UNDERSTANDING TORKSEY, LINCOLNSHIRE: A GEOARCHAEOLOGICAL AND LANDSCAPE APPROACH TO A VIKING OVERWINTERING CAMP

CHAPTER 1

INTRODUCTION

1 General introduction

This thesis focuses on the site of a Viking overwintering camp at Torksey, Lincolnshire (figure 1.1). Located in the Lower Trent Valley, Torksey is one of the recorded Viking winter camps in the *Anglo-Saxon Chronicle.* Overwintering camps are recorded between 855 and the early 10th century as the locations where the Viking Great Army would camp throughout the winter months during their raiding campaigns throughout Britain. With very little available archaeological evidence, Viking overwintering camps have been a subject of historical and archaeological debate over the past 120 years. The recent identification of the winter camp site at Torksey has provided a rare opportunity to examine a Viking overwintering camp from a landscape and geoarchaeological perspective.

The Viking Age is known as a period of instability and change in Anglo-Saxon England, from Viking armies sweeping through the countryside, to the settlement and integration of the Vikings into the Anglo-Saxon landscape and society. Little is known about the first years of Viking incursions. The *Anglo-Saxon Chronicle* records that the first Viking ships arrived in 787, followed by a raid at Lindisfarne in 793. The Vikings began staying throughout the winters at different camps around the country from 855, but aside from these records, and a few references in other annals, little is historically known about these first years of the Viking invasions. In addition to this dearth of historical records, there is even less archaeological evidence for the first decades of Viking invasions in England. Only one site at Repton has produced Viking Age archaeology in the location of a recorded winter camp. Discussions of the Repton excavations (chapter 2) have focussed primarily on burials and an apparent Viking-Age enclosure ditch, with little to no analysis completed on the environmental history of the site, or of the surrounding landscape. Despite having yielded little certain information about the morphology or landscape of the site, the published interpretations of the appearance of the Viking phases at Repton have become regarded as offering a reliable example of what a typical Viking winter camp looks like, and Repton is used repeatedly in comparative studies of other potential Viking winter camp sites in England and abroad.

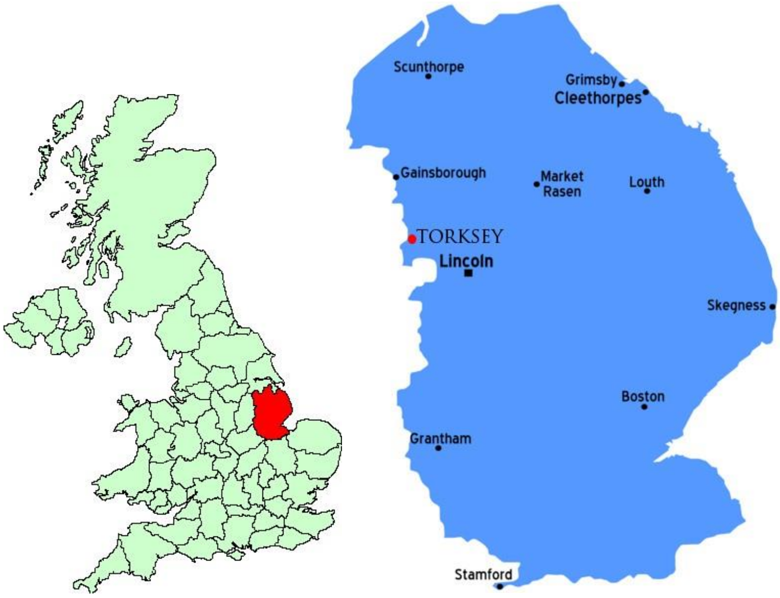


Figure 1.1: Location of Lincolnshire in the present UK, and the location of Torksey within Lincolnshire

In recent years, the location of the recorded Viking winter camp site at Torksey (recorded 872-3 AD) has been identified by Dr Mark Blackburn as the series of fields on an outcrop of Mercia Mudstone, north of the present village of Torksey, within the parish of Brampton in Torksey. Torksey is located in north western Lincolnshire, in the Trent Valley, at the western mouth of the Foss Dyke canal at the Lincoln Gap. The site was identified on the basis of a concentration of Viking metalwork dating up to the year 872 logged in the Portable Antiquities Scheme (PAS) database (Blackburn 2011). Recent work on PAS and other museum and metal detectorist collections reveals a total collection of over 1500 early medieval objects and counting, with early medieval finds accounting for about 75% of the total objects recovered from the site (Woods 2012). The recent identification of a winter camp site with no prior assumptions about the archaeology or landscape has allowed for new insights into Viking encampments of the late 9th century: why the sites were chosen, how the Army interacted with the surrounding landscape, what the landscape looked like at the time of the winter camp, what activities were taking place on the site, and any permanent impact the army and it's followers may have had on the area. The opportunity to research a newly identified winter camp site led to the formation of the Torksey Project.

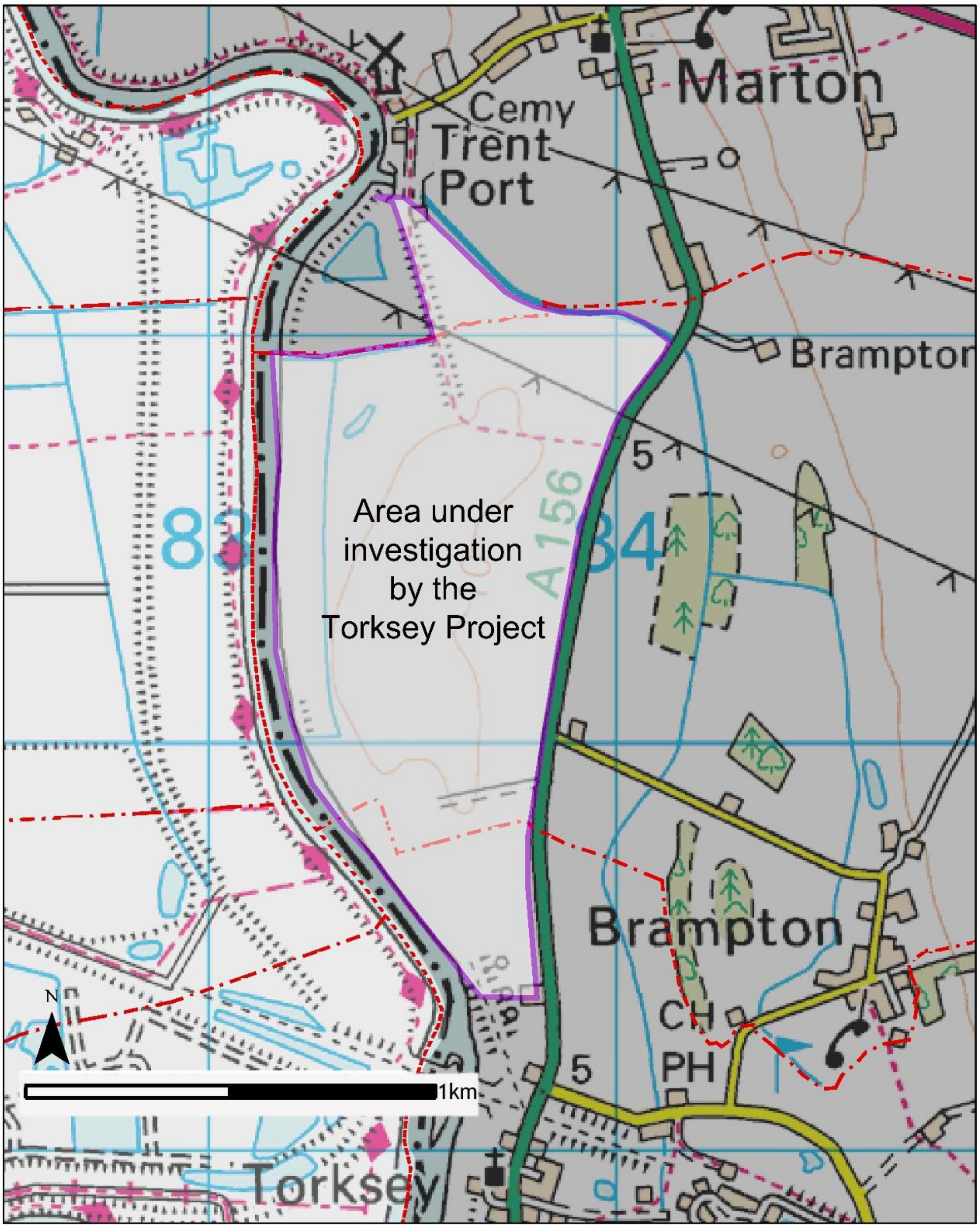


Figure 1.2: The area (outlined in purple) under investigation by the Torksey Project, and the focus of the geoarchaeological survey (chapter 5) in this thesis. This area is composed of the fields between the present settlements of Marton and Torksey. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

The Torksey Project is a collaborative project aiming to investigate the Viking winter camp at Torksey through a multi-disciplinary approach. The project is a collaboration between archaeologists at the University of Sheffield[1], University of York[2], and several external organisations[3]. The main aims of the Torksey Project are 'to understand the role and significance of Torksey by plotting the chronological and spatial development of the various centres of activity, which have been tentatively identified through metal detecting' (Torksey Project website 2014). The research being conducted includes a metal detector survey, metalwork finds cataloguing and analysis, pottery analysis of Torksey ware pottery and the associated industry, a geophysical survey, a palaeoenvironmental and geoarchaeological survey, and excavation. The study area as defined by the Torksey Project can be found in Figure 1.2**.**

The interdisciplinary nature of the project has allowed for a well-rounded and informed analysis of Torksey and the Viking winter camp. The Torksey Project is not only compiling data about the winter camp at Torksey; the methodology of the project has wider and more important implications. Since there are no identified winter camps that have been approached with such thorough multidisciplinary analysis, the results of the Torksey Project will inform future studies on Viking winter camp sites: 'The project has major implications for wider understanding of the Viking Great Army and its interaction with local populations, the development of Anglo-Saxon burhs, and the evolving nature of trade and industry in the early medieval period, and its connections with power and ideology' (Torksey Project website 2014). The inclusion of methodologies that are often neglected on early medieval sites in Britain, such as geoarchaeology and landscape archaeology, also has implications for the methodologies used in future studies of Viking overwintering camps.

[1] Co-Director Prof Dawn Hadley, Dr Gareth Perry, Samantha Stein
[2] Co-Director Prof Julian Richards, Dr Steve Ashby, Andrew Marriott
[3] Dr Gareth Williams (British Museum); Dr Søren Sindbæk (University of Aarhus); Dr Andy Woods (York Museums Trust); Hannah Brown (University of Bradford); Jane Young (freelance); Rachel Atherton (Derby Museum); Adam Daubney (Portable Antiquities Scheme)

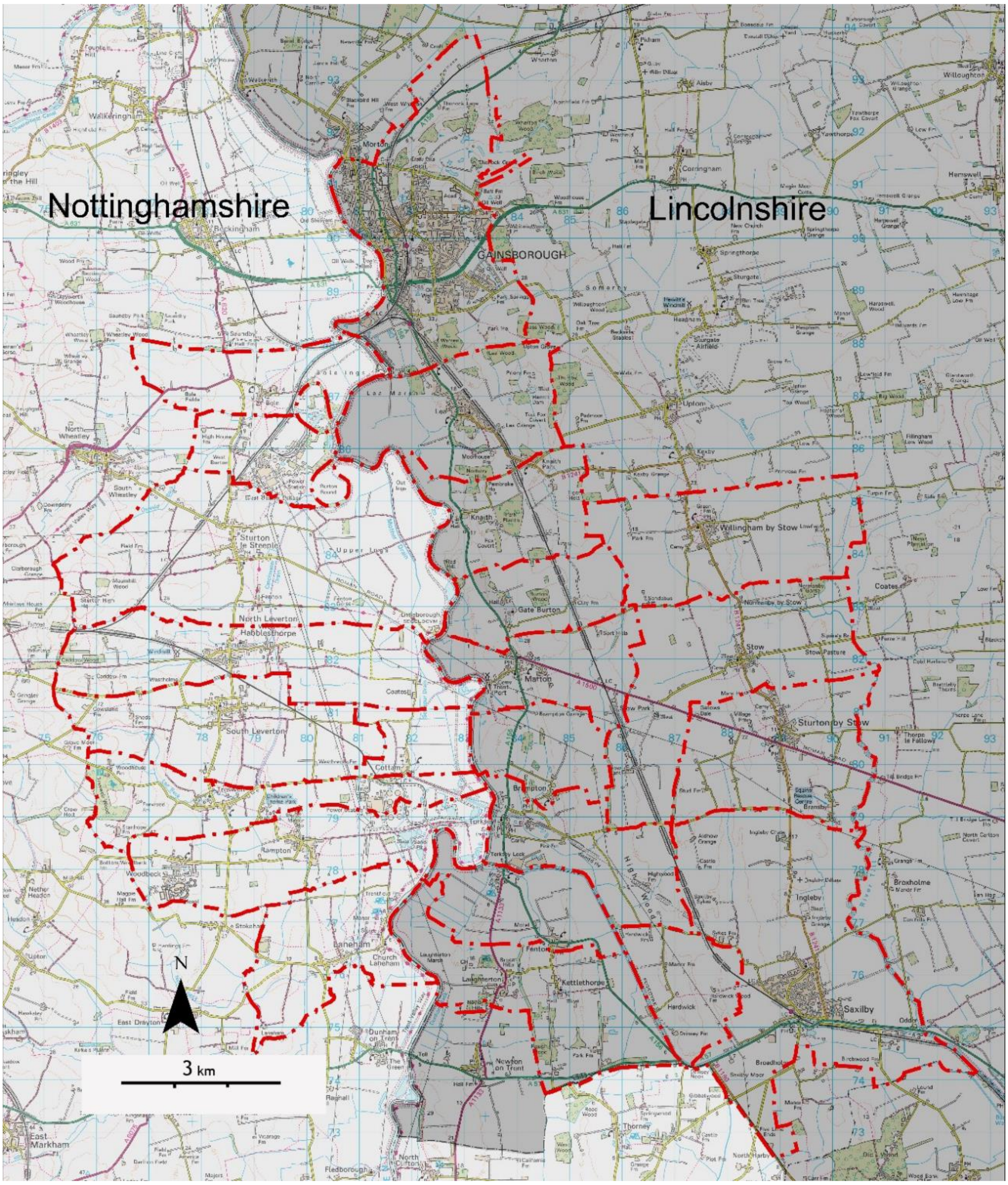
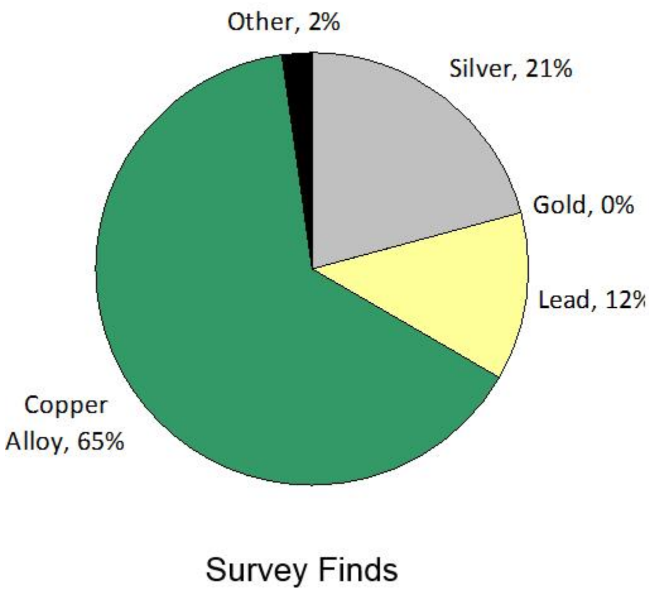


Figure 1.3: Study area of wider landscape of Torksey, which will be explored further in chapter 6. This area straddles the Trent and includes parts of both Lincolnshire and Nottinghamshire. The area is delimited by parish boundaries. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

1.1 Aspects of the Torksey Project

The site of the winter camp north of the present settlement of Torksey was first identified by a distinct concentration of metalwork found by metal detectorists and reported to the PAS. For this reason, a more regulated detector survey was continued as part of the project by providing the detectorists with hand-held GPS locators, encouraging them to log the locations of all finds from the fields. The more regular presence of the few known and trusted detectorists has also aided in keeping so-called night hawks off the fields. In addition to logging the locations of each find, the detectorists on the Torksey Project have also begun logging iron materials; iron objects are currently underrepresented among the finds recovered from the fields, as, with little monetary value, iron is not typically of interest to detectorists. Due to previously filtering out iron signals, rarer metals such as copper alloy, lead, silver, and gold compose over 90% of the finds from the winter camp site. By adding iron finds to present and future surveys, it is hoped that the final analysis will have a more representative sample of the types of early medieval artefacts that are present on the fields.



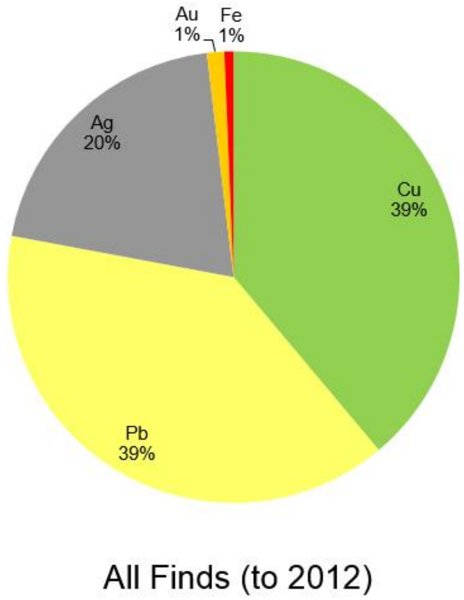


Figure 1.4: Chart demonstrating percentage of each type of material in the collection of finds both from the survey conducted by the Torksey project, as well as the metal detectorist finds as of 2012. Note that there is a higher percentage of gold artefacts than iron, as the logging of iron artefacts has only just started as of 2014. (Woods *pers. comm.* 2014).

Early analyses of the metalwork from the winter camp site at Torksey were carried out by the late Mark Blackburn (2002; 2008), and present analyses and cataloguing of data is currently ongoing by Andy Woods of the Yorkshire Museums Trust (previously of the Fitzwilliam Museum Cambridge). Up to 2012, a total of 1539 finds were logged with the Fitzwilliam Museum and the PAS. Since then, an additional 439 logged during the ongoing detectorist survey (as of 2014). Of the finds up to 2012, 75% were identified as early medieval, and ongoing detectorist survey finds contain about 40% early medieval finds.

One aspect of the analysis has included the investigation and dating of coinage found on the site to see how this evidence may relate to the year of the winter camp at Torksey. A large number of English and international coins (including 10 8th century sceattas, 105 Northumbrian stycas, 20 9th century silver pennies, and 102 Islamic dirhams) have been found on the site (Blackburn 2011; Woods 2012). These coins have been dated by Dr. Blackburn, and now by Dr. Andy Woods of the York Museums Trust, to demonstrate that the dates of circulation of each coin directly relates to the year of the Viking overwintering at Torksey, and the army's campaign throughout Europe and the middle east prior to their arrival in England. Coinage from the Islamic world date from the early 8th to mid 9th century, while coins from closer locations throughout Europe and Britain dated to the years up to the winter of 872-3. This dating of the coinage reinforces the dating of the rest of the early medieval finds, and further confirms the relationship of the finds at Torksey with the winter camp of 872-3.

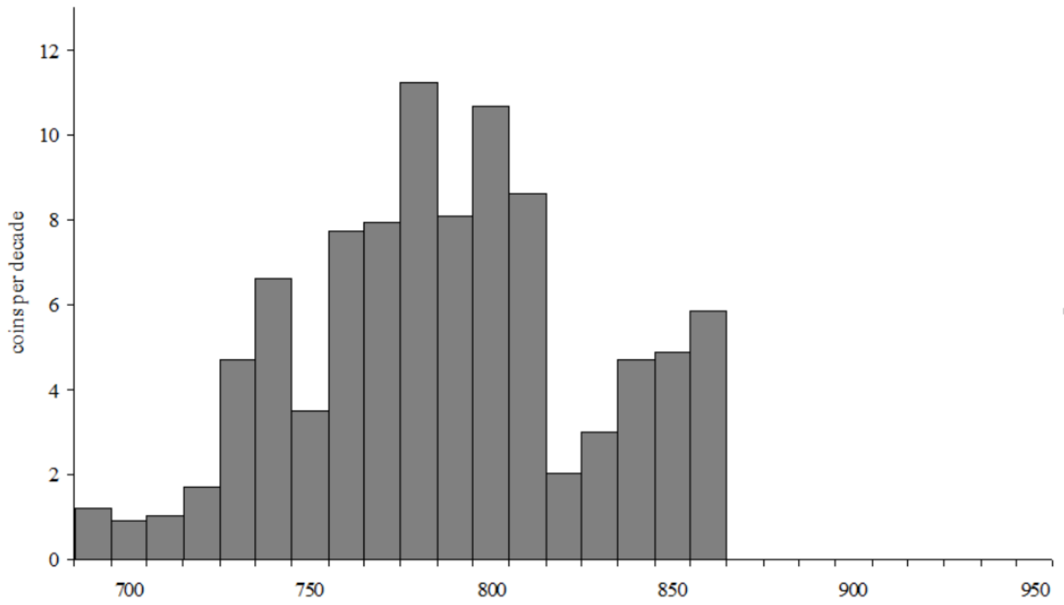


Figure 1.5: Dating of all coinage from Torksey (Blackburn 2011; Woods 2012)

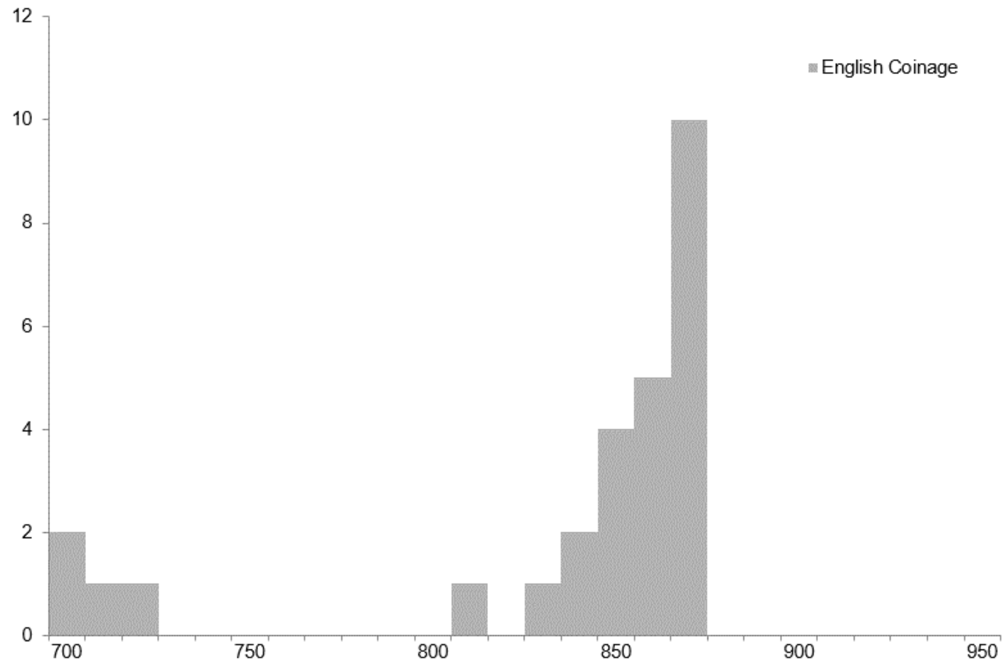


Figure 1.6: Dating of English coinage from Torksey (Woods 2012)

Another aspect of metalwork analysis is the identification and cataloguing of all the non-coinage finds from the site. From this analysis, it was demonstrated that a wide range of activities were taking place on the winter camp site. The largest number of a single type of find are lead gaming pieces; with over 400 pieces recorded, the high number of game pieces suggests that that leisure activities would have taken up a large amount of the Vikings' time. In addition to gaming, the finds include a large number of fragmentary pieces of silver, gold, and cut coins, suggesting an extensive metal weight economy. A large number of lead weights would have allowed for the standardisation of the economy. Additional fragments of metalwork are interpreted as pieces that were going to be melted down into more hackgold and hacksilver. Similar to the coinage, the metalwork is international in profile, with Irish, Carolingian, Scandinavian, as well as English pieces. Additional artefact types found at Torksey include fishing weights, spindle whorls, and needles and pins. Weaponry represents the smallest category of artefacts recovered, however many of these items would have been made of iron, and so have been excluded from the body of finds due to detectorists previously filtering out iron signals. This range of items suggests that during the winter of 872-3, the Vikings were repairing clothing or sails, fishing in the local waters, arranging the spoils of their raiding and measuring metal weights, and playing a lot of *hnefatafl*, a type of Viking board game.

Based on the dates and types of finds, it is clear that the Vikings were at Torksey after an expedition across Europe, and that at this winter camp, a wide range of domestic and possibly military activities were undertaken. The assemblage suggests that the site was not occupied over a long period of time, and supports the idea that the Great Army was only on the site for a single winter. There is a noticeable dearth of finds that post-date the 9th century from the site, which also suggests that the site was not occupied in the years following the winter camp.

South of the winter camp site, the early medieval settlement of Torksey is known for its pottery industry, which was started in the late 9th century, and continued until the 12th century (Young and Vince 2005; Leahy 2007). Excavations in 1964 by M. Barley unearthed two pottery kilns in Castle Field, south of the present settlement (see chapter 3), and since then, a total of 15 kilns have been found in and around the village. The location of Torksey on the Trent and along the Foss allowed for easy exportation of the ware, and examples of the pottery have been found in Lincoln (Young and Vince 2005), and as far as York and London. Another aim of the Torksey Project is to analyse the roots of the Torksey Ware pottery, and to determine if the Viking presence at Torksey in the late 9th century was involved in the creation of the industry. Thus far, Dr Gareth Perry has determined that the pottery industry at Torksey took advantage of the local geology, as all the raw materials required for creating Torksey Ware pottery and kilns can be found locally (Perry forthcoming). The various studies on the pottery industry have demonstrated that the local geological outcrop of mudstone naturally mixed with sand formed the kiln structures, with the Torksey Ware pottery being composed of a less calcareous local clay, with medium well-sorted sand.

A field component is also being implemented by the Torksey Project. A magnetometer survey was completed on the site of the winter camp, and in Castle Field, south of the present settlement of Torksey. The survey, completed by Hannah Brown of the University of Bradford, has shown a number of features throughout the area, including a

Romano-British enclosure on the site of the winter camp, and features related to the pottery industry in Castle Field. The results of this survey will be discussed in chapters 5 and 6, and can be found in appendix VII. A series of test pits throughout the village, and two trenches across the winter camp site were also completed, and will be described in chapter 5.

1.2 Palaeoenvironmental, geoarchaeological, and landscape survey

The final part of the Torksey Project is a palaeoenvironmental and landscape reconstruction of the site during the early medieval period, and through the winter of 872-3, which is contained within this thesis. This survey will provide the first insight into the physical landscape of a Viking winter camp in England utilising these methods.

Environmental archaeology explores the 'physical and biological elements and relationships that impinge upon a living being' (Dincauze 2000, 3). A large range of fields, including geology, biology, climatology, utilise the study of the environment. Environmental archaeology includes the investigation of climate change, geomorphology, pedology, site formation processes, landscape studies, archaeological sediments, and floral and faunal studies, to name just a few. But within the wider landscape, the environment is but only one aspect. As W. G. Hoskins stated in *The Making of the English Landscape* (1955), the English landscape is a palimpsest, though specifically what of, he did not specify. All archaeology must incorporate the landscape, just as landscape incorporates the past and present human actions. Since 1955, landscape archaeology in Britain has been defined as the past interaction and impact of humans with and on their environment. The elements of the palimpsest of the English landscape considered in this thesis is the natural geological and biological environment, the human interaction with physical changes in the environment, and the temporal effect on humans and environment. Within the landscape palimpsest, we must also consider the concept of 'place', for all human actions occur within a 'place' and 'space' where physical environment and social meanings come together (Tilley 1994, 14)

Geoarchaeology is a sub-discipline within landscape and environmental archaeology that applies geological methods and analyses to archaeological sites in order to understand the relationship of archaeology to the natural environmental and geological changes (Goldberg and Macphail 2006; Ayala *et al*. 2007; French 2002; Brown 1997). It requires a range of techniques utilised by both landscape archaeologists and environmental archaeologists. The term 'geoarchaeology' was coined in the 1970's with the use of techniques such as micromorphology, sediment analysis, and other geological methods in order to better understand archaeological deposits and site formation processes. In recent decades, the focus of archaeological, environmental, and geological research has shifted to underline the effects of the natural landscape on archaeology and the potentially dramatic effects that humans have had on their environment. Geoarchaeology can be applied on a range of scales, from microscopic analyses of archaeological sediments using techniques such as micromorphology, to site formation processes using techniques such as sediment analyses, and to analyses of landscape formation processes using geomorphological techniques such as coring and sediment mapping.

Traditionally in the British Isles, studies in prehistory have been best utilising palaeoenvironmental studies and geoarchaeology, often out of necessity due to a lack of other sources of evidence, but it is striking how little the discipline has been used in medieval contexts. Dincauze (2000, 23) explains that 'the integration of results [of environmental reconstructions into difference disciplines] and the efficiency of cooperative work can be facilitated by a strong, appropriate research design, but the communication of research goals across disciplines can be remarkably difficult'. The availability of additional lines of evidence in historical archaeology means that there is often very little room for exploration of yet another methodology. Although there have been some recent attempts to bridge the gap between geoarchaeological and medieval archaeologies (e.g. Milek 2013, Dark 2000, Macphail 2010), the general neglect of geoarchaeological studies by medieval archaeologists has been detrimental to the study of early medieval sites in particular, as there is relatively little documentary evidence to aid in understanding the archaeology of the period. The methodology utilised in this thesis hopes to fill that void in the research of Viking winter camps, by drawing on multiple, very effective methodological approaches to landscape and environment, and applying them to the archaeological investigation of the Viking winter camp at Torksey.

2 Aims and objectives of this thesis

The main aims of this thesis are to:

1) create a palaeoenvironmental reconstruction of the physical landscape of the site used by the Vikings as their winter camp of 872-3;
2) put this physical landscape into its anthropogenic context with a landscape analysis of the archaeology of the surrounding area.

These analyses will determine what the site looked like around the time of the Viking overwintering, provide some hypotheses about how the Vikings would have interacted with the physical and socio-political environment, determine what features may have been attractive to the Great Army, identify the potential impact of the winter camp on the physical and social landscape, and provide a general summary of the landscape development of the study area.

A geoarchaeological analysis of the site will produce a clear view of the physical features and surrounding environment of the winter camp site throughout the Holocene. The geoarchaeological and palaeoenvironmental survey will:

- identify all unmapped superficial deposits on the site, and characterise the present sediments
- provide insight into the superficial geological changes that occurred throughout the Holocene that may have affected the archaeological deposits in the study area.
- create a vegetation reconstruction for the area
- and identify geomorphological changes and changes in palaeoclimate and hydrology

A landscape analysis of the archaeology in the area surrounding the camp site will also help to determine the potential social interactions and political advantages this site would have presented to the Viking Great Army. To do this, the landscape study will:

- identify anthropogenic features that may have existed in the surrounding area at the time of the Viking encampment at Torksey
- determine the effect of the palaeoenvironment on the human landscape

- and examine whether the camp had any lasting effects on the contemporary surrounding landscape

Finally, the survey will consider both the landscape and geoarchaeological analyses, and determine what features may have drawn the Vikings to this location, and hypothesize how the Great Army may have interacted with the pre-existing landscape, and how the surrounding features may have contributed to the activities occurring on the site. In addition to these objectives, the results of this thesis will have implications in the wider study of Trent Valley landscapes. These implications include:

- mapping palaeochannels in the surrounding area
- assigning dating evidence to some of these palaeochannels
- determining the origins of the drainage channels and roadways in the Roman-medieval periods
- providing a practical, environmental explanation for settlement movement from the Roman-medieval periods;
- dating the Holocene aeolian reactivation phases on the winter camp site, and placing these dates in a palaeoclimatic context;
- creating a Holocene environmental history of the study area
- and mapping the unrecorded superficial deposits on the winter camp site

2.1 Geoarchaeology and the Torksey Project

A reconstruction of the physical environment throughout the early medieval period will allow contextualisation of the data produced by the other aspects of the Torksey Project. Rather than producing a conjectured image of the site based on analogy with poorly understood winter camp sites elsewhere (such as Repton), this reconstruction will allow for the accurate representation of the physical landscape of a late 9th century English Viking winter camp. By providing a detailed map of the underlying bedrock and superficial geology, the coring programme also offers some explanation for the results of the metal detectorist and geophysical surveys.

A final aim of the Torksey Project is to place Torksey and the Viking winter camp into historical, archaeological, and environmental narratives. The separate lines of research on the Torksey Project will provide insight into several aspects of the archaeology, and the evidence produced in this thesis will feed into the archaeological and environmental narratives. The results of this thesis will provide environmental and landscape data that will create an accurate physical base onto which the results of other analyses can be overlain. In addition, this thesis will produce details about the landscape and environment that would not be available without the application of geoarchaeology that directly feed into the story of the Trent Valley, Torksey, and the Viking campaigns through England in the late 9th century.

3 Thesis structure

This thesis will be presented in 8 chapters. Chapters 2 and 3 will summarise the background to the study of Viking winter camps and of the archaeology and environment of Torksey and the surrounding region. Background chapters were necessary in order to review existing knowledge of Viking winter camps, as well as to establish the already known data about the climate and environs of the Lower Trent Valley. Chapter 4 will explain the methodology behind the project, and the procedures of the different analyses used in the geoarchaeological and landscape studies. Chapter 5 will present the data and results generated by the geoarchaeological study, and chapter 6 will present the data and results generated by the landscape study. Finally, chapter 7 will combine these results and tell the story of the environment and landscape of the Viking winter camp at Torksey, while chapter 8 will demonstrate how this study has advanced the study of Viking encampments, and argue that application of the methods used in this thesis will be invaluable to the future of Viking studies.

Chapter 2 will present a brief introduction to the study of Vikings in England, and establish a summary of the previous studies completed on the topic of Viking winter camp sites. One of the primary reasons for completing this survey is that the lack of understanding of the early medieval landscape and environment has led to the introduction of inaccurate landscape reconstructions. These 'guesses' about the appearance and functionality of Viking winter camp sites have started to become part of the scholarly literature about Viking sites in England, and have even become the definitive description of a 'type site'. Chapter 2 will demonstrate that the present pre-conceptions about the physical appearance and landscapes of Viking winter camps are not based on any solid or accurate data, and that if Viking winter camps are to become a ‘type site’, with recognisable landscape features, a full landscape investigation must be completed on an identified winter camp site. Torksey offers a unique opportunity to undertake such a study; we know where the winter camp is located and the site is not encumbered by subsequent development.

A site specific background review will be presented in chapter 3. This chapter has two components: the environmental and climatic history of the wider region, and the archaeological evidence for Torksey and the surrounding area. Understanding the previously completed environmental studies in the area allows an insight into what types of sediments and geomorphological processes were common in this area, as well as providing data for the wider environmental context in which to place the results of this geoarchaeological survey of Torksey. The details of previously excavated sites in the area also provide a means of interpreting the data outlined in chapter 5. A summary and synthesis of the archaeology of Torksey and the winter camp site provides several means of understanding both sites. The archaeology reveals the degree of human occupation and use of the land at Torksey, including demonstrating where the archaeological evidence, including burials, priories, and industrial centres, were located. In this thesis, further consideration of the sediments surrounding the previously excavated archaeology has helped to define the degree to which the environmental changes in the Lower Trent Valley shaped and moulded the human interaction with the landscape at Torksey.

Chapter 4 will present the methodology used to complete both the geoarchaeological and landscape analysis. The first section will outline the methods and procedures used in the geoarchaeological analysis, including the coring and test pit recording and analysis, sediment analysis, palynology, and optically stimulated luminescence dating, and how these were catalogued, analysed, and presented. The second part of the chapter will similarly describe the methods and procedures used to complete the landscape analysis of the regional study area. This includes a list of the data sets used in the analysis, and the programmes and analyses used during the GIS analysis. Chapter 4 also includes a methodology for mapping cropmarks, although these were not used in the final analysis, and can be found in the appendices IX and X.

The data and results from the geoarchaeological and environmental survey of the winter camp site are presented in chapter 5. This begins with a map of the location of each type of sediment, followed by a full sediment description of each type of deposit encountered on the site. Following this analysis the chapter presents the results from the palynological analysis and associated radiocarbon dating. The final set of data presented in this chapter comprises the results from the OSL dating programme and portable OSL dating across the site. Finally, the chapter will present a palaeoenvironmental history of the site throughout the Holocene, up to the present day. This analysis presents the site history without any special regard to the early medieval period, as the final results from the geoarchaeological survey serves as a base on which to drape analysis of the early medieval landscape.

Chapter 6 will present the results from the landscape analysis of a larger study area, encompassing the 23 parishes surrounding the site of Torksey. This analysis is undertaken on a more restricted chronology, where the landscape of only the Roman (43BC-410AD), early medieval (410-1066AD) and late medieval periods (1066-1480) are considered (dates as defined by Knight *et al*. 2012). Though this analysis, the existing recorded archaeological sites and finds are mapped against background landscape features, including geology, topography, LiDAR, watercourses (including detected palaeochannels and drainage channels), and roads. The primary aim of mapping these features is to demonstrate the settlements, features, or buildings that were present in the landscape prior to, during, and after the Vikings overwintered at Torksey. Mapping of the archaeology in conjunction with the environmental features recorded on maps will also demonstrate the interrelated nature of environment and settlement in this part of the Trent Valley. An additional outcome of this analysis is the dating of features and boundaries throughout the study area. The results of this analysis have much wider implications in the tracking of the relationship of human settlement and environment throughout the Roman and medieval periods.

Chapter 7 will synthesise the results of the geoarchaeological and landscape survey explicitly in relation to the Viking winter camp of 872-3. In this chapter a detailed description of the appearance of the site when the Vikings arrived is presented, along with the features that would have surrounded the winter camp, including the surrounding settlements and features that may have remained in the landscape since earlier centuries. From this description, there is discussion of the reasons why the Vikings chose this site, how they would have used the site's physical characteristics, and how they may have exploited the surrounding landscape. This chapter will also consider any lasting effects that the Vikings had on the winter camp site, Torksey, and the surrounding region.

The results presented in this thesis will demonstrate the importance of the use of palaeoenvironmental and landscape studies in Viking archaeology in England. Without this survey, the ideas about what winter camps looked like would remain unsubstantiated. This is not to mean that all winter camps will look like Torksey, or that they can — or should — become a type site with an expected standard physical appearance, but, rather, it is hoped that this thesis will be the first of several landscape reconstructions of Viking overwintering camps. Chapter 8 will explain the implications of this survey to the present study of Viking overwintering camps, and will demonstrate the potential advancements that can be made to the understanding of the earliest Viking archaeology in England with the continued use of this type of methodology. The concluding chapter will also list the additional contributions of this work to palaeoenvironmental studies of the Lower Trent Valleys, and the multiple directions of further work that can be made from this research.

CHAPTER 2

VIKING OVERWINTERING CAMPS IN ENGLAND AND ABROAD

1 Introduction

There have been few attempts to define the nature of the overwintering camps of Viking armies in England, and it remains unclear to what extent they were a homogenous group of archaeological sites. There has been a tendency to assume that there must be a set of defining characteristics that can be archaeologically detected (Sawyer 1971, 129), yet these characteristics remain vague and unsubstantiated. Ideas about the nature of overwintering camps rest largely on historical sources, principally brief entries in the *Anglo-Saxon Chronicle* that rarely reveal anything more than the broad locations of the camps; the precise locations of the winter camps in relation to the places named in the *Chronicle* are almost always uncertain. Poorly-supported antiquarian estimations of the locations and appearance of winter camps have also played a significant, if highly unsatisfactory, role in shaping modern perceptions of winter camps (e.g. Hathersage Castle, Derbyshire, or Gannock's Castle at Tempsford, as identified by Chalkley-Gould 1901; discussed below). Superficial and inexpert analyses of maps have often underpinned attempts to identify the precise locations of the winter camps mentioned in the *Chronicle*, with riverine locations scrutinized for potential traces of fortifications.

There is little direct archaeological evidence for Viking winter camps, with the most well-known exception being the excavated site at Repton (Derbyshire; Biddle and Kjølbye-Biddle 1992; Biddle and Kjølbye-Biddle 2001), the interpretation of which, as we shall see, presents as many problems as it resolves. Aside from the investigation at Repton, archaeological studies of winter camps have tended to be informed by later Viking type-sites, such as the Viking settlement at York, and the evidence from later Scandinavian Viking-Age fortifications, both of which are problematic as the evidence they provide is considerably later in date, or comes from sites with very different functions (Richards 2004). And yet, despite this limited evidence, initially tentative conclusions about the physical characteristics of the winter camps have unhelpfully become part of standard archaeological literature (e.g. the description of winter camp sites in Richards 2004 or Sheehan 2008).

This chapter provides a critical review of previous interpretations of Viking winter camps, highlighting the shortcomings of previous deductions, and identifying the potential for new approaches (which will be applied to an identified winter camp at Torksey, Lincolnshire, later in this thesis) in order to revolutionise our understanding of these elusive sites. The single positively identified overwintering camp at the aforementioned Repton will also be addressed, as well as the tentatively identified sites at ARSNY (an acronym for A Riverine Site near York, Yorkshire), and Tempsford (Bedfordshire), both of which have been subject to recent fieldwork. Previous work undertaken at the overwintering camp at Torksey will also be introduced, with the most recent fieldwork on this site presented later in this thesis. The study of Irish Viking winter camps (*longphuirt*) will also be examined briefly, with a focus on the site of Woodstown (Co. Waterford, Ireland). The recent excavation of Woodstown and the ensuing interpretations provide an example of the Irish approach to the phenomenon of Viking winter camps, which provides a useful point of comparison (Russell 2003). This chapter will also address the different ways in which archaeologists have approached the identification of Viking winter camps in Britain and Ireland. These interpretations have variously envisioned the winter camps as places of maritime trade, habitation, or craft production, as temporary military encampments with few fortifications, or as fortification sites with extensive earthworks, but rarely consider that all of these activities and physical manifestations may have occurred simultaneously. In addition, previous interpretations have never considered the surrounding physical and climatic environment, and the effect that it may have had on these sites.

1.1 Terminology

Throughout this chapter and thesis, several versions of the terminology related to the Vikings, their armies, and their winter camps will be used. In this thesis, Viking winter camp, or overwintering camp, will be used to describe the encampments made by the Viking Great Army between 855 and 917, however, this is only for clarity. Distinctions in the Old English terminology for keywords can be translated into several different terms. Contemporary written sources, such as the *Anglo-Saxon Chronicle*, utilised a range of terminology, including fortress, encampment, and stronghold (Old English [OE] terminology includes: *sæt*, *geweorc*, *wintersetl*, and *fæstene*). These terms will be described in more depth in section 1.3.4. There are also differences in the terminology used for the Vikings and their army. Vikings themselves are referred to by a number of different terms: Vikings, Northmen, Danes, *Dene*, *Wicing*, Norse, etc. But just as present Danes are not Norse, nor were they in the 9th and 10th centuries. The individual meanings of the different words for Vikings is an extensive argument in and of itself, which has been explored most recently by McLeod (2014, 7). The Vikings made up the 'Great Army' (OE *micel here* or just *here*), the military or raiding army that inhabited these winter camps in the late 9th century; they are also commonly referred to as the 'heathen army.' The use of the term 'heathen army' (OE *hęþen here)* demonstrates the Anglo-Saxon bias of original sources. The *Anglo-Saxon Chronicle* also refers to a great summer fleet (*micel sumorlida, Anglo-Saxon Chronicle*, 871 AD), as well as a ship-army (*sciphere*, *Anglo-Saxon Chronicle,* 875, 877, 885, 893, 914). Again, for simplicity, this thesis will use the terms Viking, and 'Great Army', or simply 'Army.' Any alternative terminology will be used only in reference to historical contexts.

1.2 Preconceptions and 'definitions' of Viking winter camps

Recent research typically defines a Viking overwintering camp as a 'D'-shaped fortified site (e.g. Richards 2000, 39; Biddle and Kjølbye -Biddle 2001, 59). The expectation that they were in the form of a 'D'-shaped enclosure is inspired by Scandinavian trading sites at places such as Hedeby (formerly Denmark, now Germany) and Birka (Sweden), and the interpretations of the excavations at Repton. It is expected that a Viking winter camp site will be found along a river or coast, as a place to moor and protect longships (Allcroft 1908, 383; Dyer 1972, 223). The straight side of the D-shape is often thought to have been marshy, although there has been little discussion of whether this was part of the fortification, or in addition to a bank and ditch (Sheehan 2008, 284).

It has also been suggested that overwintering sites were associated with fragile political boundaries, which may also coincide with the adjacent river (Arthur 2009, 84). The sites are expected to have been heavily fortified (Dyer 1972; Raffield 2010), but also to have been places of craft working, daily living, and burials (Wall 2010; Sheehan 2008). There are differences of opinion on the average size of overwintering camps, and whether it is possible for archaeologists to confirm the identification of a camp based on the size of the proposed site (Raffield 2010); for example, a D-shaped enclosure excavated at Repton encompassed an area of 0.59 ha (incorrectly measured and cited as 1.46 hectares in publication; see explanation below) (Biddle and Kjølbye -Biddle 2001, 59), while an enclosure identified on the basis of the former line of a water course at Tempsford encompassed an area of 25.2 ha, and the inner enclosure measuring 0.6 ha (Edgeworth 2008). Though these two sites are both identified as winter camps, the areas (including the entire area of Tempsford) are not comparable. Estimations of size are also bound into the argument over the size of the Viking Great Army, estimations of which can range in number from fewer than 1000 (Sawyer 1971) to 2000-3000 men (Roesdahl 1992). The following discussion will reveal the origins of many of these assumptions about Viking winter camps, demonstrating how these discussions of Viking overwintering camps are largely based on only scattered and unsupported identifications and interpretations.

1.3 Camps in the *Anglo-Saxon Chronicle* and other historical sources

The *Anglo-Saxon Chronicle* is the main primary source for documenting the early Viking presence in England. While there are a few other chronicles documenting occasional contemporary events, such as Asser's *Life of King Alfred* (Keynes and Lapidge 1983), the *Anglo-Saxon Chronicle* remains the most detailed and thorough account of the period. Records of the main events of each year are recorded in up to 6 manuscripts (A-F) with varying versions of the text, with the first compilation occurring in the later 9th century (Whitelock 1965, xxi). First entries record Christ's birth in the year 1 AD, but these records are short, and based on stories and biblical entries; as chronicling nears the late 9th century, entries become more detailed, as they were written closer to the time that the recorded events were occurring (Swanton 2000, xviii).

It should be noted that, like any other historical document, the *Anglo-Saxon Chronicle* is not an unbiased source. Records of the events during the Viking Age were written by an Anglo-Saxon or even a Norman monk, with "early authors writing for political and religious masters, for whom they tailored their work" (Lucy 1998, 1). Its unreliability can also be attributed to the fact that, at any one time, one or multiple scribes were writing about events they had not directly encountered, were often living far away from the events they were chronicling, and were recorded in the years after the events had taken place (Foot 1999, 186; Stenton 1943, 15). It has been argued that the main author(s) of the *Anglo-Saxon Chronicle* compiled many collective memories, creating a history of hundreds of years based on oral or written stories (Whitelock 1965, 186). Despite these shortcomings, however, the information provided in the *Anglo-Saxon Chronicle* is invaluable, and the small amount of information it provides about winter camps must be considered in this study.

1.3.1 The Vikings and their campaign

The *Anglo-Saxon Chronicle* records the earliest movements of the Vikings in England, and the violence they perpetrated against the Anglo-Saxons. Referred to throughout the early raiding period as Northmen, the first time the Vikings are mentioned in the *Anglo-*

Saxon Chronicle is in 787AD, with the arrival of three ships via the North Sea. The subsequent reactions of the Anglo-Saxons is not clear from this account, but based on the nature of the event, the first impressions must not have been very positive:

> In this year King Brihtric married Offa's daughter Eadburh. And in his days there came for the first time three ships of Northmen and then the reeve rode to them and wished to force them to the king's residence, for he did not know what they were; and they slew him. Those were the first ships of Danish men which came to the land of the English (Whitelock 1965, 35; all further referenced *Anglo-Saxon Chronicle* entries from Whitelock 1965)[4][5]

The subsequent raid on Lindisfarne in 793 was the first of many recorded raids, and is specifically marked in the *Anglo-Saxon Chronicle* with vivid imagery of lightning and fiery dragons flying in the air. These ships carrying Northmen were amongst the first in a long line of Viking invaders who came to England to plunder the landscape for riches and/or land and power (Ten Harkel 2011).

For the next 62 years after these first attacks, the armies continued to raid during the summer and harvesting months, retreating to Scandinavia during the winter months. In 855, however, the *Anglo-Saxon Chronicle* records that 'In this year heathen men for the first time stayed in Sheppey [Kent] over the winter'[6] (Whitelock 1965, 43), setting a pattern that was to persist for decades of the Vikings not returning to Scandinavia in the raiding off-season, but rather settling in one place for several months before continuing their exploration of the landscape. In 865 the Vikings 'encamped on Thanet and made peace with the people of Kent. And the people of Kent promised them money for that peace'[7]. Despite that promise, the army ravaged eastern Kent (866), illustrating just how tenuous the protestations of peace were between the Anglo-Saxons and the Vikings. The next year, 'a great heathen army came into England' and wintered in East Anglia with the promise of peace and a gift of horses. From East Anglia, the great army made its way north, 'and immense slaughter was made of the Northumbrians' at York late in the year of 868. There is no record of encampment, but the entry implies that the Vikings arrived at York in the last months of the year and stayed in England for the winter. This is at least one example of Viking overwintering camps not being specifically documented, but

[4] Her nom Beorhtric cyning Offan dohtor Eadburge; on his dagum cuomon ærest .iii. scipu, þa se gerefa þærto rad, hie wolde drifan to þæs cyninges tune þy he nyste hwæt hie wæron; hiene mon ofslog; Þæt wæron þa ærestan scipu Deniscra monna þe Angelcynnes lond gesohton.
[5] All OE text from Manuscript A (up to 892), and B or C for later entries
[6] Her hęþne men ærest on Sceapige ofer winter sætun.
[7] Her sæt hęþen here on Tenet genamon friþ wiþ Cantwarum; Cantware him feoh geheton wiþ þam friþe

still alluded to, opening the possibility of early overwintering camp sites existing in areas where they have not yet been sought.

The following years' entries in the *Anglo-Saxon Chronicle* are dense with records of the Viking army traveling to a variety of places, including Nottingham, York, Thetford (Norfolk), Reading (Berkshire), Ashdown (now Oxfordshire), Basing (Hampshire), *Meretun* (Hampshire), Wilton (Wiltshire), and London. At these locations, the Vikings are recorded as carrying out a range of activities, including making peace with the Mercians, killing high ranking officials and even royalty, and having their own high ranking officials killed in battle. There is limited mention of any fortifications at any of the winter camp sites, with the exception of the entry for Nottingham in 868: '[Alfred and Ethelred] went with the army of the West Saxons into Mercia to Nottingham, and came upon the enemy in that fortress and besieged them there'[8]; earlier in this entry, the site is only referred to as an encampment (see figure 2.1). In this mention of fortifications associated with their encampment, it is not clarified whether the Great Army made use of existing man-made or natural defences, or created their own defences, and so aside from the reference to defensive features, the Chronicle leaves the type of fortification up for interpretation.

1.3.2 Torksey and Repton: early winter camps

From London, in 872 the army made their way to Northumbria to participate in a Northumbrian revolt; in the winter of that same year, the great army 'took up winter quarters (*wintersetl*) at Torksey in Lindsey; and then the Mercians made peace with the army'. In such a short entry there is little information that can be gleaned, except the circumstantial notion that Torksey must have been a sufficiently significant settlement at the time to warrant a mention of the place-name in the *Anglo-Saxon Chronicle*. The wintering at Repton in the following winter (873-4) is, in contrast, recorded in more detail:

> In this year the army went from Lindsey [Torksey] to Repton and took up winter quarters (*wintersetl*) there, and drove King Burgred across the sea, after he had held the kingdom 22 years. And they conquered all that land. And he went to Rome and settled there; and his body is buried in the church of St. Mary in the English quarter. And the same year he gave the kingdom of the Mercians to be held by Ceolwulf, a foolish king's thegn; and he swore oaths to them and gave hostages, that it should be ready for them on whatever day

[8] þæt hie wiþ þone here gefuhton; þa ferdon hie mid Wesseaxna fierde innan Mierce oþ Snotengaham, þone here þær metton on þam geweorce,

> they wished to have it, and he would be ready, himself and all who would follow him, at the enemy's service.[9]

The presence of royalty at Repton may indicate that the Great Army specifically targeted the royal estate (McLeod 2006). The Repton entry also indicates that the Vikings not only inhabited the site, but also took control of the surrounding land and people, conquering the people of Mercia from the royal centre (Biddle and Kjølbye-Biddle 2001, 45; Hadley 2006, 12). Yet, even though this entry is detailed, there is no description of the physical appearance of the camp.

1.3.3 The late 9th and early 10th centuries: winter camp or fortification

From Repton, the army split into two: the part of the army led by Healfdene marched to Northumbria where, after a year of wintering on the River Tyne and conquering the land of Picts and Strathclyde Britons, they 'proceeded to plough and support themselves'; the other half under Guthrum, Oscetel, and Anwend continued their military campaign (Whitelock 1965; all events described in the *Chronicle* are from Whitelock 1965). The division of the Great Army was not exclusive to this year, as the army would regularly break up into smaller groups with similar interests or family ties, a subject currently being researched by Prof. Neil Price (Price and Raffield *pers. comm.*). The latter part of the *micel here* continued to Cambridge, Wareham (Dorset), Exeter, Chippenham (Wiltshire), Iley (Hampshire), Cirencester (Gloucestershire), and finally, after another division of the army, to mainland Europe, overwintering at many of their stops, including Ghent (Belgium), Meuse (France), Condé (France), and Amiens (France). Guthrum, and a number of members of the Great Army, however, had not followed the rest of the army to mainland Europe. Instead, Guthrum, "the northern king" was baptized in 878, and had settled in East Anglia; his status as a king of the north and godson to King Alfred, as well as the fact that he was "first to settle that land [East Anglia]," is recorded in the *Anglo-Saxon Chronicle* with his death in 890.

By 885, the army had split into two again, part going into Paris, and Chézy to raid and camp for the winter, the other part occupying Rochester 'where they besieged the city and made other fortifications round themselves'. In 892, the *Anglo-Saxon Chronicle* records

[9] Her for se here from Lindesse to Hreopedune, þær wintersetl nam, þone cyning Burgręd ofer sę adræfdon ymb .xxii. wintra þæs þe he rice hæfde, þæt lond all geeodon; he for to Rome þær gesæt his lic liþ on Sancta Marian ciricean on Angelcynnes scole; þy ilcan geare hie sealdon anum unwisum cyninges þegne Miercna rice to haldanne, he him aþas swor gislas salde, þæt he him gearo wære swa hwelce dæge swa hie hit habban wolden, he gearo wære mid him selfum, on allum þam þe him læstan woldon to þæs heres þearfe.

Viking fortifications, or *geweorc*, when the army stormed a fortress at Milton, and rebuilt it for themselves, and then built a new fortress at Appledore (somewhere in the Thames estuary, the precise location of which has not been confirmed). 893 marked a year of intense Viking warfare, with the Danes *geweorc* in Northumbria joining the army in East Anglia, and with references to Viking fortresses in Chester: '[The Danes] went continuously by day and night till they reached a deserted city in Wirral, which is called Chester. Then the English army could not overtake them before they were inside that fortress.' Fortresses and associated hostile interactions between Danes and Anglo-Saxons are also recorded at Lea (*geweorc*) (20 miles north of London), and an episode of wintering (*sæt*) at Bridgnorth (Shropshire) (895) is also recorded. From these entries, it is clear that the Vikings had constructed fortifications in England by 894, even as early as 877, but this is all the information that is provided. It is possible that some defences were naturally present in the landscape, enhanced to form an effective fortification, or, alternatively, Viking armies may have captured and reused existing fortifications, or even built them from scratch, using a combination of both new and reused materials.

An entry in the *Anglo-Saxon Chronicle* in 900 declaring the death of King Alfred of Wessex states that he was 'king over the whole English people except for that part which was under Danish rule'. This likely refers to what is known later as the Danelaw, an area where the Danes were a permanent and dominant population in England (Hadley 2000, 1). Even so, the campaigning Viking army is featured more than ever throughout the *Anglo-Saxon Chronicle* after the year 900; peace was established with King Edward, followed by battles at Tettenhall (Wolverhampton), Hook Norton (Oxfordshire), Luton, Towcester (Northampton), Tempsford, and Maldon (Essex). There are also mentions of different Viking armies 'from' Northampton and Leicester, suggesting that the army had split and was stationed in permanent military encampments at these locations. Another fortress was built in 917, associated with battles fought at Tempsford:

> …The army came from Huntingdon and East Anglia and made the fortress at Tempsford, and took up quarters in it and built it, and abandoned the other fortress at Huntingdon, thinking that from Tempsford they would reach more of the land with strife and hostility (917). [10]

This reference to the construction of a fortification at Tempsford has led to attempts to locate any earthworks that are associated with fortification. The recent search for the

[10] Þy ilcan siþe for se here of Huntandune of Eastenglum worhton þæt geweorc æt Tæmeseforda hit budon bytledon forleton þæt oþer æt Huntandune þohton þæt hie sceoldon þanon of mid gewinne mid unfriðe eft þæs landes mare geræcan foran

location of Tempsford is outlined later in this chapter. However, it must be noted that this fortification was built nearly 45 years after Repton and Torksey were occupied, in an England where Vikings were accepted as settlers in other parts of the country; thus it may not be a directly comparable site.

Towards the middle of the 10^{th} century, many Viking groups are recorded as making peace with the surrounding populations, while other groups continued to wreak havoc across the British Isles. By 937, the vocabulary used in the *Anglo-Saxon Chronicle* demonstrates just how complex the relations between and among the Anglo-Saxons and Scandinavians had become: the Norsemen were defeated in a Northumbrian revolt and retreated to Ireland, while the Danes, who were 'previously subjected by force under the Norsemen, were redeemed by King Edmund, again settling with some peace amongst the Saxons'. Prior to this entry, the Vikings were generally referred to as Danes, however this marks the acknowledgement that there were multiple populations of Vikings, all with potentially different customs, as well as different intentions for their campaigns. There are a few more instances of Viking attacks in the latter half of the 10^{th} century; in 982, Viking ships ravaged Portland (Dorset), instigating a military campaign across Dorset, Devon, Rochester, Exeter, and Wiltshire, revisiting places such as Tempsford. In these later entries, this army is recorded as returning across the North Sea at Christmas, but returning soon afterward. By the late 10^{th} century, there are no more explicit mentions of Viking winter camps.

1.3.4 Interpretation of *Anglo-Saxon Chronicle* etymology: locations and constructions

The exact wording of the *Anglo-Saxon Chronicle* entries regarding overwintering varied from year to year: occasionally the chronicler only mentioned the locations of the camps briefly with some circumstances of the overwintering, such as in the entries concerning Nottingham (868), Torksey (872) and Repton (873); sometimes the *Chronicle* only provided a place name, such as at London (871); and sometimes the *Chronicle* detailed a battle that occurred without any mention of overwintering, such as at York (867). The entries for some years did not include any references at all to the Danes or their winter camps, though it is possible that the Vikings had winter camps every year following 855 and they were simply not recorded because it was deemed unimportant in that year. Of the details provided about overwintering camps, none of the entries go beyond the very brief allusions to encampments from 855 to 885, while references to fortifications occurring in the years following 885 coincided with the control of the army over portions of the land and people. It is clear from the entries in the *Anglo-Saxon Chronicle* that the Vikings had visited much of the English countryside by 900, and were claiming land. Also by 900, it can be said that the Viking Great Army was no longer 'overwintering,' and was instead living in England. The years following 900 demonstrate the proclivity of the Vikings for interfering in Anglo-Saxon affairs, as well as for creating structures defined as fortifications. The Danish/Viking population quickly became a permanent fixture in the English landscape, integrating with the Anglo-Saxon population, with their language even becoming one of the main tongues in Britain (Bugge 1921, 174; Loyn 1977; Townend 2000).

The etymology of the *Chronicle* references to winter camps can also provide some additional details about the progression of the form of Viking encampments. The translated versions were not always reliable in their descriptions, so the original OE version was examined closer in figure 2.1 in order to understand the etymological changes evident in the *Chronicle*. In the first descriptions of overwintering, the Viking army was described as *sæt*, or having rested, at their locations. This is used seemingly interchangeably with the Vikings having a *wintersetl*, or winter quarters, at the locations described. As of 877, there was a slight change in language used by the *Chronicle*, as it begins to describe the Viking army in *fæstene*, or a stronghold, at Exeter, and the next year having 'taken possession' (*geridon*) at Chippenham. The next years, the descriptions reverts to *sæt*, before the first description of a Viking *geweorc*, or fortifications, appear at Milton and Appledore (Kent). After this description in 892, the Vikings are almost exclusively described as being located within a fortification; although occasionally the army is also described as 'resting' (*sæt*) for the winter. There are marked similarities between the descriptions of the Viking fortifications with the *Chronicle's* records of King Alfred's contemporary fortified lodgings in 878: the fortification at Altheney, an island promontory in the Somerset levels, was described as a *geweorc*, indicating that Viking and English fortification sites both use the title of *geweorc*. Alternatively, Alfred's temporary encampment takes the name *wicum*. *Wicum* is translated as encampment, but is not used to describe the Viking winter camps, which is only described as *wintersetl*, or a location where the army *sæt* or rested. *Fæstene*, or strongholds, may be an intermediate term, where there were no formal fortifications, but it may also describe sites that were fortified by minimal constructions or natural features, although this interpretation cannot be confirmed. What is clear from the chronological use of these terms is that Viking winter camps began as simple winter quarters or resting places, which were given new names since the English had not seen any encampment like them prior to the Viking incursions. Eventually the winter camps turned into fortifications that were recognisable by the English chroniclers, and so were described in the same manner as the English fortifications.

A full list of the entries mentioning Viking camps in the *Anglo-Saxon Chronicle* can be found in Figure 2.1. This chart also includes the term used by the Chronicle for the winter camp, and their translations. This figure further illustrates how little broadly contemporary historical information there is on Viking winter camps; however, this has not prevented antiquarians from writing about them based principally on this extremely limited documentary evidence. Figure 2.2 is a map showing the locations of each of these recorded fortifications, coded by the OE term used in the *Anglo-Saxon Chronicle*.

Winter camp named in chronicle	**Year**	**Original Old English text from *Anglo-Saxon Chronicle***	**Term used for winter camp**	**Translation of term**	**Modern translation of quoted passage (Whitelock 1965)**
Sheppey	855	Her hęþne men ærest on Sceapige ofer winter sætun.	sæt	to rest	In this year heathen men for the first time stayed in Sheppey over the winter
Thanet	865	Her sæt hęþen here on Tenet genamon friþ wiþ Cantwarum; Cantware him feoh geheton wiþ þam friþe	sæt	to rest	In this year the heathen army encamped on Thanet and made peace with the people of Kent
East Anglia	866	þy ilcan geare cuom micel here on Angelcynnes lond, wintersetl namon on Eastenglum	wintersetl	winter quarters	In this same year, a great heathen army came into England and took up winter quarters in East Anglia
York	867	Her for se here of Eastenglum ofer Humbre muþan to Eoforwicceastre on Norþhymbre	-	-	In this year the army went from East Anglia to Northumbria, across the Humber estuary to the city of York
Nottingham	868	Her for se ilca here innan Mierce to Snotengaham, þær wintersetl namon;	wintersetl	winter quarters	In this year the same army went into Mercia to Nottingham and took up winter quarters there.
York	869	Her for se here eft to Eoforwicceastre, þær sæt .i. gear.	sæt	to rest	In this year the raiding army returned to the city of York, and stayed there one year
Thetford	870	Her rad se here ofer Mierce innan Eastengle wintersetl namon æt Þeodforda,	wintersetl	winter quarters	In this year the raiding army rode across Mercia into East Anglia, and took up

					winter quarters at Thetford
Reading	871	Her cuom se here to Readingum on Westseaxe	-	-	In this year the army came into Wessex to Reading
London	872	Her for se here to Lundenbyrig from Readingum, þær wintersetl nam, þa namon Mierce friþ wiþ þone here.	wintersetl	winter quarters	In this year the army went from Reading to London, and took up winter quarters there; and then the Mercians made peace with the army.
Torksey	873	Her for se here on Norþhymbre, he nam wintersetl on Lindesse æt Tureces iege, þa namon Mierce friþ wiþ þone here.	wintersetl	winter quarters	In this year the army went into Northumbria, and it took up winter quarters at Torksey in Lindsey; and then the Mercians made peace with the army.
Repton	874	Her for se here from Lindesse to Hreopedune, þær wintersetl nam,	wintersetl	winter quarters	In this year the army went from Lindsey to Repton and took up winter quarters there
River Tyne	875	Her for se here from Hreopedune, Healfdene for mid sumum þam here on Norþhymbre. nam wintersetl be Tinan þære ea,	wintersetl	winter quarters	In this year the army left Repton: Healfdene went with part of the army into Northumbria and took up winter quarters by the River Tyne.
Cambridge	875	Godrum Oscytel Anwynd. þa .iii. cyningas, of Hreopedune to Grantebrycge mid micle here, sæton þær an gear;	sæt	to rest	…the three kings, Guthrum, Oscetel, and Anwent, went from Repton to Cambridge with a great force, and stayed there a year
Wareham	876	Her hiene bestęl se here into Werham Wesseaxna fierde, wiþ þone here se cyning friþ nam	-	-	In this year the enemy army (which had been at Cambridge) slipped past the army of the west Saxon into Wareham
Exeter	877	Her cuom se here into Escanceastre from Werham,… se cyning Ęlfred æfter þam gehorsudan here mid fierde rad oþ Exanceaster hie hindan ofridan ne meahte ær hie on þam fæstene wæron, þær him mon to ne meahte	fæstene	strong-hold	In this year the enemy army from Wareham came to Exeter; … King Alfred rode after the mounted army with the English army as far as Exeter, but could not overtake them [before they were in the fortress where they could not be reached].
Chippenham	878	Her hiene bestęl se here on midne winter ofer tuel tan niht to Cippanhamme, geridon Wesseaxna lond	gerion	to take possess-ion	In this year in midwinter after twelfth night the enemy army came stealthily to Chippenham, and occupied the land of the West Saxons and settled there

Cirencester	879	Her for se here to Cirenceastre of Cippanhamme. sæt þær an gear;	sæt	to rest	In this year the army went from Chippenham to Cirencester, and stayed there for one year.
Fulham	879	þy geare gegadrode on hloþ wicenga, gesæt æt Fullanhamme be Temese;	sæt	to rest	And the same year a band of Vikings assembled and encamped at Fulham by Thames.
East Anglia	880	Her for se here of Cirenceastre on Eastengle, gesæt þæt lond,	sæt	to rest	In this year the army went from Cirencester into East Anglia, and settled there and shared out the land.
Rochester	885	Her todęlde se foresprecena here on tu, oþer dęl east. oþer dęl to Hrofesceastre; ymbsæton ða ceastre, worhton oþer fæsten ymb hie selfe.	fæstene	strong-hold	In this year the aforesaid army divided into two [one part going east], the other part to Rochester, where they besieged the city and made other fortifications round themselves.
Milton and Appledore	892	Þa sona æfter þæm com Hæsten mid .lxxx. scipa up on Temese muðan, worhte him geweorc æt Middeltune, se oþer here æt Apuldre.	geweorc	fortification; structure	…Then immediately afterwards Haesten (a Viking leader) came with 80 ships up the Thames estuary and made himself a fortress at Milton, and the other army made one at Appledore.
Thorney	893	hie flugon ofer Temese buton ælcum forda þa up be Colne on anne iggað.	-	-	They [the Danes] fled across the Thames where there was no ford, and up the Colne on to an [lonely] islet.
Wirral	893	foron anstreces dæges nihtes, þæt hie gedydon on anre westre ceastre on Wirhealum, seo is Legaceaster gehaten; Þa ne mehte seo fird hie na hindan offaran, ær hie wæron inne on þæm geweorce;	geweorc	fortification; structure	[The Danes] went continuously by day and night till they reached a deserted city in Wirral, which is called Chester. Then the English army could not overtake them before they were inside that fortress.
Mersea	894	Đa þy ilcan gere onforan winter þa Deniscan þe on Meresige sæton tugon hira scipu up on Temese, þa up on Lygan;	sæt	to rest	Then that same year in early winter the Danes who were encamped on Mersea rowed their ships up the Thames and up the Lea.
Lea	895	On þy ilcan gere worhte se foresprecena here geweorc be Lygan .xx. mila bufan Lundenbyrig.	geweorc	fortification; structure	And in the same year the aforesaid army made a fortress by the Lea, 20 miles above London
Bridgnorth	895	Þa a Deniscan hæfdon hira wif befæst innan Eastengle ær hie ut of	sæt	to rest	And the Danes placed their women in safety in East Anglia before

		þæm geweorce foron; Þa sæton hie Þone winter æt Cwatbrycge.			they left that fortress. Then they stayed the winter at Bridgnorth.
Tempsford	917	Þy ilcan siþe for se here of Huntandune of Eastenglum worhton þæt geweorc æt Tæmeseforda hit budon bytledon forleton þæt oþer æt Huntandune þohton þæt hie sceoldon þanon of mid gewinne mid unfriðe eft þæs landes mare geræcan foran	geweorc	fortification; structure	At the same time the army came from Huntingdon and East Anglia and made the fortress at Tempsford, and took up quarters in it and built it, and abandoned the other fortress at Huntingdon, thinking that from Tempsford they would reach more of the land with strife and hostility.
Alfred at Athelney	878	þæs on Eastron worhte Ęlfred cyning lytle werede geweorc æt Ęþelingaeigge	geweorc	fortification; structure	And afterwards at Easter, King Alfred with a small force made a stronghold at Athelney
Alfred at Somerset	878	he for ymb ane niht of þam wicum to Iglea,	wicum	lodging; camp; fortress?	And then after one night he went from that (Egbert's Stone) encampment to Iley

Figure 2.1: List of entries in the *Anglo-Saxon Chronicle* mentioning encampments or other places where the Vikings set down for a winter/other period of time. This list is not exhaustive of all places where Vikings may have set down prior to a battle, or of every time the *Anglo-Saxon Chronicle* mentions the location of the army, but rather is a compilation of the places that the Vikings are mentioned as overwintering. In addition, this list includes two locations where Alfred and the English Army was mentioned, in order to provide comparison of terminology for encampments; note that 'wicum' is only used as an encampment of the English Army, rather than 'wintersetl' which is used exclusively for the Viking Army. However, 'geweorc' is used for general fortified sites.

As stated above, there is very little evidence of what the Viking winter camps may have looked like in the *Anglo-Saxon Chronicle*, or indeed in any other historical document. It is impossible to confirm that there is even one type of Viking winter camp that is being referred to, or if there are several different forms of Viking temporary settlement. Differences in the appearances of various sites are inferred by the language used in the *Chronicle* throughout the late 9th and early 10th century, with the *Chronicle* referring to resting places, encampments, winter quarters, fortresses, all of which may have very different implications. Each of these sites would have had very different requirements for different landscapes and socio-political circumstances. It may even be the case that the sites were recorded by authors who interpreted and recorded the sites in different ways. Overall, the message to take away from the *Anglo-Saxon Chronicle* entries is that it is merely a way of narrowing down the potential locations of camp sites, but should not be used as the sole device for interpreting these sites.

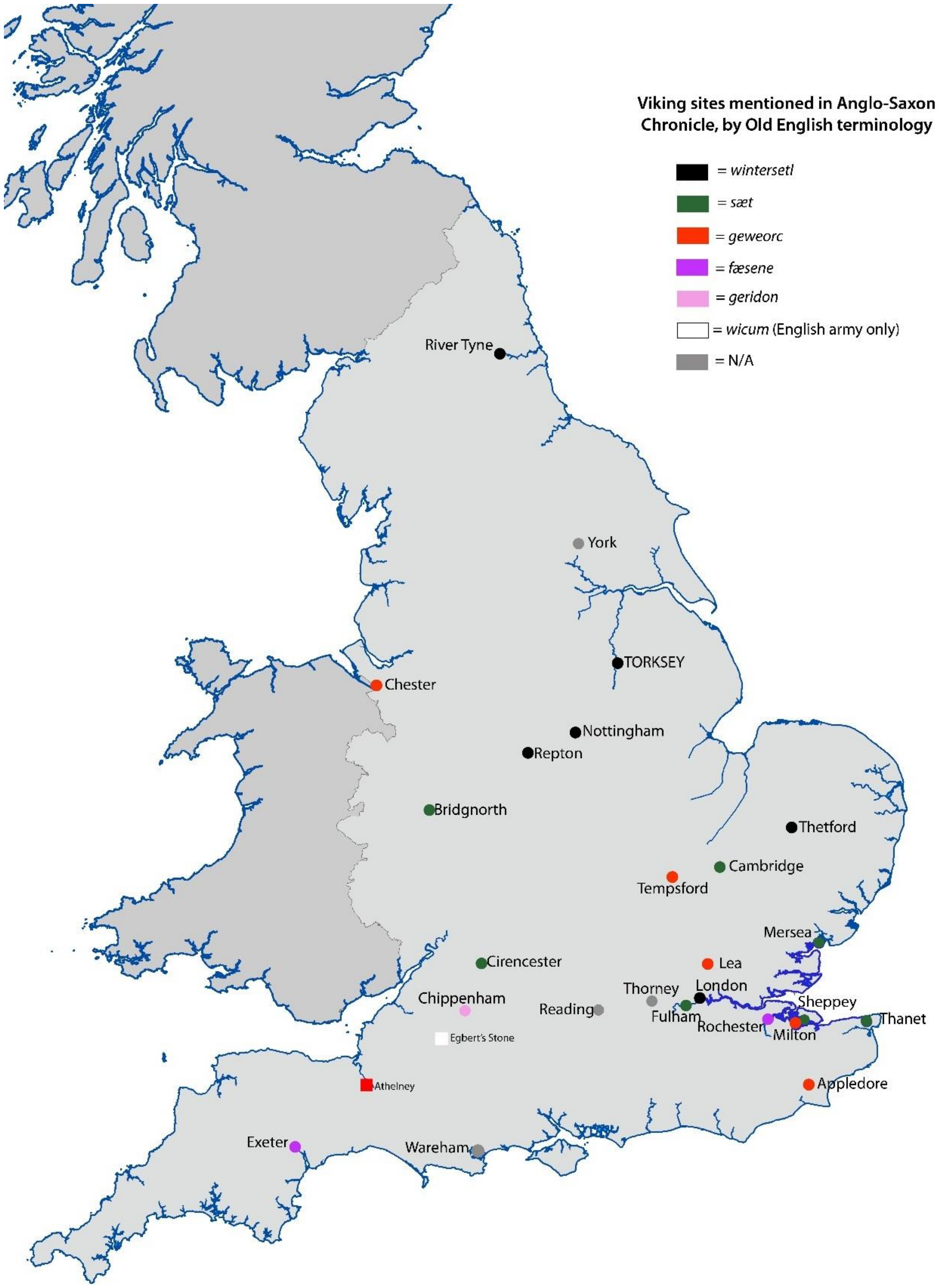


Figure 2.2: Locations of the sites mentioned in figure 2.1a, coloured by the OE word used in the *Chronicle*. Sites where Alfred and his army are recorded in 878 are represented by squares.

1.4 Antiquarian views of Viking winter camps

References to Viking winter camp sites in the *Anglo-Saxon Chronicle* inevitably led to a search for them and the treasure that was expected to be associated with them. Antiquarians frequently attempted to identify the overwintering sites mentioned in the *Anglo-Saxon Chronicle* by matching documentary evidence with physical evidence, and most often, their first points of call were local earthworks, no matter what date they may have originated, or whether any dating evidence was available at all. The main evidence used by early scholars was often a mixture of documentary sources, cultural memory, physical evidence, and folklore (Raffield 2011, 34). Despite the shortcomings of this approach, these studies have become a prominent source for modern interpretations. It has recently been argued that antiquarian accounts 'are not an obstacle for archaeologists to overcome, but are … another resource of information that needs to be taken into account when investigating a site' (Raffield 2011, 32), their data and conclusions must be treated with extreme caution. These early 'identifications' of sites will be outlined here, not as an example of the research done on Viking camp sites, but rather as a cautionary tale of how the current misconceptions about winter camp sites emerged out of antiquarian studies.

In *Lincolnshire and the Danes,* Streatfield (1884, 296) discussed the relationship of the Vikings with the Anglo-Saxon settlement at Torksey, and the potential formation and impact of the winter camp site of 872-3. He acknowledged that the 9th century Viking presence was reliant on both defensive tactics as well as functional and marketable skills of the army members, such as metalworking (Streatfield 1884, 296). The settlement of Torksey was accurately described as having 'a most advantageous situation, whether for business or defence' along the highway of the River Trent (Streatfield 1884, 296). This observation demonstrates an astute comprehension of the surrounding landscape, even if it is only in historical terms. Streatfield (1884, 296) noted the familiarity that the Vikings would have had with the Lincolnshire land prior to choosing Torksey for their winter camp, which demonstrates his early recognition that the raiding Danes were not just pilfering at random, but rather were calculating their locations for winter camps, as well as taking advantage of current events, such as the Northumbrian revolts. Much like those of other antiquarians, his study of the Danes in Lincolnshire maintained that the early Vikings were violent and dangerous, though he noted that this may be an undeserved stigma; subsequently his study emphasized the Scandinavian characteristics of place names. Although this early study did not acknowledge the significance of the landscape of the site and mainly presents the site in a historical context, it did recognise some of the advantages of a winter camp at Torksey, and did not attempt to reconstruct the site based on spurious claims or vague historical records, allowing the winter camp at Torksey to remain free of misguided interpretations.

After Streatfield's early discussion of the winter camp at Torksey, antiquarian versions of Viking camp sites became increasingly focused on identifying physical remains, often to a detrimental effect on our ideas of Viking winter camps. Isaac Chalkley-Gould discussed many of English earthwork fortresses and their dates of construction in his 1901 article, attributing many sites to the Danes and identifying them as Viking period defensive camps, but often based on no evidence at all. In fact, the lack of datable evidence is usually what drove Chalkley-Gould to state that a site was of Danish origin; however, many of the sites identified by him are now recognised as late medieval motte and bailey castles, or Iron Age forts, and none of them have been subsequently proven to be Danish in origin. Figure 2.3 shows three sites that Chalkley-Gould proclaimed to be Danish fortifications, all of which are today recognized as later medieval sites. Chalkley-Gould claimed that earthworks at Tempsford must be Danish because the 'moat does not extend into the inner face of the mound' (a characteristic not recognized as later medieval by antiquarians of the early 20th century), that Hathersage (Derbyshire), with its small mound on the rampart 'is traditionally Danish', and of the earthworks at Barking (Essex), though it is not recorded in the *Anglo-Saxon Chronicle*, he states that 'circumstances point to Danish origin' (Chalkley-Gould 1901, 30). It is unclear why he attributes any of these features to the Danes, and with what archaeological knowledge is available today, we can clearly see that his reasoning is baseless and unjustified.

Unfortunately, Chalkley-Gould's incorrect identifications live on. The earthworks at Tempsford (known as Gannock's Castle), shown in figure 2.3, have been investigated archaeologically since Chalkley-Gould penned his works, and these excavations have demonstrated the later medieval origins of the site (Maul and Chapman 2005). Even so, the idea that Gannock's Castle is the location for the Viking fortification lingers in popular accounts, including on the educational board set up on site by the Heritage Lottery Fund. The incorrect assumptions about Viking fortifications made by Chalkley-Gould and other contemporary antiquarians have persisted in local lore about some of these sites.

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Figure 2.3: Chalkley-Gould's (1901) sketches of three 'Danish' fortified encampments in Tempsford (Gannock's Castle, Bedfordshire), Hathersage (motte and bailey castle, Derbyshire) and Barking (medieval earthwork, Essex)

In 1908, A. Allcroft wrote *Earthwork in England*, a very broadly focused publication encompassing the remains of many periods, from prehistoric to medieval. His section on Danish earthworks and fortifications is just as brief as that of Chalkley-Gould, but Allcroft revealed that he had doubts about the interpretations of Gannock's Castle. Allcroft (1908) noted that Gannock's Castle resembles a later enclosure and is much too small in size to belong to a great army. He argued that the close and convenient proximity to the recorded place name does not, alone, designate the site as the Danish fortifications, a juxtaposition that antiquarians had often been using to assign surviving earthworks to a recorded Viking winter camp. Unfortunately, Allcroft went on to compare Gannock's Castle with the Danish Docks, another late medieval earthwork near Tempsford, considering the possibility that the Danish Docks at Willington were the Tempsford fortification.

One of the more prominent views of the Vikings and their winter camps is contained in Sir Frank Stenton's *Anglo-Saxon England* (1943). While otherwise an authoritative commentator on Anglo-Saxon historical sources, the information related in this volume about winter camps does not have clear supporting evidence; his sources were limited to the *Anglo-Saxon Chronicle* and other contemporary documentary evidence such as Asser's *Life of King Alfred*, yet Stenton somehow still manages to describe the overwintering camps in detail:

> It was the custom of the army to change its quarters each autumn. Its movements do not suggest that its leaders were following anything that can be called a plan of campaign. The history of their first attack on Wessex, in 870, shows that their method of operation was to seize a defensible position, fortify it, and ravage the surrounding country

> systematically until its inhabitants bought peace from them. Most of these encampments were placed near a navigable river, by which reinforcements could reach the army easily (Stenton 1943, 244-5)

Stenton includes a description the winter camp at Reading (Berkshire) in 871 as a 'camp formed by an earthwork drawn between the rivers Thames and Kennet, which meet on the east of the town', which is based on the following account from of Asser's the *Life of King Alfred*:

> …their [the Viking] earls, with great part of the army, scoured the country for plunder, while the others made a rampart between the rivers Thames and Kennet…. At length one of the earls was slain, and the greater part of the army was destroyed (Keynes and Lapidge 1983).

