associated with the main Little Heath Forward Filling Depot to the south (SHER BRD 063), which was one of five mustard gas depots established nationally between 1941 and

1944 to provide a stockpile of chemical weapons (www.subbrit.org.uk/little_heath_forward_filling_depot). At Barnham, three main compounds are visible on the photographs, surrounded by blast walls, into which a railway siding approached from the main line to the southeast. Only the westernmost of these compounds survives on the ground to any extent. A further chain of blast walls protected stores alongside another railway track located to the east. In the eastern and northern parts of the site a looped network of access roads led to bomb storage areas. Numerous pillboxes, gun emplacements and other defences protected the site.

Two further Second World War bomb storage facilities were recorded within the Stage 1 area. These were both associated with Lakenheath Airfield (SHER LKH 339; the airfield itself lies outside the western limit of the project area), which was converted into a USAAF Very Heavy Bomber Station in 1944 (Breckland Society 2016b). The two storage areas were located adjacent to one another: one within Warren Wood (SHER ELV 041; the area now occupied by the Centre Parcs Elveden Forest site) and another on Lakenheath Warren (SHER LKH 386). The Warren Wood site is densely forested on most of the aerial photographs, making identification and mapping of individual features problematic. The clearest area of bomb storage at the site is located on the northern edge of the woodland, alongside an access track (Fig 27). The features consist of cleared strips of ground perpendicular to the road. Some appear to have a slot dug into the ground, others have the remains of an elongated structure, possibly a slab or sleeper. It is possible that the incendiary material would have been stacked and stored on wooden platforms or beams, and/or on mobile units – bomb trolleys – to aid the movement of material between the storage area and the airfield. Other HER records for sites within the wood refer to concrete roadways (Rachel Riley, Forest Enterprise, pers comm). A line of possible huts or surface shelters is visible along the southeastern perimeter of the woods. Several structures are also visible along tracks or within breaks in the tree cover, although it is not clear how many are military in origin. However the bases of former huts, potentially Nissen huts or similar structures, may be visible within a cleared area on aerial photographs from 1971, located to the immediate west of the former Warrenwood Cottages/The Kennels buildings. The presence of these structures cannot be confirmed on the 1940s aerial photographs due to tree-cover, but a Second World War date is probable.

The adjacent Lakenheath Warren site (SHER LKH 386) is reminiscent of the Barnham Camp bomb stores. It comprised three access roads or tracks with bomb storage areas at regular intervals alongside them. The storage areas consisted of an elongated cleared area, with a linear bank of spoil to the south; these still survive as earthworks on the heath. As at the Warren Wood site, some appear to have a slot dug into the ground while others have the remains of an elongated structure. A group of five rectangular emplacements were cut into the boundary bank of Lakenheath Warren (SHER LKH 174) and these still survive

as prominent earthworks. Rectangular stacks of material, presumably munitions, can be seen within these emplacements on aerial photographs from 1945.

Figure 27 Second World War bomb storage areas, visible in 1945, located along the northern edge of Warren Wood, Elveden (top of image; SHER ELV 041). Photograph RAF/106G/UK/906 RP 3016 09-SEP-1945 Historic England Archive (RAF Photography).

Cold War

The role of Breckland as a focal area for military activity continued into the Cold War, and, indeed, continues to this day. Lakenheath Airfield, or RAF Lakenheath, which lies a short distance to the west of the project area, is still used by the United States Air Force (it hosts 48th Fighter Wing). Stanford Training Area (STANTA), which lies to the northeast of the project area, remains an important training area for the British Army. RAF Honington, approximately 7km to the south of Thetford, remains an active base, although its satellite, RAF Barnham, is expected to close by 2020.

Within the project area, RAF Barnham (SHER BNH 054) is the most significant Cold War site to have been encountered. As described above, the site had been in military use since at least the First World War. The Special Storage Unit at RAF Barnham was constructed following the issuing of Blue Danube, Britain's first nuclear bomb, to the RAF in November 1953. RAF Barnham, and the almost identical site at RAF Faldingworth in Lincolnshire, were established for the maintenance, refurbishment and storage of warheads (historicengland.org.uk/list-entry/1402411). The substantial atomic bomb storage facilities were constructed to house the Mark 1 Atom Bomb – code-named 'Blue Danube' and later superseded by 'Red Beard' and 'Yellow Sun'. The

main focus of the site consisted of a pentagonal compound containing three large Explosives Storage buildings and four arrays of Fissile Core Storage hutches. There were also bomb inspection and maintenance buildings – including 'Building 58', which was designated in 2011 (NHLE 1402411) – and a series of support buildings and accommodation. The closure of the station was exacerbated by the operational deployment of 'Blue Steel' missiles from late 1962, when the site was already in decline. The Maintenance Unit ceased to exist on 31 July 1963 (ibid).

Figure 28 The atomic bomb storage facility at RAF Barnham (SHER BNH 054/NHLE 1402411). Also visible, to the south of the pentagonal compound, are traces of First World War practice trenches. Photograph RAF/540/1778 F21 0128 16-JAN-1956 Historic England Archive (RAF Photography).

RESEARCH THEME: RABBIT WARRENS

Following the introduction of rabbits to England soon after the Norman Conquest, warrening became a hugely significant part of the Breckland economy (Sussams 1996, 95–96; Breckland Society 2010, 8–9). This continued well into the post-medieval period, and although there was a decline in the 18th and 19th centuries, some of the warrens around Brandon remained in use until the 1950s (Williamson 2006b, 10–11). Rabbits were a valuable commodity, farmed for both their meat and fur, and they needed to be protected from vermin and poachers. They also needed to be enclosed, to prevent them straying and to prevent damage to crops (Williamson 2006b, 45). The Breckland warrens generally lack the pillow mounds (artificial burrows) typical of many warrens elsewhere, but a great many of the extensive boundaries mapped by the project across the Breckland landscape are likely to have been associated with one or other of the many warrens recorded in the area. Considerable work has been done to trace the warren boundaries, and identify their internal features, by earlier projects (for example, Breckland Society 2010). The project reported on here has built upon and enhanced this work by providing detailed mapping of the extensive and sometimes complex systems of boundaries and trackways visible on the lidar and, less frequently, the aerial photographs. However, while an association with one or other of the warrens is likely – or indisputable – for many of the boundary features, other functions for them are also plausible: some are clearly routeways, others follow a parish and/or county boundary, while others may be subdivisions within the warren, made either during its lifetime, or when the land reverted to other uses. Distinguishing these different functions for individual elements of the mapping has, in general, been beyond the scope of this project. Often, it may in any case be a meaningless distinction: for example, the boundaries of warrens and parishes are often concomitant. The multi-purpose nature of some of these boundaries could be one reason that they are often defined by multiple banks or, less frequently, ditches. This could also be a reflection of their long-lived nature, with boundaries perhaps being reinstated on a slightly different line or alignment. Several of the warrens lay adjacent to each other, perhaps resulting in a double boundary, as each warren maintained its own. In some cases, parallel internal banks are thought to have acted as trapping banks (at Downham High Warren, for example; Breckland Society 2010, 19). A detailed description of how trapping banks were used on the Elveden estate is given in the Breckland Society's report *The Internal Archaeology of the Breckland Warrens* (2017, 14).

Figure 29 One of the large trapezoidal enclosures within Thetford Warren, together with two small rectilinear enclosures, with a possible circular enclosure to the west; banks shown as red, ditches as green. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

As well as tracing the external boundaries of the warrens, a striking feature of the mapping is the proliferation of internal features identified within the warrens. A large number of internal subdivisions and enclosures were recorded, often for the first time. There are a variety of possible explanations for these internal features (many of them outlined in Breckland Society 2017, 11–13). Some could represent changes in the extent or boundary of the warren. Others could reflect a change in use, either as earlier features incorporated into a warren, or as later features superimposed on the landscape after its use as a warren had ended. Certainly, some of the boundaries and enclosures may be related to post-medieval plantations (at Downham High Warren, for example). The use of the warrens for other purposes, alongside the farming of rabbits, may also have played a part; parts of some warrens were used intermittently for arable crops, while others were used for grazing sheep (Breckland Society 2010, 50–51). In his *General View of the Agriculture of Suffolk* (1813), Arthur Young wrote of the Elveden Estate that 'His Lordship has made three standing folds, inclosed by thick turf walls, eighty yards square, for shelters for his flock at lambing time, against driving snow and very bad weather … surrounded by plantations' (information from Anne Mason, Friends of Thetford Forest). However, many of the enclosures and boundaries may relate to the warren itself. Some of the boundaries subdividing the warrens may have been used for trapping the rabbits. Some of the enclosures may be 'clappers', used to separate

pregnant does from the rest of the warren; this appears to be the case with a rectangular enclosure (SHER BRD 105), measuring approximately 128m by 68m, which survives as an earthwork in the southeast corner of Brandon Warren, in an area called 'the clapper' (Breckland Society 2017, 12). Segregation may also have been used for selective breeding (Breckland Society 2017, 12–13). Other enclosures may have been used for growing forage crops, the use of which allowed stocking levels on many warrens to increase in the post-medieval period (Williamson 2006a, 178). Certainly, at least a proportion of the enclosures appear to be quite late, with several being depicted on historical Ordnance Survey maps, even as late as the early 20th century. The enclosures vary widely in size; many are small, measuring as little as *circa* 20m across, while others are much larger, measuring over 300m in length. Some of the enclosures recorded by the project lie outside of any documented warren (NHER 61501 at Weeting-with-Broomhill, NHER 61508 at Mundford); they are similar in appearance to the enclosures recorded within the warrens, but their purpose is obscure.

A number of warren lodge sites were also mapped and/or recorded within the project area. The lodges would have provided accommodation for the warrener and his family, a space to store equipment and carcasses, and a look-out and defensive building against poachers (Breckland 2010, 9). The lodge sites falling within the project area included those at Broomhill/Weeting, Brandon, Downham High Warren (its lodge was at High Lodge, now the Forestry Commission visitor centre for Thetford Forest), Elveden, Santon, Santon Downham (two potential lodge sites; Breckland Society 2017, fig on 27–28), and Thetford (which appears to have had as many as three lodges; Breckland Society 2017, fig on 21, 28).

At most of the known or suspected lodge sites, the mapping could add little or no new information. Within Brandon Warren, however, an area of poorly defined and undated earthworks visible on the lidar imagery (SHER BRD 312) were mapped, which could relate to one of Brandon's warren lodges. They lie immediately to the west of a building (now demolished) variously named Brandon Lodge, Two Chimney Lodge and Three Chimney Lodge, which is thought to stand on or close to the medieval warrener's lodge (BRD 093). At High Lodge, in Downham High Warren, no evidence for the lodge itself was recorded (the site of which was occupied by High Lodge Farm by the late 19th century), but a curvilinear boundary mapped in the surrounding area (recorded as part of SHER STN 156) may have defined an area marked as enclosing 'Downham (High) Lodge' and 'Lodge Field' on an 18th century estate map. Within Thetford Warren, a small mound was mapped at the site of the recently-identified Reed Fen Lodge (NHER 61000). For Broomhill/Weeting Warren, it is feasible that some of the enclosures mapped at Bromehill Priory (NHER 61992) could relate to a warreners lodge.

As stated above, the Breckland rabbit warrens are generally thought to lack the pillow mounds (artificial burrows) found within rabbit warrens elsewhere. The light sandy soils were relatively easy for the rabbits to burrow into, and the dry climate of Breckland provided a more suitable environment for them than other parts of Britain. However, a number of mounds, usually with an elongated shape, had been identified as possible pillow mounds within the project area prior to the survey. For the most part, the survey has suggested that other interpretations of the mounds are more likely – as natural features, as part of banks, or as the result of modern activity, for example. Nevertheless, the possibility that at least some of the mounds recorded previously and by the survey were used as burrows cannot be discounted. It is also possible that pre-existing features such as Bronze Age round barrows, and warren banks, were also used for burrows.

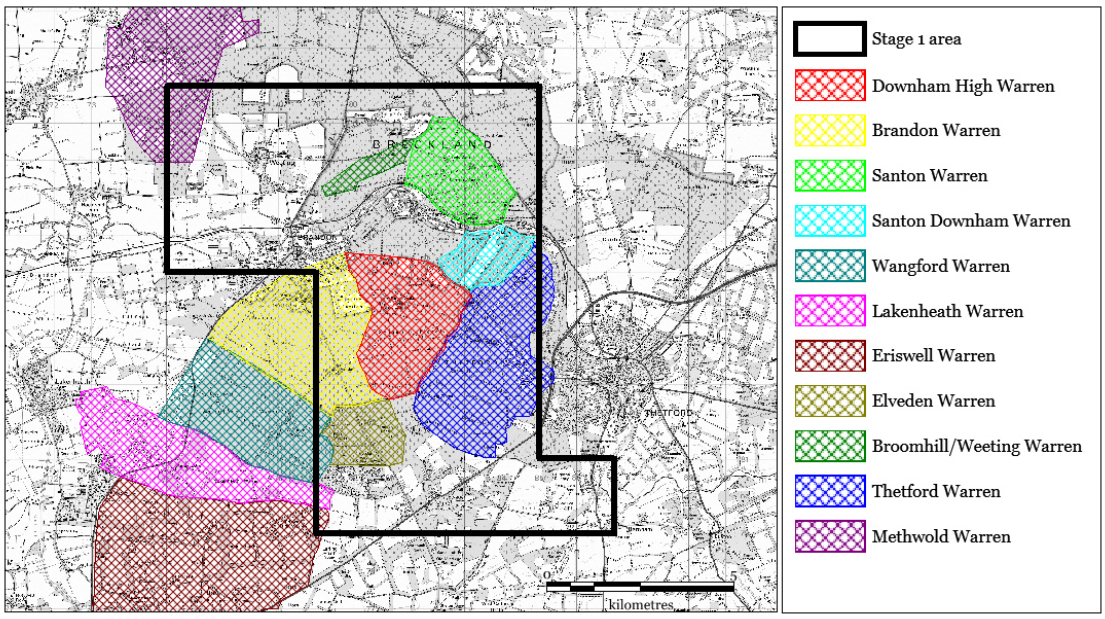


Figure 30 The documented Breckland warrens covered by the survey. Approximate extents derived from HER mapping and maps included in the Breckland Society's survey reports (2010; 2017). Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

Twenty-six managed warrens were documented in the 2008–2009 survey of Breckland's warrens by the Breckland Society (Breckland Society 2010). The information published by this survey, together with information held in the Norfolk and Suffolk HERs, formed the basis for mapping and recording by the project of known or possible warren-related features. The project area covered 11 of the documented warrens, whether wholly or in part. They comprised all those warrens lying within the central, forested area of Breckland (Breckland Society 2010, 10); four in Norfolk (Broomhill/Weeting, Methwold, Santon and

Thetford), and seven in Suffolk (Brandon, Downham High Warren, Elveden, Eriswell, Lakenheath, Santon Downham, Wangford).

It should be noted that for the purposes of recording, boundary banks have been assigned to one specific warren. However, where two (or more) warrens abut each other there may be multiple boundaries and it is often unclear which specific warren a boundary relates to; in practice, it may have served both. The fact that many of the warrens share their boundaries with a parish, or even the county boundary, only serves to confuse the attribution further.

Brandon (Suffolk; SHER BRD 082)

Only the eastern side of the warren falls within the project area. There are multiple substantial boundary banks surviving along its eastern side, where it lies adjacent to Downham High Warren. No attempt has been made to distinguish between those relating to each individual warren, and they have all been recorded as part of SHER STN 035, the banks relating to Downham High Warren. Where it abuts Elveden Warren to the south, the boundaries are complex and difficult to make sense of.

Within the warren there is some limited evidence of subdivision (SHER BRD 317) and internal banks (SHER BRD 321). However, compared to some other warrens (such as the adjacent Downham High Warren), there is a relative lack of enclosures; this assessment could, however, change once the entire warren is surveyed. A rectangular embanked enclosure in its southeast corner (SHER BRD 105) may be a 'clapper', used to separate pregnant does from the rest of the warren (Breckland Society 2017, 12). A number of mounds recorded within the warren prior to the survey were tentatively identified as pillow mounds (SHER BRD 082, BRD 195-196). Although this cannot be entirely discounted, the appearance of the mounds, and their location within an area of very uneven and 'lumpy' ground, suggests that they may instead be of natural origin, or, in part, the product 19th or 20th century quarrying.

There is considerable evidence from within the warren of post-medieval flint mining, presumably for the manufacture of gun flints. It includes the site of Ling Heath, but also numerous smaller sites. The exploitation of the flint sources within the warren must have taken place alongside the rearing of rabbits, as the warren was still functioning in the early 20th century (Breckland Society 2010, 16).

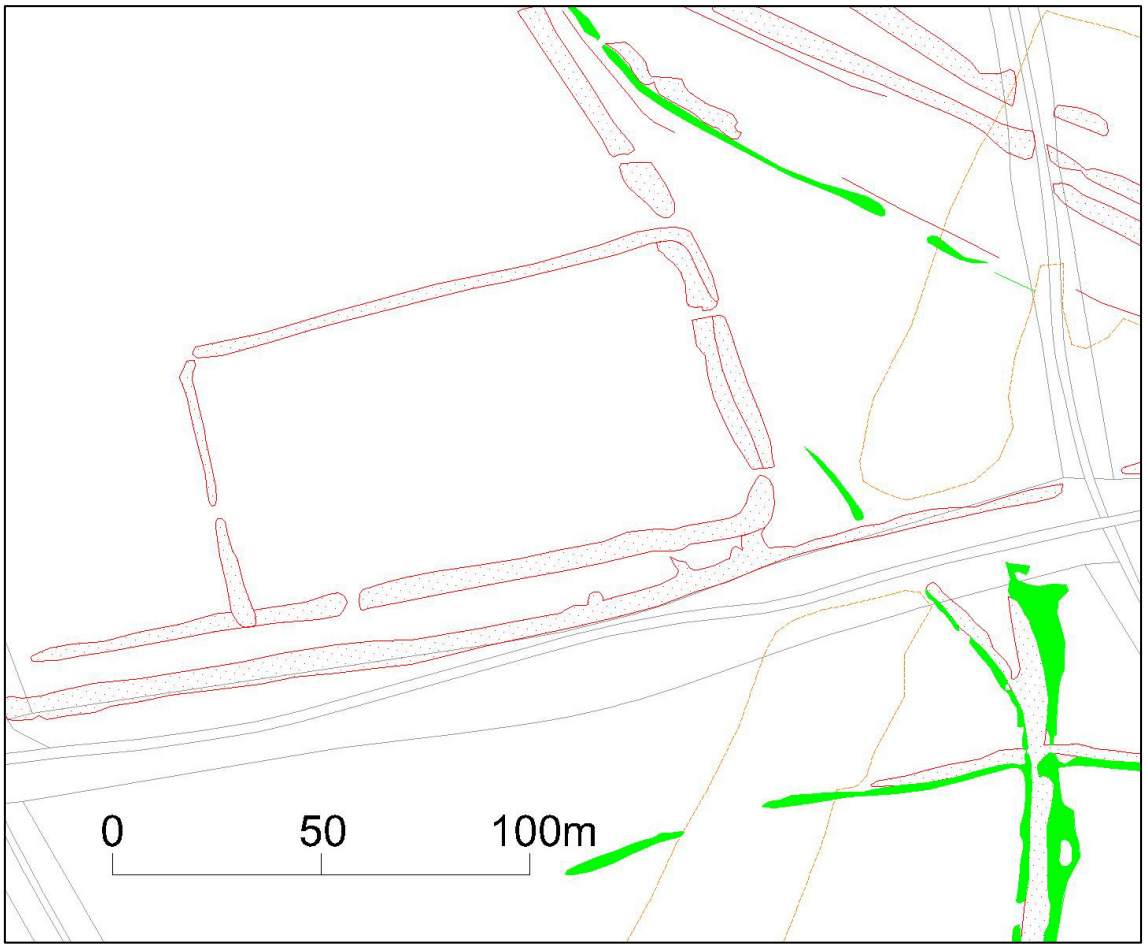


Figure 31 The possible 'clapper' enclosure in Brandon Warren (SHER BRD 105). It is located at the junction between Brandon Warren, Elveden Warren (to the south) and Downham High Warren (boundary banks just visible to the northeast); banks shown as red, ditches as green, an area of braided trackways in orange. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

Broomhill/Weeting (Norfolk; NHER 54063)

The entire warren, as recorded by the first Breckland Society warrens survey (Breckland Society 2010, 17), fell within the project area. Boundaries possibly relating to the warren were visible as earthworks on lidar imagery and aerial photographs, and were recorded as part of NHER 61537. Without more detailed research, the extent and complexity of the boundaries (and other features) mapped across the area made it extremely difficult to identify with certainty those features specifically related to the warren.

NHER 61537 comprised a large dispersed area of boundary banks, including warren banks, ditches, trackways and enclosures, predominantly likely to be of medieval to post-medieval date. It spread across the extensive areas of forestry

plantation at Weeting-with-Broomhill, extending into Lynford to the east. The area encompasses several important archaeological sites, most notably the site of Broomhill Priory (NHER 5627 and 61992) and Broomhill/Weeting medieval to post-medieval rabbit warren (NHER 54063). It also encompassed several blocks of ridges, reminiscent of ridge and furrow, which perhaps relate to the temporary arable cultivation of parts of the area, the production of fodder crops for rabbits, and/or early conifer plantations. In some places, the ridges seem to overlie boundaries or trackways; in others, the ridges appear to have been bounded by some of the boundary banks. NHER 61537 incorporated several features which were previously recorded as separate sites, including NHER 31217, 55578, 61085, and 61095.

At its western extent, NHER 61537 was bounded by a series of broadly parallel banks and ditches. The most substantial (previously recorded under NHER 55578) formed the Weeting/Broomhill parish boundary and may have also formed a monastic boundary associated with the priory or more likely related to the edge of the warren. This would extend the limits of the warren considerably, but given that two of the suggested sites for the associated warren lodge (or lodges; NHER 31601 and 61992) also lie outside of its recorded area, it may be much more extensive than previously thought. Running alongside the principal boundary are a series of parallel boundaries, comparable to the multiple banks forming the eastern edge of the warren (see below). An intermittent single or double bank continues to the north along the line of parish boundary towards the northern edge of the recorded warren.

The boundaries and trackways recorded across the central and eastern parts of the site described above, are generally much more cohesive than those in the west. Perhaps the most distinctive part of the site is its eastern boundary, where multiple banks (four or even five in places) mark the parish boundary between Weeting-with-Broomhill and Lynford to the east. This is also thought to have been the boundary between Weeting/Broomhill warren and Santon warren. This may, to some extent, explain the need for multiple boundaries, although this could also reflect the reinstatement of the boundary over a long period of time. Additional, near parallel boundaries are visible offset to the east, within Lynford parish and within or along the recorded western boundary of Santon warren.

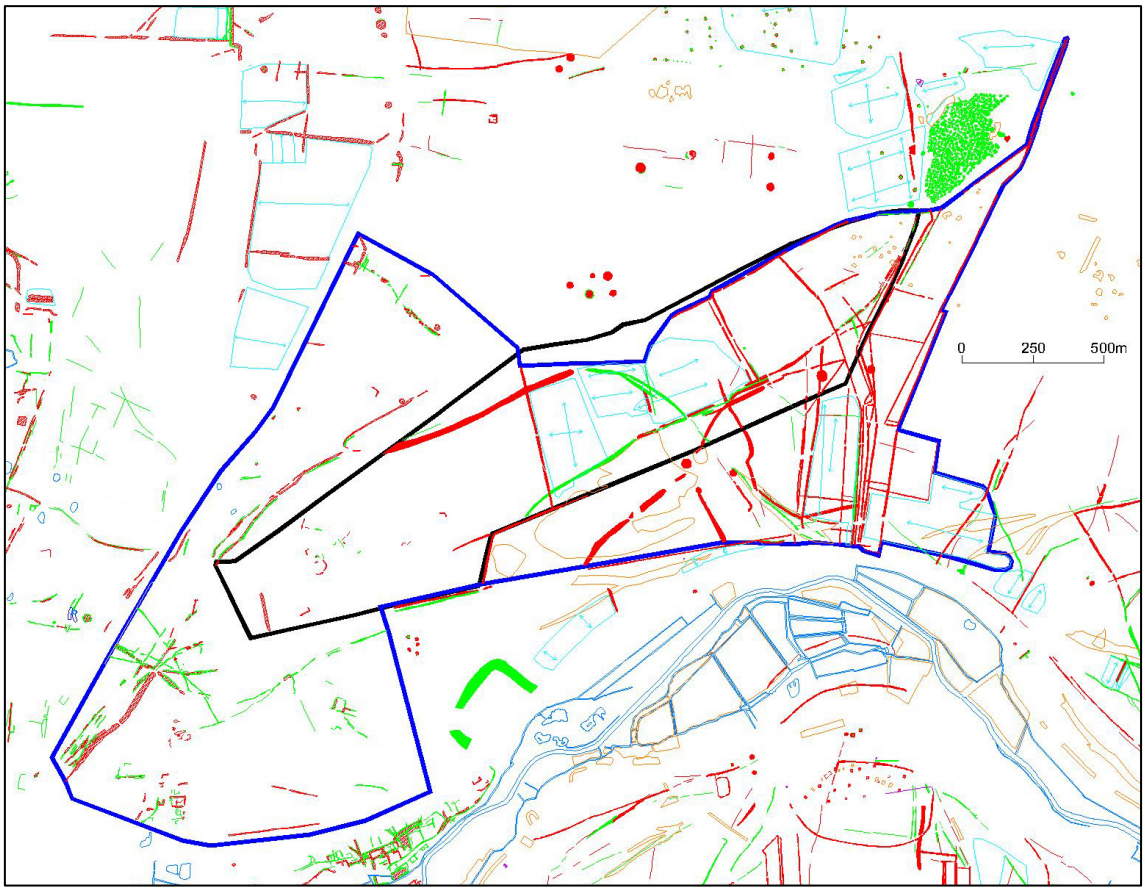


Figure 32 The mapping for NHER 61537 (extent shown in dark blue), much of which is thought to relate to Broomhill/Weeting Warren (NHER 54063; extent currently recorded by the NHER in black); banks shown as red, ditches as green, blocks of ridges in cyan, large area features in orange. The course of the Little Ouse is also shown. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

The features recorded as part of NHER 61537 overlap with several other recorded sites, including the possible remains of Neolithic flint mines (NHER 61536), and several possible barrows (NHER 62109, 62049, 62046—62048). Most notably, the central southern portion of the site is overlain by an area of post-medieval gun flint mines (NHER 31296); the lidar imagery clearly shows the flint mines on top of the low earthwork boundary bank which crosses the same area northeast-southwest. This boundary is thought to be the southern boundary of Weeting/Broomhill warren (Breckland Society 2010, 17), and this stratigraphic relationship provides a useful insight into the relative dates of some elements of the landscape.

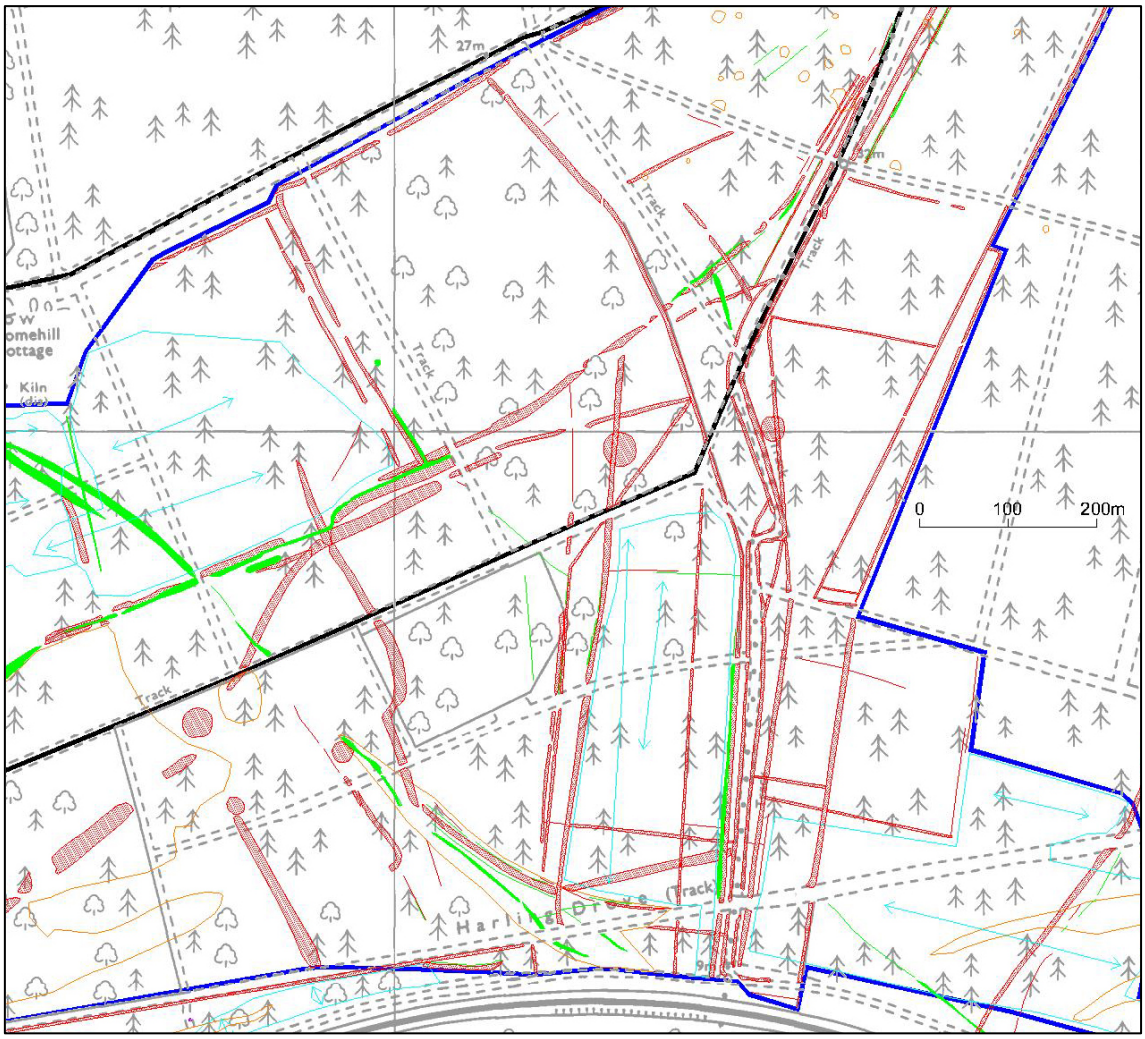


Figure 33 Detail of the complex, multiple boundaries mapped along the eastern boundary of Broomhill/Weeting Warren, where it abuts Santon Warren. Banks shown as red, ditches as green, blocks of ridges in cyan, large area features such as post-medieval flint mines, in orange; the currently recorded extent of Broomhill/Weeting Warren is shown in black, the extent of NHER 61537 in dark blue. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

Downham High Warren (Suffolk; SHER STN 035)

The entire warren was covered by the survey. The perimeter is defined by banks for its entire circuit, and these are regarded as some of the best-preserved warren banks in Breckland (Breckland Society 2010, 19). The perimeter boundary is frequently made up of multiple, parallel banks, in particular along its western and eastern sides, where it abuts Brandon Warren and Thetford Warren respectively. To the northeast, the perimeter banks are conjoined with those defining Santon Downham Warren. To the south, the warren abuts Elveden Warren, and the boundary between the two is poorly defined. It is

possible that this was always the case, perhaps reflecting the relatively late establishment of the warren at Elveden It may instead be the result of this part of the boundary being followed by a forest ride, which may have damaged or removed much of any boundary bank (or banks).

There is an east-west boundary which appears to subdivide the warren into a northern and southern portion. This boundary (SHER STN 087) for the most part follows boundaries and tracks shown on historical and modern Ordnance Survey maps. As a consequence, it is difficult to be certain of its date and function, although a plantation on its north side, named 'Warrenbank Belt' on the Ordnance Survey 1st edition 6 inch map, has been taken as an indication that it was a warren bank. Contrary to a previous suggestion (see SHER STN 087), however, it does not appear to divide Downham High Warren from Santon Downham Warren, which the Breckland Society surveys (2010, 30; 2017, 20) places further to the northeast. Rather, if it really is a warren boundary, it appears to have been an internal division, or – perhaps – a boundary relating to a contraction or expansion of the warren at some stage in its history.

The warren is notable for the considerable number of boundaries, enclosures and areas of ridging visible within it. These have been mapped almost entirely from the BNG lidar imagery, on which they are visible as earthworks, although some elements are also visible on aerial photographs. Entirely new to the record, and perhaps relatively early in the sequence, are a series of near parallel banks, which cross the warren northeast to southwest, parallel with the eastern boundary of the warren and, at least partially, perhaps the western boundary as well. They are not particularly substantial, appearing to be very low earthworks relative to the other boundaries recorded, although they are quite broad in places (perhaps due to them being spread by later forestry activity). They survive best on the eastern side of the warren, where they are relatively closely spaced, between approximately 75m and 150m apart. Further west, they are for the most part only evident towards the southwest corner of the warren, and are more widely spaced (approximately 300m apart). Where the banks extend to the northeast as far as SHER STN 087 (the bank subdividing the warren east-west), they appear to respect it. The relationship is not entirely clear, as there is a parallel ditch which appears to continue to the north, beyond STN 087, but this could be an unrelated feature. To the south, the banks appear to continue across – apparently beneath – the southern boundary of the warren and into Elveden Warren, and – less convincingly – perhaps into Brandon Warren as well. As discussed in the section on Elveden Warren, the date and function of these banks is not known. They could be early – even prehistoric or Roman – features onto which the warrens were overlain, reinstating their alignment. It is perhaps more likely, however, given their relationship with the warren boundaries, that they relate to the use of the warrens themselves. They could be trapping banks, or boundaries related to livestock being grazed on the warrens alongside

rabbits. Further investigation of these boundaries – if they can be identified on the ground – would be extremely beneficial, in particular where they meet the warren boundaries and there is the potential for a stratigraphic relationship to be established.

Figure 34 The mapping for Downham High Warren; banks shown as red, ditches as green, blocks of ridges in cyan, the extent of large area features, including post-medieval flint mines, in orange.

In the northwest corner of the warren is a complex area of boundaries (SHER STN 156) to the northwest of what is shown on the Ordnance Survey 1st edition 6 inch map as High Lodge Farm (SHER STN 064). This was later the site of High Lodge labour camp and is now the site for the Forestry Commission's High Lodge visitor centre. High Lodge Farm was formerly the site of the warrener's lodge for Downham High Warren (SHER STN 064). No traces of the lodge were

identified, but amidst the boundaries is a curvilinear bank or double bank which defines an area enclosing 'Downham (High) Lodge' and 'Lodge Field' on an 18th century estate map (see SHER STN 061). Many of the other boundaries in this area are shown on historic Ordnance Survey maps, and relate to later plantations or to High Lodge Farm. They are conjoined to such an extent, however, that it was necessary to map them in their entirety. A series of parallel, north-south aligned banks and a possible enclosure visible to the east of High Lodge Farm could date to the same period.

Along the eastern and western boundaries of the warren are a series of rectilinear and trapezoidal enclosures. On the eastern side, these are mirrored by similar enclosures within Thetford Warren. Some of these enclosures are associated with areas of ridging. This could indicate that they were used for growing forage crops, or for small-scale arable farming within the warren. However, in 1778, the estate was purchased by Charles Sloane Cadogan, who held the position of Surveyor of the King's Gardens. He began to establish plantations on the warren, which survived until the First World War (Breckland Society 2010, 19). It is possible that the enclosures and ridging date to this phase, although it is also possible that existing warren enclosures were re-used as plantation boundaries. Other blocks of ridges evident across the warren, and parallel banks crossing the warren northwest to southeast, are also likely to date to this period. Other traces of ridges, which have not been mapped, seem to relate to the plantations and boundaries visible on the Ordnance Survey 1st edition 6 inch map.

Virtually all the enclosures, ridging and boundaries just described appear to respect the east-west bank (SHER STN 087) dividing the northern part of the warren from the south. They are almost entirely confined to the southern part of the warren. To the north of the bank, there is very limited evidence for enclosures and land division. There are two small rectilinear enclosures (SHER STN 119—120), of the kind very prevalent in Thetford Warren but also found in Elveden Warren. The function of these small enclosures is unknown, but is assumed to relate to warrening. In the northwestern corner of the warren, there is considerable evidence of post-medieval flint mining.