In reading the entry from the *Life of King Alfred*, it becomes clear that Stenton may have applied some imagination in his detailed descriptions.

Stenton's statement that winter camps were always founded next to a body of water may be his interpretation of the locations of the winter camps listed in the *Anglo-Saxon Chronicle*; this statement certainly applies accurately to his example of Reading, but a mere place-name location listing of other camps cannot feasibly be extrapolated to mean all winter camps were next to water. While the record concerning Reading in Asser's *Life of King Alfred* does describe the building of a rampart, there is no evidence to support the notion that the rampart was part of a winter camp, was part of the preparations for an upcoming battle (later lost by the Vikings), or was even in the location he describes. While it would be convenient to accept Stenton's conclusions, which appear logical and uncontroversial, many of his observations cannot be definitively supported.

The studies described are by no means part of an exhaustive list of the proposed 'Danish encampments' investigated by antiquarians, but these examples do provide a brief background into the unsupported theories about Viking winter camps, especially concerning those sites that are currently being re-examined by ongoing projects. Despite occasional claims by antiquarians that a site had been positively identified, subsequent excavation or re-examination of the proposed sites — including the sites previously identified as the winter camp at Repton [the Buries (Auden 1909)], and Tempsford [Gannock's Castle (Chalkley-Gould 1901), and Danish Docks, Willington (Allcroft 1908)] — has proven that *none* of the early antiquarians were able to identify successfully an overwintering camp site. Despite much deliberation on the subject, the antiquarians provided no valuable information regarding the nature of the earliest Viking habitation, while simultaneously managing to initiate a false notion of a type site fortified with late medieval forms of defensive feature located within a war-torn landscape. This did not leave a solid platform for recent archaeological and historical studies, yet in many cases, the unsubstantiated ideas still filter their way into recent interpretations.

1.4.1 The size of the Viking Great Army

Debates about the size of Viking armies were initiated in the second half of the 20th century in the work of Peter Sawyer (1971), which had implications for the interpretations of the sizes of winter camps. While he first challenged received wisdom about the large scale of Viking armies in a paper published in 1958, it was his book from 1962, *The Age of the Vikings* (republished in revised form in 1971) that described the potentially small sizes of the army. Of particular relevance to the present argument is the fact that Sawyer explored the size of the *micel here* using, amongst other evidence, the size of the winter camp fortifications. He used the alleged scale of the 'identified' encampments to justify his theory of a relatively small army (Sawyer 1971, 129), although given that there had been no concrete evidence of the locations of any winter camps, this proved to be a difficult task. Using earthworks such as Gannock's Castle in Tempsford (measuring 120 by 84 feet [36.5 x 25.6 m]), and Shoebury (Essex) ('traces of a large earthwork 500 yards [457 m] from north-east to south-west' [Sawyer 1971, 129])− both of which were identified by antiquarian speculation with no definitive proof they were of Viking construction, and were later proven to be late medieval − Sawyer cited the measurements of these two sites and used these data as evidence of a small sized army. Inevitably, these results were problematic, due to the inaccuracy of the most basic part of the study: choosing an actual Viking winter camp.

Sawyer also projected the Viking affinity for islands during their first encampments at Sheppey and Thanet onto the later encampments: 'The raiders often preferred to shelter, if they could, not behind fortifications but on islands where they could conveniently beach their boats' (Sawyer 1971, 131). This was supported by the proposition that Scandinavian Trelleborg-type fortresses could be a possible model for winter camps (Sawyer 1971, 134). Trelleborg ring fortresses are found in Denmark and Sweden, named after the fortress excavated at Trelleborg, Denmark, which was characterised by a circular rampart divided into interior sections. Although there was no evidence of these circular fortresses across England, he argued that the Viking *micel here* was probably familiar with the type, which he believed were contemporary, and may have tried to imitate it in England

(Sawyer 1971, 132). These round fortresses measured between 12 m (as at Fyrkat) up to 240 m (as at Aggersborg) in diameter; the Trelleborg fortress measures 136 m across (Sawyer 1971, 134). This argument can now be discarded, as the earliest evidence for Trelleborg-type fortresses date to the late 10th through the early 11th centuries (Sindbaek 2012).

Although Sawyer's information on winter camps does not seem to arise from any convincing evidence or observations, he does point out one important lacuna in the broadly contemporary documentary evidence that may describe a different kind of archaeological footprint: 'Nowhere is there any suggestion that they fortified these places (York, Nottingham, Thetford, Repton, Cirencester, Wareham) and it is possible that some already had defences' (Sawyer 1971, 129). These observations are the first suggestion that, while the sites do have an archaeological footprint, they may not be homogenous in form, or even built contemporaneously, rendering it difficult to immediately recognize the sites.

The summary provided above by no means encompasses all the short entries of speculation included in countless general works on early medieval England on the activities of the Viking armies, but the selection of works summarised above are the ones that comment on the physical manifestation of a winter camp. What is universally noted by the aforementioned scholars is the concept that the encampments were probably adjacent to rivers and coasts; though not specified in the *Anglo-Saxon Chronicle*, this interpretation may stem from the recognition of the Viking affinity for seafaring, and the proximity of most of the sites mentioned in the *Chronicle* to a navigable body of water. The above examples of early studies of Viking winter camps also provide a glimpse into the limited state of knowledge prior to the first modern excavation of a Viking overwintering camp. Throughout the earliest assessments of overwintering, it is important to note that none of the descriptions of the encampments ventured to prescribe the use of a specifically D-shaped enclosure. The following section will describe how the excavation of a single site in England, has initiated the notion of the D-shape as a defining indicator of a winter camp site. This trait as a standard of overwintering camps emerged after the first excavation of a Viking site at a location mentioned in the *Anglo-Saxon Chronicle*, at Repton.

2 Repton

Despite searching for over 100 years, it was not until the 1970's that the first evidence for a Viking encampment was archaeologically uncovered. Many of the present day conceptions of Viking overwintering camps rest on the conclusions that emerged from the excavations at Repton, Derbyshire. This site, excavated by Martin Biddle and Birthe Kjølbye-Biddle in the 1970's and 1980's, was made prominent by the presence of Viking furnished burials and artefacts, as well as significant excavated earthworks. With the exception of two detailed articles (Biddle and Kjølbye-Biddle 1992; 2001), a full excavation report has not yet been published, which is a major factor that has hindered wider understanding of the form of Repton as a Viking winter camp.

The overwintering camp at Repton is recorded in the *Anglo-Saxon Chronicle* in 874, the year after overwintering at Torksey. Prior to the excavations, there had been no consideration that the grounds of St Wystan's church in Repton housed the site of the overwintering camp (Biddle and Kjølbye-Biddle 2001, 54), even though the site and immediate proximity had already produced two Viking swords and a carved hogback[11] stone prior to excavation (Biddle and Kjølbye-Biddle 2001, 55-57). In fact, until the excavation in the early 20th century by G. A. Auden, it was thought that nearby earthworks at the Buries were the winter camp; excavation of the Buries, had, however, proved it to be a late medieval animal enclosure (Auden 1909). In both the 17th and 18th century, the free-standing mausoleum to the west of St Wystan's church within the village of Repton was dug and reburied by local workmen, where they claimed that the human remains were stacked around a single warrior burial; however there was no definitive conclusions about the date of either the putative warrior or other remains (Biddle and Kjølbye-Biddle 2001, 67; Taylor 1989, 4). A church building survey was initially led by H.M. Taylor in the 1960's and 1970's (Taylor 1987, 205). Taylor's review of the history of the church focused mainly on architectural styles and development, and only briefly mentions the 'dismantling' of the church by the Vikings in the year of overwintering (Taylor 1989, 26). The survey was only meant to elucidate the history of the important Anglo-Saxon church at Repton, but, with the 'guidance' of archaeologists Martin Biddle and Birthe Kjølbye-Biddle, Taylor's work became an integral part of the interpretation of the excavations in the 1970's (Taylor 1989, 205).

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[11] A hogback is a carved stone found in Britain, but with Scandinavian artwork, with the shape of a hog back, possibly emulating a longhouse, often with two beasts in Jelling style on both ends; hogbacks may have acted as gravestones, but are often found out of context (Bailey 1980, 85)

Figure 2.4: Basic plan of the Repton Viking winter camp enclosure, as hypothesized by Biddle and Kjølbye-Biddle (1992, 39)

The site at Repton, consisting of a standing church with a 7th century crypt and Anglo-Saxon tower, churchyard, and the ruins and standing buildings of a 13th century medieval priory, sits atop an outcrop of Sherwood Sandstone, overlooking Old Trent Water, an undated palaeochannel of the River Trent (the Trent now runs 800 m north of Repton). The Biddles completed a limited excavation of the churchyard immediately east of the church, along with a magnetometry survey of the churchyard, and resistivity survey in the cloisters of the priory, both in order to determine the course of the ‘ditch’ that was detected during the excavation. The results of the geophysical surveys (Aspinall 1984: never published, but described in Biddle and Kjølbye-Biddle 1992 and 2001) claimed to have identified a possible enclosure creating a D-shape with the church along the south curved side of the ‘D’ (figures 2.3 and 2.5) (Biddle and Kjølbye-Biddle 2001, 59; Biddle and Kjølbye-Biddle 1985b, 168). Excavation around the churchyard and to the west of the Anglo-Saxon crypt revealed a feature about 3 metres deep, which was interpreted as a D-shaped enclosure, utilising the Old Trent Water as the straight-edge boundary (Biddle and Kjølbye-Biddle 2001, 59). It was also claimed that there were contemporary banks up to 2 or 3 metres high to the interior of these ditches, though there is no conclusive evidence of these banks within the published discussions (Biddle and Kjølbye-Biddle 2001, 1992).

With no publication of the excavation, there are few details available. The main 1992 and 2001 publications on the excavations at Repton focus on burial evidence. Articles published separately about findings from Repton also address weaponry (Cameron 1986), stone sculpture (Biddle and Kjølbye-Biddle 1985), funerary practice (Biddle and Kjølbye-Biddle 2001), coinage (Biddle *et al*. 1986; Grierson *et al*. 1986) and architectural history (Taylor 1987), but there has been no research undertaken on the surrounding landscape of the site. No attention was paid to the specific dimensions of the site.

The most prominent male Viking burial (Grave 511, number 8 on plan in figure 2.3) included items that might indicate high status, including a Thor's hammer necklace, beaded necklaces, a sword, a key, a buckle and a belt, two knives, a jackdaw humerus, and a wild boar tooth placed between the thighs (Biddle and Kjølbye-Biddle 1992, 50). A young male with a knife at his side was deposited alongside Grave 511, and a male (Grave 529) was deposited with a ring and 5 pennies (Biddle and Kjølbye-Biddle 2001). Finally, a double grave (Graves 83 and 84) was also defined as being of 'Scandinavian type'. It is unclear if the Biddles only use this term on the double grave due to a single copper-alloy finger ring used as a grave furnishing, although small personal belongings can occur in both Viking and Anglo-Saxon graves, and do not necessarily denote a 'pagan' burial setting (Hadley 2006, 246). These grave furnishings and other objects of Viking influence such as the hogback and the sword of Viking type found to the north of the Old Trent Water (Derbyshire HER No. 24513), confirm the presence of the Vikings at Repton.

The excavations also investigated the mausoleum, located to the west of the identified D-shaped ditched enclosure and the present church. This late 7th or 8th century two-celled structure is related to the earlier Anglo-Saxon church, perhaps to serve as a mortuary chapel. It was first opened in 1686 by workmen, who described its contents as "Skeleton of a Humane Body Nine Foot long, and round it lay One Hundred Humane Skeletons [*sic*]" (Biddle and Kjølbye-Biddle 2001, 67). It was opened again in 1787, but the skeletons had already been disturbed and were out of context. When it was finally opened the third time during the Biddles' excavation, the deposits were no longer *in situ*. On the basis of the disturbed deposits, the Biddles (2001, 72) deduced that the western chamber of the mausoleum was converted to use as a workshop, which included finds such as window glass, animal bone, moulded plaster, and iron tongs, while the eastern chamber housed the human remains. The individuals were disarticulated and in a secondary, even tertiary context, but the Biddles excavated a few artefacts that were possibly part of the original burial assemblage, including a silver band with garnet cloisonné, copper-alloy pins and tacks, an iron axe, and five silver Anglo-Saxon pennies (Biddle and Kjølbye-Biddle 2001, 70). The 5 pennies dated the funerary deposit to a *terminus post quem* of 874AD (Biddle and Kjølbye-Biddle 2001, 70; Biddle *et al*. 1986). However, this did not prove that Viking burials were present in the chamber; rather, it was the age and sex distributions of young to middle-aged men, as well as larger than average size of interred individuals, that led the Biddles (2001, 79) to state that this deposit was composed, at least partially, of members of the Viking great army.

Unfortunately, the preoccupation with the burial evidence within the churchyard and mausoleum left little time for the presentation and interpretation of the rest of the site, including where the Great Army was living and under what conditions, the potential contemporary landscape, the results of the geophysical survey, the fills of the great ditch, pottery evidence, and many other potentially informative aspects. Despite not conducting any sort of landscape survey, their brief assessment of the site concluded that the churchyard and immediate area was, without a doubt, the site of the Viking winter camp at Repton (Biddle and Kjølbye-Biddle 1992; 2001).

This failings of the limited landscape interpretation first emerged in the present thesis with the realisation that the much quoted area measurement of the enclosure of 1.46ha was, in fact, a repeated misprint. Careful measurement after a walkover survey (funded by the Medieval Settlement Research Group for this project), and follow up survey measurements, have demonstrated that the area of the proposed enclosure is in fact 0.59ha (suspiciously close to 1.46 *acres*). The misinformed measurement can easily be spotted by making a brief estimation of the scaled drawing produced in the same 1992 and 2001 publications (figure 2.4). The incorrect measurement of the D-shaped enclosure does speak to the fact that the landscape was not at the fore-front of the research. This mistake does not yet have substantial repercussions, however as these sites gain interest in the archaeological community, average measurements of the corpus of winter camp sites will become skewed if it is not publicly addressed.

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Figure 2.5: Artistic representation of the winter camp based on the Biddles' interpretation, looking north-east showing the church incorporated into the earthwork (Biddle and Kjølbye-Biddle 2001, 60). This image does not include the fact that the church and surrounding church-yard is separated from the water by a steep cliff face, rather than the small slope that is pictured.

It became even clearer that the project did not consider the surrounding landscape of the site based on their artistically rendered interpretation presented in the 1992 publication (figure 2.5). A walkover survey and GIS analysis of Repton and the surrounding landscape conducted by the author demonstrated that there is a steep cliff face eroded by the palaeochannel (Figure 2.6). While there is a slight drop illustrated on the image, a cliff such as the one at Repton, plus any mud flats surrounding the channel of the Trent, would make it very challenging to access the moving river from the area of the church, as it appears on their reconstruction.

Figure 2.6: View from the grave-yard within the D-shaped enclosure, overlooking Old Trent Waters and the Trent Valley. (Author's photo, 2011)

Figure 2.7: View from the side of Old Trent Water, along the steep slope up to the enclosure (Photo, author's own, 2011)

The results of the geophysical survey are briefly summarized in the Biddles' articles (1992, 2001), and in an unpublished interim report (Biddle and Kjølbye-Biddle 1985; Aspinall 1984), which conclude that there was a large defensive ditch (up to 6m across and 3m deep) that formed the constructed and artificial D-shape, which is the basis of the conclusions about the shape of this overwintering camp. Of this ditch, only a small portion adjacent to the church was excavated, and only a small corner was detected using resistivity; the rest was extrapolated across the site. The Biddles' claim that there was an associated bank is not supported by any of the evidence presented in their publications. In addition, throughout the summary of the excavations in Biddle and Kjølbye-Biddle's 2001 article, there is only one mention of pottery throughout the site: a sherd each of proto-Stamford ware and York ware within the bottom ditch fills. These two sherds are responsible for providing an early medieval date for the ditch.

Despite the little evidence described and published, the excavation at Repton somehow generated detailed descriptions of the overwintering camp. The published papers are lacking in any attempt to decode the landscape and consider what this Viking camp may have looked like, and if they even did, in fact, find the winter camp. There are several issues that needed to be addressed, even with recourse only to the visible modern landscape. They include:

- Why is the area of the enclosure so small?
- How did an army that was small enough to fit in an enclosure and bury their dead there also have the time and capacity to construct a 3 metre deep ditch?
- If the army was only there for a year, was such a substantial construction really necessary or feasible?
- Was the enclosure merely reused, or possibly even of later date? With only two sherds of pottery as dating evidence for the 'ditch,' either seems likely.
- Could the possible enclosure have been only a part of a larger complex, with the rest of it nearby, possibly hidden under alluvium and warp?
- What date is the palaeochannel of the Trent, and how exactly does it relate to the site?
- What other physical features of the landscape would have been visible, and how could the proposed small to medium sized army take the greatest advantage of them?

Even through these simple considerations of the landscape, alternative hypotheses have been formed, both by the author, as well as ongoing discussions with Dr Gareth Williams, the Derbyshire county archaeologists' office (Barratt 2006), and with community archaeology groups (David Knight and Howard Jones *pers. comm.*). The search for the site of the winter camp has focused on the apparent D-shaped enclosure, but consideration of the wider landscape has lately encouraged the possibility that the stream and wetlands to the east of the enclosure formed the outer defences, or even a place for mooring ships. An alternative hypothesis is that the actual camp site is located on an island within the present floodplain (where there are multiple place-names referring to islands), and the D-shaped enclosure formed a sort of gateway (G. Williams *pers. comm.*) Many of these questions about the landscape could be answered by applying the methodology outlined in chapter 4, and further work at Repton has been proposed for the near future by Trent and Peak Archaeology and English Heritage Palaeochannels Project (D. Knight *pers. comm.*) and separately by Dr Gareth Williams of the British Museum.

Despite the fact that the Biddles' excavations do not include any landscape assessment to answer any of the questions listed above, their reports conclude that this deliberate 'D'-shaped enclosure was the camp in its entirety, and it was positioned against the river to ensure the ease of docking ships (Biddle and Kjølbye-Biddle 1992, 40). The origins of this D-shaped form and earthwork formation are attributed to the Viking period enclosures found in Scandinavia, such as those at Birka and Hedeby (Biddle and Kjølbye-Biddle 1992, 40; Rosedahl 1992). Birka was established on an island, complete with underwater palisades, defensive banks, all protecting a hill fort (Ambrosani 2008, 94), while Hedeby was a coastal site with a deliberate half-oval shape bank and ditch around the site (Hilberg 2008, 106). However, neither of these sites were fortified until the late 9th or 10th centuries (Ambrosiani 2008, 97; Hilberg 2008, 106). But due to an overwhelming lack of comparative evidence in the British Isles, and the excavation of a very small corner of the Repton enclosure, this idea of D-shaped enclosures has become the standard assumption that Scandinavian-type enclosures were synonymous with Viking overwintering camps in England (as cited in Richards 2004, Sheehan 2008, Maas, 2008).

While the excavations at Repton uncovered the first archaeological evidence for a Viking presence at the site of a documented overwintering camp, it should not be assumed that the excavated features at Repton are, in fact, the camp site in its entirety, or the camp site at all. The excavations recovered few to no domestic or industrial finds of a type that would indicate that the Vikings inhabited the space directly next to St Wystan's, and there have been no investigations of the surrounding landscape to provide any evidence of inhabitability. The small amount of information that has been published (Biddle and Kjølbye-Biddle 1985, 1992, and 2001) does not provide adequate details for later re-assessment of the findings, including the geophysical data, nor does it provide enough data about the surrounding landscape or the characteristics of Repton's contemporary natural surroundings at the time of the winter camp. Throughout the aforementioned works relating to Repton, no weight is given to the importance of the landscape, no mention of the role of the marshy ground lying to the east, or of the potential river crossing sites that may have been present at the site. These reports also do not consider that the site is small in comparison with the much later trading sites at Hedeby and Birka, on which their comparative evidence relies. Finally, the publications do not address the issue that this is possibly a very small space to house any army that is referred to as the 'Great Army', no matter whether we count its membership in hundreds or thousands.

2.1 Heath Wood

In recent years, the excavation of the Viking cremation burial site at Heath Wood, Ingleby has sparked the suggestion that it could be related to the Viking site at Repton (Richards 2004). Heath Wood is located 4 km south east of Repton, 5 km downstream on the current course of the Trent. The site was subjected to RCHME survey in 1993, which identified 59 barrows within the 14 hectare area of mixed woodland (Richards *et al*. 1995). A large number of grave goods were produced from the site, including shield bosses, mounts, wire wool embroidery, and a large number of nails. The cremation cemetery is superimposed on a prehistoric ditched boundary, possibly part of a Bronze-Age field system (Richards 2004, 82), part of which dictates the layout of the cemetery (Richards 2004, 87).

Figure 2.8: Heath Wood, dotted with cremation burials, overlooks the Trent Valley (Photo, author's own, 2011)

Although a thorough landscape evaluation has not been completed at Heath Wood either, Richards has suggested that there was a close relationship between Repton and Heath Wood, and that this cemetery represents a secondary burial ground for the Great Army at the winter camp (Richards 2004, 99), and radiocarbon dating confirms that the burials date to the late 9th/early 10th centuries. The rite of cremation dating to this period, as well as the typology of the finds, determined that the site is of Viking origins. Richards *et al*. (1995) suggested that a garrison would have protected and maintained the site while the rest of the Great Army was camped at Repton. Richards (2004) also suggests that if the two Viking burial grounds were active at the same time, a link between Repton and Heath Wood may demonstrate the faithfulness of some of the Viking army to old burial practices, while other individuals were accepting new Christian ways by being buried in the church yard at Repton (Richards 2004, 108). Conceding that the construction of 60 burial mounds in one winter was an unlikely feat, Richards maintains that it is not a later colonization, but rather the same Great Army that was encamped upstream at Repton (Richards 2004, 101).

3 Recent studies on overwintering camps in Viking Age England

Since the excavations at Repton, there have been few studies of overwintering camps in England. A number of publications that survey the archaeological evidence for the Vikings in England have been published within recent years, but within these, what little is included on winter camps is almost entirely based on the excavations at Repton and comparable studies in Scandinavia and Ireland, and the misinformed insights from antiquarian studies (e.g. Sawyer 1971; Loyn 1977; Richards 2000; Hadley and Richards 2000; Graham-Campbell *et al*. 2001; Hines, *et al*. 2004; Brink and Price 2008; Hadley 2006; Hall 2012). These works are edited volumes and works of synthesis, and because there is no new research on winter camps to review, it is not surprising that there is hardly a mention of them.

Prof. Julian Richards' volume on *Viking Age England* (2000) provides a brief but well-rounded summary of the work completed in Viking Age archaeology up to the year 2000. The section of the book on winter camps is sparse, as expected, but what information Richards does present still derives from the ideas that have emerged from the baseless antiquarian suppositions. His summary of current understandings of Viking winter camps reveals that the excavations at Repton and, to a lesser extent, those at Hedeby and Birka, have clearly played a large part in the archaeological perception of all winter camp sites in Britain. Richards ventures that 'one might expect to find a D-shaped enclosure, such as those erected around Scandinavian coastal trading sites' as a universal concept concerning wintering camps (Richards 2000, 39). This assumption that Scandinavian trading sites are comparable to overwintering camps is seemingly based on the very limited data set from Repton, and the assumptions made by previous scholars such as

Sawyer (1971). Richards even cites the possibility of the presence of Trelleborg-type fortresses, a statement harkening back to already disproved antiquarian identifications of later round earthworks (Sawyer 1971).

A more recent comprehensive volume on Viking Age England (*The Vikings in England*) by Prof. Dawn Hadley (2006) says less about the physical landscape associated with overwintering camps, but considerably more about other factors that may have drawn the Vikings to winter in their chosen locations:

> It is not certain that there was an intention to settle permanently at this stage, but the involvement of the raiders in the internal politics of three Anglo-Saxon kingdoms marked a change in tactics from the hit-and-run raids of earlier periods and paved the way for subsequent Scandinavian rule and settlement in parts of northern and eastern England (Hadley 2006, 10).

This statement, at last, portrays the other features of the Viking winter camps; these camps were not placed exclusively where they could build a Trelleborg fortress as postulated by Richards (2000), nor where there was a simply a nice island to dock for the winter as suggested by Stenton (1943) and Sawyer (1971). Instead, the locations of winter camps were informed by contemporary Anglo-Saxon politics, setting the Vikings up for the most advantageous political and physical exploits. Hadley also rightly puts the identification and excavation of Repton into a more realistic context. It is customary to place Repton in a comparative pool of 'Viking overwintering camps in England', when the reality remains that there *is* no pool, there are no comparisons. Hadley recognizes this, and does not project the findings as a physical site standard, but rather examines what the archaeological investigations may show about the impact of the Vikings at Repton. This work explores the political impact the Viking army would have had, and the advantages of the Vikings locating themselves at Repton (Hadley 2006, 15).

Hadley's and Richards' attempts to survey and present the current state of general archaeological knowledge on overwintering camps have demonstrated archaeologists' reliance on evaluating inaccurate and outdated information in order to understand the concept of a Viking winter camps, as well as an overall dearth of knowledge on the practice of Viking overwintering. Other recent volumes typically do not explore the topic of overwintering camps in depth, if at all. When Viking winter camps are addressed, they are either portrayed as D-shaped enclosures on a river, similar to Richards' description, or they are occasionally grouped together with other types of Viking settlement (Hines *et al.* 2004). However, as has been demonstrated, it remains unclear what the exact purposes of the camps were. In either case, the current evaluations are inaccurate and are leading archaeologists to ineffective lines of enquiry.

3.1 Possible Viking overwintering camp sites: recent studies

Very recently, the gap in knowledge about Viking overwinter camps has been recognised, and a few direct efforts have been made to assess and define Viking overwintering camps. Recent research that has attempted to identify archaeologically two overwintering camp sites using both excavation and non-invasive landscape techniques will be discussed in this section. This section will also explore two other very recent studies that exclusively address the evasive topic of winter camps in England, as well as the research completed at two new sites of possibly identified winter camp sites in England, at Tempsford and ARSNY.

3.1.1 McLeod: Feeding the *micel here*

A different angle to Viking winter camps has been considered in 'Feeding the *micel here* in England c. 865-878' (McLeod 2006), which focused on the winter settlement as a direct reflection of the need for sources of food. This study was based on historical records of movement and social interactions of the Great Army, as well as conclusions drawn by historians about the Viking campaigns in these years. By examining the opportunistic approach to provisioning the Viking Great Army, this research considers the social interactions of the army within different conquered and unconquered territories. These social interactions are examined in relation to the availability of food, arguing that the Vikings stayed for longer periods in areas of non-hostility, or where they held political control (McLeod 2006).

McLeod argues that aspects of Viking overwintering were reliant on the amount of food required for the number of Viking soldiers within the *micel here*. Assuming that the number in the *micel here* was large, with numbers over 1000, McLeod concludes that one winter is the finite amount of time that the army could be sustained on the food that was locally available from the stores of royal estates, through peace treaties, or even by foraging (McLeod 2006). McLeod hypothesizes that one way in which the Vikings would have procured enough food to sustain themselves is by seizing royal estates to use as winter camps (McLeod 2006). Due to the storage of grain after harvest in the autumn, as well as charging *feorm* (food tax) on the local populations, royal estates would have been well equipped to feed large number of people through the winter (McLeod 2006).

These seizures of royal estates occurred at Reading and Chippenham [Wiltshire], and probably at York, Thetford, and Repton (McLeod 2006). It is possible that seizure of royal estates also occurred in instances where there is little detail in documentary records, but Anglo-Saxon royal estates nearby, such as at Torksey (with nearby estate at Stow). It is difficult to imagine that these estates would be prepared for such a large influx of people, especially a hungry army, and McLeod postulates that ‘a constant stream of foragers must have poured out of the Viking camp scouring the frozen countryside for provisions’ (McLeod 2006). Foraging, whether for food or other loot, proved to be a dangerous tactic, which, in 871 at Reading, led to the deaths of a Viking earl (*jarl*).

Projection from the *Burghal Hidage,* a document from the early 10^{th} century recording the *burh* fortifications in Wessex and the number of men required to man them, indicates that these royal estates, often precursors to *burhs*, could be capable of providing provisions for up to 1600 men (McLeod 2006). If the Vikings had control over royal, or later *burh* estates, they would have had the capability to extract the necessary food from the local area (McLeod 2006). Puppet kings were installed by the Vikings in order to ‘ensure continuity of government’ as well as ‘harness existing arrangements to new purposes under new leadership’ (McLeod 2006). These puppet kings would have remained in control over these estates while the Viking army moved on to revolts and other raiding activities during summer months, so they could return to those areas and resume taking provisions without much effort (McLeod 2006). McLeod states that sites of year-long overwintering were only populated for short periods of time, always requiring a peace treaty, where there was either plenty of available food through positive relations with the local populations, support through *Danegeld* (at least an early version of it, as *Danegeld* is not mentioned in the *Anglo-Saxon Chronicle* until 991), or the surrender of a local royal or high-status estate, which could be plundered for the winter (McLeod 2006).

McLeod’s hypothesis that the Vikings relied on local sources for food is supported by the entries in the *Anglo-Saxon Chronicle*. The *Chronicle* often mentions that the Great Army made peace with the local population when setting up their winter camp, and McLeod theorizes that it would have acquired food as part of their peace agreements; in return for food and other favours, the Viking army would presumably then have left the locals alone (McLeod 2006). Their presence in the royal estate would also have provided the army with the means to dominate the area usually controlled by the estate; by employing a forceful means of submission by seizing food and provisions and perhaps generally terrorizing the subjects, their ‘peace’ treaties would have been even more effective (McLeod 2006).

Finally, McLeod explores the idea that the Vikings travelled with their food supplies, stocking up at those estates where there were copious provisions, and transporting it on their ships, and navigating the countryside using rivers: ‘For a people [who], as merchants, were familiar with transporting goods by ship, and who could travel by ship largely unopposed, how to feed the campaigning army would surely have been obvious’ (McLeod 2006). From the entry of 876 (see figure 2.1), this research tracks the use of the fleet, postulating that it did not carry provisions on a march to Cambridge, but would have met a fleet of ships at Wareham, which would have brought food from East Anglia, where they had secured control of several royal estates (McLeod 2006). The army would then retreat to familiar territories in Mercia and Lindsey (McLeod 2006).

This work on the role of food required for the sustainability of the Viking Army provides a different take on Viking overwintering camps, demonstrating through analysis of historical accounts (and some speculation) that while food was one of the most important commodities sought by the Vikings for survival and short-term investment, it was available to them through multiple means and would not have been scarce enough to dictate the movements of the Great Army. Despite shortcomings due to the level of speculation in reaching his arguments, McLeod’s article is an example of an innovative approach to the study of overwintering camps, in which specific fields of research are applied to the elusive winter camp, instead of focusing on the conjecture (such as the assumptions of a D-shaped enclosures and proximity to water) from antiquarian studies loosely applied to prematurely identified overwintering camp sites. The research also provides consideration of historical and social landscape features that could potentially be considered when addressing the landscape of Viking winter camps in England.

McLeod’s 2006 article led to the composition of a PhD, which was published as *The Beginning of Scandinavian Settlement in England: the Viking Great Army and Early Settlers,* c. *856-900* in 2014. In this book, McLeod (2014, 107) uses migration theory in relation to the historical and archaeological evidence, especially burial evidence, for the Great Army and the late 9th century settlers. The results from this study have concluded that the early Viking settlers associated with the Great Army did not come from

Scandinavia, but rather from Eastern Europe, and that the settlers were comprised of youths and females, as much as it was young adult males (McLeod 2014, 281-283). Unfortunately, this book was published too late to be considered in depth in this thesis.

3.1.2 Raffield: Viking fortifications in the British Isles

An MPhil thesis by Ben Raffield (2010), entitled 'A study of 'Viking' fortifications in the British Isles AD793-1066', and subsequent publication (2012a; 2013) provide a brief guide to the confirmed and proposed Viking camp sites throughout England on a county by county basis. In his work, Raffield defines potential early Viking 'fortification' sites throughout England as outlined by antiquarians and modern scholars. Within this research is a useful table of all the proposed overwintering camp sites from antiquarian accounts (Raffield 2010). The list is included with the amendment that 'the study of Viking fortified sites is in a form of limbo, relying on old and sometimes unsubstantiated sources as well as the physical evidence of existing sites' (Raffield 2010, 52).

Beyond this useful starting list of the proposed overwintering camp sites, Raffield's research, focused on the idea of Viking 'fortifications', is a prime example of the detrimental effects of the presumption that Repton is a model winter camp, and that D-shaped enclosures are indicative of the Viking fortification site type in England, on modern archaeological investigations. The research suggests that the overwintering camp should only be considered a part of Viking conflict, often disregarding the inevitability that overwintering camps were also places of temporary habitation for a population. Though Raffield begins by correctly pointing out that there is a parallel portrayal of the Vikings as both bloodthirsty raiders and productive and talented craftsmen and tradesmen in both past and contemporary sources, his thesis discounts the potential productive and political aspects of these camps. This assessment of Vikings at war only considers the pre-prescribed qualities, such as the D-shape, and occasional mentions of fortification in the *Anglo-Saxon Chronicle,* as evidence for the properties of Viking overwintering.

Raffield acknowledges that a number of sites defined as Viking winter camps are identified based on a D-shape morphology, and also attempted to trace this concept to its origin (Raffield 2010, 52). Though this research, as my own outlined above, does not find any reference to this shape in antiquarian accounts, therefore concluding that the origin of this attribute stems from more recent research (though he does not define what research), Raffield still includes the D-shaped enclosures at Hedeby and Birka, as well as the D-shapes associated with Irish *longphuirt* (see below) as models for identifying winter camps. His stance on the opportunistic Viking use of different types of fortifications becomes garbled, however, when he concludes in a later conference paper that 'all the sites seem to fit the D-shaped standard' (Raffield 2012a).

What is most unfortunate, however, is that, despite making claims that there is no evidence for D-shapes outside of later Scandinavian sites, the research once again attempts to use D-shapes as a means of 'identifying sites' in the landscape, as occurred in analysis of his case study with Matt Edgeworth at Tempsford (Edgeworth 2008; see section below). Raffield's research falls short of the promise to investigate any of these sites. Although it is one of the first attempts to utilise landscape features to inform the study of Viking winter camps, Raffield has fallen into all the old traps. Despite all of these shortcomings, his call to action in his suggestion that future research '"look up" from sites and attempt to study them within their wider landscape' is an important observation for future work to address (Raffield 2010, 112).

3.1.3 Tempsford

A recent study into a potential location for the Viking fortress at Tempsford was utilised by Raffield to propagate further the idea of a D-shaped enclosure for all Viking sites in England. This site is first recorded in the *Anglo-Saxon Chronicle* in 917:

> At the same time, the army came from Huntingdon and East Anglia and made the fortress at Tempsford, and took up quarters in it and built it, and abandoned the other fortress at Huntingdon, thinking that from Tempsford they would reach more of the land with strife and hostility. And they went until they reached Bedford; and the men who were inside went out against them, and fought against them and put them to flight, and killed a good part of them ... Then after that during the same summer a great host assembled in King Edward's dominions from the nearest boroughs which could manage it and went to Tempsford and besieged the borough and attacked it until they took it by storm (Whitelock 1965, 65)

The site of the Tempsford fortification mentioned in the *Anglo-Saxon Chronicle* has yet to be definitively identified, though a few potential sites within the vicinity of Tempsford have been targeted for investigation. As we have seen, antiquarians presumed the site at Gannock's Castle was the site of overwintering (Chalkley-Gould 1901), with this assumption continuing even after archaeological evidence emerged of it being a later medieval site (Maull and Chapman 2005). There have also been suggestions that it was located at the 'D-shaped' Danish Docks in nearby Willington, where excavations identified no remains pre-dating the later medieval period (Allcroft 1908; Bedfordshire HER 769). The identification of the site of the Tempsford fortification was most recently attempted by Matt Edgeworth (2008). The reasoning for identifying this site, and the fieldwork completed, including geophysical survey and a single test pit, is summarised in an interim report (Edgeworth 2008). This site was located by Edgeworth through the identification of a D-shaped enclosure and the Caſtle place name on a 1719 map and a reference to a 'castellmeade' in the 15th century (Edgeworth 2008, 10). The boundary between the parishes of Blunham and Roxton lies along the Great Ouse, however the parish of Roxton also includes a small piece of land on the south side of the river (see Figure 2.3), which may indicate that a portion of the site was once a freestanding island (Edgeworth 2008, 12). The majority of 'The Caſtle' site sits within the parish of Blunham, near the village of Tempsford. This piece of land comprises a large, naturally formed 'D'-shaped field boundary with the 'river [Great Ouse] itself forming the straightest side', with an area of 25.2 hectares encompassed within the proposed enclosure (Edgeworth 2008, 9). The enclosure is presently represented by an irregular field boundary, and Edgeworth suggests this area was a constructed ditch, reminiscent of that excavated at Repton (Edgeworth 2008, 9; 13). Within this ditched enclosure, a smaller 'ditched enclosure' of about 0.6 ha is defined by another field boundary.

It is clear from observing the landscape during a walkover survey (conducted by the author, 2012) that both of these boundaries are derived from palaeochannels of the River Great Ouse, but this is not mentioned by Edgeworth. Instead, the small enclosure is considered by Edgeworth (2008, 9) to be 'too regular to be an unmodified former river channel and thus almost certainly represents a substantial former ditch − the digging of which effectively rendered the site an island or holme in the river'. This enclosure is focused around a small mounded 'earthwork'; while no further information about the earthwork is provided in the short report, imagery of the earthwork on Google Earth and evidence from walkover survey by the present author suggests that Edgeworth's conclusions are unconvincing, as the earthwork is actually a small overgrown depression from what looks like phases of natural flooding of the adjacent river. Geophysical survey and excavation of a small test pit yielded negative results (Edgeworth 2008, 12). Despite the negative results, the 'conclusion drawn from both these exercises was that greater resources and investigation on a much larger scale would be required' (Edgeworth 2008, 12). Additional supporting evidence used by Edgeworth includes the suggestion that the confluence of the River Great Ouse and River Ivel represents a place of power and significance; he argues that this would have been the most effective place for the Vikings to put their camp, making this site the 'superior' candidate in relation to the other proposed locations: 'The site is situated exactly where one might expect the Vikings to have located a fort' (Edgeworth 2008, 13). The question remains, however, expected by whom, exactly, as there have been no definitive studies that claim that a confluence would define the location of a Viking fortress?

Figure 2.9: Edgeworth's map of the inner enclosure of the site covering approximately 0.6 ha, drawn with his evidence for Viking occupation, using features from the 1719 map and aerial photography. The Roxton parish boundary encompasses the 'western enclosure'. The inner oval represents the earthwork, though the vegetation suggests low-lying land, and the radiating lines (though invisible on satellite imagery) are Edgeworth's evidence for ship mooring (Edgeworth 2008, Fig 8)

In addition to the increasingly dubious results, there is a distinct lack of portable finds of Viking or early medieval type recorded in the area by the Portable Antiquities Scheme (PAS), although this may be because there has been no reported metal detecting activity. This technique for identifying Viking sites was suggested by Richards and Naylor (2005), and has been successful at Torksey and ARSNY (section 3.1.4). The 'landscape' study at Tempsford can be described as speculative at best, since the conclusions are mainly based on the claim that one can 'make out' former river beds. Despite these obvious drawbacks, this interim report on Tempsford states – unconvincingly − that there is 'already enough evidence from historic maps, aerial photos and observations on the ground to provisionally equate [the site] with the lost Viking fortress at Tempsford' (Edgeworth 2008, 8-9). Though this argument rests on the importance of the formation of the river beds, and of the proximity of the river confluence, along with its importance to the Viking army (Edgeworth 2008, 11), there have been no geoarchaeological considerations to confirm the locations of the river channels or the confluence of the Great Ouse and River Ivel during the Viking period.

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Figure 2.10: Edgeworth's (2008, 13, Figure 13) comparison of Tempsford with other possible overwintering camp sites, oddly excluding the dimensions of Tempsford itself, therefore excluding the direct comparison between Tempsford and these sites that Edgeworth calls 'similar'. In his image of the entire site, his to-scale drawing shows the large enclosure at Tempsford is much larger than these sites, and the small internal enclosure is much smaller than these comparisons.

The fact that the site assumes a general 'D'-shape is the attribute which Edgeworth considers as confirmation of his theory about the camp location: 'Main fortifications [of the Vikings] consist of D-shaped enclosures formed by ditches and banks, with the river itself forming the straighter side − so that in effect fortified islands or holmes were created' (Edgeworth 2008, 13). Edgeworth includes an image that compares Repton, and Athlunkard, Anagassan, and Dunrally (all provisionally identified as Irish winter camps, or *longphuirt*), although oddly does not include Tempsford in this illustration, which, therefore, undermines the possibility of making the comparison he attempts to present. The site is also compared with Woodstown (see section 3.2.5), with which it does share similar dimensions (Edgeworth 2008, 14). With these comparisons, Edgeworth (2008, 13) proclaims that the similarity to sites such as Repton provides further evidence to confirm that this is the site of the Tempsford fortifications. Edgeworth's confidence in the site masks the facts that the topography, size, dimensions, and method of formation all differ completely from the site at Repton. The use of the D-shape as the cornerstone of an identification of the fortifications at Tempsford is a clear example of the misinformed interpretation of data prompted by the excavations at Repton.

The site at Tempsford is currently under threat by mineral extraction; while it is inevitable that this landscape be fully evaluated for archaeological potential, this hasty diagnosis as an overwintering camp should be avoided without sufficient evidence in an attempt to distance ourselves from this haphazard way of identifying winter camps. Unfortunately, even without more research and irrefutable confirmation of the evidence presented by Edgeworth for encampment or that the earthwork is part of the fortress, this site will still doubtless enter the dataset of Viking overwintering camps, thus further perpetuating the practice of drawing on poorly dated or entirely un-dated, D-shaped landscape features, to identify Viking overwintering camps.

3.1.4 ARSNY

The site of ARSNY has recently been identified as a Viking site from a concentration of metal detectorist finds, confirmed by excavations. Richards and Naylor (2005) commented on the use of metal detector surveys and use of the PAS in order to recognize Viking type items to provide an idea of where Viking sites might occur; through evaluation of the finds from different sites, the presence of Viking artefacts and metalwork in larger quantities could potentially flag sites where the Vikings may have an archaeological presence. This method was employed at ARSNY (A Riverine Site Near York). In order to deter new detectorists from night-hawking, the location of the site is not being publicly released, and it is currently being referred to as ARSNY. The number of early medieval Viking metalwork finds is slightly smaller than those from Torksey (see chapter 1), but the types of finds are comparable (Hall and Williams forthcoming). The finds and contextualisation of ARSNY in the Viking landscape have been analysed in comparison with other sites, especially Woodstown (see below) and Torksey. The ARSNY collection of finds has also been compared with later Scandinavian sites, including Kaupang, Birka, and Hedeby, which all produced similar finds. On the basis of these comparisons of small-finds, ARSNY has been interpreted as a Viking encampment (Hall and Williams forthcoming). The location of ARSNY does not appear in the *Anglo-Saxon Chronicle* (although the precise location is not, being revealed, there are, in any case, no recorded winter camp site anywhere near York), though it may be interpreted as being part of the corpus of encampments established by the Vikings in the years 865-875, possibly coinciding with the recorded movement of the Great Army into Northumbria shortly after the encampments at Torksey and Repton (Hall and Williams forthcoming).

The finds from the site were acquired by the British Museum in 2006, and analysis has been ongoing. Based on finds alone, Hall and Williams were able to determine some of the activities that were taking place on the site. A large number of weights and bullion provide evidence of trade and exchange, and local and foreign coinage (such as Islamic dirhams) show the distances travelled by the Great Army and the long range nature of its trading contacts (Hall and Williams forthcoming). Ingots and other processed metals may indicate that there was some crafting occurring on the site. Loom weights and domestic items may reveal the presence of women on the site, indicating a domestic side to the population, while a small amount of weaponry and horse mounts demonstrates a more military aspect, as would be expected on a site with a Great Army (Hall and Williams forthcoming). Gaming pieces also demonstrate an aspect of habitation throughout the winter season, with traditional board games being played by the Viking inhabitants. Excavated materials demonstrate that there was a variety of activities occurring across the site, including cooking and metal working.

Unfortunately, since the location of the site is not being included in the future publication, any landscape analysis that has been completed cannot be thoroughly completed, as doing so would reveal the site location. Some specifications will be released, however, and only the released data will be used here for comparison. Despite not yet being published, some basic geoarchaeological and landscape surveys have been undertaken. The site is located within a river valley, on top of a glacial formation of till, with sand and gravel; the formation is surrounded by Holocene floodplain deposits that reach up to 1.3 metres depth (Howard, in Hall and Williams forthcoming). In addition, aeolian deposits may obscure archaeology. The site covers a total of 31 ha, and within the site, a sub-rectangular ditched enclosure was detected by a geophysical survey (Hall and Williams forthcoming). This enclosure has been described as ‘D-shaped’, although the enclosure is within several phases of ditched enclosures, and the interpretation as D-shaped seems more to do with fitting it within the ongoing discussion of Viking encampments, rather than an accurate description of the earthwork, especially since there was no western ditch to the enclosure.

The limited amount of landscape archaeology has not permitted the reconstruction of the setting of the site, but the finds have clarified that the site may represent a 'proto-urban' habitation (Hall and Williams forthcoming). Although it lacks many features that define a town or city dwelling, including urban-type houses or longevity of habitation, the trading, craftsmanship, domestic activities, and leisure activities that were taking place may be some of the earliest urban-type habitation in early medieval England, dating from the 9th and 10th centuries, or perhaps even one of the earliest settlements with Viking roots in England (Hall and Williams forthcoming).

The focus on the artefacts from ARSNY as evidence of domesticity and habitation is in stark contrast to most of the earlier research completed on Viking camps. At Repton, Tempsford, and many of the studies of earthworks completed by antiquarians, the focus was always on the construction of defences and fortifications for the Great Army, but the finds at ARSNY demonstrate that this site has a distinctly different character from those offered in earlier interpretations. The similarities of ARSNY with Torksey and Woodstown support the theory that the Viking camps were not merely fortresses. ARSNY is one of the first winter camp sites that will be formally published in the near future that clearly demonstrates that Repton may not be a model winter camp as has been previously imagined.

3.2 Woodstown and Irish *longphuirt*

A lengthier discussion on the archaeology of Viking camps in Ireland, referred to as *longphuirt* (singular *longphort*), has taken place, mainly due to the excavation of a Viking enclosure at Woodstown in 2003-4 (County Waterford). Additional possible *longphort* sites have also been identified at Dunrally (Co. Laois), Athlunkard (Co. Clare), and Anagassan (Co. Louth). *Longphort* sites are recorded in the Annals of Ulster from 841-916 AD (Harrison 2013, 61). The term *longphort* is a compound of Old Irish forms of the Latin meaning 'ship-place', or 'ship port', though the etymology may have eventually come to mean 'camp or dwelling with fortification features' (Harrison 2013, 61; Sheehan 2008, 282). *Longphort* sites are often linked with Viking winter camps in England (e.g. Edgeworth 2008; Sheehan 2008), but this association is slightly problematic. For example, it has regularly been accepted that the *longphort* at Dublin, as well as the one at Woodstown, are related to longer-term settlement, while Viking winter camps are only thought to have been occupied for the single winter. Additionally, many Irish sites are slightly later in date than the late 9th-century English winter camps. Because it is still unclear how or if they are related to Viking activity in England, they will not be discussed in detail in this thesis.

The excavations at Woodstown took place in 2003-4 in preparation for a bypass road (Russell 2003). The site lies a few miles north of Waterford, along the banks of the River Suir. Due to the rich archaeology on the site, the road has since been re-routed to the south of the site. Geophysical survey showed a narrow and roughly D-shaped ditched enclosure about 450m in length, and excavations have shown that the site is comprised of multiple phases of ditched enclosures. Excavations have unearthed a large amount of Viking archaeology, including a furnished burial, and evidence of domestic and industrial activity (Russell 2003). Radiocarbon dating of the materials suggests that it was occupied for several centuries, possibly from as early as the 5th century to as late as the 11th century.

With the excavation report and maps publically available, the site has inspired many recent publications regarding the identification and interpretation of Irish *longphuirt*, and what these sites can bring the state of knowledge about early Irish Viking archaeology (Harrison 2013; Wall 2010; Arthur 2009; Maas 2008; Sheehan 2008; Valente 2008; Gibbons 2004). These publications discuss what life was like in the enclosures at Woodstown and how it may be similar or different from other *longphuirt* sites (Harrison 2013), how Woodstown may be a model for the urbanisation that occurred throughout the early medieval period (Wall 2010), how Woodstown and other Viking *longphuirt* may fit chronologically and linguistically into the evidence form the chronicles (Maas 2008), if it is possible to locate a *longphort* by analysing the Irish landscape (Arthur 2009), and finally what is a *longphort* and is Woodstown one of them (Sheehan 2008). Since the identification and excavation of Woodstown as a *longphort*, the very term has been undergoing redefinition: are these sites temporary encampments, proto-urban sites, long-term settlement, or all three? Was the Viking army on the site alone, or was it a simultaneous domestic settlement? Are these short-lived settlements, long-term settlements, or both? Adding the ongoing discussions of Woodstown into the body of evidence regarding Viking overwintering camps in England confuses both subjects more than clarifying our understanding of the sites.

Similar to the discussions of Viking winter camps in England, there is little to no consideration of the landscape in studies of *longphuirt*. Despite many recent publications on the site, there has been no formal assessment of the appearance of this type of site during the early medieval period, such as determining if there were any environmental features such as palaeochannels that would have affected the Vikings' choice of site, or if the contemporary water level may have affected where the camp was located. There has been no investigation of the surrounding landscape, to determine if there were any nearby settlements or features that would have drawn the Vikings to the site, or what impact their long-term settlement may have had on the landscape. Instead, assumptions are presented about the locations of camps, such as the belief that they were sited close to fording points, or have marshy surrounding land, or were dependent on both the natural landscape and opportunistic selection (Arthur 2009, 84), but never with any supporting evidence.

Unfortunately, some recent discussions have also indicated that the sites may take on an intentionally D-shaped formation, and have made the comparison with Repton and Hedeby (Gibbons 2004, 19; Sheehan 2008, 284); hopefully the excavation at Woodstown, and recent research into the opportunistic use of the landscape by the Vikings in Ireland (Arthur 2009), and recent investigations of English Viking winter camps at Torksey (this study), and ARSNY will eliminate the tendency towards the standardisation of sites. However, due to the infancy of the archaeological studies of both English Viking encampments and Irish *longphuirt*, the two types of sites should continue to be considered separately.

4 Conclusions: Torksey as a model for landscape reconstruction

This chapter has presented a chronological overview of the studies undertaken on Viking winter camps since the end of the 19th century. This has clearly demonstrated that there has previously been little reliable evidence to lead archaeologists any closer to determining the form or landscape setting of Viking overwintering camp sites. No antiquarian identifications were conclusive or convincing, though they were clearly focused on fortifications, as most of the sites misidentified were later determined to be defended later medieval sites. The site identified at Repton is a miniscule enclosure of 0.59ha, clearly not of a size capable of holding even a small army. Repton has not been subject to a landscape evaluation; although the site has been excavated, more work is required around the site and surrounding area (including the landscape up to and around Heath Wood) in order to determine the Vikings' use of the landscape, and to determine more convincingly the nature of this camp.

Recent studies, especially that focussing on Tempsford, have made the mistake of creating a type site out of the evidence derived from work at Repton and antiquarian guesswork, and Tempsford must be used as an example of ways *not* to identify a winter camp: using an actively changing landscape without any investigation of how much that landscape has been transformed over time and through climate changes, and by identifying vague D-shapes in the landscape; D-shapes are formed naturally in alluvial environments with the cutting off of a channel meander, so there is no shortage of D-shapes along a river. Not all such D-shaped features were Viking winter camps; indeed, most were certainly not.

Identification of winter camps by metal detected finds recorded through the PAS, the locations of which have been confirmed on the basis of on subsequent excavations and analysis of the associated finds, has been successful at ARSNY, and preliminarily successful at Torksey. The excavation at Woodstown through commercial archaeology endeavours has also aided the discussion of late 9th century temporary Viking settlement in the Britain and Ireland. Through the finds and analysis from these sites, the discussion of winter camps has taken a sharp turn away from discussion of military D-shaped enclosures, to consideration of the sites as proto-towns with trade and exchange, metal working, and domestic and leisure activities. There is, of course, some evidence for weaponry, and the sites still house the Great Army, but the finds from these sites are fuelling a discussion of about what the *micel here* was really doing during their late 9th and early 10th century campaign.

What is still missing from this discussion of winter camps, of course, is an idea of what these sites looked like in the landscape, and how the Viking Great Army may have used the pre-existing landscape to their advantage; landscape evaluation should also address what happened to these the camp sites, and if they had an impact on the development of the later landscape. What also needs to be determined is whether there is a set ‘model’ of the form of a winter camp that can be identified and applied to different sites throughout Britain, or if each camp is distinctive, and the Vikings were making use of what was available each year. These issues can potentially be addressed through a detailed geoarchaeological study of the identified sites, and a landscape analysis of the surrounding area, and that is what this thesis hopes to achieve. Until this is done, investigations of the size of the Great Army based on the size of the camps, or where they were getting food during their time at each camp, are slightly premature.

After over 100 years of discussion, only two sites, ARSNY and Torksey, have been positively identified as Viking winter camp sites in England. There are a number of reasons why winter camp sites have continued to evade archaeologists throughout the past century or more, including the following:

1) the Viking overwintering camps lasted for less than one year, which may mean that they did not leave a significant archaeological trace beyond the metalwork retrieved as Torksey and ARSNY
2) overwintering camps sometimes occurred within or adjacent to major towns, and have since been lost during the building and expansion of such towns as London, Reading, Northampton, Leicester, Exeter, etc.
3) the sites may be larger (or indeed, smaller) than archaeologists are expecting, and potentially relevant evidence may, therefore, have been overlooked
4) the sites are along alluvial systems, and thus may have been lost with shifting river courses, or inland sites have been affected by other geomorphological processes

In the hopes of overcoming these issues, this thesis on overwintering camps in England will assess the winter camp at Torksey, Lincolnshire with the aforementioned limitations and processes in mind.

The overwintering camp at Torksey will be the main focus of this PhD, demonstrating the potential of using methods in geoarchaeology and landscape archaeology to understand the development and use of an overwintering camp. These methods will attempt to overcome the obstacles that have emerged from over 100 years of misidentification and misuse of data in the field of Viking winter camp analysis in order to build a more robust picture of a winter camp from analysis of the landscape. The results of the study of Torksey will be the first ever landscape and geoarchaeological reconstruction of a site of Viking overwintering in England.

CHAPTER 3

HISTORY AND ENVIRONMENT OF THE STUDY AREA

1 Introduction

Chapter 3 will present a review of the archaeological and environmental evidence for Torksey and the surrounding region. The archaeological evidence and historical sources for Torksey have been discussed in multiple published and unpublished reviews (Cole 1906; Barley 1981; Blackburn 2001; Brown 2006; Hadley and Richards forthcoming), so the first section of the chapter will only briefly discuss the primary sources and the results from the various analyses. The palaeoenvironmental history of the region will then be summarised using existing available information about the palaeoenvironment of the study area. The chapter will first outline the underlying geology and the pre-Holocene superficial deposits, and then describe all Holocene drift geology. Following a discussion of the climatic and environmental changes throughout the Holocene in England, and more specifically in the Trent Valley, the chapter will then examine the palaeoenvironmental studies that have already been completed in the study area within the Trent Valley, as well as a few relevant case studies from across Lincolnshire and the north east of England.

2 Review of the history and archaeology of Torksey

2.1 Early medieval Lincolnshire

Anglo-Saxon kingdoms emerged in the 5th and 6th centuries, but there is little available evidence of the political status of Lincolnshire in this period. Archaeological evidence of the early Anglo-Saxon period is mainly funerary, suggesting a pagan, widely dispersed population. Although there was continued settlement at Lincoln , the capital of Lindsey, since the Roman period, the population throughout the area was probably not continuous (Sawyer 1998, 44). On the basis of the available archaeological evidence, the population likely emigrated from the Germanic and Scandinavian areas of the mainland during these centuries (Leahy 2007, 35). The area was part of a locally-controlled British territory, known as *Lindēs*, before Anglo-Saxon populations slowly moved into the area in the 7th century, to create the 'Kingdom' of Lindsey (Green 2012, 99; 106). Lindsey is described in the *Tribal Hidage* in the mid-7th century as the 'Kingdom of Lindsey' (Leahy 2007, 9). Lindsey did not follow the same boundaries as Lincolnshire, but was rather bounded on the south by the Foss Dyke and the River Witham, with the North Sea to the east, the Humber Estuary to the north, and the River Trent to the west (Leahy 2007, 13; Sawyer

1998 45). Leahy (2007, 100) states that, although its status as a kingdom cannot be confirmed on the available historical evidence, the presence of Lindsey (along with the neighbouring kingdom of Elmet) within the *Tribal Hidage*, an early medieval text listing the tribes across Anglo-Saxon England suggests that the kingdoms were intentional creations of the larger kingdom of Mercia. From 765-779, Lindsey was governed by its only known king, Aldfrið (Sawyer 1998, 49), although it probably remained largely under the control of Mercia from the 7th through the 9th centuries (Sawyer 1998, 76).

7th century England was defined by the struggles between Mercia and Northumbria, during which Lindsey was annexed and later re-established as part of the Mercian kingdom (Sawyer 1998, 58). The first Christian activity is recorded in Lindsey in the 630s, when one of the first missionaries in Lincolnshire, Paulinus, was recorded by Bede as performing a baptism at *Tiouulfingacaestir* (possibly identified as present-day Littleborough; see chapter 6) in the presence of King Edwin (Sawyer 1998, 59). By the late 7th century, Lindsey was its own religious and, to some extent political, entity, and was beginning to be split into several sees (Sawyer 1998, 61).

The end of the 8th century in England brought the first Viking raids on Lindisfarne, although the Great Army did not winter at Torksey until 872-3; during the intervening period, the Vikings travelled across the country, and were likely very familiar with the midlands by the late 9th century. By 876, the Vikings began settling in these areas, and had conquered much of the northeast (Hadley 2000, 8). This area, now Lincolnshire, Yorkshire, Nottinghamshire, and Derbyshire, made up the Danelaw, an area that was, from the 10th to 12th centuries, governed by separate laws from the rest of Mercia and England, due, in part, to the large immigrant Scandinavian population (Hadley 2000). The Scandinavian settlers brought both conflict and wealth to the Danelaw. Although the Vikings are often condemned by documents such as the *Anglo-Saxon Chronicle*, the settlement of Scandinavians in Lincolnshire brought wealth and a booming economy (Sawyer 1998, 178). By 1086, when the Domesday Book was written, Lincolnshire had three major settlements: Lincoln, Stamford, and Torksey, each of which were prosperous towns in late Anglo-Saxon Lincolnshire.

2.2 Previous reviews of the archaeology of Torksey

Prior to the advent of the Torksey Project, understanding of medieval Torksey rested on historical records, excavations in the 1960's by Maurice Barley, other more recent developer-funded excavations, and metal detected finds. Torksey has long been on the radar of archaeologists and historians alike, especially since the Vikings had a known presence. The earliest historical review of Torksey was completed by Reverend E. G. Cole (1906). His survey addressed only the historical records, summarising and translating the late medieval charters. Barley (1964; 1981) reiterated much of Cole's historical summary prior to his excavation report and analysis. More recently, Anglo-Saxon and Viking Torksey was interpreted by Blackburn, based mainly on the small finds, first those that were in the Fitzwilliam Museum (Cambridge), and later on the PAS finds (2002). Later identification of the find-spots of the metalwork indicated that the concentration of artefacts north of the present and early settlements of Torksey, and to associate the fields on the bluff north of Torksey with the Viking overwinter camp of 872-3. This association was made in a comparative study of the finds from Torksey recorded in the PAS and the finds from the trading site at Kaupang in Norway (Blackburn 2007). Analysis of small finds has been continued by Andy Woods as part of the Torksey Project (in progress); his work has already been discussed in chapter 1.

Prior to the Torksey Project launch, Hannah Brown completed a review of all of the historical and archaeological assessments completed within Torksey and across the winter camp site, and a catalogue of some of the finds from the site. In this work, the attempt to define the Middle Anglo-Saxon settlement of Torksey based on these metalwork finds and historical records were not entirely successful (Brown 2006), as there was not nearly enough evidence for the nature of settlement at Torksey in the archaeological record. Brown did conclude, however, that the location of Torksey, at the junction between the Trent and the Foss, was the reason for the town's success in the early medieval period, but also determined that there is no clear relationship between the Viking overwintering and the success of the settlement from the late 9th century onwards. In her work, Brown (2006) also determines that 'it is difficult to tell whether the Viking choice of Torksey was a surprising one or not, but presumably the decision to establish a camp here was not random'. The review also concluded that a Scandinavian presence remained in the area until the 10th century, mainly on the basis of local place names and personal names in historical records, and even went as far as to suggest that the Vikings occupied the winter camp site prior to the Anglo-Saxon population at Torksey (Brown 2006).

2.3 Historical records regarding Torksey

The first record of Torksey in the *ASC* refers to *Tureces ige*. This has been traditionally been translated as 'Turoc's Island,' with Turoc as an Old English personal name, and the suffix *–ey* meaning 'island,' or 'dry ground in fen, raised land in a wet area' (Ekwall 1960; Watts 2005, 301; Cameron and Insley 2010, 123). While the suffix part of the place name remains secure, mainly because *–ey* is a regularly used suffix and it corresponds with the local landscape, there has been some recent debate over the first part of the place name. Turoc, while it may be an unrecorded Old English personal noun, it may also be loaned from the British word for boar, *torco* (Cameron and Insley 2010, 123; Insley 2002, 163). Another possible translation for the first part of the place name is that it stems from the OE term for 'throat', which may correspond to the 'throat,' or confluence of the Foss Dyke along the Trent at the Lincoln Gap (Hadley and Richards forthcoming). Both Brampton and Hardwick are recorded in the Torksey parish as early as 1237; Brampton has been translated as OE for 'the farmstead, village where broom grows,' and Hardwick is OE for 'herd farm', or the 'part of the estate devoted to livestock rather than to arable farming' (Cameron and Insley 2010, 127).

The *Anglo-Saxon Chronicle* entry for 872-3[12] is undoubtedly the most quoted historical source regarding Torksey. However, the entry provides no details about the nature of the site, the role of Torksey in the Danelaw, or within early medieval England. Both Stenton (1943, 388) and Whitelock (1965, 209) have proposed that there is an additional indirect reference to Torksey in the *Chronicle*. A 942 entry had described five boroughs of the Danelaw as Lincoln, Stamford, Leicester, Nottingham, and Derby; however, in 1015, the annalist describes 'Seven Boroughs' of the Danelaw, with the final two boroughs hypothesized to be York and Torksey (Whitelock 1965, 209). Torksey is thought to be the final borough, mainly due to its large size; Domesday Book described Torksey as the third most important town in Lincolnshire after Lincoln and Stamford.

The Domesday census of 1086 records that there were 102 occupied burgesses (freeman holdings, and thus only a fraction of the total population), with 111 empty burgesses, implying that prior to this record, there were 213 total burgesses (Domesday Book, trans. 2003; Sawyer 1998 196-197). Domesday also recorded that the lords in 1066 were

[12]Her nam se here wintersetl on Lindesse æt Tureces iege

Godric, and Swein son of Svavi, both with Scandinavian names, as well as King Edward, but by 1086, the lord was King William. In 1086, Torksey had 63 households, 20 acres of meadow, 60 acres of woodland, and 11 fisheries (Domesday Book, trans. 2003). At the time of Domesday, Hardwick was taxed as part of the same vill as Torksey, as manors in both areas were held by the queen (Sawyer 1998, 196-197). The early medieval population were also utilising the location to their advantage, as Domesday records that shipping from Torksey could reach as far as York via the Humber and Ouse: 'if the king's officers should come there the men of this small town should conduct them with their ships and their means of navigation as far as York' (Sawyer 1998, 18; Domesday book: f. 337a). Symonds (2003, 20) has hypothesized, based on distribution of Torksey ware pottery and other local wares, that navigation of ships to Lincoln was also available via the Foss Dyke in the 10th century. Sawyer has also suggested that the reason that Torksey was a large trading centre before the Danes arrived, was because it had the great advantage of access to the Trent and the Foss; however there has been no archaeological evidence to support the argument that there was pre-9th century occupation (Hadley and Richards forthcoming).

Later records indicate that Torksey remained a large town into the 11th through 13th centuries. Coinage from outside of Torksey has demonstrated that there was a short-lived mint in Torksey by the 11th century (Sawyer 1998, 196; Dolley and Strudwick 1956). By the 12th century, Torksey also had a court system, known as a *burwarmoot*, and three parish churches, a nunnery, and an abbey (Barley 1964, 167; Sawyer 1998, 196). It has been suggested that, within the confusion and changes occurring during the Conquest, the Foss had silted up, requiring this major work be undertaken in the 12th century, and in 1121, Henry II ordered maintenance of the Foss, which would have reopened Torksey's connections with Lincoln (Sawyer 1998, 197). Sawyer (1998, 197) also suggested that the frequent siltation of the Foss was responsible for the decline of Torksey in the 13th and 14th centuries, and this led to the eventual growth of the port at Gainsborough in the later medieval period. Records translated by Cole (1906, 497) indicate that weirs and banks within the Trent also needed to be removed to help navigability around Torksey in the 13th century. A record of 1237, 'Inquisition into the Liberties and Boundaries of Torksey', provided a detailed description of the boundaries of Torksey, describing the same boundaries as the modern parish (Brown 2006), which will be explored further in chapter 6. This inquisition also reveals that number of courts in Torksy had increased to three at the time of recording (Cole 1906, 473). This same charter records Torksey as the 'key of Lindsey as Dover is the key of England' (Cole 1906, 473).

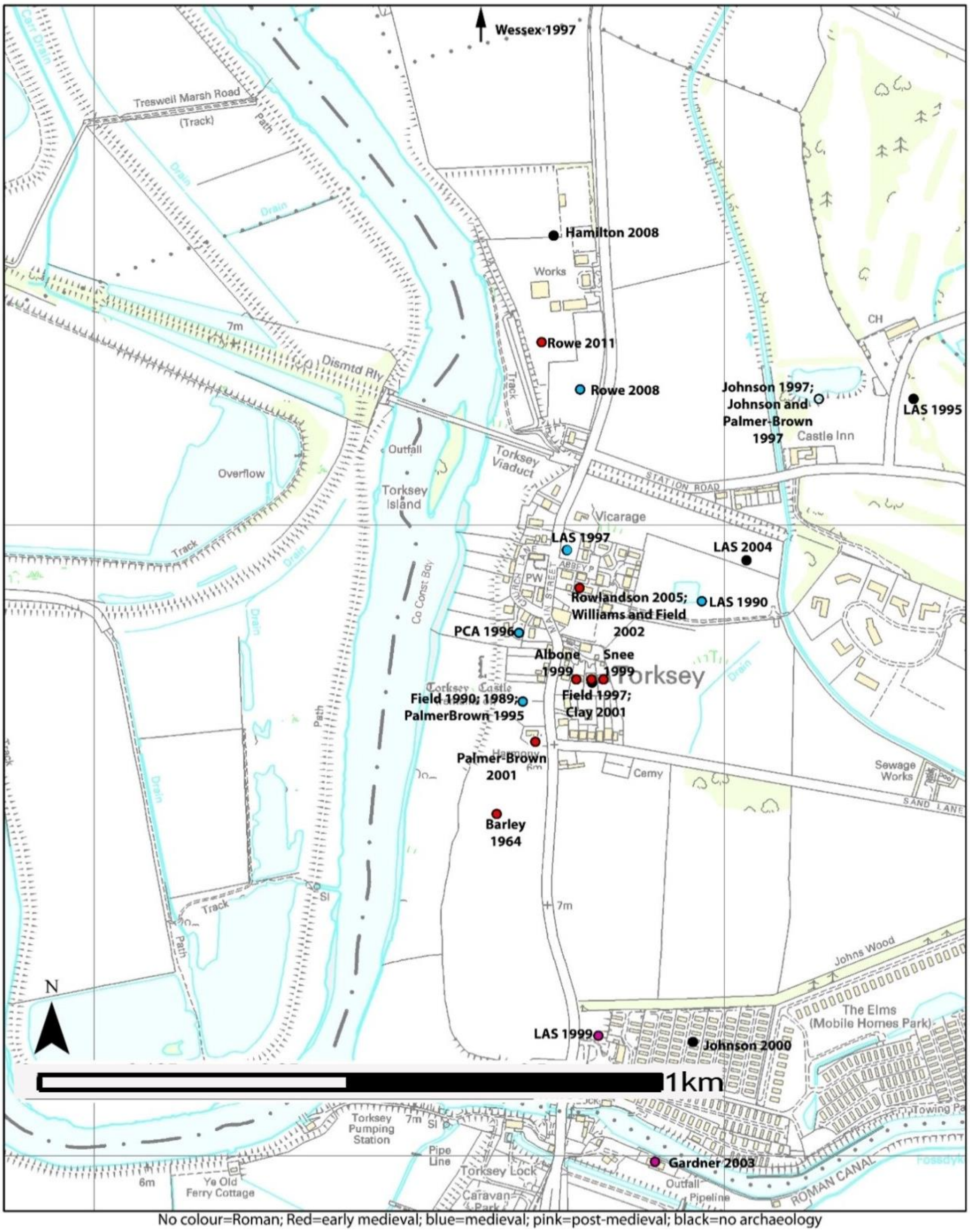
Figure 3.1: 19th century image of clearing out the 'Roman Canal, Lincolnshire,' which is referring to the Foss Dyke. This kind of major undertaking is required to keep the canal and drainage channels from silting up o on a regular basis. Painting by Peter de Wint

Later charters record various properties changing hands in Torksey, Hardwick, and Brampton in Torksey, but there are few later medieval records of Torksey, mainly because the town had started to decline. By the post-medieval period, the settlement had shrunk dramatically. By the 16th century, Torksey Castle was built on the banks of the Trent, along the southwest side of the modern village. In the mid-16th century, John Leland records:

> It is seven miles from Lincoln to Torksey, partly, but not entirely, over marshy ground, with very little woodland. The old settlement at Torksey lay to the south of the new town, but there is now little to see of the old buildings, except for a chapel, which people say was the parish church of old Torksey; and beside the Trent the ground has been so built up as to indicate that there were probably walls there. Nearby is piled up an earthen mound, which is called the Windmill Hill, but I think that it is the site of the keep of an old castle. To the south of Old Torksey sand the ruins of Fosse nunnery, next to the stone bridge over the Fosse Dyke, which here joins the Trent. In New Torksey, there are two small parish churches, and to the east stands St Leonard's Priory. The bank of the Trent on which Torksey stands is rather higher than the west bank (Leland, trans. Chandler 1993).

In this entry, Leland observes the presence of an 'Old Torksey' south of the later village (present-day Torksey). This entry mentions the presence of three parish churches, including one within the old village, as well as the still-visible St Leonards Priory, and ruins of the nunnery south of 'Old Torksey'. It also mentions a possible site of a motte and bailey castle on the eastern side of the village, though the site may have been an abandoned windmill in the later medieval or the post-medieval period, as there is no record of a castle in this part of the village. These observations are the last recorded indications of the presence of Anglo-Saxon and medieval Torksey.

2.4 Excavations at Torksey



No colour=Roman; Red=early medieval; blue=medieval; pink=post-medieval; black=no archaeology

Figure 3.2: Excavation locations within Torksey, and the authors of the ensuing report. This only includes excavation reports, not HER records, up to and including 2011. The Torksey Project has added to the number of excavations since 2011, which will be discussed in more detail further in this thesis. Sites are marked as they are cited in the text, and a full list of the results of these excavations can be found in Appendix XII. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

Excavation, archaeological survey, and finds collections since the 1960s has produced a very different picture of early medieval and medieval Torksey than emerges from the recorded history. Historical records such as the descriptions by Leland, the entry in the *Anglo-Saxon Chronicle* led antiquarians, such as Cole (1906) and Streatfield (1894), to explore the history of Torksey, but it was not until Maurice Barley (1964; 1981) excavated what is known as Castle Field, or the field south of modern Torksey, that the extent of the industrial archaeology at Torksey came to light. In the 1930s, A. Oswald (1937) excavated a series of Romano-British pottery kilns at Little London, south of the present Foss Dyke, in the parish of Fenton. During the 1949 and 1960-62 excavations of 'Castle Field,' no indication of any Roman activity on the north side of the Foss Dyke was unearthed, but two kilns and a series of later medieval burials were excavated on the north side of the field (Barley 1964). The kilns in Castle Field were dated to the 9th and 10th century based on associated finds (Barley 1964). Barley also concluded that the burials were 13th century Christian, due to their east-west orientation and the presence of later shelly ware rather than Torksey ware around the burials (Barley 1964).

2.4.1 Pottery kilns

An additional five kilns were later excavated by Barley across the southern end of Torksey (Barley 1964); to date, a total of 13 kilns have been excavated across the village of Torksey, many identified as a result of developer-funded excavations in advance of construction (Field 1990; Palmer-Brown 1995). These kilns were producing what is known as Torksey ware, which has been found from Lincoln to York (Hadley and Richards, forthcoming). Barley dated the Torksey ware industry to the early 9th century, prior to the Viking overwintering in 872, based on the discovery of the ware at Goltho (Barley 1981); however, this context was later re-evaluated, and the industry has most recently been dated to the later 9th century at the earliest (Perry forthcoming). Petrographic analysis completed by Gareth Perry as part of the Torksey Project has determined that Torksey ware was wheel-thrown, and that almost all examples of this pottery type found across the country originated at Torksey. A similar production centre was also founded at Newark-on-Trent in the 10th century, using the same technique (Abbott *et al*. 2005; Hadley and Richards forthcoming).

Whether the industry was founded before or after the winter of 872-3 remains unclear. The kilns at Torksey may range in date, and do range in technological abilities (Perry, forthcoming), but there is no archaeological or historical evidence to determine whether the Vikings were involved in the changes in technology, or if they were even responsible for the introduction of pottery making in the area. The clay used to make the pottery was a local Lias clay, pre-tempered with the local sands and gravels of earlier terrace deposits (Perry, forthcoming). The Romans were the first to notice this prime location for pottery production, utilising the same clay as the later Anglo-Saxon population (making the Roman ware and later Torksey ware identical in fabric, and nearly impossible to tell apart) but situated their kilns south of the Foss at Little London (Oswald 1937). The early medieval population sited their kilns on slightly higher ground, where there would be less chance of flooding, but still with easy access to the Trent. Further investigation of the orientation of the kilns shows that the ventilation was always lined up to the prevailing easterly wind direction (Perry, forthcoming; Stein 2012). The industry is thought to have ended at about 1100 AD, just after the Norman Conquest (Perry forthcoming), around the same time that Torksey began to decline and shrink in population size. On the winter camp site, Torksey resumed its pottery industry for a few short decades in the 19th century, with the presence of Torksey china factory (Exley 1970, 15), but aside from this short interlude, there is no evidence of a Torksey pottery industry after the 12th century.

2.4.2 Cemeteries

Burials are distributed across the village in at least 4 different locations. Barley first excavated approximately 30 burials in Castle Field, which he dated to the 13th century. Fieldwalking completed as part of the Torksey Project collected many human bones across the field, representing at least 20 different individuals, and two radiocarbon dates indicated that these were dated to the late 10th/early 11th, and the 13th centuries (J. D. Richards *pers. comm.*). A long term cemetery may have corresponded to an enclosure on Castle Field, which was identified as part of the magnetometer survey undertaken as part of the Torksey Project (Brown 2012; Hadley and Richards forthcoming). Another concentration of burials was found at Castle Farm, at the south end of the present village, near more pottery kilns (Field 1990; Palmer-Brown 1995); these burials were dated to the 11th century, and are thought to be associated with one of the lost parish churches of Torksey. A third set of burials were identified east of Main Street within the present village (Williams and Field 2002; Rowlandson 2005). These are located near the site identified as the Augustinian prior of St Leonard, however cist and stone-lined burials within the complex, and the presence of gold thread in one of the burials may indicate a high status early medieval church complex on the later medieval site (Hadley and Richards forthcoming; Hadley 2000). The final group of burials were found on the north side of the village, these also associated with a group of kilns (Rowe 2008; 2011). This cemetery is preliminarily dated as 13th century, and is the only one that hasn't been associated with any religious site in Torksey, although Hadley and Richards (forthcoming) have suggested that the ditch separating the burials and kilns was a boundary for a church and cemetery.

2.4.3 Settlement remains

Despite the wealth of evidence for the Torksey pottery industry and funerary practices, there has been no evidence of early medieval or medieval settlement across Torksey. A possible sunken feature building was identified during the watching brief along Main Street, Torksey (Rowlandson 2005), but the feature was never confirmed. A possible line of a fence post was also identified along the north side of the village, dated roughly to the 9th through 11th centuries (Rowe 2008). Finally, a trackway with ruts was recorded on the west side of the village, along the present floodplain, which may also date to the 11th to 12th century based on associated finds (Pre-Construct Archaeology 1996). Late-Saxon pottery is found across the village, and may be indicative of the period in which Torksey was the most active (Hadley and Richards forthcoming), however, the pottery that is found, is never found in domestic contexts, but is rather in the form of wasters, or discarded pottery from the pottery industry. There is no pottery, in waster form or otherwise, on the fields north of the village on the winter camp site. The minimal evidence of settlement in the archaeological record does not reflect the historical records of Torksey being the third largest settlement in Lincolnshire in the 11th century.

2.4.4 Small finds

The bulk of the evidence of early medieval Torksey comes from stray finds and metal detector finds from Torksey and the surrounding fields. Coinage and metalwork finds have proven that the winter camp site was an active trade and exchange sites, though this is perhaps only representative of the year of the overwintering. Other finds from the winter camp site include gaming pieces, fishing weights, loom weights, spindle whorls, gold and silver bullions, and weights (Hadley and Richards forthcoming). Blackburn concluded that there was a strong bullion economy at both of these sites, with polyhedral weights allowing the trade and exchange of valuable scrap metals, which continue to be found on the winter camp site in the form of hack silver and hack gold (Blackburn 2011; Hall and Williams forthcoming). Coinage and small finds from the winter camp site have been studied and analysed by Mark Blackburn (2002; 2008; 2011), and later by Andy Woods; which has been outlined in chapter 1.

2.4.5 Other investigations at Torksey

The excavations at Torksey have mainly focused on identifying the early medieval remains of Torksey, however several developer-funded excavations and watching briefs have also identified remains of several different periods. While there have been no identified *in situ* remains of earlier periods in Torksey's history, an excavation on what is now the Torksey Golf Course identified a peat deposit that was radiocarbon dated to the late Bronze Age through the Roman period (Johnson and Palmer-Brown 1997). Marshy lands are recorded in historical sources (i.e. Leland), in place names (both Brampton Marsh and Torksey Marsh were identified on the 1237 charter (Cole 1906; Brown 2006), and in more recent accounts of the landscape (e.g. engineer observations during the construction of the pump houses at Marton and Torksey Lock: NA C 54/1-32), and the excavated peat provides a late Bronze age date of formation of the marsh on the east side of the village (Johnson and Palmer-Brown 1997).

Architectural survey of Torksey Castle has determined that the monument is Elizabethan in date, but that Roman brick and tile are incorporated into the fabric of the building (SMR 50570), which may indicate that there were Roman buildings on the north side of the Foss Dyke, contrary to the impression conveyed by Barley's excavations in Castle Field. Inspection of the Castle, the surrounding banks, and the changes in the River Trent have also informed understanding of some of the changes of the river in relation to the village in more recent centuries; an engraving dated 1802 by J. Buckler, as well as a painting in 1835 by P. de Wint demonstrates varying distances between the Trent and the Castle (figures 3.3 and 3.4); today the land around the castle is often marshy, but these images demonstrate that the Trent may have meandered further west from the old village and Castle Field at different periods (Brown 2006). Additionally, the meandering Trent west of the modern village has moved further west since the 19th century, as two islands recorded on early maps have since merged with the eastern bank of the Trent (Brown 2006).

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Figure 3.3: Engraving, drawn by J. Buckler 1802, showing the location of the River Trent in relation to Torksey Castle in the early 19th century. The Trent in this engraving is flowing further east to where it presently flows.

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Figure 3.4: Painting of Torksey Castle, a perspective from Nottinghamshire by Peter de Wint, 1835. Again in this image, the Trent is flowing further east than where it presently flows. This image shows a bit more of the surrounding landscape. A large berm appears just behind the castle, as it does today. It also shows that there are no standing buildings in the field to the immediate south of the Castle, and that the Castle is already isolated from the rest of Torksey, to the north, in the background in this image.

In addition to the early medieval remains found along the floodplain, later medieval 13th and 14th century remains were also found north of Torksey Castle (Pre-Construct Archaeology 1996), including the remains of a later trackway and rubbish pits. Also dating to the later medieval period are the stone structures excavated on the northeast side of the village, which, with associated early medieval and later medieval burials, have been interpreted as the stone buildings of St Leonard's Priory (Rowlandson 2005).

Very little archaeological investigation has been undertaken on the fields that make up the winter camp site. A transect across the winter camp site was excavated in 1996 when the Blyborough pipeline was installed (Wessex Archaeology 1997); this excavation did not find any archaeological remains, however the associated assessment did identify several cropmarks in the fields. Metal detectorists present during the watching brief also identified a concentration of Roman finds across the excavated area (Pete and David Stanley, *pers. comm.*). Aside from this excavation across 4 of the 15 fields of the winter camp fields, there was no indication of what sort of deposits were underlying the fields north of Torksey.

Figure 3.5: The pottery at Brampton in Torksey, printed on a jug made at Brampton in Torksey, in the winter camp fields. 19th century. (Exley 1970)

3 Environment and climate in the Trent Valley and beyond

In order to understand the Torksey and the Viking overwintering camp site in its Holocene context, it was necessary to compile a summary of the regional and local climate and environment. The deposits that lie across Torksey, the winter camp, and the wider Trent Valley have all been drastically changed throughout the Holocene, and continue to change, at the hands of both the environment and humans. The final part of this chapter will present a summary of these changes, according to the published works regarding the past 10,000 years in the Lower Trent Valley.

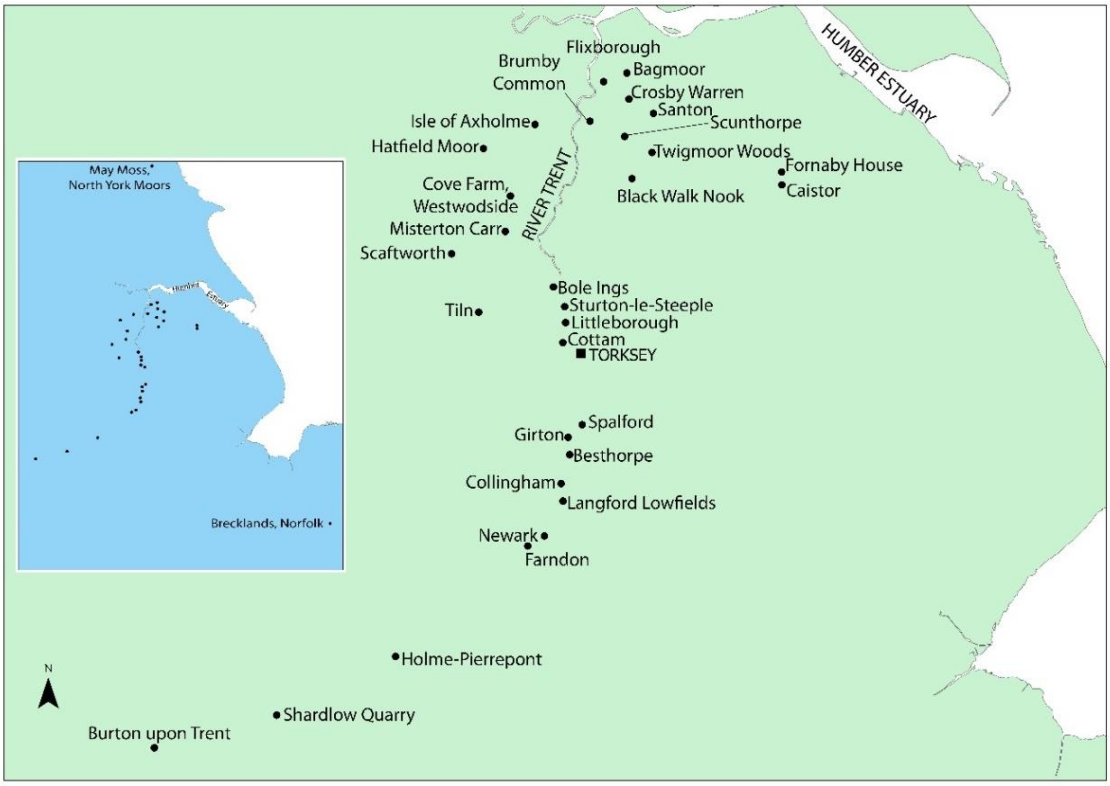

Figure 3.6: Sites mentioned in the environmental review of Britain, the Trent Valley, and Torksey

3.1 Holocene climate in Britain

The general climate of Britain after the last ice age has been summarised in a variety of studies, usually using low-resolution proxy palynological and hydrological data, to determine wider trends (e.g. Chiverrell 1999). From these sources, sometimes combined with local records, a broad and very general climatic record of the Holocene begins to emerge, which can be seen summarised in figure 3.7:

- The Younger Dryas (12,800 – 11,500 BP) represents a short cold and wet period immediately prior to the Holocene (Bell and Walker 2005). Though there have been few studies within the Trent Valley relating to the very early Holocene, proxy beetle sequences from Britain, Poland, Sweden, and Norway suggests an initially oscillating late-post glacial climate, followed by a quick (9800-9500 BP) progression to a temperate climate, similar to the present-day climate (Coope and Lemdahl 1995). This period is noted for the redeposition of post-glacial alluvial sand-deposits in the form of aeolian dunes across much of North Lincolnshire (Bateman and Buckland 2001, 15). Sparse vegetation with some pine forests detected in pollen sequences corroborate a tundra-like climate (Tweddle 2001, 35; Tweddle and Edwards 2010).

- Throughout the Boreal (9500 -7000 BP), Atlantic (7000-5000 BP), and Sub-Boreal (5000-2500 BP) periods of the Holocene epoch, a dramatic rise and stabilization of temperature and decrease in precipitation is known as the Climatic Optimum (Bell and Walker 2005). There is some variability in the precise dating of this climatic period (Knight and Howard 2004, 32 and 48), though it falls between 8000 and 2500 BP. This period of climatic amelioration, however, is also characterised by 'varied precipitation', (Bell and Walker 1990, 71; Knight and Howard 2004, 48) with oscillations and variability of rainfall within the wider trend.

- Proxy palaeohydrological changes of ombotrophic mires of upland environments indicate that the Later Bronze Age and early Iron Age were faced with a cooler and wetter climate from 3500-2500 BP (Barber *et al.* 1994, 198). Fluctuations throughout the period, as noted within the same source (Barber *et al.* 1994, 198), also indicate that climate was subject to local variation.

- Evidence of climate in the Roman period presents a more detailed and dated palaeoclimatic chronology than the preceding and following periods. Overall, evidence presented in climatic reconstructions (e.g. Chiverrell 2001), as well as evidence from sites local to the study area (e.g. Littleborough and Rampton), implies that the Roman period started warm and dry, and became progressively cooler (Knight and Howard 2004, 116; Dark 2000, 130). These trends were again recognised on the basis of the palaeohydrological records of bog surface wetness in upland sites in Cumbria, Scotland, and in closer proximity, the North York Moors (Chiverrell 2001). Work by Chiverrell (2001) at May Moss, North York Moors, indicates a shift to a wetter climate from 260-540 AD; however, the same paper claims there was a dry and warm period from 200-400 AD, so there are clearly discrepancies within these proxy studies. Increased rainfall in the Lower Trent Valley may also be evidenced in the increased rate of sedimentation along the channel, an issue that will be addressed below.

- Wider palaeoclimatic evidence suggests that the climate continued to become wetter and cooler into the early medieval period, especially according to palaeohydrological data from the uplands (Knight and Howard 2004, 154), with some summaries suggesting climatic deterioration in the 5th century AD, based on both glacial cores and dendrochronological data (Dark 2000, 27; Baillie 1995, 135). This climatic downturn was shortly followed by the "Medieval Warm Period" from 900-1300 AD, which in turn was followed by the "Little Ice Age" from 1300-1800 AD (Dark 2000, 27). Climate records from the results of individual techniques (e.g. dendrochronology, palynology, etc.) of the early medieval period appear as very detailed palaeohydrological records, such as that from May Moss (Chiverrell 2001). Late Roman textual sources that indicate a cooling trend into the early medieval (Dark 2000, 19), and dendrochronological records, that suggest poor tree growth around the year 540 AD, and optimum tree growth at 900-1000 (Baillie 1995, 135). However, each of the date ranges of supposed warm or cold, and wet or dry, seem to overlap, and even contradict each other (i.e. Chiverrell 2001, where 1700-1800 AD is listed under *both* cold/wet and warm/dry periods; figure 3.7).

After detailed examination of these proxy climatic records from across Britain, it has been observed that the conclusions to emerge from analysis of general trends are often subjective. While there is some merit in generalisations that suggest that the Climatic Optimum was warm and dry, there were probably long periods within the span of about 5000 years that were equally as cold and wet. Alternatively, despite the general consensus that a wetter, cooler climate dominated the thousands of years spanning the Later Bronze Age and Iron Age, it must also be assumed that there were periods within those years that were warm and dry. This low level of precision in recreating climatic trends over thousands of years is the result of a combination of studies generating broad trends, such as the palaeohydrology, glacial coring, and studies with very high resolution and specific data applying to only short periods, such as dendrochronology, and palynology. These studies contradict each other as often as they correspond, creating a jumbled climatic timeline. The higher resolution data of the late Roman and medieval periods, in conjunction with availability of textual sources and dendrochronological data, may prove more useful in determining the short-lived climatic anomalies. However, the contradictory evidence across various methods and sampling locations indicates that accurate climatic reconstruction must be established on a local level.

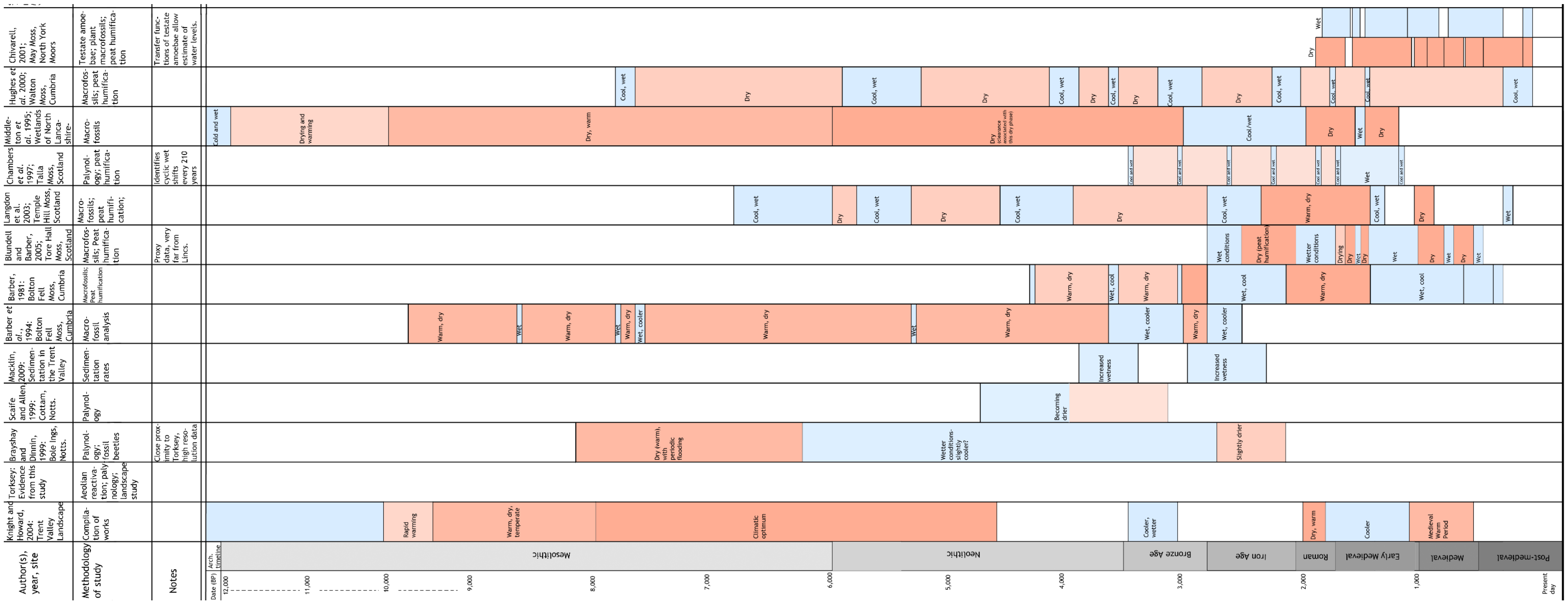

Figure 3.7: Timeline of climate changes from several different climate reconstructions; although many of these are only locally representative, there is a clear trend towards a cool climate at the start of the Iron Age, a warming throughout the Romano-British period, and a climatic decline in the early medieval period

3.2 Features and geological deposits of the Trent Valley study area

3.2.1 The River Trent

Torksey, and many of the sites discussed in the following review, are located in the Trent Valley. The River Trent is the fifth longest river in Britain, with the second largest catchment area, covering approximately 1/3 of England's landmass (figure 3.8) (Knight and Howard 2004, 2). Accessible by the Humber Estuary and today navigable to Burton upon Trent (Staffordshire), the Trent was, and still is, an important route way through the midlands. The Trent also acts as a major archaeological landmark and boundary throughout history.

Figure 3.8: Area of Trent Valley catchment (from Baker 2002, 4)

The Trent Catchment dominates the midlands. The Trent can be divided into the Upper, Middle, and Lower Trent Valley. This study takes place in the Lower Trent Valley, which is the area downstream from Newark, Notts, although throughout the study there will be some reference to sites across the Middle Trent Valley. The overall study area lies along a 12.59 km north to south stretch of the present Trent Valley, occupying both sides of the Lower Trent Valley, and within this north-south axis, the Trent meanders a total of 18.55 km. The average width of the channel through this area is 100m, though this stretch of the Trent is tidal, due to its close proximity to the tidal Humber Estuary, and the channel overflows its banks after heavy rainfall, especially through the winter. The underlying geology determines the course of the river, especially along the Lower Trent Valley, where the water has exploited the weak geology between the Mercia Mudstone and Lias and Scunthorpe Mudstone formations. The alluvial deposits throughout the Trent are also variable, and river terrace deposits of the Trent are spread across much of the midlands.

3.2.2 Solid geological formations

The study area lies across two major geological units: multiple formations of the Mercia Mudstone Group (MMG), and the Scunthorpe Mudstone Formation (SMD), part of the Rheatic Penarth Group (PNG). The Torksey winter camp site lies within the MMG on the east side of the Trent. Straddling the River Trent, the MMG forms the western part of the study area, covering all the Nottinghamshire parishes on the west bank of the Trent, and a small number of the Lincolnshire parishes on the east bank. The MMG geological formation is Permo-Triassic in date (291-199 MYA), and forms the majority of the lithostratigraphic division previously known as the Keuper Marl. Overlying the Sherwood Sandstones, the MMG is composed of a series of finely laminated argillaceous silt and mudstones, often red in colour, but with some mudstone and claystone variations in green and grey. In 2008, Howard *et al.* aimed to define the varying strata within the MMG. While recognising strata in the northern stretches of this geological group was not always possible, the exposed mudstones within the study area probably belong to the Branscombe Mudstone Formation, and the Blue Anchor Formation (Howard *et al*. 2008a, 14-16). The Branscombe Mudstone Formation is commonly reddish-brown, with occasional greyish-green facies, as well as occasional intergrowths of gypsum, and has been described as ‘structureless, with a blocky weathering habit’ (Howard *et al.* 2008, 15; BGS Lexicon, MMG). The Blue Anchor Formation, formerly known as ‘tea green marl’, overlies the Branscome Mudstone, and is formed of facies of dolomitic mudstones, with a grey-green colour.

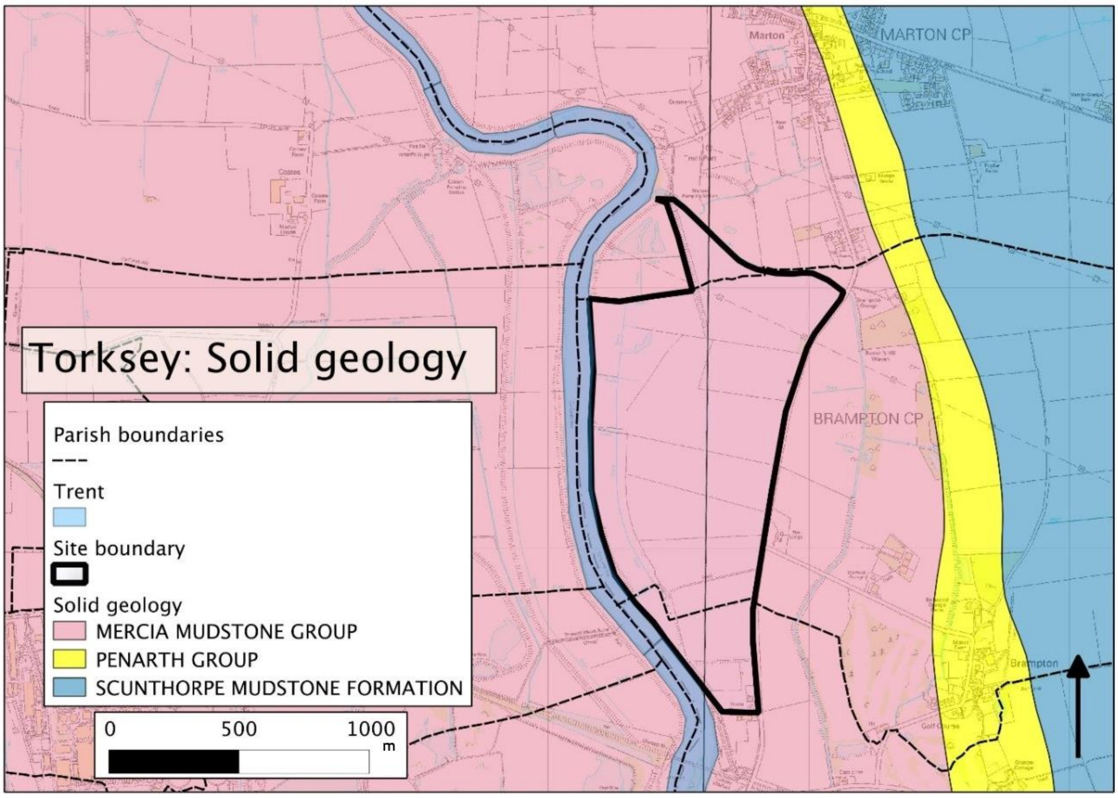

Figure 3.9: Solid geology around the study area at Torksey (1:50,000 map British Geological Survey) © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

The boundary between the MMG and the PNG runs along a north-south axis in the Lower Trent Valley (figure 3.9), just on the western side of the River Trent, with the PNG forming the eastern half of the study area. At the boundary between the MMG and the overlying PNG, is locally identified Jurassic limestone, probably part of the Langform Formation, which has also been identified at Gainsborough and Marton (Smith *et al*. 1973, 205; BGS lexicon). These deposits form the lowest strata of the Lower Lias (Lower Jurassic, 200-174 MYA) of the PNG. These local limestone deposits are subsequently overlain by the SMD. This Formation, overlying the MMG, represents an 'abrupt' change in environment from desert to marine at the end of the Triassic (Smith *et al*. 1973, 198). The SMD is described by the BGS as a calcareous mudstone formation, with facies of limestone and siltstone, and occasional iron formations.

The MMG and PNG form a diverse topography, especially along the Lincolnshire side of the River Trent. East of the Trent, the MMG outcrop rises abruptly from 4-5m AOD to heights up to 16m AOD within the study area, and slopes down to the east of the site. Only 1000 m to the north of the winter camp site at Torksey, the PNG again rises to 25m AOD at Marton. These slopes are in sharp contrast with the surrounding Trent valley, which is only 4-5m AOD on average. The underlying geology and unique topography play a major role in the geomorphological and anthropogenic interactions with the landscape.

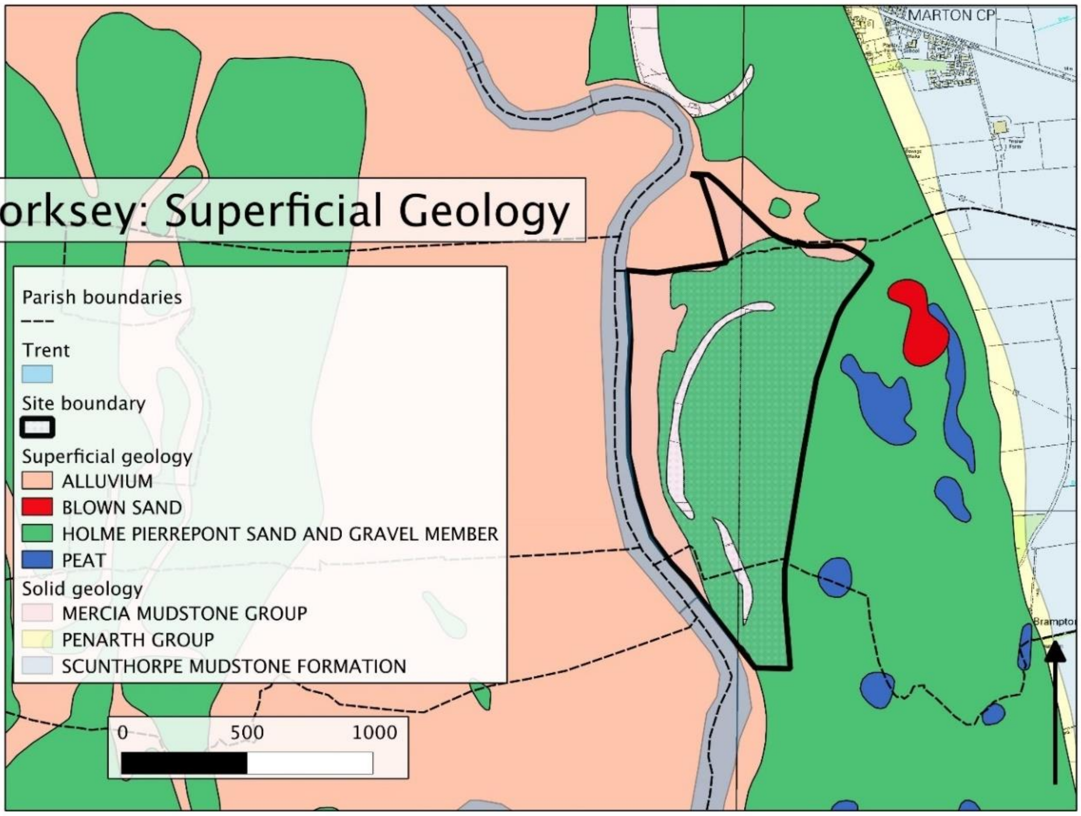

Figure 3.10: Recorded superficial geology around the study area at Torksey (1:50,000 map from British Geological Survey) © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

3.2.3 Superficial geology

The Lower Trent Valley has a wide range of drift geological deposits. Drift geology, as opposed to solid geology, is usually more recent in age (often glacial within the study area), and is often non-consolidated. Drift geology in the area includes head, till, and alluvial terrace sands and gravels (all deposits related to glacial processes), and peat, alluvium, and aeolian deposits (mainly Holocene deposits). Recent OSL dating throughout the Middle and Lower Trent Valley determined that glacio-fluvial deposits throughout the Middle and Lower Trent Valley date from anywhere between 212 ka, and

10.9 ka, representing several glacial and inter-glacial phases (Schwenninger *et al.* 2007, 14). Peat and organic deposits are also occasionally found within these deposits, allowing for precise dating of specific pre-Holocene and Holocene palaeochannels, and peat and alluvium also continues to accumulate across the Trent Valley. Across the winter camp study area, there are a total of 4 different types of superficial deposits: glacial terrace sand and gravels, aeolian sands, peat, and alluvium.

Figure 3.11: The Trent Valley Terrace sequence. The HPSG is one of the latest formations in the sequence. The Hemington Gravels do not occur over this part of the Trent Valley (Cooper 2008, 7).

3.2.3.1 Holme-Pierrepont Sand and Gravel

In the Late Devensian, (~12,000 BP), the Lower Trent Valley was also adjacent to Lake Humber, a glacial lake, caused by the blocking up of the Humber Estuary and its tributaries by the North Sea Ice Lobe (Howard 2001, 23). The silting up and drainage of the large glacial body of water led to early accumulations of sediments along the Trent Valley (Howard 2001, 21). The draining of Lake Humber and other glacial and post-glacial run-off resulted in a very active alluvial channel, and the formation of the Trent Valley terrace sequence (figure 3.11). The Holme-Pierrepont Sand and Gravel member (HPSG, so named for its identification at Holme-Pierrepont, Nottinghamshire) has been dated by organic deposits within the sand and gravel, as well as several OSL dates throughout the deposit (Schwenninger 2007). HPSG was deposited in the Late Devensian

(12,800-11,500 BP) when the Trent was a fast moving channel in response to the post-glacial drainage of a large amount of water (Howard *et al*. 2011, 420). Covering much of the study area, the HPSG (formerly known as the Floodplain Terrace by the BGS) is the last deposition of the Pleistocene Trent Valley terrace sequence (Howard *et al.* 2011, 419; Cooper 2008, 5).

The exposure at the Holme-Pierrepont quarry is described as bedded sandy gravel, composed of rounded quartzite, and glacially reworked angular chert and flint (Smith *et al*. 1973). Occasional slough channels within the sediment are filled with cross bedded sand. At Holme-Pierrepont, the sediment reached depths up to 4 metres (Howard *et al.* 2011, 421). This deposit type is indicative of a fast-moving braided channel in a Younger Dryas cold weather climate; though no ice casts were seen at Holme-Pierrepont, there is evidence for permafrost features throughout the Trent Valley (Howard *et al*. 2011, 421). This braided channel resulted in gravel islands, liable to shift while the braided channel was still active. These small gravel islands from the braided channel remained within the floodplain after the end of the Devensian, creating small outcrops of slightly higher level ground overlooking the lowland Trent Valley alluvium accumulation. The HPSG and its gravel islands play an important role in the development of human settlements within the Lower Trent Valley and the study area, as these islands would encourage human settlement and activity on the otherwise low-lying Trent Valley (see chapter 6).

At the time of HPSG deposition, alluvial forces also may have shifted and redeposited the underlying Mercia Mudstone, which is easily weakened by water (as evidenced within this study). The red clayey silt of the Triassic Mudstone has been identified as overlying the later HPSG. An example of this sediment redeposition event has been observed and recorded within the larger study area, during an archaeological watching brief at Church Laneham, Notts. (Budge 2010, 15). This event has also been observed within the study area of this research (chapter 5). This sediment redeposition is not regularly recorded, and can create some confusion in profiling the superficial deposits across the Lower Trent Valley.

3.2.3.2 The Lincolnshire Coversands

The Lincolnshire Coversands are another superficial deposit attributed to the Late Devensian (Younger Dryas); however, recent archaeological and thermoluminescence dating shows that their depositional timescale is much more complex (Baker *et al*. 2013, 108; Bateman 1998, 314). Stratigraphically, the aeolian deposits covering portions of Lincolnshire and Nottinghamshire (figure 3.12) directly overlie the HPSG, as well as the MMG and PNG. The coversand particles are generally well rounded and spherical, medium to fine particle size quartz grains. They are characterized by their often localized deposition, banking up upon existing landscape features, or creating dune formations across the generally flat landscape of north Lincolnshire and west Nottinghamshire (Bateman 1998, 314). The Lincolnshire Coversand deposit covers areas from Caistor in the east, the Isle of Axholme to the west, the Humber Estuary in the north (Bateman 1998, 314) and to Besthorpe to the south (Baker *et al*. 2013, 109). There have been various recent studies into the date and place of origin of these coversands, as well as their date of deposition, and recent studies on the Lincolnshire Coversands (Buckland 1973; Bateman *et al.* 1997; Bateman 1998; Bateman *et al.* 2000, Bateman *et al.* 2001a; Bateman *et al*. 2001b; Howard *et al*. 1999; Howard *et al*. 2007; Murton *et al.* 2001).

Figure 3.12: Map of the extent of the Lincolnshire Coversands (Baker *et al*. 2013)

The majority of the coversands in the Lower Trent Valley and across north Lincolnshire can be attributed to a cold climate occurring during and towards the end of the Younger Dryas, after the deposition of the HPSG (Bateman and Buckland 2001, 15). Lower sea levels during the Last Glacial Maximum exposed local alluvial sands left from the last of the braided channel terrace deposition and the deposits of Lake Humber, which, in combination with peri-glacial medium and high velocity winds, resulted in a saltation rotation and the ‘winnowing’ out of sand from alluvial or coastal deposits to form outcrops of well-sorted medium sand, which were later deposited across Britain as the Lincolnshire coversand aeolian dunes (Bateman 1995, 791; Bateman 1998). Although water levels had receded, “there is no strong evidence for aridity during sand deposition”, and organic facies and horizons throughout the sand indicates that the water table was often changing, and the moistness of the sand would have slowed transportation and reactivation of the aeolian deposits (Bateman 1998, 318). Earlier studies of aeolian sands from Lincolnshire sites at Conesby Quarry and Black Walk Nook definitively show that the Lincolnshire coversands began deposition around the same time, during the Late Devensian/Early Holocene (Conesby: 11,850±960, and Black Walk: 12,480±1,130 years) (Bateman 1995, 796). Other late Devensian aeolian deposits in Britain include those in Southwest Lancashire, the Vale of York, and East Anglia, and a similar, but separate, process is visible on a larger scale on mainland Europe, as far as Poland, Belgium, and Denmark (Bateman 1995, 791). Dunes in the Netherlands have even confirmed a prevailing westerly wind during the Younger Dryas, based on orientation of dune horns and slipface (Maarleveld 1960, 49-58); the same westerly wind may have deposited the Lincolnshire Coversands on the site of the winter camp, though the reactivation and ploughing out of dunes across Lincolnshire prevent confirmation of this hypothesis (Bateman 1998, 318).

The Lincolnshire Coversands are not extensively described in early geological investigations (Ussher 1888; 1889). The aeolian sands along the Trent Valley were previously known as the “Spalford Sands” after their identification at Spalford (Brandon and Sumbler 1988, 128), and were originally assumed to be part of the Trent Valley terrace sequence (Trent Valley Formation). In the first Geological Memoir of the East Retford region, W. A. E. Ussher describes a “general” aeolian drift overlying an alluvial or estuarine peat (Ussher 1888, 151). This early account of the aeolian deposits does provide a brief description of the appearance of these dunes on the Lincolnshire side of the Trent Valley:

> The very irregular occurrence of the sands in the alluvium, on the east of the Trent, in which, here and there, they form low mounds, and the extensive Blown Sand tract which conceals the junction of the Keuper, Rheatic, and Lias rocks, suggest Aeolian derivation from an extensive estuarine deposit, which, except in the vicinity of the river, is found to underlie the Peat and Warp (Ussher 1888, 163).

This description continues to explain that the same deposit of sand can be found both overlying and underlying Holocene peat and alluvium deposits (see below). This description differentiates between the "grey land" or greyish-white sand overlying the MMG and SMD and underlying peat deposits, and the other "light sand" aeolian deposits on the surface, as the "light sand" has been continuously blown (Ussher 1888, 163). The description does include some obvious but essential landscape evaluations that demonstrate some of the sands' natural behaviours, including Ussher's observation that at Brumby Common (Lincs.) "blown sand forms low hills and mounds and occurs in a labyrinth of irregular patches of swampy ground, apparently consisting of the Peat and Warp; the surface is covered by rank marsh vegetation and the topography of the Map is very defective" (Ussher 1888, 162), which can be interpreted as referring to small sandy islands within otherwise dense marshland. Also described is the difficulty in determining if dunes are *in situ*, or redeposited: at Marl Hill, Haxey, "a marked feature … over which sand had been continuously blown, induced Mr. Cameron [geological cartographer] to draw a line separating the sand mantling over the slope from that occupying the low-lying traced at its foot ... it has some agricultural significance, but it must not be taken as a geological boundary" (Ussher 1888, 163). This reference demonstrates that the dunes were not stable in the 19th century, and likely still have potential to move due to wind reactivation or agricultural shifting.

There have been many recent localized investigations into the origin, behaviour, and interactions of these dunes, especially in the Lower Trent Valley, including at Girton (Notts.) (Kinsley 1998; Baker *et al*. 2013), Tiln (Notts.) (Bateman *et al*. 1997; Howard *et al.* 1999), Besthorpe (Notts.) (Knight and Howard 1995), Caistor (Lincs.) (Bateman *et al*. 2000), Black Walk Nook (Lincs.) (Bateman 2001) and Twigmoor Woods (Lincs.) (Bateman *et al.* 1999). Many dunes, such as those at Girton and Besthorpe which were described in the 1888 and 1889 geological memoirs, have largely been ploughed out to an unrecognizable form, or even removed completely by quarrying or alluvial processes.

Despite these challenges in understanding the origin and development of the coversands, profile and sediment drawings, thermoluminescence dating, radiocarbon dating of associated organic deposits, aerial photography, documentary evidence, and the presence of archaeological deposits, all help to date the deposition and redeposition of the coversands across the East Midlands. Though the sorting and accumulation of such a large body of well-sorted sediment was probably instigated by the periglacial conditions of the Younger Dryas, the deposition and redeposition of these aeolian dunes continues well into the Holocene, and into the present (Bateman 1998, 322; Bateman *et al*. 2001a, 133). The strong winds that sorted the Lincolnshire Coversand deposits in the late Devensian and the early Holocene are no longer a common occurrence in the present climate (see below); however, it does not take such a strong gale to move the already-well-sorted deposit. The redeposition of sand in the Holocene has been explored extensively elsewhere in eastern England, on a site in the Brecklands, which is located on the East Anglia aeolian deposit (Bateman and Godby 2004). In the Breckland assessment, it was concluded that while aeolian deposits remained *in situ* as per their original Devensian and early Holocene deposition beneath a peat deposit, subsequent layers of sand that was not covered by peat was subjected to later reactivation and deposition during the Anglo-Saxon period, and again after the year 1800 (Bateman and Godby 2004, 582-583). This process occurs with the Lincolnshire Coversands as well, as evidenced at sites including the Frederick Gough school, Scunthorpe, where aeolian deposits were redeposited over a series of (evidently Roman) ditches which were filled with organic rich deposits (Allen Archaeology, *pers. comm*.). A comprehensive list of dated sites, complied by Colin Baker, compares each investigated and dated site along the Lower Trent Valley and Lincolnshire to demonstrate clearly that the dunes were also being continuously deposited and redeposited throughout the Holocene (Baker *et al.* 2013, 116). The deposits at Tiln (Belmoor Quarry), have produced TL dates from the Mesolithic to post-medieval period from 7510±800 years, 7700±700 years, and 300±30 years, with observations of shifting sands in the present day (Howard *et al.* 1999; Bateman *et al*. 1997). The deposits at Twigmoor Woods include dates ranging from the Mesolithic to the Anglo-Saxon period in date, with TL dates at 10320±800 years, 5660±600 years, and 1310±200 years (Bateman *et al.* 2001; Bateman *et al*. 1999).

At Torksey only a small outcrop of aeolian sand is recorded by the BGS at Bunker's Hill Warren (chapter 5), but aeolian deposits have been detected in several archaeological contexts throughout the village, obscuring early medieval and medieval archaeological deposits (Rowe 2008, 8). The presence of redeposited Lincolnshire coversands deposits in the Roman and post-Roman contexts is not surprising: at this time, aeolian deposits were probably more susceptible to reworking in the post-Roman period due to the continuing widespread clearance, the stabilisation of wetlands along the River Trent, and the recorded cold shift at the end of the Roman period, leaving sands exposed and highly susceptible to reactivation. In the field of archaeology, the reworking of aeolian deposits is not an irrelevant, past geological event; episodes of sand blowing across open fields and accumulating on roads are still reported today, and may be obscuring archaeology throughout Lincolnshire, the Trent Valley, and much of eastern England. Within the study area, several of these late Holocene aeolian deposits have been recorded, though not always with the realisation of the implication of the deposits: at Torksey Golf Course, a sand deposit overlies peat that stopped forming at 1869±171 BP (Johnson 1997, 7), and at Castle Farm, Torksey, aeolian deposits overlie later medieval remains (Albone and Field 2002). The coversands, though an important part of the geology and archaeology at Torksey, have not been extensively studied in this area, a gap in the academic literature that will be filled by this thesis.

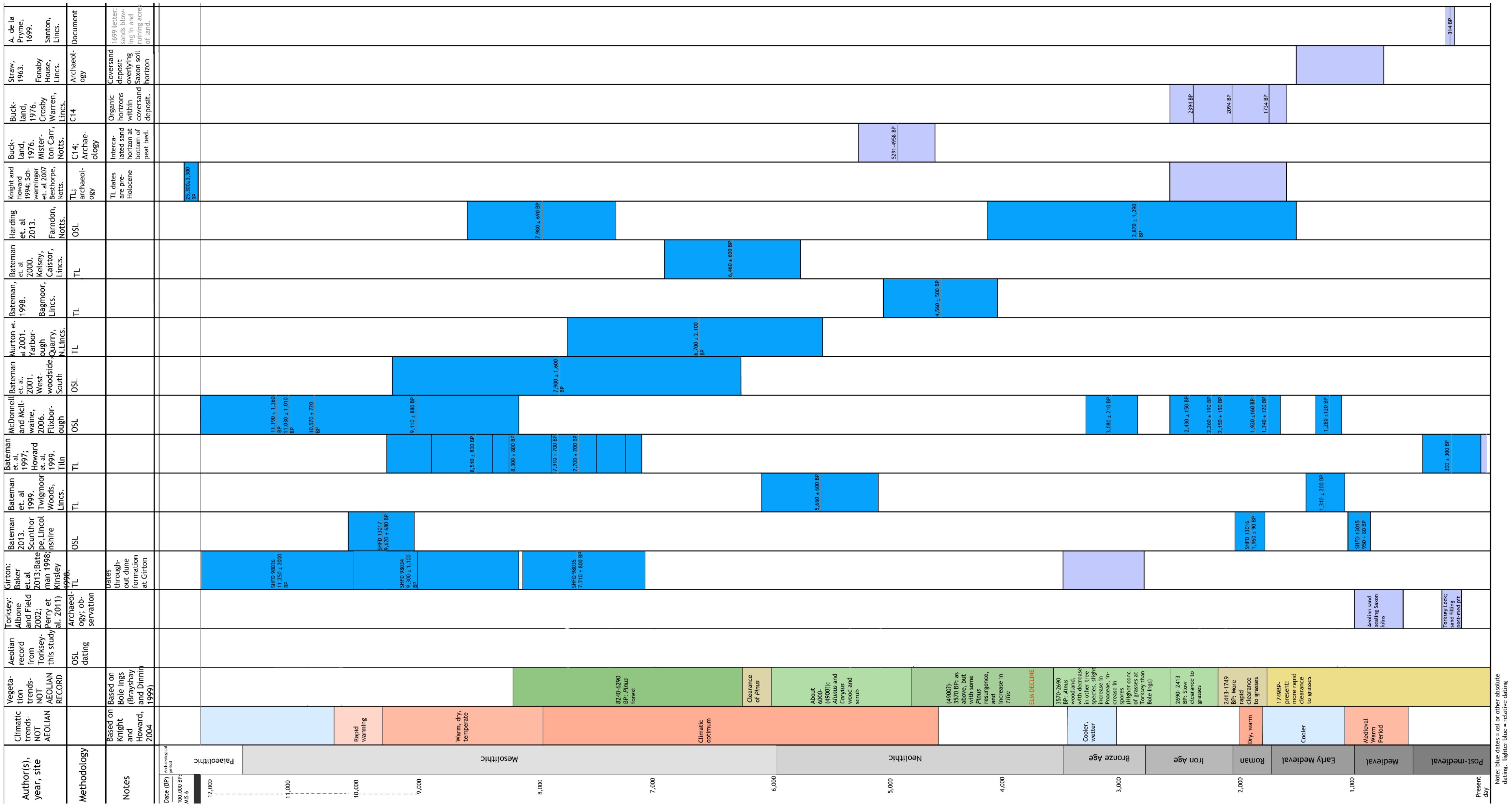

Figure 3.13: Dating of aeolian deposits within the Lincolnshire coversands to date. Darker blue indicates OSL dating of sediments, while mid-blue represents relatively dated sediments based on archaeological or other observations. This chart will be presented again in chapter 5, with the dating of the sediments from Torksey included.

3.2.3.3 Peat and alluvium

Peat and alluvium are currently actively accumulating throughout the Lower Trent Valley. Alluvium is drift sediment that is eroded and/or deposited by non-marine moving water systems, and the wide meandering channel of the Trent around Torksey has facilitated the accumulation of alluvium over the Holocene epoch. In addition to alluvium build-up, recession of water levels and consolidation of drainage and alluvial channels has led to the accumulation of pockets of peat where alluviation has not eroded wetland sedimentation.

Alluvium across the floodplain varies in depth, and continuous flooding across the floodplain had led to the deep accumulation of dark-brown clayey silt within the study area at Torksey. In 2002, a study was completed on the sources of alluvium, indicating that throughout the Middle Trent Valley had alluvium sources from the limestone further upstream, rather than the local Mercia Mudstone (Hudson-Edwards *et al.* 2002); similar studies are still to be carried out on the Lower Trent Valley. The Lower Trent is a wide meandering channel with low energy and high sediment load output, and the size of the channel allows for deep accumulation of alluvium across the valley.

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Figure 3.14: Floodplain sediment accumulation and its effects on archaeological/organic preservation in low energy/high sediment load river systems, such as the Lower Trent Valley (from Howard and Macklin 1999).

Additional studies completed by the Trent Valley Geoarchaeology Group (TVG) have aimed to map the alluvium depths throughout the Trent Valley (Challis 2002). Infrequency of boreholes did not allow for complete subsurface modelling, but did provide a framework from which depths throughout the larger valley could be approximated. The mapping done by Challis (2002) determined that the Lower Trent was covered in a blanket of fine-grained alluvium with reworked sands and gravels. Unfortunately, very few boreholes were taken within the study are of this thesis during this phase of the TVG research (see figure 3.15). However, boreholes taken in the vicinity demonstrate that there are alluvial deposits ranging from 2.5 metres at Cottam to 5.7 metres in depth overlying terrace sediments (at Littleborough) (Havelock *et al.* 2002, 48).

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Figure 3.15: Boreholes taken from throughout the Lower Trent Valley as part of the Trent Valley Geoarchaeology project (from Challis 2002).

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Figure 3.16: Stratigraphy of core at Seymour Drain, Cottam (from Havelock *et al*. 2002, 47)

Although Challis (2002) indicated that there was very little opportunity for peat and organic remains within the Lower Trent, excavations and coring through the area have produced occasional deposits of peat and organic silt. Blanket peat does not cover large areas, but rather small pockets of peat have been discovered mainly during archaeological excavations. Peat deposits, interspersed with aeolian sand deposits around Torksey were uncovered during excavations on the Torksey Golf Course (Johnson and Palmer-Brown 1997). The peat overlies a Mesolithic ground surface, and stopped accumulating in the Romano-British period. Additional peat deposits were detected at Rampton and Sturton-le-Steeple, both within Romano-British ditches on the present floodplain (Knight 2000; Howard 2004). Organic-rich silt deposits were also found on the Nottinghamshire side of the river valley during the coring survey completed as part of the Blyborough Pipeline project (Wessex Archaeology 1997). The presence of these mainly late Holocene peat deposits across this part of the Lower Trent Valley demonstrates that there may also be abandoned palaeochannels in the area also with datable peat and potential pollen preservation (including the palaeochannel detected east of the winter camp site, see chapter 5), and that deposits datable by archaeology can demonstrate changes in water levels and palaeoclimate.

3.3 Vegetation, Sedimentation and Hydrology of the Lower Trent Valley

Changes in the landscape of the Lower Trent Valley throughout the Holocene are closely interlinked with post-glacial topography and the changing landscape, therefore this section will be dedicated to a detailed chronology of the environmental changes that took place throughout the Holocene. The following summary will use an anthropogenic time scale, for clarity in relating the environmental changes with archaeological changes, detailing the changes that occurred from the Mesolithic through to the post-medieval periods, as many environmental changes are closely linked with the relationship between humans and their environment. In this section, hydrological and vegetational history will be outlined using local evidence, with respect to the wider and local climate changes.

The climatic change between the Devensian and the early Holocene was the main catalyst for the multiple phases of climatic, hydrological, sedimentary, and anthropogenic change across the Trent Valley, and more specifically, the study area. Each of these environmental changes altered the nature of the River Trent and the Trent Valley, from the sands and gravels associated with the high velocity late Devensian braided channel and open landscape of grass and scrub birch (Bateman 2001, 137), to the slow flowing, meandering and anastomosing River Trent with wetlands and vegetation as it is seen today. The development of peat, alluvial silt, and clay deposits with associated palynological sequences, formed due to climate and anthropogenic-based alterations, allows for analysis of the sedimentary, hydrological, and vegetational history of the Lower Trent Valley. The deposition and redeposition of aeolian deposits added an additional dimension to the sequence. The following summary of background research will outline the various environmental changes that have been previously recorded across the Lower Trent Valley, with special reference to those studies already completed within the study area of this research.

3.3.1 Mesolithic: 9500-4000 cal BC

The drastic transition from the Last Glacial Maximum of the Late Devensian to the temperate climate of the Holocene is well documented in the environmental record (the climatic record, sea level and hydrology changes, sedimentation changes, and especially vegetation changes). Prior to the draining of Lake Humber, rivers incised up to -19m AOD; after Lake Humber had been drained, the braided channels along the Trent Valley began accumulating sediments, up to 2.5m thick (Bateman and Buckland 2001, 15). This process continued until 8500 BP, when an equilibrium between sedimentation and incision occurred (Lillie and Neumann 1998, 22). A later breach of sediments at the Humber Estuary around 7000 to 6000 BP, led to another incision phase, which was followed by accumulation of finer grained sediments, and eventual stabilisation (Bateman and Buckland 2001, 15-16). An amalgamation of factors led to the stabilisation, and anastomosation of the (possibly multi-channelled) River Trent in the early Holocene, including low channel gradients, the input of fine-grained sediment due to a slower flow velocity, and channel banks with vegetation (Knight and Howard 2004, 32). Oscillations in climate and precipitation, rising sea levels, and changing vegetation also would have initiated sediment accumulation. Despite equilibrium and anastomisation, sea levels did not reach OD until approximately 6000 BP (Tooley and Shennan 1987) to 5000 BP (Lillie and Neumann 1998, 22). Marine environments continued to reach into the Lower Trent Valley throughout the Mesolithic, as evidenced by alternating marine and freshwater deposits as far upstream as Gainsborough (Knight and Howard 2004, 31; Lillie and Neumann 1998, 22). This trend continued intermittently until the Late Bronze Age/Iron Age (Lillie and Neumann 1998, 22).

Accumulation of organic deposits began around the same time as channel stabilisation (around 8500 BP). These sedimentation accumulations permitted the preservation of vegetation records via palynological sequences. A sequence from the basal peat at Black Walk Nook provides insight into the early Holocene. The earliest vegetation sequence of the Holocene (10,200-9500 BP), shows an influx of *Betula, Salix, Pinus*, all species that favour bare and open landscapes and arctic climates (George 1992; Bateman 2001, 137; Buckland 1982). Similar species were counted along the River Went (a tributary of the River Don, Yorks.) during the early Holocene (Birks 1989, 508-520), evidence of the many different vegetation species during the climate amelioration at the end of the Pleistocene (Lillie and Neumann 1998, 25). Increase in sediment accumulation is also evidenced by the organic sediment build-up from Bole Ings (Notts.), dated to 8500 BP (Brayshay and Dinnin 1999, 117).

Bole Ings, located on the Nottinghamshire side of the study area, also produced an early Holocene pollen record (Brayshay and Dinnin 1999; Dinnin 1997). A peat core from this site provided both a palynological sequence and an entomological sequence to create a climate reconstruction. These deposits date from 8240 ± 60 BP to 2780±60 BP, covering about 5500 years of the Holocene. While providing an excellent background of the pre-existing environments throughout this part of the Lower Trent Valley, this long sequence of palaeoecological data ends, unfortunately, just before the 1st millennium AD. The bore holes at Bole Ings mainly presented a sequence of clay and silt with *Alnus* macrofossils, overlying HPSG gravels, and sands. Zone 1 of the sequence (8240±60 BP to 6280 ±70 BP) provided evidence of a *Pinus*, *Ulmus*, and *Corylus* local vegetation, with some *Quercus.* These species represent a wooded environment, with dense deciduous woodland canopy, with tree taxa constituting the majority of the assemblage (Brayshay and Dinnin 1999, 119). The authors hypothesize that the *Pinus* species would have preferred the exposed Devensian gravel islands, while *Quercus and Ulmus* would tolerate a wetter environment; *Salix* and *Populus* would have endured regular flooding (Brayshay and Dinnin 1999, 118). The presence of *Corylus*, and gradual rise in *Alnus*, also indicates a moderately and increasingly wet environment, as *Corylus* frequently inhabits dry and basic pH level soils, or slightly moist with neural to acidic soils, indicating that the Hazel plants at Bole Ings "was occupying drier areas of the wetland margin and the surrounding landscape" (Brayshay and Dinnin 1999, 119). On a larger scale, this Mesolithic environment ranged from woodland to "fringing reed swamp" (Brayshay and Dinnin 1999, 124).

Pollen data from sequences at Girton (Notts.) indicate a vegetational environment of hazel, grass and oak, with expanding hazel and alder, ranging from 9148 BP to 7454 BP (Green 1996; Baker *et al.* 2013, 113), and an undated sequence from Hatfield Moor, S.Yorks., hypothesized to be Mesolithic in date, indicates a pine and oak woodland environment on drylands (Smith 1958, 25; Chapman and Gearey 2013). As part of the Blyborough pipeline sequence (Wessex Archaeology 1997), a short pollen sequence from Cottam was also completed. Though undated, vegetation trends such as an elm decline (see below) have tentatively dated the peat deposit to late Mesolithic through to the Bronze Age (Scaife and Allen 1999, 19). This pollen sequence also demonstrates a *Pinus* forest at the basal level, followed by a *Quercus, Corylus Avellana*-type and *Alnus* vegetation (Scaife and Allen 1999, 18), matching the other local pre-elm-decline sequences (Bole Ings [Brayshay and Dinnin 1999]; Rampton [Knight 2000]). Woodland clearance due to expanding wetlands was observed at Langford Lowfields [Notts.] where large oak trunks were interbedded within alluvial sand and gravel; the earliest of these trees dated to 6200-6100 BP, though another series of fallen timbers date to 4300-4000 BP (Garton *et al.* 1996, 9). Other early evidence of post-glacial fluvial environments in the Trent Valley is from Shardlow Quarry, south of Derby, where a piece of wood dated to 8540-8230 BP, accompanied by a pollen sequence showing an environment rich in pine, birch, and ferns (Brayshay 1994, 1), was discovered.

3.3.2 Neolithic: 4000-2200 cal BC

The end of the Mesolithic left the Lower Trent Valley in the temperate climate of the Climatic Optimum, with continually rising sea levels and the initiation of sediment accumulations composed of peat and organic rich clay across much of the valley. Pollen sequences from this period also demonstrated expanding reed swamp and fen carr landscapes, with additional evidence of densely wooded areas on dryer land (Knight and Howard 2004, 31). This increasingly stable riverine landscape with expanding wetlands, framed by gravel islands and surrounding woodlands, continued into the Neolithic.

The expansion of alder carr wetlands continued throughout the Neolithic, which is also indicative of an increasing hydrological output throughout the fifth millennium BC (Knight and Howard 2004, 50-51). As mentioned above, the oak trunks from Langford Lowfields were dated to 4300-4000 BP, with no evidence of human or animal interference, which strongly supports the hypothesis implied by pollen data that the wetlands were gradually expanding (Garton *et al.* 1996, 29; Coles 1992, 95; Knight and Howard 2004, 49).

Increased hydrological output is also evidenced in sediment accumulation rates from 6300-5200 BP at Bole Ings (Brayshay and Dinnin 1994, 125). Palynological evidence from Bole Ings (Brayshay and Dinnin 1994, 125) is marked by a rise in *Alnus* and *Tilia* species at 6290 BP (zone 2a), simultaneous with a woodland decline (Lillie and Neumann 1998, 26; Brayshay and Dinnin 1999). Rise in *Alnus* pollen grains in the sequence at Bole Ings reflects a trend mirrored in other pollen sequences across the Lower Trent Valley (Lillie and Neumann 1998, 24), including that at Girton (Green 1996), and at Cottam (Scaife and Allen 1999). This sharp rise in *Alnus*, accompanied by the decline in other woodland species, was the result of a higher water table (Brayshay and Dinnin 1999, 125).

The resurgence of the other (dryland) tree taxa after 6290 BP, including *Fraxinus*, *Pinus*, and *Corylus* within the Bole Ings peat core may indicate the reestablishment of these species further afield (Brayshay and Dinnin 1999, 125); alternatively it may represent the development of a Trent Valley floodplain with less flooding, and a drier, more stable environment (Brayshay and Dinnin 1999, 125). The decline in preservation of pollen grains coincides with a drier sediment horizon. This dehydrated sediment demonstrates a period of a drier climate that did not allow a constant saturation of the peat deposit. This period of lower rainfall and less frequent flooding probably aided in the reestablishment of woodlands in the Trent Valley (Brayshay and Dinnin 1999, 125). This hypothesis is supported by the contemporary pollen sequence at Hatfield Moor, which indicates an elm and lime dominated woodland environment. The pollen evidence at Girton also presents a ‘diverse woodland’ that includes not just alder and hazel, but oak as well, at 6140 BP (Green 1996). These sequences may denote the resurgence, or perhaps the resilience, of the dryland woodland environments. The nature of resurgence also confirms that the earliest clearance phases of the Lower Trent Valley were natural, and not caused by early anthropogenic interference.

Preliminary studies of boreholes in the parish of Sturton-le-Steeple (Howard 2004) corroborate the expansion of alder carr wetland, with standing water, open fen, and open wooded areas across the Trent Valley flood plain. The results of this report also suggest the use of some pasturing, based on the presence of dung beetles throughout the boreholes (Howard 2004). Radiocarbon dates demonstrate that the expansion of wetlands in the

Lower Trent Valley occurs throughout the Early Bronze Age, and through the Iron Age (Howard 2004).

While the early Neolithic environment in the Lower Trent Valley does not provide any evidence of anthropogenic influence, the area was not immune to the nation-wide *Ulmus* clearance. The 'Elm-decline' is a phenomenon recorded across the British Isles, dating to about 5036 BP (Parker *et al*. 2002, 26), probably caused by a variety of factors, including beetle infestation or disease blown in from continental Europe, early anthropogenic woodland clearance, and climate change (Parker *et al*. 2002, 1; Brayshay and Dinnin 1999; Knight and Howard 2004, 51). This distinct feature in the pollen record allows for the relative dating of sequences throughout the Lower Trent Valley (and to some extent, across the country); this includes matching the record at Bole Ings, where the Elm decline dates to about 5100 BP (Brayshay and Dinnin 1999, 125), with the undated sequence at Cottam (also within the study area) (Scaife and Allen 1999, 20), and Collingham (Knight 2000, 1), as well as the sequence at Hatfield Moor (Smith 1958). These post-Elm-decline pollen assemblages indicate marshy and wet grasslands along the Trent, with continued deciduous forest vegetation, including oak hazel elm, lime, pine, and ash, on the dry lands adjacent (Scaife and Allen 1999, 19; Knight and Howard 2004, 51).

3.3.3 Bronze Age: 2200-800 cal BC

While there is little evidence of agriculture or clearance throughout the Neolithic, the Bronze Age palaeoenvironmental records indicate an increasingly agricultural landscape, with a rapid woodland decline, and sharp increase in grasses. A continued expansion of *Alnus* meant that woodland diversity continued to decline, and expansion of Poaceae and Graminae types means that while wetlands were continually expanding, dryland woodland was quickly being replaced by agricultural land (Brayshay and Dinnin 1999). In their analysis of the pollen sequence from Cottam, Scaife and Allen (1999) suggest that widespread clearance may have been taking place as early as 4600 BP, although this cannot be confirmed since this sequence remains undated. Further upstream, the palynology at Girton also indicates that by 3050 BP, woodland had been almost completely removed, and the area had reverted to reed swamp with cultivation on the surrounding drylands (Green 1996). Additionally, the sequence at Hatfield Moor demonstrates that just after the elm decline there was a shape rise in herbaceous plants, with increased *Alnus* as well as cereal grains (Smith 1958, 26).

This change in vegetation also contributed to change in sedimentation in the Trent Valley. At Bole Ings, poor preservation of pollen seems to indicate a drier local environment from 5350-3570 BP continuing from the late Neolithic, but nearing the end of the Bronze Age, the sedimentation turned into a 'woody peat' and 'organic clay' (Brayshay and Dinnin 1999, 126), indicating a higher water level during this period.

3.3.4 Iron Age: 800 cal BC-AD 43

While there is some debate over the first time the influences of human activity (e.g. woodland clearance or agriculture) is visible in the palaeoenvironmental record, by the Iron Age, there can be no question that many of the major changes to the landscape were made by human interference. Continued and steady decline in woodland species corresponds to the widespread clearance of woodland, and anthropogenic clearance across the landscape was mainly for the purposes of agricultural usage, including crop planting or animal grazing (Knight and Howard 2004, 79-85). Many of the remaining woodland species were replaced by Poaceae and Graminae during the Iron Age (Smith 1958; Green 1996; Brayshay and Dinnin 1999, 126). Continued local expansion of wetland environments, as evidenced by the continued rise of alder pollen counts, limited the areas that were suitable for agricultural practices, and wiped out any dryland tree species that remained (Brayshay and Dinnin 1999, 127). The sequence at Girton corroborates this trend through the Iron Age, with the last pollen zones dated to the Late Bronze through to the Early Iron Age (Green 1996).

Most notable during the Iron Age, however, are the changes in sedimentation rates throughout the study area. During this period, some peat accumlations stopped forming completely. At the same time in other areas, peat accumulations, as well as alluvium accumulations, were initiated. At Sturton-le-Steeple, the peat deposit accumulation that formed due to standing water of a stagnant wetland environment in the Bronze Age promptly ended between the dates 3050-2700 BP (Howard 2004). The deposits at Bole Ings also shifted from a woody peat and organic clay accumulation of still water to silt alluvium at 2200 BP (Brayshay and Dinnin 1999, 126). While the sequence at Cottam is undated, up to 4m of alluvium covers the Bronze Age peat deposits, which ended abruptly with a shift in the course of the Trent (Scaife and Allen 1999, 19). The dramatic change of sedimentation type at each of these Nottinghamshire sites indicates major channel shifting taking place within the Trent Valley during the Iron Age. On the other side of the river, the peat deposits at the Torksey Golf Course began accumulating at 2540 BP (Johnson and Palmer-Brown 1997). The authors hypothesized that this peat deposit was caused by the earlier incision of a channel, followed by a slowing of the channel due to reduced hydrology or change in sediment accumulation, and the standing water slowly filled with peat (Johnson and Palmer-Brown 1997). The similar date for all of these sedimentation changes within such a small area suggests dramatic hydrological, vegetation, and land use changes throughout the Iron Age:

> As in the second millennium BC, a rich wetland mosaic dissected by a network of major and minor channels flowing across the Valley floor may be postulated. Continued clearance of woodland from the floodplain, gravel terraces and adjacent upland areas would have created a progressively open landscape, which in turn would have been more vulnerable to soil erosion and the redeposition by colluviation and alluviation of fine-grained sediments. Close to the main channels, the river remained laterally mobile, while in minor streams or abandoned channels fringed by reed swamp, minerogenic and organic sediments would have accumulated under lower energy conditions (Knight and Howard 2004, 80).

These alluvial and vegetative changes are often linked to intensive Roman clearance and agricultural practices introducing more sediment into the system through the destabilisation of sediment on slopes and along the floodplain, but the dates associated with so many of the changes within the study area point to these instigators occurring during the Iron Age. The warmer, dryer climate may also be linked to the slower moving channel, allowing for fine-grained sedimentation across much of the valley.

3.3.5 Romano-British: AD 43-AD 410

After the widespread landscape clearance of the Iron Age, climatic deterioration, gradually higher hydrological output, and continuing clearance and agriculture, deep alluvial deposits began accumulating across the Lower Trent Valley in the Roman Period. Roman and post-Roman alluvial deposits are evidenced clearly at the Roman site of Littleborough [Notts.] (Riley *et al* 1995, 257). This Roman fort, known as *Segelocvm*, was placed along the Roman road from Lincoln to Doncaster; the archaeological nature of site will be further examined in chapter 4, but the post-abandonment deposits at Littleborough also demonstrate and date palaeoenvironmental change. A small farmstead settlement still exists at Littleborough, including an 11th century, and possibly Anglo-Saxon church. Although the presence of a modern settlement may indicate continuous settlement (or at least human presence), the Roman fort was abandoned at some time between the Roman and Anglo-Saxon period, probably due to the deposition of thick alluvial deposits over the fort (Riley *et al.* 1995., 257), as well as a gradual decline in use at the end of the Roman occupation. A very high sediment output in the Lower Trent Valley would be necessary to obscure an important Roman fort prior to the construction of the medieval church building on the site. Other sources suggest that there is evidence for the rising water levels in the Roman place name: *Segelocvm* was possibly derived from the British words *sego* (power or force) and *loch* (pool), meaning ‘violent pool’, or even ‘pool on Trent with rapid current’ (Rivet and Smith 1979, 477).

Similar gradual abandonment of Iron Age and Romano-British field systems was observed during a survey of the parish of Sturton-le-Steeple, just northwest of Littleborough (Elliott 2004). The survey concludes that the IA/Romano-British field systems had become unusable, even for grazing, by the end of the Roman period (Howard 2004). Similar infilling at Rampton is evidenced by the recognition of a palaeochannel with Romano-British pottery in peaty fill of the abandoned channel, dating the accumulation to the 1st to 3rd century AD (Knight 2000, 1). The archaeology at Rampton was sealed by two layers of alluvium, leaving the authors to conclude that the relatively large settlement site was abandoned due to flooding (Knight 2000, 1).

On the Lincolnshire side of the Trent, however, peat development at Torksey Golf Course stopped at 1920 BP (late Roman), and the area was covered in an aeolian deposit (Johnson 1997b, NP); there is no clear explanation in existing reports for why this environmental shift occurred, and why the pattern of heavy alluviation on the Nottinghamshire side of the Trent was replaced with aeolian deposition on the Lincolnshire side. It is possible that the channel shifted towards Nottinghamshire during the Roman period leaving aeolian deposits to dry and become redeposited near Torksey.

There are similar late-Holocene/Roman aeolian sedimentation sequences at Girton (Baker *et al*. 2013), and Frederick Gough School, Scunthorpe. The pattern of peat infilling into Roman ditches occurs across the study area and the rest of North Lincolnshire (see below), which may indicate that the cooler and wetter climate trend at the end of the Roman period had widespread effects.

With the shift from peat deposits to alluvium accumulation, the palynological sequences from peat deposits at Bole Ings stopped forming. The beginnings of the Roman period at Bole Ings were dominated by Poaceae and *Plantago lanceolata*, indicative of cleared fields, and increasing wetland areas (Brayshay and Dinnin 1999, 126). Although not located in an alluvial setting, sequence at Hatfield Moors continues through the Roman period (Smith 1958). This sequence contains Graminae, which implies mixed farming regimes, as well as *Plantago* and *Pteridium*, signifying increased surface wetness (Smith 1958; Lillie and Neumann 1998, 24). These species support the theory of increased cultivation on the broader landscape, with increased wetness occurring around the Trent Valley.

3.3.6 Medieval Period: AD 410- 1485

There is an unfortunate lack of palaeoenvironmental records between the Roman and the late medieval periods, and much of what is 'known' has been extrapolated from both the earlier Roman and later medieval periods (thus making it difficult to separate the literature about early medieval and medieval palaeoenvironmental changes). The Medieval Warm Period followed the climatic deterioration of the Roman period (Dark 2000, 27), and is corroborated by several climatic indicators across much of north western Europe; however estimations of the exact date for the onset of the climatic change ranges from 600 to 900 AD (Dark 2000, table 2.2). The pollen evidence from Hatfield Moor indicates a brief spell of general woodland regeneration in the early medieval period (just prior to 900AD), followed by another spell of clearance and arable farming practices (Smith 1958; Dark 2000, 22; Lillie and Neumann 1998, 24; Knight and Howard 2004, 154). Knight and Howard (2004, 155) hypothesize that this brief spell of woodland regeneration occurred at the end of the climatic deterioration that had begun in the Roman period, prior to the onset of the Medieval Warm Period. The changes associated with the Medieval Warm Period, which includes increased flooding, and higher hydrological output, likely affected the Middle Trent Valley the most, altering the Trent's course from a single stable channel into an "unstable, multi-channelled system" into the 10th century (Knight and Howard 2004, 155; Brown 1997). There is no direct evidence that suggests that the alluvial patterns were changing similarly in the Lower Trent Valley, however increased output upriver must have led to at least increased flooding, and/or the creation of new channels downriver.

The other medieval indicator of palaeoenvironmental change in the Lower Trent Valley is the gradually accumulating alluvium. The accumulation of thick alluvium across the Lower Trent Valley along with the waterlogged sediment deposition across Romano-British field systems, probably encouraged the restructuring of open land into the medieval field systems. The abandonment of the Roman fort at Littleborough due to the accumulation of fine-grained alluvial deposits across the site demonstrates the potency of the alluvial accumulations along the River Trent. There are multiple sites along the River Trent that met a similar fate, including the Roman settlement at Rampton (Notts.) (Knight 2000). Similar alluvial processes were occurring across much of the Humber Estuary catchment system, including alluvium accumulation on the River Idle floodplain at Scaftworth (Notts.), which led to the abandonment of the Roman fort at Scaftworth (McElearney 1991). Even field systems as far as three miles from the course of the River Trent, including the Romano-British field boundary ditches at the Frederick Gough School, Scunthorpe, were affected by changing water levels, with peat deposits infilling previous ditched boundaries (Mark Allen, Allen Archaeology, *pers. comm.*). The slight rise in water level across the region led to the establishment of medieval settlements on slightly higher elevations within the valley, usually on top of natural Pleistocene gravel islands, such as the settlement at Laneham (Budge 2010); this hypothesis will be addressed further in chapters 5 and 6.

The accumulating fine-grained alluvium also led to the re-establishment of a stable, anastomosing, meandering channel, which would have made a prime location for resettlement in the early and later medieval periods. A continuation of intensive forest clearance and arable production in the Roman period (Knight and Howard 2004, 154) led to shifting river courses, increased output of silt, and eventually in the post-medieval period, to the creation of more drainage channels (Knight and Howard 2004, 154-6).

Throughout all of the above mentioned geoarchaeological and palynological studies, only one early medieval artefact was recovered from the peat and alluvial deposits within the study area: a single wooden stake, radiocarbon dated to 790 to 1030 AD, was recovered from the peat deposits infilling Roman features at Sturton-le-Steeple (Elliott 2004, 15). The archaeological implication of this find will be addressed later in this thesis (chapter 5, section 3).

The ‘Little Ice Age’ spanned from 1300-1800, but the slight shift in climate did not discourage the arability of the region (Knight and Howard 2004, 156). Intensifying agriculture throughout the medieval and post-medieval period resulted in continued increase in soil erosion and colluviation, especially in the wide meanders of the Lower Trent Valley. There are no palaeoenvironmental records of the period, but documentary and cartographic records, as well as analysis of alluvium accumulation can help decipher the changes that occurred during this period. While interpretation of boundaries will be addressed further in chapter 6, current field and parish boundaries and those appearing on earlier maps may provide clues as to the location of palaeochannels and river course shifts that have occurred throughout the medieval period. Salisbury (1992, 155-6) hypothesizes that the river course was highly susceptible to lateral motion throughout the medieval period, which resulted in linear parish boundaries along the Lower Trent Valley; this may have been done so the parishes would only share a short boundary with the shifting river course, and if the river course shifted, the change would not alter the boundaries too extensively (Salisbury 1992).

3.3.7 Post-Medieval and modern: AD 1485-present

Although there are no presently available pollen sequences from the post-medieval Lower Trent Valley, this period demonstrates the highest rate of change to the fluvial system, mainly as a result of human interference. In 1671, an Act of Parliament under King Charles II was authorised to Lincoln to improve the Foss Dyke to Torksey led to the building of the sluice at Torksey Lock (Wright 1982, 23). This coincided with the major land reclamation movement instated by Dutch engineer, Cornelius Westerwyck Vermuyden, who was responsible for engineering the draining of the Lincolnshire Fens and area surrounding the Isle of Axholme (Harris 1953, 41; 59; Rotherham 2013, 11), and the Lower Trent Valley was also affected by campaigns for land drainage.

The construction of multiple land drains near Torksey and the surrounding area drained much of the remaining wetland environment in this section of the Lower Trent Valley. Land drains include Mother Drain, which runs directly adjacent to the site examined in this study, as well as Seamere Drain, Seymour Drain, and Seamere Dyke on the Nottinghamshire side of the site. Construction of these land drains spanned from the 17th-20th centuries, with the major Torksey Lock construction dating to the 19th century. Prior to the construction of these land drains and steam powered drainage systems, historical documents describe the routine flooding that occurred throughout the area. The Spalford and Torksey Drainage Valuation book, dated 25-30 January 1850, describes the road from Torksey to Fenton, and its flooded state after severe weather, just after the construction of some land drains. In this document 'old men' in the neighbourhood ascertain that it was a 'normal' flood, as water flowed down the main street between Torksey and Fenton, and that banks of sand sometimes poked out above flood waters (Notts. Archives, 16/10/1877/33). Only a year later, in January of 1851, plans were made to construct the 'very best' steam powered pump house near Torksey Lock to further aid in the drainage system (Nott. Archives, C 54/1-32; 16/10/1877/40). Unfortunately, the reclamation of land from wetland encouraged farming on peat, probably destroying many pollen records from the local area.

Also prevalent in the post-medieval period is the practice of warping, or redirecting water flow slowly, and effectively moving the flow of an established channel and building up thick blankets of alluvium, or warp, at the same time. This practice was especially popular near Hatfield Chase during the original 17^{th} and 18^{th} century draining. No historical records of warping have been found within the study area, however there is evidence of channel redirection and expedited alluvium build-up in several areas along the Nottinghamshire side of the Trent, including at Cottam, North Leverton, and Sturton-le-Steeple, while at West Burton and Bole the channel was simply redirected and straightened, with palaeochannels still clearly visible.

Anthropogenic landscape alterations dominate the post-medieval and historical period, rendering an almost unrecognisable landscape from the waterlogged environment centuries earlier. Land that had once been relegated to permanent wetland status is now being used for arable farming, creating different physical boundaries than the wide wetland of the past. Changing water levels, changing vegetation, changing overlying sediment levels and types, changing river channel paths, and changing land use within the study area all create a greatly different landscape; however, evidence required for recreating the past landscape is still available, etched within the existing environment.

CHAPTER 4

METHODOLOGY

1 Introduction

The study of overwintering camps presents a unique challenge in that there is so little that is known about the Viking camps of the late 9th and early 10th century. As was demonstrated in chapter 2, recent studies by the late Richard Hall and Gareth Williams on the winter camp near York (ARSNY), and by Dawn Hadley and Julian Richards on the camp at Torksey, have offered new insights into, and prompted discussion about the activities taking place within these camps, which have produced evidence of trade, craft, and aspects of domestic and military life. These discussions, however, are still missing an accurate picture of the setting of the winter camps. In earlier studies of Viking winter camps, landscape has only ever been considered casually; despite their presence along active river channels, the interaction of these winter camps with the drift geology, topography, or surrounding archaeological landscape, has been largely omitted from any published discussions. This PhD aims to use methods based in geology, landscape studies, archaeology, and history in order to create a vivid picture of Torksey and its surrounding landscape before, during, and after the Viking overwintering of 872-3. This chapter will briefly discuss the methods and procedures used to do this, and how the methods used were blended together in order to produce the landscape reconstruction presented in chapters 5-7.

1.1 Methodology background

The methods employed by geoarchaeologists and environmental archaeologists can be very effective in reconstructing environments throughout the Holocene. Unfortunately, these methodologies are under-utilised in medieval contexts. Palaeoenvironmental reconstructions of landscapes and climates in the British Isles are often focussed on the evidence from prehistoric contexts; in part this is sometimes due to lack of archaeological evidence, or a large amount of pollen or insect evidence relating to the prehistoric land-use changes, but it is also, in part, due to the types of questions asked by prehistoric research (e.g. Golding *et al.* 2011; Buckland 1977; Evans 1975). In contrast, archaeological investigations of the post-Roman period often replace environmental and geoarchaeological techniques for other more 'direct' lines of evidence, such as historical sources, landscape evidence, or dendrochronological and radiocarbon dating of excavated sites (e.g. James 1981; Rackham 2001; Hooke 2010; Higham and Ryan 2011; Higham

2010; Aberth 2013). Detailed evaluations and understanding of the processes behind every sediment present on a site are not often applied to medieval archaeological assessments; even when they are, only those sediments directly related to archaeological deposits are assessed, with any over or underlying 'sterile' sediments being considered 'natural', rather than related to contemporary environments. Many apparently sterile deposits are directly related to human activity, and/or climatic changes that can impact on human activity, and these details are missed by interpretations of medieval contexts. Early medieval archaeological evidence found along floodplains (such as the fish weir at Colwick, Nottinghamshire, or early medieval settlement at Girton) benefits from geoarchaeological analysis, especially in these alluvial contexts (Brown 1997, 259; Losco-Bradley and Salisbury 1979). Even so, many early medieval sites are still not analysed in enough depth to make sense of the surrounding physical environment. The Heslerton Parish Project, a project focussing on determining the origins and progression of a North Yorkshire parish, included an augering survey to assess the underlying superficial deposits, however the data were only used to assess archaeological deposits, rather than as a means of understanding the environment (Powlesland 2003; 2014). When geoarchaeological and palaeoenvironmental methods *are* used, it is often to answer very specific and detailed questions, such as defining diet and economy (Rackham 1994), using micromorphological analysis to refine knowledge about uses of social spaces (Milek 2009; 2012), or soil chemistry to reconstruct agricultural practices (Gerrets 1995), rather than to help understand the wider landscape.

Medieval and post-medieval environments have been included in environmental chronologies of wide study areas (Knight and Howard 2004; Tipping 2010; Bridgland *et al*. 2011; Bridgland *et al*. 2014), however, for the most part, these works are not written with the sole consideration of the medieval periods. The works that do focus on environmental evidence from the medieval and post-medieval periods are few and far between. Petra Dark (2000) utilised several threads of evidence, including palynology, dendrochronology, plant and animal remains, and peat and alluvial sediments to reconstruct the climate of the years 0-1000 AD for all of Britian. Tom Williamson (2012) used underlying geology as a means of understanding medieval regional agricultural practices. John Aberth (2013) used documentary and illustrated evidence for clues about the environmental history of the medieval period. Nevertheless, with few exceptions, solid and superficial geological changes in relation to human and environment interaction, particularly on a site-by-site basis, have remained largely omitted from studies of medieval archaeology. Where it is included in site reports, very few pages are dedicated to the consideration of the contemporary climate or environment (e.g. Milek 2009; Gaunt *et al*. 2007). However, on a site such as a Viking winter camp, where there is very little recorded, and no obvious visible remains, a geoarchaeological survey will start to answer the some of the questions about the early medieval landscape in which the Great Army campaigned. While the methodologies employed in this thesis have been previously used extensively in geology or prehistoric archaeology contexts, the application of a detailed analysis of the results in relation to early medieval archaeology will be relatively new.

While the analysis of the medieval landscape has been used more often than geoarchaeology in recent years, medieval landscape studies often consider only one aspect of landscape archaeology in relation to the medieval landscape (e.g. settlement mapping, or land use patterns), rather than considering the role of climate and natural environment changes in relation to the changing human environment. Studies of medieval settlements traditionally focussed on domestic structures, social spaces within settlements (such as market places), and urban or rural life, but, since Hoskins published *The Making of the English Landscape* in 1955, the examination of the role of settlement in the wider English landscape has become an increasingly popular topic. These more recent studies of the medieval English landscape and settlements within it have focused mainly on the organisation and development of medieval settlements (Roberts 1987; Aston *et al*. 1989; Lewis *et al.* 1997; Jones and Page 2006; Gardiner and Rippon 2007; Dyer and Jones 2010; Higham and Ryan 2010; Stamper 2011). The study of the desertion of medieval settlements has also been a popular topic over the past decades, beginning most famously with the deserted medieval village (DMV) of Wharram Percy (Yorks.) (Wrathmell 2012 is the most recent, and final Wharram Percy publication; additional literature on deserted medieval villages include Dyer and Jones 2010; Beresford and Hurst 1989). Recent methodologies for exploring these villages include mapping and map regressions (comparing present maps with ancient maps) (Rowley 1974), aerial photography (Powlesland 2003), and land use patterning and mapping of earthworks (Everson *et al.* 1991). Although these studies are focussed on single entities within the landscape, the study of English medieval rural settlement has also been studied in relationship to specific aspects of the landscape, such as place names (Gelling 1997; Higham and Ryan 2011) and underlying geology (Williamson 2012), often enhanced using documentary evidence. Occasionally, a wider approach is also employed, examining patterns of settlement and their development in the wider landscape (Hamerow

2002, 9). Through these wider landscape approaches, mapping settlements on the basis of a combination of documentary evidence and the results of archaeological excavation, such as in the study of Mucking, Essex (Hamerow 1993), have also considered the underlying geology and topography as a means of explaining settlement shift and changes in agricultural practice (Hamerow 2002).

One of many aspects that sets this thesis apart from previous landscape analyses is the scale of the study area. On one hand, previous medieval landscape projects have been conducted on a very large scale, considering an entire county or region (Roberts 2007, 77; Williamson 2012), which leads to the ensuing conclusions omitting small details such as estate boundaries, minor changes in roadways, or palaeochannels. On the other hand, previous studies have also considered the development of a single parish or couple of parishes, focussing on settlement development, but only throughout the medieval period, and only within a limited area (Page and Jones 2007, 145; Powlesland 2003; Stamper 2011), often overlooking wider landscape development. This current thesis addresses a study area that is between these two scales of analysis, benefitting from focussing on a large area with much evidence of change and continuity, while also having a sufficiently small scale to enable consideration of the details in the landscape that may affect social and environmental changes.

1.2 Methodology application

The first phase of the research for this thesis involved a detailed review of the environment of the study area as defined by the larger Torksey Project and the immediately surrounding area. This phase employed geoarchaeological and palaeoenvironmental techniques including mapping sediments through coring, pollen analysis, sediment analysis, and radiocarbon and OSL dating. This phase of the project also considered early maps and landscape analysis to provide a view of the environment and changes that have occurred around Torksey. Throughout the course of the analysis, a reconstruction of the landscape throughout the Holocene was created.

The next phase of the project was to analyse the recorded archaeological evidence and its relationship to topography and natural features and features recorded on historic maps, with some consideration of place names and cropmarks. The study area for this analysis comprised the surrounding 27 parishes surrounding Torksey, located in both Lincolnshire and Nottinghamshire. This study area was defined by the parish boundaries, which were generally founded in the medieval period (Pound 2000) and were often based on natural or pre-existing landmarks and landscape features. This analysis was completed using GIS, and was aimed at identifying and assessing the archaeological and natural features present, as well as settlement and environmental changes in the wider area.

The final chapters of the thesis blend together the results of these two areas of investigation, in order to create a full view of the environmental and settlement changes that occurred before, during, and after the Viking Age, and to establish how these changes were interrelated. The final results also present how these methodologies could be blended together to present a detailed landscape view throughout the early medieval period.

2 The palaeoenvironmental reconstruction: methodology and procedures

The site of the Viking overwintering camp was the focus for the employment of an intensive and multi-technique approach to palaeoenvironmental reconstruction. The techniques utilised in this study included a walkover survey, and topographic investigation using a geographic information system (GIS) and LiDAR data, followed by the undertaking of a coring programme, sediment sampling and collection, sediment analysis, pollen analysis, optically stimulated luminescence (OSL) dating, and geomorphological analysis.

Many of the techniques employed required sampling of underlying sediments. Throughout each sampling phase, the number of samples taken was determined by an assessment of how many samples would answer the questions set out in the aims of the project. For this purpose, the number of samples in the sediment analysis, pollen analysis, OSL dating, or coring programme correspond to the number required to create a reconstruction of the site throughout the Holocene. The number and types of samples, as well as the types of analyses completed, also reflects the types of sediments available for sampling on the site.

2.1 Reconnaissance phase

Prior to conducting this survey of the landscape of Torksey, a reconnaissance phase assessed the available data about the area, including all previous related studies of the archaeology and environment and maps of the area, including aerial photographs and LiDAR data (in chapter 3). During the first phases of field work, the walkover survey was completed, during which each potential archaeological or geomorphological feature was observed, documented, and mapped. The latter included earthworks, exposed sediment profiles, any evidence of recent or ancient changes in fluvial activity or changes to the wider landscape. During the survey, any changes to the land use since the most recent Ordnance Survey (OS) mapping were also noted.

2.2 Coring and test pitting

During the walkover survey, it became clear that the variation of superficial deposits across the site was not reflected on the 1:10,000 BGS and Mineral Assessments maps. The BGS records a single aeolian deposit, and a small area of peat on the east side of the site (see chapter 5). Walkover survey, however, indicated that much of the site was covered in varying depths of these deposits. In order to map these deposits, a coring and test pitting programme was undertaken on the site.

To produce a higher resolution sediment map of the site of the Viking overwintering camp at Torksey, a series of 85 cores were taken across the entirety of the site. In 2011, the first series of cores were placed in order to obtain a general idea of the depths and nature of the underlying deposits. A total of 42 cores were extracted using a 1 meter gouge auger (3cm diameter) evenly spaced at 200-300m apart across the site. An initial plan was set out for the exact locations for each core, but had to be relocated due to obstructions on the ground, while additional cores were added where there was a suspected change in underlying deposits. Each of these cores were drawn, described, and sub-sampled for sediment analysis and characterization (section 3.3; appendix II).

Figure 4.1: The author taking a core in the test pit at Bunker's Hill Warren

Once an overview of the depth and type of the deposits on the site had been achieved, another coring programme for 43 cores was planned in 2012 to examine further the depths of the sand deposits, this time with the intention of implementing a higher resolution systematic augering of each targeted sand dune (see results). During the second stage of coring, the location of the cores were spaced at a higher resolution than the previous survey (30-50m), creating transects across each of the sand deposits across the site. The sand auger (15cm diameter) was capable of reaching depths of up to 6 metres. The sediment depth data were then mapped using QuantumGIS (QGIS) and ArcMap, in order to determine the depths across the site, and to provide a map of the extent of the superficial deposits, especially sand, across the site (see chapter 5).

Following the completion of the coring programme, a programme of test pitting was also implemented, in order to generate a better understanding of sediment relationships, as well as to identify subsampling opportunities for the application of both OSL and radiocarbon dating. Each excavated test pit measured 1 x 1 metre. The siting of test pits was informed by the results of both the auger survey and the geophysical survey (Brown 2012). This enabled the targeting of areas with sand that had spread out from the original dunes, as well as sand in original dunes, and also potential archaeological deposits. Test pits were dug by hand to a depth of 1.2 metres in unstable (sand) contexts, or to the bottom of any superficial deposits, whichever was encountered first. Each context related to individual geological unit. Changes within each deposit type, descriptions of sediments, and scaled drawings were recorded in a field notebook (reproduced in appendix II).