Elveden (Suffolk; SHER ELV 039)

The entire warren was covered by the survey. It is a post-medieval warren, established in the early 17th century, apparently on the 'border' (land deliberately left between warrens) between Eriswell, Downham and Lakenheath warrens (Breckland Society 2010, 20), although it in fact lies adjacent to Wangford, Brandon, Downham and (albeit with a >500m gap) Thetford warrens.

The warren is divided into an eastern and a western half by a trackway, the route of which is partially flanked by banks. The eastern half, Parsonage Heath, is itself subdivided into two linear strips by a substantial boundary bank, flanked on either side by a narrow bank. This division is depicted on the 1848 Tithe map as 'Old Bank' (SHER ELV 038). Perimeter banks are evident for all except the southern side of the warren. In places these are multiple and complex, usually where bordering adjacent warrens (Downham High, Brandon, Wangford), but also in the southeast corner where the boundary banks and 'Old Bank' meet. Where the warren lies adjacent to Wangford Warren (WNG 025) there is an unusual 'V'-shaped arrangement of banks (SHER ELV 050), with a third bank creating a triangular area. This area is shown as woodland on the Ordnance Survey 1st edition 1 inch map of 1836.

Figure 35 The mapping for Elveden Warren (SHER ELV 039); banks shown as red, ditches as green, blocks of ridges in cyan, the extent of large area features, including Second World War activity, in orange. The outline of the warren as recorded in the Suffolk HER is shown in black.

'Old Bank' is aligned more-or-less parallel to the eastern boundary of the warren, and its orientation is also followed by the aforementioned trackway, located an equal distance to the west. There are further fragments of banks on a

similar alignment even further to the west. These could represent trapping banks, of the type described above. Tom Turner, in his book *Memories of a Gamekeeper, Elveden 1868–1953*, describes how such banks were constructed and used on the Elveden Estate (Breckland Society 2017, 14).

There are a variety of enclosures within the warren. Relatively large, broadly rectilinear enclosures against its western boundary (SHER ELV 119) show traces of ridges within them, perhaps related to their use for growing arable and/or forage crops. Smaller enclosures towards its southern and eastern boundaries (SHER ELV 112-114) are similar to those seen within other warrens, in particular Thetford. A large enclosure in its northwestern corner defines an area known as Elveden Upper Warren (SHER ELV 036). This may have been an area set aside for arable agriculture, as it has a pit – thought to be a marl pit – within it.

As well as the relatively substantial (and possibly quite late) northwest to southeast oriented banks, there are a series of much more ephemeral and fragmentary banks crossing into the warren from the northeast. Some appear to be a continuation of banks evident in Downham High Warren. These appear to cross the southern boundary of Downham High Warren – which, in contrast to the boundaries along the rest of its perimeter, is very insubstantial. They then cross an apparent 'border' area before continuing into Elveden Warren across its northeast boundary. It is not clear whether these insubstantial banks are earlier or later than the warren boundaries. As described in the section on Downham High Warren, these could again be trapping banks, or related to grazing livestock on the warrens. They could even pre-date the establishment of the warrens, or at least the construction of the banks defining their boundaries. This is most likely in the case of Elveden Warren, which seems to have been established relatively late.

Eriswell (Suffolk; SHER ERL 102)

Only the extreme northeastern corner of the warren was covered by the survey. Here the earthworks relating to the northernmost section of the eastern boundary were mapped from aerial photographs. To the north, where it abuts Lakenheath Warren, the boundary consists of two banks. Further south, one broader bank, with flanking ditches, was recorded. A possible third bank was tentatively identified in the central section. A series of boundary banks and ditches were recorded within the northeastern corner of the warren (SHER ERL 241), some of which may relate to warren activity and trapping banks.

Lakenheath (Suffolk; SHER LKH 174)

Only the extreme eastern end of the warren was covered by the survey. This is predominantly defined by a double bank and internal ditch, with additional sections of bank in places. (It should be noted that the Breckland Warrens Survey identified four banks defining parts of the eastern end of the warren; Breckland Society 2010, 25.) The northwestern edge of the warren has two main banks; these appear to have been augmented with additional narrow banks in places, however some of these more minor earthworks could relate to later activity, as evidenced by the Second World War bomb storage areas cut into the warren banks in this area (SHER LKH 386). Further north, banks defining Warren Wood and the southeastern corner of Wangford Warren (SHER WNG 068) flank the Lakenheath boundaries.

An area of earthwork enclosures and banks, of uncertain date and archaeological significance, although possibly related to warrening activity, were recorded within the eastern end of the site (SHER LKH 385). A possible polygonal enclosure, a rectangular enclosure and individual bank segments were tentatively identified on the aerial photographs. However, due to the presence of multiple tracks relating to recent and 20th century activity on the heath, it is hard to be certain about the origin of these features. Additionally, looking at only the extreme eastern end of this large area of heath, it is hard to put any possible archaeological features into context. It is possible that older, pre-medieval elements survive. Further investigation on the ground and access to good resolution lidar data would be beneficial, as would an aerial investigation and mapping survey encompassing the entire warren.

Methwold (Norfolk; NHER 55577)

Only the southeastern corner of the warren was covered by the survey. No features specifically relating to the warren were recorded, although the Fossditch – a linear earthwork, probably an Anglo-Saxon territorial boundary (NHER 1089) – which forms its eastern boundary, was mapped as far as it extended within the Stage 1 area.

Santon (Norfolk; NHER 54065)

The entire warren was covered by the survey. Two different outlines are depicted in the reports relating to the Breckland Society's warrens surveys, with the outline in the earlier survey (Breckland Society 2010, 29) covering a less extensive area. In the report covering the second survey (Breckland Society 2017, 20), the warren is shown with the same extent as the former parish of Santon (now part of Lynford), bounded by the Little Ouse to the south, the A134

Mundford road to the northeast, and Grimes Graves and the parish boundary with Weeting-with-Broomhill to the northwest.

Banks, often multiple banks, evident along the eastern, southern and western limits of the warren, are likely to be part of its perimeter boundary, but may also (or instead) have served as parish boundaries. The number of banks is greatest on the western boundary of the warren (recorded as part of NHER 61537), where it lies adjacent to the eastern limit of Broomhill/Weeting warren. No features were mapped at the site of the associated lodge (NHER 31770).

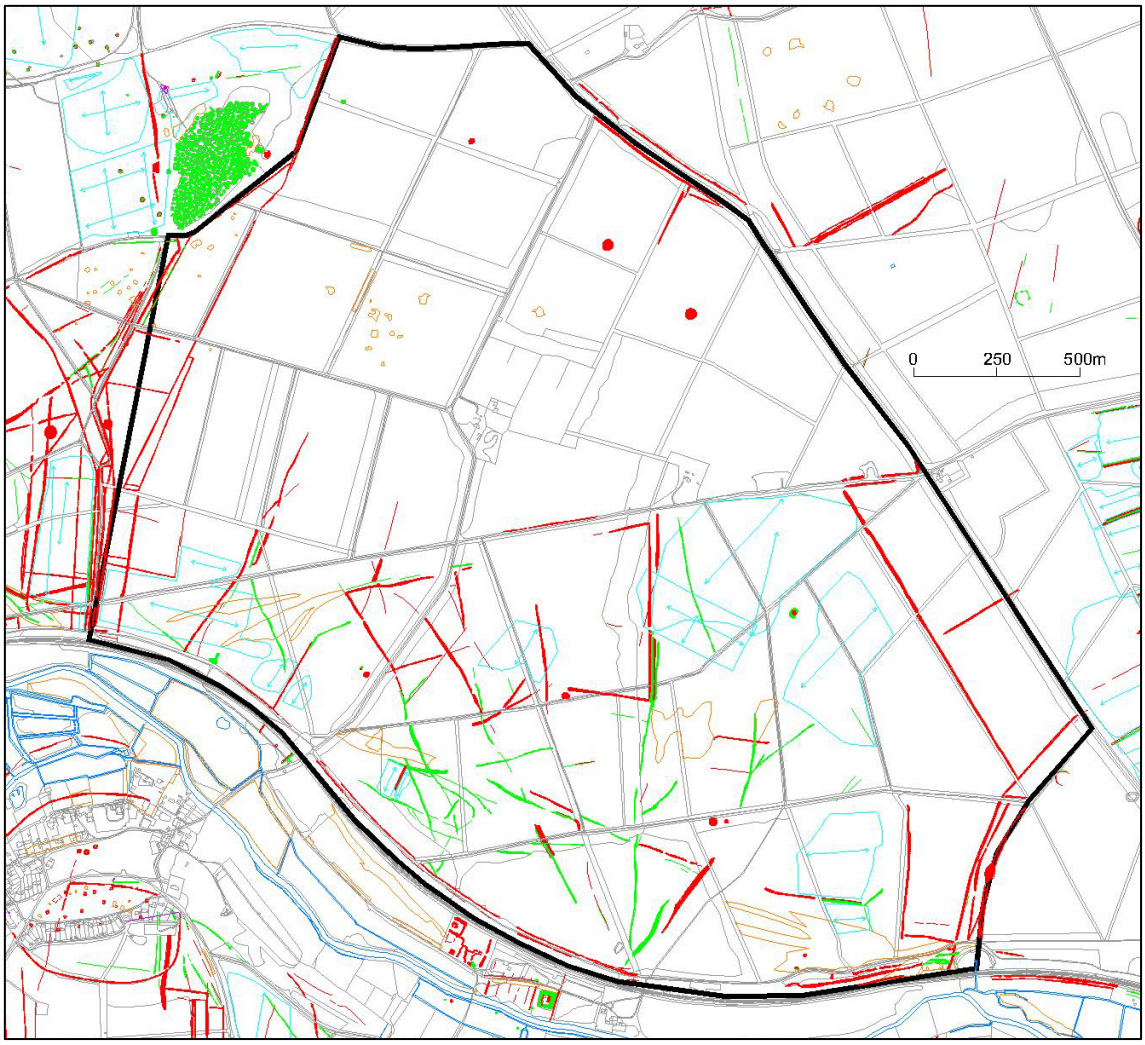


Figure 36 The mapping for Santon Warren (NHER 54065), shown with the extent of the warren as recorded by the 2017 Breckland Society survey (in black; Breckland Society 2017, 20); banks shown as red, ditches as green, blocks of ridges in cyan, the extent of large area features, such as braided trackways, in orange. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

An extensive spread of rather irregular and non-cohesive boundary banks, ditches, and trackways (NHER 62073), was mapped by the project across the southern half of warren. These features were visible as earthworks, predominantly on lidar imagery but also on aerial photographs. Most were thought to be of medieval to post-medieval date, and some at least associated with the warren. However, the incoherence of the features, and the uncertainty regarding the limits of the warren, made it difficult to be certain which are warren related, and which instead relate to earlier or later activity. They include blocks of ridges, reminiscent of ridge and furrow, which might relate to temporary arable cultivation, the growing of forage crops for rabbits, and/or early plantations. They also include areas of braided trackways, which were mapped by extent. It is possible that some of the features mapped at the western end of the site are earlier, and perhaps relate to the probable Roman settlement previously recorded in this area (NHER 5659). At the same time, the site is located in an area where there also appear to be a large number of geomorphological and topographical features visible on the lidar, and it is possible that some of the features are of natural origin. The site incorporated a number of smaller sites that had previously been recorded individually, including NHER 42026, 60123, 61100.

Santon Downham (Suffolk; no overall HER number)

The entire warren was covered by the survey. It does not, at present, have its own site record in the Suffolk HER, but its perimeter boundaries are recorded as part of SHER STN 035. Two different outlines are depicted in the reports relating to the Breckland Society's warrens surveys. In the report covering the earlier survey (Breckland Society 2010, 30), a relatively small area is shown, with an area of land separating it from Downham High Warren to the southwest. In the report covering the second survey (Breckland Society 2017, 20), a larger area is shown, covering the entire area between the Little Ouse to the north and Downham High Warren to the southwest.

The boundaries mapped by the project support the second, more extensive outline for the warren. Multiple banks were mapped, principally from lidar, along the northwest, southwest and southeastern limits of the warren; the river appears to have been adequate as the northern boundary, or, possibly, any earthwork boundary that did exist has been destroyed. As the southeastern boundary is shared with Thetford Warren, the southwestern with Downham High Warren, and the northwestern boundary conjoined with the northern boundary of Downham High Warren, no attempt at separation between the boundaries relating to the three individual warrens has been attempted in the recording.

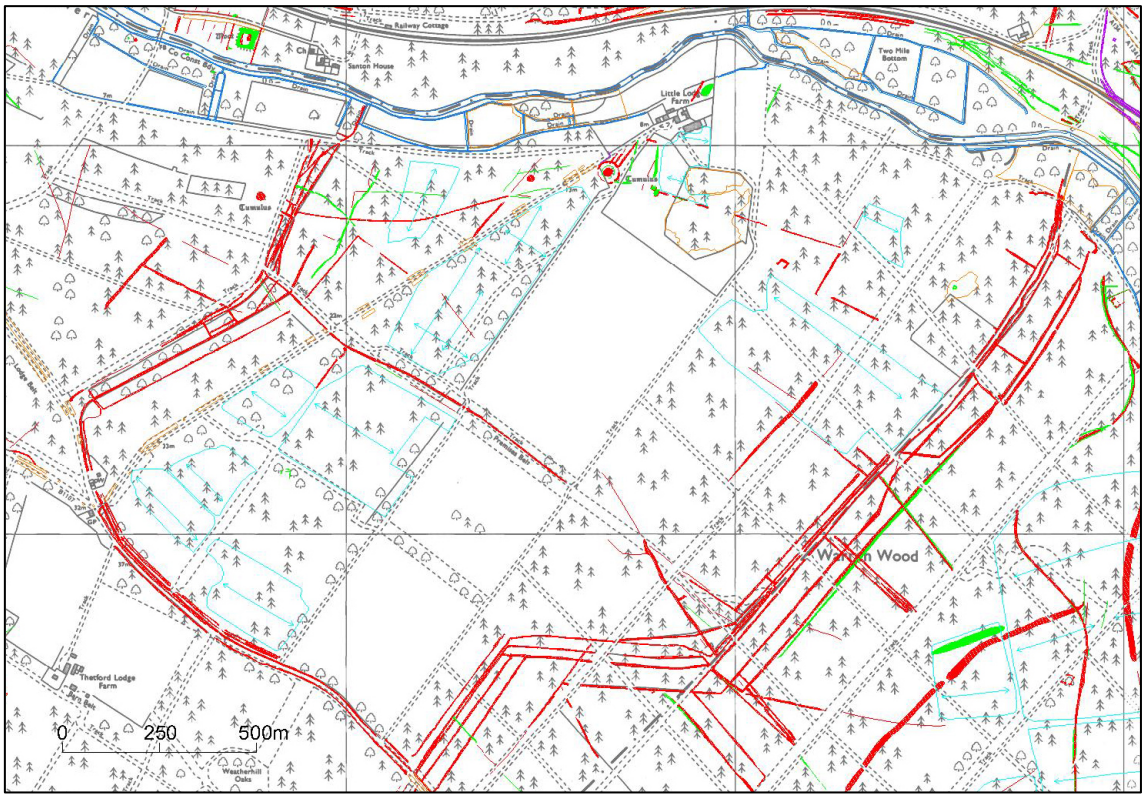


Figure 37 The mapping for Santon Downham Warren; banks shown as red, ditches as green, blocks of ridges in cyan, the extent of large area features, including Second World War activity, in orange. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

A further boundary was also mapped (SHER STN 188), subdividing the warren northwest to southeast, and correlating with the southwestern limit of the warren shown in the first Breckland report (Breckland Society 2010, 30), and with an undescribed boundary in the second report (Breckland 2017, 20). No features were identified at either of the two lodge sites shown in the 2017 report. A number of less cohesive boundaries, areas of ridging and small enclosures were also mapped.

Thetford (Norfolk; NHER 54069)

This warren was mapped almost in its entirety, with only parts of its easternmost edge falling outside the project area. The aerial sources were checked for the entire warren. The most substantial perimeter banks belonging to the warren are those along its western edge, where it abuts Downham High Warren and, further north, Santon Downham Warren. There are fragmentary banks along its southern boundary, where it follows the parish and county boundary. To the east, its northern half seems to have been bounded by the Little Ouse; there is no evidence of an additional earthwork boundary, and here

the river may have been regarded as adequate (see too Santon Downham Warren). The eastern boundary for the southern portion of the warren is unclear. Multiple boundaries have been mapped in this area, but it is not certain which – if any – mark the perimeter of the warren. It is possible that the perimeter banks in this area have been destroyed by later forestry and development, leaving only internal subdivisions. Variations in the extent of the warren as recorded by the Norfolk HER, and as recorded by the Breckland Society (2010, 34; 2017, 21) also confuses the issue. Further work to integrate the results of the mapping with existing HER records, the results of the two Breckland warren surveys (ibid), and ongoing work by local researchers (Anne Mason, Friends of Thetford Forest, pers comm) would be beneficial, and might help to distinguish the perimeter boundary from the mass of features visible on the aerial sources.

Within the warren, a complex network of boundaries, enclosures and trackways has been mapped. The density and complexity of visible features has meant that any attempt at phasing the features has been outside the scope of the project. The area of open heathland – now largely occupied by Thetford golf course – which surrounds the surviving warrener's lodge (NHER 2760), is crossed by multiple trackways, many of which continue into the surrounding forestry plantations. Within the latter, banks dominate, with a variety of irregular and more regular complexes visible. As described in the section on Downham High Warren, there are a number of rectilinear enclosures abutting both sides of the multiple banks defining the boundary between the two warrens. Those within Thetford Warren are, for the most part, very rectilinear in plan, and several are depicted on the Ordnance Survey 1st edition 6 inch map. They are presumed to be a fairly late addition to the warren. Further within the warren are a number of large, rectilinear or trapezoidal enclosures with rounded corners. These are generally not depicted on historic maps. Their morphology is broadly comparable with the enclosures identified on Lakenheath Warren, which are thought to have been used for growing crops such as turnips or swedes, either as forage crops or for human consumption (Williamson 2006, 49, fig 32). Like the Lakenheath enclosures, some of the Thetford enclosures contain ridges.

Thetford Warren is particularly notable for the small (20—25m across) rectilinear (usually square) and circular enclosures, defined by banks, which are found across the entire area. Some of these are depicted on historical and even modern Ordnance Survey maps. Their purpose is not known but is assumed to be related to warrening, as they are found on other warrens, albeit in lesser numbers. It is also not known why they are found in such numbers at Thetford Warren in particular.