2.3 Sampling methods

Sediment samples (and samples for OSL dating, see below) were collected from the test pits and cores across the site. Sediment samples were collected from test pits and augered cores as recommended by a number of studies (e.g. Goldberg and Macphail 2006, Gale and Hoare 1991; Hodgson 1978*)* (appendix I and II). Each of the sediment profiles that produced samples was drawn to scale (appendix II), and sample locations were recorded by GPS location and depth below present surface. Application of sediment analysis techniques was conducted in the laboratories at the University of Sheffield Department of Archaeology and Department of Geography.

The samples taken were chosen in order to establish several aspects of the palaeoenvironment of the site. The superficial deposit sampled the most was aeolian sand from across the site; because aeolian reactivation can be historically and archaeologically dated to the late Holocene in the local and regional area (Perry *et al.* 2011; Bateman *et al.* 2001; Johnson and Palmer-Brown 1997), this deposit was deemed particularly relevant to this study. Other samples were largely taken from the peat surrounding the site, as well as from the alluvium, the underlying glacial sands and gravels, and the Mercia Mudstone.

The targeted aeolian sand deposit was sampled widely across the site, with the aim of comparing particle sizes and sorting to determine different aeolian reactivation phases, or even slight changes within the dunes. Sub-samples of vertical cores and test pits were also taken across the site, with the aim of identifying environmental changes on and around the site.

2.4 Sediment analysis

The sampled sediments were subjected to several analyses, including measurement of magnetic susceptibility, calcimetry, organic content, and particle size analysis. These analyses were used to track similarities and changes of the sediments across the site, and, like the depth of sediments, the sediment data were mapped and analysed using ArcMap.

2.4.1 Magnetic susceptibility

Magnetic susceptibility is a measure of the extent to which a material becomes magnetised when placed within a given magnetic field. Soils and sediments can become magnetised through natural processes or anthropogenic means (Ayala *et al.* 2007; Thompson and Oldfield, 1986). While naturally positively magnetically susceptible minerals may be deposited through physical means, the magnetic susceptibility of those minerals (and therefore of the deposits containing those minerals) may also be affected by chemical changes to sediments due to archaeological or other post-depositional processes. For example sediments may develop enhanced magnetic susceptibility through the formation of magnetite and maghaemite as a result of burning (above c. 200 C) in archaeological contexts (Thompson and Oldfield 1986, 73-75). Additionally, soil formation processes can cause chemical changes including the formation of magnetite and maghaemite and other magnetic iron-oxide minerals through the fermentation processes associated with biological activity in the soil (Walden et. al. 1999). Deposits of enhanced magnetic sediments will provide higher magnetic readings, while the detection of magnetic minerals within a larger (less magnetically susceptible) sediment matrix will give off lower readings. This dampening or dilution effect of many sediment matrices is the result of some minerals and other materials which are diamagnetic. These are effectively ‘non-magnetic’ and therefore do not exhibit strong magnetic characteristics. Examples of these components of deposits are quartz and calcite minerals and organic materials, which are commonly found in sediments (and widely expected at Torksey, where a large part of the site is covered in a quartzite aeolian sand).

In this study the magnetic susceptibility of deposits quoted is Specific Susceptibility (also referred to as Mass Specific Susceptibility). This is where the susceptibility measurement of a standard volume sample (in this study 20cc) is adjusted in relation to its weight in grammes (see below for calculation). Single frequency measurements were taken using a Bartington MS2 magnetic susceptibility meter using an MS2B sensor. The measurements were taken using the low frequency setting (0.45 kHz) and consequently the magnetic susceptibility of the sample is expressed in this study as $X_{LF.}$

The samples taken in the field were sub-sampled and dried at <30 C and weighed before having their magnetic susceptibility determined. To determine the magnetic susceptibility of the sample with the MS2, an initial ‘air’ reading was taken, followed by two readings of the sediment, and finally another air reading. The additional readings to ‘air, were to identify (and eliminate) any drift in the instrument (primarily caused by temperature variations). Any drift at the time of the sediment reading was corrected for using the following averaging formula:

κ (corrected; 10^{-5} SI) = Mean sediment reading – (air reading 1 + air reading 2)/2)

The results were then adjusted for weight using the following formula:

X_{LF} (10^{-6} m^3 kg^{-1}) = (κ/weight (g))/10

2.4.2 Calcimetry

Measuring the amount of calcium carbonate ($CaCO_3$) present in a sample reveals the percentage of carbonate present in a sediment (Courty *et al.* 1989, 23). The carbonate is represented by bone, shell, or geological formations such as limestone. The overwintering camp site is located on a mudstone outcrop with no carbonate materials, so any trace of $CaCO_3$ would indicate a sediment that had been transported, or even the presence of archaeological strata. The amount of carbonate can be tested using a calcimeter, which measures pressure from CO_2 in a controlled environment, created by mixing HCl 3N and the $CaCO_3$ in the sample ($CaCO_{3(s)} + 2\ HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$). The percentage of the $CaCO_3$ was calculated using the following formula (also correcting for present temperature and barometric pressure):

$$\%\ CaCO3 = \frac{Vol\ of\ CO2\ (mL)}{Weight\ of\ Samples\ (g)} \times \frac{Barometric\ pressure\ (mmHg)}{Temp\ (°C + 273)} \times K$$

$$\text{where } K = \frac{273 \times 100}{760 \times 224} = 0.1604$$

2.4.3 Organic content

Organic content is measured using a technique known as loss on ignition (LOI). Used in sediments and soils, LOI can be useful for distinguishing topsoils or buried soils from surrounding sediments, since organics tend to accumulate near the surface. In an alluvial environment, organic content may also indicate changes in the rate of sediment accumulation or in the stability of the environment (Ayala *et al*. 2007; Stein 1984). It can also be a useful tool in understanding the human input into anthropogenic sediments, such as the addition of manure, the impact of agricultural practices, or the dumping of waste.

Organic matter has a complex relationship with sediment characterisation. While the procedure of LOI is simple and the results are easily understood on a superficial level, the nature of organic content cannot be discerned from this test alone (Stein 1992, 194). It is important to consider that, over time, organic matter forms a complex chemical relationship with inorganic elements, and that the results produced by no means determine if a soil was present at the testing site or if it was part of a secondary deposit (Courty *et al*. 1989, 22; Stein 1992, 193). For this reason, a fuller understanding comes with its interrelationship with the other analyses completed, especially magnetic susceptibility for determining soil formations.

After drying at 100ºC to remove any moisture, LOI involves weighing each sample followed by weighing the sediment again after ignition at 500ºC for one hour. At this temperature, organic matter is incinerated, but the heat does not break down the water molecules bonded into clay compounds (Ball 1964; Stein 1984; Stein 1992). The organic content of soils is expressed as a percentage, and calculating it is achieved using the following equation:

$$\%\, Organics\ (L.O.I.) = 100\ \times \frac{dried\ sample - incinerated\ sample}{dried\ sample - crucible\ weight}$$

2.4.4 Particle size analysis

Particle size analysis is a measure of grain-size distribution in sediment. A measure of determining the energy of deposition, it can be useful in identifying agents of deposition, soil formation processes, and anthropogenic, biological, and the effect of erosion (Reineck and Singh 1980, 132; Canti 1993). In general sedimentological terms, the higher the energy of the depositional environment, the larger the particle size, and/or the poorer the sorting; however, in geoarchaeological terms, it is important to consider human influence by clearance or changes in land use as a very high-energy secondary depositional agent.

The grain size analysis undertaken in this study included two practical techniques: wet sieving and laser diffraction. Sieving was utilized to determine grain size distribution as a whole, separating pebbles and cobbles from different sand sizes, while laser diffraction could only handle fine fraction sediments under 1.4 mm, or 2φ ($\varphi = -\log_2$ (diameter). Phi scale was used in this analysis, and a diagram of the Phi scale in relation to metric measurements can be seen below (Selley 1988, 41; Wentworth 1922). From the laser diffraction data, a grain size mean, sorting, skewness, and kurtosis were calculated.

To complete particle size analysis on grain sizes less than 1.4mm, the Horiba LA-950 Laser Diffraction Particle Size Distribution Analyser was employed. This analyser uses light diffraction to measure particle size, assuming that light will bounce off each size at a different angle. Using photodiodes, it then collects the scattered light and analyses the pattern to provide a precise distribution of the particle sizes (http://www.horiba.com/us/en/scientific/). These bouncing light particles then calculate the percentages of each different grain size within the sample. This technique calculates the mean and median grain size, the sorting of the sediment, the skewness (or which way the data are skewed) and the kurtosis, or the probability distribution of the variables, of the sample. These data are used to determine the primary and any secondary particle sizes within the sample and their distribution.

Figure 4.2: Wentworth scale of particle sizes, from US Geological Survey (http://pubs.usgs.gov/of/2003/of03-001/htmldocs/nomenclature.htm)

2.5 Palynological analysis

One of the main methods of investigating the palaeoenvironment of the Torksey site employed in this study was an analysis of the pollen to determine vegetation changes. Palynological investigation involves the counting of individual grains of pollen and spores of different types of plants in order to reconstruct local and regional vegetation, and is useful in determining changes in climate, landscape, land use, and human impact on the landscape over time (Moore *et al.* 1991, 9). Pollen grains, preserved best in anaerobic and waterlogged environments, may represent a number of different landscape scales, from the very local, immediate environment, to a large-scale, regional, national, or international landscape. Given the lowland topography and wetland location of the bog at Torksey, it was concluded that the pollen sequence is derived from local sources, including the immediate local vegetation, with secondary pollen sources deposited by both water transport and regional wind deposition. The peat deposit at Torksey comes from a rheotrophic environment (Moore *et al.* 1991, 14).

The coring programme at Torksey helped to determine the locations where the peat deposit was at its deepest and least likely to have been disturbed by later drainage. On the east side of the winter camp site, a test pit was dug to the bottom of dry sediments, and a Russian corer extracted the bottom part of the sequence. This core was then subjected to a series of radiocarbon dates, and a pollen analysis.

In the laboratory at the University of Sheffield Department of Archaeology, the cores were subsampled every 4 cm for pollen extraction. Pollen extraction was prepared using KOH digestion and acetolysis, with added *Lycopodium* spores for concentration calculation. The full pollen extraction procedure can be found in appendix I.

The pollen was mounted onto slides using a silicone gel, where a total of 600 individual grains were counted in each sample. Identifications were made as advocated in Moore, Webb, and Collinson's (1991) *Pollen Analysis* and Bennett's (1994) *Annotated catalogue of pollen and pteridophyte spore types of the British Isles*, and the University of Sheffield reference collection. Pollen data was input into DOS programme *Tilia 2*, and charted using *TG View* (Grimm 1993). The Latin and common names for pollen species can be found in appendix VI.

2.5.1 Radiocarbon dating

Four radiocarbon dates were processed throughout the column used in the pollen analysis. Each sample was extracted from the original pollen core in the sterile pollen laboratory at the Department of Archaeology, avoiding any contamination, and sent to individual radiocarbon laboratories. The first radiocarbon sample was taken at the bottom of the core at 121 cm, in order to determine if the deposit began formation within an appropriate timescale (i.e. during the Holocene). This sample, taken at a depth of 121cm on the core, was sent to BETA Analytic (BETA-317584) for radiocarbon dating. The sample was sieved and treated with an acid wash (BETA Analytic, *pers. comm.),* and the fine fraction was submitted for radiocarbon dating.

The next three samples were sent to the ^{14}CHRONOS Centre, following the receipt by the author of the ^{14}CHRONOS Centre radiocarbon dating award (June 2012) from the Quaternary Research Association. Samples at depths of 48cm, 68cm, and 96cm were taken; these depths were chosen as they were a good general representation of the column, and also corresponded to changes in various levels of humification of the sediment. The same preparatory processing, sieving, and an acid wash, was used on each of these three samples.

2.6 Luminescence dating

Previous excavations (Perry *et al*. 2011; Rowe 2008; Johnson and Palmer-Brown 1997) throughout Torksey and the immediate area demonstrate that aeolian sand deposits are directly related to archaeological strata, and walkover survey and coring also determined that the site of the Viking winter camp is covered in aeolian deposits.

Studies on the dating of Lincolnshire Coversands using luminescence dating across northern Lincolnshire and surrounding areas have successfully proven that these aeolian deposits were susceptible to reactivation throughout the Holocene, and into the present day (Bateman 2001; Bateman *et al*. 2001a; 2001b; 1999). For this thesis, a series of optically stimulated luminescence (OSL) and portable luminescence dates were taken from separate dunes across the site, in the hope of determining different period of clearance and/or increased wind activity. All OSL dating procedures were conducted by the author in the University of Sheffield Department of Geography under the guidance of Professor Mark Bateman.

2.6.1 OSL dating

OSL dating is a technique that measures the amount of trapped radiation within sediment grains (usually quartz) that has built up since the last time the sediment was exposed to light before it was buried. Over the time spent buried, quartz grains regularly accumulate energy from uranium (U), thorium (Th), and potassium (K) isotopes within the surrounding matrix and this energy is released the next time they are exposed to light.

A series of OSL dates were taken from 4 different locations across the site, each within one of the test pits. The OSL samples were taken from 3 separate dunes, including BHW, and one from a potentially archaeological context. Samples were extracted from the profile by pushing 20cm long black canisters into the section in order to get a sample that included sediment that had not been exposed to light, and were kept in light-tight conditions. In the field, where the light-tight samples of the sediment were taken, the rate of isotope decay was measured by a gamma spectrometer. This absorbed radiation is measured in units known as Grays (Gy). The gamma spectrometer gathers the accumulation rates over a 45 minute period (depending on the probable amount of radiation in the sediment), and records the radiation levels. The dataset was downloaded in the lab, and atomic levels of each of the relevant elements were recorded; as each isotope accumulates differently, the accumulation rate affects the radiation signal given by the samples.

In the laboratory, the samples were processed, and quartz grains were extracted from any moisture, feldspars, organics, or heavy minerals that was within the sample, and sieved down to 90-250 μm (for full procedure see appendix I). Changes in moisture, mineralogy, and/or particle size, as well as changes in age, can have an effect on the radiation accumulation, so it is important to extract and factor in the effect the external factors may have had on the samples.

Sand grains within aeolian deposits are generally considered to have few issues with incomplete bleaching at time of deposition (Duller 2008b, 602). Previous studies of single-phase aeolian deposits show that samples are generally uniformly bleached, or fully reset by light exposure at deposition, with D_e dispersion values less than 20% (Duller 2008, 602). Aeolian deposits are occasionally not uniformly bleached at redeposition, and can be affected by iron coatings on grains (Lomax *et al.* 2007), or more commonly, bioturbation may affect the signal with closer proximity to the surface (Bateman *et al*. 2007), resulting in wider dose distributions. Since the dune deposits at Torksey were suspected to have been multi-phase depositions, the samples were run using single aliquot regenerative dose (SAR) methodology. SAR works on the assumption that the many sand grains across the steel disc will provide an average regenerative dose across the disc of grains.

Once sieved, with non-quartz sediments isolated, the samples were mounted on ‘aliquots’, or small steel discs with a single layer of sand across the surface. The samples were loaded into the OSL reader for preheat testing, infrared light testing, and finally equivalent dose (D_e) OSL measurements, or the amount of trapped radioactive energy since the sample’s last exposure to light. These measurements took place on a TL-DA-18 automated Risø TL/OSL reader with Hoya U-340 filter. The samples were then exposed to blue light in a controlled environment, so that the radioactive isotopes are emitted as a light signal, which is then measured by a sensitive light detector.

To determine age, the equivalent dose is divided by the rate of radioactive accumulation:

$$\textit{Age (kyr)} = \textit{Equivalent dose } (D_e)/\textit{Dose rate (Gy/kyr)}$$

Once the equivalent dose was corrected for the dose rate, the dataset was sorted, and outlying aliquot data were calculated and excluded. The remaining data were calculated for mean and probability of D_e, thus providing the most probable age based on the regular distribution of D_e. The mean and probability (central age model) calculate the D_e based on the average D_e across all the aliquots, and the skew of their distribution. Two additional statistical models, the minimum age model, and the finite mixture model were also applied (figure 4.3) (Duller 2008, 596; Rodnight 2006). The minimum age model considers all the results, factoring in the probability that the sediment is closer in age to its younger, lower counts than the older, higher counts, since these may be a result of inconsistent rebleaching.

Figure 4.3: Simplified age models used in this dissertation. Db represents simplified theoretical De distributions, which were used for age calculation. A. Central Age Model, or probability density function. B. Minimum Age Model. C. Finite Mixture Model. Modified from Duller 2008, figure 6.

The dispersion of aliquot data was also analysed for an indication about the rate and mode of deposition or post-depositional disruption. These outlying aliquots provide information about incomplete bleaching that indicates several phases of slow accumulation of sand. While this was invaluable information about depositional processes, portable luminescence was also used to determine accumulation rates and phases of deposition.

2.6.2 Portable OSL dating

Portable OSL (pOSL) is based on the same principles as OSL: that sediment grains, including grains that are not quartz, begin to accumulate energy from surrounding radioactive isotopes as soon as they are buried. The method was first developed in 2005, when the Scottish Universities Environmental Research Centre (SUERC) created the portable, battery-powered OSL system. The technique requires only a small, light-proof canister for sample collection. Using this technique means there is no need to separate out quartz grains, since unstable isotopes will accumulate on most particles, and the portable OSL reader can be used in *any* sedimentological environment with fine or medium sediment grain size, providing proper sampling techniques have been employed (Duller 2008, 6; Muñoz-Salinas *et al.* 2011, 658). The pOSL reader includes a photodetector, a photon counter, and a laptop with a control board (Sanderson and Murphy 2010). It has so far successfully provided accurate OSL generated counts for Neolithic ditches in Petrilli, Italy, helping to identify rate of sediment deposition and lapsed time since burial (Sanderson and Murphy 2010, 302), as well as aeolian dunes associated with historic storms along the Norfolk coastline at Holkham (Bateman *et al.*, forthcoming). Further studies in a fluvial environment in Cambodia have also provided evidence of long periods between depositional phases (Muñoz-Salinas et. al. 2011, 656).

POSL is considered 'portable' since it can be used in the field on battery power to generate quick measurements, and does not require a lengthy sample preparation as in OSL dating. Simple processing of samples makes it equally quick and useful in the laboratory. Without sample preparation and long sample run times, it has the benefits of simpler field sampling processes, allowing for a greater number of samples to be run in a short amount of time, and the ability to use the technique on all mineral fabrics. Of course, the drawback of such an easy method is that it does not provide exact dates, instead only the crude OSL counts recorded by the light sensitive filter are generated. In conjunction with the OSL dates acquired from various places at Torksey, however, these numbers can be calibrated to provide a series of relative ages.

Figure 4.4: The SUERC portable OSL unit (from Sanderson and Murphy 2010, 300).

As mentioned in section 2.7.1, OSL counts in sand can fluctuate due to the following factors: age changes; moisture fluctuations; mineralogical changes (including feldspars); particle size; and colour changes (Sanderson and Murphy 2009, 300). The purpose of the portable OSL reader is to acquire OSL readings quickly and without processing. Correcting for all these factors would be just as time consuming as OSL dating, but not correcting at all will result in failure to produce accurate results. For this reason, the pOSL data from Torksey were corrected for moisture, feldspars, and particle size, but in the final dataset, were only corrected for moisture. Bateman *et al*. (forthcoming) have determined that the most consistent results were achieved by correcting for moisture and feldspars using infrared (IR) light, and that by incorporating other known factors, including the IR signal of feldspars and particle size, did not improve the data.

Samples for pOSL at Torksey were taken in the field, but were run exclusively in the laboratory for consistency of procedure (Bateman *et al*. forthcoming). Samples were taken from core samples that had not been disturbed across the entire site, as well as in 10cm increments where available in test pits and larger excavation areas. For sample locations and results, see chapter 5, and for list of all samples, see appendix V. Samples were run through the SUERC pOSL, first using IR light to remove any feldspar signals, and then with blue diodes, measuring the isotope reaction. The results were measured in raw OSL counts detected by the filter. These measurements were corrected (normalised) for moisture content (measured separately). All results were comparable due to crossnormalising to get the same ratio of moisture for all samples across the entire site in comparison to a single sample. Overall, the method is relatively straightforward, however the methods and procedures used for processing of the data are still in their infancy, and refinement of the data will improve with further understanding and additional field studies.

2.7 Palaeoenvironmental reconstruction

The application and combination of all of these techniques to the study of the Viking winter camp site north of Torksey resulted in the creation of a detailed physical reconstruction of a Viking winter camp, as well as an accurate physical reconstruction of the site throughout the Holocene. Mapping the sediments and analysing the sediment data not only produced a detailed map of the superficial deposits and base map for the landscape reconstruction, but it also provided a general overview of climate change, a record of environment and landscape change, as well as a means for analysing the vegetation and climatic record. By combining the sediment, pollen, and dating record, the landscape of the site was more accurately reconstructed and dated.

2.7.1 Problems and biases

The geoarchaeological and palaeoenvironmental reconstruction was very successful, however there were unavoidable problems. The main issue encountered was that the floodplain landscape of the modern Trent could not be adequately mapped due to a shortage of time and a lack of appropriate equipment. It would have been necessary to take many cores across the floodplain using a percussion auger in order to understand the alluvial profile and the movement of the Trent at Torksey, but the time and resources were not available for such a survey. Nonetheless, it was possible to estimate the alluvium on the west side of the site on the basis of previous auger surveys (Wessex Archaeology 1997) and test pits (Perry *et al.* 2011) on nearby parts of the floodplain. In the absence of an auger survey across the floodplain, reconstructions of alluvium in the floodplain are hypothesised on the low resolution data available.

The taphonomy of the peat introduced an additional problem. Unfortunately, with the installation of land drains and pump houses in the 19th century, most of the wetlands in and around Torksey have been dried out, and the average water level has been lowered by several centimetres. While wetland peats are conducive to good pollen preservation, the pollen grains have largely dried out from 50cm depth to the surface. The pollen under the microscope became sparse and difficult to identify from 50cm and up, so the sequence could be skewed towards more robust grains, or those that occur most frequently, missing the less frequently occurring species. These two issues are of limited significance and do not alter or nullify any of the results of the wider environmental survey.

3 Landscape reconstruction

The next phase of the project involved a landscape analysis of the area surrounding the winter camp site. The landscape reconstruction was completed for the periods prior to, during, and after the construction of the Viking camp. This was intended to determine what pre-existing Roman archaeological features may have been present at the time of the Viking overwintering, any early medieval features that were present at this time, and any changes to the landscape or environment in the area that may have been caused by this major single event. In the course of mapping the data, environmental changes and its effect on human activities throughout these periods also became evident, enhancing the climatic and environmental reconstruction defined in the palaeoenvironmental survey. Where mapping sediment analysis of cores was a task that was simpler to convey using QGIS, the landscape analysis required much more processing and analysis, and was processed entirely using ArcGIS.

3.1 Defining the study area

For the analysis of the wider landscape, the study area includes not only the site of the Viking winter camp at Torksey, but also the surrounding 23 parishes on both sides of the River Trent (listed in chapter 3), covering a total of 69.22km^2 in Notts., and 113.73km^2 in Lincolnshire, covering a total area of 18,295 ha (182.95km^2). The parishes and their boundaries considered in this study are the pre-19th century re-appropriated civil parish boundaries as determined by the Local Government Act of 1894, and as they appear on the 1st edition OS maps in the area (1860s). Parish boundaries were chosen as the delineator of the study area (as opposed to an arbitrary circle around the winter camp site), as the boundaries themselves hold information about the formation of the social landscape in relation to the physical landscape.

3.2 Maps and spatial data

A series of maps and topographic information detailing different aspects of the study area were required to complete this analysis. These maps included:

- Modern OS maps at scales of 1:10,000, 1:2500
- 1st edition 1:10,000 OS map
- Satellite imagery (via Google Earth)
- Archived maps from Lincolnshire and Nottinghamshire Archives and local libraries
- Topographic map
- Available LiDAR data
- Superficial geology map
- Solid geology map
- Aerial photographs

Ordnance Survey raster maps, historic Ordnance Survey maps were downloaded via the Digimap via Edina service, using their data download system, and these maps were imported into ArcGIS as separate tiles. The tiles could not be effectively stitched together; since the study area straddles two separate counties there were some discrepancies, including two copies of the same tile, but with different parts whited out, or with the counties not quite matching side by side. Creating a folder with all the tiles and making overlapping and partial white tiles partly transparent fixed this issue. Non-OS historic maps from archives were georeferenced, but were simpler to refer to as separate image files, rather than in the GIS. 1:10,000 maps of the underlying and superficial geology were also downloaded from British Geological Survey (BGS) data on Digimap via Edina, and imported into ArcMap as a shape file.

Topographic data for the entire study area was also downloaded from Digimap, and a triangulated irregular network (TIN) was created in ArcMap. Where available, light detection and ranging (LiDAR) data with 1 metre resolution, was downloaded courtesy of the Geomatics Group (www.geomatics.co.uk). LiDAR is a form of remote sensing through lasers reflecting off the ground surface from aerial reconnaissance vehicles (Crutchley and Crow 2009, 3). LiDAR is available in the form of Digital Surface Models (DSM) or Digital Terrain Models (DTM), where DSM is the topographic data of all the features on the ground, including buildings and trees, and DTM is just the terrain, stripped of any trees or buildings. For this thesis, DTM data was used. From the LiDAR topographic data, a hillshade file was also created in the ArcMap programme, showing detailed earthworks on the ground. Unfortunately, the available coverage of the 1m LiDAR data did not cover the entire area, but they were, nonetheless, used as much as possible, and, where not possible, topographic data was used.

Aerial photograph databases of the National Monument Record (English Heritage) and the Sheffield Library of Aerial Photographs (SLAP) were consulted for any relevant images of the study area. Only one image of the winter camp site, and several from the larger study area, were found, rectified, and drawn to scale in ArcMap. These images, in addition to Google Earth imagery, were analysed for evidence of palaeochannels or cropmarks; although none of the data was deemed relevant to this dissertation, as the cropmarks were largely un-dateable, the results and a catalogue of detected cropmark and palaeochannel features can be found in the appendix IX.

Once all these files were downloaded and added to the GIS, several separate features were redrawn and saved as separate shape files. These features include: waterways including the River Trent, the Foss, palaeochannels detected on LiDAR and satellite imagery, and all drainage channels; all roadways, including trackways; field systems on and around the settlement at Torksey.

3.3 Catalogued data

The second set of data applied to the GIS, and compared to the spatial data listed above was a catalogue of recorded data from the Historic Environment Record (HER), published excavations (included in HER data), and grey literature from unpublished excavations. The two separate counties included in the study area both use different means of collecting and distributing HER and grey literature data. The Nottinghamshire HER had a table of all records and locations available immediately upon request to the Nottinghamshire County Council, while the Lincolnshire HER records had to be accessed via online records. Lincolnshire unpublished reports were available via the Archaeology Data Service (ADS), however all grey literature reports from Nottingham required finding while physically in the Nottinghamshire County Council Planning Department.

While reading grey literature reports, it became clear that the alluvial or recent geological sequences uncovered during both academic and commercial archaeology projects were not always thoroughly understood, so apart from noting and locating all evidence of Roman, Anglo-Saxon, or medieval archaeological sites, the sedimentological profile was also noted by the author where available, in order to assess the extent of Holocene alluvial or aeolian sedimentation that had not been recorded in the original excavation report.

The sites recorded in these databases were categorised in an excel spreadsheet that indicated site name, 10 digit OS coordinates, a short description, chronological period and, where available, century, site type (settlement, industry, ecclesiastic, ridge and furrow, etc.), and finally the evidence for the site (earthwork remains, excavated remains, stray finds, historic records, etc.). Where available, the relationship of the archaeology to surrounding drift geology (e.g. if the archaeology was beneath aeolian or alluvial deposits) was also recorded. The catalogues can be found in appendix XI and XII. When cataloguing GL, every excavation was noted, but was mapped as 'non-archaeological' if there were no associated archaeological remains.

In addition to these records, a file for place names and cropmarks was also created, however these could not be used for the final analysis for several reasons. Place names, while useful in identifying the general locations and linguistic origins of the local names, proved very difficult to map, as many only appeared in historical records, and not on any available maps. Cropmarks, while easily mapped, were not included because there was rarely any substantial dating evidence for them, and thus it was not always clear if they are relevant to the survey of the Roman-medieval periods. For this reason, cropmarks and place names were not used in the final analysis, but a full catalogue can be found in appendix IX.

Once the data were catalogued, they were saved as a .CSV text file so the data point locations could be read and mapped by ArcMap. Once in the GIS, the sites could be broken down and mapped or excluded based on period, site type, existing evidence, location, or any other catalogued data type. The 10 digit OS coordinate system allowed for the georeferencing of the site, and thus the relationship to the raster and shape file base maps and data described in section 3.3.

3.4 The analysis

To analyse the dataset, a series of maps were created for each period in question. The HER and grey literature data from each period were mapped against the background maps, including topography, the superficial and solid geology, as well as the waterways, and the roadways. These maps were created for the Roman, early medieval, and medieval periods to determine any correlations between these archaeological sites and natural landscape features. The HER and grey literature data were also separated out by site type if known, to determine whether there were any visible changes in uses of landscape, and if the changes are directly related to the natural landscape.

In addition to the maps of each period, a map with the intersection of both periods was created to show clearly how much the landscape had or had not changed between those periods, and was used to make an assessment of what environmental or other social shifts caused these changes. This included mapping palaeochannels throughout the study area. The Trent Valley Geoarchaeology group has undertaken studies of the visible palaeochannels of the Trent Valley (Challis and Howard 2006; Challis 2002; Havelock *et al*. 2002; Baker 2002); the use of LiDAR data and boreholes on these projects to map the palaeochannels of the Trent Valley has offered a methodology that was used to recognise palaeochannels in the study area (Challis and Howard 2006, 17). Features on maps and aerial photographs including relict channels, depressions or vegetation bands along the floodplain, relict parish or field boundaries, cropmarks, satellite imagery, and LiDAR data were used to recognise the location of palaeochannels. If possible, historical, mapping, and landscape data was applied to the identified palaeochannels to provide dating evidence.

The selected maps and highlighted features were chosen in an attempt to draw out any patterns related to both settlement (including habitation, industry, agriculture, and ecclesiastical activity) and/or environmental data (including geology, topography, water level, and movement of the River Trent and other water channels). Through these maps, changes in settlement in reaction to environmental or anthropogenic changes became clear. The final output rendered a clear picture of settlement and society in the Roman, early medieval, and medieval periods, and the changes that occurred within the study area for the past 2000 years.

This analysis was conducted exclusively using ArcMap, with the static and archaeological feature layers being turned on and off according to the relevant period and analysis. In addition to ArcMap, ArcScene was used for clarity in final images in the analysis chapters.

3.5 Potential problems and compensations

Since the data compiled from publicly recorded archaeological finds have been accumulating over years, and the dataset is not part of a carefully planned survey, there are some issues to compensate for and overcome. Biases in HER and grey literature data are easily identified, and within this study area, many of the common problems with using HER data are very relevant. These include: biases towards areas with modern activity due to commercial archaeology; alternatively, empty spaces where no excavations have occurred; and excavations and finds not being reported. Additionally, there are numerous problems with the data itself, including: excavations and data that are not properly recorded, misidentified, or simply not submitted to the HER; sites that do not have any dating information, especially with regard to cropmarks; and differences in levels of preservation depending on location in the landscape and age of the site. Since combing the records for the entire study area, field by field is not practical for a three-year timeframe, this analysis tried to address these issues as they were encountered within the area, providing the best possible analysis with the extensive, if problematic, database.

Another misrepresentation of data can be found in the form of geological maps, and indirectly in the topographic maps. As will be demonstrated, the aeolian sand and peat deposits across the site at Torksey are not fully recorded by the BGS, despite reaching depths over 1m. With these missing deposits on this small area within the smaller study area of the geoarchaeological survey, it must be considered that the rest of the study area may also have some similar omissions, and that some of the drift deposits do not appear on the map of superficial deposits used in this section. Where available, cores and excavations with sediment data or indications about the underlying sediments throughout the larger study area were noted and mapped in order to assess the unrecorded superficial deposits in the area. As a result, a map of the potential locations of aeolian sand where it is not already recorded was produced.

Drift deposits across the area also cause additional problems in that they create a topography that is slightly different from the topography in the past. Alluvium attributed to the post-medieval period that blankets the valley presently reaches depths of 2 metres or more, which accounts for an additional 2 metres added onto the ground elevation that may not have existed in the Roman through to medieval periods. Peat east of Torksey reaches depths of 1.5 metres, and that ground, prior to the peat accumulation beginning in the late Bronze Age, would have been 1.5 metres lower than the present day. Similarly, redeposition of aeolian deposits would have created a dynamic topography across the site, covering much of Torksey in a meter or two of sand, and thus altering the topography recorded in present day surveys. Coring of the datable superficial deposits has provided some idea of the topographic changes that have occurred on the winter camp site, and it is likely that similar changes have occurred throughout the study area where there are superficial deposits.

4 Surveying the winter camp at Torksey: results and discussions

The Holocene environmental landscape and the multi-period archaeological landscape survey both produced a large amount of information relating to the historic landscape of the Lower Trent Valley around Torksey, and though all of the data are fascinating, and will require further future investigations, the results directly pertaining to the Viking winter camp and the main aims stated at the start of this dissertation are presented in detail in chapter 7. In order to paint a vivid picture of the landscape before, during, and after the 9th century, and thus the period of the winter camp, both and environmental and social data were combined and analysed.

The data from both surveys answered the questions set out in the objectives, and were combined to create a multi-dimensional approach to understand the winter camp of 872-3. Firstly, the environment and the effect it had on human interaction with the landscape were considered. This analysis used data from both the geoarchaeological survey and the landscape survey to recreate and assess environment changes. Aeolian deposits, wetlands, and water level changes in relation to human settlement location and movement were observed.

Next, the human landscape from the Roman to medieval periods was considered, including what features and settlements were present and visible during the year of the overwintering, in order to determine what features would have directly influenced the

Vikings decision to use the site north of Torksey as a base camp. In addition, this analysis considered what landscape features would have played a role in the setting of the Great Army's camp during that year, and what effect these features would have had on daily life in the camp, such as leisure, raiding, and food gathering activities. The environmental reconstruction also played a large role in this part of the analysis, as the physical landscape would have limited or enhanced the ability of the Great Army to interact with the people, route ways, and settlements in the surrounding areas.

Finally, the post-winter camp landscape was analysed, including the post-depositional processes that were a direct and indirect result of the winter camp, the impact of the Vikings on the immediate and surrounding area, and the potential for Viking settlement or re-settlement on the winter camp site, or in the nearby landscape.

The final results of the surveys provide a highly successful insight into the Viking winter camps of the 9th century that has not been attempted before this thesis. Primarily, this survey acts as the first ever landscape survey of a Viking winter camp site. As was demonstrated in chapter 2, a detailed survey of the landscape setting of a winter camp of the Great Army has never been completed, and the lack of application of landscape archaeology methods has led to a misguided interpretation of the morphology of a Viking camp. The landscape survey in this thesis considers not only the immediate and surrounding landscape of the Viking winter camp site, but also gathers physical evidence to create an impression of the physical characteristics of the site, supported by geoarchaeological methods. In the final chapter of this thesis, the wider applicability of the results and interpretations of this survey will be considered alongside consideration of how the use of a landscape and geoarchaeological survey can enhance our understanding of the Great Army and its campaign. By applying this methodological approach to other known sites and sites identified in the future, we will also be able to determine if winter camps are a 'type site', as they have been addressed before, or if, in fact, each one is different, drawing on different and unique aspects of every unique landscape, and that there is no checklist that can be used to identify a Viking winter camp.

In addition to being the first geoarchaeological and landscape survey of a Viking winter camp site, the survey also acts as one of very few investigations on an early medieval or medieval site and study area on this scale of landscape. Often, the overlap between geology and archaeology is overlooked in medieval and early medieval archaeology in favour of historical records or small finds analyses. The exclusion of geoarchaeological studies on post-Roman archaeological sites has led to changes in human settlement almost exclusively being considered as the result of social changes. With the application of the methodology outlined above, in all physical environments, not just those similar to Torksey, understanding of early medieval and medieval archaeology would no longer be so elusive, and the reasons for settlement change and movement could be evaluated with a full understanding of the landscape and environment. This level of understanding cannot be attained without a survey completed on a similar scale to the one presented in the landscape study. A single parish, as has been the focus for medieval landscape projects to date, is often too small to understand the repercussions of the environmental changes of the regional landscape, while a regional study does not have enough focus to hone in on the results of large scale changes on small communities. This survey, with this size of study area and the methods applied to it will hopefully address this void in the study of medieval landscape.

CHAPTER 5:

INVESTIGATING THE PHYSICAL ENVIRONMENT OF TORKSEY

1 Introduction: geoarchaeology and palaeoenvironment at Torksey

This chapter provides a detailed description and interpretation of the geoarchaeological and palaeoenvironmental survey that was conducted on the Viking overwintering camp site at Torksey. Although the primary focus of this dissertation is the early medieval period, more specifically the years 872-3, this geoarchaeological survey has recovered details of the palaeoenvironment throughout the Holocene. All of the data are relevant and essential to understanding the formation of the site of the Viking winter camp, and the processes that have occurred on it since the early medieval period. This geoarchaeological and palaeoenvironmental survey is confined to the winter camp site (figure 5.1), but includes some of the surrounding fields for further contextualisation of the landscape, creating a study area of 1.43km^2. For clarity, the study area is broken up by field, where each field in the present field system is given a corresponding letter (i.e. field A, field B, etc.); the corresponding letter to each field can be found in figure 5.2.

The British Geological Survey 1:50,000 map of superficial and solid geology deposits reveals that the Torksey overwintering camp site lies on one of the topographically varying outcrops of the MMG along the east side of the River Trent in the Lower Trent Valley (see underlying geology, chapter 3, figure 3.8). The apex of the MMG bedrock on the winter camp site reaches a height of 16m AOD, and another apex, labelled as HPSG, reaches a height of 15m AOD. Mapped by the BGS as drift geology (chapter 3, figure 3.9), HPSG lies along the eastern length of the site, on the east-facing slope. The western slope, an exposed area of the Mercia Mudstone, is a much steeper gradient, due to geological formation, as well as the ongoing incising of the slope by the River Trent. At the bottom of the western slope, the present Trent Valley is covered by a blanket of alluvium, at an elevation of 4 to 5m AOD. The low-lying south end of the site is also covered in HPSG. The north edge of the site, however, is mapped as alluvium. To the east of the A156, the BGS has mapped HPSG deposits, as well as small areas of peat. Finally, on the northeast edge of the site, is a small outcrop of aeolian sand; this feature is logged by the Ordnance Survey as ‘Bunker’s Hill Warren’. This chapter will demonstrate that, while the BGS maps provide a good basic knowledge of the present geology, with detailed examination, it can be seen that there are many more unmapped outcrops of both peat and aeolian deposits blanketing the site.

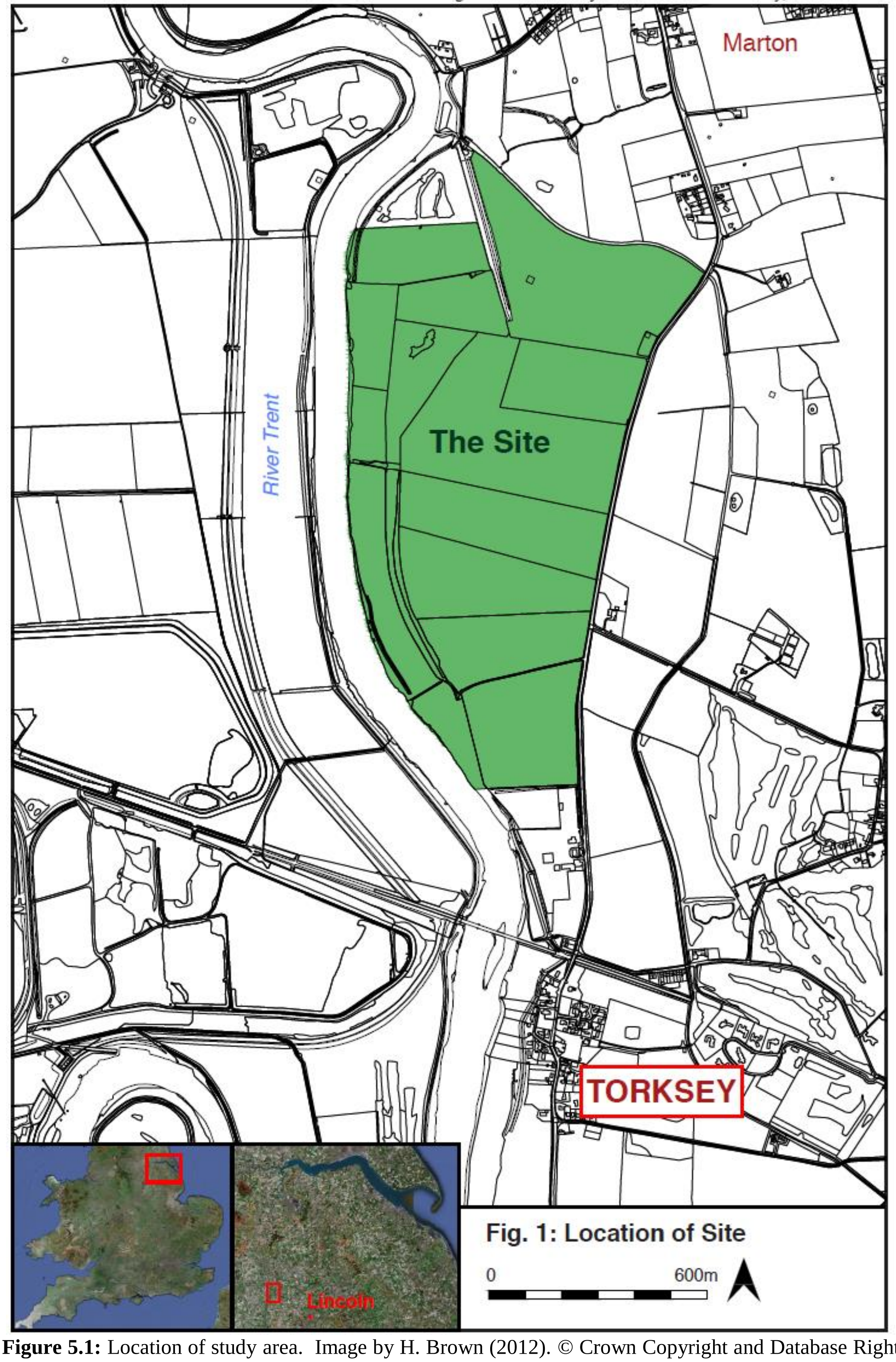


Figure 5.1: Location of study area. Image by H. Brown (2012). © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

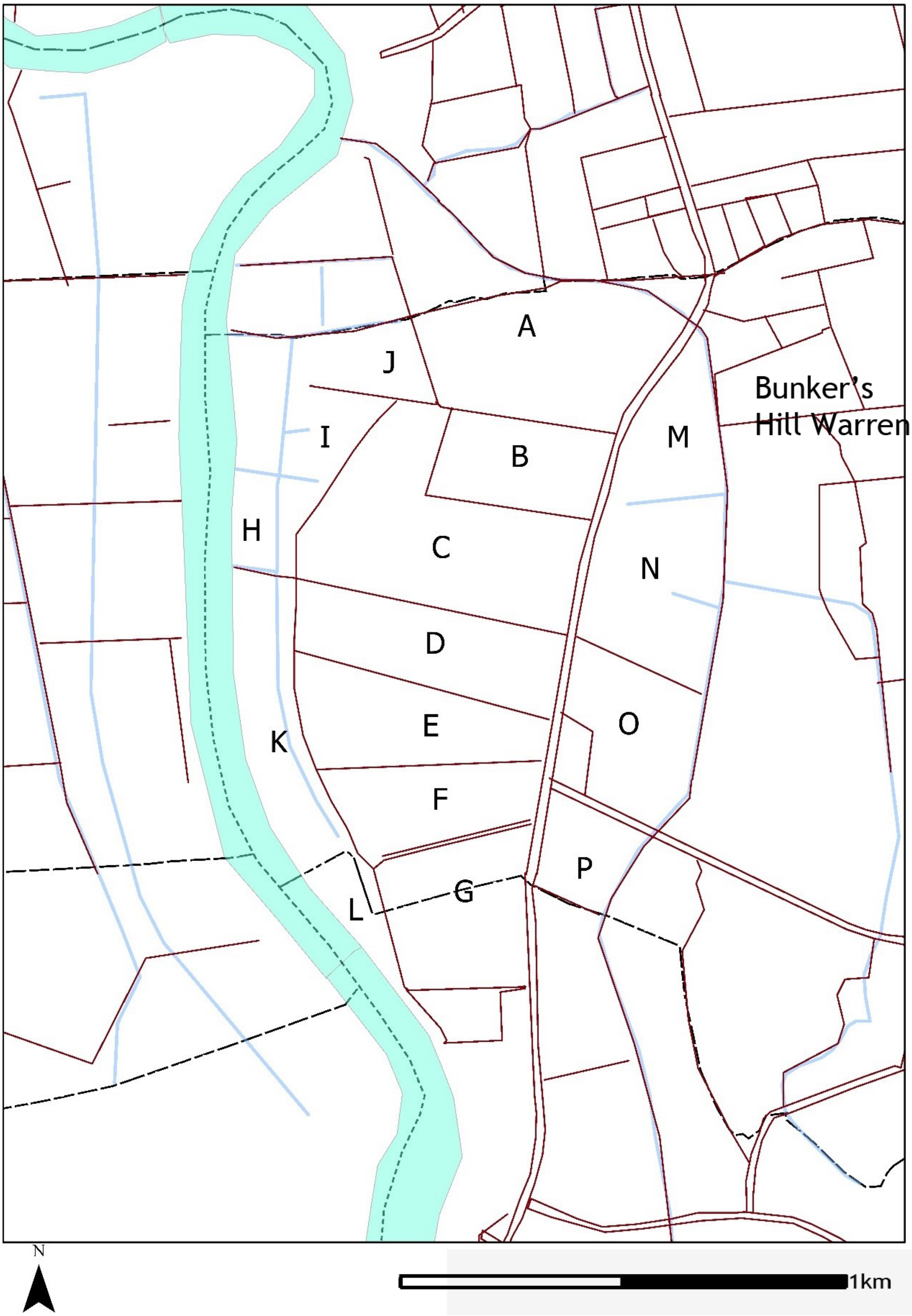


Figure 5.2: Map of fields by letter, as referred to in the text and appendices.

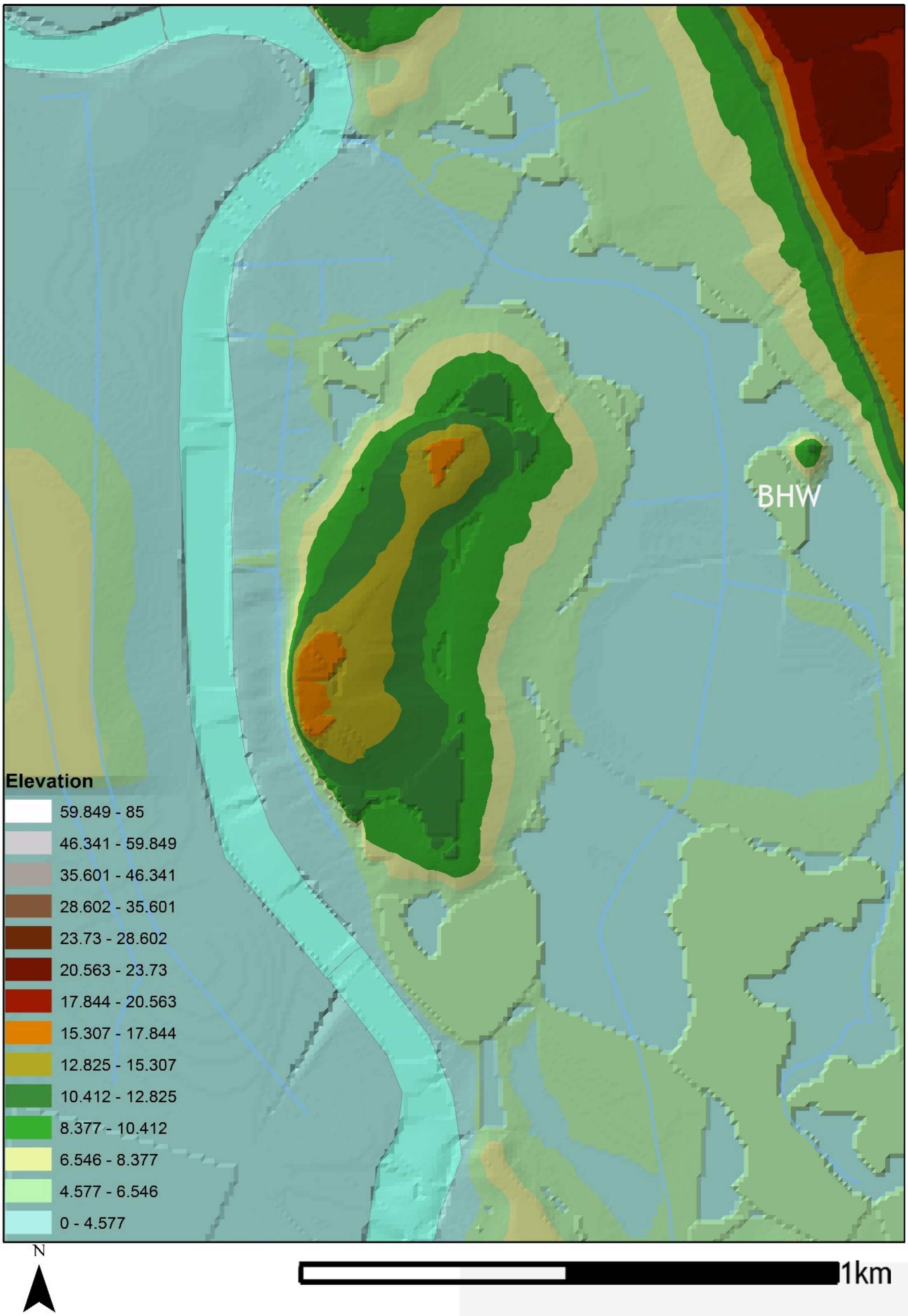


Figure 5.3: Topography of the site; DTM based on OS mapped elevations.

1.1 Previous archaeological work within the winter camp site

Despite the multiple excavations conducted throughout the settlement of Torksey (see chapter 3), prior to the present study there had only been one excavation completed within the study area, undertaken as part of a larger pipeline project. Unfortunately, there are very few details recorded in ensuing reports. The Blyborough Pipeline was installed in 1996, and it runs from Blyborough (Lincs.) to Cottam (Notts.), approximately 26 km in length. The excavations conducted by Wessex Archaeology reached 2 m depth across the excavated area (Wessex Archaeology 1997). On the winter camp site, it runs through fields B, C, I, H, and M. In the Wessex excavation report, only short segments of the survey within the study area were highlighted in the report (sites C43 and C45 as defined in Wessex Archaeology 1997). C45 was determined to have no relevant archaeological remains. At C43, no remains were recovered, but nearby cropmarks were noted on the final plan (Wessex Archaeology 1997, figure 21; see figure 5.4). No archaeological features were found during excavations, and there was no information about the sediments excavated within the final report; however, conversations with local metal detectors who were on site during excavations reported that the trench went through a well-sorted sand deposit (P. Stanley and D. Stanley, *pers. comm.*), and contained Roman artefacts. The large amounts of sand on the site were not mapped by the BGS as aeolian deposits, but descriptions by the detectorists, and later ground truthing, determined that much of field B was covered in aeolian coversands.

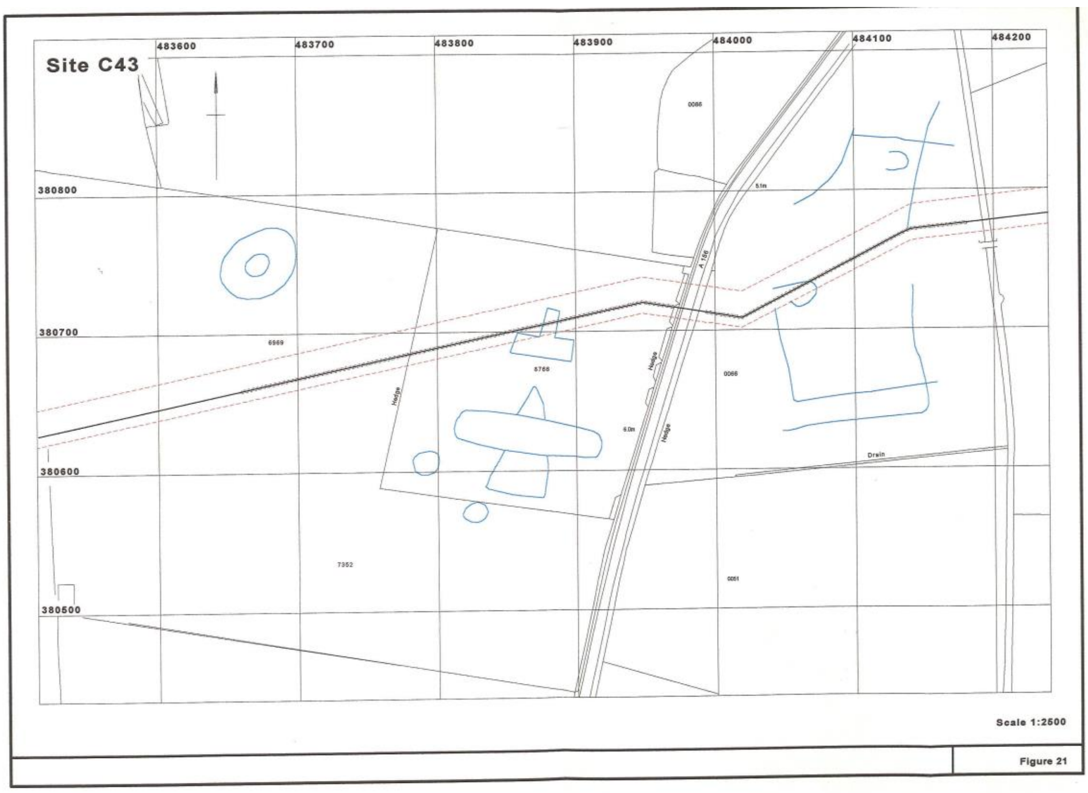


Figure 5.4: Plan of analysed aerial photograph and cropmarks site C43 from Wessex Archaeology 1997, located within the northeast corner of the study area of this survey. The cropmarks to the east of the A156 are visible on multiple aerial photographs (including Google Earth), while those west of the A156 are tentative, as the original source is not listed, and could not be located.

Although not located within the study area, it is worth noting that the excavations at Torksey Golf Course included the investigation of a peat deposit located northeast of the present village of Torksey (Johnson and Palmer-Brown 1997; Johnson 1997b). Through the excavation of the golf course, evidence of the complex prehistoric environment was uncovered, with a preserved Mesolithic palaeosol, or buried soil, overlying an aeolian drift deposit (Johnson and Palmer-Brown 1997, 8). The palaeosol is covered by a fluvial basal sand, which was covered by a peat deposit (Johnson and Palmer-Brown 1997, 8). Radiocarbon dating determined that the peat deposit had started accumulating in the late Bronze Age, and may have stopped accumulating in the Romano-British period (Johnson and Palmer-Brown 1997, 8); the deposit may have been truncated by post-medieval ploughing or other activity, so a final date of accumulation cannot be confirmed. Environmental samples were taken by Johnson and Palmer-Brown (1997) from the peat deposits at the golf course, but the results were never publicly reported.

Figure 5.5: Sediment sequence from Torksey Golf Course (Johnson and Palmer-Brown 1997, plate 3), annotated by S. Stein, with sediment interpretations.

A Mineral Assessment Report was also published as a resource on the sand and gravel resources in the SK87 grid (Price 1975). This report only covered fields G, P, and part of F. While the presence of aeolian sand is recorded in the area in this report, all sands encountered in boreholes across Torksey were classified as glacial sand with little gravel. This report does not consider archaeological evidence of later deposition within many of the borehole locations.

Until the launch of the Torksey Project, there had been no other intensive archaeological or geological investigations into this particular area of the Lower Trent Valley. There have been investigations in close proximity, many of which were described in chapter 3, including geoarchaeological studies and coring programmes focused on the Nottinghamshire side of the Trent (Howard 2004a; Wessex Archaeology 1997), and archaeological work focused within the settlements of Torksey (e.g. Johnson and Palmer-Brown 1997; Palmer-Brown 1995; Rowe 2008) and Marton (Cope-Faulkner 2003; Brooks 2003).

The foregoing review of previous investigations with palaeoenvironmental insights within the study area and the Lower Trent Valley demonstrates that the landscape record of the study area has focused on everything from the late Devensian to the Romano-British period. The plethora of aggregate extraction sites, especially on the Nottinghamshire side of the River Trent (e.g. Rampton, Cottam, and Bole Ings), have provided more geoarchaeological and palaeoenvironmental information about the later prehistoric and Roman periods (Knight and Howard 2004, 154). There have been no palaeoenvironmental investigations along this stretch of the Lower Trent Valley, and no investigations of the medieval period environment within close proximity to the site. There have been a few excavations of medieval sites along the Trent, including Barley's excavations to the south of the current village of Torksey in Castle Field (Barley 1964), but since these archaeological investigations were focussed on the anthropogenic remains, the reports often neglect to discuss any geomorphological traits that emerge during the excavations.

1.2 Aims and objectives of this survey

This study aims to provide a local palaeolandscape reconstruction of the winter camp site at Torksey and the surrounding study area. As an extension of this reconstruction, this thesis aims to determine what sort of landscape the Vikings encountered during their 9th century campaign, and seeks to relate the physical landscape to their military and social requirements. This reconstruction also aims to identify any Holocene landscape changes that occurred before or after the Viking period. The methods listed below were used in order to target the palaeoenvironmental record of Torksey.

Both field and laboratory methods were employed in order to answer the main questions set out in the methodology chapter. The main aims of the palaeoenvironmental survey overall were to:

1) Create a palaeoenvironmental reconstruction of Torksey during the early medieval period, including an understanding of vegetation, water levels, and topography, using environmental and geoarchaeological techniques
2) Reconstruct the local and regional vegetation of the site throughout an extended archaeological timescale
3) Understand the date of deposition of aeolian sediment

The main objectives of the fieldwork were to:

1) Identify any existing pedological formations, post-deposition structures, or archaeological strata in the sand and other underlying sediments
2) Identify and describe in detail each of the different sediments present across the entire site
3) Record in detail the location and depth of each type of deposit across the site
4) Sample each of the sediment types for further laboratory analysis

These objectives would be met through the following techniques:

- Coring
- Test pitting
- Trenching
- Walkover survey
- GPS mapping of surface features

Laboratory analyses were largely dependent on the results of fieldwork and available sampling. The main objectives for the laboratory analyses were to:

1) Create a pollen diagram for the peat sequence located at Torksey
2) Date the aeolian sand deposits on the site using OSL dating
3) Enhance and contextualise the OSL dates using SUERC portable luminescence
4) Further refine the identification of pedological features or changes within the sediments across the site, or within each core/test pit

5) Characterise each sediment type, and any changes within sediment types that may be indicative of environmental or anthropogenic changes using geoarchaeological methods

To complete this analysis, the site of the identified Viking winter camp at Torksey has been intensively surveyed and sampled using palynological and geoarchaeological field and laboratory techniques. These techniques included:

- Pollen extraction and analysis of a palynological sequence from Torksey
- Radiocarbon dating on the peat sequence listed above
- Geoarchaeological analyses of sediment characteristics including: loss on ignition, mineral magnetics, calcimetry, and particle size analysis
- Optically stimulated luminescence dating of aeolian deposits
- Portable OSL relative dating of aeolian deposits

1.3 LiDAR and mapping

The availability of LiDAR data and historic maps across the site has provided an insight into archaeological features on the surface, as well as a detailed topographic and surface detail for an even more enhanced environmental interpretation. Topographic data aided in reconstructing the locations of palaeochannels and wetlands, as well as post-medieval aeolian redeposition locations, and hillshade has also demonstrated potential palaeochannels, and archaeological features. Historic maps, including 1st editions of OS maps have also provided useful details about the environment over the past two centuries. Figures 5.6 and 5.7 show the raw hillshade and LiDAR elevations; the changes in environment through time will be illustrated on these images.

2 Summary of fieldwork sessions

There have been several episodes of fieldwork undertaken as part of this thesis by the author, and as components of the Torksey Project. At the start of the research for this thesis, the Torksey Project had only excavated 5 test pits within the hamlet of Torksey, outside the area of palaeoenvironmental survey, and had not yet begun collecting data on the winter camp site. All coring, sediment, and profile data discussed throughout the dissertation is, thus, the author's own collection, unless otherwise specified. Data collection completed as part of the thesis included: walkover survey (completed in October 2011); coring programme (October 2011 and November 2012); peat core sampling (November 2011); and test pitting (July and November 2012). Larger excavations and surveys completed by the Torksey Project include: test pitting (July 2011); geophysical survey (October 2011); fieldwalking (November 2011); excavation of Torksey 2012 Trench 1 (December 2012); and excavation of Torksey 2013 Trench 1 (August 2013). Additional work completed by the Torksey Project includes geophysical survey and fieldwalking on Castle Field, south of the present village of Torksey in November 2012.

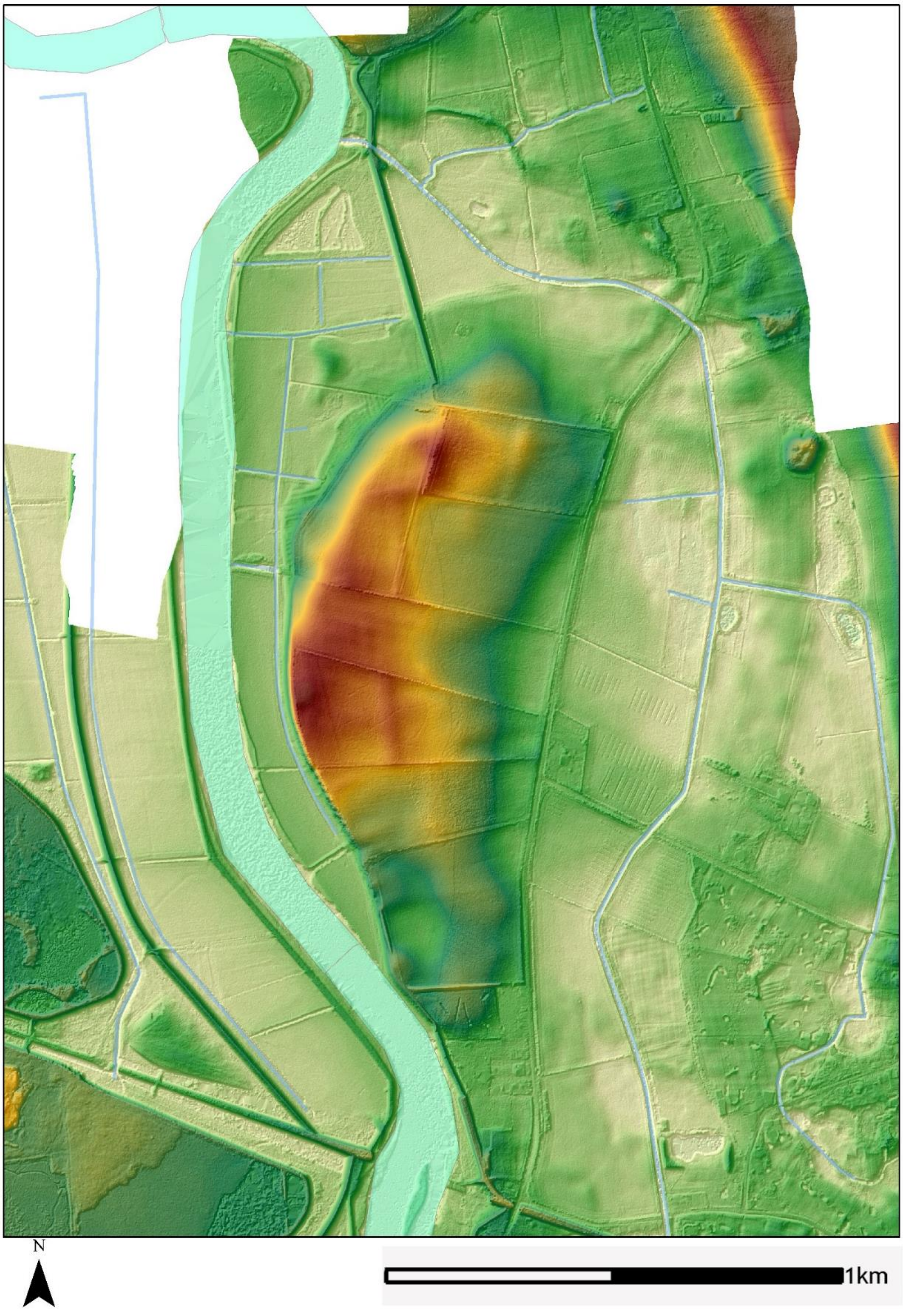


Figure 5.6: LiDAR topography data

Figure 5.7: Hillshade of the LiDAR data (with light projected from the northwest)

2.1 Walkover survey

A walkover survey was the first part of the planned evaluation, and it aimed to identify any standing archaeological earthworks, exposed sediment profiles, indicators of present or past environment, and to get an overall feel for the landscape. Evaluation of the landscape also allowed for informative placement of cores and sampling (see section 2.2). The walkover survey provided evidence of both archaeological activity and environmental changes. The results of this survey are presented in this section as background information to the environmental evaluation. The majority of the site is under the plough, and there are not many opportunities for the survival of visible earthworks. Across the floodplain, however, there are several opportunities for observing changes in the physical environment as caused by natural alluvial processes.

2.1.1 The floodplain

The BGS has previously mapped alluvium across field J, I, H, K, and L. This deposit varies greatly in character and depth across these fields, and changes rapidly. The only remaining archaeological earthworks visible on the surface within the study area are on the alluvium on the floodplain, in the form of ridge and furrow, and a possible brick structure in field I (see figure 5.13). The survival of these (recent) earthworks indicates that there is some potential for archaeological preservation across the floodplain in alluvial context, at least of post-medieval remains. However, alluvium is not distributed evenly across the entire site, and other parts of the floodplain within the study area may have different degrees of preservation. Evidence of ridge and furrow and abandoned field boundaries indicates that this part of the Trent Valley floodplain was once dry enough to allow the maintenance of field systems, but has now been reduced to wetlands used for occasional grazing.

There are several sediment profiles exposed along the floodplain, due to recent erosion by the River Trent. Erosion has exposed profiles that demonstrate several recent changes in sedimentation rate and size along this short stretch of the bank of the Trent. Figures 5.8 and 5.9 show one of these profiles, where almost 50cm of silt is overlying sand, and has been partially eroded away. The presence of plastic, and the sharp boundary between the two deposit types, is indicative of a rapid accumulation, probably initiated by a single, recent flood event, followed by a later event that eroded this section. There are also several profiles similar to this exposure along the east side of the present course of the

River Trent, each displaying varying depths of alluvium and different particle sizes, ranging from clayey silt to silty sand (also see figure 5.12).

2.1.2 The higher ground

Fields A, B, C, D, E, F, and part of G are along a ridge of higher ground on the west side of the site. Due to ploughing, there were no visible archaeological earthworks across most of the site. Change in soil composition and colour is very apparent, with light sandy soils overlying aeolian deposits and HPSG differing greatly from the dense clay soils that overlie alluvium and Mercia Mudstone.

The Blyborough/Cottam Pipeline (Wessex Archaeology 1997) lies across this high ground, and, on a dry day, it is a clearly visible linear feature indicated by a change in surface soil colour. Also notable in this field is evidence of the erosion of sand top and subsoils due to agricultural practices and wind erosion. This is apparent from the exposed profiles along the present hedgerows; the hedgerow rises at least 1 metre above the surrounding surface, a direct effect of the ease or erodability of sand deposits with no vegetation. Wind across the topographic peak, aided by constant ploughing, has led to the erosion of these deposits along the hedgerows, which may indicate that the topographical rise may have been higher in the past.

While much of the site is covered in sand or sands and gravels, at the crest of the bluff overlooking the River Trent is exposed mudstone. The mudstone is slowly being ploughed into at some locations, leaving behind a thick, silty clay top soil across some parts of the fields, a stark contrast to the light sandy topsoil in other parts. The mudstone is also exposed over the bluff, though it is being held by only a small amount of vegetation, and is otherwise being slowly eroded by gravity.

The wooded landscape at the southeast corner of field A may provide preserved archaeological evidence. There is no indication that this area had ever been ploughed; it is recorded as unused wetland on the 1856 1st edition OS map, and subsequently was occupied by a residential building. Since the demolition of the building on this land (R. Brownlow *pers. comm.*, 2011), a small birch scrub has been permitted and encouraged to grow. The mapped wetland covered the eastern half of field A. A drainage channel was installed at the north end of the field at the same time as the Marton pump house (Wright 1982, 25), however the field still floods regularly (R. Brownlow, *pers. comm.*).

2.1.3 Peat

To the east of the A156, in fields M, N, O, and P, is an area of ground with high organic content in the topsoil. The excavation of the Torksey Golf Course has shown that this peat extends south into Torksey (Johnson and Palmer-Brown 1997). Though mapped on the BGS as small patches of peat, the few excavations done in the area suggest that, the deposit covers most of the area east of the A156. The deposit changes to organic clay and silt to the north of the site, with an unrecorded berm or trackway delineating this boundary, acting as a means of keeping the land east of the site from flooding; it should also be noted that the division between the two types of natural deposits corresponds with the road, an observation which will be explored further in Chapter 6.

A drainage channel, 'Inclosure Drain', runs through the peat deposit; this drain, along with the installation of Marton Pump House, was probably one of the main causes of the drying out of the peat, and the recent accumulation of unhumified deposits on the surface. According to aerial/satellite photography from the past two decades (Google Earth), and historic OS maps, the fields containing peat (M, N) were once entirely under the plough. In recent years, however, agricultural practices have been abandoned in the eastern half of the fields, probably due to the failure of crops on the persistent wetland; birch woodland is now encouraged to grow on this area. Two artificial ponds are also recent installations, making the most of existing natural depressions, which are visible on 1st edition OS maps. The ponds are dug into white clayey sand, matching the description of the white 'basal' sand in the Golf Course excavation report (Johnson and Palmer-Brown 1997).

2.1.4 Bunker's Hill Warren

A natural feature that stands out on the landscape on the east side of the A156 within the study area, is Bunker's Hill Warren (BHW). BHW is the only mapped and preserved sand dune in the study area, and even in the surrounding area; however, there is little to no information available about this feature. It is recorded in the HER (no. 53786), though it is only listed as a possible warren based on its place name, and is dated to the post-medieval period. Rising about 2m above the surrounding peat and sand deposits, this sand dune still fulfils the purpose of its place name, with established rabbit warrens dotting the surface. It has been mapped by the BGS as a parabolic aeolian dune, and 1m resolution LiDAR data hints at a parabolic shape, however only the southeast side remains at a substantial and noticeable height, and is preserved as a conical mound. It is possible that it naturally survived so well because it is sheltered by the Scunthorpe Mudstone Formation, which rises quickly to 17m AOD immediately to the east, or possibly that this area was never cultivated due to the surrounding peat and wetland, and the poor fertility of just sand as a top soil. BHW's continuous function as a naturally formed rabbit warren may have also led to its preservation and protection from ploughing. The plants surviving on the sand are common in dry, well-drained environments, including birch scrub and grasses; these give a good idea of what the vegetation on the site west of the A156 may have looked like prior to clearance for agriculture.

2.1.5 Environmental observations

Environmental changes that occur in this landscape on a seasonal basis were also encountered, due to the many seasons of fieldwork on the site. While much of the land has been altered in the post-medieval period by drainage and large modern berms, the effects of flooding around the floodplain can be observed quite clearly. While the Trent is currently up to 450 m away from the higher ground, flooding of the channel results in the site becoming a temporary 'island', with the areas north and south of the site flooding. The peat to the west of the site similarly becomes increasingly wet, however it is pumped out of the drainage channel to avoid flooding in Brampton and Torksey. Prior to pumping and drainage, however, it is probable that the areas all around Torksey would have flooded often. The difference between a flooded and dry site can be seen in figures 5.10 and 5.11.

Tidal fluxes of the Trent can also be observed in calm weather. As was mentioned in chapter 3, alternating fresh and salt water marshes can be observed just upstream from Gainsborough (Lillie and Neumann. 1998). Water can clearly be seen flowing upstream, changing from south-north to north-south directionality in high tides, however there is no evidence of salt water making its way this far upstream in the Lower Trent Valley. The tidal movement of the water does have some implications on the prospective palaeolandscape, which will be addressed in the conclusions of this survey.

2.1.6 Walkover survey results outside the overwintering camp site

There were a few opportunities for walkover surveys outside of the main area of investigation. Many of these surveys were focused on archaeological remains, however there were a few instances of landscape changes and exposed alluvial profiles.

Immediately to the east of the study area, geological changes are defined by a clear change in topsoil. The change from Mercia Mudstone to Lincolnshire Lias Formation is denoted by the large pieces of limestone within the topsoil; there was also a distinct lack of sand and gravel deposits. This same sharp contrast in parent material composition is also visible in soils south of the settlement of Torksey, where at the east end of Sand Lane the topsoils turns from sandy to clayey with limestone inclusions (G. Perry, *pers. comm.*).

The next brief walkover survey that identified evidence of environmental change took place across the river in Sturton-le-Steeple (Notts.). While investigating the place name and landscape of Knaith Hall Lane in Sturton-le-Steeple, the floodplain on the Nottinghamshire side of the Trent Valley displayed massive deposition of alluvium, up to 5 metres above the present floodplain. This deposition has been eroded by later events, displaying one to two events of massive deposition, and some alluvial deposits overlie pieces of plastic or other modern artefacts. This deposition is much more substantial than the alluvium on the east side of the river, and may represent a longer period of accumulation prior to abandonment, with fewer recent erosive flood events.

The walkover survey provided little new information about the archaeology within the winter camp site, as much of the area is under the plough, and any potential earthworks have been destroyed. It did, however, provide an initial insight into the landscape and potential environments that would be uncovered in the more detailed survey.

Figure 5.8: Profile in field L of rapidly accumulated alluvium overlying aeolian or fluvial sand.

Figure 5.9: Profile exposed by erosion in field L, showing medium brown silt overlying orangey-brown sand. Image facing east away from River Trent.

Figure 5.10: View across River Trent, October 2011

Figure 5.11: Similar view as above, showing the flooded River Trent in December 2012

Figure 5.12: Profile exposed by erosion (field L) at base of a grown-out field boundary. This field boundary possible corresponded to the edges of aeolian dunes, which have since, and continue to be, eroded away by flooding of the River Trent. Image facing east away from River Trent.

Figure 5.13: Ridge and furrow in field J. Image facing west towards River Trent.

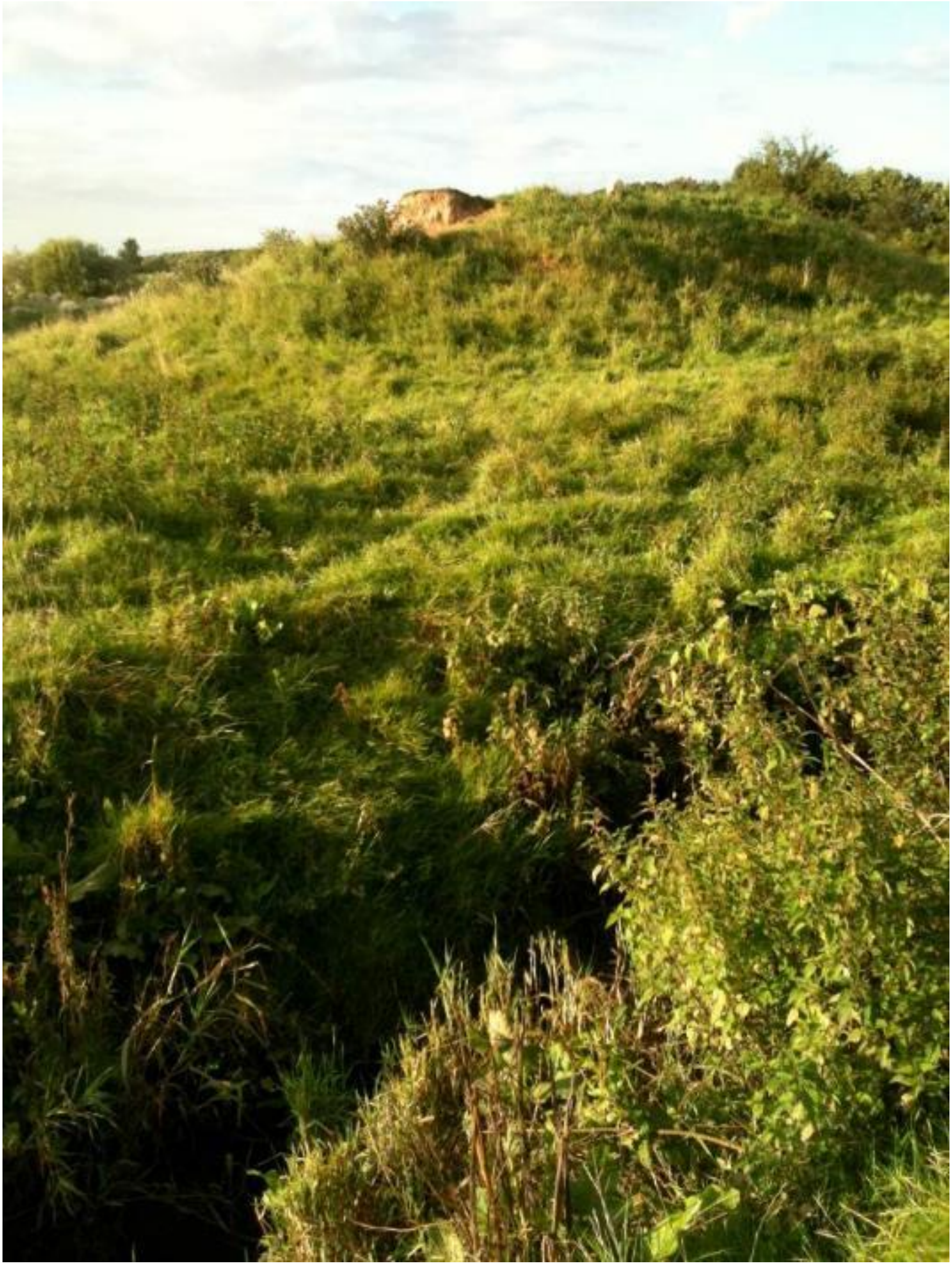


Figure 5.14: Inaccessible banks of alluvium on the Trent floodplain in Sturton-le-Steeple, directly across from Knaith. Despite standing on a bank of up to 5m of alluvium, the deposition in the background stands another 3-5 metres above the position of the camera. The bumpy appearance of the ground surface has been caused by episodes of interspersed accumulation and erosion.

2.2 Coring programme and peat sampling

The coring programme was informed by the walkover survey, with sampling undertaken at places of clear geology change, or at any other areas of interest, such as across the peat deposit. In addition to targeted coring, a north-south transect and several east-west transects were also cored. The exact methodology is explained in chapter 4.

A total of 43 cores were completed in October 2011, and these ranged to no more than 1 metre in depth due to equipment restrictions. Additional coring of 42 cores was done in 2012 providing depth data up to 5m, though the deepest superficial deposit was only 3.40m in depth. Records of these cores can be found in appendix II, cross referenced with a map of the site (figure 5.15). Detailed sediment descriptions, variations, and drawings can also be found in appendix II. Each of these sediments encountered was characterised by descriptions in the field, and laboratory characterisation, including particle size analysis, magnetic susceptibility, and organic content. Evidence acquired from cores will be referred to by the year and core number. The coring programme was most useful for highlighting the depth of the aeolian sand deposits (as opposed to the alluvium or terrace deposits), but also was useful in determining any changes or disruptions that took place within the sediment profiles. A selection of samples was also subjected to OSL dating and portable OSL dating. The geoarchaeological survey will be presented first according to the physical characterisations of each of the deposits, how each deposit type relates to the site and the other deposits, and finally, a chronological interpretation of the environmental site history and the deposition of each sediment on the site.

The dried peat that lies just east of the site was sampled and analysed for a palynological record of the immediate site of the Viking winter camp. The core and test pit were located at SK 484151 380430. The site was chosen as it was at the deepest identified deposit. A small test pit was dug through the top 45 cm of the peat sequence, and sampled using Kubiena tins. The remaining 75 cm was sampled using a Russian corer. The samples were returned to the cold store and palynology laboratory at the University of Sheffield, where the core was sampled and were processed at 4 cm intervals for pollen, which was counted to 500, as per the protocol in chapter 4 and appendix I. This test pit and core will be referred to as Tork 2011 TP1.

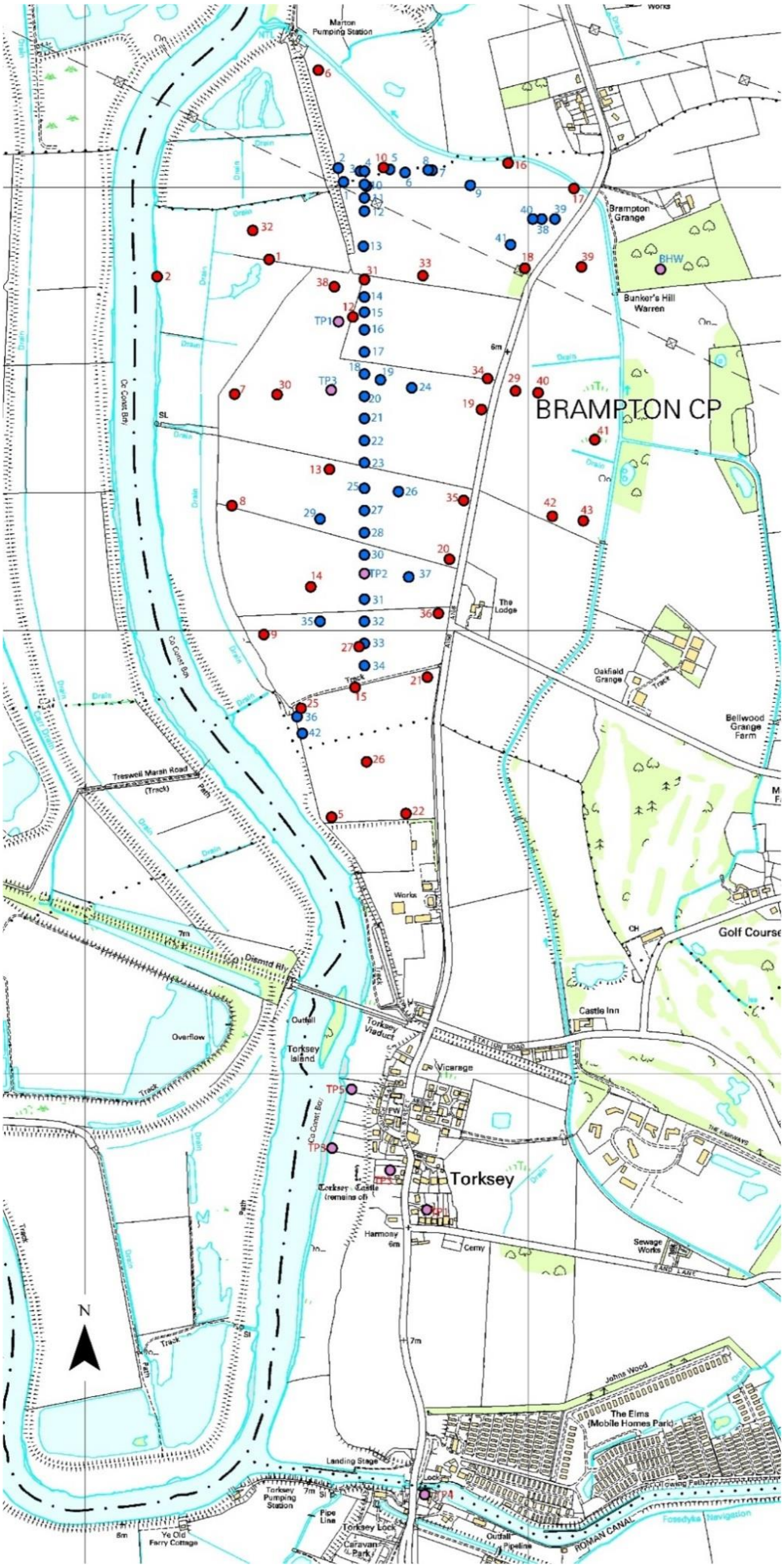


Figure 5.15: Locations of all cores and test pits; 2011 samples in red, 2012 in blue. Test pit locations are purple, with text colour representing the year it was excavated. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

2.3 Test pitting

A total of 4 test pits were excavated and recorded from July to November 2012, and the profiles were subsampled for sediments and for OSL dating. The first test pit was excavated to investigate whether there were any features present on Bunker's Hill Warren; additional coring was also completed to determine the total depth of the dune, and if there were any sedimentary changes within the dune. This test pit will be referred to as BHW TP1.

Three test pits were placed in three fields across the winter camp site west of the A156, two along the north-south axis of the 2012 coring programme, and one east of the transect. The locations of the test pits were informed by the results of the coring programme of 2011, targeting different sand dunes and stratigraphy across the site. Test pits are referred to throughout the text as Tork 2012 TP1, 2, and 3. All test pits were subsampled for sediment analysis, as well as luminescence dating. Drawings of stratigraphic relationships and a context index are in appendix III.

2.4 Fieldwork as part of the Torksey Project

In addition to the fieldwork conducted as part of this thesis, the Torksey Project also completed several phases of fieldwork that were used to inform the conclusions of this thesis, including fieldwalking, geophysics, and trenching. In 2011, a test pitting programme was conducted by the Torksey Project, with 5 test pits located in the back gardens of volunteer Torksey residents. These test pits are fully recorded in Perry, Young, and Stein 2011, and include: a plethora of Anglo-Saxon Torksey ware pottery within sand deposits on Sand Lane; Torksey ware within alluvial deposits at Castle Bank, Main Street; a post-medieval pit in sand at Torksey Lock Café; post-medieval pottery under 1.3 metres of alluvium at Verity House on Church Lane; and a post-medieval berm at Water's Edge house on Church Lane.

A magnetic gradiometer survey of the winter camp site was carried out by Hannah Brown from 2011 to 2012. The main aim of the survey was to cover a 60m wide strip through the north-south axis of the site, and after that, cover as much of the remaining fields as possible. The total area surveyed during the geophysical survey was 26.9 ha (Brown 2012, 7). The final results of the magnetometer survey can be found in appendix VII.

Fieldwalking was completed in both field C of the winter camp site study area, as well as across Castle Field, south of Torksey. The fieldwalking across field C produced a large amount of Roman pottery, with very little evidence of early medieval activity, whereas the fieldwalking south of Torksey produced a large amount of Torksey ware, the Anglo-Saxon pottery type native to Torksey. A full report of these fieldwalking programmes is forthcoming as part of the final Torksey Project publication (Hadley and Richards forthcoming).

Finally, two trenches were excavated as part of the Torksey Project. In December 2012, a trench measuring 5 by 3 metres was excavated in field D; this trench will be referred to as Tork 12 TR 1. This trench did not reach depths below 50cm before bedrock was encountered, so there was very little space for sampling. In July 2013 a 10 by 5 metre trench (Tork 13 TR 1) was excavated in field G. The trench was excavated up to a 1 metre depth, and coring confirmed that the superficial deposits extended up to 2 metres in depth. The excavation was placed on drift geology, recorded as sand and gravel but appeared as two separate depositions of sand. These deposits were sampled for sediment characterisation, as well as for OSL dating.

3 Sediments and sediment characterisations

A number of different superficial sediments were encountered across the site, including: clay sediments derived from the underlying geology; sand and gravel terrace deposits; fluvial sand; peat and organic silt; aeolian sand; and silt alluvium. Many cores across the higher ground of the site followed a similar stratigraphic pattern, with aeolian sand, terrace sand and gravel, or both, overlying mudstone. On the floodplain, dense alluvium prevented deep coring, but where it was possible, coring showed basic alfisol formation over mudstone. On the north end of the site, coring produced very dense organic-rich clay, possibly a lacustrine clay, overlying aeolian sand. Along the east end of the site lies a blanket of peat, all underlain by bright white medium to coarse sand.

One ‘sediment’ that was encountered during the coring survey that will not be discussed is the abattoir waste. This material appeared in fields D, E, F, and G, and is injected on an annual or bi-annual rotation. The layer appears as a black material, or, when fresh, a tan and pink paste-like clay, composed of chemically sterilised animal and butchery waste; is injected below the level of ploughing (approximately 50-60cm depth), in an effort to provide nutrients to the sandy soil. Abattoir waste was located in many of the cores from the aforementioned fields, and though it is above sub-soil layers, it does often obscure the boundary between the top and sub soils, and presents an unpleasant working environment. Understanding the process of abattoir waste injection became important for the interpretation of later trenches (esp. Tork 2013 Tr 1), and test pits (Tork 2012 TP13, see below).

3.1 Solid geology

The Mercia Mudstone (described in chapter 3) spans much of the midlands and south of England, however the bedrock does take on several forms and appearances that change locally (Howard *et al.* 2008, 3). Within the Torksey study area, the Mudstone takes on two different appearances, which correspond to the top two formations of the Mercia Mudstone: Branscombe Formation and Blue Anchor Formation. Both bedrock formations, although they are considered solid geology, are degraded for the first few centimetres, and form the parent material for topsoil where there is no superficial geology.

3.1.1 Branscombe Formation

The Branscombe Mudstone Formation is a reddish-brown sandy silt bedrock. Although it is part of a solid bedrock formation, it is easily degraded, and appears as a loose sediment in many areas across the site. It is exposed only at the crest of the outcrop, which is demonstrated on the BGS map. At the locations where it is exposed, sloping topography and constant ploughing has led to the erosion of the mudstone, and the formation of shallow clay topsoils. The degraded sediment form of the Mercia Mudstone also appeared at the bottom of many cores, though only the top few millimetres of degraded sediment were able to be cored through with the available equipment.

Unit	Year taken	Core number	Depth of deposit	$CaCO_3$ (%)	Organics (%)	Mag Sus (X_{LF})
Mercia Mudstone: Branscombe	2011	7	80-95	0	0.99	5.79
	2011	8	27-41	-	1.13	7.8
	2011	9	40-52	-	1.16	8.39
	2011	15	35-40	0.21	1.49	10.02
	2011	15	80-90	0	2.35	7.94
	2011	18	81-100	-	1.09	2.06
	2011	22	40-65	0.23	1.37	6.61
	2011	32	37-89	-	1.66	5.5
Redeposited Mudstone	2012	TP 3	120-122	-	1.68	6.74

Table 5.1: Sediment analysis of Mercia Mudstone Branscombe Formation

Unit	Year taken/ core	Mean (phi)	Median	Sorting (σ1)	Skewness	Kurtosis	Coarse sand (%)	Medium sand	Fine sand	Silt	Clay
Mercia Mudstone: Brans.	2011 Core 22	3.23	2.24	-2.38	-0.53	0.74	14.6	29.9	24.9	28.4	2.3

Table 5.2: Particle size analysis of Mercia Mudstone Branscombe Formation

Sediment analysis of the degraded bedrock indicates bedrock in the area has negligible $CaCO_3$, low organics, and low magnetic susceptibility. Particle size analysis shows that the 'mudstone' is actually a mixture of fine sand and silt sized particles. Due to the availability of sampling locations, the medium and coarse sand may be contamination from soil formation over the mudstone, and mixing between the mudstone and nearby outcrops of sand and terrace gravels. The Branscombe Formation of the Mercia Mudstone is only exposed with no overlying superficial deposits along the western ridge of the site, and coring and ground truthing confirmed the areas of exposure (as confirmed in the walkover survey). At this location, the highest elevation on the site, the mudstone is actively eroding due to fluvial activity and gravity, and this active erosion would have quickly removed any overlying superficial sediments on the ridge, and is now eroding into and smoothing out the crest of the bedrock.

3.1.2 Blue Anchor Formation

Though still a part of the Mercia 'Mudstone' Formation, the Blue Anchor has a much different composition than the underlying sandy silt; it is a dense clayey-silt that appears as a mottled green-grey and blue with occasional red bands. Unlike the Branscombe Formation that is easily weathered due to the very poor sorting of the smaller particles, the clay of this formation forms a hard surface when dry, and remains intact when wet. It is possible that this formation is part of a thick facies deposit within the Branscombe formation, however the thickness, as well as the major differences between the two types of deposits indicates that it is likely part of a later geological formation.

Unit	Year taken	Core number	Depth of deposit	$CaCO_3$ (%)	Organics (%)	Mag Sus (X_{LF})
Mercia Mudstone: Blue Anchor	2011	10	40-50	0	2.43	5.4
	2011	34	35-51	0	3.09	14.73
	2011	37	45-60	0	2	9.1

Table 5.3: Sediment analysis of Mercia Mudstone Blue Anchor Formation

Unit	Year taken/ core	Mean (phi)	Median	Sorting (σ1)	Skew ness	Kurto sis	Coarse sand (%)	Medium sand	Fine sand	Silt	Clay
Mercia Mudstone: BA	2011 Core 34	7.23	6.69	-2.48	-0.27	1.94	0	2.4	5.4	69.4	22.8

Table 5.4: Particle size analysis of Mercia Mudstone Blue Anchor Formation

Readings of organics and magnetic susceptibility of the Blue Anchor clay are similar to the Branscombe Formation, despite the obvious difference in appearance and particle size. Slightly higher organics may be an indication different conditions during formation. A lack of $CaCO_3$ on this lightly coloured formation suggests that there were no carbonates present during formation.

The Blue Anchor Formation does not form the same deep bedrock formation as the Branscombe Formation (up to 53m) across the site; instead, in many places it forms a thin layer of only a few centimetres overlying the red mudstone, while in others it appears to be a much thicker deposit. The formation is so thin in places that it is possible that it can be considered as facies within the Branscombe formation. The Tork 12 TR 1 excavation revealed a substantial outcrop of the formation. It also appeared across the middle of the site, and appeared in cores in fields C, F, and G.

3.1.3 Solid geology conclusions

Both formations of mudstone have also been redeposited in several instances across the site, as well as in the larger Trent Valley. The excavation of Tork 12 TP3 uncovered a deposit of unmistakable Branscombe and Blue Anchor Formation mudstone overlying Devensian terrace deposits (section 3.2.1). Sediment analysis of the sediments produced by the Mercia Mudstone has determined that it has the same organic content and magnetic susceptibility as the *in situ* samples; however occasional rounded pebble inclusions within the sediment, as well as the stratigraphic relationship of the Jurassic deposit above the Pleistocene deposits, indicates that it must have been redeposited. A similar situation was uncovered on the gravel island at Church Laneham, where Mercia Mudstone was found to be overlying a layer of terrace deposits (Budge 2010).

Although the solid geology was encountered in most cores, and it is underlying the entire site, no additional samples were taken or analysed, and only these baseline measurements were made. It was deemed that more samples would not provide any additional information about the Holocene environment, and these data are only background information that was necessary in order to understand the chronology and interaction of overlying deposits.

3.2 Superficial geology

A total of five types of superficial geology were detected during this survey: terrace sands and gravels, fluvial sand, peat and organic silt, aeolian sand, and alluvium. Each of these deposits represent a change in environmental conditions throughout the Pleistocene and Holocene. Sediment description, analysis, and mapping has illuminated the events that led to the multiple environmental shifts caused by climate change, human movements and change, and time.

3.2.1 Terrace sands and gravels

It was difficult to access the sand and gravel in cores (part of the HPSG member), as large pebble and cobble particles prevented the narrow corer from going into the sediment. There were no also no opportunities to expose a section of the HPSG; where terrace deposits were exposed (in Tork 2012 TP3), they were heavily mixed with locally redeposited mudstone, and later aeolian derivations and soils formations composed of the sand and gravel.

The appearance changed across the site, but the deposit was overall a very poorly sorted fine pale brown sand, with large rounded pebbles and cobbles; this sediment matches the description of the terrace deposits encountered across the valley at Cottam (Wessex Archaeology 1997), as well as the deposits recorded at Holme Pierrepont (Notts.) (Howard *et al*. 2011, 421). Although a clear section could not be exposed at Torksey, the sediment has similar characteristics as at Holme Pierrepont, which is composed of massive or bedded clast-supported coarse to fine sandy gravel, of quartzite sand with chert and flint inclusions; the deposit at Torksey also includes rounded cobbles and pebbles of granite and other igneous inclusions.

Unit	Year taken	Core number	Depth of deposit	$CaCO_3$ (%)	Organics (%)	Mag Sus (X_{LF})
HPSG	2011	30	57-65	0	0.2	1.14
	2012	TP3	115-120	0	0.60	10.24
	2012	TP3	130-135	0	0.65	7.48

Table 5.5: Sediment analysis of HPSG

Unit	Year taken/core	Mean (phi)	Median	Sorting (σ1)	Skewness	Kurtosis	Coarse sand (%)	Medium sand	Fine sand	Silt	Clay
HPSG	2011, core 30	2.17	2.18	-0.81	-0.02	1.06	7.0	34.1	55.6	3.2	0
	2012 TP3 130-135cm	2.16	2.10	-0.88	-0.22	1.33	5.12	39.13	50.11	5.51	0.12

Table 5.6: Particle size analysis of HPSG

Although the sediment is mainly composed of sand and is white, brownish-white, or reddish-white depending on whether the deposit has mixed with other locally derived sediments. The fine fraction is mainly composed of fine sand with some medium sand; a representative sample of both fine and coarse fractions in particle size analysis would demonstrate even poorer sorting with the pebble and cobble sized particles (although this was not possible in this study due to the unavailability of a representative outcrop). Low but noticeable variation in magnetic susceptibility is a result of the mixture of different materials included in this glacial deposit.

Tork 12 TP3 provided the clearest exposure of the sediment and sediment features that characterise the HPSG. In this profile (figure 5.16), redeposited mudstone overlies and sits adjacent to a poorly sorted sand, which includes several bands of mudstone that are identifiable as red Branscombe mudstone. Within the sand of the HPSG, glacial deformation is visible in the sediment in the form of a possible ice wedge or other glacial deformation structure in the sediment (figure 5.17). Ice wedges are expected to be within the HPSG, and have been found at Holme Pierrepont (Howard *et al.* 2011, 421). This feature first appeared to be a root cast, however the formation continued for 10 cm within the section, and continued beyond that, indicating that it was likely a glacial sediment structure. The phase of glacial features and bedrock redeposition are truncated and covered by a sand sediment that is overlain by a bed of very rounded pebbles and cobbles. Initially interpreted as an archaeological surface, their relationship to the underlying terrace deposits and their characterisation as a clast-supported sediment confirms that the terrace deposits are underlying the later sediments in TP3.

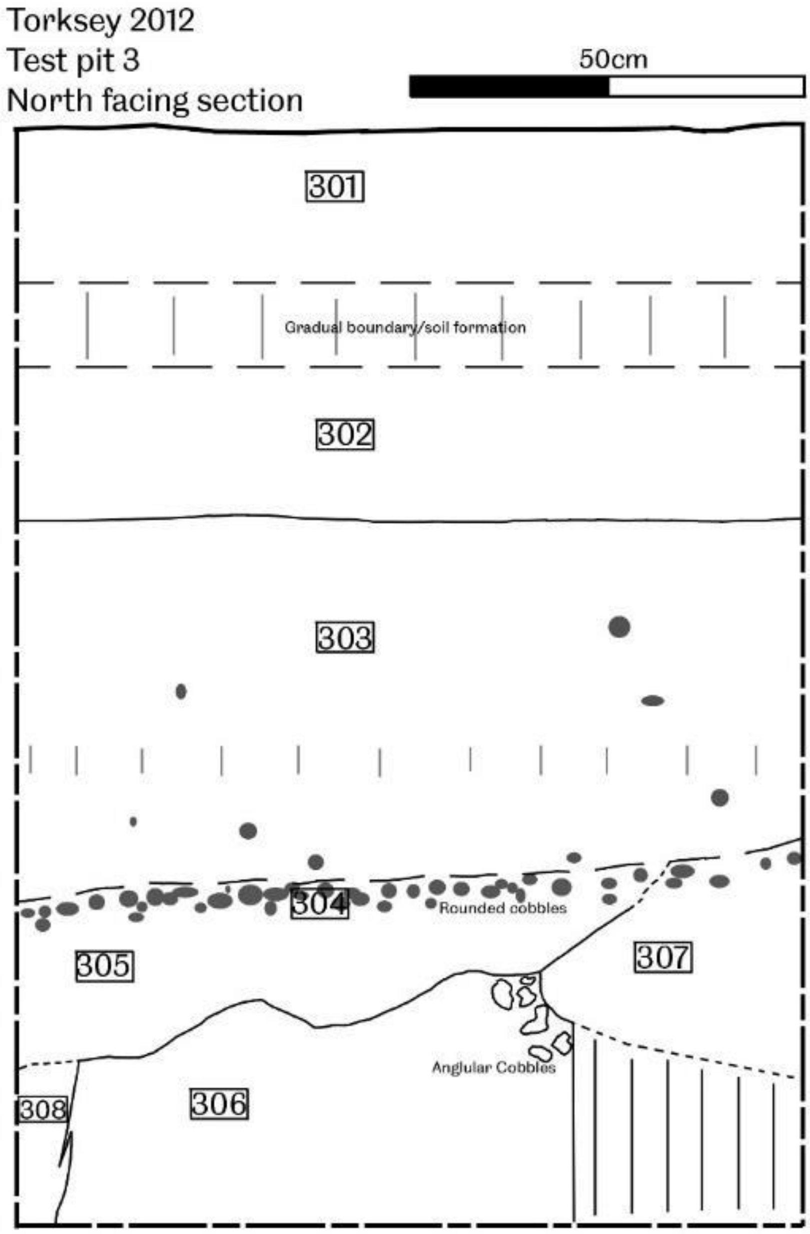


Figure 5.16: Section of Tork 12 TP3. The sand in this test pit had a very different texture and colour than the previous three test pits. All sediments below 304 are part of the HPSG and MM redeposition. Context index can be found in Appendix III

Figure 5.17: Possible ice wedge or other glacial deformation feature within the sand of the HPSG in Tork 13 TP 3. On the right of the photo is redeposited Blue Anchor Formation Mercia Mudstone. [scale: photo is approx. 30cm across]

The sand and gravel was encountered mainly in field C, spanning from the east to the west side of the field. In this field there is no overlying aeolian sand deposits. This is evidenced clearly by the excellent results of the geophysical survey in field C that do not occur in any other field with overlying sand deposits (appendix VII). Although the HPSG can be dated to the early-late Devensian (Howard *et al.* 2011, 429), a thorough understanding of these deposits was necessary in order to address fully the aeolian and fluvial sediments that characterise the site at Torksey.

3.2.2 Fluvial sands and peat deposits

The fluvial sand and peat units will both be discussed in this section, as this sand deposit underlies the peat in every location, and is directly related to the deposition of the peat. Although low wetlands surround the site on all sides, the peat sampled and described in this section is the peat from the eastern part of the site. The organic-rich sediment to the north of the site was separated from the peat to the east by an undated sand boundary, meaning that these two organic-rich deposits, although mere metres from each other, developed in very different conditions. The organic silt on the north side of the site, and the separation boundary, will be described in the alluvium section 3.2.4.

The basal sand deposit is a bright white gleyed coarse sand with clay matrix. There are no cobble-sized inclusions, though overall particle size differs from the aeolian or terrace deposits, marking it out as a different unit.

Unit	Year taken	Core number	Depth of deposit	$CaCO_3$ (%)	Organics (%)	Mag Sus (X_{LF})
Fluvial sand	2011	39	55-70	-	1.04	0.27
	2011	39	70-85	-	0.77	0.68
	2011	40	80-100	0	0.70	0.65
	2011	43	36-62	-	1.28	2.44

Table 5.7: Sediment analysis of basal sand beneath peat deposit

Unit	Year taken/core	Mean (phi)	Median	Sorting (σ1)	Skewness	Kurtosis	Coarse sand (%)	Medium sand	Fine sand	Silt	Clay
Fluvial Sand	2011, Core 39	1.83	1.7	-1.17	-0.45	2.35	10.7	55.6	25.2	8.1	0.3
	2011, Core 40	3.14	2.1	-2.18	-0.63	0.88	8.1	38.8	24.8	26.5	1.8
	2011, Core 43	2.20	1.92	-1.42	-0.49	1.79	8.8	44.5	34.3	12.1	0.3

Table 5.8: Particle size analysis of basal sand

Overlying the sand is a very-humified black peat and organic silt deposit. The boundary between the sand and peat is gradual, with the bottom 10-20cm of peat having a mixture of sand and peat, gradually with less sand higher in the profile. The peat ranges up to 1.25 metres in depth, with decreasing humification higher in the profile. Approximately 50 cm into the peat deposit, the sediment has completely dried out; however, humification indicates that the profile was once all waterlogged, and only recent drainage events and ploughing are responsible for the change in the state of the current sediment.

Unit	Year taken	Core number	Depth of deposit	$CaCO_3$ (%)	Organics (%)	Mag Sus (X_{LF})
Peat	2011	39	50-55	0	28.15	3.59
	2011	40	0-80	-	-	-
	2011	41	110-112	-	-	-
	2011	43	0-36	-	-	-

Table 5.9: Particle size analysis of peat

The peat and sand deposits roughly mirror the sequence uncovered on the Torksey Golf Course excavation, interpreted as a fluvial episode followed by wetland development (Johnson and Palmer-Brown 1997). The detailed evaluation here confirms that this area to the east was a fluvial channel, flowing from the south side of the site and around the east side of the present settlement of Torksey. In a multi-channel environment of the Trent, and this channel created an island site that is now the winter camp. During the Late Bronze Age, the channels were cut off; it remains unclear why the flowing water no longer reached these channels. The abandonment of the palaeochannel east of the winter camp site in the Late Bronze Age led to the formation of a wetland east of the site. Occasional moving water would have gone through the area immediately after the channel abandonment, leading to the gradual boundary between the fluvial sand and accumulation of peat; however standing water and peat accumulation would have continued to define the area. Drainage would not occur naturally, as the land was at or below the level of the adjacent Trent Valley, at 0-2m AOD. Without systematic drainage, and prior to the accumulation of over a metre of peat, this low land would have been constantly inundated with water, rendering it uninhabitable until the medieval and post-medieval periods.

Radiocarbon dating was executed on the profile in preparation for the palynological study (see section 3.2.3). The sampling depths were chosen based on changes in lithology, as well as preliminary pollen counts. The dates determined that the peat was deposited between the late Bronze Age (3316±39 cal BP) and the post-Roman period (1746±46 cal BP) (figure 5.18). Although the stratigraphy was disturbed in the top 40cm due to post-medieval ploughing, the peat would have continued developing well into the early medieval and medieval periods. Additional radiocarbon dates within the middle of the sequence dated the peat deposit accumulation to 2915±42 and 2413±55 BP.

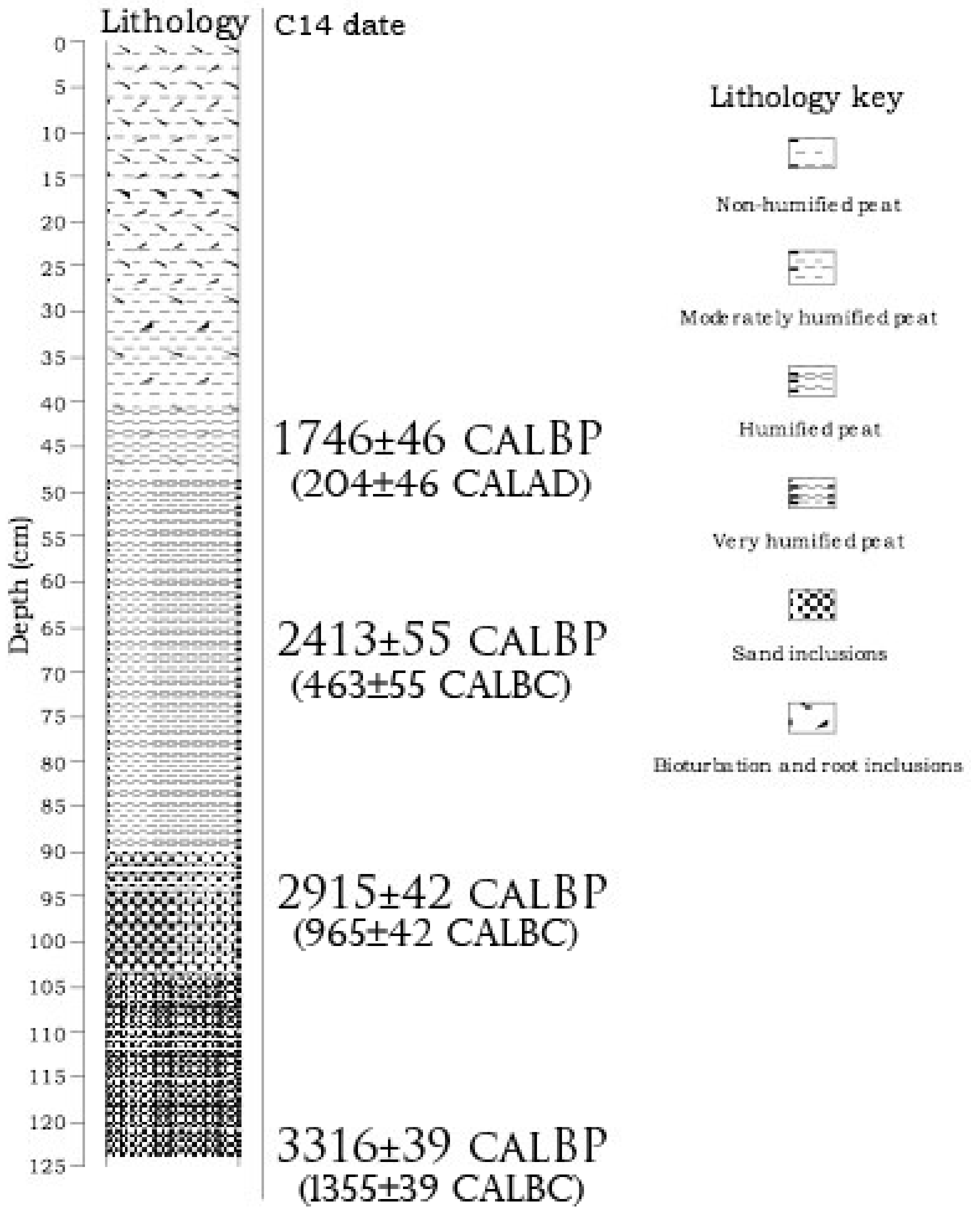


Figure 5.18: Lithology of the peat core, with associated radiocarbon dates

3.2.3 Results of palynological assessment

Varying depth of the peat on the eastern part of the site was identified during coring, and the location of peat core extraction was chosen in November 2011 as it was located on the deepest identified deposit. The sampled peat is part of a rheotrophic mire ecosystem, where much of the pollen within the sequence is deposited from the local vegetation, which provided a locally representative sample. The sequence at Torksey represents the environment of both the local area and the immediate region, much like the peat sequence at Bole Ings (Brayshay and Dinnin 1999).

Preservation

Preservation of grains improved with increasing depth, and corresponding increasing moisture. The top 20 cm (20-40cm) of the profile had very poor pollen preservation. From 20-40 cm, the sediment had clearly been disturbed in recent years, but three samples were counted from this sample, in order to get an estimation of the most recently deposited pollen; the top two samples were only counted to 200 grains. Preservation improved with increasing depth. Drier and less humified peat sediments occurred from 20-48cm, though pollen was well preserved by 48 cm. Sediment was wet and moderately humified from 48-90 cm, and pollen preservation was very good. From 90-125cm, the peat was very humified and waterlogged, with very good pollen preservation. From 110-125cm, the peat was mixed with medium-coarse grey gleyed sand, with 10-15% clay, and had very good pollen preservation.

Figures 5.19-5.21 are final pollen diagrams, showing the raw counts of each species and type, key and rare species, percentages of each key and rare species and type, and percentages of each species and type with smoothed data (smoothed with Tilia data smoothing feature, Grimm 1993). This peat core shows three separate Local Pollen Assemblage Zones (LPAZ), LPAZ Ia, LPAZ Ib, and LPAZ II. These zones were defined by a change in percentage of pollen types counted in each sample. The entire core represents over 3000 years of accumulation, and the pollen counted represents 2000 years of an undisturbed pollen sequence.

LPAZ IA

LPAZ IA (125-88cm depth) is representative of the initial phases of peat accumulation. Overlying the medium-coarse sand deposit that was part of a fluvial channel prior to 3316±39 cal BP, this assemblage zone demonstrates the local environment at the time of that channel abandonment in the Late Bronze Age, and subsequent transformation into a waterlogged marshy environment at the beginning of the Iron Age.

In this largely waterlogged environment conducive to peat development, the surrounding local area was dominated by trees and shrubs. Overall, the most common species in this area of the Trent Valley were *Alnus*, *Quercus* and *Tilia* tree species, and *Corylus* shrub types. There are also traces of *Betula, Fraxinus*, *Salix*, *Ulmus*, and *Calluna*. Poaceae, *Plantago lanceolata, Rumex,* and *Urtica diotica* were also present in small amounts. Nearly 50% of the total land pollen is composed of tree species, and 75% of the total is composed of both tree and shrub species, leaving 25% for heaths and herbs.

There are trace amounts of *Pinus* species throughout the profile. A similar amount of pine grains appeared in the sequence from Bole Ings during this time period. This small pine presence is interpreted by Brayshay and Dinnin (1999) as indicative of a concentrated pine forest within a few tens of miles away from the site, rather than the presence of a few pine trees in the immediate vicinity, and the sequence at Torksey may be picking up the same pine tree concentration as was detected in the pollen sequence at Bole Ings.

The woodland-dominated landscape was present throughout the late Bronze Age, from the time that this peat began accumulation, and probably prior to the start of this peat sequence. The second date within LPAZ Ia, 2915±42 cal BP (965±42 BC), is also late Bronze Age, around this time that the start of woodland decline in the area is visible (LPAZ Ib). Though more drastic vegetation changes occur 10cm above this date, it is in 965±42 BC that the first hint of widespread clearance is visible in the sequence. The woodland decline officially occurs 10cm above the level at which this date was taken, coinciding with the emerging field systems and enclosures of the LBA/early Iron Age.

<u>LPAZ Ib</u>

LPAZ Ib (88-58cm depth) is representative of the start of major woodland decline in the local area and wider Trent Valley. Though the woodland species such as *Alnus* and *Quercus* still dominate the pollen assemblage, these species are slowly declining through this period. There is also no more *Pinus*, potentially due to the dying out or clearance of the original source, as well as a rise in *Fagus* and *Ulmus*, which indicates a change of woodland type, possibly a result of slightly drier local conditions. Throughout this period, there is also a rise in herb species, especially Poaceae, *Rumex*, and *Urtica*.

A date of 2413± 55 cal BP (463±55 BC) from the middle of this transition suggests that the end of the Bronze Age and the Iron Age brought about a slow change from woodland to an open grassy landscape. This corresponds to the Iron Age/Romano-British enclosures recorded in the local area, especially on the Nottinghamshire side of the Trent (see chapter 6). The clearance slowly crept across the region; this process sped up in the Roman period, with more occupants in the area, as is demonstrated in LPAZ II.

LPAZ II

The most notable attribute of LPAZ II (20-58cm) is the high herb count, dominated by Poaceae and Graminae, and including species such as *Rumex*, and *Urtica Diotica*. Other rare species in LPAZ II are *Valeriana*, and *Ranunculus*. There is also a slight spike in *Calluna* grains in the top two samples, however this could be a by-product of poor grain preservation, better preservation of *Calluna* grains, and lower pollen counts.

There are still some tree species present in LPAZ II, accounting for just over 20% of the total land pollen. *Alnus* is the most commonly occurring species present in zone II, but it declined from LPAZ Ib to II. Some tree species made a comeback with the general local clearance phase; *Taxus*, a species that was rarely present in LPAZ I, became a large portion of the tree population. *Pinus*, although only present in trace amounts in both zones Ia and II, again has a rare presence throughout LPAZ II. LPAZ II is dated at 48cm (within 20-58cm) to 1749±46 cal BP, or 201±46 AD, or the Romano-British period. At the end of LPAZ Ib, clearance was swift, directly corresponding to the increased population and changes in land management that came in the Roman period, leading to the cleared landscape of LPAZ II.

The widespread clearance is likely a product of Roman occupation and use of land for farming and other agricultural properties. There is a large proportion of domesticated grains in zone II, enough to determine that the local area did have agriculture throughout the Roman period, and into the medieval period. The presence of nettle, dock, and other low-lying herbs, might indicate that the land was also used for pasture. The resurgence of *Pinus* in trace quantities may imply the reinstating of pine woodland further afield, as in LPAZ Ia, or was possibly due to the presence of a few local trees.

Post-Roman period

The pollen sequence at 45cm is indirectly dated to the 1-2nd century AD. Although an accurate pollen record and datable sediment is not present, does not mean that the peat stopped formation at the end of the Roman period. The top soils at this location are composed of dry peat (hence why the land was under plough for only a century), indicating that peat would have continued to form well into the early medieval, medieval, and even post-medieval period, and would not have been dry enough to plough until drainage was installed and pumped from Marton pump house in the 19th century. This dry peat represents the accumulation in the post-Roman period.

A precise dating record that was available in LPAZs I and II is not available for the period between the 1-2nd centuries and the present day, however some information may be extrapolated and built upon other environmental data. At the end of the Roman period, widespread clearance had created a landscape of mainly herbs and grasses, with shrubs, likely in the immediate vicinity of the River Trent and around the peat wetland. The wetland continued into the early medieval period, and probably remained as a shrub-lined bog until drainage was installed. Outside of the wet and low lying areas a mixture of cleared lands and forests dotted the landscape. The medieval deer park at Stow on the site of an earlier Romano-British farmstead may give some indication of the regeneration of woodland in place of Roman cleared land. Alternatively, some land would have remained clear for agricultural practices. Changing land management practices since the Roman period from a landscape perspective will be further discussed in Chapter 6.

Review and comparison

A clear pollen sequence from the Late Bronze Age through the end of the Roman period has demonstrated that the site was once dominated by a woodland environment, followed by several periods of local and widespread clearance. This peat deposit did not present a clear palynological sequence through the early medieval period, however it did provide an idea of the chronology of the formation of the open landscape that exists today.

During, and shortly after the abandonment of the fluvial channel on the east side of the winter camp site, the local area was dominated by woodland, including Alder and Oak trees. There was also a large shrub presence, especially of Hazel, which was probably in the immediate vicinity of the wetland, where trees could not properly adapt. The increasingly agricultural landscape of the late Bronze Age and early Iron Age led to a slow deforestation across the region. Alder and Oak were slowly replaced by Beech and Elm, and Hazel by grasses and nettles. The species present at Torksey during this period indicates that the immediate area was still not heavily farmed, and may not have been intensively occupied throughout the Iron Age; the pollen sequence may be a result of changes on a more regional scale. During the Roman period, however, the clearance was accelerated. Much of the local woodland was quickly cleared and replaced by grains in agricultural contexts and grasses. Shrubs and other herbs remained around the wetland. While several centuries of vegetation record are missing from this log, there is no evidence that woodland ever dominated the area again after the Bronze Age, and much of the landscape remained clear, with occasional woodland encouraged to grow, possibly in some of the local deer parks and royal estates. The area is now dominated by agricultural crop, managed beech woodland, and grassland.

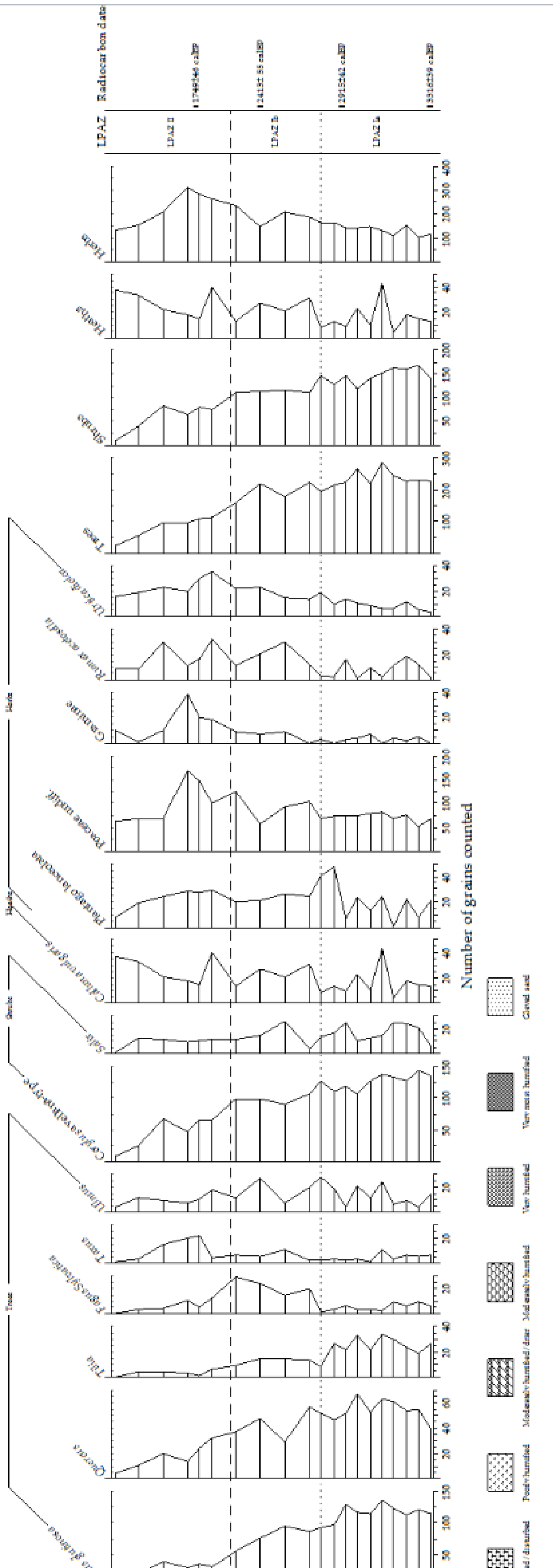
This pollen sequence overlaps with one other dated palynological sequence in the area. The study completed at Bole Ings (Notts.) (Brayshay and Dinnin 1999) displays a remarkable similarity in overall contemporary trends (see figure 5.22). The sequence at Torksey has provided a more detailed record of the low resolution sequence at the end of the Bole Ings pollen sequence, and provides additional data about the vegetation after Bole Ings peat stopped developing. The parts of the sequences that do overlap, match with great precision. Radiocarbon dating of Zone BI/2D at Bole Ings corresponds with Torksey LPAZ Ia. Zone BI/3 at Bole Ings only just overlaps with the Torksey sequence, and is cut off abruptly by a change in sedimentation, but the overall pattern demonstrates that it can be correlated with Torksey LPAZ Ib and II.

The sequence, and LPAZ Ia at Torksey begins only 200 years after the start of Bole Ings zone BI/2d, but displays very similar vegetation, with many tree and shrub species, especially alder and hazel. There is also a large presence of oak in both sequences, with elm and birch trees present throughout the period. The dominance of alder is the most notable correlation, along with the presence of all the same rarer species. There is a slightly larger pine presence at Bole Ings than at Torksey, which may signify that a pine forest is closer to the Nottinghamshire site, and that the sequence at Torksey is picking up a reduced signal further away from the pine source; pine does have the capability of travelling for hundreds of kilometres, so this is not necessarily the case.

At Bole Ings, the clearance of tree species that occurs during Torksey LPAZ Ib is greatly compacted and truncated by a slowing and eventual halt in sedimentation, however in the small space that covers Bole Ings Zone BI/3 is an accurate summary of the changes that occur throughout Torksey LPAZ Ib and II. A slight spike at the end of Bole Ings Zone BI/3 may be all that exists of Torksey LPAZ II. This zone is characterised by the drastic decline in woodland species, likely due to a late prehistoric and Roman influence, as evidenced by the sharp rise in charcoal species at Bole Ings. In this zone, general grasses rise sharply, and the presence of cereal type grass is noted. There is also a slight rise in nettle, dock, and ribwort. Hazel continues into this zone, but at a greatly reduced rate. Oak is reduced greatly in both sequences. There is a small spike in lime at the boundary between zones BI/2d and BI/3 at Bole Ings, which is missing at Torksey.

The pollen sequence at Torksey greatly augments the information that was already available at Bole Ings, with enough overlapping between sequences to show the comparable results during the 2nd millennium BC. Torksey also presents a much more detailed and extended sequence for the truncated latest zone at Bole Ings, extending the available palaeoenvironmental data almost another 1000 years.

Counts of each pollen type- key species



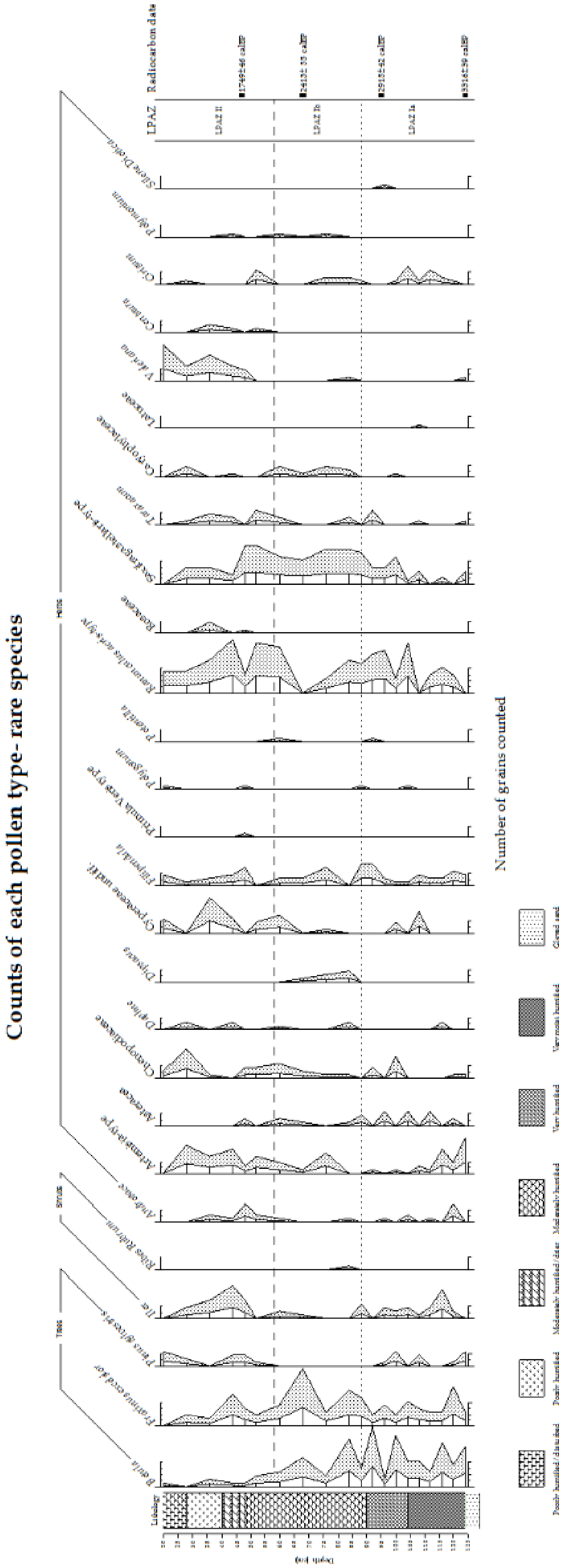
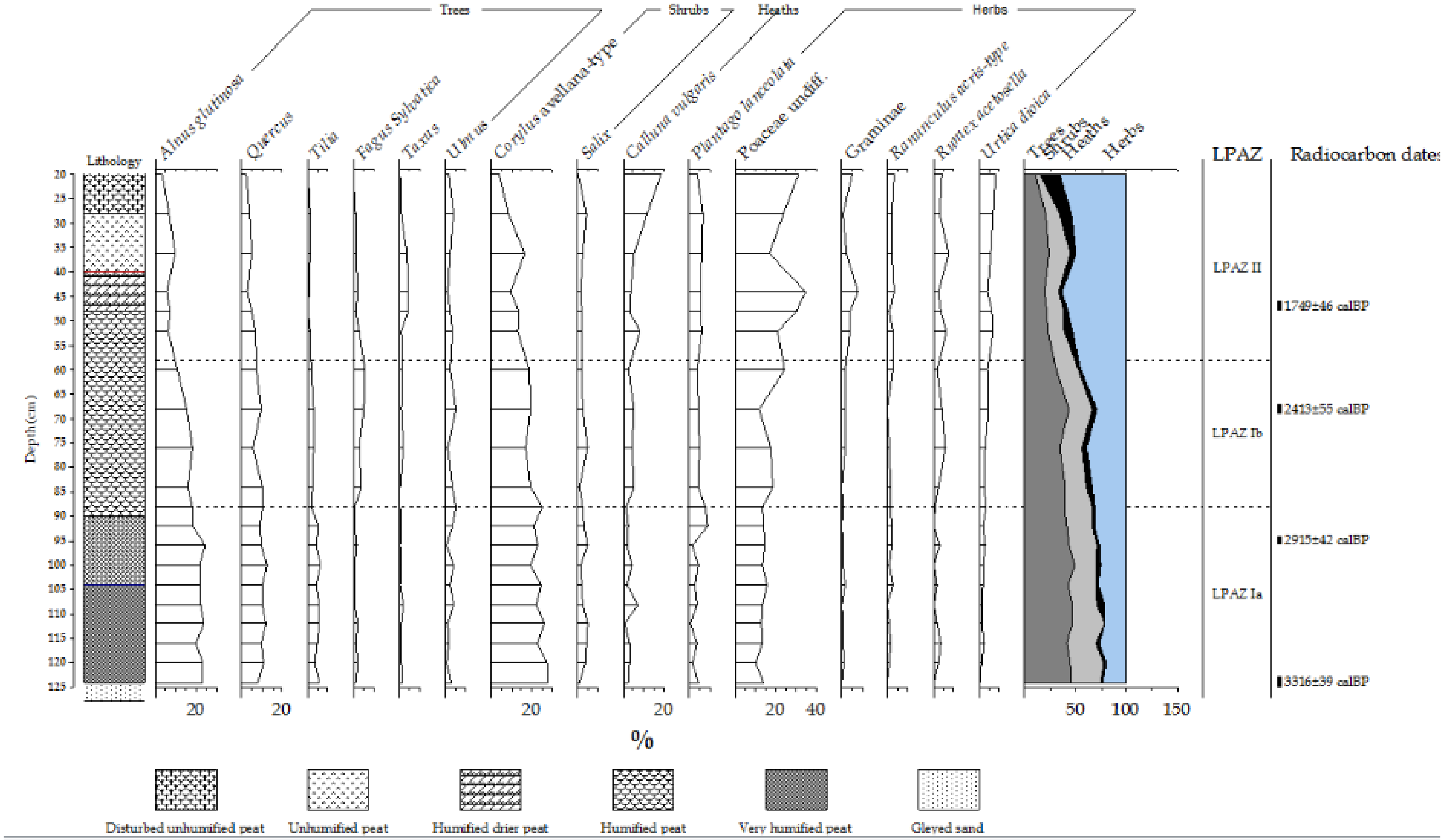


Figure 5.19: Raw counts of key and rare species type. Rare species are exaggerated x 5.

Percentage of key species and species types



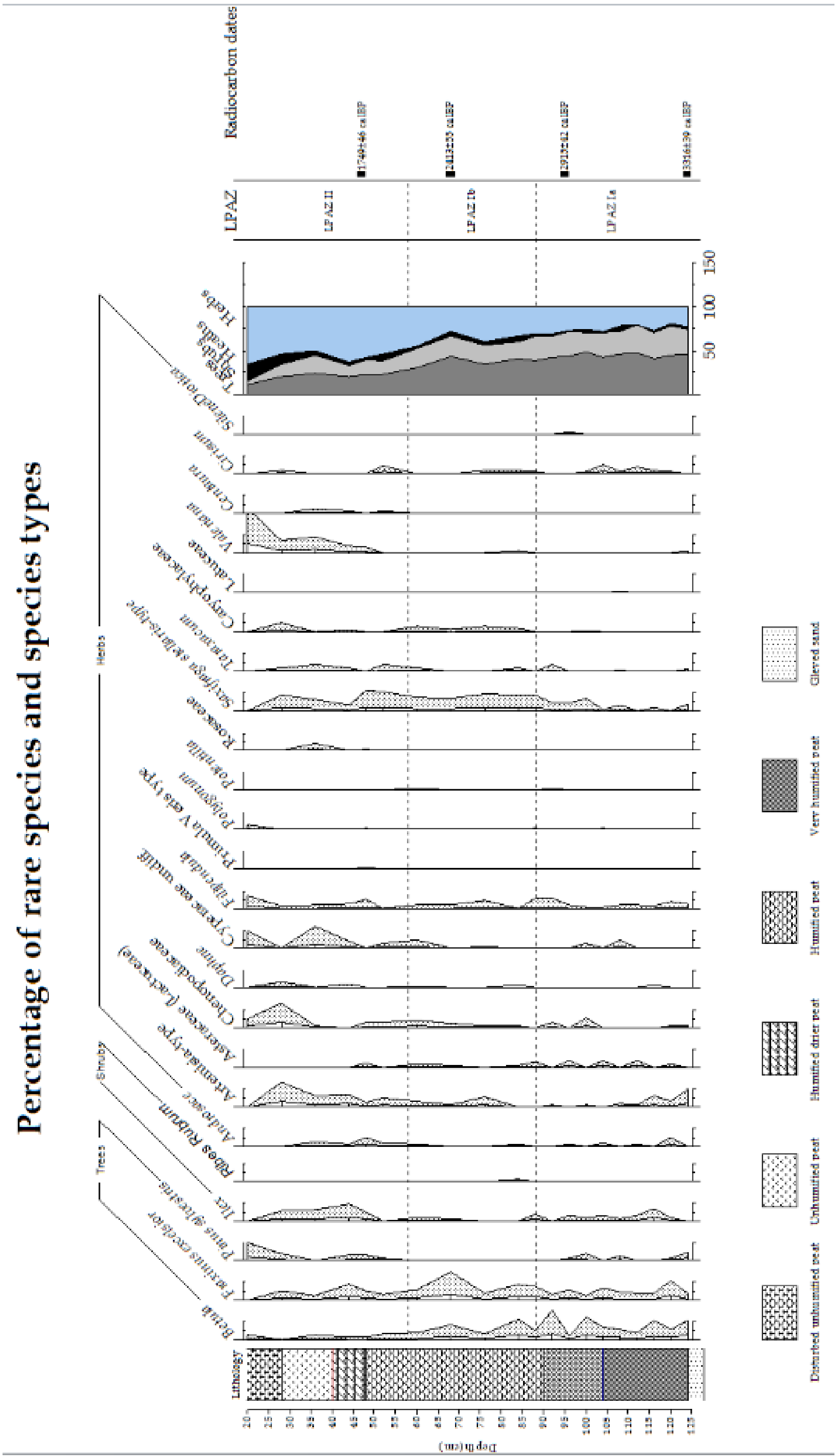
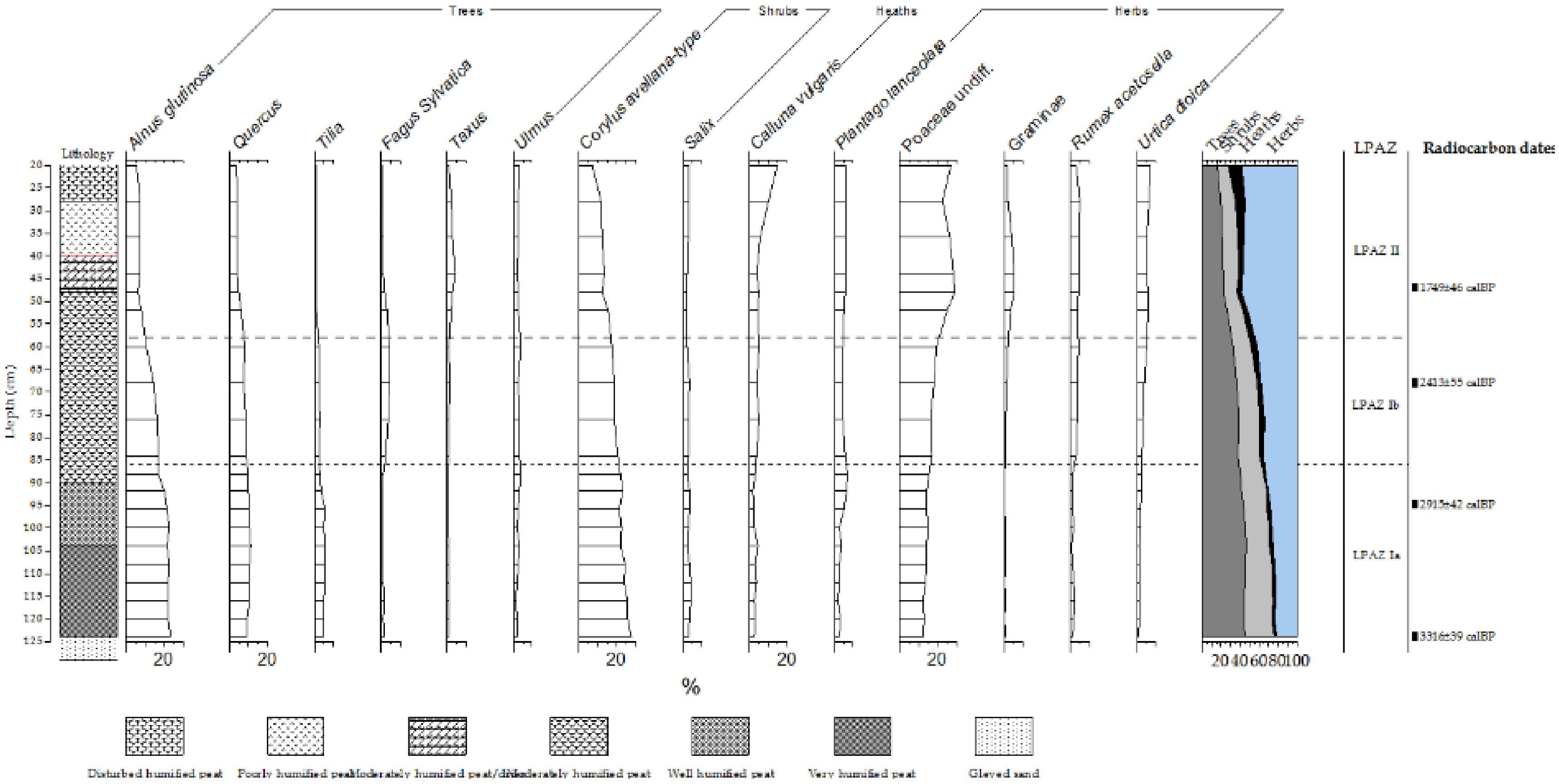


Figure 5.20: Percentages of each key and rare species. Rare species are exaggerated x 3.

Percentage of key species and types; smoothed data



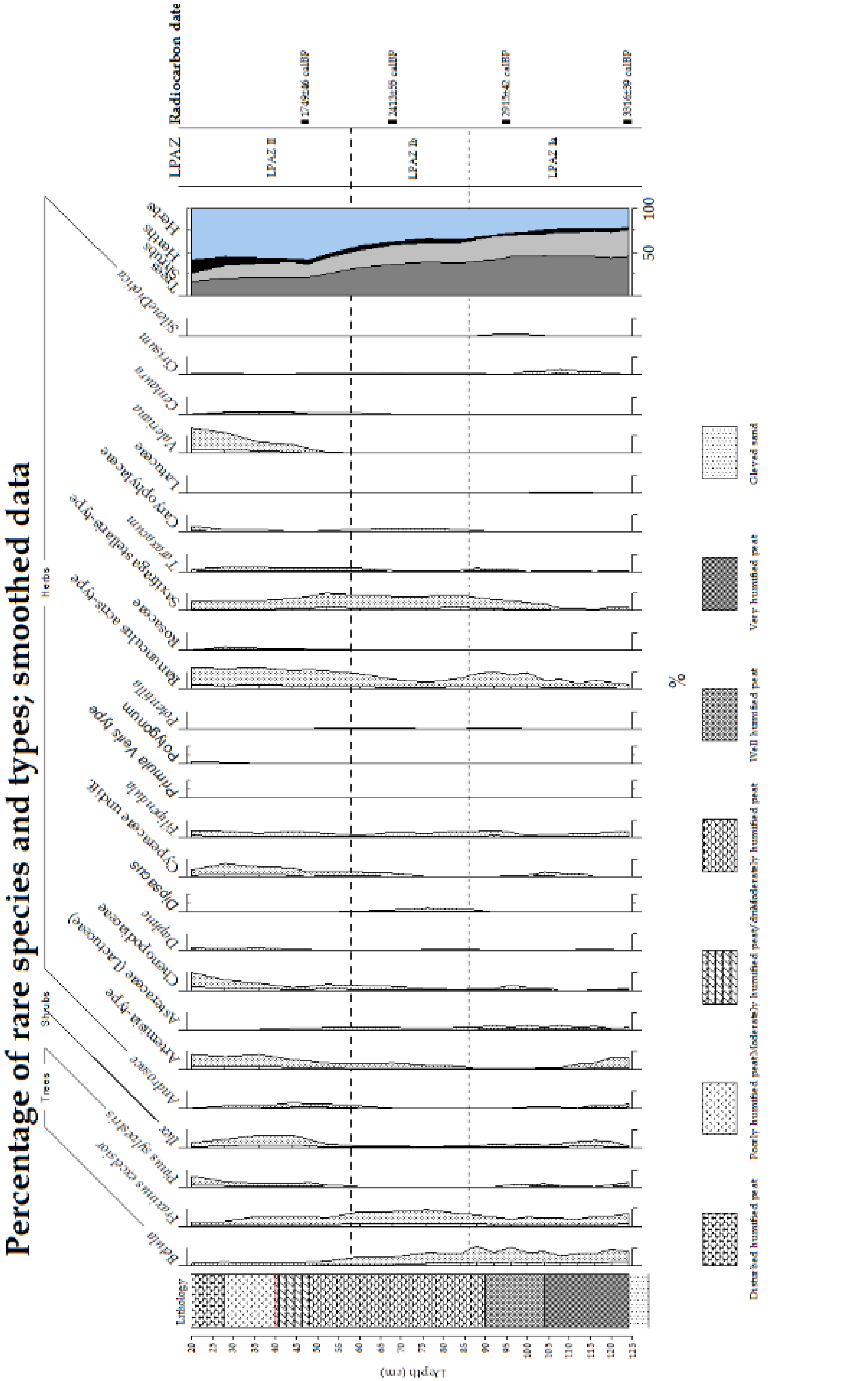


Figure 5.21: Percentage of key and rare species with smoothed data to emphasize trends. Rare speices are exaggerated x 3.

Figure 5.22: Pollen diagrams (of selected species) from two different cores at Bole Ings, Nottinghamshire (Brayshay and Dinnin 1999, 26).

3.2.4 Aeolian deposits

Sand covers a very large area of the site. Though it is classified as part of the HPSG on the BGS survey, the sand across the site closely matches descriptions of Lincolnshire Coversands (Bateman 1995), and this sediment analysis has determined that the sand on recorded aeolian deposits at BHW matches the characteristics of the sand across the site. Windblown sand deposits are notoriously unstable, and are known to shift quickly with wind, clearance, or both. The sand winnowed out from the HPSG deposit by steady wind (Bateman 1995; see chapter 3) forms the sorted deposit that appears on the site today.

The presence of early medieval, late medieval, and post-medieval archaeology within and below aeolian deposits at Torksey has indicated that the movement of aeolian deposits in the post-Roman period played a substantial role in the formation of the environment in the last two millennia. At Castle Farm, aeolian sand seals a layer of Anglo-Saxon pottery, and is cut by 16^{th} to 17^{th} century post-holes (Palmer-Brown and Allen 2001). At the Main Street New Medical Centre, medieval features dating from the 10^{th} through 13^{th} centuries cut into the sand (Williams and Field 2002). At Verity House on Church Lane, several medieval features, including a road with cart ruts and several rubbish pits, all dating from the 12^{th} to 14^{th} century, are located below an aeolian deposit, with 15^{th} to 16^{th} century pottery within the sand unit (Pre-Construct Archaeology 1996). On the land north of the railway, 9^{th} to 11^{th} century post holes, shallow ditches, and a fence line lie below an aeolian deposit, with 13^{th} century graves cut into the sand, indicating a 12^{th} to 13^{th} century accumulation (Rowe 2008). On Sand Lane, Anglo-Saxon pottery was found dispersed throughout an aeolian deposit for the top 100cm, with clean sand below that level (Perry *et al.* 2011). Nearby, at Torksey Lock, a 16^{th} century pit was found dug into the sand, which later filled in with sand that was slightly altered from the original deposition (Perry *et al*. 2011). All of this evidence provides clear evidence that Torksey was not only affected by the shifting Trent Valley landscape, but it was also greatly affected by the reactivation of wind-blown sand in the area.

This element of changing environment during the early medieval period led to the aeolian deposits becoming the main foci of this part of this geoarchaeological analysis. Therefore, the sand was mapped and analysed in more detail than the other deposits, in order to gain a more detailed picture of the post-Roman environment. OSL and portable OSL dating was also applied to date the deposits and the potential impact of the environment and/or human activity on the physical landscape of the site.

When *in situ*, the aeolian sand has a distinctive appearance, with an orangey-brown colour. The sediment is a well-sorted medium sand, with a generally massive structure. There is no evidence of cross bedding or any other structures. Although systematic thin section analysis was not completed, thin sections of the deposit were created as part of the pottery analyses, determining that 95% of the deposit is quartzite sand, with <1% heavy minerals, igneous rock, and calcareous sediment, all of which is rounded to sub-rounded fine to medium sand. All particles are coated in red clay, probably the local Mercia Mudsone. Sand deposits usually shared a gradual boundary with the overlying topsoil, and acted as a parent material for the ploughed sediment above. The sand, with very few nutrients, acts as a parent material, with abattoir waste and ploughing of grasses that grow naturally creating the soil horizon. Even with the help of farmers using abattoir waste and manuring, the soil on the sand deposits is extremely thin, ranging from 20-40 cm in depth.

The orangey-brown sand stands out against other sediments, allowing any changes to be clearly visible in excavation, as has been noted in previous excavations in Torksey, especially in the excavations north of the railway line (Rowe 2008), and at Sand Lane and Torksey Lock (Perry *et al.* 2011). Unfortunately, no archaeological remains have been clearly detected in the sand on the winter camp site during this survey.

The quartz sand is very sterile, with little to no $CaCO_3$. Carbonate particles in the sand have appeared in sediment thin sections (G. Perry *pers. comm.*); these particles are rounded and coated in red clay, much like the quartz particles, indicating that any limestone particles were part of the original aeolian deposition, have been through saltation on the site, and were possibly picked up during glaciation and deposited with the HPSG. The low but present organic composition are visible in the sand as macro particles of displaced roots from bioturbation. Though it is low, magnetic susceptibility is also variable, and may be due to change in glacial erratics, the accumulation of iron and other heavy mineral particle accumulation on the crest and/or within ripples of an earlier dune formation, or due to post-depositional illuviation. Further work on the chemical components of the sediment were deemed unnecessary, as this would only determine the origins of the sand of the Devensian HPSG deposit, and not add to the reconstruction of the Holocene environment.

Unit	Year taken	Core number	Depth of deposit	$CaCO_3$ (%)	Organics (%)	Mag Sus (X_{LF})
Aeolian sand	2011	Core 5	40-100	-	0.45	4.7
	2011	Core 7	37-80	-	0.3	2.3
	2011	Core 9	52-64	-	0.74	4.7
	2011	Core 12	30-50	0	0.42	2.34
	2011	Core 12	58-62	0	0.44	1.43
	2011	Core 12	86-100	0.11	0.33	1.84
	2011	Core 13	32-100	-	0.61	12.31
	2011	Core 15	40-80	-	0.58	9.86
	2011	Core 16	25-43	-	0.66	4.93
	2011	Core 17	40-68	-	0.52	3.79
	2011	Core 17	72-80	-	2.84	3.27
	2011	Core 18	47-81	-	0.99	2.21
	2011	Core 20	80-100	-	0.8	2.41
	2011	Core 21	30-90	0.23	0.48	8.83
	2011	Core 21	90-100	-	0.96	7.22
	2011	Core 25	45-100	-	0.47	1.4
	2011	Core 30	40-57	0	0.92	9.06
	2011	Core 33	70-100	-	0.11	1.66
	2011	Core 38	45-49	-	0.48	6.55
	2011	Core 39	55-70	-	1.04	0.27
	2011	Core 39	70-85	-	0.77	0.68
	2011	Core 40	80-100	0	0.7	0.65
	2011	Core 43	36-62	-	1.28	2.44
	2011	Bunker's Hill Warren	25	-	0.92	2.63
	2012	TP1	50.00	-	0.60	2.41
	2012	TP1	100.00	-	0.40	1.49
	2012	TP1	125.00	-	0.40	1.65
	2012	TP2	50.00	-	1.57	18.63

Table 5.10: Sediment analysis of aeolian sand deposits

A post-depositional feature that appears in many of the *in situ* sand deposits is lamellae, which are thin bands of clay within the sand, formed by the illuviation of clay particles by water over time (Frederick *et al.* 2002). This feature is common in sand deposits, where mineral illuviation does not form typical soil horizons, but rather creates bands of clay lower in the profile (figure 5.23). The present lamellae may represent the coatings on sand grains that accumulated during initial aeolian deposition that has since washed down in the profile through illuviation, to create clay bands of Mercia Mudstone within Holocene aeolian deposits.

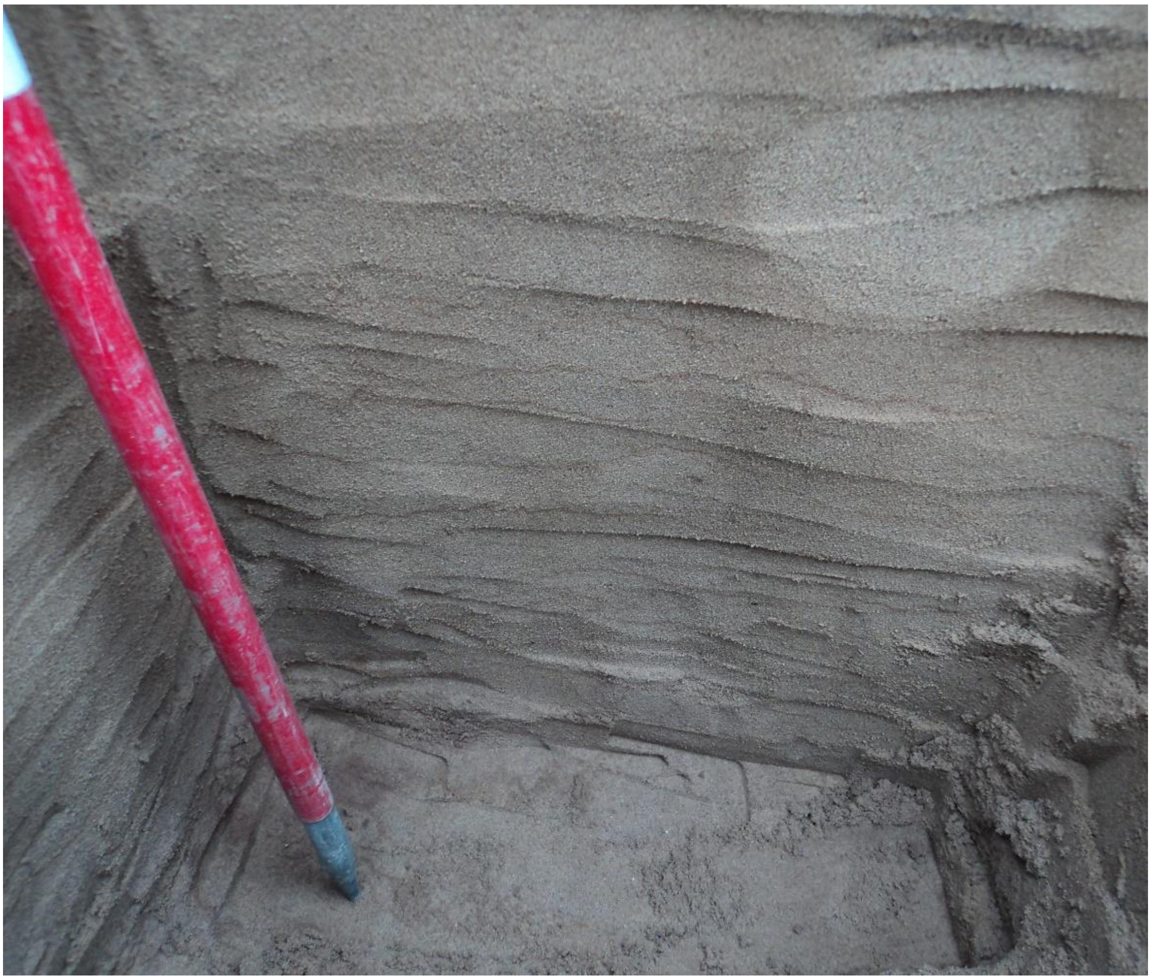


Figure 5.23: Details of Tork 12 TP1, showing horizontal lamellae lines caused by illuviation of clay from the topsoils and between sand particles across the deposit.

In addition to lamellae, a profile in TP 2, in field E, shows some evidence of temporary surfaces within the sand. These may be short lived surfaces; there is no evidence of ploughing, and the sediment is a thick, dark brown/black organic sediment. There are lamellae interspersed between these thicker layers possible surfaces. The thick organic sediment of the layers between sand may indicate that these fields spent some time as part of the peat bog to the east, allowing some organic sediment to build up during flooding and before the peat receded to the east.

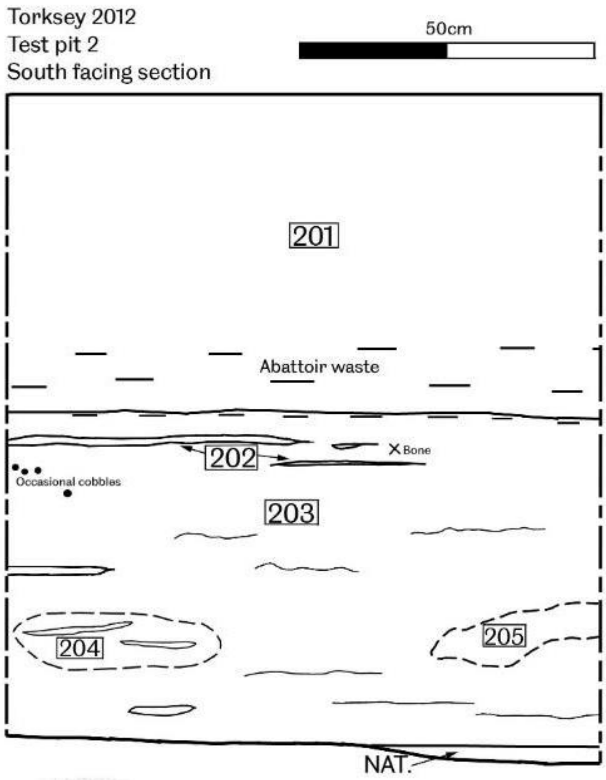


Figure 5.24: Tork 12 TP2. There is a clear boundary between modern topsoil, which is bounded by abattoir waste. The thin lines are lamellae, while thicker lines represent possible temporary surfaces within the sand, on which organic silt accumulated. The sand does show some indication of poorly formed surface layers throughout, as well as lamellae, as in TP1.

At present, the deepest aeolian deposit on the winter camp site is 3 metres deep in field B; other aeolian deposits are currently between 1-2 metres in depth. The sand formations no longer resemble typical dunes; ploughing has significantly altered the form of the aeolian deposits. Some of the aeolian deposits may have once stood taller, resembling typical sand dunes across the site, such as the dune at Bunker's Hill Warren. At Bunker's Hill Warren, ranging up to 4.5 metres in depth, neither the sand nor the surrounding peat provides fertile agricultural soil, and the dune was perhaps better used as a rabbit warren, which allowed for the preservation of the feature. The dry sand, surrounded by wetland would have provided an ideal environment for rabbit farming, with plenty of opportunities for rabbit burrows, and the rabbits' natural avoidance of water, keeping them in the warren (Williamson 2006; 2007a). Aeolian movement across the rest of the site may have also formed low dunes across the site with shorter and slower wind storms. A total of 8 individual sand dunes cover the site, and each was detected by coring through, and mapping, the deposit. Figure 5.25 shows the location of cores, with darker colour corresponding to deeper aeolian deposits. Figure 5.26 illustrates the locations of each of the dunes across the site, demonstrating how extensively the sand deposits are covering the site.

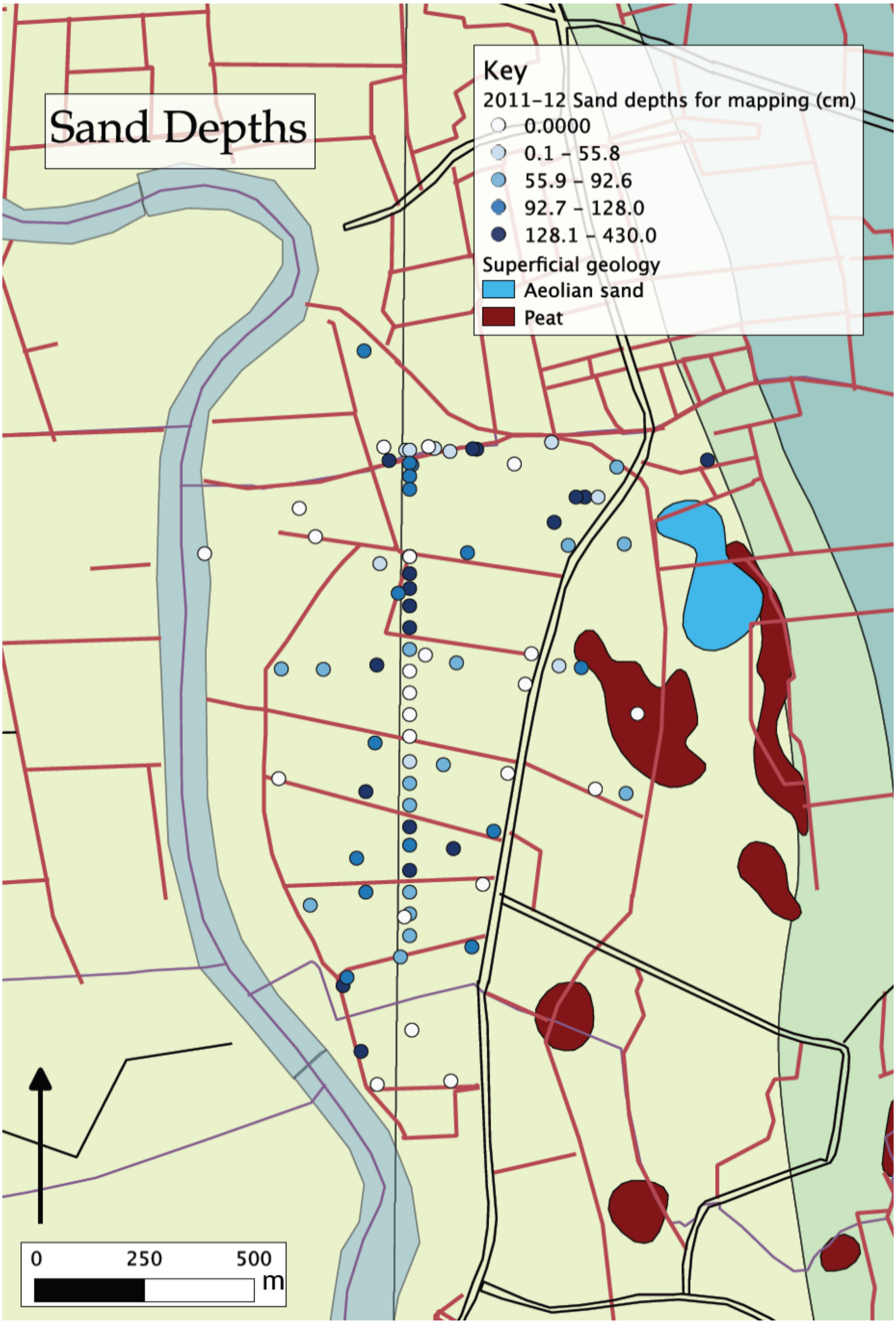


Figure 5.25: Sand depths as recorded during coring. This map, in conjunction with the PSA, aided in identifying the dunes across the site.

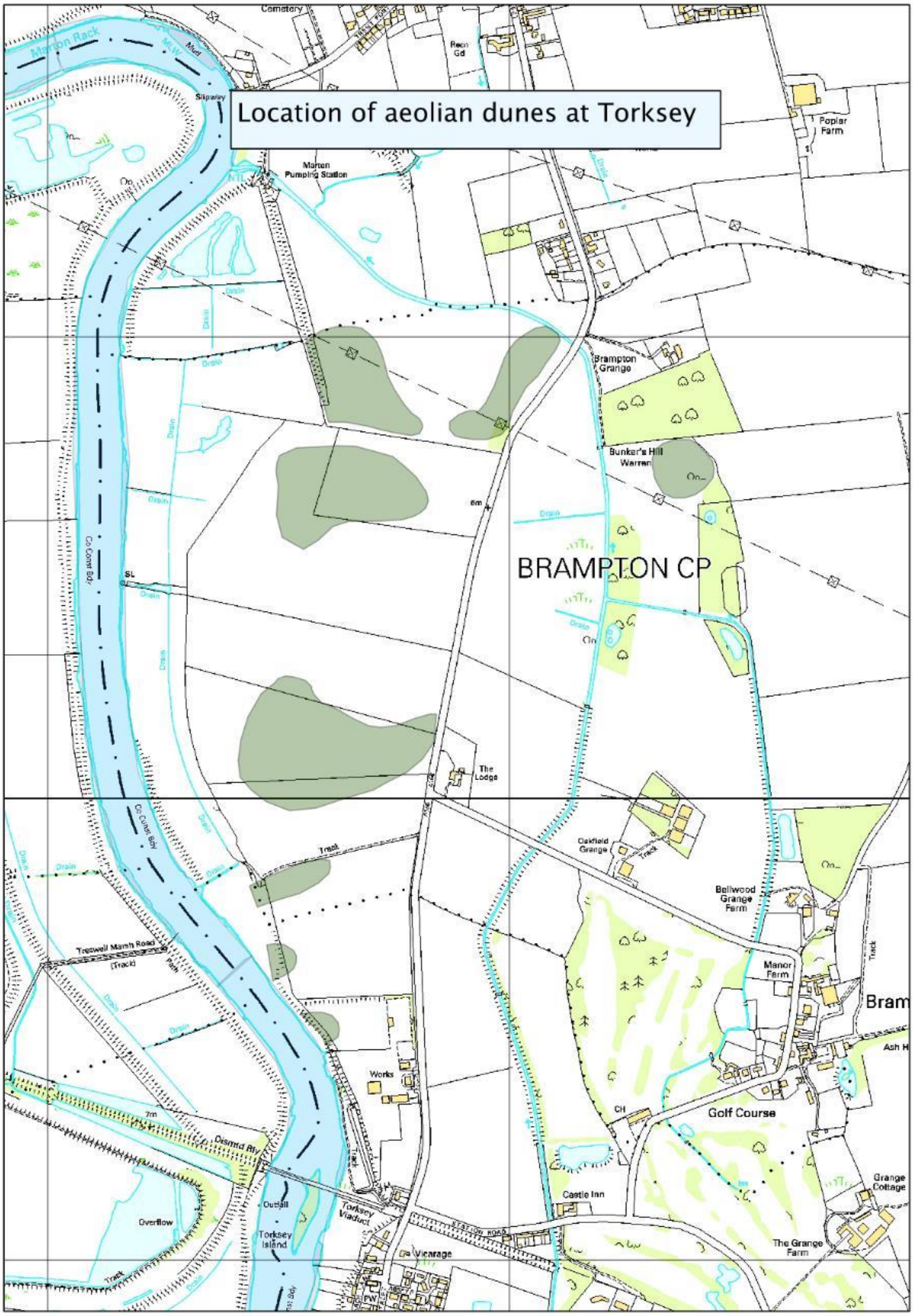


Figure 5.26: Map of locations of aeolian deposits based on coring programmes of 2011-2012. The aeolian deposits are shown in shaded green. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

3.2.4.1 Particle size analysis on aeolian sediments

A detailed particle size analysis was completed in an attempt to map any subtle particle size changes and discern any patterns across the site. The analysis showed that the dune at Bunker's Hill Warren and the dunes on the site were composed of sand with nearly identical particle size, demonstrating a similar mode of deposition. The analysis was also compared with particle size analysis undertaken on sand from a test pit on Sand Lane, south of the present village of Torksey (Perry *et al*. 2011), again confirming a similar particle size and thus mode of deposition.