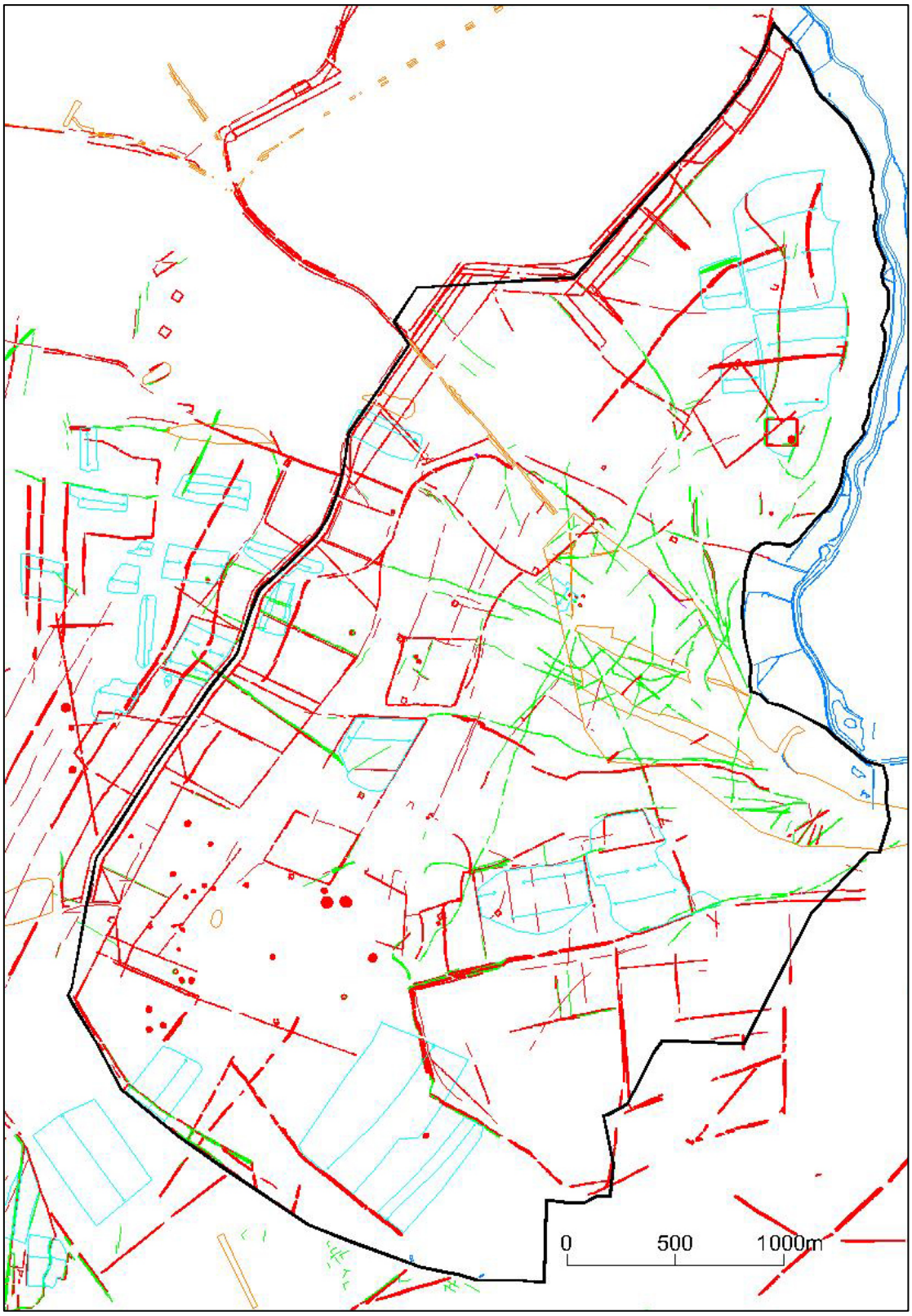


Figure 38 The mapping for Thetford Warren (NHER 54069); banks shown as red, ditches as green, blocks of ridges in cyan. The outline of the warren as recorded in the Norfolk HER is shown in black. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

Wangford (Suffolk; SHER WNG 068)

Only the easternmost end of this warren was within the Stage 1 area. The perimeter banks on the eastern side (SHER WNG 025) were recorded predominantly from the BNG lidar imagery. Between three and four banks were recorded between Wangford and Elveden Warrens. It is notable that where the warren abuts Elveden Warren (which was established much later; SHER ELV 039), there is an unusual 'V'-shaped arrangement of banks (SHER ELV 050). The Ordnance Survey 1st edition 1 inch map of 1836 shows this area as a triangular block of woodland.

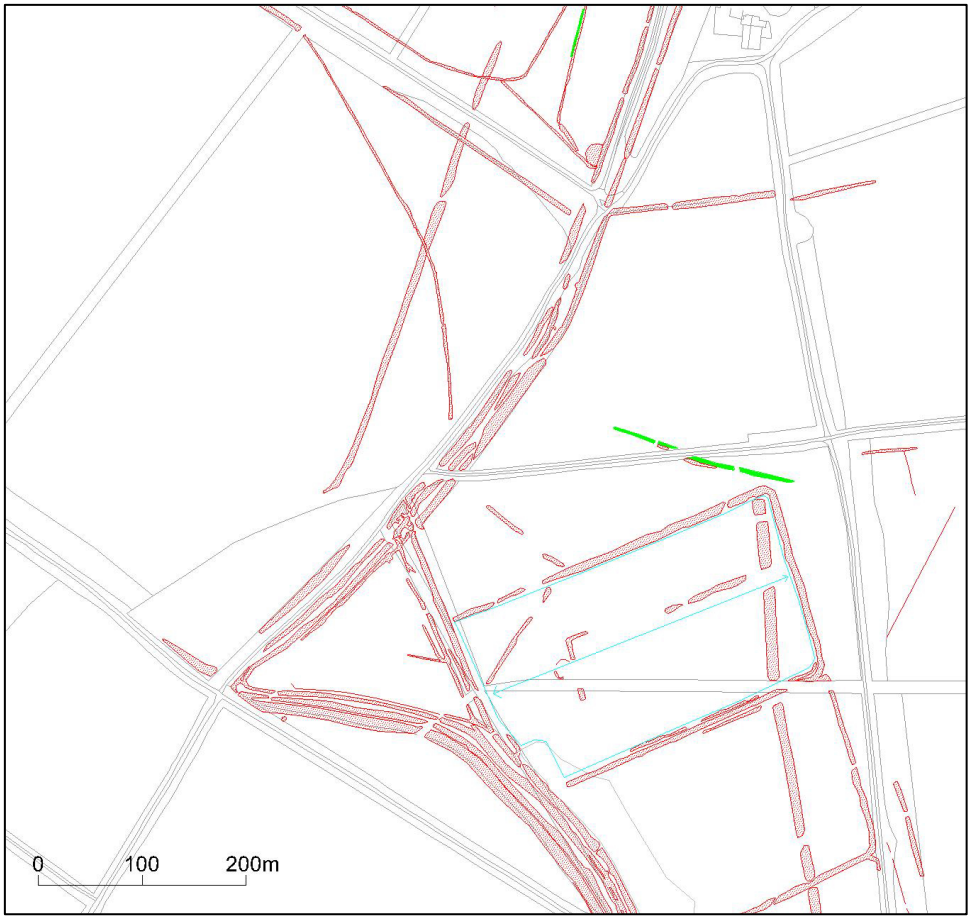


Figure 39 The triangular area of land created by the abutment of Wangford (left) and Elveden (right) warrens (SHER ELV 050); banks shown as red, ditches as green, blocks of ridges in cyan. The rectilinear enclosures within Elveden Warren (SHER ELV 119) are also shown. Base map © Crown copyright and database rights 2018 Ordnance Survey 100019340.

Although most of the warren lay to the west of the project area, and was therefore not included in the survey, it is clear from the BNG lidar imagery that there is a parallel arrangement of at least seven substantial banks running much of the length of the warren. Their purpose is not clear, but they could relate to

the varying use of the warren, and perhaps its use for grazing sheep, as well as farming rabbits. Alternatively, it may relate to a need to separate different groups of rabbits, and/or manage their grazing, or to a method of trapping them. They may represent trapping banks, of the kind described as being used on the Elveden Estate in the late 19th and early 20th century (Breckland Society 2017, 14).

Within the southeastern part of the warren – that is, that part which did fall within the project area – a series of earthwork boundary banks, enclosures and possible areas of ridge and furrow, or cultivation/plantation ridges were identified on the lidar imagery (SHER WNG 056). The boundary banks appear to relate to an area of enclosures set against the edge of the warren. It seems likely that these enclosures are contemporary with the warren and were either used to grow and protect fodder crops or as stock enclosures. The presence of ridges within this area could also suggest areas of cultivation within the warren (see above for a more general discussion of such features). The slightly curved alignment of the ridges, could indicate that they are comparable to medieval ridge and furrow, and therefore could feasibly pre-date the warren, which is poorly documented before 1766 (Breckland Society 2010, 36). Alternatively, they may relate to later, post-medieval cultivation ridges and/or plantation ridges, and although the evidence is not conclusive they do appear to overlie one of the parallel banks traversing the warren.

CONCLUSIONS

Stage 1 of the Breckland AIM survey has added 470 new records to the Norfolk and Suffolk HERs – over 90% of which relate to new discoveries – and amended a further 305 existing HER records, in addition to creating an archaeological map covering 96 sq km. These results represent a very significant contribution to our knowledge and understanding of the historic environment of Breckland. The increase – by 57 per cent – to the number of known sites within the project area represents a significant advance in our understanding of the archaeological landscape of the central Brecks. In terms of the NRHE, the contribution has been even greater, with the results representing a massive 334% increase to the record as it stood at the start of the project.

In addition to highlighting a number of significant findings – perhaps most substantially those relating to rabbit warrens – this report has provided a brief chronological overview of the entire results for the Stage 1 area. The project mapped and recorded a range of sites, dating from the Neolithic to the Cold War, relating, for example, to settlement, industry, agriculture, funerary practices and military activity. Perhaps one of the most spectacular products of the mapping has been the numerous round barrows and barrow cemeteries recorded by the project – 180, or nearly 2 records per sq km. The new barrow group recorded within Thetford Warren is a significant new discovery, albeit one which requires further investigation on the ground, to establish which of the 20 mounds recorded are likely to be of Bronze Age date. The extensive funerary landscape recorded on the heaths and warrens at Weeting-with-Broomhill, overlooking the Little Ouse to the south, is not a new discovery. The project, however, has greatly enhanced the record by adding new sites, accurately recording previously known barrows, and providing a detailed digital map showing each barrow and cemetery visible across the area. This detailed, accurate and comprehensive data will be an essential resource for future work.

Similarly, the mapping and records relating to Breckland's rabbit warrens – or, at least, the 11 documented warrens covered by the project – will inform future research and heritage protection measures, including the proposed warrens designation project (Caroline Skinner, HE, pers comm). Further work is needed to draw together and correlate the results of the project with the information compiled by earlier surveys. This includes the results of the Breckland Society's warrens surveys (2010; 2017), and ongoing work by local researchers (Anne Mason, Friends of Thetford Forest, pers comm). Also, as the results from some of those warrens covered in their entirety have demonstrated – Downham High Warren and Thetford Warren, for example – the benefits should be clear of further aerial investigation and mapping surveys, to wholly cover those warrens where coverage by the Stage 1 survey was partial or non-existent. Stage 2 will go some way towards this, in covering parts of Methwold Warren, Ickburgh/Langford (possibly), Culford (possibly) and Eriswell (only

marginally), and effectively covering Wordwell Warren in its entirety. However, this will still leave large tracts of some of the largest warrens with little or no AIM/NMP standard data. For those warrens where high resolution lidar data exists – including the BNG lidar data – further investigation, mapping and analysis should be seen as a priority.

In recent years, and in response first to the formation and publication of the NHPP (English Heritage 2012), and subsequently Heritage 2020 and the Historic England Corporate Plan and Action Plan (Historic England 2015a; 2015b), NMP/AIM projects have increasingly focussed on heritage protection as one of their principal outcomes. Heritage protection is also a key theme in Historic England's more recent *Research Strategy* (2016) and *Corporate Plan* (2017). The incorporation of the project's results into the Norfolk and Suffolk HERs, and eventually the NRHE, will ensure better heritage protection across the project area: those charged with the management and guardianship of the historic environment will be better informed as to the existence, location, nature and extent of archaeological sites within the project area. For the first time, this information will not be 'hidden' on a variety of aerial sources, stored at several different locations, but readily accessible in a standardised and comprehensible format, namely HER records and maps (accessible online via each HER's 'Heritage Explorer' website). The mapping created by the project will also be provided directly to the Forestry Commission, who own and/or manage approximately 60% of the Stage 1 area. The fact that such a large proportion of the archaeological features recorded by the project still survive as earthworks, in particular within the forestry plantations managed by the Forestry Commission, means that the provision of accurate mapping to land managers – and those providing them with heritage advice – is of especially vital importance.

Recommendations for Heritage Protection and Further Work

As agreed in the Project Design (Tremlett 2016), a list of heritage protection recommendations – including sites for potential designation – is included as Appendix 3. This list is not exhaustive, nor is it intended to be proscriptive, but rather it includes the sites that appeared to the air photo interpreters to be the most significant, best preserved or with the greatest potential to benefit from additional work or heritage protection measures.

A list of suggested updates to the NHLE has also been compiled, and is included as Appendix 4. This lists all 19 Scheduled Monuments within the Stage 1 area, plus an additional two NHLE sites which fall just outside but were included in the survey. For most sites where an update is recommended, this relates to correcting the locational information for the site to correlate with the mapping resulting from the project. For most NHLE sites, the provision of updated and more accurate information regarding location and extent has been the project's

most obvious contribution. However, by providing enhanced contextual information, by mapping, interpreting and recording other sites in the vicinity, the project has also improved our understanding of many of the NHLE sites in the project area.

In addition, the project team have compiled a list of more broad-based suggestions for future work in the area. These are focussed more on future investigation and research, rather than heritage protection, and deal with themes and landscapes, rather than specific sites. The list is already being circulated to relevant stakeholders (such as Anne Mason, local researcher and Chair of Friends of Thetford Forest), and is included below.

Suggestions for Future Work

Aerial Photograph and Lidar Assessment and Mapping

Even after the completion of Stage 2 of the Breckland AIM Project, there will still be areas of the BNG lidar survey that have not been assessed. The identification of unknown, mis-located and/or partially recorded sites within these areas should be seen as a priority.

It would be useful to assess the aerial photographic material held by USAF Lakenheath; for example, the record for a field system recorded prior to the survey (SHER BRD 039) refers to a 1970s USAF aerial photograph. An attendee at a 'Brecks from Above' talk mentioned the existence of a large collection of photographic material at Lakenheath.

Neolithic Flint Mines

The project tentatively identified a number of sites possibly related to Neolithic flint mining. An investigation of these sites on the ground, perhaps including field walking or, where viable, geophysics, might help to throw light on the nature of the sites (they could instead be natural, or relate to 19th or 20th century quarrying).

Bronze Age Round Barrows

The project recorded large numbers of mounds and possible round barrows. Many had been recorded previously, but many others were new discoveries. The majority of the sites would benefit from a visit to better establish their character and record their condition. Many were recorded solely from lidar imagery, and some might be the product of the laser re-bounding from dense vegetation,

rather than the presence of an earthwork. Even those sites recorded prior to the survey would benefit from this, as many have not been visited for many years (or, at least, have not had a visit that has been recorded in the HERs).

More broadly, the Breckland barrows would benefit from a more holistic assessment, as a regional group. Their density, layout and variety of form has parallels with funerary landscapes recorded elsewhere, such as Salthouse Heath in north Norfolk.

Unfortunately, as relatively few of the known or possible barrows have been excavated (at least under modern conditions) establishing even relative chronologies within the group will be extremely difficult. However, it would be beneficial to at least review the dating evidence – and that for contemporary activity in Breckland – to establish a baseline.

Iron Age/Romano-British/Saxon

Where are the sites for these periods? There is plentiful evidence from outside the forested areas (Hockwold, Brandon, Two Mile Bottom, Thetford, A11 Improvements), but relatively little from within the plantations. Where activity is known (High Lodge, Lynford), the evidence is principally in the form of finds, any remains having presumably been levelled, or confused with evidence for later activity.

It is highly likely that Iron Age, Romano-British and Saxon populations were using the areas now under forest cover – and in particular the Little Ouse Valley – as intensively as the areas outside the forestry plantations. The fact that this is not apparent from the air photo and lidar mapping, however, means that land managers need to be aware of the potential to damage 'missing' or hidden sites, and future research needs to target this gap in knowledge.

As for other themes and periods, assessments which draw together all existing information would be beneficial in establishing baselines for specific topics. These can then be used as the springboard for future work. For example, a review of Anglo-Saxon material from the area might help identify the site of potential burials within contemporary or pre-existing round barrows.

Medieval to Post-Medieval Sites

St Helen's Church, Santon

It would be useful for the air photo and lidar evidence – and the mapping produced by the project – to be more closely correlated with the excavated

evidence and with the 1:2500 survey which Historic England records as being carried out in the 1970s, but which was not located by the AIM survey.

Geophysical survey might help establish the location of buried masonry or other features.

Rabbit Warrens

This report includes a summary of the results for each rabbit warren covered by Stage 1; this comprises: Broomhill/Weeting, Downham High Warren, Elveden, Santon, Santon Downham and Thetford with complete or near-complete coverage, and Brandon, Eriswell, Lakenheath, Methwold and Wangford with partial coverage. Further work to link the mapping for these warrens with documentary research and fieldwork would be really helpful, as this level of detailed research and data integration has been beyond the scope of the survey. Introducing some chronological depth to the boundaries and enclosures defining and within the warrens would be particularly useful – for example identifying the various phases of activity in Downham High Warren, and interpreting what the different types of boundaries were used for (and when). High Lodge, which has already been the subject of a considerable amount of research and fieldwork, might be a good starting point.

The kind of work just described would be extremely useful for feeding into proposed work looking into designating some of Breckland's warrens (Caroline Skinner, HE, pers comm). It would be helpful to have further discussions with both Historic England and the HERs about what kind of information they need to enhance their records and support the case for designation.