Though subtle, a slightly lower particle size on the south and south-western side of the dune formations may indicate a regular north-easterly wind direction during the initial deposition of the dunes, at 10,000-8,000 BP, however, more detailed sampling and 3D analysis is required to further test this hypothesis. In figure 5.27, particle size is mapped by mean phi size, with large particles shown in a darker colour. Figure 5.28 shows sediments mapped by sorting, showing poorer sorting of non-aeolian sediments. These figures only show the particle size of samples taken at a depth of 1 metre.

Unit	Year taken/core	Mean (phi)	Median	Sorting (σ1)	Skewness	Kurtosis	Coarse sand (%)	Medium sand	Fine sand	Silt	Clay
Aeolian sand	2011/5	1.89	1.84	-0.82	-0.26	1.54	7.4	52.6	34.8	5.0	0.1
	2011/7	1.51	1.42	-1.25	-0.46	3.27	20.3	59.6	11.4	8.1	0.6
	2011/9	1.93	1.79	-1.16	-0.44	2.16	8.8	53	29.5	8.6	0.1
	2011/12 30-50cm	1.50	1.43	-1.24	-0.44	3.19	20.4	59.5	12.1	7.5	0.5
	2011/12 58-62 cm	1.48	1.40	-0.88	-0.36	1.95	21.9	58.6	14.0	5.6	0
	2011/12 86-100 cm	1.45	1.41	-0.84	-0.32	1.99	21.4	60.9	12.5	5.0	0.1
	2011/13	1.70	1.63	-0.95	-0.34	1.96	13.2	57.5	23.4	5.6	0.3
	2011/15	1.73	1.69	-0.70	-0.21	1.41	10.3	59.6	26.0	3.7	0.4
	2011/17 40-68 cm	1.58	1.56	-0.58	-0.12	1.27	13.1	66.4	18.2	2.6	0
	2011/17 72-80 cm	1.52	1.45	-0.80	-0.33	1.82	18.3	34.9	15.1	4.8	0
	2011/18	1.69	1.61	-0.86	-0.33	1.77	12.9	59.6	21.9	5.5	0.1
	2011/20	1.82	1.73	-0.89	-0.33	1.66	10.0	55.5	28.7	5.6	0.2
	2011/21	1.92	1.81	-0.98	-0.38	1.76	5.8	56.8	30.7	6.6	0.1
	2011/25	1.76	1.70	-0.80	-0.27	1.61	10.4	57.8	26.8	4.5	0.5
	2011/30	2.22	2.00	-1.42	-0.43	1.73	9.9	40.3	37.7	11.7	0.4
	2011/33	1.83	1.77	-1.00	-0.38	2.39	7.4	57.9	28.2	6.3	0.1
	2011/39	1.83	1.70	-1.17	-0.45	2.35	10.7	55.6	25.2	8.1	0.3
	2011/40	3.14	2.10	-2.18	-0.63	0.88	8.1	38.8	24.8	26.5	1.8
	2011/43	2.20	1.92	-1.42	-0.43	1.79	8.8	44.5	34.3	12.1	0.3
	BHW	1.51	1.48	-0.58	-0.12	1.18	17.0	64.5	16.4	2.0	0.1
	2011 TP1 90cm	2.84	1.91	-2.02	-0.63	1.12	11.26	41.81	24.35	22.07	0.51
	2012/16 100 cm	1.46	1.43	-0.57	-0.15	1.28	15.42	70.72	10.04	3.82	0
	2012/16 300 cm	1.63	1.61	-0.55	-0.09	1.15	8.04	71.04	18.56	2.25	0.11
	2012/17	2.24	1.66	-1.70	-0.63	1.92	14.5	49.62	19.77	15.55	0.57
	2012/28	2.94	1.97	-2.05	-0.65	1.34	8.74	42.43	27.6	20.32	0.91
	2012/32	2.31	2.07	-1.43	-0.48	1.97	6.24	40.41	40.43	11.99	0.93
	2012/37	1.89	1.77	-1.26	-0.46	2.66	8.8	54.74	27.02	8.47	0.97
	2012/38	2.13	1.69	-1.52	-0.59	2.21	12.73	52.34	20.42	14.35	0.15
	2012/40	1.86	1.73	-1.11	-0.42	2.09	10.72	53.86	27.89	7.1	0.43
	2012/41	2.27	1.95	-1.48	-0.55	2.17	6.13	46.23	33.28	13.53	0.83
	2012 TP1 50cm	1.54	1.49	-1.16	-0.42	3.33	15.84	64.15	13.04	6.66	0.3
	2012 TP1 100cm	1.54	1.50	-0.68	-0.21	1.46	16.58	62.90	16.41	3.83	0.28
	2012 TP1 125cm	1.58	1.51	-1.20	-0.42	2.91	17.68	58.76	16.51	6.53	0.51
	2012 TP2 50cm	1.61	1.56	-0.92	-0.35	2.3	13.75	63.07	17.33	5.58	0
Average		1.88	1.69	-1.12	-0.39	1.93	12.43	55.67	23.07	8.46	0.37

Table 5.11: Particle size analysis of aeolian deposits

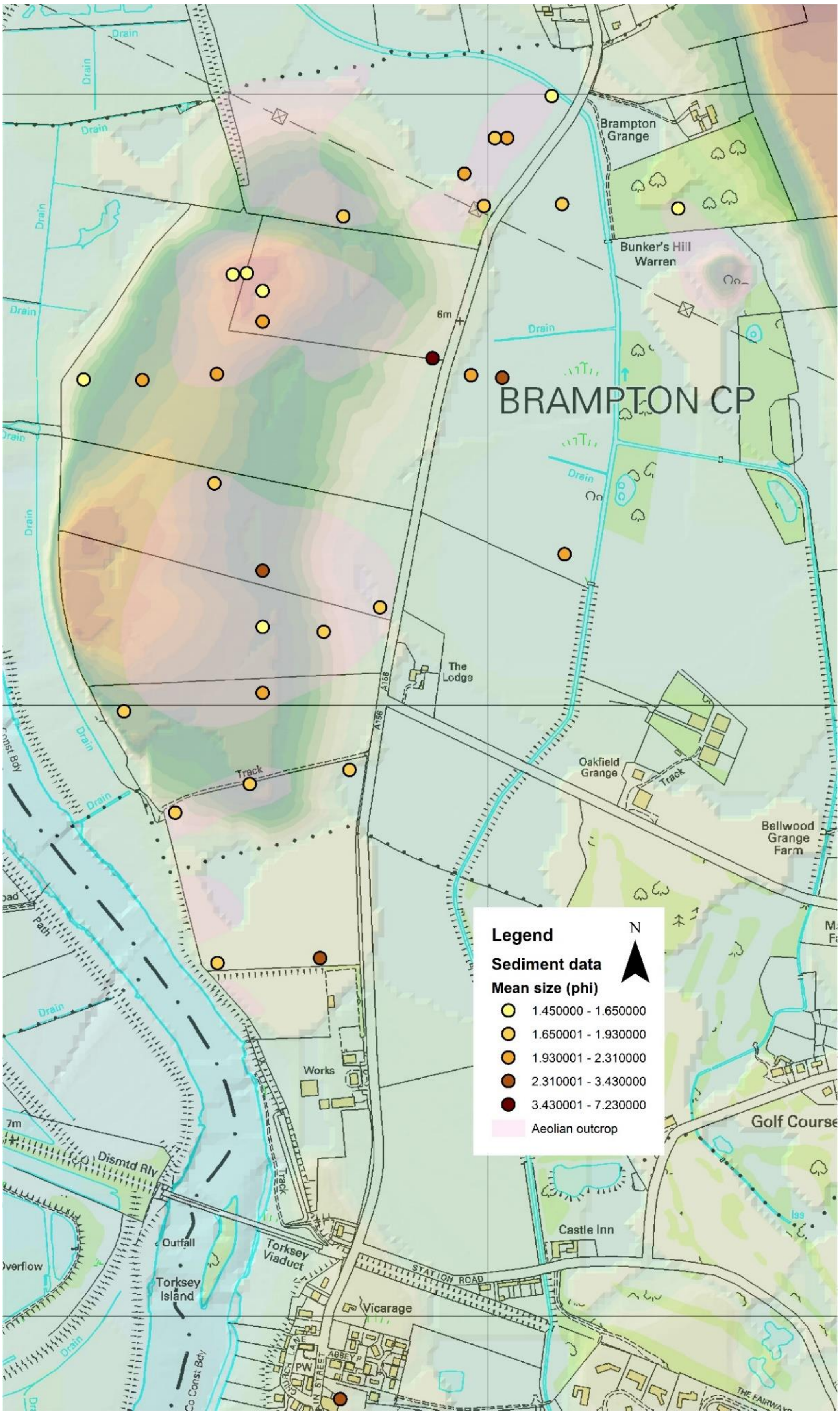


Figure 5.27: Sediment data presented by mean particle size. Cores with multiple particle size samples show the top-most mean. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

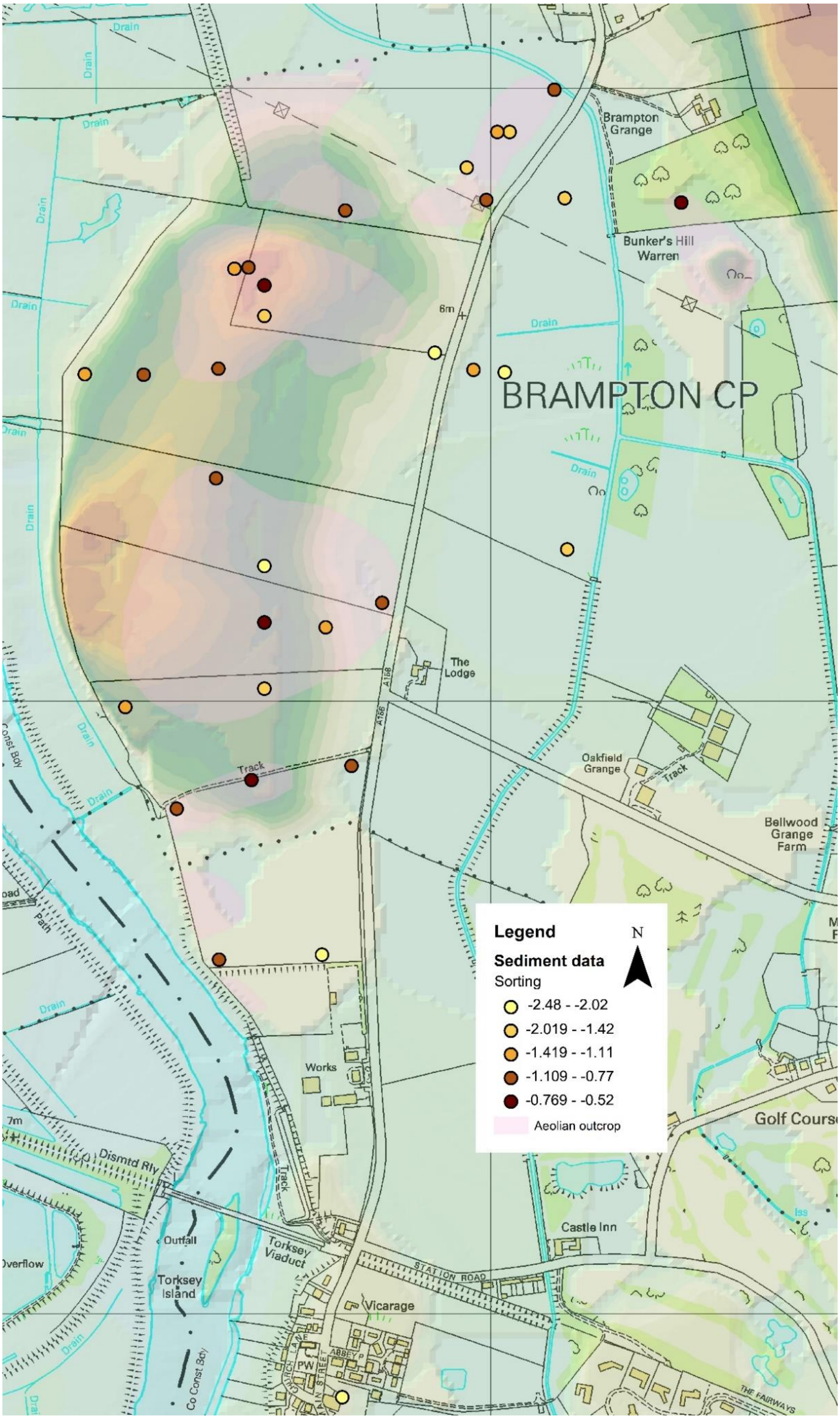


Figure 5.28: Sediment data presented by sorting of each sediment. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

A sample from an aeolian context from Sand Lane (Tork 11 TP1), on the south side of Torksey was also subjected to PSA to determine if a similar source could be determined. The sand from this context was sorted similarly to the aeolian samples from the winter camp site and BHW, but the mean size was smaller than the average mean size. The results of one sample is not conclusive, but it may point to different wind speeds for different events, or possibly that the sample from Sand Lane was from a later, weaker, more localised event, or that it has been affected by the human presence at Sand Lane.

3.2.4.2 Aeolian derived sediments

Across the site, a later derivation of the aeolian sediment occurs in the form of a silty sand sediment, interpreted as the result of slow accumulation of an aeolian sand-derived colluvium. This sediment was encountered at 2012 TP3 (figure 5.16), at the edge of an aeolian dune and a terrace gravel deposit, and in Tork 2013 TR1, where it was overlying an earlier deposition of aeolian sand, but was not recorded in any cores across the site.

The accumulated sediment is a light brown silty sand, with a fine sand and silt matrix. The sand is the same medium quartz sand as is found in the aeolian deposits, though this sediment has a silt and fine sand matrix. The sediment in both Tork 2012 TP3 and Tork 2013 TR1 has a massive structure and uninterrupted appearance. One visible difference in Tork 12 TP3 is the presence of rounded cobbles, which are increasingly frequent with increasing depth; this is probably a result of the underlying terrace deposit, versus the underlying aeolian sand in Tork 13 TR1. The silty-sand sediment is also similar to the present topsoils in fields B and C (other fields may have been altered due to the effect of later abattoir injections). The sediment was identified as a gradual accumulation of stable aeolian derived topsoil for several reasons: the location of the sediments on or at the base of aeolian dunes; the gradual increase of rounded pebbles and cobbles with depth and with proximity to the gravel terrace deposits in TP3.

The possible palaeosol is present within the sediment in Tork12 TP3. This palaeosol is detected based on a spike in organics and a change in particle size, from coarser to finer, at 70 cm depth in the profile of Tork 12 TP3. A very slight change in colour to a slightly darker colour, indiscernible in most lights, is also indicating that there is a change in sediment deposition at this level. There is no other indication that there is any change in sedimentation other than these nearly invisible changes, but these could indicate a palaeosol, a change in land management, or other unknown environment change. The presence of a palaeosol buried by later stable soil accumulation could also denote environmental or land management change, as the formation of a surface, and the later burial of the surface is caused by one or multiple changes on the site. The proximity of this test pit to an enclosure detected in the geophysics may indicate a relationship between the archaeology and sedimentation at this location.

Although access and time constraints prevented a full sediment analysis in Tork 2013 TR1, there was no visible change in the profile of this trench as there was at 70 cm in 2012 TP3. Overlying abattoir injection may have also altered the soil formation, or perhaps the lack of archaeological interference meant there was no change in sedimentation.

The same silty-sand deposit was also encountered at Castlebank, in TP2 of the 2011 test pitting programme (these observations are based on the author's own involvement with the excavation of the test pit; sediment description is omitted from the report by Perry *et al.* 2011); in this location, Torksey ware pottery was also found within this silty-sand deposit, highlighting the potential historical significance of the accumulation of this colluvial sediment.

Unit	Year taken	Core number	Depth of deposit	$CaCO_3$ (%)	Organics (%)	Mag Sus (X_{LF})
Silty-sand	2012	TP 3	30	-	2.51	45.59
	2012	TP 3	40	-	1.48	47.74
	2012	TP 3	50	0	0.99	52.95
	2012	TP 3	60	-	0.87	58.57
	2012	TP 3	70	-	4.21	49.76
	2012	TP 3	80	0	4.48	57.05
	2012	TP 3	90	-	0.0	47.08
	2012	TP 3	100	-	0.71	18.47

Table 5.12: Sediment analysis of silty sand deposit

Unit	Year taken/core	Mean (phi)	Median	Sorting (σ1)	Skewness	Kurtosis	Coarse sand (%)	Medium sand	Fine sand	Silt	Clay
Silty-sand	2012/TP3 40cm	3.31	2.29	-2.25	-0.57	0.74	8.38	33.60	27.31	29.36	1.34
	2012/TP3 60cm	3.30	2.23	-2.30	-0.59	0.75	8.94	34.48	26.73	27.95	1.90
	2012/TP3 80cm	3.40	2.60	-2.16	-0.49	0.80	6.33	29.29	31.98	31.01	1.38
	2012/TP3 100cm	3.43	2.52	-2.21	-0.52	0.84	6.77	27.81	35.97	28.05	1.40

Table 5.13: Particle size anlaysis of silty sand

3.2.5 OSL dating programme

A selection of the aeolian deposits were also subjected to optically stimulated luminescence absolute dating. This method was applied in order to determine the phases and locations of different aeolian redeposition across the site, and whether these corresponded to, or were potentially blanketing, any archaeological remains of the Viking winter camp site. This method was used in conjunction with a newly emerging method of relative dating, known as portable OSL, providing relative counts within each profile, and determining changes in deposition, especially where it is not visible within the profile.

OSL samples were taken from several dunes, as well as the silty sand deposits. One OSL sample was taken from each test pit (BHW at 100cm depth, TP1 at 100cm depth, TP2 at 80cm depth, TP3 at 95cm depth), and two were extracted from Tork 2013 Tr 1, at depths of 95 and 135 cms.

Figure 5.29: Photo of the gamma spectrometer reading background dose rate in Tork 12 TP1.

Once processed and run, the dates were calculated based on three models: probability, minimum age model, and finite mixture model. This analysis provided three potential age ranges for the 2012 samples.

Year taken	Sample location	Sample depth	Lab number	Result (ka) (highest probability)	Year	Minimum age model	Finite mixture model
2012	BHW	100 cm	SHFD 12016	1030 ± 60	980 ± 60 AD	830±70 AD	908±60 AD
2012	TP 1	100 cm	SHFD 12017	111,190± 6270	109180 ± 6270 BC	110,720 ±28,820 BC	99,260 ±6110 BC
2012	TP 2	80 cm	SHFD 12018	7470 ± 500	5460 ± 500 BC	6310± 1250 BC	4220±410 BC
2012	TP 3	95 cm	SHFD 12019	5030 ±360	3020 ± 360 BC	4750± 1110 BC	3090±310 BC
2013	TR 1	95 cm	SHFD 13080	2140±440	130 ± 440 BC		
2013	TR 1	135 cm	SHFD 13081	10,810±670	8800 ± 670 BC		

Table 5.14: OSL dating results

The results of the OSL dating programme from Torksey produced a wide range of dates, ranging from the late Pleistocene to the early medieval period. Surprisingly, there were no two dates that obviously corresponded to a single aeolian event, meaning that the sand that is spread over the site has been in constant state of flux since its initial deposition. Five of the six samples date to the Holocene (12016, 12018, 12019, 13080, 13081), indicating that the hypothesis that the dunes at Torksey are redeposited aeolian deposits was correct.

The implications of each of these dates is discussed below; this discussion will also include an analysis of the probability density function, or the distribution of the palaeodose results for each sample. This function is not only used to calculate error of results, but can also be used to make generalisations about the rate of accumulation, mode of deposition, incomplete bleaching, and possible disruptions such as bioturbation.

SHFD 12016

Bunker's Hill Warren sampling provided the only date that demonstrates an early medieval (re)deposition of aeolian deposits on the site. At one metre depth, the date of 980 ± 60 AD dates to only ~100 years after the winter camp occupation; FMM and MAM demonstrate that the date falls within an error range of the Viking occupation. The deposition of this dune within a few years of a major recorded local landscape change may not be a coincidence; clearance on the winter camp site, a site with a large amount of aeolian drift, plus a single episode of slightly stronger westerly wind, could very probably have resulted in a large dune at BHW. The location of this dune may be a direct result of the surrounding topography, with wind not carrying aeolian deposits over the scarp of the Penarth group, and therefore gathering at the foot of the topographic rise. This early medieval date and placement on the fringe of the existing peat deposit, combined with its convenient use as a rabbit warren, may have resulted in the preservation of the dune.

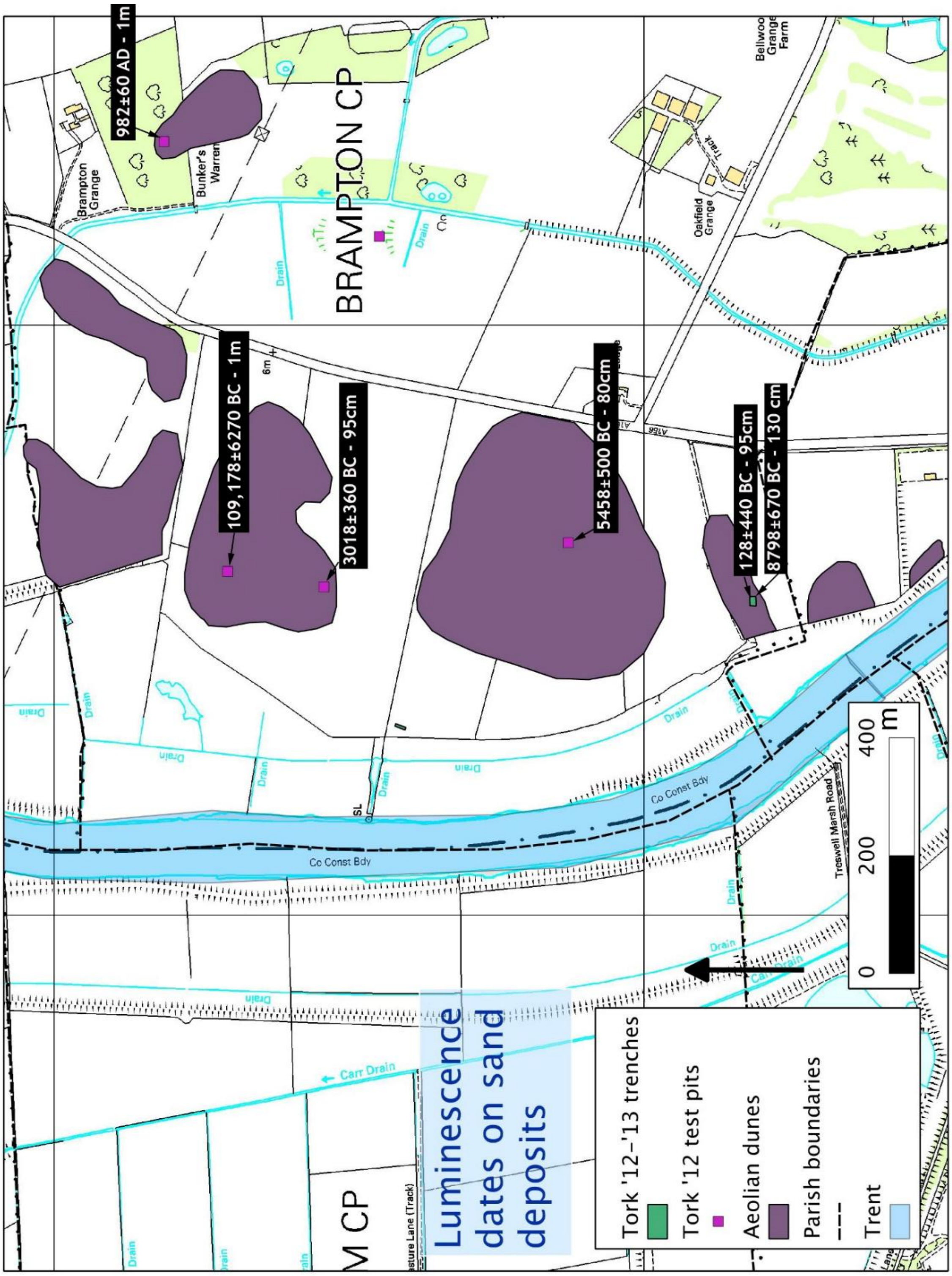
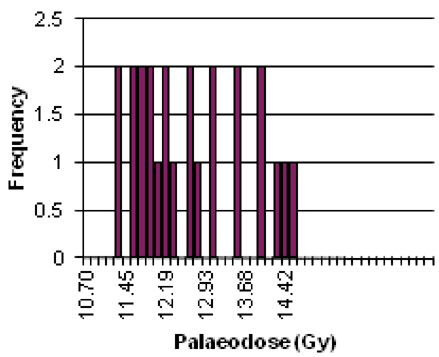
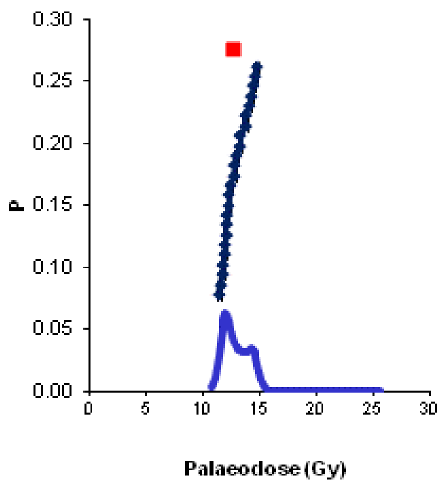


Figure 5.30: All aeolian sediments mapped across the study area, with OSL dates. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

The numerous episodes of aeolian redeposition within the village of Torksey in the years after the winter camp may also be linked with this episode at BHW. The clearance of the vegetation on the winter camp site during and after the Viking occupation may have been a major catalyst in the aeolian redeposition episodes across the village. Many of these phases temporally and physically fall between Anglo-Saxon and later medieval archaeological deposits. It is possible that the sand deposition is the direct result of clearance on the winter camp site. Archaeology, OSL dating, and particle size analysis demonstrates that there is little difference in sand deposits that date to the early medieval and medieval periods across the area. More OSL and particle size samples taken in archaeological contexts within Torksey and at BHW, however, will need to be taken before this hypothesis can be explored further.

The probability density function, or distribution of aliquot readings of the palaeodose (D_e), may demonstrate a relatively quick deposition of sediment. At the time of redeposition, the grains were all equally bleached, and buried at the same time, in a quick single aeolian episode. The dune is probably *in situ,* and was not disrupted after the deposition. In this sample, there is little evidence of later bioturbation, and little evidence of incomplete bleaching; the second, older spike in average D_e might be attributed to the deposit being locally mobile in the first years after the initial deposition, or contemporary bioturbation.





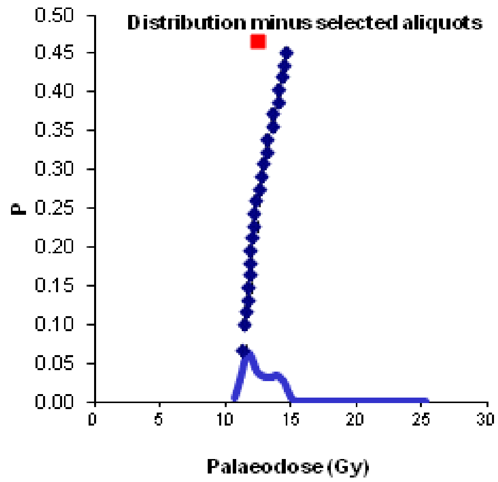


Figure 5.31: Probability density functions of D_e for sample SHFD12016, BHW TP1, excluding outliers. The unweighted mean is represented by the red square, and the result of each aliquot is represented by blue diamonds. Age increases with increased palaeodose.

SHFD 12017

The deposition of the sand in TP1 dates to marine isotope stage 5 (~130-82 kya), a period of glaciation throughout this area; this sample dates to much earlier than the proposed deposition of all glacial and aeolian deposits of the Younger Dryas (~14-10 kya). This may have several implications; this area may have been part of a braided channel during earlier inter-glacial phase, leading to the accumulation of aeolian sand based on earlier fluvial deposits on the site, which are currently indistinguishable from the HPSG of the Devensian; glacially deposited sand from a much earlier phase and further afield was redeposited *en mass*, not allowing for light to reset the isotopes. An aeolian deposit of this age has not been detected within the Lincolnshire Coversands (Bateman 1995; Baker *et al.* 2013). Dates of this age and older *have* been identified in the OSL dating of Pleistocene terrace deposits throughout the Trent Valley in a glacio-fluvial context at East Leake Quarry, Norton Disney, and Tattershall-Thorpe (Schwenninger *et al*. 2007). Regardless of the origins of this deposit, and whether it is glacio-fluvial or aeolian, it was an unexpected result with the study area, where all deposits were hypothesized to date to the Younger Dryas or later.

The regular probability density function of D_e, suggests that this deposit is also an *in situ* formation of its original deposition. Despite a wider distribution of D_e amongst the aliquots, the few samples that are younger than the average might be attributed to bioturbation, since these samples are substantially younger; however, there is also a wide distribution of ‘older’ sediments, which indicates that some of this sediment was not completely bleached at the time of deposition. This does not necessarily mean that the deposit is not 100,000 years old; the deposit may have shifted without complete bleaching at a later inter-glacial phase. There is no reason, however, to consider that the sand within this dune has been disturbed after its original aeolian or glacio-fluvial deposition.

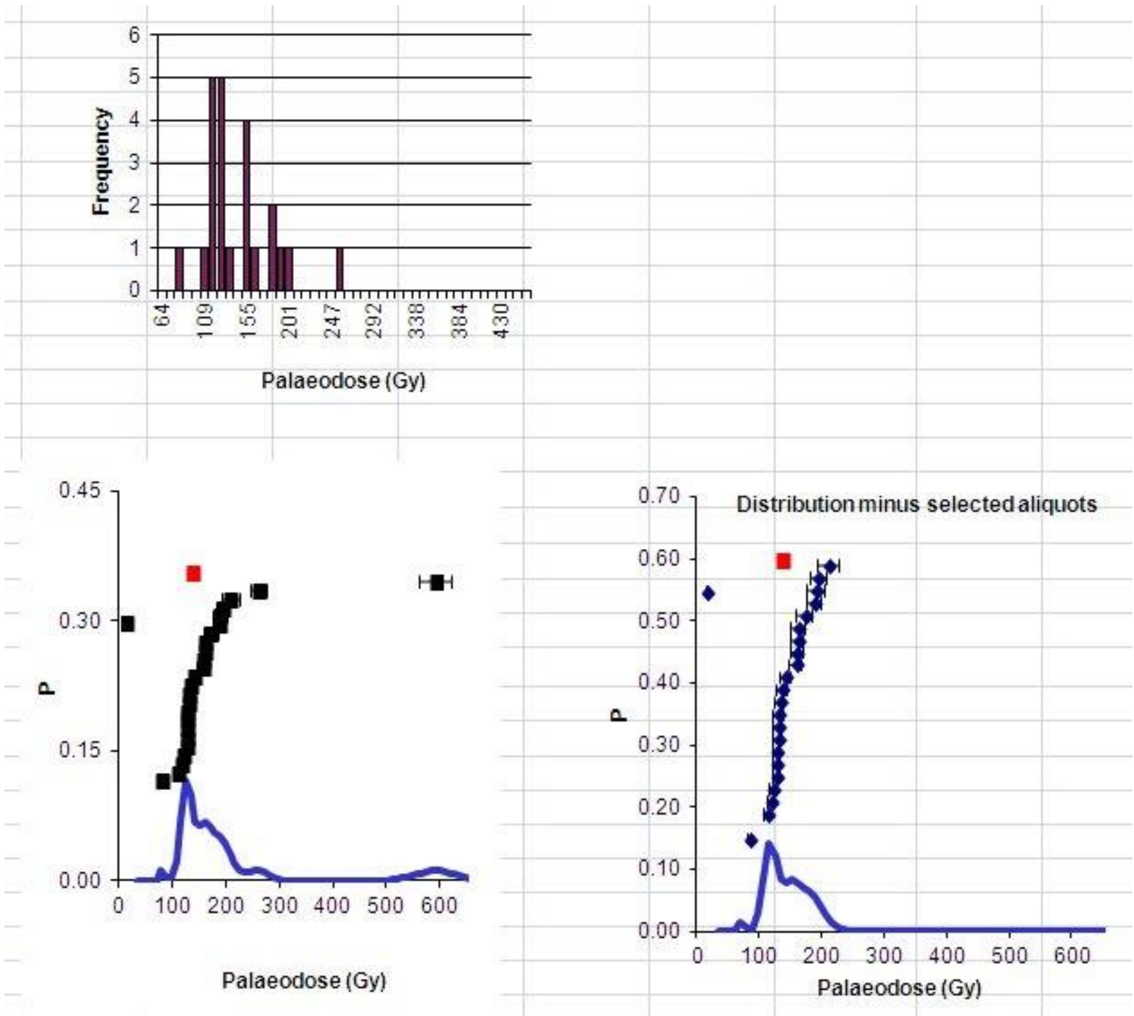


Figure 5.32: Probability density functions of D_e for sample SHFD12017, Tork TP1, excluding outliers. The unweighted mean is represented by the red square, and the result of each aliquot is represented by blue diamonds.

SHFD 12018

Sample 12018 is of mid-Holocene date, confirming that it is a redeposited post-glacial aeolian sand. This date corresponds with other local redepositions of Lincolnshire Coversands deposits, including that at Girton, Notts. (Bateman 1995; Baker *et al.* 2013). This phase of aeolian deposition is too late to be a result of post-glacial winds on terrace deposits, and the deposition is a direct result of natural or anthropogenic alterations in the Neolithic. The sand in this part of the dune may be a direct result of local clearance during initial clearance and agricultural phases on the site or nearby. The silt facies within the deposit (see figure 5.25) may be indicative of a recently cleared landscape, where aeolian deposits are frequently disturbed and redeposited due to the loss of vegetation, but raised water levels allow the adjacent peat deposits to encroach upon the forming sand dunes.

Sample 12018 from Tork TP2 demonstrates an even wider distribution of probability density function, with multiple peaks across the sample, indicating incomplete or inconsistent bleaching of the sediments. Considering the sediment appears to be of aeolian origin, this factor may be a result of bioturbation, fluvial movement of sediment, mass movement processes, ploughing, or other disruption of the sediment after it was deposited, and before it was covered by later aeolian depositions. The silt facies that are spaced throughout this profile also hint that the sand was disturbed and redeposited in several phases, and the inconsistent bleaching of the grains may be a reflection of that process.

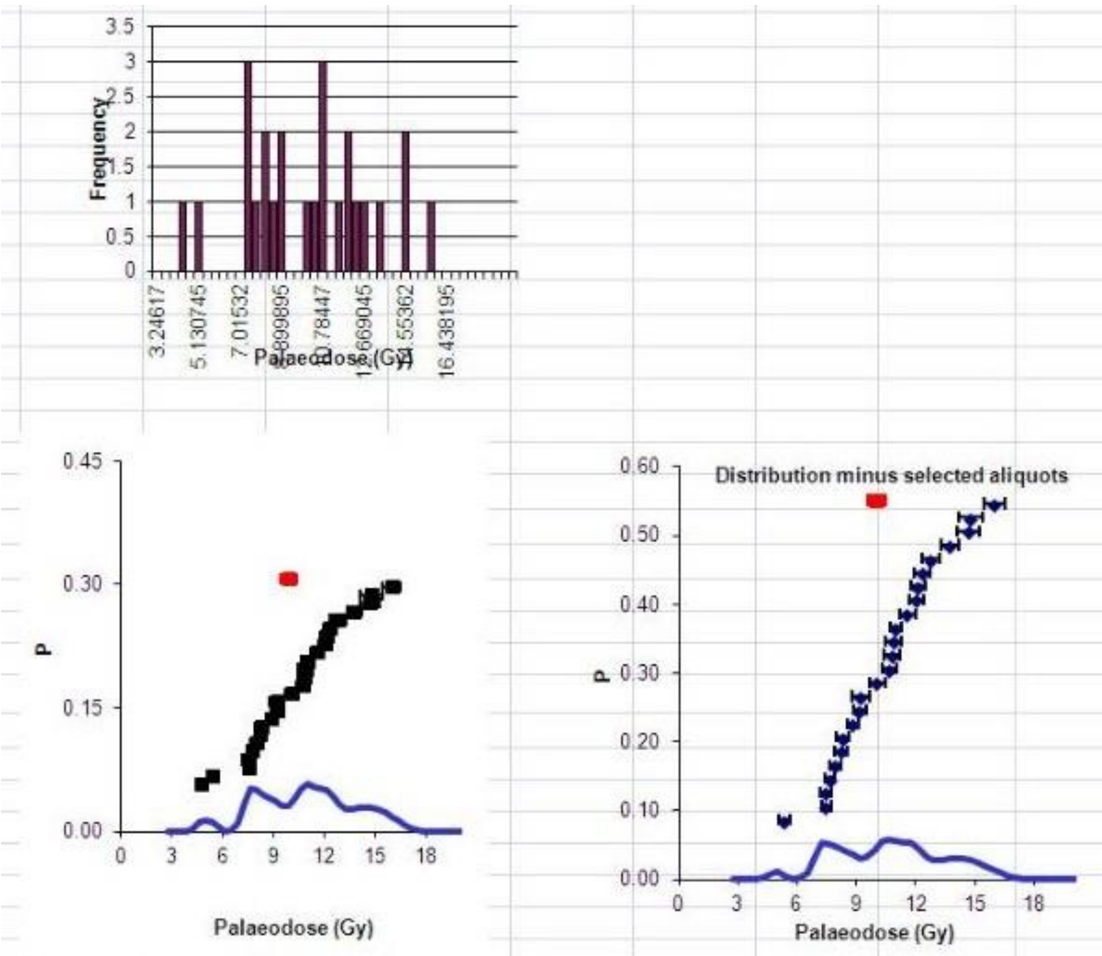


Figure 5.33: Probability density functions of D_e for sample SHFD12018, Tork TP2, excluing outliers. The unweighted mean is represented by the red square, and the result of each aliquot is represented by blue diamonds.

SHFD 12019

Sample 12019 was not taken from a recognizable aeolian context, but rather from the aeolian derived silty-sand deposit in Tork 12 TP3. The sample was taken below the line of the possible palaeosol as identified in section 3.2.3.2. This date, 2000 years later than 12018, but still in the Neolithic may indicate that there was stable, possibly open ground surface, and the area may have been used for grazing or even early agriculture on the site. The date within this test pit, adjacent to the Romano-British settlement as identified in the geophysical survey, may indicate that this area was subjected to steady agricultural use since well before the Roman period, though further excavation is required to test this hypothesis.

Incomplete bleaching of sediment and scattered probability density confirms suspicions that this sediment was accumulated at a slow pace. The sediment may have been disturbed post-burial by bioturbation or even ploughing if it was a soil within a late Neolithic field system.

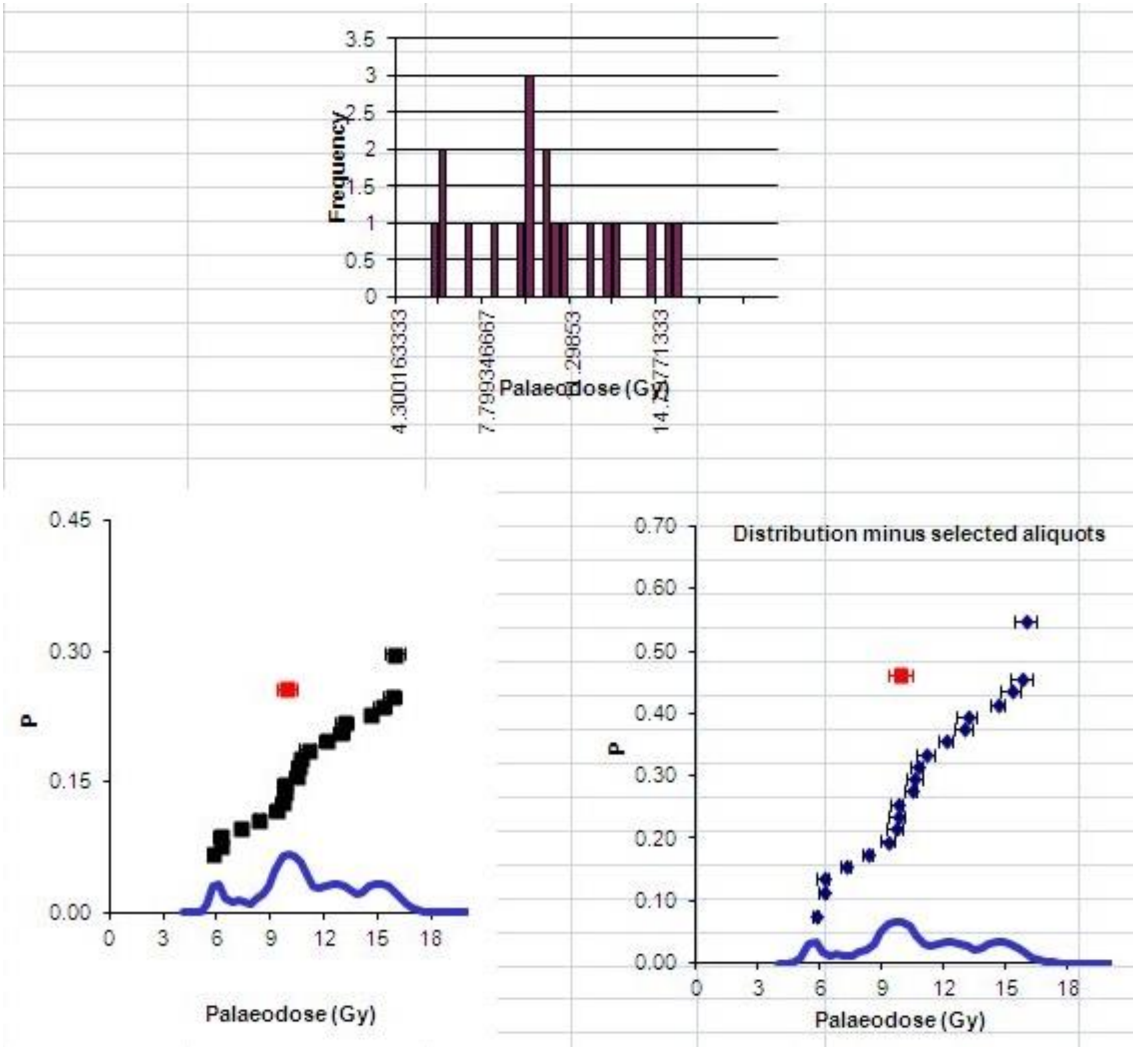


Figure 5.34: Probability density functions of D_e for sample SHFD12019, Tork TP3, excluding outliers. The unweighted mean is represented by the red square, and the result of each aliquot is represented by blue diamonds.

SHFD 13080

This sample, the higher of two within a profile in Tork 13 TR 1, is also located on a silty-sand deposit, this one located on top of an aeolian deposit rather than terrace gravels. There were no clear visible changes in this silty sand deposit with massive structure. The late Iron Age date again alludes to the agricultural use of this area, atop two dunes that overlook the wetland inlet to the south of the site.

As with the sediment in TP 3, a slow accumulation is assumed on the basis of massive structure of the sediment in TR1. The probability density function displays a tri-modally distributed curve, suggesting incomplete bleaching at the time of deposition, post-depositional disturbance, and a slow rate of accumulation and sediment burial. This hypothesis is confirmed following the finding of a Viking gaming piece several centimetres above the dated Iron Age sediment.

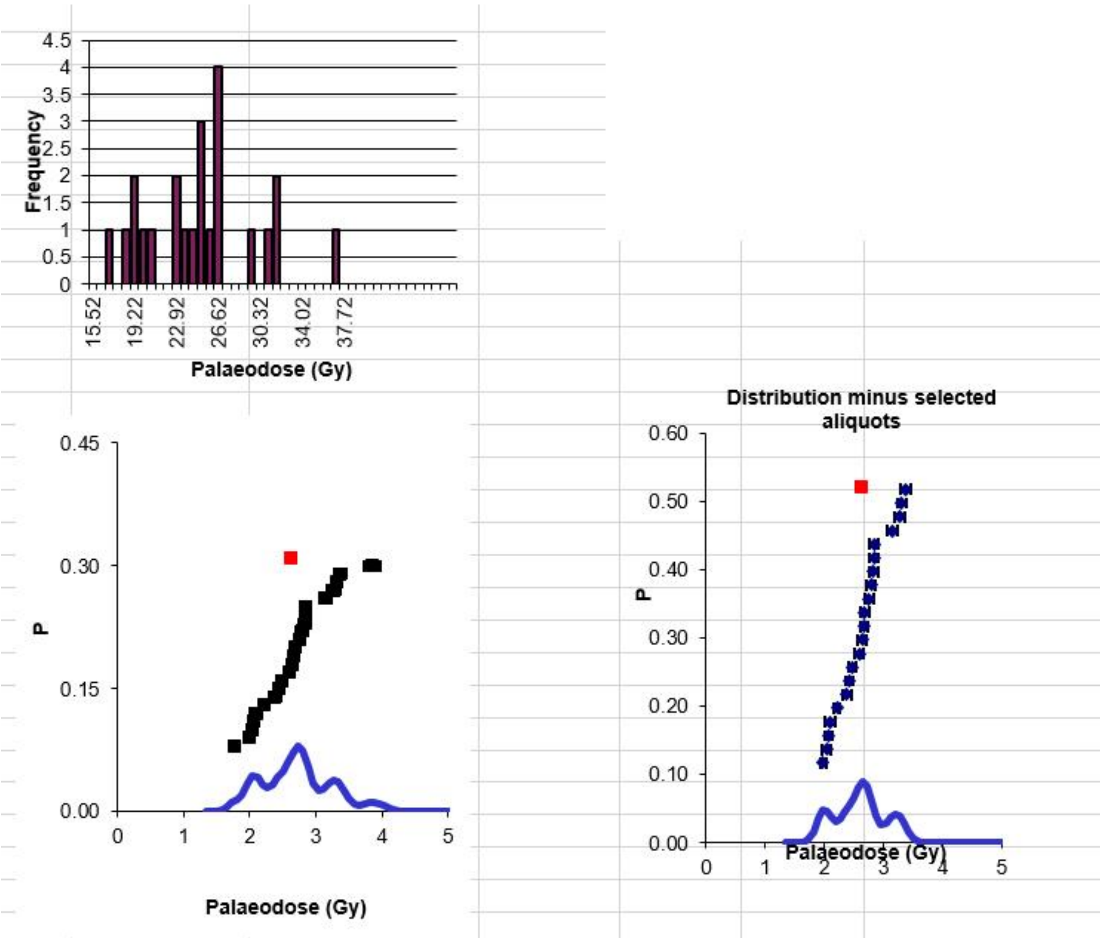


Figure 5.35: Probability density functions of D_e for sample SHFD13080, Tork 2013 TR1 95cm, excluding outliers. The unweighted mean is represented by the red square, and the result of each aliquot is represented by blue diamonds.

SHFD 13081

The parent material of the sediment sampled in SHFD 13080, this sample was taken out of a medium sized sand, consistent with other aeolian deposits across the site. The date of 8,800 BC places it just at the end of the Devensian and beginning of the Holocene, perhaps as an example of the very first aeolian sand deposit from the HPSG.

Though hypothesized to be an *in situ* early aeolian deposition, the incomplete bleaching of the sediments and bimodal distribution of the palaeodose probability may suggest a post-depositional disturbance of sediment. The earlier palaeodose probability may represent the original deposition, with the latter two spikes corresponding to slightly later disturbance. Since the sample was taken at 130-135cm depth, and the boundary between contexts was gradual between 100 and 120cm, this incomplete bleaching may be the result of disturbance close to a palaeosurface, similar to the incomplete bleaching in SHFD12018. It does not appear to be contaminated by the Iron Age deposit just above it, though the proximity of these two contexts may have affected the results.

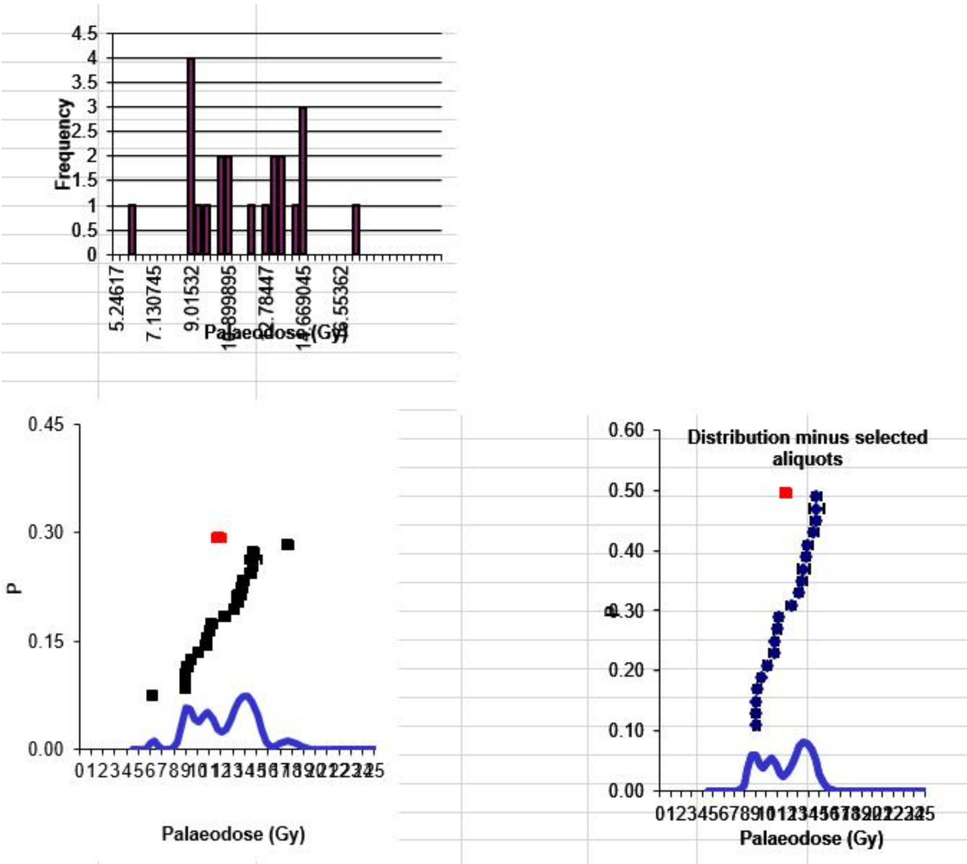


Figure 5.36: Probability density functions of D_e for sample SHFD13081, Tork 2013 TR1 135cm, excluding outliers. The unweighted mean is represented by the red square, and the result of each aliquot is represented by blue diamonds.

The OSL dating on Torksey demonstrates a highly active Holocene environment, with no overlap between different sediment depositions. The dating programme has identified a deposit that dates to nearly 90,000 years earlier than the earliest dated drift deposits in this region. The dating of dune merits additional research at a later date, but the Pleistocene date is not directly relevant to the aim of this chapter to produce an environmental reconstruction of the Holocene.

Holocene aeolian deposits date to approximately 8,800 BCE, 5,500 BCE, 128 AD, and 900 AD, and each redepositional event is representative of changes in the local landscape and environment. The early Holocene date in field G most likely is a result of post-glacial environmental changes, with a cleared landscape allowing for aeolian drift. The mid-Holocene aeolian sand may be the result of either climate change and higher wind velocity, a shift in the channel of the Trent and therefore a change in local vegetation, or clearance of vegetation due to local agricultural usage (although the pollen analysed above implies that clearance for agriculture did not take hold in this region until the Iron Age). Finally, the early medieval aeolian date corresponds to human changes as well as environmental changes in the area. Environmental records indicate a sharp downturn in climate in the post-Roman period, corresponding to colder temperatures and higher rainfall averages (Dark 2000). This climatic downturn, in conjunction with local clearance for a Viking winter camp, and an extensive Anglo-Saxon village, even town, at Torksey would have reactivated the poorly rooted sands, resulting in the redeposition of aeolian sands from the camp site to BHW and across Torksey. These OSL dating results refute the hypothesis that *all* the aeolian deposits on the site at Torksey obscure Viking period remains, but it does not completely dismiss the possibility that aeolian sand has shifted in the years around and after 872-3, and the archaeological remains may have been buried by shifting sands. The OSL dating also provides some temporal context for the silty sand colluvium found in fields C and G, placing them both at times when the site could plausibly have been part of an agricultural, grazing, or at least occupied site.

3.2.6 Portable OSL dating

In addition to OSL dating, a series of portable OSL dates were also taken (a full methodology of this technique is outlined in chapter 4 and appendix I). The methodology states that profiles can be corrected for feldspars and moisture, though these corrections are not always necessary; however results vary between sample to sample; all corrections and raw counts can be found in appendix V (reasons why the samples require different corrections is explored further in Bateman *et al.* forthcoming in *Geochronology*). Within each profile, pOSL samples were taken in 10cm intervals, for comparison against lithology changes and OSL dates. Every profile sampled clearly showed increasing luminescence counts with increased depth, which can be interpreted as several phases of deposition. Appendix V describes the locations and labels of each of the pOSL samples.

Tork 12 TP 3 luminescence counts show two clear phases of deposition, that correspond to two separate stratigraphic units, with a large jump in luminescence counts at a depth of 100cm. The top unit, colluvium, is OSL dated to 3018±360 BC, and the bottom was interpreted as HPSG terrace deposit and redeposited Mercia Mudstone, dating to the late Devensian, and these luminescence counts fully support this interpretation of the profile at Tork 12 TP3.

This profile demonstrates that the top unit was all deposited in a similar timescale, as each datum point has a similar luminescence signature. The slightly decreasing counts may indicate the gradual accumulation of the sediment. A change between 80 and 90 cm corresponds with the particle size and organics change identified as a palaeosol during the sediment analysis. The bottom phase shows very scattered luminescence counts, but all readings have several thousand more counts than the top phase. This scattering of counts demonstrates that this unit is a mixture of several sediments that were deposited in a variable glacial environment.

In the other sample of silty-sand, the pOSL readings again correlate with stratigraphic changes, and also closely correspond to the OSL dates that were produced from this sequence exposed with excavation and coring. In this sequence, two OSL dates are also able to confirm the success of the pOSL relative dating of this profile. An OSL date on the top unit, at 95cm depth is 128±440 BC, and at 130cm is 8798±670 BC. The bottom unit is much older than the overlying unit, a result that is also evident in the pOSL results. Just as in TP 3, this sequence can determine that the top unit was deposited at around the same time, at a moderate rate, based on the slightly increasing counts with depth. The bottom unit was deposited much earlier, and has several thousand more counts than the top unit.

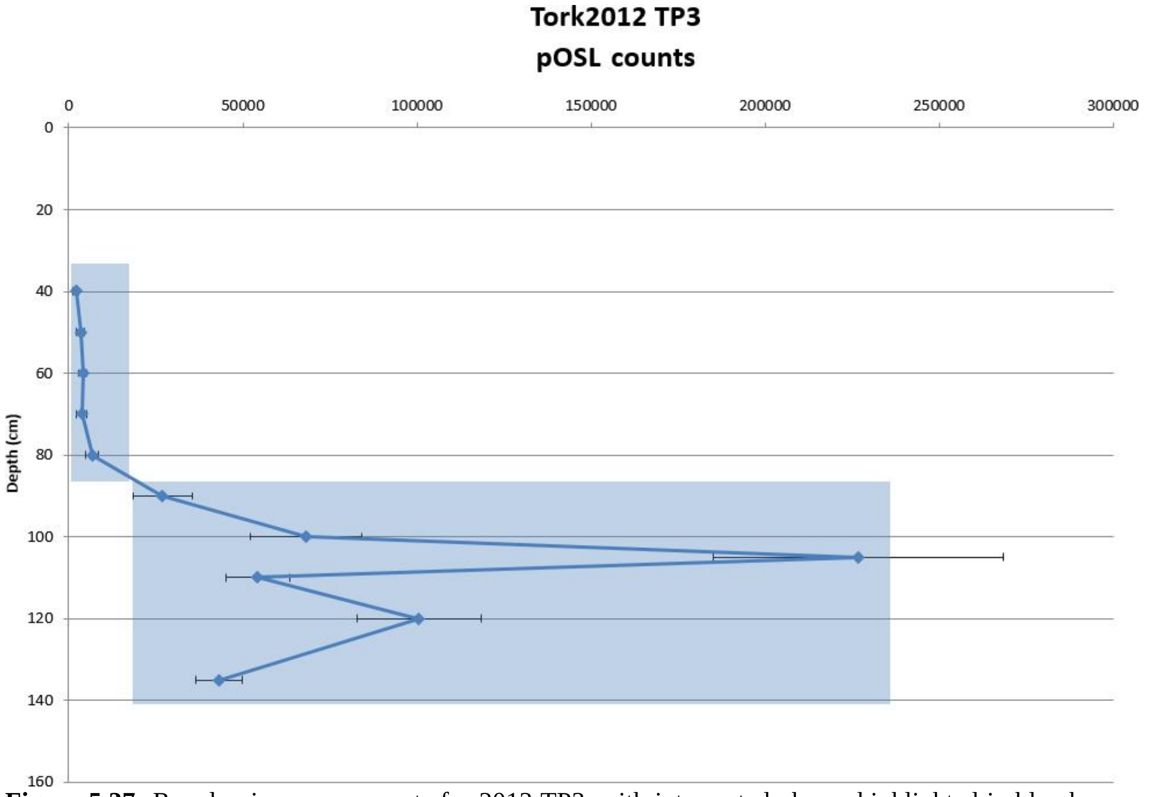


Figure 5.37: Raw luminescence counts for 2012 TP3, with interpreted phases highlighted in blue boxes. The top phase (colluvium) shows a clear single depositional event, with slightly increasing counts with depth. The bottom phase (terrace deposit) shows higher counts, as well as much more variability. OSL dating determined that at 80cm depth, the sediment was deposited in 3018±360 BC.

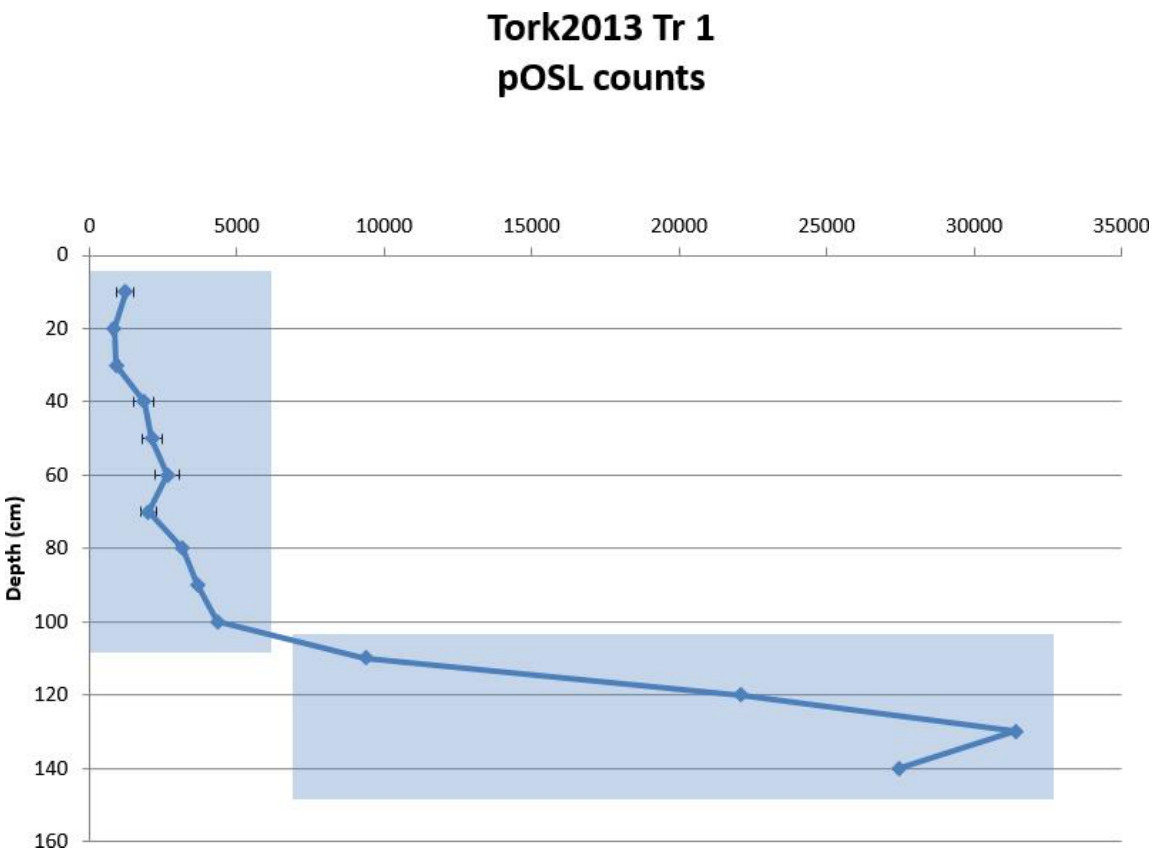


Figure 5.38: POSL counts showing two phases of deposition. The top silty sand demonstrates a moderate or rapid accumulation, and is overlying an early phase of aeolian sand. Stratigraphically a difference between silty sand and medium sand highlights two phases, and OSL dating confirms these phases, with a date of 128±440 BC at 95cm, and 8798±670 BC at 130cm.

The younger unit has a similar accumulation rate as the deposit from 2012 TP3, and sediment properties determines it has possibly formed from similar depositional processes. The similarities between the profiles of the silty-sand on two parts of the site indicates that the accumulation of this silty-sand sediment occurred at a very similar rate. On the basis of the associated archaeological finds, however this rate may be over several hundred years; the date at 95cm is 128BC, but at 50cm, a Viking game piece was found during excavations. Despite an obvious temporal change, there were no stratigraphic changes within the unit to indicate any periods of exposed surfaces.

The pOSL samples taken on aeolian contexts did not have the advantage of the clear stratigraphy visible at TP3 and TR1. Despite this difference, however, the pOSL proved that, even without obvious changes in stratigraphy, the aeolian deposits were sometimes deposited in several phases. In Tork 12 TP2, the corrected data shows two phases of deposition. Multiple phases of exposed ground surfaces are visible in thin microfacies within the profile, however these are truncated and overlain with aeolian deposits until the deposition of the current ground surface. The OSL date at 5458±500 BC was taken at 80cm, which indicates that the entirety of the top 80 cm of aeolian sand dates to the mid to late Holocene. The increased luminescence counts in aeolian sand below 80cm may indicate that there are two units and two deposits of aeolian sand; however, this temporal difference is not apparent in the stratigraphic sequence based on sediment appearance or properties. This pOSL sequence highlights the multi-phase deposition of aeolian deposits within this dune, where there was one later aeolian reactivation in the Mesolithic, and another earlier aeolian phase in the early-mid Holocene, even though these are not visibly apparent.

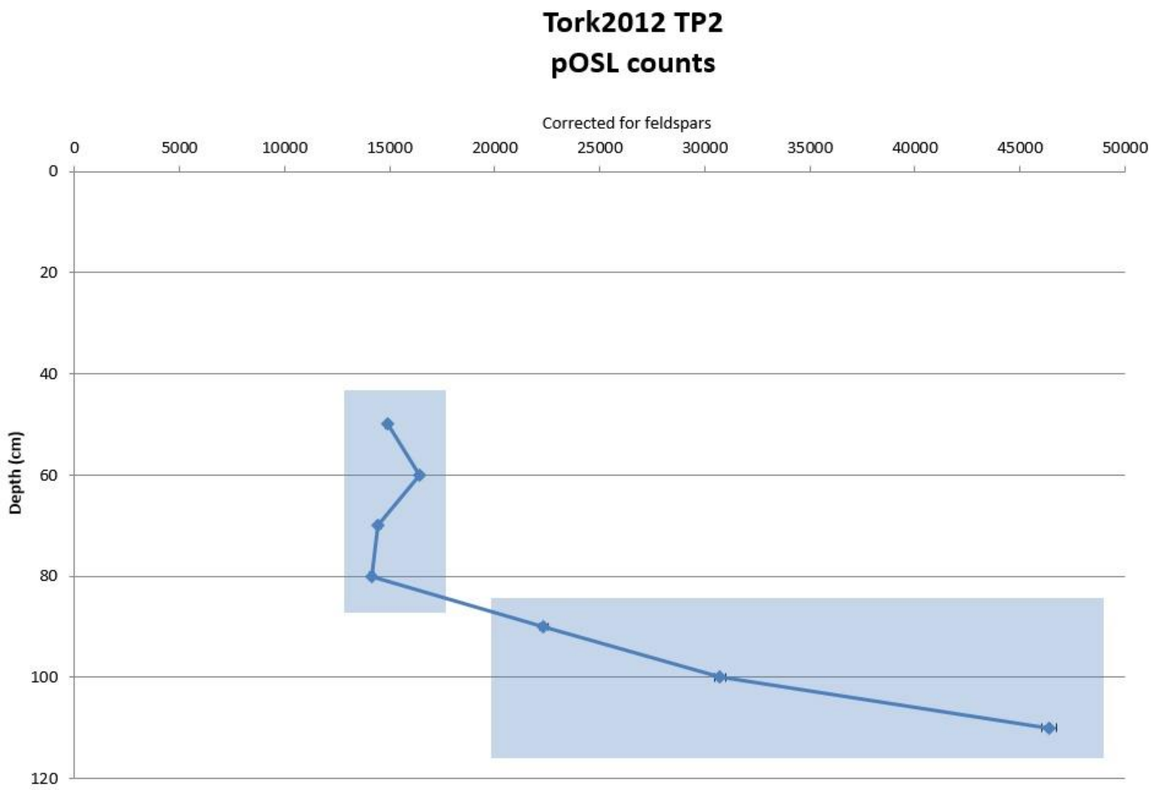


Figure 5.39: POSL counts showing two phases of aeolian deposition within 2012 TP2. This sediment appeared as a single aeolian deposit with some post-depositional features, however the luminescence counts have shown that there are two phases of aeolian reactivation within this profile. OSL dating at 80cm depth has provided a date of 5458±500 BC.

The sequence from Bunker's Hill Warren demonstrates a two or possibly three phase aeolian deposition. The top phase, undated, represents a rapid and relatively recent accumulation of sediment. The middle phase can be interpreted as an intermediate phase, and may represent a slowly accumulating deposit, or a ground surface with bioturbation between the upper and lower phases. The third phase, with a jump in luminescence counts and two samples with similarly high readings, represents the earliest phase within this sequence. Sand at 100cm depth was dated to 982±60 AD, meaning that the top 80 cm of sand are all medieval or post-medieval in date, and are either phases of sand redeposition, or of post-depositional disturbance. Similar to 2012 TP2, the pOSL methods applied to BHW was again successful in identifying phases within seemingly uniform aeolian deposits. This dune was deposited much more recently than the other sand deposits that have been sampled and dated, yet provided similarly coherent results; however, numerically, raw counts are similar at BHW and earlier dunes on the winter camp site, even though these phases were hundreds of years apart, rather than thousands.

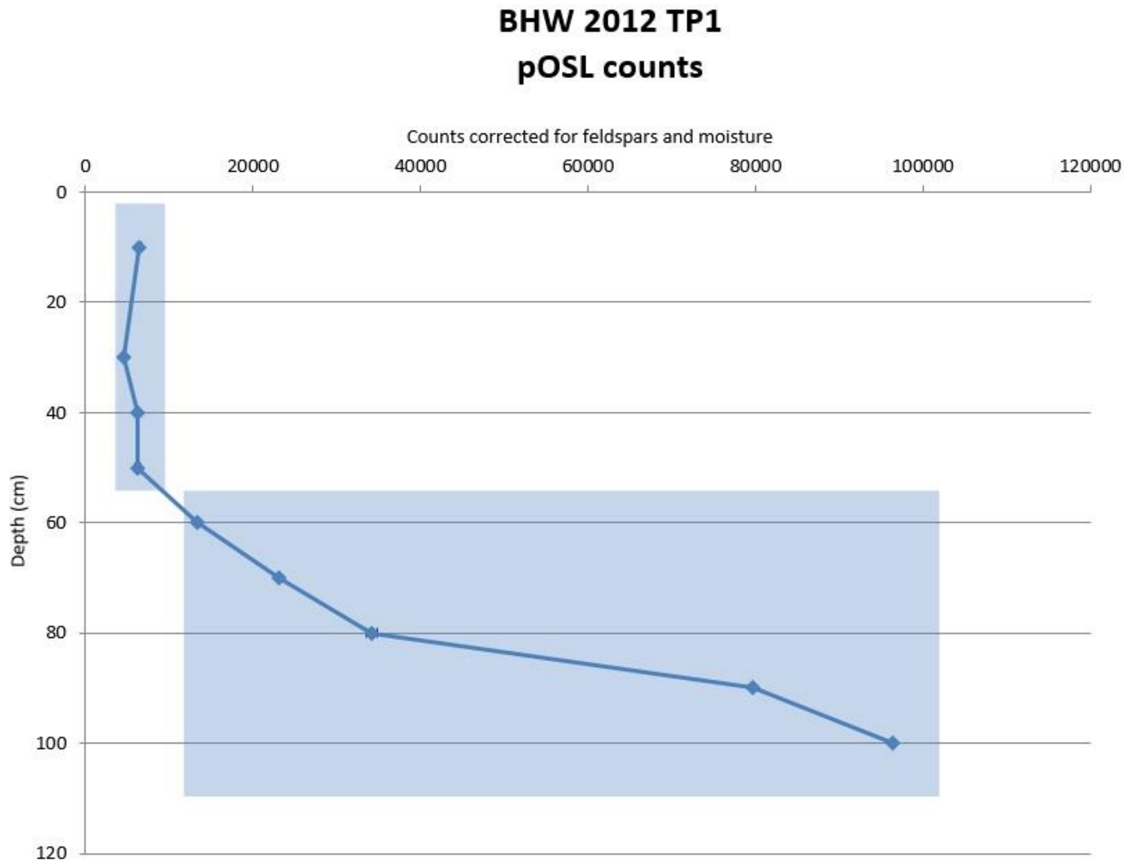


Figure 5.40: POSL counts at Bunker's Hill Warren showing three phases of aeolian deposition. The slowly increasing counts within the middle phase may represent a later truncated ground surface, or mixing between the upper and lower phases from bioturbation. OSL measurement at 100cm dates to 985±60 AD.

Finally, the profile at 2012 TP1 displays evidence of two possible phases of aeolian deposition. Despite a limited number of samples, the profile shows increasing luminescence counts with depth. The sample at 100cm dated to 109,178±6270 BC, but was interpreted as an unrefreshed sediment. The sample at 125 cm is likely from a similarly unrefreshed sediment, accounting for the high counts. A later phase is just below the present topsoil, and has been deposited more recently than the dated phase below.

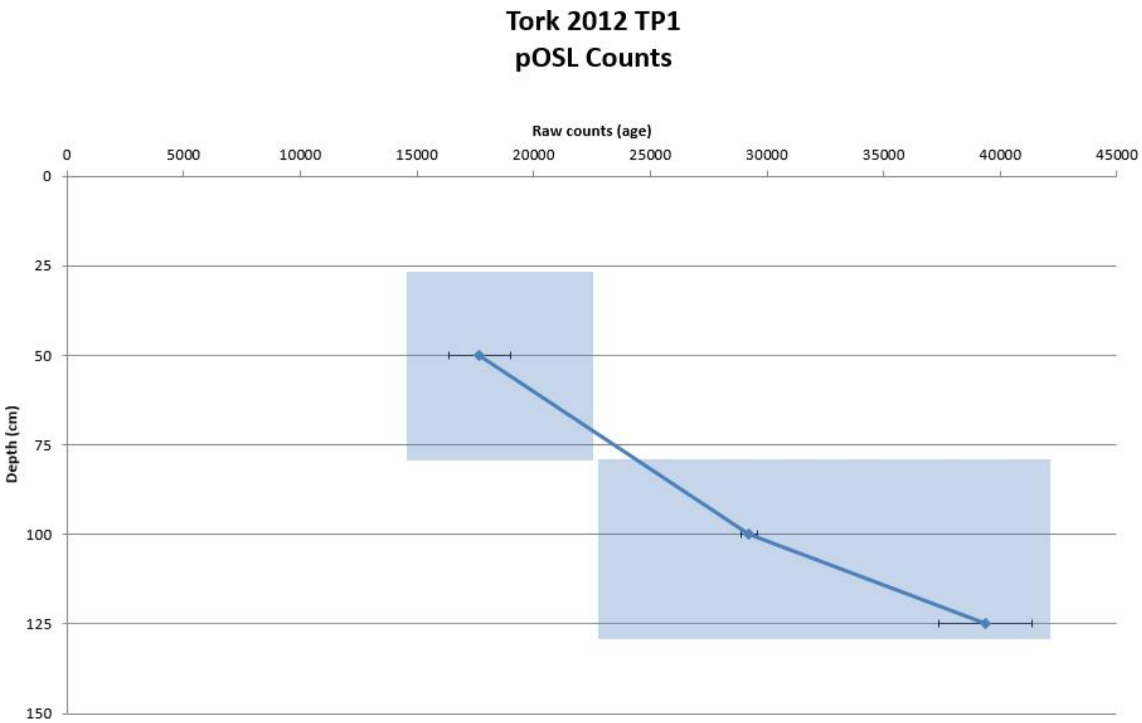


Figure 5.41: Portable OSL counts form 2012 TP1, showing two possible phases. Sediment at 100cm was dated to 109,178±6270 BC, and sediment above that is of a younger phase.

Conclusions from pOSL

All of the above profiles have demonstrated the effectiveness in the pOSL technique, which has been supported by stratigraphic differences in 2012 TP3 and 2013 Trench 1, and by OSL dating in 2013 TR 1. Based on the success of the technique on these profiles, the application of the technique on aeolian sequences demonstrated that multiple periods of deposition could be detected by the use of pOSL only, even when there was no evidence of stratigraphic sediment change. The data has proven that there are multiple phases of deposition within each sediment profile, and that there are multiple phases to each dune and aeolian derived deposit. If archaeological remains are buried between aeolian deposits, previous ground surfaces may not be immediately apparent based on sediment changes. This pOSL data has temporally contextualised each of the OSL dates and the sediments they came from, clarifying that even though many OSL dates were early-mid Holocene, there are sediment depositions later than those dated units. Finally, it has become clear from this data that, despite there being no visible previous surfaces within the profiles, there are buried surface horizons that have been truncated or are simply invisible with simple descriptions.

The complex nature of each profile also confirms that, although no early medieval OSL dates were detected on the winter camp site, that the archaeology of the Viking winter camp may be obscured by aeolian sand. The aeolian redistributions across the area are very complex, with each dune having at least two, even three different depositional units. Of the very few samples taken, each dune had several phases at that location alone, and several more may have occurred across each dune since the initial deposition. Aeolian sand remains the main cause of the obscuration of archaeological data of any and every period on the site.

3.2.7 Alluvium

The complex and dynamic nature of the alluvium on this part of the Trent Valley flood plain became obvious with the excavation of Tork 2011 TP 3 at Verity House. The excavation of 130cm of alluvial clayey-silt, only to find later post-medieval pottery beneath the sediment, revealed how quickly and drastically the floodplain can change around Torksey. Due to the equipment available and time constraints, it was not possible to core or sample across the floodplain. While the alluviation of the floodplain in the Lower Trent Valley is a highly active and defining feature of the landscape, mapping the movement of the river just within the study area and without any means of precise dating would not add substantial information to the analysis, and was deemed unnecessary for understanding the site and study area, and was addressed from a landscape perspective in chapter 6. Based on walkover survey on the site, much of the top 50-100 cm of alluvium is the result of recent flooding and erosion, and coring may have presented a very similar picture throughout the study area. In contrast, post-medieval ridge and furrow does survive on the northwest side of the study area, which indicates that some parts of the alluvial plain have not been altered in several centuries.

Where alluvium was visible, it ranged from dark brown silt to medium brown sandy silt, and was usually in massive or columnar structure. There was often much bioturbation throughout the sediment. The silty clay of field A is very dense with no inclusions, and ranging in colour from dark brown to black.

Although it was open to the Trent Valley floodplain until the construction of the berm and pump house at Marton in the 19th century, the organic-rich clay on the north end of the site in field A is not classified as alluvium, as the Trent no longer infiltrates the area. The area across field A, however, is a relict floodplain of the Trent. It is currently under plough, though this is a recent development, as it was mapped until the 19th century as a permanent wetland. Standing water occupied the area since the abandonment of the palaeochannel east of the site.

Unit	Year taken	Core number	Depth of deposit	$CaCO_3$ (%)	Organics (%)	Mag Sus (X_{LF})
Organic silt (north of the winter camp site)	2011	39	35-50	-	46.51	0

Table 5.15: Sediment analysis of alluvial clay

LiDAR data makes it clear that this area has been a problem for residents and farmers for a long time. The use of the area as an 'overflow' for the Trent in times of flooding, and its low elevation, means that standing water has created a nearly lacustrine environment. Flood defence north of field A, and on the east side of field A (figure 5.42), clearly demonstrate the historical attempts at protection against this encroaching water. The defence on the east side of field A also accounts for the separation between the peat and the organic silt north of the site; despite the fact that both of these deposits accumulated due to their low elevation, the continuous slight movement of the waters in field A, in contrast with the stagnant water in the peat bed, has created two alternate types of organic build-up.

The berm, east of the standing water and parallel to the current A156, may have a more important role than simply being a defence against flooding; it may be an early causeway to the site, prior to the draining of the area in the post-medieval period. The bank dates prior to the construction of Inclosure Drain in the 17th century, as the drain cuts through the berm/causeway. The role of this causeway will be further discussed in section 4 and chapter 6.

The present Trent Valley is also slowly eroding into the side of the Mercia Mudstone outcrop, wearing away at the soft mudstone during every flood. This is especially visible on the steepest slopes of the MM outcrop on the western edges of the site. Undercutting into the soft bedrock with flooding has led to the erosion of the entire cliff face, with higher mudstone slipping down the face to replace the mudstone eroded by the river. The site would have been slightly wider to the east before the Trent reached its current course and this erosion began to occur.

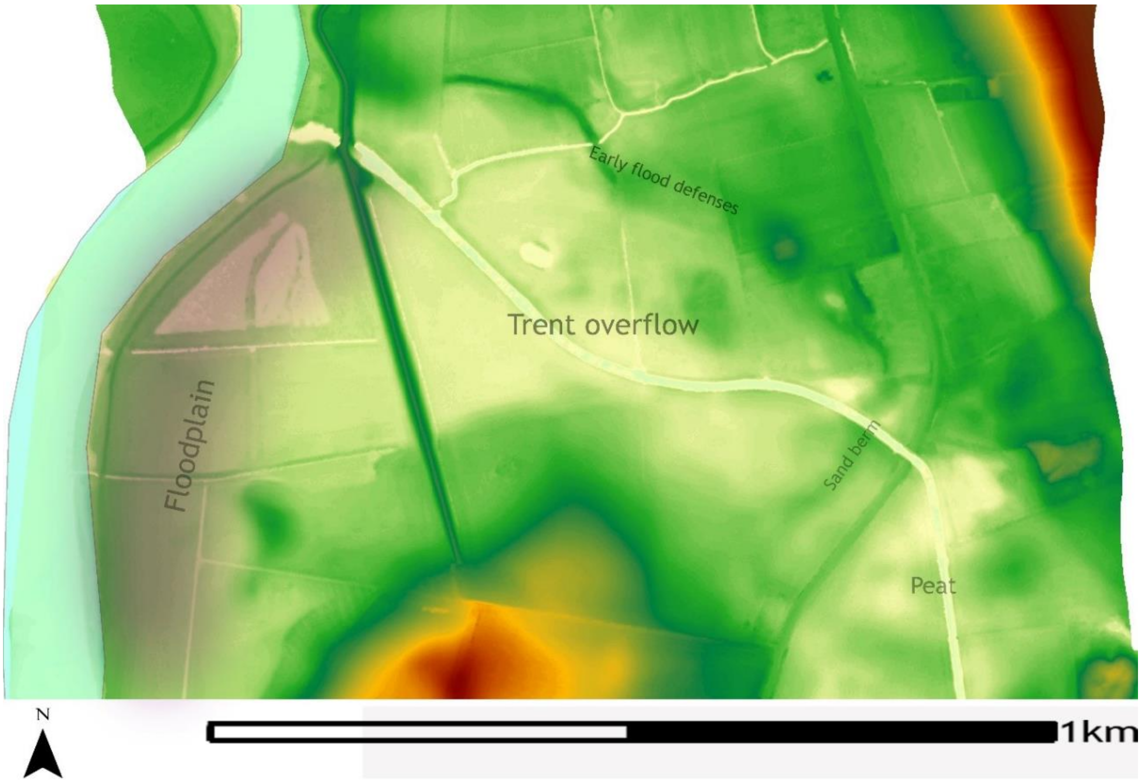


Figure 5.42: Area of alluvium accumulation on the north end of the site within the Trent overflow. Although part of the same low ground, the low areas east of the sand berm are composed primarily of peat, while the area to the west is fine silt and clay alluvium.

Despite having no detailed sediment data for the floodplain, interpretation of the changing environment of this 'Trent overflow' area does pertain to this analysis. Although the alluvium and mud flats that are currently in the floodplain are mostly modern in date, it is equally possible that alluvium and wetlands occupied this space for much longer, and that the alluvium has been eroded and replaced several times. Prior to modern drainage and channel alterations and controls on the Trent, the landscape may have appeared much different. Early maps indicate that much of the present Trent Valley landscape was relegated to water meadow and 'ings', meaning that it would flood regularly, and was largely uninhabitable wetland. The overflow floodplain in field A and to the north of the site caused a continuous problem for the installation of the road and keeping the land dry. For the purposes of this study, the present floodplain will be considered to be an uninhabitable and frequently flooded landscape, especially prior to 1671 and 1816 drainage (Wright 1982, 22 and 81).

4 Chronological interpretation

The main aim of the survey was to reconstruct the landscape at the time of the Viking overwintering in 872-3 AD, however the dating evidence and environmental data produced permit much more detailed insight into the evolution of the site since the start of the Holocene.

Coring and test pitting identified the wide range of sediments present across the site, and aided in mapping the previously unknown locations of each of the sediments. Soil formation features, and other post-depositional features in the sediments were identified, and the means of all changes in the sediments were analysed through observational or sedimentary analysis. The cores, test pits, and trenches also aided in the overall sampling, which allowed the various palaeoenvironmental techniques to take place.

Across the site, the mere presence or absence of different sediment types have indicated landscape changes- from standing water and lacustrine deposits, to mixed sand and peat deposits, to aeolian dunes. The sediment analysis has allowed for the detailed scrutiny of changes across aeolian sediments, thus demonstrating the directionality of deposition, potentially levels of soil formation within sand deposits, and base characteristics of each of the sediment types on the site. A vegetation reconstruction has provided information about the wider landscape and anthropogenic or natural changes. Radiocarbon dating of pollen-rich peat deposits provided a dated sequence of the vegetation changes.

OSL and portable OSL data added another dimension to the analysis of the site at Torksey. Although OSL dating has been used successfully on the Lincolnshire coversands in archaeological contexts, and on Trent Valley terrace sequences (McIlwaine and McDonnell 2006; Schwenninger *et al*. 2007), it is often excluded from the consideration of late Holocene archaeology. In this research at Torksey, however, OSL has provided important information about the dates of deposition and redeposition of this fringing member of the Lincolnshire coversand deposit, including evidence of a large-scale environmental change during years around the Viking overwintering at Torksey. Portable OSL has also added another dimension to OSL data, allowing the dissection of each dune, and indicating multiple phases of deposition within some dunes, and singular deposition within others. The OSL dating has also proven that the sands covering the site at Torksey, while some are part of glacial sand and gravel deposits, a large proportion of the aggregates are redeposited in the Holocene.

This section will temporally contextualise the analyses of each of the sediment deposits encountered on the site and described above, mainly using the available OSL and radiocarbon dating information, but also extrapolating based on pre-existing data, topography, and established climatic timelines.

Period	Environment	Sediment changes	Pollen	Peat radiocarbon dates	Aeolian luminescence dates
Pre-early/mid Holocene	Formation of terrace deposits; River Trent is a large braided channel, forming many small sand and gravel islands; Torksey is occasionally under water, but also forms a gravel island due to underlying Mercia Mudstone. Strong winds begin to winnow out and separate Lincolnshire Coversands, forming aeolian dunes across Torksey	Deposition of HPSG Initial deposition of aeolian deposits Aeolian redeposition			SHFD12107:109,178±6270 BC SHFD13081: 8798±670 BC SHFD12108: 5458±500 BC
Neolithic	Tree cover, with low wetland shrubs. Occasional strong winds create episodes of aeolian shift on the site. The area to the east of site is a freeflowing channel, a palaeochannel of the Trent.	Aeolian redeposition			SHFD12109: 3018±360 BC
Bronze Age	Channel to the east begins to silt up with peat, possibly due to increased agriculture upstream. The channel is slow moving at first, then completely silts up with peat.	Peat begins accumulating	Zone Ia- Local trees and shrubs. Regional trees, including pine forest.	BETA317584: 1366±39 BC UBA21481: 965±42 BC	
Iron Age/Romano-British	The channel continues to silt up, and the land on the site is slowly deforested throughout the Iron Age. Swift deforestation occurs with the influx of Roman populations. Agricultural soils accumulate, and there is some minor aeolian redeposition	Peat continues accumulating Aeolian redeposition	Zone Ib- trees and shrubs, but a notable woodland decline Zone II- Herbs, grasses, possible agriculture	UBA21480: 463±55 BC UBA21479: 204±46 AD	SHFD13080: 128±440 BC
Early Medieval	Cleared landscape, surrounded by wetland. Any remaining tree or scrub cover that was allowed to grow on or around the site was cleared during the Viking overwintering. The site is naturally fortified by wetland and the River Trent.	Widespread aeolian redeposition	Cleared landscape		SHFD12106: 982±60 AD
Medieval	The present floodplain establishes itself, and the landscape stabilises into agricultural land. Wetlands remain marshy, but begin to dry out with a warmer climate and installation of land drains. Aeolian deposits drift, but nothing large scale.	Alluvium deposition			
Post-medieval-present	Stabilisation into present landscape. Mother drain is installed. Peat dries out, birch forest grows, but the site remains under the plough.	Alluvium deposition Drainage channels/pump houses built.			

Figure 5.43: Summary of environmental changes across the site

Figure 5.44: Placement and summary of all aeolian deposits (yellow) presently on site. A) Aeolian deposit dated to post-Bronze Age, since it fills in previous wetlands. The elevation is currently below the level of the peat across the golf course, which stopped forming in the Roman period, so this sand may date to the Bronze-Iron Age. This area also has an unmapped cropmark on this location, likely medieval in date, which filled in with organic sediments, or topsoils in the post-medieval period. B) A dip between two aeolian dunes indicates a previous drainage channel on the Brampton-Torksey parish line; later analyses demonstrate that this break is associated with the 'Burghdyke'. The original formation of these aeolian dunes predates the current floodplain, since they are currently being eroded from the west. The bottom unit of these dunes dated to 8,800 BC, with the top unit to the late Iron Age. C) A potentially altered aeolian deposit, or constructed berm or trackway, leading to both the site and to BHW and eventually Brampton. Undated. D) BHW, a relatively undisturbed aeolian dune in the middle of an established peat bog. Low banks of sand within the peat deposit create a division within the peat, and may also host a trackway to Brampton.

4.1 Pre-Holocene

The Triassic Mercia Mudstone is the bedrock across the entire site, but presently only appears on the crest of the site, where it is actively being eroded by the Trent. The Branscombe Formation of the bedrock is very soft, especially when wet, so it often mixes with overlying sediments, or creates a thick, silty topsoil. The Blue Anchor formation is not exposed on the surface across the site, but is does overlie the Branscombe Formation across much of the site. It is primarily the mudstone that creates the high rise of the site, however the plethora of Holocene deposits on the site create a much different topography from the natural bedrock surface.

It is not clear what the original shape of the MM island would have been at the start of the Holocene, because the River Trent in its past and present forms has eroded the area of higher ground to its present shape. It is possible that the island was slightly larger during the early Holocene, particularly on the west side, due to its near vertical slope that has been highly susceptible to erosion.

Inter-glacial deposits were deposited on the site approximately 111,000 kya. The site may have acted as part of a braided channel formation during this inter-glacial, as well as the post-glacial period at the end of the Pleistocene, with gravels and subsequent aeolian sand left behind on the site, forming the dune that covers fields B and C. Though mainly covered by later glacial and aeolian sands, earlier glacial formations were logged elsewhere nearby in the 1975 mineral resource assessment (Price 1975). Despite the early formation of the dune, later redeposition has altered its formation, and moved the sand across other parts of the site.

The terrace deposits across the site are attributed to the Younger Dryas and the formation of the Holme-Pierrepont Sand and Gravel member. These deposits range in characterisation throughout the Trent Valley, and those at Torksey are no different. White sand and gravel is common across the site and under aeolian dunes. Large cobbles are also spread out across the site, sometimes mixed with redeposited Branscombe and Blue Anchor mudstones. The HPSG deposits are very poorly sorted, standing out from the later sorted sand deposits.

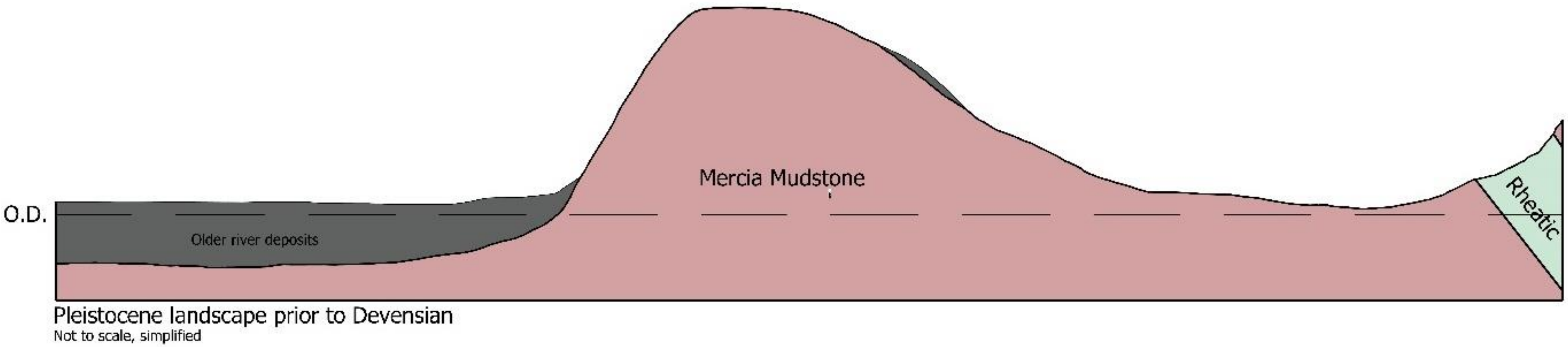
4.2 Early Holocene

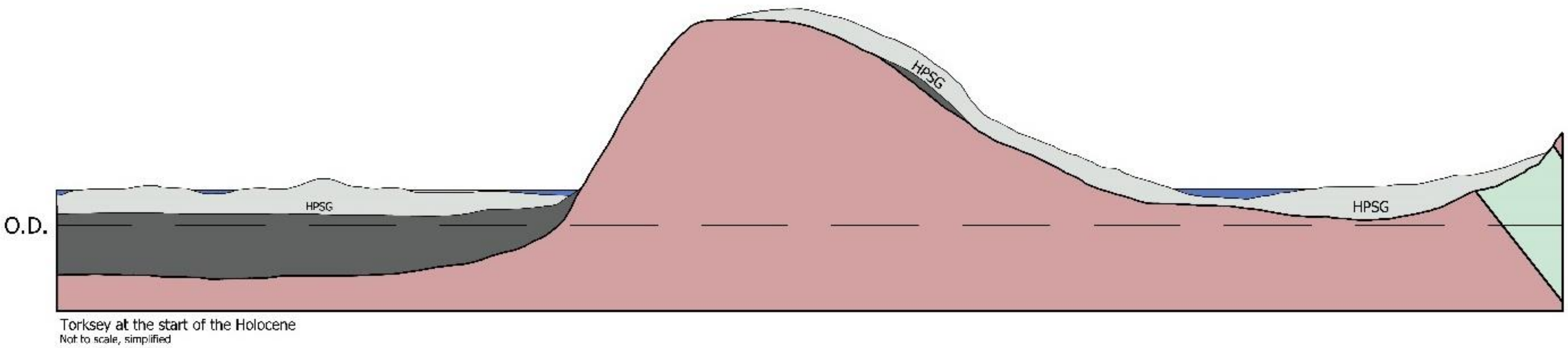
After the deposition of the HPSG in a post-glacial Trent Valley, the landscape was left with very little vegetation (Howard *et al*. 2007; Bateman 1998). This allowed for high velocity winds to winnow out aeolian sand deposits (average particle size 1.88Φ; Bateman 1995; 1998). The aeolian deposits across the site are part of the Lincolnshire Coversands, which are dotted across much of North Lincs. and Notts. The dunes in field G are dated to this initial aeolian deposition, at 10,800 kya, the very end of the Pleistocene, and the very start of the Holocene. This deposit represents the original deposition of terrace sands, but the sand continued to be reactivated as an aeolian deposit throughout the Holocene.

To the east of the site, a free-flowing channel, a primary or secondary channel (now palaeochannel) of the Trent, surrounded the site. The channel was probably fed by either an inlet south of field G, a channel that also ran east of the island that houses the present settlement at Torksey, or a combination of both. This channel, possibly once a main channel of the Trent, or possibly a divergent course flowing parallel with another channel, deposited a coarse, fluvial sand with clay matrix throughout the low-lying wetlands. The sand (mean particle size 2.39Φ), was much smaller than the aeolian sands that blanketed the high ground of the winter camp site.

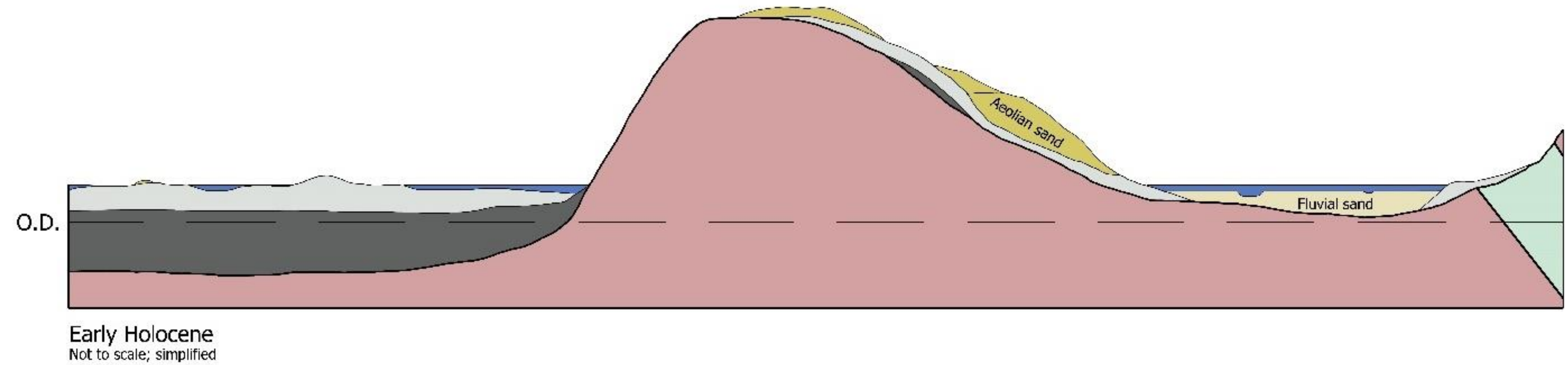
In the Mesolithic, aeolian sands began to be redeposited across the winter camp site, with OSL dates at 7470±500 BP on a quite unstable dune. The thin layers of aeolian sand between organic silt surfaces in 2012 TP2 show an alternation between flooded landscapes, and dry, windy climates in the Neolithic. In the Neolithic, a silty-sand deposit dates to 5030±360BP, demonstrating that either agriculture, or the development of stable soils in a possibly wooded environment began to take place on the site. Redeposition of the Lincolnshire coversands in the Mesolithic and Neolithic periods was a common occurrence, and has been detected elsewhere across Lincs. and Notts. in several other studies (e.g. Tiln, Girton, and Farndon).

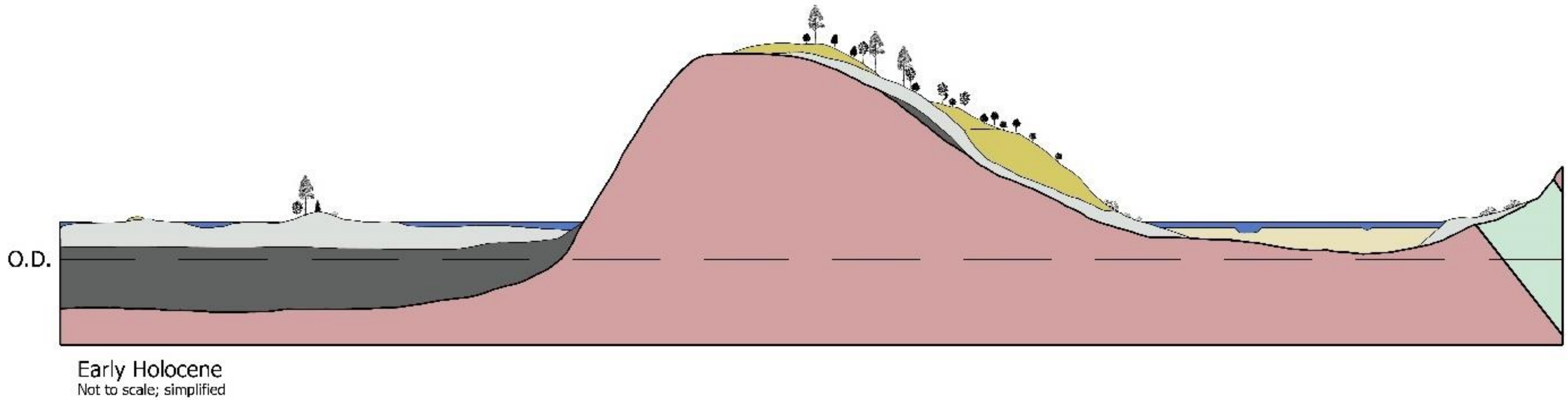
These schematics show the landscape and the accumulation of drift deposits throughout the Holocene. Each colour represents a different unit, and will only be labelled once, when it first appears in the landscape.





Figures 5.45 and 5.46: Schematics of the Pre-Holocene geological landscape of the study area





Figures 5.47 and 5.48: Schematics of the early Holocene geological landscape of the study area

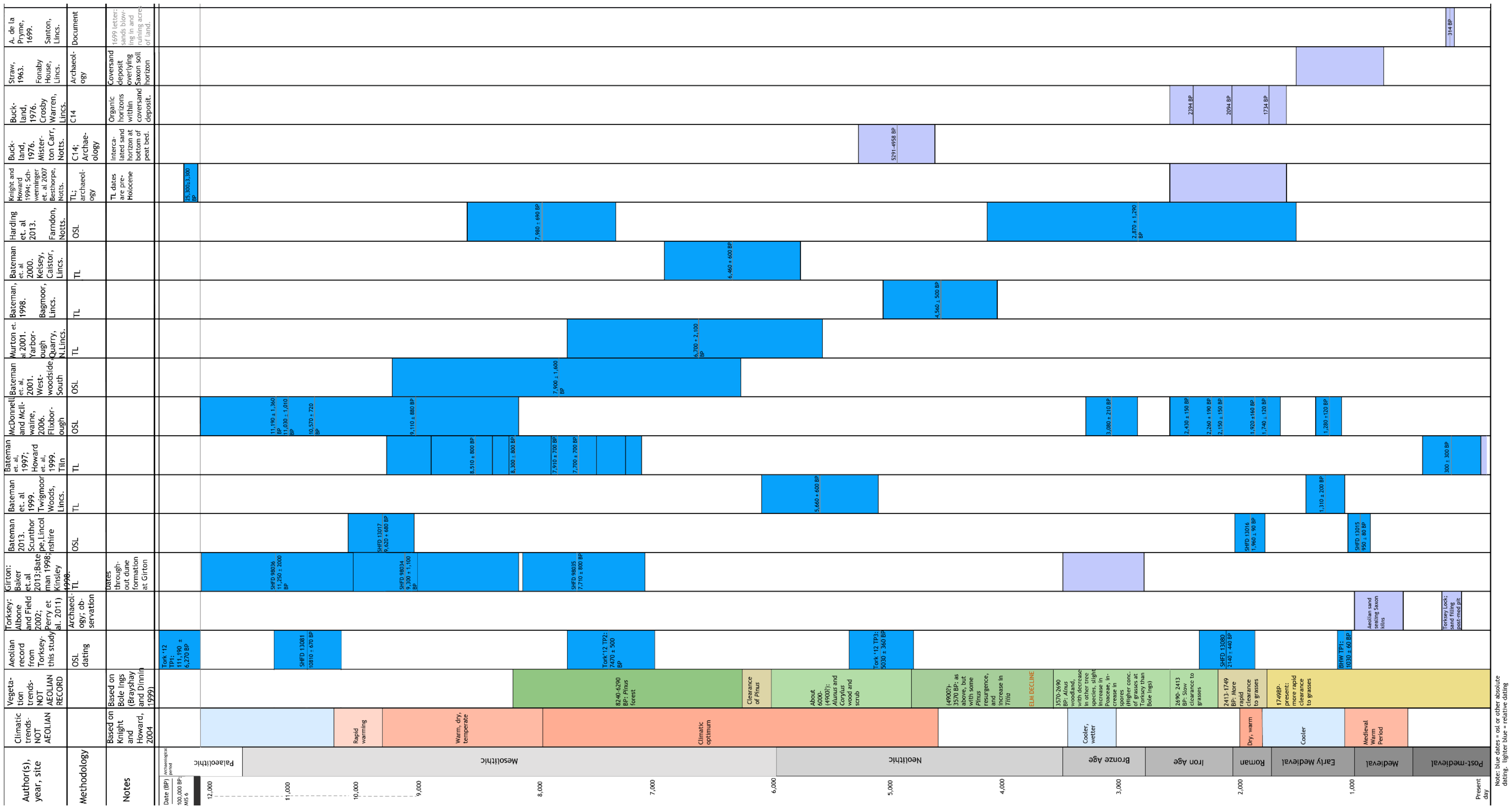


Figure 5.49: Timeline of all recorded aeolian reactivation phases of the Lincolnshire coversands. Darker blue are absolute dating examples plus error; light blue are relative dating examples.

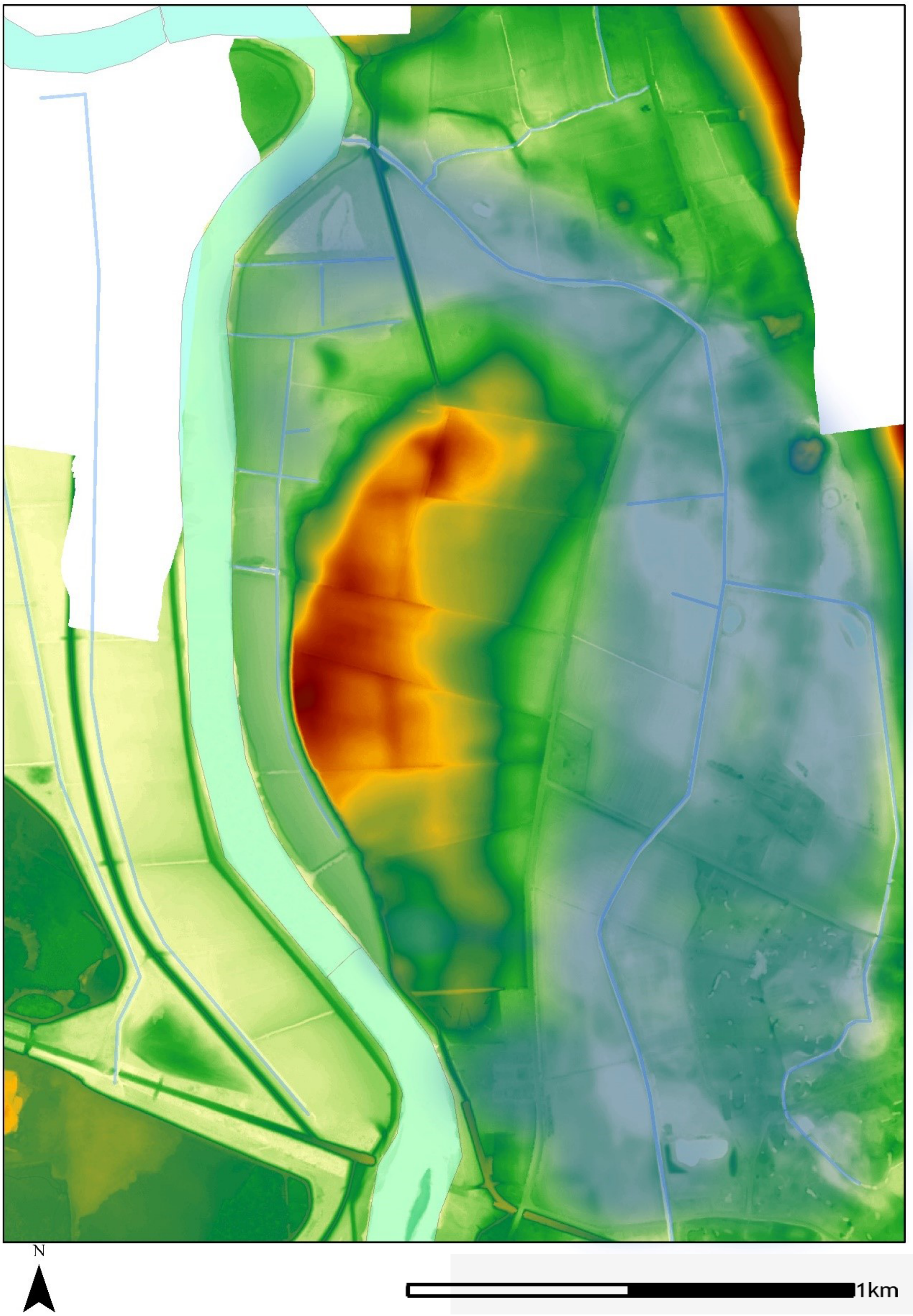


Figure 5.50: Map of the locations of all potential wetlands around Torksey outside of the present Trent Valley. All of the land highlighted in blue was either occupied by a fluvial channel or wetlands. A fluvial channel, part of the Trent Valley system, occupied the space between the Late Devensian/Early Holocene, and once the channel was blocked south of the settlement of Torksey and the space south the site, the low elevation area hosted a wetland with peat accumulation. North of the site, continuous flooding of the Trent occupied the space with standing water. This map has a wider overall coverage of wetland, as this is prior to the accumulation of many peat, alluvium, and sand deposits, so elevations levels around the site would have been up to 1.5 metres lower than present.

4.3 Bronze Age

At about 3316±39 cal BP, water flow in the channel east of the site was drastically reduced. The sediment sequence demonstrates that a trickle of water still accessed the area, creating a mixing of fluvial sand and peat development in the bottom centimetres of the deposit. The reasons for the cut off of water supply could be the result of several environmental changes, or a combination of them: 1) Increased clearance from upstream caused an upswing in sediment output, and alluviation blocked the access of this channel from the main channel west of the MM outcrop; 2) aeolian sand build-up south of the site/Torksey filled in the access channels, creating a barrier between the channel and the Trent; 3). The channel on the floodplain moved, and this channel slowly died out; 4) the area south of present Torksey (now the location of the Foss Dyke), once a lacustrine and alluvial environment (Wood 2006, 3; figure 5.51), became completely silted up, or was filled with aeolian sand, restricting access to the channel.

Figure 5.51: Alluvial silt and (lacustrine?) clay, underlying aeolian sand redeposited in the Roman or Anglo-Saxon. Section recorded just south of the present Foss Dyke Canal (Woods 2006).

Instead of the fluvial channel, a peat deposit began to accumulate. The peat that began in the Late Bronze Age also initiated a pollen sequence accumulation, recording a local and regional vegetation sequence. The local pollen assemblage zone dated to the Late Bronze Age (LPAZ Ia) indicates a deciduous woodland with Alder and Oak. In addition to the local woodland, species that can adapt to wetland environments, including Hazel, would have lined the waterlogged peat and Trent Valley. The sequence also detects pollen of pine forests in the distance.

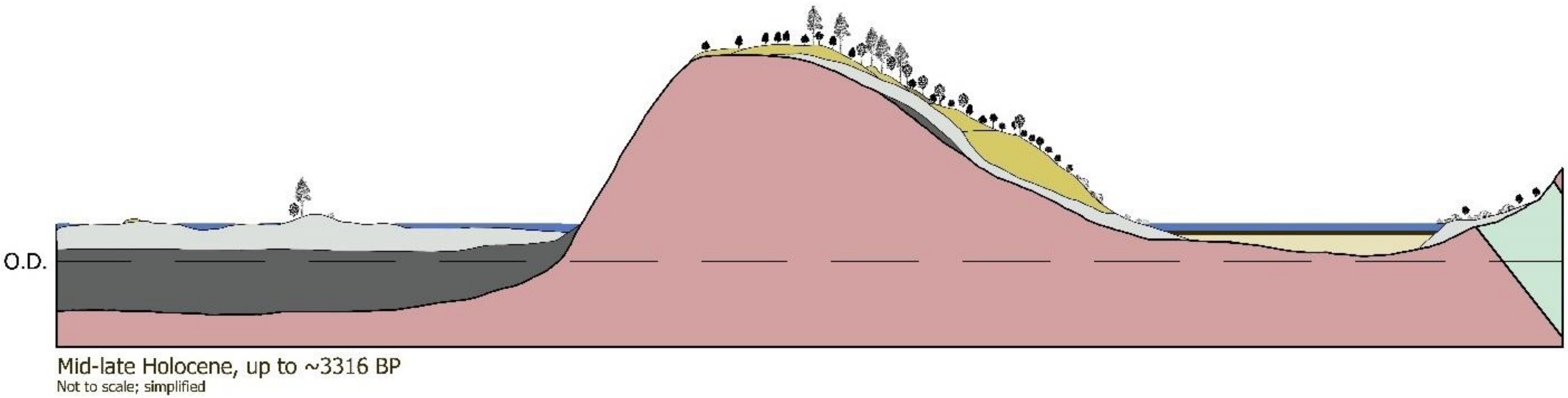


Figure 5.52: Schematic of the mid to late Holocene geological landscape of the study area

4.4 Iron Age

In the Iron Age, the peat continues to accumulate, and eventually the trickle of moving water ceases, and there is no more mixing of sand and peat, only organic silt. The pollen sequence (LPAZ Ib) also indicates that the woodland is slowly being cleared, and replaced by grasses. The slow clearance is the result of encroaching agricultural practices and the establishment of Iron Age farmsteads.

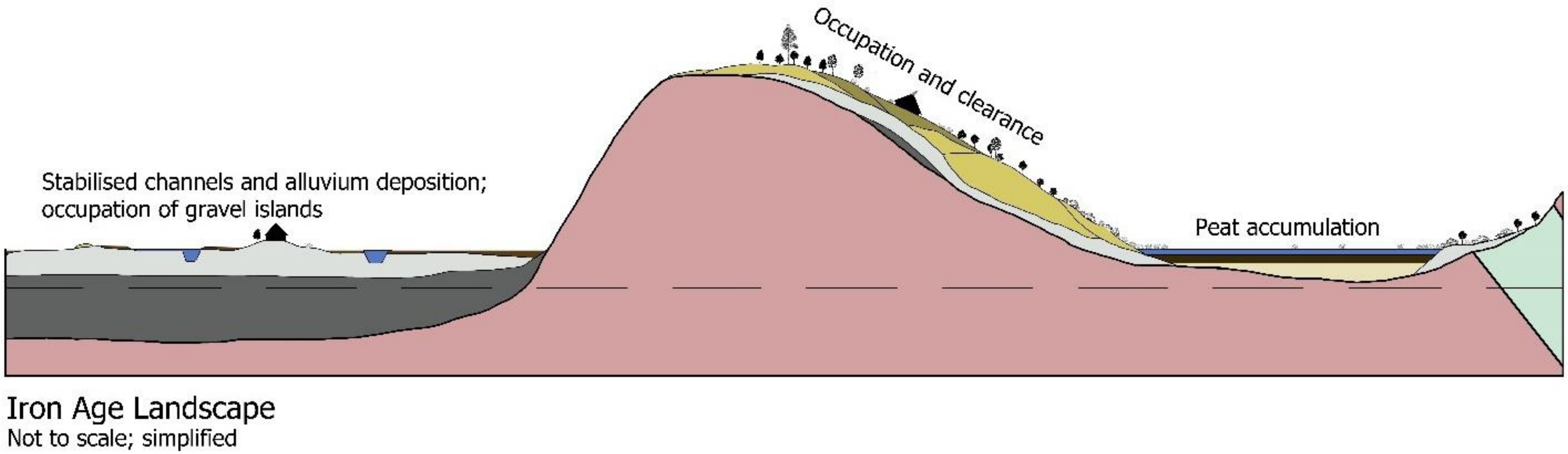
An additional silty sand deposit dates to the Iron Age to the south of the site, just overlying an early Holocene aeolian deposit. The silty sand, indicative of a stable cleared environment, continues to develop into the present day.

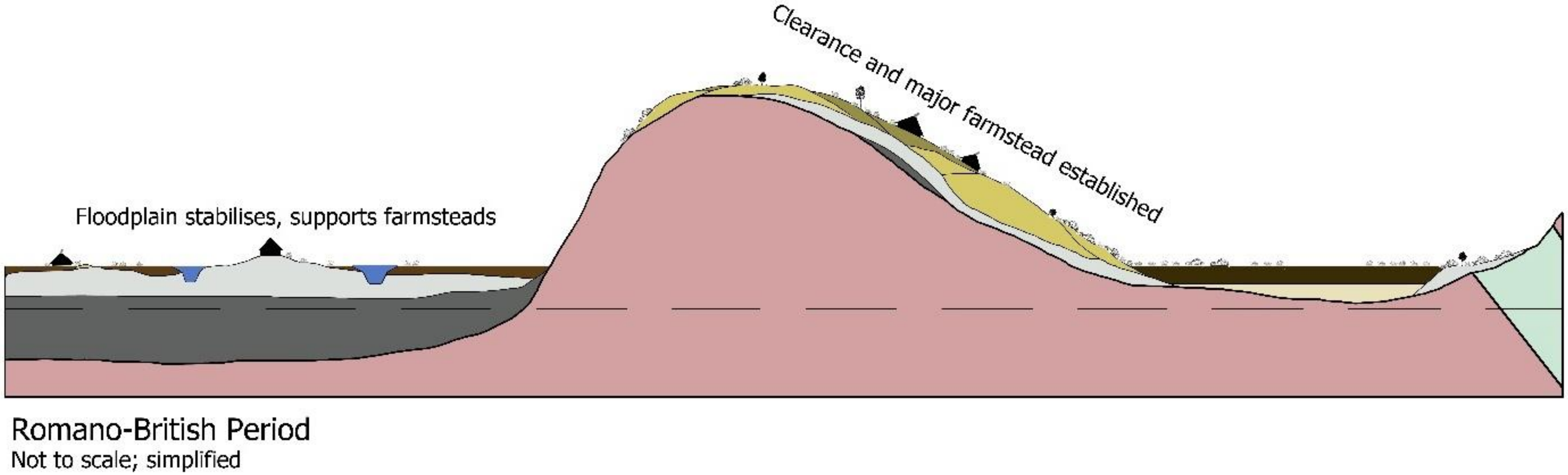
4.5 Romano-British

Warmer, drier temperatures are recorded throughout Britain from the Iron Age to the Romano-British period (Brayshay and Dinnin 1999). The success of the agricultural communities at and around Torksey demonstrate that the Lower Trent Valley benefitted greatly from the improving climate.

The continued accumulation of peat and pollen sequence show that the slow initiation of vegetation clearance in the Iron Age is greatly accelerated in the Romano-British period (LPAZ II). Despite the clearance of the woodland vegetation in favour of grasses and herbs (and continued wetland species lining the peat deposit and Trent Valley), there has not been any indication of redeposited aeolian sands. This could be due to simply not sampling an area with aeolian deposits, however it may also correspond to a less windy environment in a warmer drier climate.

The Romano-British period also saw the installation of a farmstead in field C, as detected by the geophysical survey (Brown 2012). The settlement location may have roots in the Iron Age, as farmsteads were established throughout the Trent Valley throughout the Iron Age (Knight and Howard 2004), but the settlement detected by magnetometry morphologically matches the rectangular enclosures introduced by Roman populations. This farmstead is located directly on an HPSG deposit, so it was not obscured by later aeolian deposits, or dug within sand and then filled back in with later sand, rendering it invisible to a magnetometer. The establishment of the large farmstead in the Roman period closely corresponds to the pollen sequence demonstrating quick local clearance.





Figures 5.53 and 5.54: Schematics of the Iron Age and Romano-British geological landscape in the study area

4.6 Early medieval

The landscape in the early medieval period, and at the time of the Viking overwintering, would have been dominated by expansive wetlands and tidal flooding zones delimiting the winter camp site as an island. Disappointingly, insight into the vegetation cover in the landscape is cut short at the end of the Roman period. The peat was still accumulating well into the early medieval and medieval periods, with 40-50 cm of organic silt accumulating in the post-Roman period. However, the Inclosure drain was installed in the early post-medieval period and the pump house at Marton in the 19th century, and as a result, the peat was dried out, and ploughing destroyed the pollen sequence and decimated any surviving pollen grains. Although there is no complete record of vegetation, there is no reason to believe that the cleared environment of the Roman and immediately post-Roman period changed in the early medieval period. With the more extensive wetlands, part of the island area may have receded into wetlands, leaving a smaller area for cultivation and grazing clearance. It is probable that the winter camp site remained mostly cleared, with continued occupation of the Romano-British farmstead on the site, although it is possible that the farmstead was not permanently occupied due to the isolation of the site.

The continued accumulation of the (now dry) peat indicates that the area continued as a wetland throughout the early medieval period. A rise in water level at the end of the Roman period is documented in climate sequences (Dark 2000; Knight and Howard 2004), and is also evidenced within the large study area of this thesis (see chapter 6). The higher water level would have isolated the island even more than it had been in the Roman period (figure 5.55). The peat bog would have been fully saturated year-round, and the bog may have reached past its present borders and extended west onto the higher level of the site. The area to the north of the site would have continued to be susceptible to the tidal influx of the lower Trent. Coring around the flooding area to the north of the site demonstrates that the clays overlie an aeolian deposit. Though there have been no archaeological remains found, the area north of the site would have created a natural port, with a sloping bank to the island camp site, and a tidal inlet sheltered from the moving waters of the Trent. Tidal waters may have also extended into the fields south of the site, separating the island completely from the early medieval settlement of Torksey.

Overall, the site would not have been accessible throughout much of the year in the early medieval period, since all surrounding grounds would have been covered in peat, marshland, or alluvial mud flats; the construction of temporary or permanent causeways would have been the only means of accessing the site. The site may have also been accessed in very cold winter months when the ground was completely frozen. There were no causeways found that solidly date to the early medieval period, but the sand bank that stretches between Marton and the island site creates an ideal dry causeway connection between the two sites, in addition to making an effective berm to keep the water of the Trent from spreading inland. The artificial augmentation or creation of the bank may date to the medieval or post-medieval periods, but the formation of a natural sand causeway may have existed at this location as early as the early medieval period.

Aeolian sand redeposition is also detected in the early medieval period. Reactivation may have been spurred by colder climate and higher wind speeds, or by an increased amount of clearance. The OSL dating of the dune at Bunker's Hill Warren to 980±60 dates this feature to only 100 years after the Viking occupation of Torksey. The reactivation may have been encouraged by the swift clearance of any extant vegetation by the Vikings on the site. Aeolian sand across the settlement at Torksey also dates to the 10th century by archaeological remains; this reactivation phase may be the same reactivation that formed BHW.

LiDAR data around the dune at BHW has also detected a stretch of higher ground in the middle of the peat bog. Although this area was not within the study area, and no cores were taken across this low bank, the formation appears to coincide with the dune formations at BHW, and may have been deposited over the peat bog in the early medieval period. This area of higher ground leads from Marton to the medieval settlement of Brampton. This deposit is not securely identified or dated, however the shifting of aeolian sands in the early medieval period may have allowed for increased movement across the landscape, and the foundation of a settlement at Brampton.

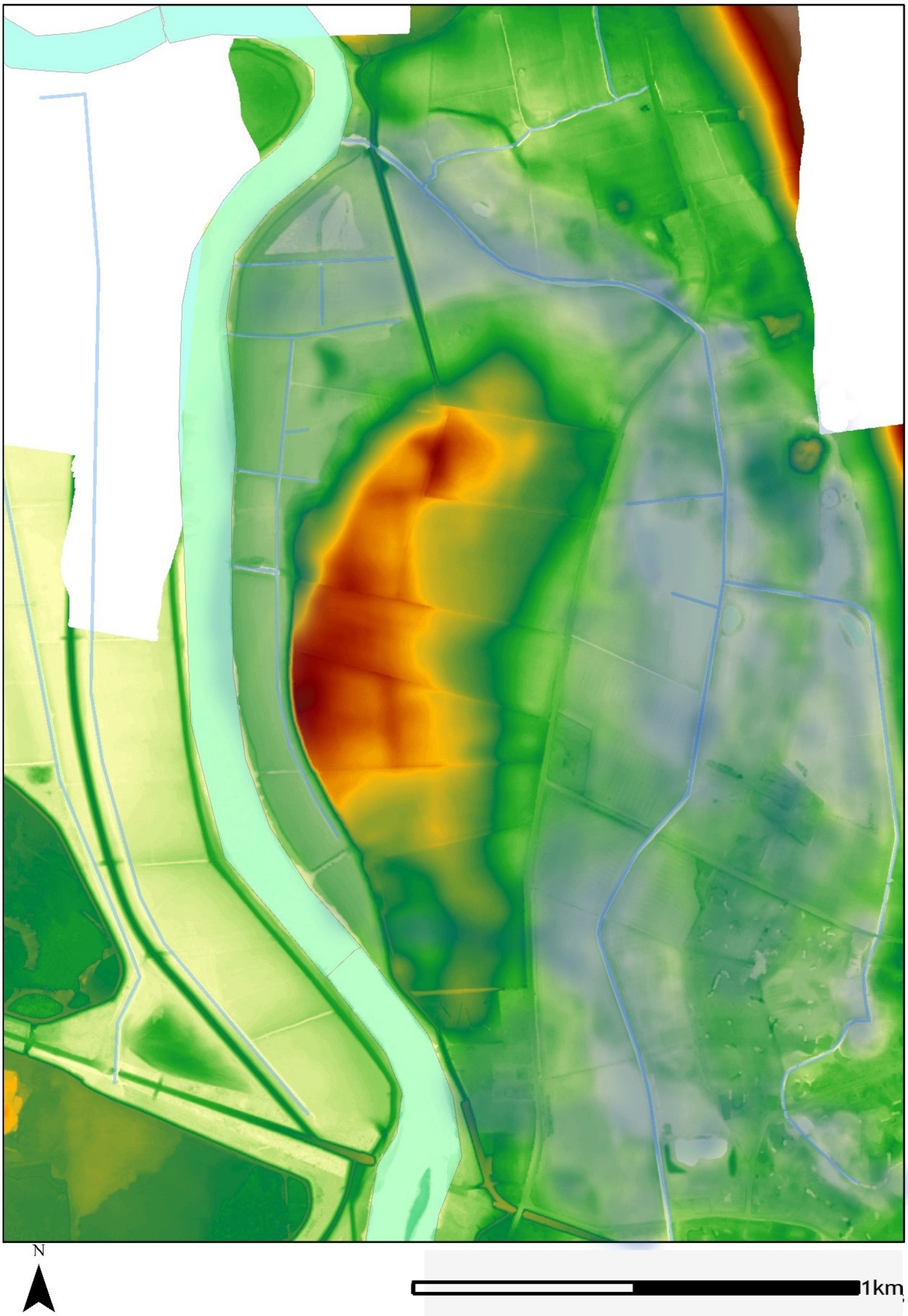


Figure 5.55: Sand accumulation to the south of the site prevents access from the Trent to the wetlands. This map shows the potential expanse of wetlands at the time of the Viking Winter Camp. With a higher water level, the areas surrounding the site, as well as the depression in field G would have been constantly wet, creating a protective barrier around the site.

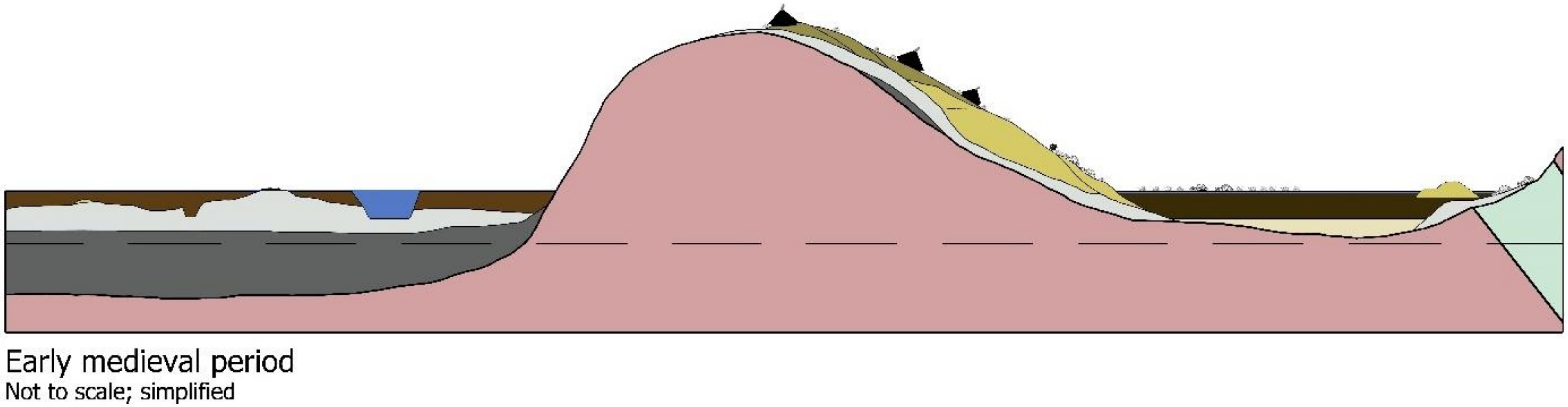


Figure 5.56: Schematic of the early medieval geological landscape of the study area

4.7 Medieval

From the medieval period through the present day, there were no large-scale deposition of sediments as in previous periods. Mapping evidence in combination with LiDAR allows for a more detailed view of the previous landscape. In this period, map regression and geophysical survey add to the reconstruction.

There is still no indication of vegetation in the medieval period, though the establishment of the later medieval town of Torksey and nearby nucleated villages, the formation of royal estates, and the expansive ridge and furrow through the study area, confirms that management of the landscape was intensifying in the medieval period. This population intensification was no doubt aided by a recession of water level and warmer climates recorded in the 12th century (Dark 2000). This improvement of climate also meant that parts of the floodplain were available for grazing throughout parts of the year, increasing the amount of management required across the landscape. The island site would have subsequently been parcelled into open field systems and used as agricultural or grazing land, despite the poor soils on the site.

The cleared landscape of the medieval period probably extends to the winter camp site. Prior to the installation of drainage, the island site would have remained separate from the established town at Torksey, and from the settlement at Brampton, but occupation on the site probably continued as it had done prior to the Viking incursion: a single farmstead that utilised any available dry land. The orientation of the post-medieval field system as recorded on the 1st edition OS map follows the lines of the Iron Age/Romano-British settlement detected on the geophysics. Throughout the Trent Valley, reuse of earlier field and enclosure boundaires as medieval field boundaries is common (D. Knight, *pers. comm.*), and it is not impossible that the Roman enclosure had continued presence throughout the medieval period, and that present field boundaries mirror this enclosure.

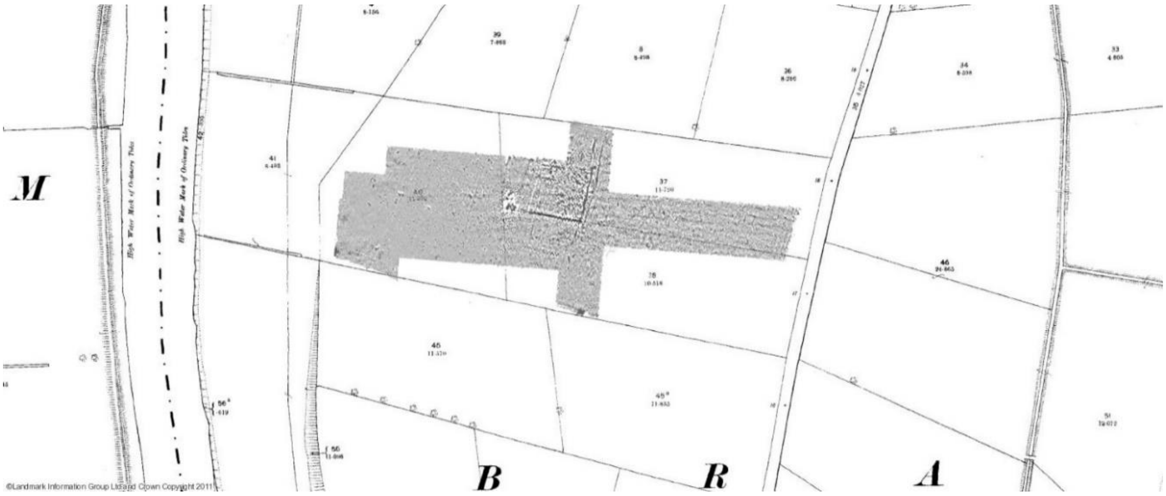


Figure 5.57: 1880s OS map with geophysical survey overlay. The south boundary of the Romano-British enclosure follows the line of the 1880s field boundary. Continuation of the western boundary of the Roman enclosure joins with the field boundary to the north. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

The excavation of drainage channels in the late medieval period initiated the development of the modern landscape. Though the first excavation of drainage channels is not recorded, a drain that followed the line of the Inclosure Drain was possibly excavated in the later medieval period, at the same time as the establishment of parish boundaries (chapter 6). Though parish boundaries throughout the surrounding area are largely based on drainage and palaeochannel systems (chapter 6), at the island site, the parish boundaries to the north and south of the site no longer have extant drainage but rather follow lines of abandoned drainage. These are visible in the (not to scale) 1824 county map (figure 5.58); the topography of the LiDAR highlights that the location of these drains falls directly on the parish boundaries (figure 5.59).

Though a later installation of the drain was placed south of the parish boundary figure 5.58), an earlier drainage ditch within field G and along the boundary was detected by satellite imagery, and faintly by the geophysical survey (figures 5.60 and 5.61). The drainage north of the site appears with more clarity on the geophysical survey and the LiDAR. The drainage along the north side of the site also follows the line of the parish boundary, and would have been active until the 19th century pump house was installed. These early drains would have been helpful in draining the lands around Torksey, but without the engineering applied in the 19th century and effective berms, the low grounds would still have been susceptible to frequent flooding.

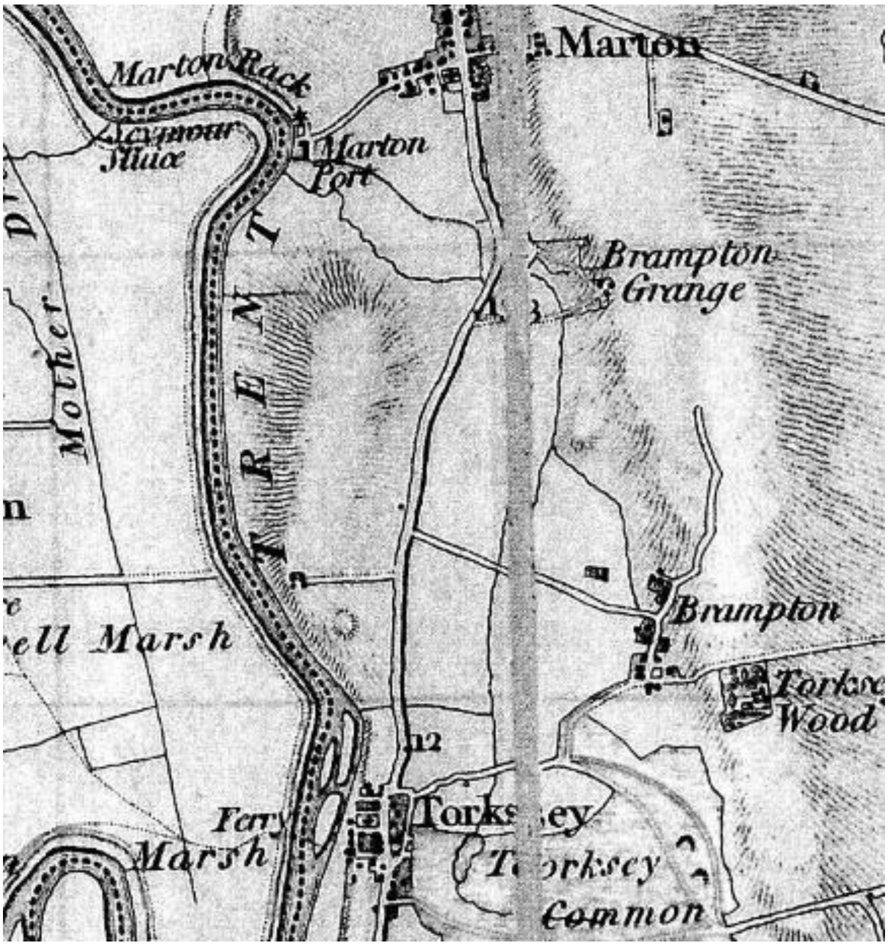


Figure 5.58: 1824 county map, showing drainage channels in the post-medieval period. The main channel has shifted further west in the present day, and the channel connecting the Inclosure drain with the floodplain has been abandoned.

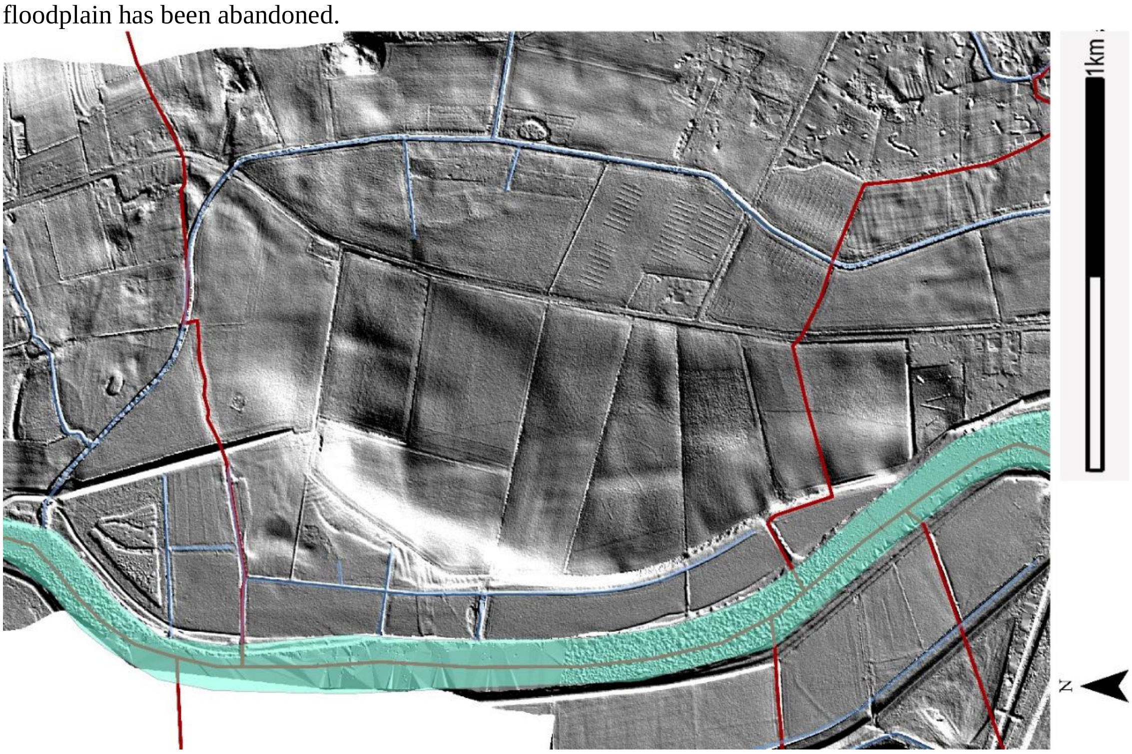


Figure 5.59: LiDAR data, with parish boundaries outlined in red. Although neither drainage ditch still follows the lines of the parish boundaries, previous ditches did follow these lines in the medieval or early post-medieval periods.

Figure 5.60: Google satellite imagery showing the line of the abandoned drainage channel along the Brampton-Torksey parish boundary (©Google Maps 2014).

Figure 5.61: Geophysics from field G, showing a very faint line that represents what was once a previous drainage channel that once delimited Brampton and Torksey. Despite being a major feature in the landscape at one time, this feature barely appears on the geophysical survey, demonstrating how poorly the archaeological features show up when they are buried under any depth of sand. The eastern half of the field does not have any sand, while the western half is covered, and this is clearly visible in the change in quality of results across the field (Brown 2012).

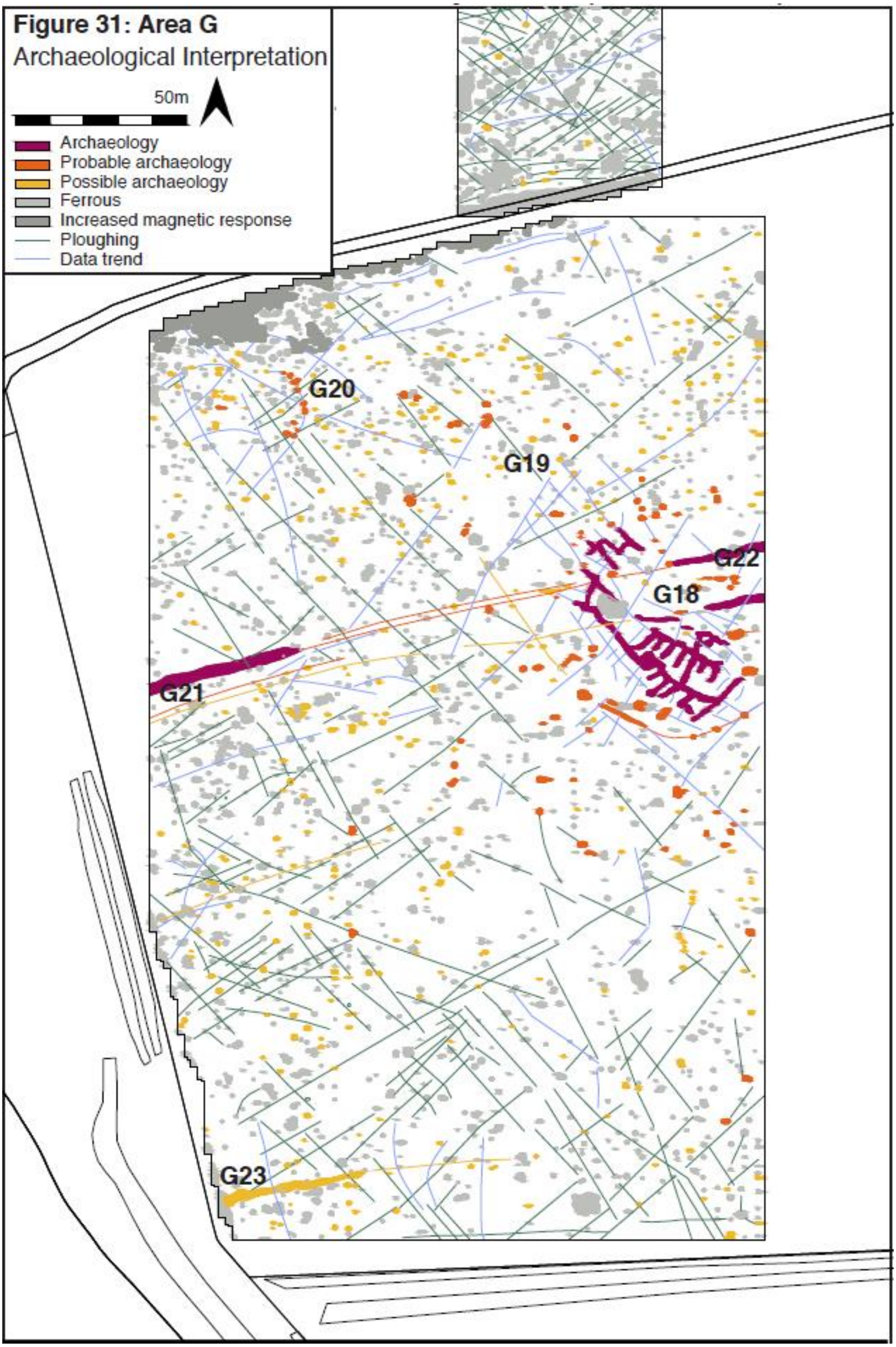


Figure 5.62: Interpretation of geophysical survey in field G. Archaeological features around the drainage channel may be related to a causeway between Torksey and the winter camp site (Brown 2012).

The results of the magnetometer survey of field A shows a remarkable contrast between alluvial and aeolian drift geology. Archaeological features appear with blatant contrast on the organic clays, but as soon as the geology shifts to sand, any hint of archaeological features disappear. This phenomenon occurrs across the entire site, with aeolian sands masking any archaeological features that may be present. The diagenic nature of quartz sand gives off zero magnetic signal, leaving the magnetometer to pick up only features that are near, or on, the surface. Coring determined that much of field C was not covered in aeolian deposits, corresponding with the appearance of a rectilinear enclosure in field C. There is a large probability that there are many archaeological features on the winter camp site; however, ditches dug into sand, and later filled with sand, or covered by a meter of sand, are not likely to appear on a magnetic resistivity survey.

Figure 5.63: Geophysics in field A on satellite imagery (Brown 2012).

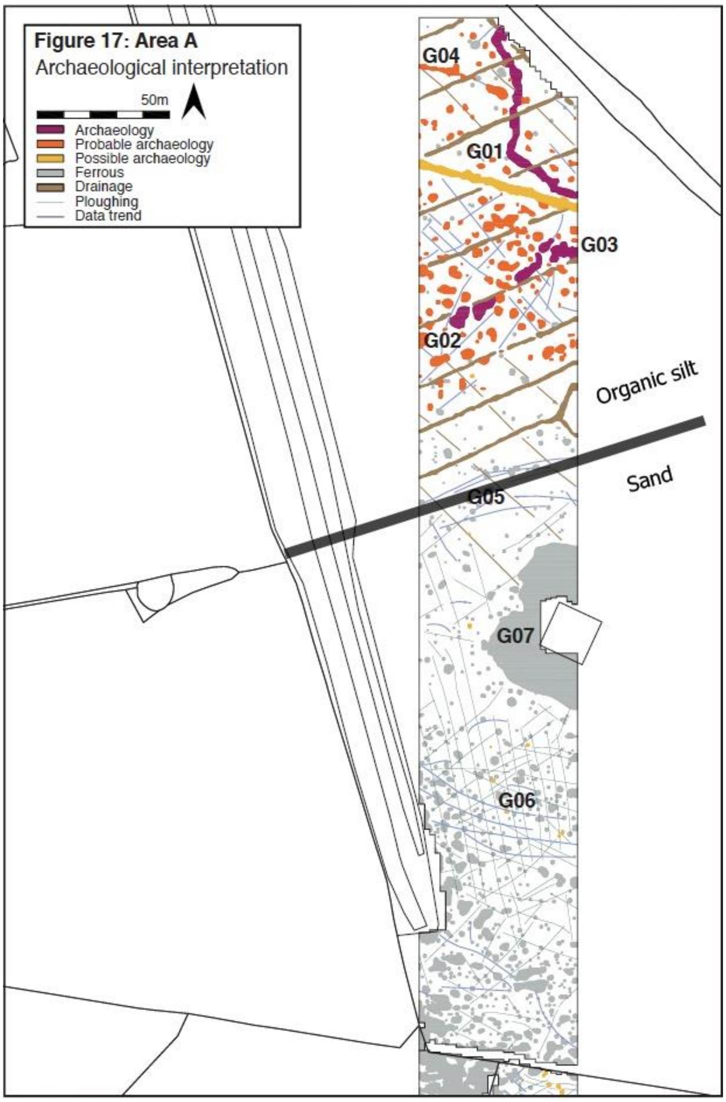


Figure 5.64: Geophysics in field A, showing the difference in results between alluvial silt and sand (Brown 2012).

It is not clear when the sand bank on the east side of field A, potentially hand-altered to create a causeway, was formed, but it creates a clear access point between Marton and the winter camp site. It is sharply cut by the 18th century drainage ditch, indicating alteration of the dune in the historical period, and it does not appear on early maps as a causeway. The feature is also cut at the location of the parish boundary, with may indicate that it was present prior to the formation of the parishes, or perhaps that later land management and ownership affected the feature differently. Whether this is the causeway that connected the island site to the surrounding dryland in the early medieval period remains unconfirmed; further excavation and OSL dating is required to determine its date of formation.

Aeolian drift continued within the settlement of Torksey south of the winter camp site, covering much of the early medieval settlement remains, and again covering later medieval archaeological remains. The settlement continued to thrive from the early to high medieval periods, and continued to use the advantageous location at the corner of the Foss and the Trent.

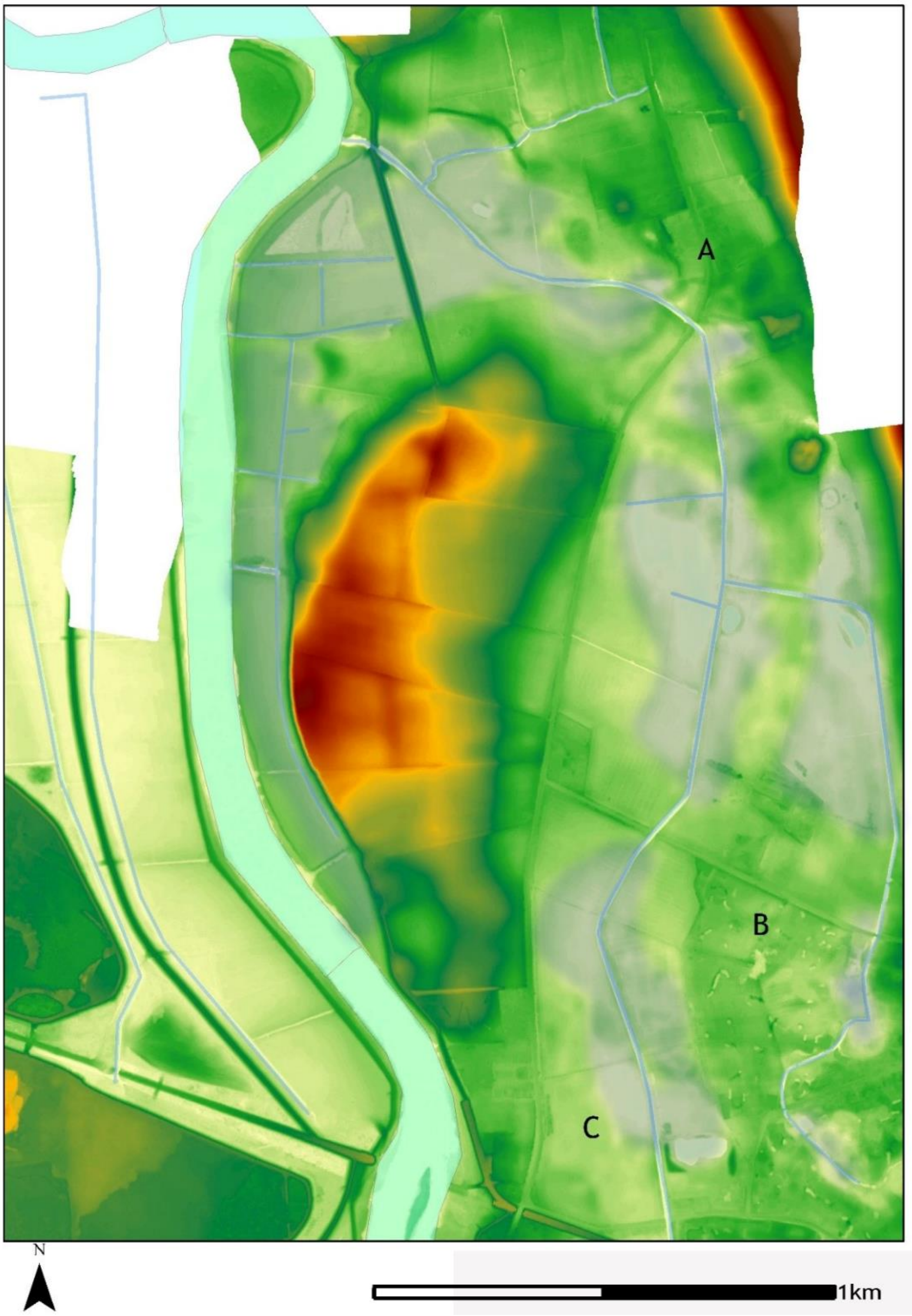


Figure 5.65: In the medieval and early post-medieval periods, especially the Medieval Warm Period, recession of water, the construction of some local drainage, accumulation of peat, and redistribution of aeolian sand means that the low-lying wetland receded slightly. However, occasional flooding, particularly the constant flooding throughout the Little Ice Age caused flooding similar to that of the early medieval period. Bunker's Hill Warren and low dunes are distributed throughout the middle of the marshland. A) The construction of this berm is undated, but it appears to have a double function as a causeway through the wetlands. B) The top-most peat at Torksey Golf Course dated to the Roman period (Johnson and Palmer-Brown 1997, 7). At the current elevation, this area may have also remained dry more consistently than the surrounding lowlands. C) An enclosure of possibly medieval date is dug into a Holocene aeolian deposit, and fills in with organic sediment (see cropmarks in appendix IX).

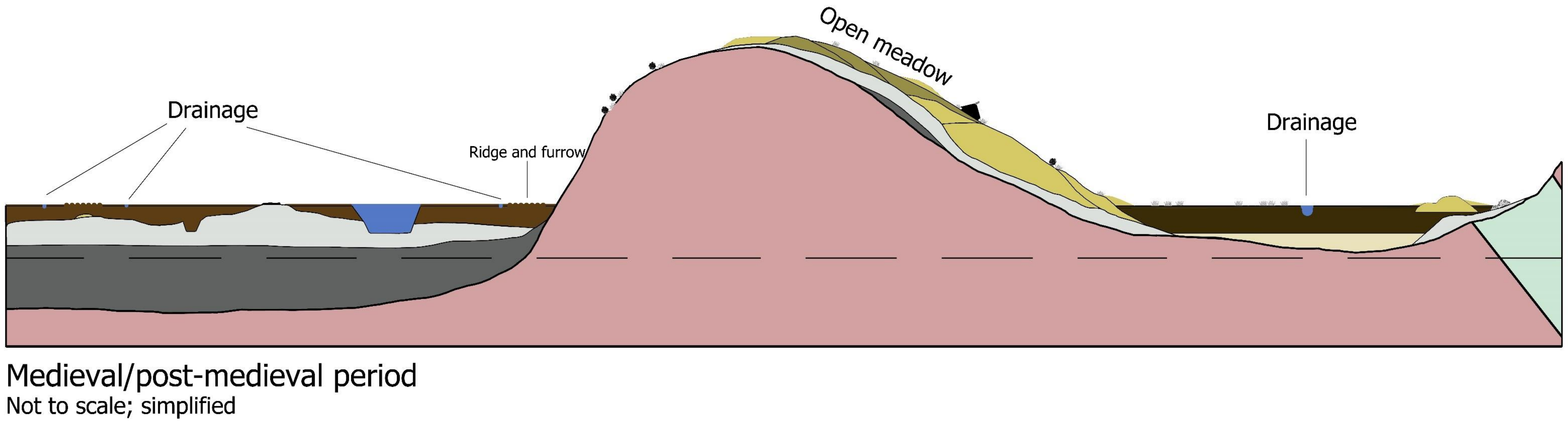


Figure 5.66: Schematic of the medieval/post-medieval geological landscape of the study area

4.8 Post-medieval

The excavation and improvement of the drainage channels in the medieval and post-medieval and modern periods are a response to both shifts in water levels, as well as an increase in alluviation across the floodplain. Despite warmer climates and a decrease in water level throughout the Medieval Warm Period (1000-1200 AD), the Little Ice Age (1500-1700 AD) brought another period of floods and high winds, reinstating the flooding that dominated the early medieval period. The drains were excavated/improved in the 17th century, and improved again in the 19th century, with the installation of the Torksey and Marton pump houses, to create a dry, predictable, and, most importantly, controllable landscape.

Linear drains carry water from the floodplain into the River Trent; where mudflats and wetlands were once difficult to traverse, the floodplain is now a regularly stable surface, staying dry throughout most of the year. Alluvium along the bank of the River Trent does continue to be an unstable and constantly moving deposit across the floodplain, changing with rapidity in periods of flooding, but overall, with the aid of drainage, the floodplain in the modern period remains a stable grazing and/or ploughed area during dry weather.

The River Trent is stabilised and managed, however has moved laterally very slightly over the past 200 years; where there were once three islands within the channel just south of the present railway, the Trent has shifted west, and two of the three islands have joined the mainland, though still as part of the uninhabited alluvial plain. While there is no concrete evidence that the channel west of the winter camp site has shifted laterally, some movement is highly likely.

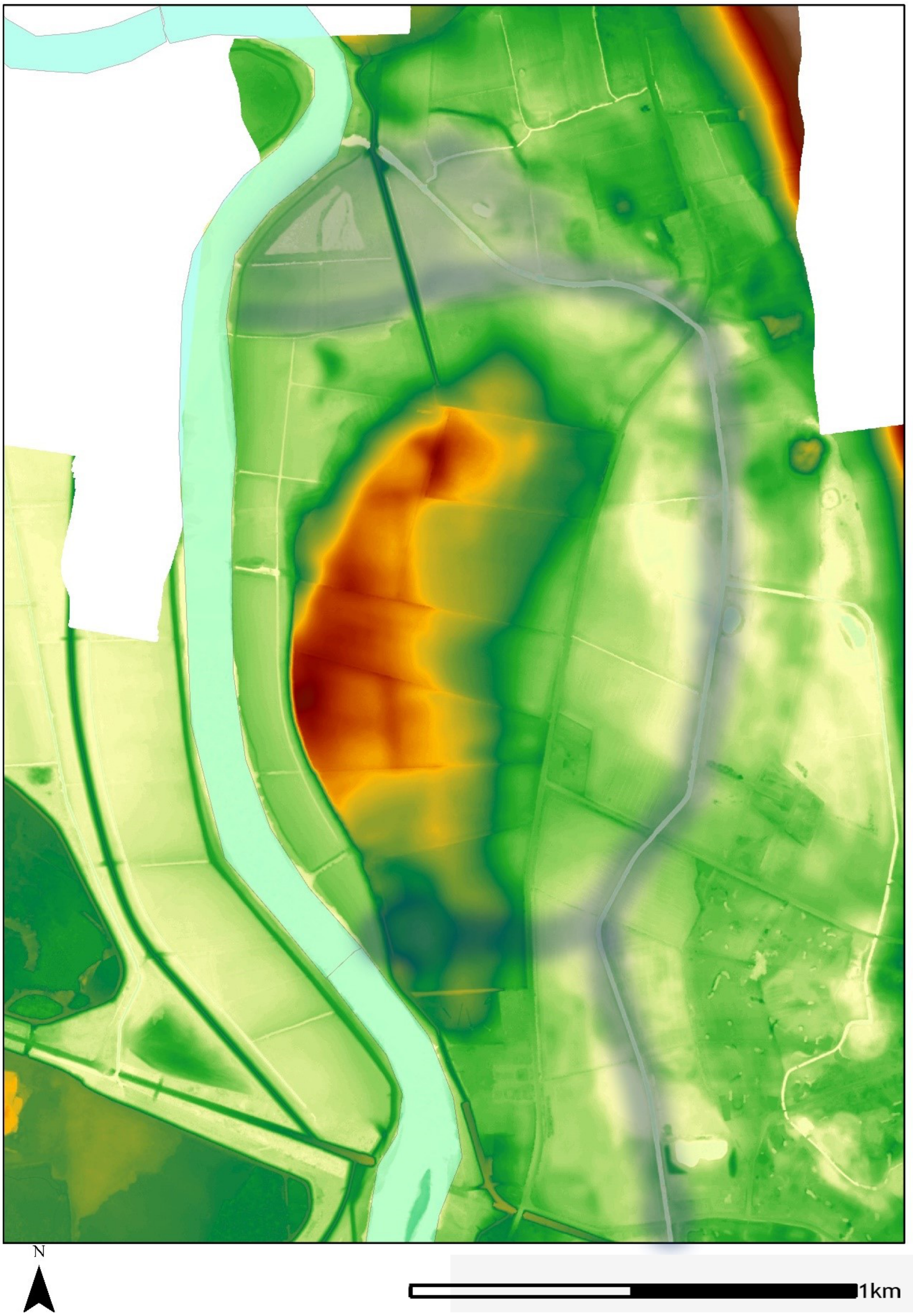


Figure 5.67: The site in the post-medieval period. The very deep Inclosure Drain was installed prior to the 18th century. To the north of the site, the original channel flowed straight into the Trent (rather than around the present berm). The line of the original drainage channel demarcates the parish boundary. The drainage channel cuts through the earlier undated berm west of the A156. A drainage channel also cut present the bottom of field G, between the two dunes on this site, forming the Brampton-Torksey parish boundary. This drain can still be seen on aerial photos and faintly on the geophysics. This inlet also may have acted as a small port of the 19th century pottery kilns and workshop. Despite the drainage construction, the land still flooded frequently, and the more efficient berm and pump house was installed north of the site. The later berm can be seen in dark green.

Figure 5.68: 1st edition OS map (1880s). Fields are divided into smaller parcels, but a similar structure remains today. Sand bank adjacent to the road is acting as a berm, however it has been cut by the drain on this map. The northeast part of field A is still a permanent wetland, but fields M and N are being actively ploughed. Both drains along the parish boundaries have been abandoned by this point. Bunker's Hill Warren remains untouched. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

Despite the local landowners' best efforts, with the construction of a large berm and pump house, the land north of Torksey still regularly floods (Roger Brownlow *pers. comm.*). Large ponds reappear in field G with regularity, a reminder of the once impassable marshlands between Torksey and the winter camp. Agriculture was instated on the peat bog fields in the years following the installation of Marton Pump house; in these fields, too, nature has won again, and the peat bog is now a managed birch forest and a managed wetland nature reserve.

Only Bunker's Hill Warren seems to have escaped the post-medieval management intensification. Despite the post-medieval namesake, the dune has remained since at least the early medieval period either due to its usefulness as a rabbit warren, or its uselessness as an agricultural field. Only in the past decade has it has found a new purpose as a natural burial ground (Lapwings Consultants 2010).

The site of the Viking winter camp still stands prominently in the landscape. As one of the taller features along this stretch of the Trent Valley, it is still clearly visible from both the floodplain as well as from other tall bedrock outcrops at Marton and Torksey and gravel islands within the floodplain (figure 5.69). The surrounding wetland, a feature that made it a unique site in this part of the Trent Valley, however, has now been drained, completely masking the main physical feature that would have drawn humans to the site since the end of the Holocene, including the Viking raiders passing through the Trent Valley.

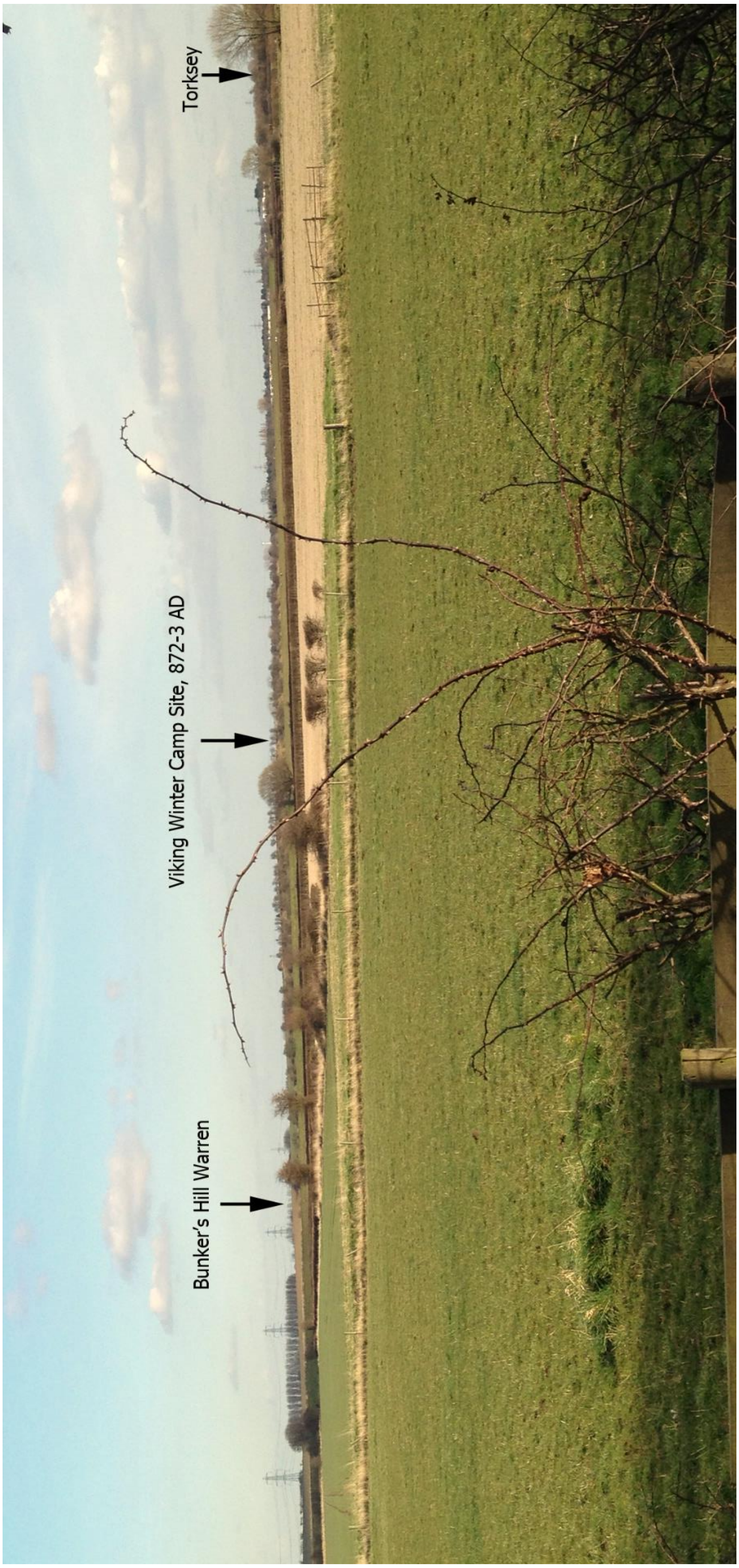


Figure 5.69: View of the Winter Camp Site from Cottam (Notts.), across the present floodplain. Prior to drainage, Torksey would have stood above the floodplain, a small area of dry land within an expanse of wetlands.

5 Conclusions

The palaeoenvironmental survey and geoarchaeological analysis above allowed a detailed reconstruction of the landscape throughout the Holocene. Figure 5.70 provides an overview of the environmental changes that have occurred since the beginning of the Holocene through the present day. This palaeoenvironmental reconstruction has allowed for a detailed view of the landscape at the time of the Viking winter camp. Vikings making their way up the Trent, which was, at the time, a vast floodplain with multiple channels and surrounding wetlands, would have chosen the site at Torksey for several purposes. Additional landscape features that would have made the site covetable are covered in chapter 6, but an equal part of the reasoning behind choosing the site north of Torksey was based on the convenience of the physical landscape. The site would have remained dry throughout the winter season, but was also mainly accessible via the Trent, or by creating temporary or permanent, easily defendable trackways that connected the site with Marton or Torksey.