There are warren-type enclosures outside of the 'known' warrens. Are they related to warrening or to something else?

Ridges

What is the date and origin of the blocks of ridges (reminiscent of ridge and furrow) visible on the lidar? Some may be modern and related to forestry, but most of those mapped appear earlier, and have relationships with former boundaries.

Water Meadows

Possible water meadows have been identified all along the Little Ouse – not just by the survey reported on here, but also by Professor Tom Williamson (UEA). Are these all really water meadows or are some of them osier beds? Could they relate to something else instead? Documentary and cartographic research may be helpful.

Flint Mining

There are at least two distinct types of feature visible on the aerial sources at the post-medieval flint mining sites: circular pits, usually surrounded by a crescent-shaped spoil heap, and chains of pits which join up to make gullies. A possible third type – shallow, closely spaced pits – was identified by the field survey at Ling Heath (Pearson 1996), and is also visible (but not particularly distinctive) on the aerial sources. Only the first type is fully described in the literature. Are the conjoined pits/gullies earlier features? Or do they represent a different type of mining, or a different stage in the mining process? Similarly, are the shallow pits also related to flint mining at a different time and/or using a different method of extraction, or were they created by a different process, such as the extraction of sand or gravel?

20th Century Activity

There is lots of information relating to 20th century activity which is visible on the photographs (and to a lesser extent the lidar), but has not been mapped or interpreted in detail, as such work falls outside the scope of the project. Others with a specialist interest in this period would be in a better position to further investigate and interpret these sites, in terms of knowledge and time/resources. The project's records define the sites (or, at least, those within scope) by extent, and give a brief summary of what is visible, and also signpost the relevant sources (usually photographs held by the Historic England Archive in Swindon). These records can be used as the starting point for a more detailed study of specific sites.

Future work could include not only military sites but other features relating to notable developments in the area – the establishment of Thetford Forest, the labour camps, the establishment (and removal) of industrial sites, etc.

Structures visible within the forest on 1940s aerial photographs – such as huts lining forest rides – could relate to military activity or to forestry. Similarly, High Lodge Labour Camp may have been in military use in the Second World War, but it has been difficult to identify features or structures relating to this on the aerial photographs. However, a researcher (or researchers) with more detailed knowledge of the site, and who can also access documentary and oral history research, would be in a better position to address these questions.

BIBLIOGRAPHY

Albone, J, Massey, S and Tremlett, S 2007 'The archaeology of Norfolk's coastal zone. The results of the National Mapping Programme'. Norfolk: Historic England and Norfolk County Council (unpublished)

Ashwin, T 1996 'Neolithic and Bronze Age Norfolk'. *Proceedings of the Prehistoric Society* 62, 41–62

Bales, E and Pendleton, C 2001 'Rapid Earthwork Identification Survey for Forest Enterprise'. Suffolk: Suffolk County Council Archaeological Service (unpublished report 2001/93)

Bales, E, Cattermole, A, and Horlock, S with Tremlett, S 2011 'The archaeology of Thetford 'Growth Point' and environs. Results of the Thetford Growth Point National Mapping Programme (NMP) project. English Heritage project no. 5313'. Norfolk: Historic England and Norfolk County Council (unpublished)

Barber, M, Field, D and Topping, P 1999 *The Neolithic Flint Mines of England*. English Heritage

Barber, M, Field, D and Topping, P 2000 'Grime's Graves Norfolk'. Cambridge: Royal Commission on the Historical Monuments of England (Survey Report, unpublished)

Bates, S 2003 'Part 3. Excavations at Two Mile Bottom, Thetford, 1995–6 (site 5738)', in Bates, S and Lyons, A *The Excavation of Romano-British Pottery Kilns at Ellingham, Postwick and Two Mile Bottom, Norfolk, 1995–7*. (East Anglian Archaeology Occasional Papers 13). ALGAO East of England, 57–95

Bishop, B 2012 'The Grime's Graves Environs Survey. Exploring the social landscape of a flint source'. Unpublished PhD thesis, University of York

Breckland Society 2010 *The Warrens of Breckland. A Survey by the Breckland Society*. Available at http://www.brecsoc.org.uk/projects/warrens-project/

Breckland Society 2016a *Flint in the Brecks. A Report by the Breckland Society*. Available at http://www.breakingnewground.org.uk/our-projects/a-window-into-the-past/flint-in-the-brecks/

Breckland Society 2016b *The Military History of the Brecks 1900—1949. A Report by the Breckland Society*. Available at http://www.breakingnewground.org.uk/our-projects/a-window-into-the-past/brecks-military-history/

Breckland Society 2017 *The Internal Archaeology of the Breckland Warrens. A Report by the Breckland Society*. Available at http://www.breakingnewground.org.uk/our-projects/a-window-into-the-past/the-internal-archaeology-of-the-warrens-and-lodge-sites/

Brudenell, M 2017 'Late Bronze Age to Middle Iron Age, *c.* 1150 – 100 BC'. (Unpublished period-based summary written for the Regional Research Framework Review). Available at http://eaareports.org.uk/algao-east/regional-research-framework-review/

Cushion, B 1995 'St Helen's picnic site, Santon. Norfolk County Sites and Monuments Record No 5688 (Part). Brief Archaeological Assessment for Forest Enterprise'. (Unpublished)

Edwards, P 2009 *Elveden Conservation Area Appraissal*. Forest Heath District Council

English Heritage 2012 *National Heritage Protection Plan*. English Heritage

Gibson, C 2004 *Lines in the Sand: Middle to Late Bronze Age Settlement at Game Farm, Brandon*. (East Anglian Archaeology Occasional Paper 19). ALGAO East of England

Gurney, D 1986 *Settlement, Religion and Industry on the Fen-edge: Three Romano-British Sites in Norfolk*. (East Anglian Archaeology 31). ALGAO East of England

Gurney, D 2005 'Roman Norfolk (c. AD 43–110)', *in* Ashwin, T and Davison, A (eds) *An Historical Atlas of Norfolk*. Chichester: Phillimore, 3rd edition, 28–29

Harrison, S 2003 'The Icknield Way: some queries'. *The Archaeological Journal* 160, 1–22

Healy, F, Marshall, P, Bayliss, A, Cook, G, Bronk Ramsey, C, van der Plicht, J, and Dunbar, E 2014 *Grime's Graves, Weeting-with-Broomhill, Norfolk. Radiocarbon Dating and Chronological Modelling. Scientific Dating Report* (Historic England Research Report Series no. 27-2014). Available at http://research.historicengland.org.uk/Report.aspx?i=15259&ru=%2fResults.aspx%3fp%3d1%26n%3d10%26a%3d4784%26ns%3d1, accessed 12th October 2018

Historic England 2015a *Action Plan 2015—2018*. Previously available at http://historicengland.org.uk/imagesbooks/publications/he-action-plan-2015-18/, accessed 14th July 2015

Historic England 2015b *Valuing Our Past Enriching Our Future. Historic England Corporate Plan 2015 to 2018*. Available at http://historicengland.org.uk/images-books/publications/he-corp-plan-2015-18/, accessed 14th July 2015

Historic England 2016 *Research Strategy*. Available at https://historicengland.org.uk/research/agenda/, accessed 25th May 2018

Historic England 2017 *Three Year Corporate Plan 2017—20*. Available at https://historicengland.org.uk/about/what-we-do/corporate-strategy/, accessed 13th June 2017

Holt-Wilson, T 2017 *The Brecks Earth Heritage Trail*. Norfolk Geodiversity Partnership

Horlock, S and Tremlett, S with Ford, E 2016 'National Mapping Programme Project for the Suffolk Coast and Heaths AONB. Heritage Protection Commissions Programme Project No. 7085'. Norfolk: Historic England and Norfolk County Council (unpublished)

Kokalj, Ž, Zakšek, K and Oštir, K 2011 'Application of sky-view factor for the visualization of historic landscape features in lidar-derived relief models'. *Antiquity* 85 (327), 263–273

Lang, C, Palfryman, C and Willett, M undated 'Breckland Society flint mine survey Sep/Nov 2014. Site ref BRD 067 – MSF988. Elms Plantation Brandon'. The Breckland Society (unpublished)

Lees, M 2013 'A11 Fiveways to Thetford road improvements. A post excavation assessment of archaeological excavations 2012–2013'. Cambridgeshire: Pre-Construct Archaeology (unpublished report R11454; draft)

Martin, E 1999 'The Bronze Age', *in* Dymond, D and Martin, E (eds) *An Historical Atlas of Suffolk*. Suffolk County Council/Suffolk Institute of Archaeology and History, 3rd edition, 38–39

Martin, E and Satchell, M 2008 *'Wheare most Inclosures be' East Anglian Fields: History, Morphology and Management*. (East Anglian Archaeology 124). ALGAO East of England

Medlycott, M 2011 *Revised Research Framework for the Eastern Region*. (East Anglian Archaeology Occasional Paper 24). ALGAO East of England. Available at: http://www.eaareports.org.uk/

Pearson, T 1996 ‘Lingheath Farm, Brandon, Suffolk’. Cambridge: Royal Commission on the Historical Monuments of England (Archaeological Field Survey Report, unpublished)

Plouviez, J 1999 'The Roman period', *in* Dymond, D and Martin, E (eds) *An Historical Atlas of Suffolk*. Suffolk County Council/Suffolk Institute of Archaeology and History, 3rd edition, 42–43

Sussams, K 1996 *The Breckland Archaeological Survey 1994–1996*. Suffolk County Council/Norfolk Museums Service

Tester, A, Anderson, S, Riddler, I and Carr, R 2014 *Staunch Meadow, Brandon, Suffolk. A High Status Middle Saxon Settlement on the Fen Edge*. (East Anglian Archaeology 151). ALGAO East of England

Tremlett, S 2016 ‘Project design for a National Mapping Programme project for part of the Norfolk and Suffolk Breckland region (revised). English Heritage ref. 7014 PD’. Norfolk: Norfolk County Council (unpublished, revised January 2016)

Wade-Martins, P 2016 ‘The date of the west Norfolk linear earthworks – an unresolved debate’. *Norfolk Archaeology* 47(iii), 329–333

Wade-Martins, P with Everett, J (eds) and photography principally by Edwards, D 1999. *Norfolk from the Air. Volume 2*. Norfolk Museums Service

Watkins, P 2006 ‘An archaeological evaluation in advance of the A11 Fiveways to Thetford road improvement scheme’. Norwich: NAU Archaeology (unpublished report 1080; draft)

Williamson, T 2006a *England's Landscape Volume 2: East Anglia*. London: Collins

Williamson, T 2006b *The Archaeology of Rabbit Warrens*. Shire Archaeology

Wilson, D 2000 *Air Photo Interpretation for Archaeologists*. Stroud: Tempus

Winton, H 1998 ‘The cropmark evidence for prehistoric and Roman settlement in West Lincolnshire’, *in* Bewley, R (ed) *Lincolnshire’s Archaeology from the Air*. (Occasional Papers in Lincolnshire History and Archaeology 11). Lincoln: The Society for Lincolnshire History and Archaeology, 47–68

Winton, H 2015 ‘Standards for National Mapping Programme projects’. Swindon: Historic England (unpublished)

Zakšek, K, Oštir, K and Kokalj, Ž 2011 'Sky-View Factor as a Relief Visualization Technique'. *Remote Sensing* 3, 398–415

APPENDIX 1. METHODOLOGY

The methodology employed by the project for the most part conformed to that detailed in the Project Design (Tremlett 2016, 12-16, 45-59). It was based on 'Standards for National Mapping Programme projects' (Winton 2015), but drew upon the prior experience of the Air Photo Interpretation Team of undertaking NMP/AIM projects in Norfolk and Suffolk.

Archaeological Scope of the Survey

All archaeological monuments, both plough-levelled and upstanding, dating from the Neolithic period to the 20th century, including industrial sites pre-dating 1945 and military remains up to the Cold War, were recorded. Those features adequately depicted by readily accessible historical maps, existing surveys or excavation plans were usually ignored. However, where they formed part of a larger record, for example a warren boundary, or where they had been recorded by previous surveys but existing locational information was inaccurate, they were depicted in the mapping.

AIM projects are intended to provide only assessment-level data, at a nominal scale of 1:2,500. Any detail not clearly visible and comprehensible at a 1:2,500 output scale was usually omitted, eg internal features within buildings.

Plough-Levelled Features

All cropmarks, parchmarks and soilmarks representing sub-surface archaeological remains were recorded.

Earthworks

All earthwork sites visible on the aerial photographs and/or lidar were mapped, unless the information visible was already recorded adequately, and at a comparable scale, by existing and readily accessible earthwork surveys. Earthworks were recorded whether or not they were still extant on the latest aerial photographs/lidar source. The accompanying HER database records specify which elements of earthwork groups are surviving or plough-levelled, and monument types were indexed with the evidence visible on the latest available photographs (usually the BNG lidar data or Google Earth). Significant archaeological features depicted on Ordnance Survey maps, such as moats, were usually included in the mapping.

Buildings and Structures

For the most part, the mapping does not include buildings other than where these are recorded as earthworks, masonry foundations or as cropmarks or soilmarks. Standing buildings that have been destroyed have been recorded where there is no other adequate record, although it is probable that a map record existed in most cases; where this was not the case, they were transcribed and the date and cause of their destruction, where known, was recorded. Buildings relating to military or industrial sites were mapped and/or defined by an 'extent of area' where appropriate.

Industrial Archaeology and Areas of Extraction

The survey recorded baseline evidence of industrial activity, such as salt-making, lime burning and brickmaking, where they could be recognised as pre-dating 1945 and only where the sites were not adequately recorded already by map evidence. Areas of former extraction were only mapped where they were judged to be of archaeological significance or had a bearing on surrounding sites; where such features had been recorded by previous surveys, an updated outline was recorded where required and when time allowed. Urban industrial areas were excluded from the recording, unless archaeologically significant or if they contained evidence for the provision of air raid shelters for workers, for example.

20th-Century Military Archaeology

All former military sites and installations, up to and including the Cold War, which were visible on the aerial photographs and lidar were recorded. First and Second World War military remains, such as airfields and camps, were recorded to an appropriate level of detail, ranging from an outline defining their extent, to the recording of all structural components, depending on their significance and the amount of time available. Isolated military sites, such as pillboxes and searchlight batteries, were mapped and recorded, again to an appropriate level of detail. Small domestic air raid shelters, which are not readily visible at 1:2500 scale, were only mapped if time allowed or their location was of particular significance.

Sites relating to post-Second World War military activity were only mapped if they related to significant activities and were characteristic of the Cold War era and strategies, ie not merely relating to general military training activities. At sites where multiple phases of 20th-century military activity were evident, a single phase was usually mapped; the air photo interpreter used their judgement as to which was the most significant and most in need of a record by

transcription. Other phases were described briefly in the descriptive record. Where Cold War features overlay a First or Second World War site, preference was usually given to the earlier site, unless the Cold War features were particularly significant and otherwise unmapped.

Coastal and Inter-Tidal Archaeology

The project area did not include any coastal or inter-tidal areas.

Post-Medieval Field Boundaries

Where post-medieval field boundaries were visible as cropmarks, earthworks or still extant on aerial photographs or lidar they were not usually plotted or recorded, in particular if they could be seen on the available Ordnance Survey mapping. If they were extensive or archaeologically significant, and/or could be confused with the remains of earlier field systems, their presence and extent may have been noted and in some cases mapped and recorded.

Post-medieval plantation boundaries depicted on readily accessible historical maps were treated in a similar manner. However, where they formed part of a larger site (such as a warren boundary, subdivision or enclosure, for example), or where they had been recorded by previous surveys but the existing locational information was inaccurate, they were usually mapped, or included in a new or updated Monument Polygon.

Ridge and Furrow and Water Meadows

All remains of ridge and furrow were recorded using a standard convention to indicate the extent and direction of the furrows. As for other sites, the distinction between earthwork and levelled ridge and furrow was made in the HER database record. A list of levelled/earthwork ridge and furrow sites will be supplied to Simon Crutchley (Historic England) for the purposes of maintaining national AIM datasets.

Areas of water meadows were mapped to a basic level of detail, usually by extent rather than in detail.

Drainage Features

It is not within the usual scope of the AIM methodology to map drainage features. Where archaeologically significant, information can generally be

derived from a detailed historical map-based search. Consequently drainage features were not recorded as part of the project.

Parks and Gardens

Earthworks and levelled landscape features associated with historic parks and gardens were recorded, including those listed in the Historic Parks and Gardens Register maintained by Historic England, Suffolk County Council's Survey of Historic Parks and Gardens in Suffolk, and Norfolk County Council's Inventory of Parks and Gardens of Special Historic Interest. Where appropriate other parkland features, such as tree avenues, may have been mapped or, more often, a note made in the record; this was done on a site-by-site basis and decisions were inevitably influenced by the amount of time available, the relative archaeological significance of the feature, and whether it could be recorded adequately from non-aerial photographic sources.

Features relating to modern or 20th-century parks and gardens may have been recorded where information on the aerial photographs added significant new information to the record. This was judged on a case-by-case basis, but might include evidence for public parks being used for allotments during the Second World War, or a record of a park or garden which has since been entirely redeveloped.

Transport

Major transport features, such as disused canals or main railways, were not mapped unless the evidence visible on the aerial photographs or lidar was considered to be of particular archaeological significance; in general, it is probable that such features were already adequately recorded by other sources such as historical maps. Smaller features, such as tramways or industrial railways, were recorded where they are not depicted on historical maps, and/or where they were archaeologically significant, for example in relation to a nearby industrial or military site.

Geological and Geomorphological Features

Geological features were not plotted unless their presence helped to define the limits of an archaeological site or feature. Geological and geomorphological features may have been noted in site records, as their presence in some instances could assist with an assessment of the archaeological potential of an area.

The geology of Breckland is of considerable interest; it is particularly noteworthy for the many traces of the last glaciation still evident in its landscape. This project report includes an interpretation of the results of the project in relation to various environmental factors, including geology. However, the constraints of the survey means that this constitutes a relatively broad-brush overview.

Sources

Aerial Photographs

The principal aerial photographic and lidar sources that were consulted by the project were as follows:

Collection	*Type*	*Media*
Historic England Archive (HEA)	Vertical, oblique, military oblique	Prints and digital
Historic England Aerial Survey	APGB data: colour verticals, infra-red, contour data	Digital
Norfolk County Council	Vertical, oblique	Prints
Suffolk County Council	SCCAS: oblique and vertical Suffolk Record Office: vertical	Prints and digital
Forestry Commission	BNG lidar, vertical photographs (only when locational information available)	Digital (lidar), prints (photographs)
Online Sources	Google Earth: vertical photographs Bing Maps: vertical photographs Environment Agency: lidar	Digital

It was not possible to consult vertical and oblique prints held by Cambridge University Collection for Aerial Photography (CUCAP) as the library is currently closed. Copies of CUCAP photographs held by other collections were consulted when available. A list of all CUCAP material for the entire project area (both Stage 1 and 2), generated from the online catalogue, will be included in the Stage 2 report. This will indicate which prints were consulted using copies held in other collections.

Only a proportion of the aerial photographs held by the Forestry Commission were supplied with any locational information. Only those prints whose location was known were consulted. For the most part, these consisted of copies of CUCAP vertical prints, the location of which could be worked out through consulting the CUCAP online catalogue.

Background Sources

The primary archival sources for the project were HER digital maps and records. HER secondary files and paper records, including grey literature reports, were not consulted as a matter of course, due to time constraints and limited accessibility (the team working remotely from the Suffolk HER, for example). Where such material was judged to be fundamental to the interpretation and recording of a site, it was consulted on a site-by-site basis. NRHE archaeological records, geology and soils maps, maps and notes from previous NMP/AIM surveys, and digitised historical Ordnance Survey maps (dating from the 1880s onwards) were consulted throughout.

A selection of bibliographic sources were used where relevant and where time allowed. However, due to the limited resources available, such additional research took place for only a limited number of sites.

Digital Transcription

Transcription was undertaken in AutoCAD, at a nominal scale of 1:2,500. Separate drawings were created for each OS 1:10,000 quarter sheet, or equivalent mapping area. As each mapping block was completed, these were combined into a master CAD drawing, from which MapInfo exports were made.

Wherever possible, archaeological features were mapped from georectified sources, such as the BNG lidar, or from scanned images rectified in AERIAL, with control information derived from OS MasterMap (usually scale 1:1250). Where necessary, and where adequate control existed, the digital terrain model function in AERIAL was used to compensate for distortion due to slope and terrain. A level of accuracy of +/- 2m should have been achieved at this scale of mapping. However, across the Stage 1 project area, there were frequent issues with inadequate or inaccurate control points, and at several sites a lower level of accuracy should be anticipated. Where the mapping was affected by such problems, a note was made in the relevant HER record(s).

Rectified images were imported into AutoCAD. Archaeological features were transcribed using a project specific set of AutoCAD layers (see Appendix 2). These were based upon and formatted in line with national AIM standards (Winton 2015; H Winton, Historic England, pers comm) and the output of other NMP/AIM projects in Norfolk and Suffolk. Additional layers (eg DITCH_DOUGHNUT and DITCH_FILL) were used to streamline the export process to MapInfo and to create ‘filled’ polygons where appropriate. Any deviations from the national AIM layer conventions have been changed back to the required format in readiness for submission to the NRHE. The original

photographic scans and rectified images will be discarded following submission of the final report.

The project used several georeferenced digital photo layers, supplied by Suffolk County Council and Historic England (images supplied to Historic England by Next Perspectives through the APGB Agreement), and on-line via Google Earth and Bing Maps. It also used lidar data supplied by BNG/Forestry Commission, or, where this was absent, Environment Agency lidar data downloadable online. (For some limited areas, no lidar data from either source was available.) When required, these digital layers were inserted into AutoCAD and mapping undertaken directly from the image; Google Earth images were inserted and 'aligned' onto the map base. In some instances, where the image file format did not support insertion into AutoCAD, mapping may have been undertaken in MapInfo. Given the limited time available to complete the mapping, rectifications were kept to a minimum, particularly where good vertical coverage (or other sources) showed the main components of sites. Where necessary, small amounts of additional detail were added directly to the plot by eye.

Once the mapping was complete, checks were undertaken before export of each required layer to MapInfo. Final editing of the mapping, for example to fill 'doughnuts' correctly, and formatting was then undertaken in MapInfo. At the end of each mapping block, and once all database records had been added, Monument Polygons defining the extent of each site were copied to the Mon layer of the relevant HER and linked to the related database record.

Database Records

Drawings

Object Data tables were created and incorporated into each AutoCAD drawing. To reduce the amount of time required, and the issue of attached data becoming outdated, this included only the Monument UID, derived from the HBSMR databases, and HER Parish Code (in Suffolk) or Pref Ref (in Norfolk), derived from blocks of codes/numbers requested from the relevant HER. This data has been exported to MapInfo along with the mapping as attached Attribute Data. Additional fields, for example 'period', 'evidence', or 'monument type', can be exported from the HER and added to the mapping as and when required. This ensured that time spent attaching Object Data to the mapping was minimised, and that any Object/Attribute data should remain up-to-date.

Norfolk and Suffolk HERs (ExeGesIS HBSMR)

HER Parish Codes/Pref Refs were allocated in liaison with the HER officers for each county. A record of each number used was maintained, continuing the method used for previous NMP/AIM projects in both Norfolk and Suffolk.

For each individual monument or group of monuments (both new and previously recorded) in Suffolk, the Air Photo Interpretation Team created a temporary record, which contained their descriptive records, sources and indexing. This information was then transferred to the live Suffolk HER in batches, team members travelling to Suffolk County Council offices to undertake this task on a periodic basis. In Norfolk, records were inputted directly, although individuals may have used a temporary Word document for greater ease of editing, etc, before cutting and pasting text into the database. Each record includes a short written description and summary, an index of monument types and dates, evidence type, locational data, and links to sources, events and other monument records, as necessary. Once the mapping was complete and imported into the HERs, each record was linked to a Monument Polygon defining the extent of the site on the HER Mon layer. Any sensitive sites have been flagged up by the Air Photo Interpretation Team and noted in the report. Once integrated into the HERs, the data will feed directly into uploads to the Heritage Gateway, and the Norfolk and Suffolk Heritage Explorer websites, with sensitive sites handled in the same way as for the core HER data.

Upon request, and once a suitable transfer mechanism is in place, copies of the mapping and records will be exported to the NRHE.

Event Records

A parent Event Record for the whole project has been created in each HER. Event Records for each mapping block and for each OS quarter sheet or mapping area were also created, within a linked hierarchy. These provide information on the compiler, date of work, associated events and any additional information that would have previously been included on the paper Map Note Sheets. Event Records at the lowest level of the hierarchy are linked to all associated monument records.

Progress Sheets

Formal progress sheets for each quarter sheet/mapping area were not kept, but team members were able to use a checklist of sources to ensure that all have been referred to. Registers of Parish Codes/Pref Refs for new and amended sites were maintained for each county, and correlated against both the completed mapping and the number of records linked to each Event Record. Time spent on

each individual project task, including mapping and recording, was recorded in a bespoke timesheet. Information on areas completed, time taken and numbers of new and amended records was included in quarterly progress reports to HE. Information required for the archive has been or will be transferred to the relevant Event record, and/or included in the Archaeological Report or Closure Report, or will form part of the Project Management file.

Reports and Publications

Archaeological Report

This is the second of three reports written/to be written to quantify and assess the results of the project. The first, funded by the Heritage Lottery Fund, summarised the results for the 'Brecks from Above' project, covering Mapping Block 1 and 54 per cent of Block 2. This report (the second), funded by HPC, updates the 'Brecks from Above' report with the results from the remainder of Block 2, and amends it to conform with AIM Standards. It has also been formatted for publication as part of the Historic England Research Report Series. Funding for Stage 2 has now been agreed, and the second phase of work started. As a consequence a third report will report on the results from Mapping Blocks 3 and 4, as well as providing an overview and assessment of the results from the project area as a whole. The reports are intended to summarise the main chronological trends and the character of the archaeological sites and landscapes recorded; to highlight any significant and/or sensitive sites and provide a synthesis of the results of the mapping and interpretation, assessing its significance in the context of both the county and the region; and to make recommendations for future work, including further aerial reconnaissance, ground truthing and ground survey, and publication.

A list of sites which might benefit from further heritage protection measures, including potential candidates for designation, is included as Appendix 3. A list of potential updates to the NHLE is also included, as Appendix 4. These will both be submitted to Historic England, Suffolk County Council and Norfolk County Council.

Data Access and Copyright

The copyright for all maps and accompanying records is held by Historic England, licensed jointly to Suffolk County Council and Norfolk County Council. The provision of the mapping and records to other users by Norfolk County Council and Suffolk County Council will be subject to a series of existing data agreements for using HER data. Within the Brecks from Above area, Norfolk County Council must grant BNG and the HLF permission to freely use samples

and images of project outputs (ie maps and records) in their own publicity and interpretation.

Storage, Data Exchange and Archiving

All photographic material on loan from the HEA, CUCAP, Suffolk County Council and the Forestry Commission was stored in a locked fire-proof cupboard within the Norfolk Air Photo Library, which is itself locked and alarmed. HEA photographs were loaned on a rolling programme, and held according to their terms and conditions.

Provisionally, all digital mapping and recording data was stored on the Norfolk County Council Environment Team shared drive for the duration of the project, as this has a daily back-up. The exported data is stored within the Norfolk and Suffolk HERs, as part of their ExeGesIS HBSMR databases and GIS data. Responsibility for storage and access lies with the HERs; the Air Photo Interpretation Team has retained copies of the data for reference purposes. Copies of the mapping and database records will be provided to the NRHE upon request and once a suitable transfer mechanism is in place.

A copy of the finalised report will be supplied to Historic England, to be made available as part of their Research Report Series.

All other project data (report files, management and administration documents, etc) have been (or will be) rationalised before archiving on the Norfolk County Council network (where appropriate, copies will be provided to Suffolk County Council and Historic England on request).

APPENDIX 2. MAPPING LAYERS AND OBJECT/ATTRIBUTE DATA

Continuing the methodology used for the Suffolk Coast and Heaths AONB NMP Project (Historic England Project 7085), object/attribute data was confined to the Mon UID and Parish Code/Pref Ref. If required, additional fields can be added as an update from the HERs, thus minimising the time spent on this task during mapping and ensuring that any attached data is up-to-date.

Again continuing from this earlier project, the following mapping layers were used:

Layer Name	*AutoCAD Object Type*	*AutoCAD Colour*	*AutoCAD Linetype*	*Description*	*Permanent/ Temporary?*	*MapInfo Layer Name*	*MapInfo Object Type and Style*
AIR_RAID_ SHELTER	Point	Red (1)	N/A	Use for small domestic air raid shelters, if mapped.	Permanent, but can be converted to circles if required. (Historic England guidelines discourage the use of points for mapping due to formatting issues)	AIM_AIR_ RAID_ SHELTER	tbc

Layer Name	*AutoCAD Object Type*	*AutoCAD Colour*	*AutoCAD Linetype*	*Description*	*Permanent/ Temporary?*	*MapInfo Layer Name*	*MapInfo Object Type and Style*
BANK	Closed polyline (wide or area feature) or open polyline (narrow feature <2m wide)	Red (1)	Continuous	Use to outline positive features (banks, platforms, mounds, etc), drawing a polygon to define wide or area features, but using a single line for narrow features <2m wide. NB. Historic England guidance requires enclosures defined by a narrow (<2m wide) bank to be mapped as a narrow 'doughnut'. These should be mapped on the BANK_DOUGHNUT layer.	Permanent	AIM_BANK	Region Fill: pattern E2 (dots), foreground E1 (Red), no background Region Border: style B1 (continuous line), colour E1 (red), width pixels = 1 Polyline: as for Region Border
BANK_ DOUGHNUT	Closed polyline	Red (1)	Continuous	As for BANK but use to outline positive features (banks, platforms, mounds, etc) which form a 'doughnut' shape when mapped. Variations in software and export processes cause these to be filled in different ways in GIS, so objects may need to be edited further in AutoCAD before export or exported separately to GIS for editing.	To be merged with BANK in MapInfo	AIM_BANK	N/A (added to AIM_BANK layer)

Layer Name	*AutoCAD Object Type*	*AutoCAD Colour*	*AutoCAD Linetype*	*Description*	*Permanent/ Temporary?*	*MapInfo Layer Name*	*MapInfo Object Type and Style*
BANK_FILL	Hatch	Red (1)	Dots (scale 2.25, angle 53 degrees)	Use to fill BANK and BANK_DOUGHNUT objects in AutoCAD, if required (eg for printing).	Temporary as not required in MapInfo where outline layers can be filled automatically.	N/A	N/A
DITCH	Closed polyline (wide or area feature) or open polyline (narrow feature <2m wide)	Green (3)	Continuous	Use to outline negative/cut features: ditches, ponds, pits, hollow ways, etc, drawing a polygon to define wide or area features, but using a single line for narrow features <2m wide. NB. Historic England guidance requires enclosures defined by a narrow (<2m wide) ditch (eg narrow ring ditches) to be mapped as a narrow 'doughnut'. These should be mapped on the DITCH_DOUGHNUT layer.	Permanent	AIM_DITCH	Region Fill: pattern B1 (solid), foreground G1 (green), no background Region Border: style B1 (continuous line), colour G1 (green), width pixels = 1 Polyline: as for Region Border

Layer Name	*AutoCAD Object Type*	*AutoCAD Colour*	*AutoCAD Linetype*	*Description*	*Permanent/ Temporary?*	*MapInfo Layer Name*	*MapInfo Object Type and Style*
DITCH_ DOUGHNUT	Closed polyline	Green (3)	Continuous	As for DITCH but use to outline negative/cut features (ditches, ponds, pits, hollow ways, etc) which form a 'doughnut' shape when mapped. Variations in software and export processes cause these to be filled in different ways in GIS, so objects may need to be edited further in AutoCAD before export or exported separately to GIS for editing.	To be merged with DITCH in MapInfo	AIM_DITCH	N/A (added to AIM_DITCH layer)
DITCH_FILL	Hatch	Green (3)	Solid	Use to fill DITCH and DITCH_DOUGHNUT objects in AutoCAD, if required (eg for printing).	Temporary as not required in MapInfo where outline layers can be filled automatically	N/A	N/A
EXTENT_OF_ FEATURE	Closed polyline	Orange (30)	Dashed x 2	Use to depict the extent of large area features such as airfields, military camps, or major extraction.	Permanent	AIM_EXTENT _OF_ FEATURE	Region Fill: none Region Border: style A3 (dashed line), colour D9 (orange), width pixels = 1
GRID	Line	White	Continuous	Use to draw grid at 1km intervals across map sheet.	Temporary (no longer required by HE)	N/A (not exported)	N/A

Layer Name	*AutoCAD Object Type*	*AutoCAD Colour*	*AutoCAD Linetype*	*Description*	*Permanent/ Temporary?*	*MapInfo Layer Name*	*MapInfo Object Type and Style*
HER_ MONUMENT _UID	Text	Yellow (2)	Arial at height 20	Use to annotate mapping with HER Mon UID number, eg MSF27212.	Temporary, to be used only if required for mapping, illustrations, etc.	N/A (not exported)	N/A
HER_PARISH _CODE [Suffolk], HER_PREF_ REF [Norfolk]	Text	Yellow (2)	Arial at height 20	Use to annotate mapping with HER reference number: in Suffolk, HER parish code, eg SOL 030; in Norfolk, HER Pref Ref, eg 26437.	Temporary, to be used only if required for mapping, illustrations, etc.	N/A (not exported)	N/A
MAP	Image	White	N/A	Use for OS 1:10,000 base maps.	Temporary	N/A (not exported)	N/A
MONUMENT _POLYGON	Closed polyline	White	Continuous	Use to indicate the extent of the monument record as defined in the Monument database. NB. Two temporary layers - MONUMENT_POLYGON_ NEW and MONUMENT_ POLYGON_AMENDED used for initial mapping, to aid transfer of data to HERs. However, all data should be on this layer for final exports and archive.	Permanent	AIM_ MONUMENT _POLYGON	Region Fill: none Region Border: style B1 (continuous line), colour D1 (black), width pixels = 1 Does not need to be displayed with AIM mapping, as should be replicated by/subsumed within HER Mon layer

Layer Name	*AutoCAD Object Type*	*AutoCAD Colour*	*AutoCAD Linetype*	*Description*	*Permanent/ Temporary?*	*MapInfo Layer Name*	*MapInfo Object Type and Style*
MONUMENT_POLYGON_AMENDED	Closed polyline	White	Continuous	Temporary layer used to indicate the extent of the monument record for Amended Records as defined in the Monument database. Required to facilitate transfer of Monument Polygons to HERs. NB. All data to be transferred to MONUMENT_POLYGON layer for final exports and archive.	Temporary	N/A (temporary export)	Region Fill: none Region Border: style B1 (continuous line), colour D1 (black), width pixels = 1
MONUMENT_POLYGON_NEW	Closed polyline	White	Continuous	Temporary layer used to indicate the extent of the monument record for New Records as defined in the Monument database. Required to facilitate transfer of Monument Polygons to HERs. NB. All data to be transferred to MONUMENT_POLYGON layer for final exports and archive.	Temporary	N/A (temporary export)	Region Fill: none Region Border: style B1 (continuous line), colour D1 (black), width pixels = 1

Layer Name	*AutoCAD Object Type*	*AutoCAD Colour*	*AutoCAD Linetype*	*Description*	*Permanent/ Temporary?*	*MapInfo Layer Name*	*MapInfo Object Type and Style*
NOTES	Various	Magenta (6)	Continuous	Use for mapping notes to archive in working drawing.	Permanent in working drawing but retained in 'clean' AutoCAD drawing and not exported. In Suffolk, some annotations may be suitable for transfer to POSSIBLES	N/A (not exported)	N/A
PITS_ QUARRIES	Closed polyline	Blue (5)	Continuous	Use for areas of former extraction. NB. Such areas will usually fall outside the scope of this NMP/AIM project.	Permanent (requested by Suffolk County Council and used by previous NMP/AIM projects in Suffolk)	AIM_PITS_ QUARRIES	Region Fill: none Region Border: style B1 (continuous line), colour I1 (blue), width pixels = 1
POSSIBLES	Various	Various	Various	Used by previous NMP/AIM projects in Suffolk for notes and sketches of features of uncertain archaeological significance.	Permanent. Requested by Suffolk County Council and used by previous NMP/AIM projects in Suffolk; can be used for information usually left on NOTES layer	AIM_ POSSIBLES	Non-standard layer with no defined style, objects remain as exported from AutoCAD

Layer Name	*AutoCAD Object Type*	*AutoCAD Colour*	*AutoCAD Linetype*	*Description*	*Permanent/ Temporary?*	*MapInfo Layer Name*	*MapInfo Object Type and Style*
RIDGE_AND_ FURROW_ AREA	Closed polyline	Cyan (4)	Dot x 2	Use to outline a block of ridge and furrow.	Permanent	AIM_RIDGE_ AND_ FURROW_ AREA	Region Fill: none Region Border: style D1 (dotted line), colour H1 (cyan), width pixels = 1
RIDGE_AND_ FURROW_ ALIGNMENT	Open polyline	Cyan (4)	Continuous	Line or arrow(s) (hand drawn not a symbol) depicting the direction of the rigs in a block of ridge and furrow.	Permanent	AIM_RIDGE_ AND_ FURROW_ ALIGNMENT	Polyline: style B1 (continuous line), colour H1 (cyan), width pixels = 1
STRUCTURE	Closed polyline (wide or area feature) or open polyline (narrow feature <2m wide)	Purple (200)	Continuous	Use to outline structures including stone, concrete, metal and timber constructions eg buildings, Nissen huts, tents, radio masts, camouflaged airfields, wrecks, fish traps, etc. NB. Historic England guidance requires enclosures defined by a narrow (<2m wide) structures (eg an unbroken blast wall) to be mapped as a narrow 'doughnut'. These should be mapped on the STRUCTURE_ DOUGHNUT layer.	Permanent	AIM_ STRUCTURE	Region Fill: pattern B1 (solid), foreground P1 (purple), no background Region Border: style B1 (continuous line), colour P1 (purple), width pixels = 1 Polyline: as for Region Border

Layer Name	*AutoCAD Object Type*	*AutoCAD Colour*	*AutoCAD Linetype*	*Description*	*Permanent/ Temporary?*	*MapInfo Layer Name*	*MapInfo Object Type and Style*
STRUCTURE_ DOUGHNUT	Closed polyline	Purple (200)	Continuous	As for STRUCTURE but use to outline structures (stone, concrete, metal and timber constructions, etc) which form a 'doughnut' shape when mapped, eg a continuous blast wall. Variations in software and export processes cause these to be filled in different ways in GIS, so objects may need to be edited further in AutoCAD before export or exported separately to GIS for editing.	To be merged with STRUCTURE in MapInfo	AIM_ STRUCTURE	N/A (added to AIM_ STRUCTURE layer)
STRUCTURE_ FILL	Hatch	Purple (200)	Line (scale 0.75, angle 60 degrees)	Use to fill STRUCTURE and STRUCTURE_ DOUGHNUT objects in AutoCAD, if required (eg for printing).	Temporary as not required in MapInfo where outline layers can be filled automatically.	N/A	N/A

APPENDIX 3. RECOMMENDATIONS FOR HERITAGE PROTECTION AND FURTHER WORK

Potential candidates for designation assessment are listed in bold type. Detailed information – accurate mapping of form and extent, written interpretation and indexing, references for aerial photographs and other sources, information on survival, and so on – is recorded for each site in the HER database for the relevant county. The database records include a link to a designation record where applicable.

Much of the heathland and forestry plantations covered by the project contained surviving earthworks of various kinds, in particular boundary banks, trackways, enclosures and mounds. While individually, many of these sites are of relatively low archaeological importance, they have considerable group value as a record of the changing use of the Brecks over time. Further survey and investigation, to ensure the continued survival of the earthworks that have historically been protected by the plantations or heathland, to better record and understand them, and to locate any as yet undetected remains, would clearly be of benefit.

At the same time, the potential for buried, pre-medieval archaeological sites to exist undetected within the same areas must also be kept in mind. Even those sites that have been recorded are poorly understood and their extent unknown. While the earthworks surviving on the Brecks are clearly of considerable significance in the local and regional context, the necessity of protecting and investigating the still 'hidden' pre-medieval archaeology of Breckland's plantations and heaths should not be forgotten.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*Parish*	*Description*	*Condition / Evidence*	*Comments / Recommendations*
MSF9884	**SHER BRD 066**	**Brandon**	**Extensive post-medieval flint mines at Ling Heath**	**Substantial areas still visible as earthworks on imagery from BNG lidar survey flown in 2015.**	**Potential for designation assessment of surviving earthworks? Significant as visible evidence of important regional industry, with international reach. Levelled areas also of interest, as mine shafts show well as cropmarks (2013), and earlier/different forms of mine shaft may be present (linear rather than pits).**
MSF37200, MSF37201	SHER BRD 257, BRD 260	Brandon	Linear spread of possible surviving earthworks and vegetation marks of potential settlement of Roman date alongside the Little Ouse to south of Hockwold Roman settlement.	Environment Agency Lidar and Google Earth imagery would suggest that some degree of earthwork survival remains. Roman pottery and tile on surface.	Site visit to check condition of site. The effects of vegetation and drainage works made the earthworks hard to confidently map and interpret in some areas. But potentially the floodplain of the Little Ouse preserves a significant spread of settlement earthworks, which may require further investigation and protection. See too BRD 007 and BRD 008 to the west (outside of project area) which are Scheduled. The potential for earthworks of similar significance to survive on the north bank of the Little Ouse, in Norfolk, should also be considered (see NHER 62016 and 5587).

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*Parish*	*Description*	*Condition / Evidence*	*Comments / Recommendations*
MSF37275	SHER BRD 310	Brandon	A small, sub-circular mound, of unknown date and uncertain archaeological significance. It is rather small for a Bronze Age round barrow, although this interpretation remains a possibility. It lies in an area of uneven ground, and could instead be of natural origin, or be a product of recent ground disturbance or forestry activity.	Visible as an earthwork on imagery from BNG lidar survey flown in 2015.	Site visit to assess archaeological significance of the feature.
MNF69026	**NHER 61495**	**Hockwold cum Wilton**	**The site of a Bronze Age round barrow cemetery comprising up to six mounds identified on the ground or on aerial photographs and lidar. The group consists of the scheduled barrow NHER 4992 (NHLE 1015254), NHER 33455-7, and another two newly identified possible mounds (NHER 61496-7).**	**The site of a Bronze Age round barrow cemetery is indicated by a cluster of up to six earthwork mounds identified on the ground or on aerial photographs and lidar.**	**One of group of six is designated as a Scheduled Monument. Potential for designation assessment of whole group, depending on condition?**
MNF69024	**NHER 61496**	**Hockwold cum Wilton**	**Low circular mound and partial ditch, probable barrow, part of cemetery (NHER 61495).**	**Earthworks visible on BNG 0.5m resolution lidar data flown in 2015 – suggesting survival – and to a lesser extent on the 1946 aerial photographs.**	**Site visit to check on existence and condition. Potential for designation assessment?**

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*Parish*	*Description*	*Condition / Evidence*	*Comments / Recommendations*
MNF69025	**NHER 61497**	**Hockwold cum Wilton**	**Low circular mound and ditch, probable barrow, part of cemetery (NHER 61495).**	**Earthworks visible on 1946 aerial photographs and to a lesser extent on the 0.5m resolution BNG lidar data, suggesting some survival.**	**Site visit to check on existence and condition. Potential for designation assessment?**
MNF69194	**NHER 61515**	**Hockwold cum Wilton**	**The site of a probable Bronze Age round barrow cemetery is indicated by a cluster of up to five possible mounds identified on the ground or on aerial photographs and lidar. The group consists of three convincing round barrows (NHER 4991, 33605 and 56274), and potentially another two newly identified possible mounds (NHER 61513-4), although these may relate to later spoil heaps.**	**The group of up to five possible mounds are visible on aerial photographs and are still visible as earthworks on imagery from BNG lidar survey flown in 2015. NHER 4991, 33605 and 56274 have been identified on the ground.**	**Site visit to ascertain the relationship between mounds (61513—61514) and the Fossditch Saxon boundary (NHER 1089) to establish date and archaeological significance. Also to look for evidence of possible circular enclosure at TL 7594 9030. Potential consideration of 'group value' of the probable barrow cemetery in terms of designation and heritage protection, also the relationship with the Saxon boundary.**
MNF69979	NHER 62079	Lynford	Possible mound, perhaps a small Bronze Age round barrow.	Visible as an earthwork on imagery from BNG lidar survey flown in 2015.	Site visit to check existence and assess archaeological significance of the feature.
MNF69623	NHER 62110	Lynford	Undated earthworks, perhaps relating to settlement and likely to be of medieval to modern date.	Visible as earthworks on aerial photographs. BNG lidar survey indicates that some elements still survive although others may have been levelled.	Site visit to check existence and assess archaeological significance and interpretation of the features. Documentary research, geophysics, field walking and/or test pitting might reveal new information about date and character of the site.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*Parish*	*Description*	*Condition / Evidence*	*Comments / Recommendations*
MNF69624	NHER 62112	Lynford	Huts, of modern, perhaps Second World War date, are visible on aerial photographs taken in 1944–1945. They may have been used by the military, or could have been used by forestry workers.	Huts removed before February 1946, but earthworks left after the removal are still visible on imagery from BNG lidar survey flown in 2015.	Site visit to check condition of earthworks. Documentary/oral history research to elucidate date and function of huts.
MNF69909	NHER 62113	Lynford	Bank-defined enclosures and boundaries, possibly relating to medieval settlement. They lie immediately to the west of the deserted medieval settlement of Santon (NHER 5688), which is designate as a Scheduled Monument (NHLE 1015256).	Visible as earthworks on aerial photographs from 1945, and then as soilmarks on aerial photographs from 1955, no above-ground remains appear to survive at the site.	Documentary research, geophysics, field walking and/or test pitting might reveal new information about date and character of the site.
MNF13719	**NHER 13719**	**Lynford**	**Probably Bronze Age round barrow.**	**Survives as an earthwork. No recorded visits since 1999, but clearly visible on BNG lidar imagery (flown in 2015).**	**Site visit to check on condition. Potential for designation assesment?**
MNF5684	NHER 5684	Lynford	Site of St Helen's Church, Santon	Earthworks mapped from 1940s aerial photographs and lidar, but complex area (amidst broader area of boundaries and trackways), and some difficulty relating features visible on aerial sources with written descriptions in HER, HEA and NHLE.	Further correlation of project mapping and aerial sources with existing records, including RCHME survey (undertaken in the 1970s), and with earthworks currently surviving. Geophysics could help elucidate the plan of the buried features. Already designated.
MNF68896	NHER 61477	Lynford	A possible mound, perhaps the site of a Bronze Age round barrow. Second mound (NHER 61478) nearby.	Visible as an earthwork on lidar imagery (flown in 2015).	Site visit required to verify existence and archaeological significance of mound.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*Parish*	*Description*	*Condition / Evidence*	*Comments / Recommendations*
MNF68897	NHER 61478	Lynford	A possible mound, perhaps the site of a Bronze Age round barrow. Second mound (NHER 61477) nearby.	Visible as an earthwork on lidar imagery (flown in 2015).	Site visit required to verify existence and archaeological significance of mound.
MNF69401	NHER 62059	Lynford	A possible mound, perhaps the site of a Bronze Age round barrow.	Visible as an earthwork on lidar imagery (flown in 2015).	Site visit required to verify existence and archaeological significance of mound.
MNF69402	NHER 62060	Lynford	A possible mound, perhaps the site of a Bronze Age round barrow. Rather flat and surrounded by a bank; both could relate to a post-medieval plantation instead.	Visible as an earthwork on lidar imagery (flown in 2015).	Site visit required to verify existence and archaeological significance of mound.
MNF69403	NHER 62061	Lynford	Circular enclosure. Probably a post-medieval plantation bank but not on historical maps and earlier origin cannot be ruled out.	Visible as an earthwork on lidar imagery (flown in 2015).	Further investigation (map research, site visit) to establish date and function.
MSF37263	SHER STN 158	Santon Downham	Small undated mound, possibly a Bronze Age round barrow. Lies less than 200m to west of Scheduled barrow STN 001 (NHLE 1018042).	Visible as an earthwork on imagery from BNG lidar survey flown in 2015.	Site visit to assess archaeological significance of the feature.
MSF16189	SHER STN 043	Santon Downham	Possible Bronze Age round barrow, designated as a Scheduled Monument (NHLE 1017786).	Small mound visible on 2015 BNG lidar survey, but smaller than originally recorded (15m rather than 32m diameter), and difficult to distinguish from other, presumably natural mounds in surrounding area.	Site visit to assess current condition and validity of interpretation.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*Parish*	*Description*	*Condition / Evidence*	*Comments / Recommendations*
MSF26322, MSF26321, MSF37024	SHER STN 097, STN 098, STN 143	Santon Downham	Two previously identified Second World War spigot mortar emplacements (STN 097, STN 098), which may equate to pits and/or an enclosure identified on lidar imagery, and a third pit (STN 143) which could feasibly represent a third emplacement.	Emplacements STN 097 and STN 098 identified during site visit in 1995, when full of water and covered in vegetation, but with structural components surviving. Pits and enclosure visible as earthworks on imagery from BNG lidar survey (flown in 2015).	Site visits to check correlation between previously recorded emplacements, and pits and enclosure visible on the lidar. Checking of third pit (STN 143) for any evidence of date and function: does it represent a third emplacement?
MSF37004	**SHER STN 118**	**Santon Downham**	**Newly identified, circular mound. Possibly a Bronze Age round barrow. Located 300m southwest of a designated round barrow (STN 005; NHLE 1016256).**	**Visible as an earthwork on BNG lidar imagery (flown in 2015).**	**Site visit to check existence and condition of mound. Potential for designation assessment?**
MSF37007	SHER STN 126	Santon Downham	Newly identified, small oval mound. Probably modern but prehistoric origin not yet discounted. Located 20m south of a Scheduled round barrow (STN 005; NHLE 1016256).	Visible as an earthwork on BNG lidar imagery (flown in 2015).	Site visit to check existence and condition of mound, and to assess potential date.
MNF69982	NHER 62000	Thetford	Possible mound, perhaps a Bronze Age round barrow. Lies within rectilinear enclosure NHER 62023.	Visible as a low, poorly defined earthwork on imagery from BNG lidar survey flown in 2015.	Site visit to check that mound exists, and assess its archaeological significance.
MNF69968	NHER 62064	Thetford	Possible circular enclosure, perhaps defining a mound; potentially the site of a Bronze Age round barrow, but earthworks low and poorly-defined, and feature could have been created by vehicle movement, at least in part.	Visible as earthworks on imagery from BNG lidar survey flown in 2015.	Site visit to assess archaeological significance of the feature.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*Parish*	*Description*	*Condition / Evidence*	*Comments / Recommendations*
MNF70441	**NHER 62464**	**Thetford, Santon Downham**	**Extensive dispersed round barrow cemetery, comprising up to 20 mounds: SHER STN 089, NHER 61555-61558, 61998, 62004, 62007, 62465-62469, 62471-62478.**	**Multiple mounds (or possible mounds) visible as earthworks on lidar imagery (flown in 2015).**	**Site visit to check for earthworks on the ground – some of the features seen on the lidar may instead be dense vegetation. Where earthworks do exist, further investigation (analytical field survey, geophysics, small-scale excavation) may be needed to confirm their identification as barrows, as some may be mounds of natural origin, while others may be small, warren-related enclosures rather than barrows. Potential for designation assessment?**
MNF69168	NHER 61501	Weeting-with-Broomhill	Small, undated, embanked square enclosure. Perhaps relates to stock or heathland management, or warrening?	Visible as an earthwork on lidar imagery (flown in 2015).	Site visit to check for existence of earthworks and to assess character and survival. Further investigation to discover date and function of the site might begin with documentary/map research. This should also investigate any potential relationship with warrens, as although similar in appearance to enclosures recorded within the warrens, it lies outside the boundaries of those currently documented.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*Parish*	*Description*	*Condition / Evidence*	*Comments / Recommendations*
MNF69172	**NHER 61502**	**Weeting-with-Broomhill**	**Probable Bronze Age round barrow cemetery, comprising four mounds. Mound excavated prior to 1934 recorded in this approximate location recorded as NHER 5649, but whether any of earthwork mounds equates to this is not known.**	**Surveyed in 1973 and depicted on Ordnance Survey maps. Visited winter 1986-7 but no convincing mounds identified. Visible on lidar imagery (flown in 2015) to varying degrees, from barely visible to moderately clear. Seen recently during brief site visit (David Robertson, formerly NHES, pers comm).**	**Site visit to check on condition. Potential for designation assessment?**
MNF69182	**NHER 61509**	**Weeting-with-Broomhill**	**Possible Bronze Age round barrow cemetery, comprising up to four possible mounds.**	**One mound (NHER 40317) identified during forestry operations in 2004; however this was barely visible on BNG lidar imagery flown in 2015. Another mound (NHER 61510) very clear on the lidar. Two further possible mounds (NHER 61511-2) are of uncertain significance.**	**Site visit to check on existence and condition. Potential for designation assessment?**
MNF69604, MNF69606, MNF69607	NHER 62046, 62047, 62048	Weeting-with-Broomhill	A group of three possible mounds, mainly visible on lidar. Their date, function and archaeological significance are uncertain. Each could potentially be a Bronze Age round barrow, and as a group they could form a cemetery.	Earthworks on 2015 BNG lidar.	Site visit to largest barrow (NHER 62046) confirmed existence and rather conical nature of the mound. A more thorough site visit, and/or further investigation is needed to elucidate the nature and significance of the mounds.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*Parish*	*Description*	*Condition / Evidence*	*Comments / Recommendations*
MNF69584	NHER 62086	Weeting-with-Broomhill	A broad, sub-rectangular ditch, possibly an enclosure, which is undated but could be linked to Roman and/or medieval settlement evidence in the vicinity. It could even represent a Roman camp. However, it could instead be more recent, be a former channel (natural or man-made) or be of non-archaeological origin,	Low(?) earthwork on 1940s aerial photographs and on 2015 BNG lidar.	Site visit to check existence, condition and character. Further investigation of the site to elucidate date and function, and to assess significance and relationship with surrounding sites.
MNF69316	**NHER 61986**	**Weeting-with-Broomhill**	**A group of probable barrow mounds, perhaps a cemetery, has been identified on the ground (NHER 29253, 33412) and also on imagery from the BNG 0.5m DTM lidar data (NHER 61982-5, 62025).**	**Earthworks visible on imagery from BNG lidar survey flown in 2015. Only NHER 29253 and 33412 visited on ground to date.**	**Potential consideration of 'group value' of the probable barrow cemetery in terms of designation and heritage protection. Those mounds newly identified from the lidar (NHER 61982-5, 62025) would benefit from a site visit to assess condition.**
MNF69377, MNF69608	NHER 62049, 62109	Weeting-with-Broomhill, Lynford	A pair of possible mounds, potentially barrows, located either side of the parish boundary.	Earthworks on 2015 BNG lidar.	Site visit and further investigation to confirm existence of mounds, and assess date, function, survival and significance.
MNF11278	NHER 11278	Weeting-with-Broomhill	The site of a substantial earthwork Bronze Age round barrow, which is located in close proximity to other barrows forming a cemetery (NHER 62104)	Earthworks visible on 0.5m resolution BNG lidar data, suggesting good survival, as also indicated by ground visits.	The lidar data indicates an outer bank is present. A site visit may be beneficial. Already designated as a Scheduled Monument (NHLE 1015258).

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*Parish*	*Description*	*Condition / Evidence*	*Comments / Recommendations*
MNF4992	NHER 4992	Weeting-with-Broomhill	The site of a substantial earthwork Bronze Age round barrow, which is located in close proximity to other barrows forming a cemetery (NHER 61495)	Earthworks visible on 0.5m resolution BNG lidar data, suggesting good survival, as also indicated by ground visits.	The lidar data indicates an outer bank is present. A site visit may be beneficial. Already designated as a Scheduled Monument (NHLE 1015254).
MNF66504	**NHER 60120**	**Weeting-with-Broomhill**	**Site of Bronze Age round barrow, located in close proximity to other barrows forming a cemetery (NHER 62104)**	**Earthworks visible on 0.5m resolution BNG lidar data. Possible outer ditch, evidence inconclusive from lidar.**	**Site visit to check on condition and existence of ditch. Potential for designation assessment?**
MNF5640	NHER 5640	Weeting-with-Broomhill	The Neolithic flint mining complex at Grimes Graves, and related sites.	Earthworks. The site is already designated as a Scheduled Monument (NHLE 1003619), and is in the guardianship of Historic England.	Although the site has been the subject of considerable amounts of investigation, it would be beneficial, as far as the record is concerned, for further work to be undertaken to collate all sources of information, up to the present day, and for this to be added in a coherent and uniform way to the Norfolk HER, the HEA, and the NHLE. At the moment, all three sources contain different information, often linked to different sources, and often out-of-date, so that an overall view of all the work that has taken place – and its results – is currently lacking.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*Parish*	*Description*	*Condition / Evidence*	*Comments / Recommendations*
MNF68964	**NHER 61485**	**Weeting-with-Broomhill**	**Small low circular mound, possible small barrow, part of cemetery (NHER 61498).**	**Earthworks visible on 0.5m resolution BNG lidar data, suggesting survival. Archaeological significance uncertain, could relate to modern activity.**	**Site visit to check on existence and condition. Potential for designation assessment of group NHER 61498?**
MNF69027	**NHER 61486**	**Weeting-with-Broomhill**	**Small low circular mound, possible small barrow, part of cemetery (NHER 61498).**	**Earthworks visible on 0.5m resolution BNG lidar data, suggesting survival. Archaeological significance uncertain, could relate to modern activity.**	**Site visit to check on existence and condition. Potential for designation assessment of group NHER 61498?**
MNF69028	**NHER 61487**	**Weeting-with-Broomhill**	**Small low circular mound, possible small barrow, part of cemetery (NHER 61498).**	**Earthworks visible on 0.5m resolution BNG lidar data, suggesting survival. Archaeological significance uncertain, could relate to modern activity.**	**Site visit to check on existence and condition. Potential for designation assessment of group NHER 61498?**
MNF69029	**NHER 61488**	**Weeting-with-Broomhill**	**Small low circular mound, possible small barrow, part of cemetery (NHER 61498).**	**Earthworks visible on 0.5m resolution BNG lidar data, suggesting survival. Archaeological significance uncertain, could relate to modern activity.**	**Site visit to check on existence and condition. Potential for designation assessment of group NHER 61498?**
MNF69030	**NHER 61489**	**Weeting-with-Broomhill**	**Small low circular mound, possible small barrow, part of cemetery (NHER 61498).**	**Earthworks visible on 0.5m resolution BNG lidar data, suggesting survival. Archaeological significance uncertain, could relate to modern activity.**	**Site visit to check on existence and condition. Potential for designation assessment of group NHER 61498?**

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*Parish*	*Description*	*Condition / Evidence*	*Comments / Recommendations*
MNF69031	**NHER 61490**	**Weeting-with-Broomhill**	**Small low circular mound, possible small barrow, part of cemetery (NHER 61498).**	**Earthworks visible on 0.5m resolution BNG lidar data, suggesting survival. Archaeological significance uncertain, could relate to modern activity.**	**Site visit to check on existence and condition. Potential for designation assessment of group NHER 61498?**
MNF69063	**NHER 61491**	**Weeting-with-Broomhill**	**Small earthwork mounds, possibly associated with possible barrow cemetery (NHER 61498).**	**Earthworks visible on 0.5m resolution BNG lidar data, suggesting survival. Archaeological significance uncertain, could relate to modern activity.**	**Site visit to check on existence, condition and archaeological significance. Potential for designation assessment of group NHER 61498?**
MNF69066	**NHER 61492**	**Weeting-with-Broomhill**	**Small oval mound, possible small barrow, part of cemetery (NHER 61498).**	**Earthworks visible on 0.5m resolution BNG lidar data, suggesting survival. Archaeological significance uncertain, could relate to modern activity.**	**Site visit to check on existence, condition and archaeological significance. Potential for designation assessment of group NHER 61498?**
MNF69067	**NHER 61498**	**Weeting-with-Broomhill**	**The site of a probable Bronze Age round barrow cemetery is indicated by a cluster of up to ten mounds identified on the 0.5m resolution BNG lidar data (NHER 61485-92) or on the ground (NHER 33623-4).**	**Earthworks visible on 0.5m resolution BNG lidar data, suggesting survival.**	**If the mounds do appear to represent funerary group then possible consideration for designation assessment might be appropriate.**

APPENDIX 4. POTENTIAL UPDATES TO THE NATIONAL HERITAGE LIST FOR ENGLAND

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*NHLE No. (source: NHLE dataset)*	*Legacy UID. (source: NHLE dataset)*	*Current NGR (source: NHLE dataset)*	*Description (source: NHLE dataset)*	*Scheduled Area on NHLE Accurate?*	*Condition*	*Comments / Recommendations*
MNF5640	5640	1003619	NF 66	TL 81698 89878	Grimes Graves, including round barrow in Grimes Graves Plantation	Yes	Earthwork on 2015 BNG lidar survey.	Although the site has been the subject of considerable amounts of investigation, it would be beneficial, as far as the record is concerned, for further work to be undertaken to collate all sources of information, up to the present day, and for this to be added in a coherent and uniform way to the Norfolk HER, the HEA, and the NHLE. At the moment, all three sources contain different information, often linked to different sources, and often out-of-date, so an overall view of all the work that has taken place – and its results – is currently lacking.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*NHLE No. (source: NHLE dataset)*	*Legacy UID. (source: NHLE dataset)*	*Current NGR (source: NHLE dataset)*	*Description (source: NHLE dataset)*	*Scheduled Area on NHLE Accurate?*	*Condition*	*Comments / Recommendations*
MNF5587	5587	1003621	NF 299	TL 75688 87281	Leylands Farm Romano-British site, Hockwold (NHLE); site of a substantial Roman settlement with a strong religious focus, known from cropmarks, excavations, fieldwalking evidence and metal-detected finds (NHER)	The aerial photograph evidence indicates that the site extends further to the west, south and east – although to the east it is harder to distinguish between Roman and later evidence	LIDAR Environment Agency TL7587, TL7687 DTM_2M 2005-2010 and Google Earth imagery from 2006 both indicate the survival of earthworks within the eastern part of the site.	The eastern part of the site exhibits good earthwork survival in places and would benefit from a ground visit to assess condition. The site is also more extensive than previously recorded and the NHLE boundary should be amended to show this.
MNF5636	5636	1003702	NF 394	TL 77774 87869	Roman building E of Fengate Farm	Yes	Latest Google Earth imagery (2007) shows location of building under grass.	Cropmarks of enclosures and boundaries associated with building mapped from aerial photographs, providing context (NHER 5636), but nothing added to record of building.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*NHLE No. (source: NHLE dataset)*	*Legacy UID. (source: NHLE dataset)*	*Current NGR (source: NHLE dataset)*	*Description (source: NHLE dataset)*	*Scheduled Area on NHLE Accurate?*	*Condition*	*Comments / Recommendations*
MNF1089	1089	1004040	NF 51	TL 77110 95405	Devil's Dyke (Fossdyke or Fendyke)	The site extends beyond the current boundary.	LIDAR Environment Agency TL7588, DTM_2M 2005-2010 shows that NHLE boundary to north of Leylands Farm, Hockwold (TL 7555 8824) does not cover extent of significant surviving earthworks. Earthworks, admittedly less well preserved, do also continue as far south as Little Ouse River.	Extend the NHLE boundary to include surviving earthworks alongside Hockwold Heath and towards Little Ouse River.
MSF9826, MSF37206	BRD 018, BRD 267	1005971	SF 229	TL 78073 86597	Middle Saxon occupation on Chequer Meadow	Uncertain from aerial photo evidence.	Earthwork survival across the eastern part of the site is relatively good (Environment Agency lidar imagery from 2014, Google Earth imagery from 2003).	The Scheduled area could be extended to incorporate more of the site as mapped by the survey (see SHER BRD 267). This may be dependent, however, on the survival of features across the western part of the site.
MNF2760	2760	1014778	21410	TL 83927 84062	Thetford Warren Lodge	Yes	Extant building	None; as the site is depicted by modern Ordnance Survey mapping it was not mapped by the project.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*NHLE No. (source: NHLE dataset)*	*Legacy UID. (source: NHLE dataset)*	*Current NGR (source: NHLE dataset)*	*Description (source: NHLE dataset)*	*Scheduled Area on NHLE Accurate?*	*Condition*	*Comments / Recommendations*
MNF5626	5626	1014779	21411	TL 77808 89132	Weeting Castle moated site and 12th century manor house with post-medieval ice house	Yes.	Earthworks visible on LIDAR Environment Agency TL7789, DTM_2M 2005-2010	Identification of some additional structural elements to the north of the building, which are visible as parchmarks in July 2006. Some clearly relate to the remains of the exposed masonry foundations recorded during the earthwork survey (Brian Cushion, 1999), but additional possible subsurface walls may be visible to the north and west.
MNF4992	4992	1015254	21422	TL 75899 91073	Bowl barrow in Lynnroad Covert, 870m south east of Heath Farm	No– slight spatial correction required.	Earthwork on 2015 BNG lidar survey.	Scheduled area needs to be amended to correlate with project results.
MNF5655	5655	1015255	21423	TL 84082 87656	Bowl barrow known as Blood Hill with associated remains of a boundary bank	No – slight spatial correction required.	Earthwork on 2015 BNG lidar survey.	Scheduled area broadly accurate but could be amended slightly to correlate with project results. Boundary bank now recorded as part of more extensive site NHER 62066.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*NHLE No. (source: NHLE dataset)*	*Legacy UID. (source: NHLE dataset)*	*Current NGR (source: NHLE dataset)*	*Description (source: NHLE dataset)*	*Scheduled Area on NHLE Accurate?*	*Condition*	*Comments / Recommendations*
MNF5688	5688	1015256	21425	TL 82684 87293	Santon moated site and associated medieval settlement	Yes	Earthworks mapped from 1940s aerial photographs but also from 2015 BNG lidar. Some elements may have been levelled, but most of the more substantial elements still survive as earthworks.	Scheduled area could be expanded slightly to the north, to take in full extent of mapping by the project. It should be noted that some of the earthworks mentioned in the description of the site in the existing NHLE record could relate to the Second World War huts which lined the east-west track crossing the northern part of the site (NHER 62112).
MNF5684	5684	1015257	21426	TL 83982 87388	Site of St Helen's Church with adjacent earthworks and holy well	Site extends beyond current NHLE boundary.	Earthworks on 2015 lidar survey, but in absence of detailed plan of site it is difficult to correlate features visible on aerial sources with written descriptions in NHER, HEA and NHLE.	Scheduled area could be extended slightly to reflect project results. Further correlation of project results and aerial sources with existing records (1973 RCHME 1:2500 survey not yet examined) and re-examination of surviving earthworks. Geophysics could help elucidate the plan of the buried features.
MNF11278	11278	1015258	21428	TL 76859 90935	Bowl barrow on Bunker's Hill, 760m west of Pilgrims' Walk	Site extends beyond current NHLE boundary.	Earthworks on 2015 BNG lidar survey show good survival. Outer bank recorded.	NHLE area needs amending to fully cover earthworks, as depicted by project's mapping.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*NHLE No. (source: NHLE dataset)*	*Legacy UID. (source: NHLE dataset)*	*Current NGR (source: NHLE dataset)*	*Description (source: NHLE dataset)*	*Scheduled Area on NHLE Accurate?*	*Condition*	*Comments / Recommendations*
MNF56930	51529	1015259	21429	TL 76980 91049	Bowl barrow on Bunker's Hill, 650m west of Pilgrims' Walk	Uncertain based on air photo/lidar evidence.	Lidar data for the area of this previously recorded barrow did not reveal any convincing evidence of a mound at this location. A sub-circular/oblong mound of approximately the right dimensions was apparent 18m to the west (at TL 7695 9104). However the lidar would suggest that it is located on top of the edge of historic quarrying activity and as such it was interpreted as a spoil heap. However the evidence is not conclusive and it may represent the previously recorded barrow. It has not been included in the AIM mapping.	Further assessment in the field alongside the 0.5 resolution lidar imagery may be beneficial.
MNF5143, MNF5144	5143, 5144	1015263	21433	TL 80350 90072	Two bowl barrows 560m east of Emily's Wood	No - spatial correction required.	Earthworks on 2015 lidar survey	Update NHLE Scheduled Area to fully encompass barrows, as depicted by mapping produced by project.
MNF5616	5616	1015264	21434	TL 78673 88129	Pepper Hill bowl barrow, 400m north east of Mill Farm	Yes	Earthworks on 2015 BNG lidar survey.	None.

HER Mon UID	*HER Pref Ref (Norfolk) or Parish Code (Suffolk)*	*NHLE No. (source: NHLE dataset)*	*Legacy UID. (source: NHLE dataset)*	*Current NGR (source: NHLE dataset)*	*Description (source: NHLE dataset)*	*Scheduled Area on NHLE Accurate?*	*Condition*	*Comments / Recommendations*
MSF7460	STN 006	1015265	21435	TL 82783 86870	Bowl barrow 380m south west of Santon House	Yes	Insubstantial/poorly defined earthwork on 2015 BNG lidar survey, perhaps reflecting low height of earthwork. External ditch not visible.	None, although note SHER entry which suggests it could be a natural feature.
MSF7459	STN 005	1016256	21436	TL 80276 86790	Bowl barrow 580m north east of The Lodge, Brandon	No – spatial correction required.	Earthworks on 2015 BNG lidar survey.	Update NHLE Scheduled Area to reflect extent as recorded by the survey from lidar.
MSF16189	STN 043	1017786	31083	TL 81021 87590	Bowl barrow 100m south east of Woodcock Cottage	Yes	Small mound visible on 2015 BNG lidar survey, but difficult to distinguish from other, presumably natural mounds in surrounding area.	NHLE Scheduled area could be adjusted slightly, so that mound mapped by the survey is at centre. Site visit to assess current condition and validity of interpretation.
MSF7037	BNH 004	1018041	31098	TL 86772 79079	Bowl barrow in the garden of The Old Mill	No – spatial correction required.	Environment Agency 1m resolution Lidar indicates survival of mound and parts of the ring ditch.	Update NHLE Scheduled Area to reflect extent as recorded by the survey from lidar.
MSF7450	STN 001	1018042	31099	TL 83677 86941	Bowl barrow 230m south west of Little Lodge Farm	No - spatial correction required.	Mound, part of bank, and possible ditch visible on 2015 BNG lidar survey.	NHLE Scheduled area could be adjusted slightly to encompass entirety of monument as mapped by the survey.
MSF17763	BNH 054	1020781	30608	TL 85148 79912	Atomic bomb store on Thetford Heath	No	Extant buildings and structures.	None, although the survey has greatly enhanced knowledge of the earlier, First and Second World War phases of activity at Barnham camp.

In addition, the grid reference for Listed Building 1297901 (monument at NGR 8457 8266, 100 metres south of Friary House (Friary House not included) is incorrect. The site is located in the urban area of Thetford, whereas its current location is within forestry plantation to the west of the town.

The grid reference for HEA monument number 1498812 (NMR number TL 18 SW 24; cropmark of a possible Iron Age or Roman rectilinear enclosure visible on aerial photographs). This site is located in Great Gidding, Cambridgeshire, but appears in the HEA mapping at TL 8259 8891, in the parish of Lynford, Norfolk.

Historic England Research and the Historic Environment

We are the public body that looks after England's historic environment. We champion historic places, helping people understand, value and care for them.

A good understanding of the historic environment is fundamental to ensuring people appreciate and enjoy their heritage and provides the essential first step towards its effective protection.

Historic England works to improve care, understanding and public enjoyment of the historic environment. We undertake and sponsor authoritative research. We develop new approaches to interpreting and protecting heritage and provide high quality expert advice and training.

We make the results of our work available through the Historic England Research Report Series, and through journal publications and monographs. Our online magazine Historic England Research which appears twice a year, aims to keep our partners within and outside Historic England 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.HistoricEngland.org.uk/researchreports

Some of these reports are interim reports, making the results of specialist investigations available in advance of full publication. They are not usually subject to external refereeing, and their conclusions may sometimes have to be modified in the light of information not available at the time of the investigation.

Where no final project report is available, you should consult the author before citing these reports in any publication. Opinions expressed in these reports are those of the author(s) and are not necessarily those of Historic England.

The Research Report Series incorporates reports by the expert teams within the Research Group of Historic England, alongside contributions from other parts of the organisation. It replaces the former Centre for Archaeology Reports Series, the Archaeological Investigation Report Series, the Architectural Investigation Report Series, and the Research Department Report Series

ISSN 2398-3841 (Print)
ISSN 2059-4453 (Online)