The wetland to the west of the site provided an effective natural defence, but even more useful were the flooded areas on the north and possibly on the south side of the site. The area on the north side of the site (and to a lesser extent on the south side, though this may have filled in with some aeolian sand by the early medieval period) would have provided an area of open water, protected from the free flowing channel of the Trent, but with a permanent tidal and freshwater pool. Although this area may or may not have been vegetated prior to the Viking landing, the small inlet may have been cleared in order to function as a docking and repair yard. This would have provided a convenient waterside location, next to the higher ground of the winter camp, and with instant access to the Trent.

The site would have been mainly cleared by the inhabitants of the Romano-British farmstead, and the camp would have focused in and around the existing enclosure, as evidenced by the high concentration of early medieval, and specifically Viking finds around this space, which also produces a high concentration of Roman-period artefacts (Woods *pers. comm;* Pete and David Stanley, *pers. comm.*). Although the land was cleared for grazing or ploughing, the settlement of a large number of Viking army members may have further cleared the areas of sand deposits, leading to a reactivation of aeolian sediments on the site; these deposits were redeposited on the site, at Bunker's Hill Warren, and possibly across the burgeoning town of Torksey.

The Viking Great Army at the Torksey winter camp would have been both protected from any surprise attacks, as well as connected to an important and prosperous region. Their access to both land routes, by either naturally formed or built causeways across the marshland, as well as to travel by water, would have put the army at an advantage in the landscape over the course of the winter, and allowed for trade and exchange with the local population. This location also would have placed the army at the edge of the Mercian and Lindsey border, where they could be near to and within, as well as protected from, both political regions. The site would have also provided some sustenance for the army; an existing farmstead on the site may have been producing a steady amount of meat or grain for the local population; food sources were also available elsewhere in the landscape, though this will be discussed in chapter 6.

This study has successfully determined several reasons why the Vikings chose this particular site for overwintering in 872-3, and has defined the surrounding landscape of the camp and its formation. Although the physical landscape was a major draw and asset to the Great Army, it would not have been the only factor that led them at Torksey; the surrounding landscape had much more to offer than a safe shelter, though for an understanding of what the landscape had to offer, a wider view of the local landscape is required. In chapter 6, another aspect of Viking overwintering will be reviewed by exploring the human presence in the surrounding landscape.

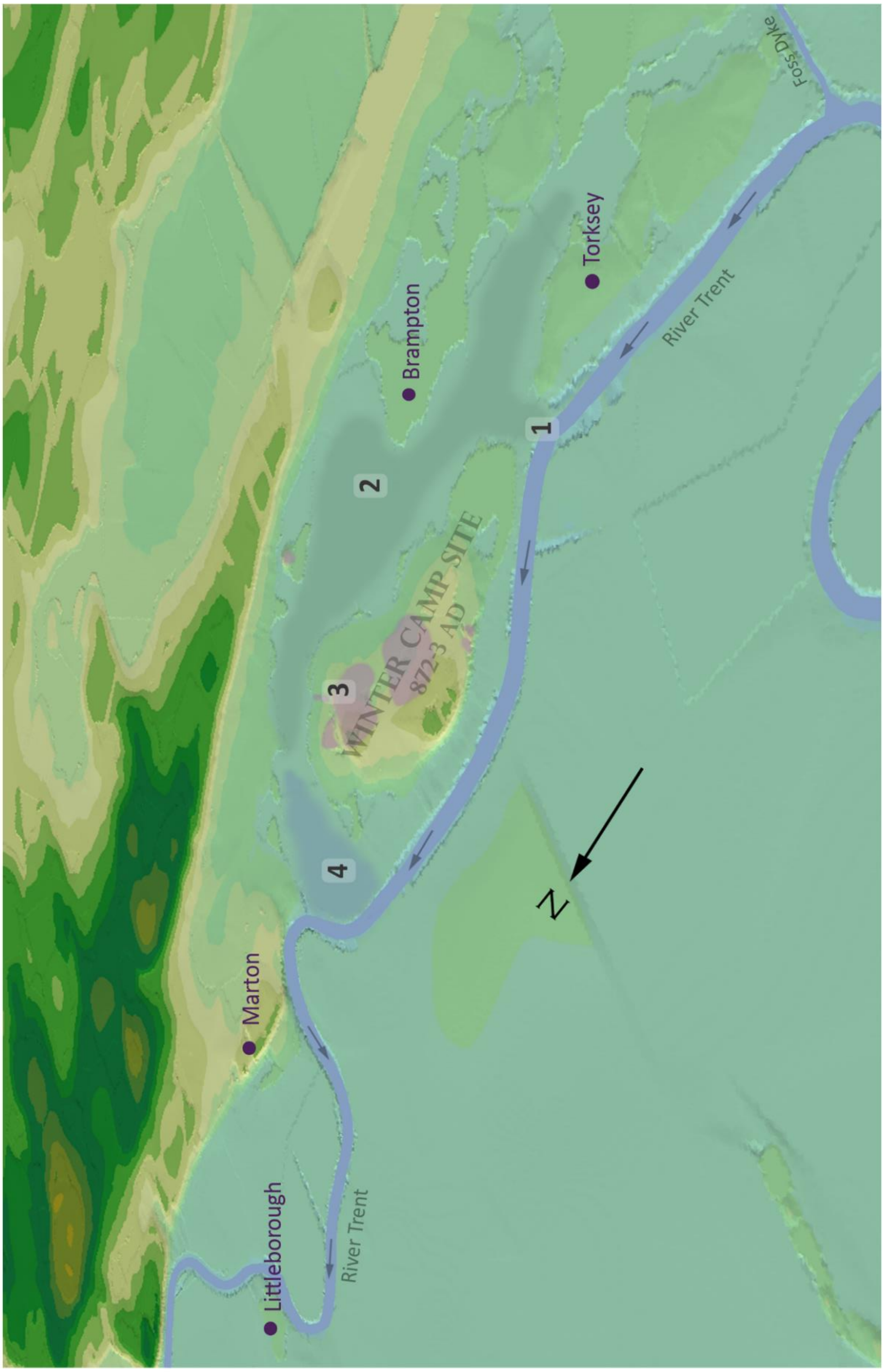


Figure 5.70: Diagram of surrounding landscape of the Viking winter camp. 1) Potential inlet for docking ships, also known as the 'Burghdyke'; may have had a causeway between the site and the settlement of Torksey during the early medieval period; 2) a wide area of marshland, with continuously accumulating peat; 3) site of the winter camp, as well as active aeolian sand deposits (major aeolian sand outcrops highlighted in purple); 4) tidal inlet with still or calm waters that may have acted a an area for docking and repairing ships.

CHAPTER 6

CHARACTERISING THE LANDSCAPE OF TORKSEY

1 Introduction

In the last chapter, the palaeoenvironment of Torksey throughout the Holocene was established, including the physical environment at the time of the Viking winter camp. This chapter will focus more closely on the human landscape of the study area during the Roman (A.D. 43-c.410), early medieval (c.410-1066) and later medieval (1066-1480) periods (Knight *et al*., 2012). Within these chronological parametres, this study will address the human interaction with, and reaction to, the changing environment in the wider region. The study will also examine the chronology of visible features which currently survive in the landscape. By examining this temporal development of the landscape, this study will define features (settlement, industry, etc.) which were in the landscape prior to and during the Viking occupation of the overwintering camp and which may have influenced the selection of Torksey as an overwintering site.

The landscape analysis will be achieved through the comparison of maps of different environmental and archaeological features, including topography, underlying solid and superficial geology, currently mapped roadways and waterways in the area, and recorded archaeological sites. Each section will present the established climatic and environmental evidence for that period as well as the known archaeological sites within the study area. Next the major features, including roadways, drainage and palaeochannels will be defined and presented in relation to the mapped archaeological remains. These features will then be draped over base maps of the study area, including topographic (or LiDAR data where present) and geological data. The comparisons between archaeological and natural features will demonstrate the environmental parametres that defined each period. By observing these relationships in each period, and by cross-comparing each period, this chapter will primarily answer the following questions:

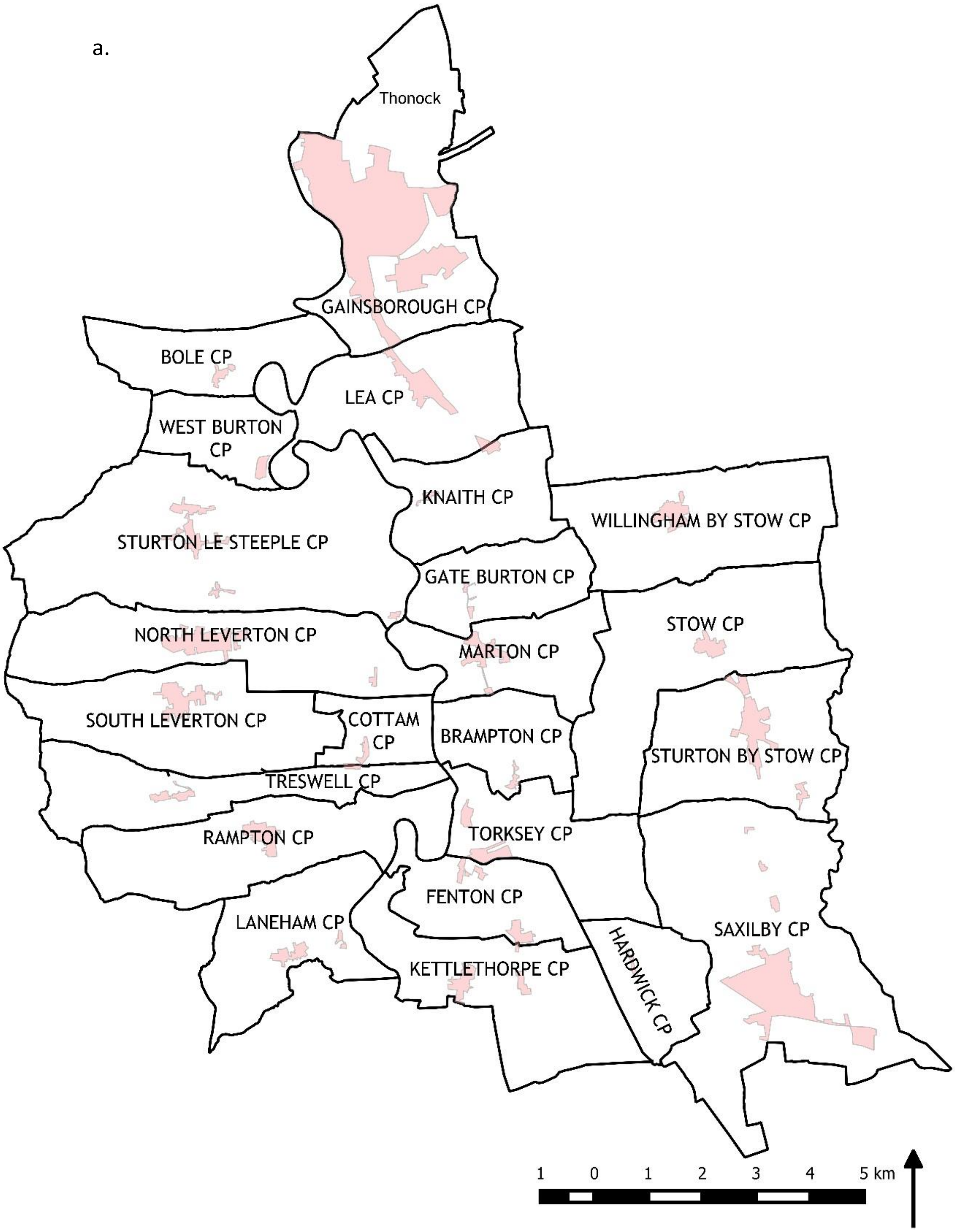
- Can environmental change be observed by tracking settlement change?
- How does the geology affect the settlement patterns?
- Was settlement shift driven by environmental change, or other factors?
- How has settlement shifted between the Roman and medieval periods?

By addressing these questions, the landscape changes prior to and following 872-3 will determine the formation of the physical and social environment that was encountered by the Viking Great Army, and demonstrate the post-Viking winter camp evolution of the landscape.

The available data for each chronological period varies due to the changing environment, preservation inconsistencies and differences in documentary records. For example, archaeological examinations of Romano-British sites throughout the area have produced evidence of the activities that took place on each site, which allows the differences between sites used for different activities (e.g. industry, agriculture, settlement) to be briefly analysed. Alternatively, archaeology from the later medieval periods has not produced substantial information about individual site use; however it does include data about the use of the larger landscape. Due to its role in the formation of the modern landscape, there is a noticeably larger volume of data available for the medieval period than there is for the previous two periods. During the discussion of the late medieval period, a distinction had to be made between 'static' areas (areas used irregularly, such as deer parks or agricultural fields) and 'dynamic' areas which were in constant use (settlements and manor houses). Although the in-depth discussions of the static sites and parish boundary formations in the later medieval period are arguably unrelated to the Viking winter camp of 872-3, the analysis provides detail on features in the landscape that can occasionally be projected back into the early medieval period, and that can speak of the environmental changes that occurred in the years after the winter camp.

The study area for this analysis will include not only the site of the Viking winter camp at Torksey, but also the surrounding 23 parishes on both sides of the River Trent (figure 6.1). The parishes to be explored are: Bole, West Burton, Sturton-le-Steeple, North Leverton, South Leverton, Cottam, Treswell, Rampton, Laneham (in Nottinghamshire), Gainsborough, Lea, Knaith, Gate Burton, Marton, Brampton, Torksey, Fenton, Kettlethorpe, Hardwick, Saxilby, Sturton-by-Stow, Stow, and Willingham-by-Stow (in Lincolnshire). The parishes considered in this study are the original parishes, defined on the 1st edition OS maps. Parish boundaries were chosen as the delineator of the study area (as opposed to an arbitrary circle around the winter camp site), as the boundaries themselves hold information about the Anglo-Saxon and later medieval archaeological and physical landscape (Pantos 2003, 38). It is important to consider that these boundaries were not solidified until the 10th to 12th centuries, though the parish boundaries will be compared to earlier landscape features, to determine the effect that earlier features may have had on later boundaries. A detailed analysis of the parish boundaries and their formation will be addressed in section 4.6.

a.



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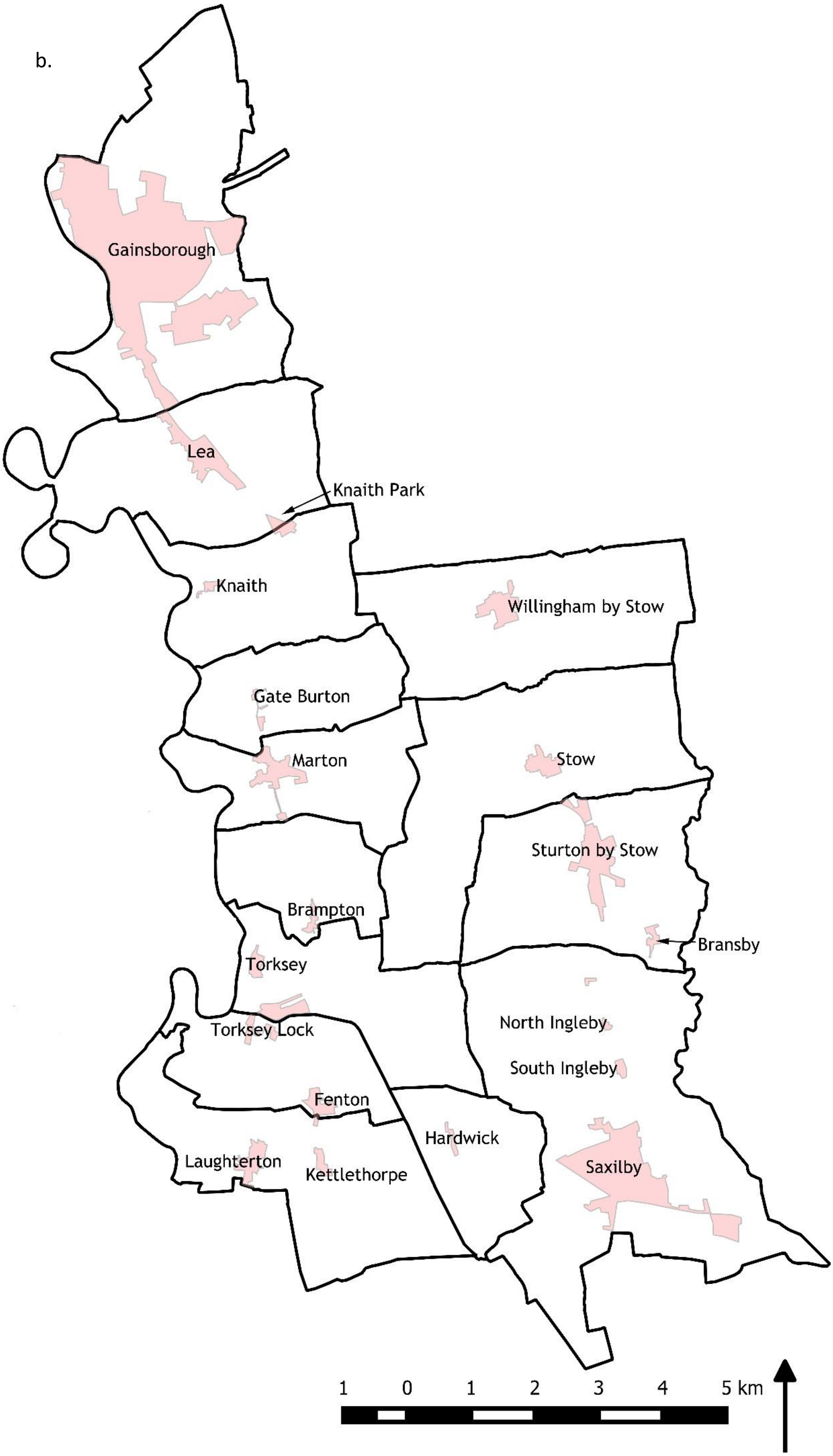
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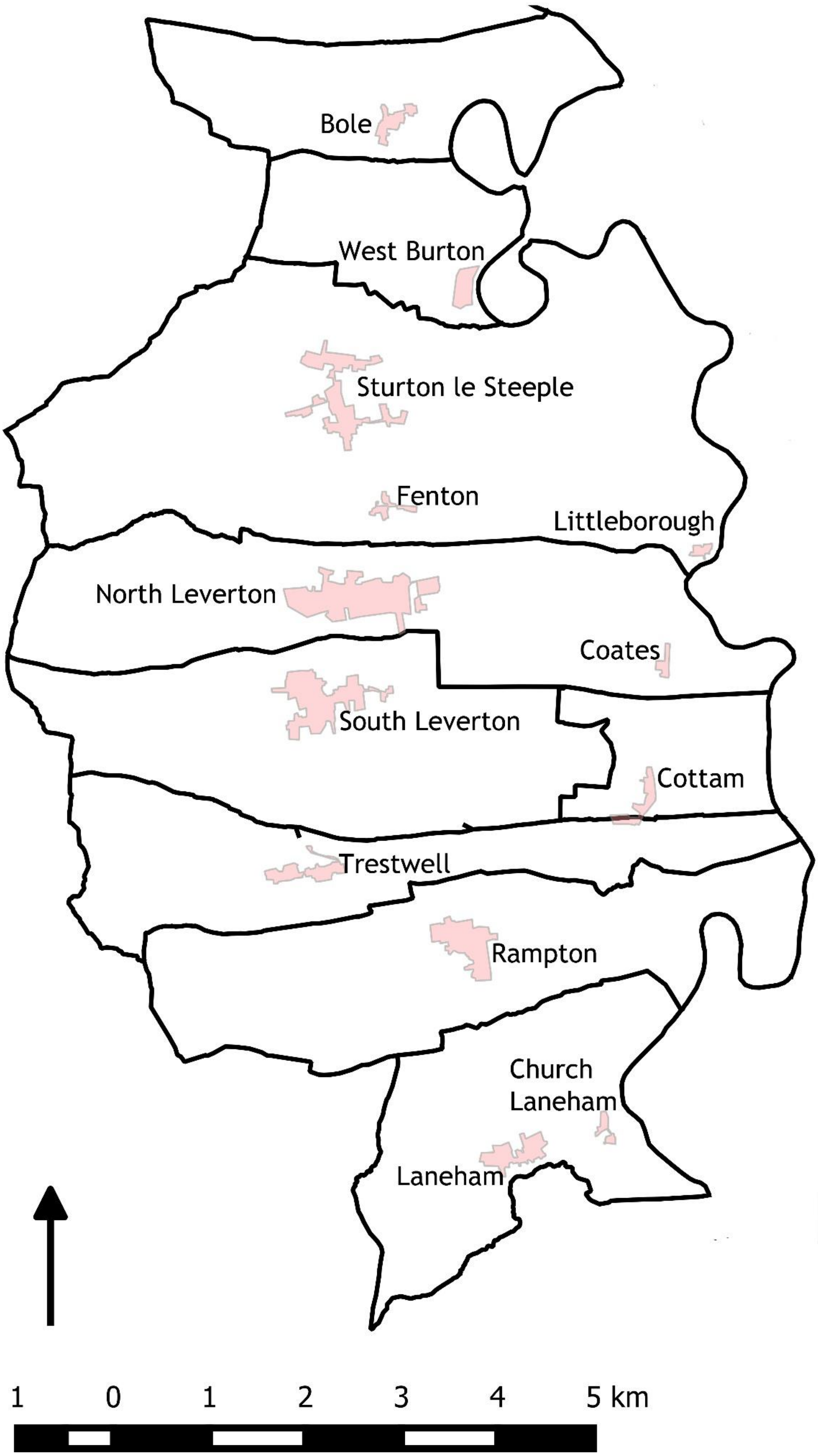

Figure 6.1a: Study area and parish names with settlement shaded in pink. 6.1b Existing settlements within the study area in Lincs. 6.1c Existing setlements within the study area in Notts.

2 THE ROMAN PERIOD

2.1 Archaeological and environmental evidence for Roman activity

Though the Romans are widely known for their military installations and the idea that they imposed a Roman way of life on the existing Iron Age population, evidence from nearby South Yorkshire demonstrates that in rural settings, the shift to the Romano-British cultural period was gradual. Existing Iron Age field systems and agricultural methods were adopted by the incoming Roman populations (Chadwick 2008; Knight and Howard 2004). Within the study area of this research there is evidence, which will be discussed below, of both the adoption of Iron Age field systems, as well as the imposition of Roman structured settlements and roads.

Within the setting of the Lower Trent Valley, the Romano-British period would have been defined by dryland grass vegetation and lower water levels. The pollen preserved in peat deposits at Torksey (see chapter 5) and, to a lesser extent, at Bole Ings (Scaife and Allen 1999) has indicated that rapid clearance occurred in the 2nd century AD. A milder climate from the 2nd through the 4th centuries has been established in regional climatic chronologies (Dark 2000), though there is no direct environmental evidence for this within the study area. Slightly lower water levels throughout the Trent Valley in the 1st century BC through the 3rd century AD also facilitated the rapid clearance phases of the low and fertile alluvial floodplain. Clearance in the local area meant open fields lined the Trent, which resulted in aeolian drift at sites throughout the study area, including at Torksey (2013 OSL dating, chapter 5), and possibly Rampton (Knight 2000). Despite clearance of woodland species, wetland scrub remained in some of the surrounding wetlands. This landscape supported an industrious and highly active Roman society.

The Roman landscape within this part of the Lower Trent Valley is defined primarily by the major planned settlement, known as *Segelocvm*, at Littleborough, Nottinghamshire (Riley *et al.*, 1995), the Roman Road leading from Doncaster to Lincoln, and the Foss Dyke. These particular settlements and features were (reputedly) imposed onto the landscape by the Romans; however it is possible that these Roman features were mirroring the location of earlier trackways, settlements, and river crossings. There are also several lesser known sites in the area, which are consistent with the incorporation of

Iron Age field systems into the Roman landscape, including the settlements at Rampton (Knight 2000), Sturton-le-Steeple (Elliott 2004), and Thonock (John Samuels Archaeological Consultants 1993). Evidence for industry in the study area has also been found at sites in Fenton (Torksey Lock) and Lea (Oswald 1937; City of Lincoln Archaeology Services 2001), as well as in Torksey.

Tillbridge Lane (Littleborough Rd on the Nottinghamshire side of the study area) is considered the main Roman road in the area, and it connected the Roman centres of Doncaster and Lincoln, passing through the Roman riverside forts of Bawtry and Littleborough (Riley *et al*. 1995). The route of this road has been lost from Sturton-le-Steeple to Bawtry, but through the study area, the original route has remained largely intact. The straight road from Littleborough to Sturton by Stow follows the original line of the Roman route, including a small detour to the south at Littleborough, around the Roman settlement of *Segelocvm* (Riley *et al*. 1995; see below). At Littleborough, a ferry or bridge provided a crossing place across the River Trent. The road continues to the east as Tillbridge Lane, until it reaches the River Till at the Sturton by Stow parish boundary, and then on to meet the road to Lincoln (now the A15). This road formed an important connection across the Trent Valley throughout the Roman period. This 'Roman Road' is certainly not the only road that was being utilised during this period. Through mapping the Roman archaeology, this analysis will identify which roads in the study area may pre-date the Romano-British period and may have seen continuous usage for more than 2000 years.

The River Trent acted as a major route way for goods and people in the area throughout the Roman period, and throughout the Holocene. The Trent provided a quick and easy north-south route through the Trent Valley, facilitating trade and travel, as well as providing wetland resources to the local population. Aside from providing a useful means of transport, the River Trent defines the hydrological systems in the study area, with all drainage within the study area eventually emptying into it. The Trent, however, is a meandering channel within the river valley, and has created a series of palaeochannels, and thus, the route it took during the Roman period cannot be confirmed. These palaeochannels are visible from both aerial and LiDAR data and are also revealed through the mapping of existing drainage channels, which, in some cases, are palaeochannels that have since been utilised as drainage routes. There has been some suggestion that an early course followed by the river was along the route which is now defined by the 'Mother Drain' on the west side of the valley (Riley *et al*. 1995). This hypothesis will be examined further in the analysis below.

The Foss Dyke, another means of transport via water, is an artificial canal running from the Trent to the Fosse Way just south of Lincoln. The Foss Dyke has been interpreted as being constructed in the Roman period, and a Roman statuette was found in the silt at the bottom when the canal was dredged (HER record 54784; White 1856, 19). Despite the origins being of Roman date, the canal that presently flows to Lincoln may not represent the original route of the channel. The line of the original Foss Dyke will also be examined as part of this analysis. The River Till on the eastern edge of the study area would have also been present in the Roman period, although this water way would not have held the same importance as a route of transport.

The settlement at Littleborough (see figure 6.2) is the most well-known Roman settlement within the study area. It is located on an area of slightly higher ground, corresponding to a gravel island to the west of the present course of the Trent. Known for its well-defined cropmarks that were photographed from the air by Derrick Riley, Littleborough was excavated in the 1950-60s, and reported in detail in the 1990s (Riley *et al*. 1995). Pottery recovered during these excavations determined that the settlement was occupied from approximately 50-200 AD (Riley *et al.* 1995, 268). The excavations determined that the site was used primarily for domestic purposes, with some military and flood defences. The impact of *Segelocvm* on the landscape persists into the modern layout of the hamlet (Riley *et al.* 1995, 256), although the north-western area of the settlement has since been abandoned. Alluvial deposits on the west side of the current settlement have led to the hypothesis that a palaeochannel of the Trent also flowed to the west of the settlement in the post-Roman period (Riley *et al*. 1995; figure 6.9); flood defences on the west side of the settlement may confirm this theory.

Figure 6.2: Extent of Littleborough and areas of excavation (Riley *et al.* 1995, 255)

Other Roman settlement sites on the Nottinghamshire side of the study area are Rampton, Sturton-le-Steeple, and Cottam. Only Rampton has been published in detail (Ponsford

1992), as well as in grey literature (Knight 2000; Challis 1990). Rampton has been thoroughly investigated through cropmark evidence and developer-funded excavations, primarily because it was on a site with invasive sand and gravel extraction. The area has since been completely stripped of the aggregates which once formed a gravel island rising slightly above the floodplain. This gravel island has attracted human attention throughout the Iron Age and Roman periods. (Challis 1990, 2). Pottery dated the site to the 1st-3rd century, with a progression of settlement from an unenclosed Iron Age/Romano-British farmstead, to a multi-enclosure, multi-household village, with complex, multi-period remains (Knight 2000, 1). Like Littleborough, there is evidence on the site that there is a relict channel of the Trent to the west of the settlement (Challis 1990, 2), in this case a southern extension to Mother Drain at Seamere Dyke. Post-Roman aeolian redeposition is a geological feature at Rampton that does not occur at any other abandoned Romano-British site on the Nottinghamshire side of the Trent: on the western end of the site, a layer of orange-brown sand seals Roman features, and is covered by 3rd to 4th century alluvium (Challis 1990, 14). The description closely resembles a late Holocene aeolian deposition, and this layer probably represents a post-Roman aeolian deposition. Without sampling the deposit, it is, however, impossible to confirm if it is an aeolian sand deposit, but if the descriptions are accurate, the sand would be the only recorded aeolian deposit on this side of the Trent within the study area, and with tight archaeological dating to the 3rd-4th century.

The Iron Age/Romano-British settlement in the present parish of Sturton-le-Steeple also occupies an island and terrace of sand and gravel. Peat dating to the Late Bronze Age through the Iron Age surrounds the gravel islands, and, much like the peat to the east of the Torksey site, it is humified, and overlies a grey-white clayey sand. Preliminary pollen counts also match the sequence at Torksey and Bole Ings (this volume, chapter 5; Scaife and Allen 1999). Two groups of settlement enclosures, each over 100m across and dated to the 2nd-4th centuries, were detected at Upper Ings (Sturton-le-Steeple) using geophysical survey (see figure 6.3) (Elliott 2004, figure 8). The equidistant placement of these enclosures to Littleborough and to each other led to the conclusion that they were possibly outlying settlements that relied on the larger Roman town (Elliott 2004, 59).

Boreholes and excavations revealed that the site is comprised of sand and gravel terrace deposits buried by post-Roman alluviation across the entirety of the settlement areas (Howard 2004). The results from Sturton-le-Steeple correspond to the pattern of increased flooding and shifting water courses in the 3rd-4th centuries AD, similar to that demonstrated at Littleborough and Rampton.

Figure 6.3: Results of geophysical survey at Sturton-le-Steeple, north of Littleborough, showing several clusters of Romano-British settlements beneath the alluvium and on the gravel terrace (Elliott 2004, fig. 8).

Cottam is the final site with evidence of Romano-British activity on the Nottinghamshire side of the Trent. While no excavations have been undertaken, fieldwalking has produced a large quantity of Roman pottery dating from the 2nd-4th centuries (Smith 2007, 5). While this does not provide a lot of evidence for an environmental history of the Cottam area in comparison with the other sites, when mapped within the Romano-British landscape, the relationship of each of these Roman settlements produces a distinctive pattern of settlement in the area, all adhering to terrace sand and gravel islands within the lowlying alluvial floodplain, all at 2-4m AOD.

On the Lincolnshire side of the River Trent there are only three recorded settlement sites which may be identified as being Roman in date. These are sites which were originally identified as Iron Age or Romano-British enclosures on the basis of cropmark evaluation at Thonock, Marton, and Westwoods.

The settlement at Thonock was investigated through a geophysical survey and fieldwalking programme (John Samuels Archaeological Consultants 1993). The pottery and metalwork finds cover an area of at least 5ha on a gentle south-facing slope, with a small pond to the south of the site (John Samuels Archaeological Consultants 1993). Finds from Thonock have not been catalogued and therefore cannot provide a more precise date for the occupation of the site. The survey determined that this was a multi-enclosure settlement with associated pottery and ironworking kilns (John Samuels Archaeological Consultants 1993). The site at Thonock is on substantially higher ground than those sites on the floodplain, and the geophysical survey report states that the underlying geology is sand (John Samuels Archaeological Consultants 1993). The clear results of the Thonock geophysical survey, however, differ from the fuzzy or non-existent results of other surveys completed on diagenic sand deposits. This suggests that if the underlying deposits are sand, then the sand is likely to be beneath, and therefore pre-date, the Romano-British site, or perhaps the sand deposit is very thinly spread over the archaeological deposits. There is no evidence that this site was abandoned due to environmental changes. Without excavation it is not possible to answer the many questions that can be raised about this site. It is not clear what types of deposits are filling the features or if the site was slowly or rapidly abandoned, or whether the sealing deposits might provide any evidence for aeolian redeposition at this location. The current evidence does not allow us to determine if social changes were responsible for the demise of Thonock Roman settlement, or whether there is any evidence of continued occupation between the Roman settlement and the detected early medieval remains on the site.

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Figure 6.4: Results of geophysical survey at Thonock, Gainsborough (John Samuels Archaeological Consultants 1993).

The evidence for a Roman presence at Marton is limited. However it is reasonable to expect there would be some Roman activity in Marton as it lies on the Roman Road, on the bank of the Trent opposite from Littleborough. Pottery scatters date settlement along Tillbridge Lane to the 2^{nd}-4^{th} centuries, and excavations in 2013 uncovered several Roman pits and ditches, filled with butchery and pottery waste (S. Malone *pers. comm.*). A Roman altar was also found within the present settlement of Marton (Lincs. HER No. 56534). Cropmarks visible on aerial photographs have also tentatively identified a Roman fort to the west of the settlement evidence along the Roman Road (Lincs. HER No. 54200), although the identification of some of the remains, such as the fort and major settlement remains, are possibly premature. On the basis of the spatial dispersion of finds and features, the settlement appears to be linear along either side of Tillbridge Lane, though recent excavations of features north of Tillbridge Lane west of Marton suggest that there were earlier Iron Age features being used in the Roman period, oriented north-south along the Trent Valley (S. Malone *pers. comm.*).

There has been no archaeological evidence of Roman settlement remains found within the village of Torksey, but building materials within the walls of the early post-medieval

Torksey Castle have been interpreted as Roman building materials, and possibly indicative of nearby Roman structures (Anderson and Glenn 2013). Roman finds have been picked up from the ground surface across the settlement and in the surrounding fields. Consequently, it must be considered likely that some Roman activity would have existed within the area north of the Foss Dyke, with Roman pottery kilns south of the Foss (see below).

A potential Romano-British settlement on the winter camp site has only recently come to light as a result of the Torksey Project magnetometer survey (Brown 2013). The results revealed a square enclosure with several phases of ditched enclosures, and smaller cells within the enclosure. There has been no direct dating of this enclosure, but the settlement layout suggests that it may be Roman in origin, and the metal detector survey has produced a moderate number of Roman finds focused in this area. There is no indication of the function of this enclosure definable from the magnetometer plot (such as obvious kilns as at other sites), and so this may have been a farmstead with areas for animal penning. The ditches appear very clearly on the magnetometer survey because they are on the sand and gravel deposits underlying Mercia Mudstone, rather than within a diagenic sand context (information based on coring programme

The last settlement present within the study area is in the eastern half of the study area, on West Skye Lane in the current parish of Sturton by Stow. Roman buildings, most notably a mosaic floor, were uncovered in the 1920s by ploughing, and artefacts have been found on the site since it was first discovered (Lincs. HER No. 50566). The finds were tentatively interpreted as a high-status residence or villa (Lincs. HER No. 50566).
in chapter 5).

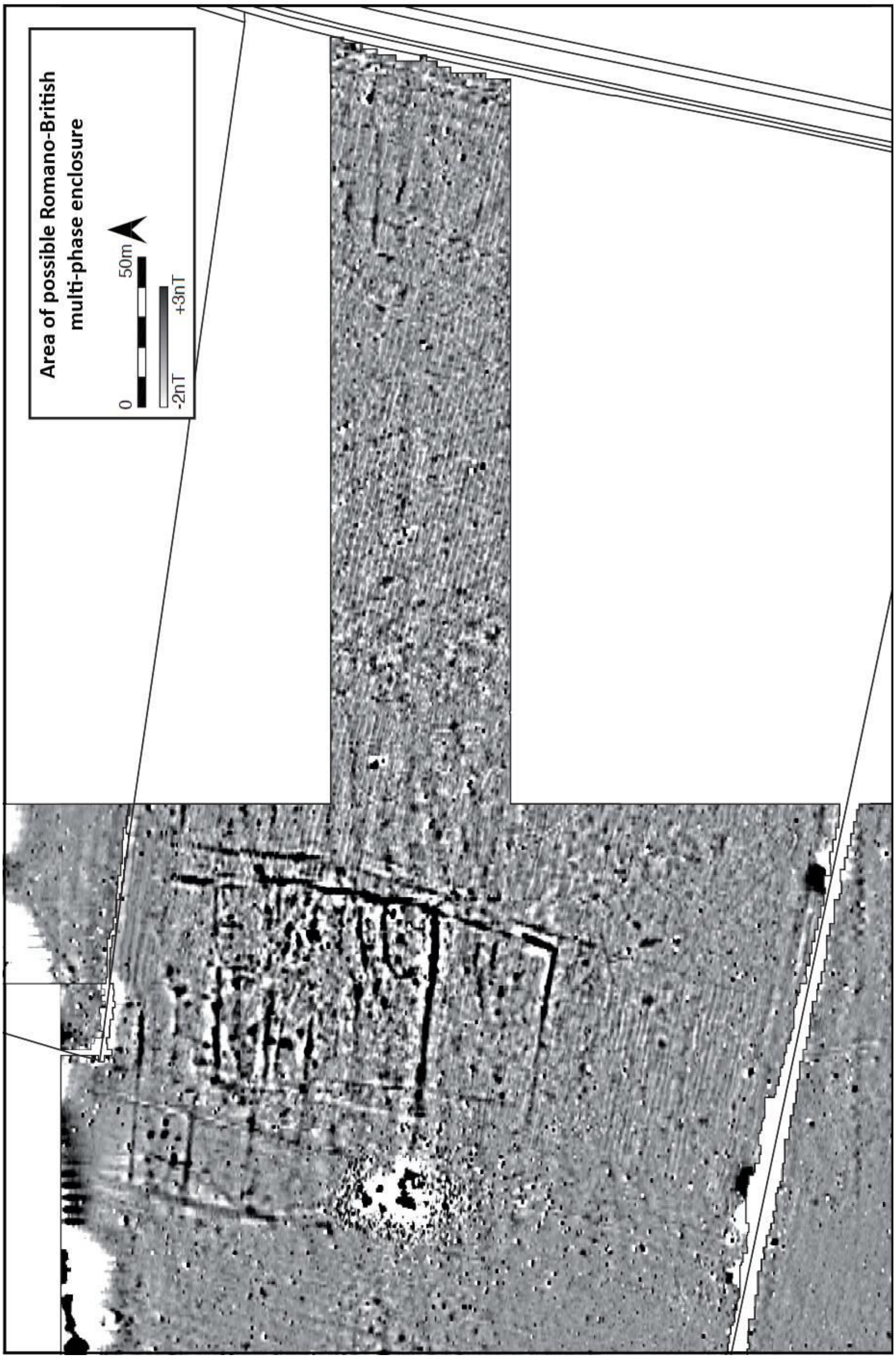


Figure 6.5: Magnetometry survey of the enclosure on the Torksey site. The site shows a multi-phase enclosure. The ferrous concentration in the southwest corner corresponds to a shed that stood on the spot until the 1970s (Brown 2013).

Sites at Lea, Torksey, Knaith, Littleborough, and Thonock (all Lincs.) have all revealed evidence of industry dating to the Romano-British period. These industries range from grain processing to pottery kilns to iron working. At Littleborough, features identified as grain drying kilns were located to the south of the site (Riley *et al.*, 1995), and at Thonock, the magnetometer survey identified circular features that were interpreted as pottery kilns (John Samuels Archaeological Consultants 1993).

At Torksey, Roman pottery kilns were excavated south of the Foss Dyke (Oswald 1937). The pottery from the site (known as 'Little London') closely resembles the early medieval Torksey ware pottery. More evidence of Romano-British industry was found in the parishes of Lea and Knaith. At Gainsborough Road, Lea, a number of Roman pottery kilns were found (Lindsey Archaeological Services 1999b). This site is situated close to the kilns at Thonock and the kilns at Torksey, and consequently demonstrates a geographical focus for Roman greyware production in this area in the 2^{nd}-4^{th} century. Sand filled and covered the kiln features at Lea, though no test pit was excavated deeper than 90cm, so the full extent of sand was not revealed (Lindsey Archaeological Services 1999b, 4). The presence of this possibly aeolian deposit provides a secure date for a period of aeolian reactivation at Lea in the immediate post-Roman to early Anglo-Saxon period.

A Romano-British ironworking site is present at Knaith Park. The ironworking site is also possibly covered in aeolian deposits, but the photographs and descriptions are not completely clear. Photographs show an iron bloomery below a layer of orange-brown sediment (Sherlock and Cox 2009, Plate 3), however the descriptions for each orange-brown sand say it is a natural layer with no underlying archaeology (Sherlock and Cox 2009, 5). There is a similar industry at Dragonby, Lincolnshire (also affected by post-occupation aeolian deposits), so this site it is not an isolated ironworking site in the wider region (Holland 1975).

2.2 Roman landscape: Maps, description, and analysis

The archaeology of the Roman landscape demonstrates a clear structure that utilises the physical topography and environment to its greatest potential. Mapping of all these sites has produced insight into the human and environmental landscape of the Romano-British period within the study area, for example settlement focus on the flood plain and around major route ways, a shift of the main channel of the River Trent, different environmental conditions, and lower average water level.

Figures 6.6 and 6.7 show the distribution of the Roman sites throughout the study area in relation to superficial geology and topography. Through considering the distribution of the sites in relation to the geology and topography, the following section will determine the relationship of the archaeology to the environment and contemporary climate. Figure 6.6, the distribution of the sites mapped against the superficial geology, shows a concentration of sites on the alluvium within the Trent Valley, and on the gravel islands and terrace gravels on the fringes of the alluvium. Where sites are not along the alluvium, sites are also concentrated on gravels above the floodplain, with very few sites where there is no recorded superficial geology. Figure 6.7, the sites mapped on the topography of the study area, demonstrates that the majority of the sites are on low elevations, at, and sometime below, 6m AOD. Where the sites are not located along the floodplain, settlements are sited on the top of the low hills in the study area, overlooking the Trent Valley, or overlooking the surrounding landscape.

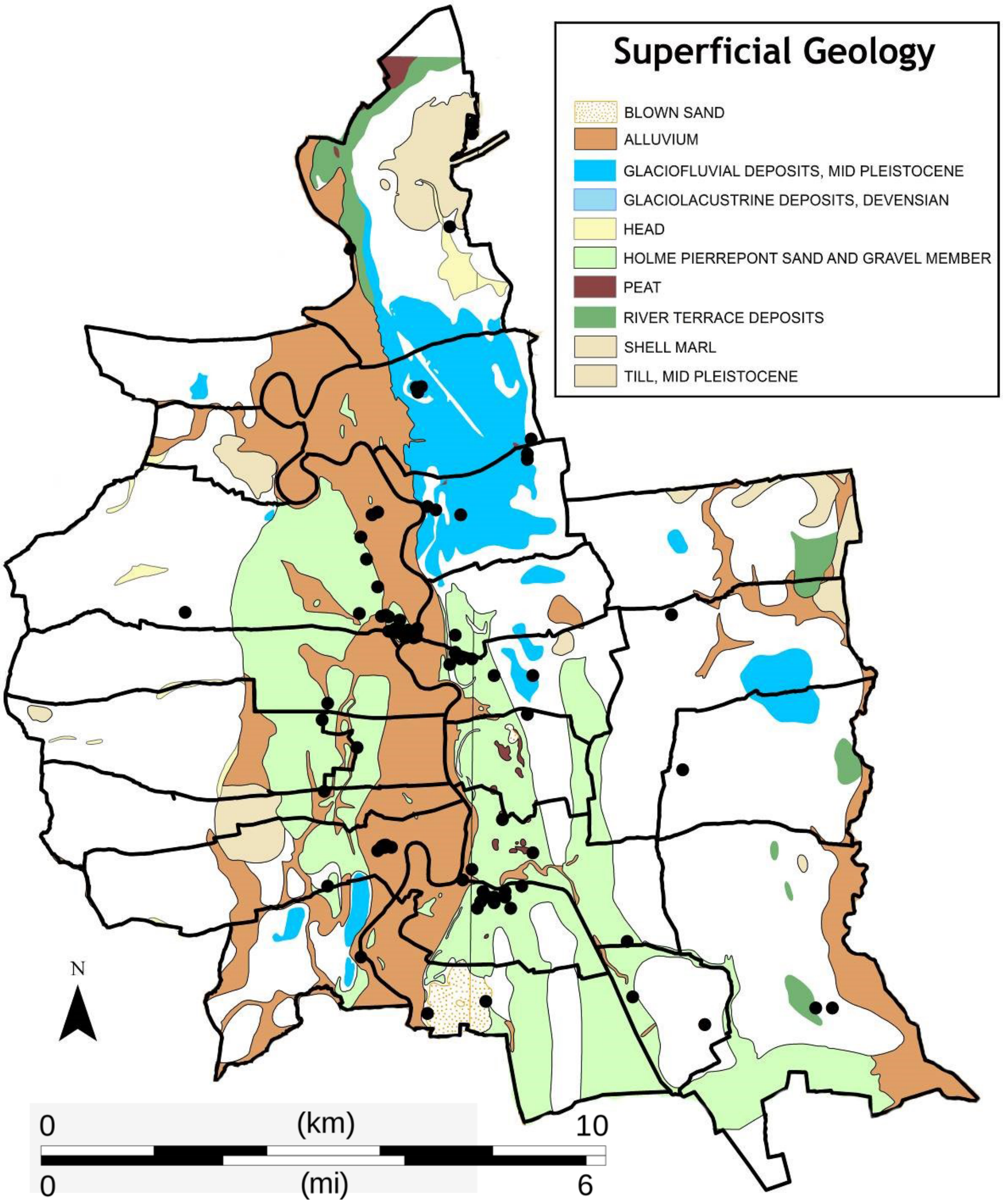


Figure 6.6: Roman sites on drift geology.

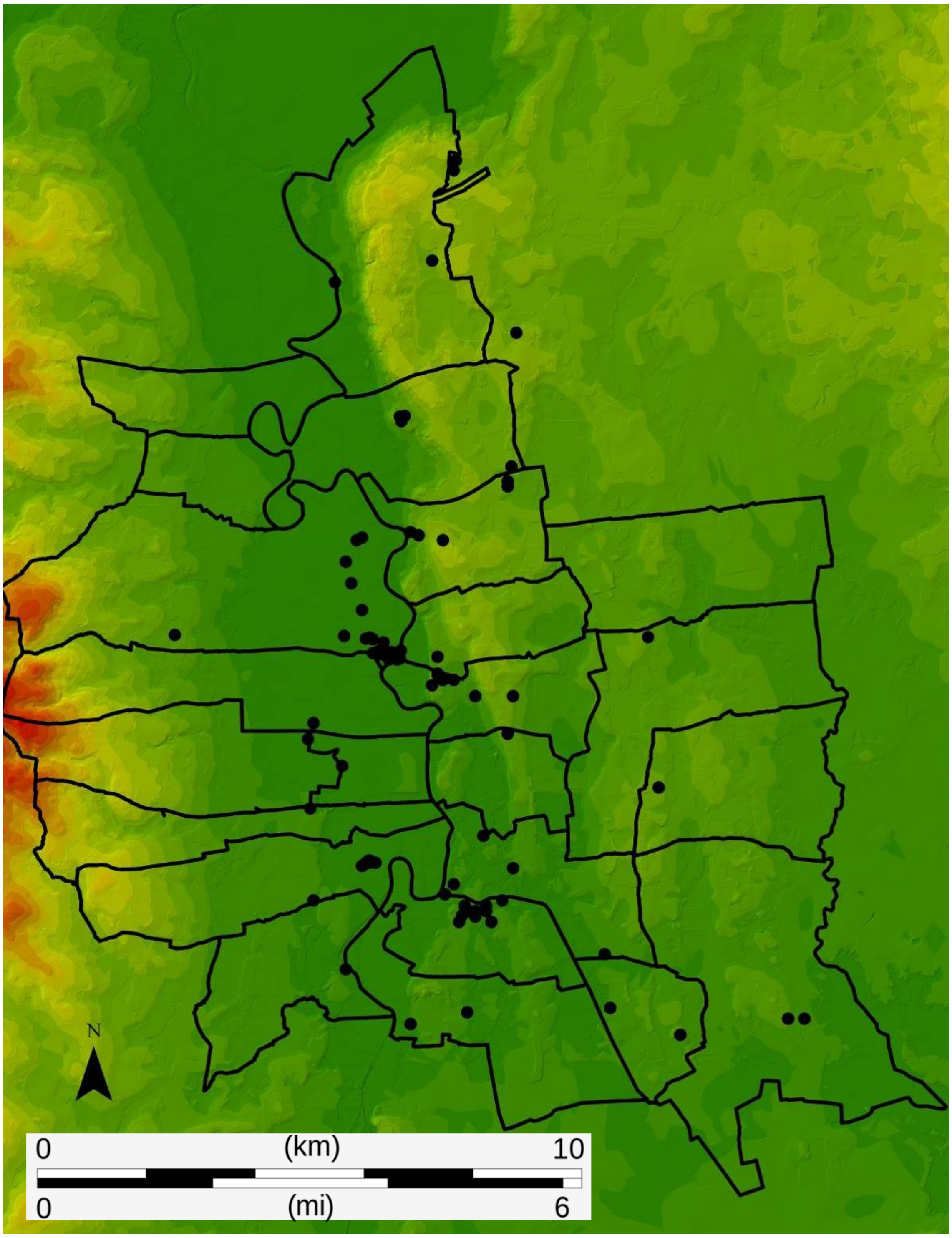


Figure 6.7: Roman sites on topography.

On these maps, the sites with evidence of Romano-British settlement display several patterns. They are mainly located on the floodplain, and are concentrated along a major drainage channel, today known as Mother Drain. It has been noted above that during the excavation of several of these settlement sites that they were located on gravel 'islands', or outcrops of deposits of terrace sands and gravels that are slightly higher than the surrounding floodplain. Settlements not located on the floodplain usually correspond to other known Roman features, such as the Foss Dyke or Tillbridge Lane. The distribution of sites in the Roman period strongly suggests that the water level remained quite low throughout the year, regularly remaining below 4-5m AOD. If the water level had been any higher than this, the settlements documented across the floodplain would have been flooded often and not viable occupation sites.

The location of the settlements on the floodplain, interpreted as small farmsteads or multi-household settlements (Ponsford 1992), highlights the value of the floodplain in the Roman period. It must have been dry enough in all seasons to support permanent habitation. The availability of habitable land at low elevations on the floodplain confirms a drier climate from the 2nd to the 4th centuries. The location of these settlements with features such as drying kilns, combined with the palynological evidence which shows widespread clearance and increased grain production (see chapter 5), suggests that the floodplain was the most productive agricultural land in the surrounding area at this time.

Another pattern that emerges from the placement of the settlements is their coaxial relationship with the major drainage channel known today as the Mother Drain. It was hypothesized by Knight (2000) and in the publication on Littleborough (Riley *et al*. 1995, 263), that the River Trent may have shifted from a single or multi-channel system, with a channel to the west of the site, to a single channel to the east of the site around the 4th century AD. By mapping the archaeology along the floodplain in this analysis, the spatial distributions of the identified Romano-British sites confirm that the Roman landscape in this part of the Trent Valley is heavily centred on the Mother Drain and the connected Seamere Dyke (to the south of Mother Drain) drainage channels. The distribution of farmsteads along this part of the Trent Valley provides strong evidence that the Mother Drain was the, or the main, channel of the River Trent from the 2nd to 4th centuries AD. The pottery finds from all of these sites indicates similar Roman period dates from the 2nd-4th centuries AD. However considering that pottery was not commonly in use in the Iron Age in this area, it is possible that these settlements were established prior to the

Romano-British period, which may also provide an Iron Age date for Mother Drain as a secondary channel of the River Trent.

The double channel of the Trent during the Roman period would have also had an effect on the services provided at Littleborough. While *Segelocvm* was occupied, it would have provided crossing not just across the present channel of the River Trent, but also across the Mother Drain channel that ran to the west of the settlement, possibly in the form of a second bridge or ferry. Alluvium sealing parts of the Littleborough and Rampton sites can be securely dated to the late 2nd-early 3rd century, with river channel stabilisation on the west side of the sites by the middle of the 3rd century (Riley *et al.* 1995, 263).

Figure 6.8: Mother Drain, looking to the north from Littleborough Lane.

Figure 6.9: Stukeley map of 1722 of Littleborough showing a very wide and probably unmanaged version of the Mother Drain. The bridge pictured on the left of this map is likely to be an earlier construction of the same bridge that the previous photo was taken from.

The land used for farming was located on the fertile alluvium and sands of the Lower Trent Valley; however the settlement sites were actually often placed on slightly higher ground, usually on terrace gravel (remnants of colluvial gravel from when the Trent was a braided channel system in the late Devensian and early Holocene). Throughout the Romano-British period, the areas of higher land on these gravels would not have been islands for most of the year, however the placement of settlement structures on the areas of higher ground would have protected the settlements from any flooding that occurred across the floodplain during the winter.

Roman archaeology on the higher ground outside of the floodplain is much more sparsely distributed. It is mainly sites with industrial purposes that lie on the highest parts of the low hills in the study area (above at least 5-6m AOD) and these locations may be deliberately chosen to avoid flooding as well as to exploit the local resources such as clay and sand (Perry, forthcoming). These sites, however, would have been susceptible to aeolian redeposition throughout the year, and sites such as Thonock and Lea were eventually covered in aeolian deposits. Despite occasional aeolian redistributions, the dry land above the floodplain would have provided an ideal location for pottery and smelting workshops.

Figure 6.10 displays the Romano-British settlements superimposed on the palaeochannels, drainage channels, and other tributaries that currently exist in the study area. Through comparing the locations of the settlements and how they relate to the existing water ways, as well as a consideration of the topography of the area, the hydrological landscape of the Roman period was re-created and the movement of the waterways since the Roman period can be established.

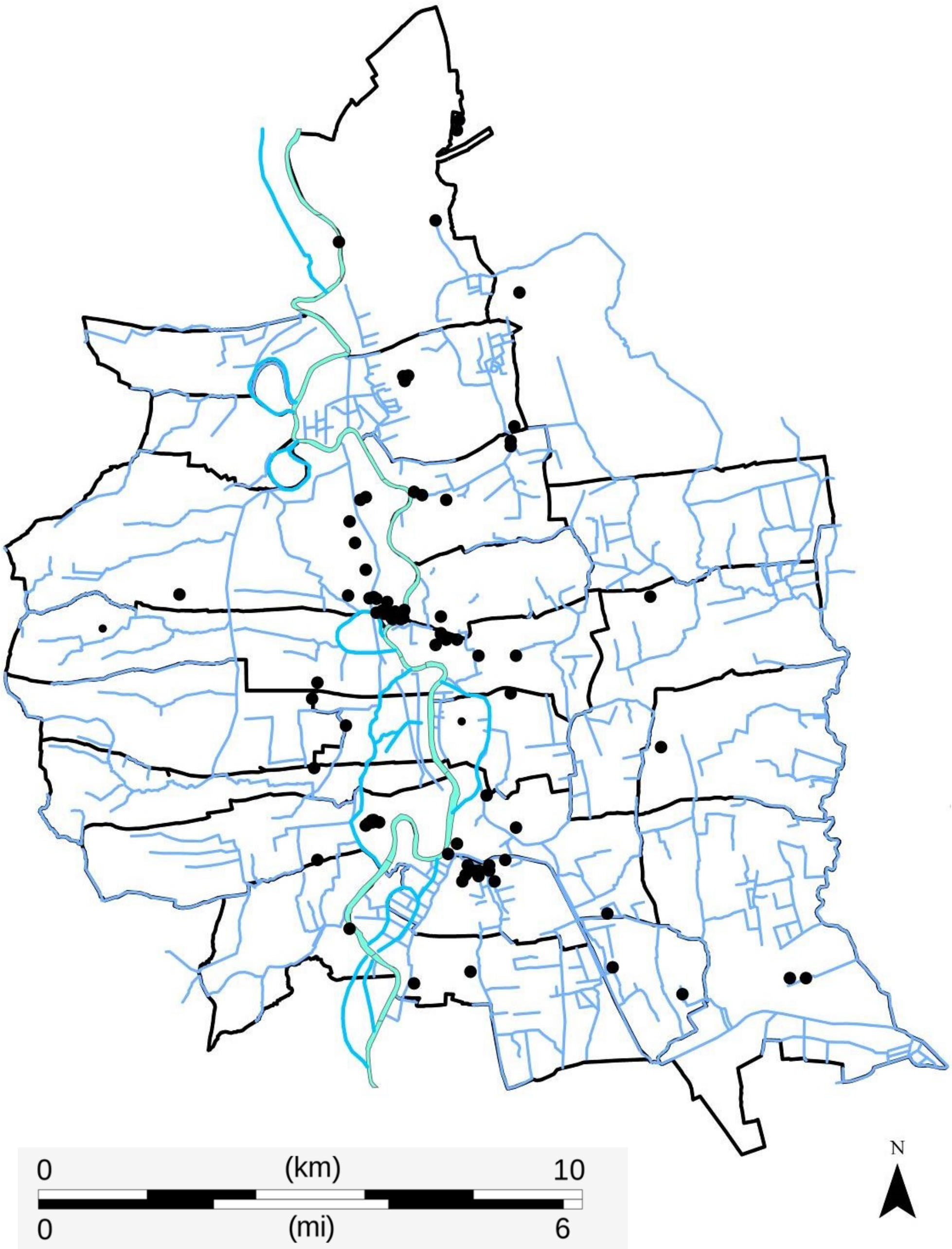


Figure 6.10: Roman sites on present rivers, drainage channels and palaeochannels.

The movement and use of the River Trent was considered in previous sections; however only by comparing the present drainage and palaeochannels of the study area in relation to the Romano-British sites can the previous course of the Trent be fully appreciated. A secondary channel of the Trent on the west side of the valley can be clearly seen in the form of Mother Drain and Seamere Dyke (figure 6.11). The farmsteads within the Trent Valley line the side of this channel, rather than the present main course of the Trent. This does not indicate that this drainage channel was the primary course at the time; in fact, the Roman community may have preferred to be located next to a smaller, more manageable and predictable channel than the main river. In any case, the settlement in the floodplain is clearly reflecting the course of the Trent, and taking full advantage of fertile alluvium, available wetland alluvium, and access to a major trade and transportation route.

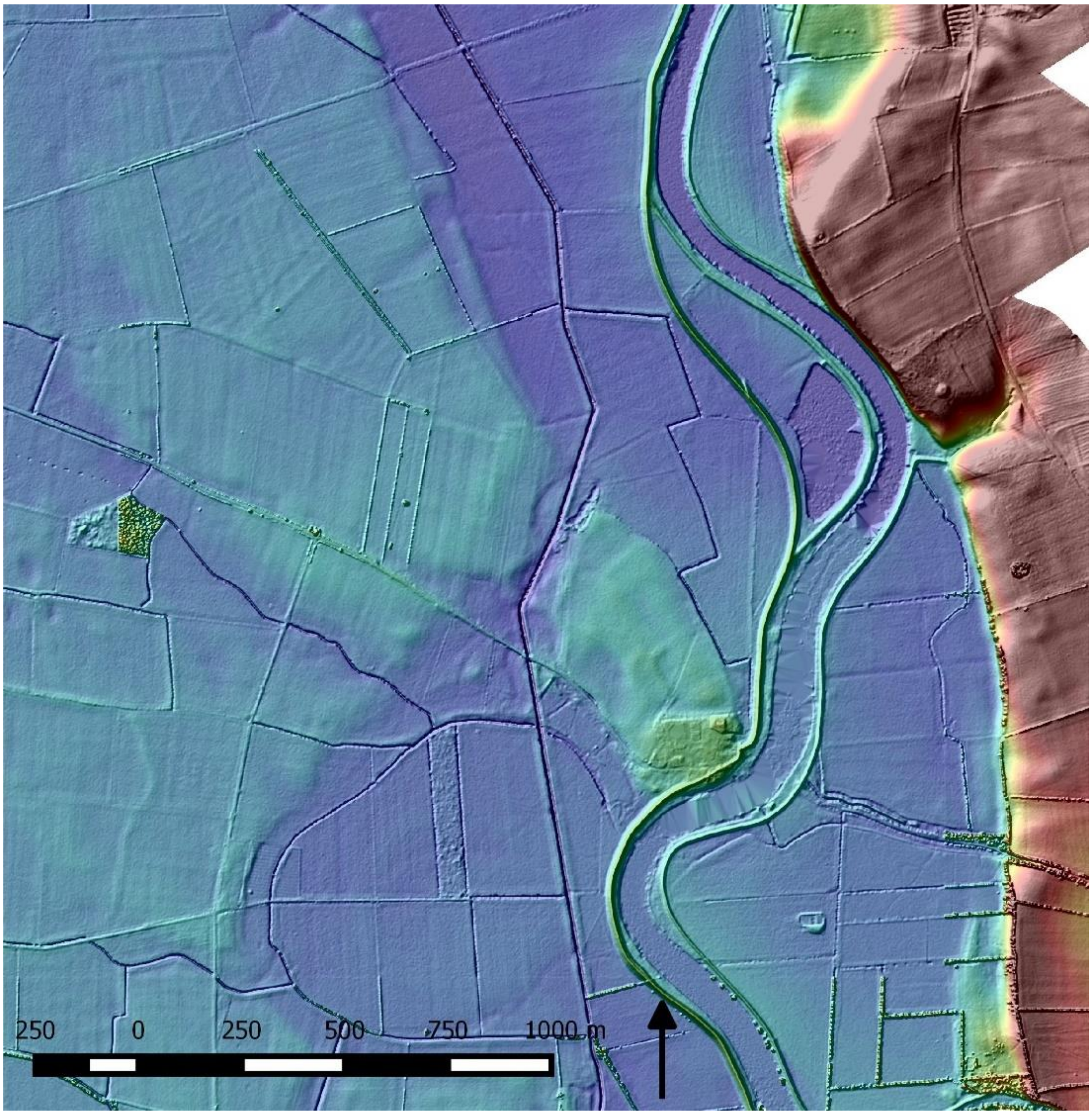


Figure 6.11: LiDAR image of the palaeochannel to the west of Littleborough

The Romans are credited with constructing the Foss Dyke, just south of present day Torksey. The Foss Dyke follows the line of land that is topographically low, the only location that was below 6m AOD throughout the study area, and indeed much of the nearby area. This low topography continued to the east, with a break in the Mercia Mudstone and Lias outcrops, known as the Lincoln Gap to provide an easily constructed route to Lincoln. This water way, in combination with the series of small 'islands', or small patches of higher ground, would have provided a very unique and useful landscape for trade and travel.

Records of restoration of the Foss Dyke in the medieval period indicate that the original Roman channel may have changed since its construction in the Roman period (Leahy

2007, PG). Upon closer inspection of the topography, present day water ways, locations of the Roman activity, place names, and the transformation of the later medieval landscape, it has become evident that the Foss Dyke was originally was constructed to the north of the present parish of Hardwick, rather than south of it, where it now flows. The suggested original course of the Foss Dyke remains at a low elevation from the Trent all the way east of Saxilby. The proposed original course can be found in figure 6.13. The first evidence of this early course was detected by observing that Roman and early medieval sites line the low ground to the north of Hardwick, rather than the south; there is more likely to be activity clustered around the working trade channel than far to the north of it. Further evidence for this movement will be discussed in the section regarding the later medieval period, when the change occurred; the evidence presents strong evidence of this change, and the suggested original course will be utilised throughout all sections.

Inevitably, other drainage courses and tributaries flowed through the study area during the Roman period, and many probably followed similar courses to the present-day channels. However, there is very little evidence of which were already in place, and which have been constructed or naturally formed since. The River Till would have been present, but with no known Roman sites directly related to the channel, it is difficult to determine how the Till related to the Roman landscape. Figure 6.11 presents an estimation of which channels were present during this period, based on the locations of sites in the study area and the present morphology of the region.

The map in figure 6.12 of the current roads with the Romano-British sites on it has provided some insight into which currently existing roads may date to the Roman period or earlier, and allows some extrapolations to determine where some Roman roads may have since been abandoned. The map of the known Roman sites on road ways in the study area demonstrates that they are another major underlying structure of the Roman landscape. This analysis will address the relationships between the roads and sites with settlement and industry.

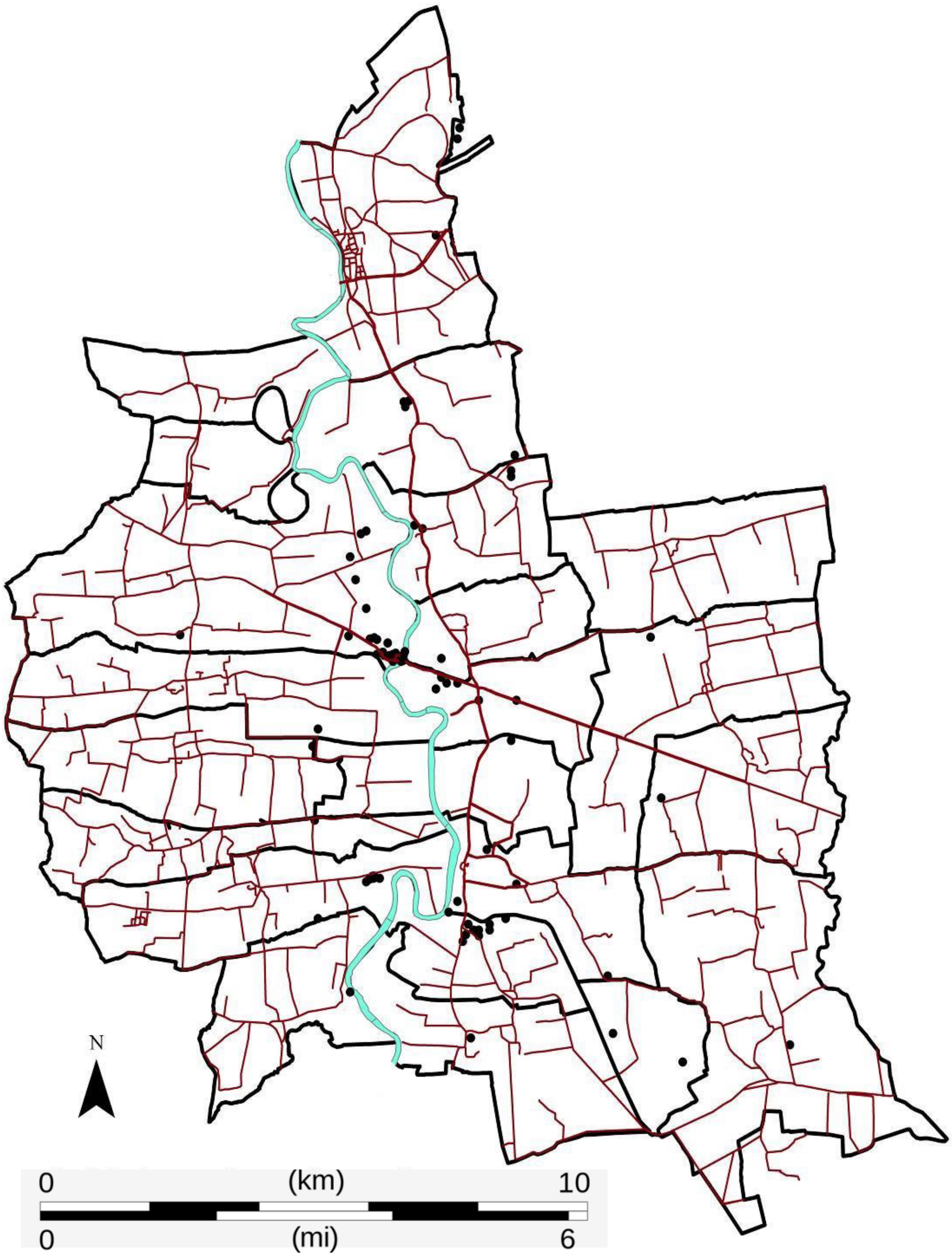


Figure 6.12: Roman sites on present road and track ways.

One road that may predate the Roman period is the pre-cursor to the present-day A156, a road that runs parallel to the Trent, on the Lincolnshire side. This road may have existed in the Iron Age in the form of a track, and the development of Roman settlements along it meant that the track became a significant route way during the Roman period. The morphology of the road does not resemble the typical straight Roman road and this may have been a dry land route offering an alternative to traveling along the Trent from pre-

Roman times. This road would have remained dry during periods of flooding and difficult river conditions.

Tillbridge Lane/Littleborough Lane, the major Roman road through the landscape, has probably changed very little since the Roman period. So named since it has a bridge over the River Till and leads to present day Littleborough, it also has a major river crossing at the Trent at Littleborough and Marton. Many of the sites that do not correspond to environmental features correspond to this road. The settlement at Marton may have spread out to create a linear settlement along the road, and the possibly high-status settlement at Westwoods may also be sited so that it is in close proximity to, but still set back from, this major road from Doncaster to Lincoln. This road has been split at Sturton-le-Steeple in a later period; however its original line is recreated in figure 6.13. Another road that may have Roman origins is Torksey Ferry Road. This is a road which would have led to a possible ferry site leading to Torksey and the Foss Dyke, with the large ancillary settlement of Rampton on the way. Rampton would have also benefitted from its location on this road gaining better access to traded goods.

2.3 The Roman landscape: Conclusions

The study area in the Roman period was a highly functional and prosperous landscape throughout the 1st to 3rd centuries; this is substantially a result of the environmental components making up this landscape. With industrial sites on higher ground, agricultural land on the low-lying alluvium, and settlements on gravel islands or at the crests of higher ground, the Roman population in this area made full use of the resources available.

The industrial sites at Thonock, Lea, Marton, and Torksey are in close proximity to a roadway that mirrors the Trent and so are closely connected to local food sources on the other side of the Littleborough crossing. These industry sites are well placed to have access to the route ways moving materials locally and from longer distances such as sites further north, and further in to the Roman Empire via the Humber. It is no accident that the sites are clustered close to the Trent, and there are fewer detected sites further to the east, as areas that were not near, or connected to, a frequently traversed route way, would have struggled to benefit from the Roman trading network.

The settlements along the floodplain would have had easy access to incoming goods from the rest of the British Isles, locally by way of Bawtry and Doncaster via the Roman Road, and from the continent via ships moving down the Trent into Littleborough and the Foss Dyke. The communities at some of these sites, such as Rampton and Littleborough, gradually grew into larger villages and/or towns (in the case of Littleborough, a planned town), to support the influx and constant movement of people through this very important part of the Roman network (Knight 2000; Riley *et al*. 1995). It is likely that the settlements across the Trent Valley were primarily farming communities, taking advantage of the fertile alluvium, and low water levels during this period. The pollen sequence at Torksey indicates that regional vegetation clearance took place just prior to the 2nd century, and the establishment of these settlements on this part of the floodplain may have been responsible for much of that clearance. The substantial settlement at Littleborough was responsible for processing grain, as evidenced by the drying kilns, and nearby settlements may have had similar facilities to process the crops grown on the floodplain. At a prime location on the Trent and the Roman road, Littleborough may have acted as a trading hub for the local agricultural and industrial communities.

Mapping the archaeology in this period has helped to define several aspects of the environment in the local area. Overall, water levels were low; the landscape was already used for agricultural activities during the Bronze and Iron Ages, but Roman settlement in the area increased agricultural use of the land and sparked a local clearance event. Pollen evidence collected in chapter 5 suggests that there would have been some wooded areas up to and during the Roman period, which may have filled in some of the blank spaces in the mapped landscape. The vegetation clearance throughout the floodplain may have induced the shifting of the river course from the secondary channel in the Mother Drain in the 3rd-4th centuries, due to increased silt output from upstream. Towards the end of the Roman period, increased sediment load, combined with wetter conditions and climate deterioration in the post-Roman period, would have led to a rise in the water table, wetter conditions in the lower part of the valley and increased flooding. This, in turn, led to the abandonment of the floodplain settlements. Colder climates also led to increased strong winds, which facilitated the redeposition of aeolian sands from the fields that had been cleared.

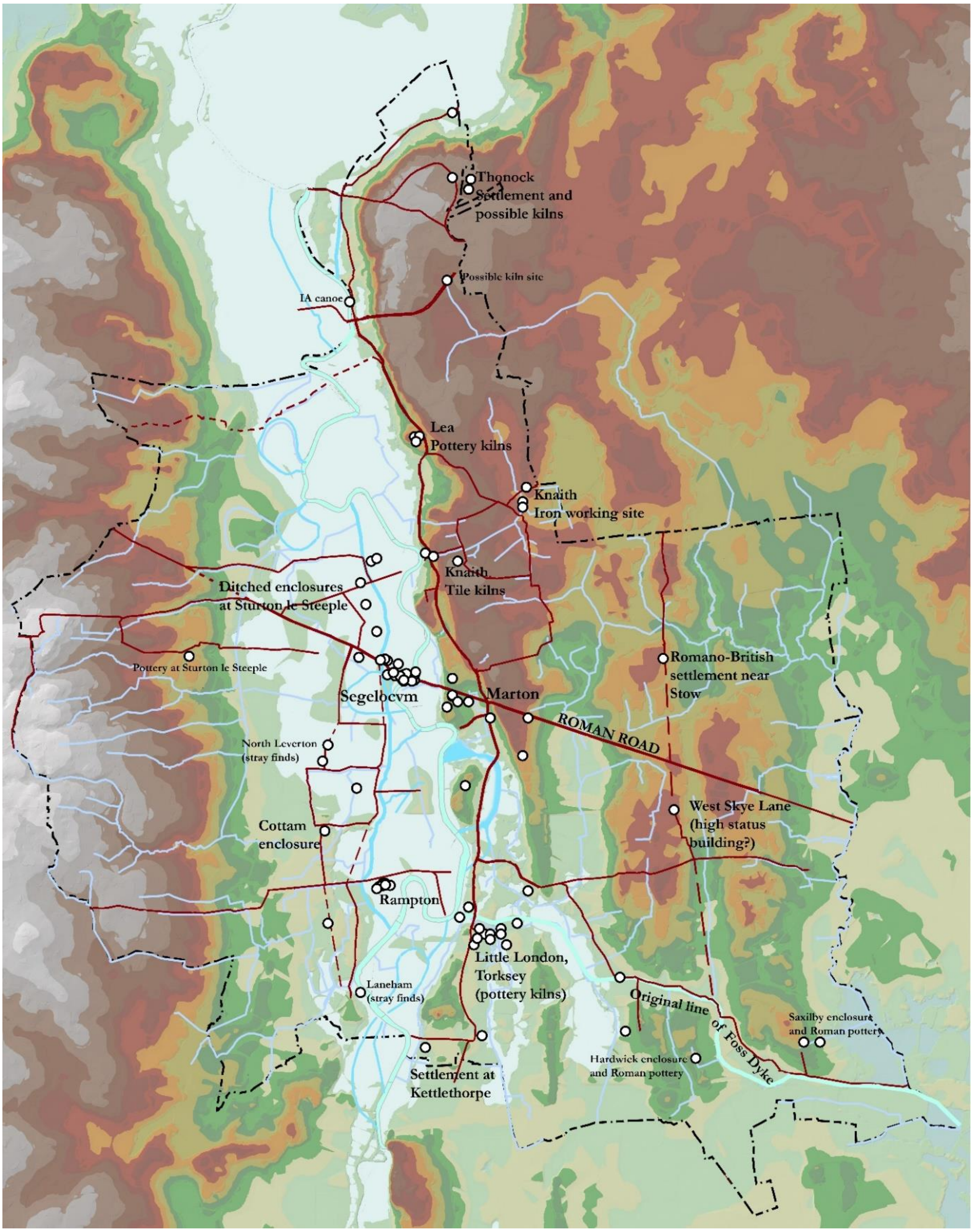


Figure 6.13: The sites, routes and water courses that were present in the Roman period (colour range has been enhanced for this image to demonstrate contrast between elevations; applies to all final landscape images).

2.3.1 The transition from Roman to early medieval

The review of the archaeology of Roman settlement within the study area has demonstrated that there was a strong Roman presence, especially on the Nottinghamshire side of the study area. The sites were occupied from the 2nd-4th centuries, though many may have foundations in the Iron Age. The abandonment of these sites in the 4th century indicates that major landscape changes occurred around that time, which may be due to cultural changes and the withdrawal of the Roman Empire, and landscape changes that occurred due to environmental change, or a combination of both. While the evidence of Roman settlement has been useful in determining the nature of the sites and their relationship to the landscape, it is the post-depositional processes that occurred on each of the sites that actually provides the greatest insight into the Roman and post-Roman environment. The most notable change that occurred after the Roman settlement sites on the floodplain were abandoned is that the ditches of the excavated farmsteads at Sturton-le-Steeple, Littleborough, and Rampton all filled with peat and organic rich silt. Riley *et al*. (1995) attributed this change at Littleborough to the shifting of the River Trent at Mother Drain and Seamere Dyke to its current course and this is visible in the LiDAR analysis produced as part of this study.

The post-abandonment accumulation of alluvium and peat within negative features in the excavated Romano-British sites is evidence of rising water levels in the post-Roman period. This water level would have risen from 2-3m AOD, slightly lower than the level today, to over 4m AOD, enough to flood the previously fertile land, and make the floodplain largely uninhabitable. With rising water levels, the settlements along Mother Drain were abandoned, a major facet of the transition to the early medieval settlement patterns. The accumulation of peat within deeply incised features in the landscape of the Trent Valley is not unique to the Roman period—peat accumulation within palaeochannels and excavated features occurs widely in alluvial floodplains; in the Trent Valley, peat deposits still occupy interglacial palaeochannels (Knight and Howard 2004). Peat had accumulated in a similar fashion in the palaeochannel to the east of Torksey from the Bronze Age into the Roman and probably Anglo-Saxon period. The infilling of this palaeochannel only occurred because the start of the channel was blocked, and thus still water and frequent flooding led to the accumulation of an anaerobic peat environment. Though the features at Rampton, Sturton-le-Steeple, and Littleborough were never filled with flowing water, the rising water level led to a similar effect in these features after the 4th century AD.

An early medieval wooden stake, radiocarbon dated to the 8th century AD, from the organic fills of the enclosure at Sturton-le-Steeple has determined that the stake was driven into organic deposits that had only partially filled in the feature (Elliott 2004).

Tentatively interpreted as part of a fish weir, the presence of this stake further perpetuates the suggestion that the Roman settlements of the 2nd-4th centuries AD were filled with water and used as fishing resources by the 7th-8th centuries AD. Howard (2004, 5) interprets the stratigraphic location of the stake (driven into peat dating to the Roman period, and under several metres of later alluvium) as an indication that the waterlogged Roman features were still visible into the medieval period, and that alluvium began accumulating after the 11th century (Elliot 2004, 11). The stake is (tentatively) interpreted by Elliot as part of a fish weir (Elliot 2004, 11), possibly comparable to the early medieval fish weirs identified at Colwick (Notts.) in the Middle Trent Valley (Salisbury *et al.* 1984).

In addition to peat development, Roman settlements were also partially obscured by aeolian sand. The settlement at Rampton was covered by a layer of sand, but only after the organic sediments had already begun accumulating, which dates the deposition to approximately the 4th century or slightly later (Ponsford 1992). If this sand is aeolian in nature, it would be the only identified aeolian deposit west of the Trent within the study area; unfortunately, the site has been quarried away, so testing this hypothesis is not possible. Similar aeolian deposition may cover the site at Thonock, though this sand has not been excavated, and cannot be contextualised (John Samuels Archaeological Consultants 1993). Additionally, the site detected at Torksey was also lost in shifting sands across the site, as was described in Chapter 5. Additional post-Roman sand, potentially aeolian cover sands, have been detected at Thonock and Lea.

Overall, climate change in the late 3rd or early 4th century raised water levels, and accumulating alluvium and encroaching wetlands forced settlement out of the Trent floodplain and onto higher ground. These dramatic changes in the floodplain landscape in this part of the Lower Trent Valley led to a dramatic restructuring of the human landscape in the early medieval period.

3. THE EARLY MEDIEVAL PERIOD

Apart from the Viking overwintering in 872-3 AD, the early medieval period also saw drastic climate change, population movement, and the foundation of the beginnings of the modern landscape. The year of the Viking winter camp falls in the middle of the early medieval period, and it is thus difficult to separate the changes that occurred prior to or after this year. The specific dates associated with certain sites will be discussed if known, but otherwise, the period between the 5th and 11th centuries will be discussed as a whole. Additionally, in this section, there will be no differentiation between settlement or industrial sites. While the difference between settlement and industrial sites in the Roman period was clear, there is not quite enough evidence in the early medieval period to detect any similar patterns.

Similar to the previous section, this discussion of the early medieval landscape will first introduce what is known about the early medieval period throughout the area. Much of the archaeology around Torksey was already discussed in chapter 3, so this will be only discussed briefly. Following the introduction to the evidence used, the analytical maps of the area will be presented, and the differences between the Roman and early medieval period and the effects of the environment will be presented. Finally, a detailed analysis of the landscape of the area will be discussed.

3.1 Archaeological evidence for early medieval activity

Unlike the Roman period, the foundation of any route ways or water ways cannot be firmly attributed to the early medieval period. It is equally unclear which features present in the Roman period were maintained for continuous use, which were changed, or which were created. What is known about the landscape during the early medieval period will be outlined in this section, and the landscape analysis will aim to clarify which features may have been active during this period.

As was discussed at the end of section 2, the River Trent underwent major changes at the end of the Roman period in the 4th and 5th centuries. Higher water levels and cooler climate throughout the early medieval period, as revealed through climate records and archaeological evidence, would have had a drastic effect on the use of the floodplain in the early medieval period. These climatic and hydrological differences would have caused changes in the laterally shifting channel. Changes in the course of the Trent are difficult to decipher, since post-medieval accumulation has obscured many of the potential courses of the palaeochannels. However one of the aims of this chapter is to chart where the Trent may have flowed in the early medieval period.

It is unclear whether the Foss Dyke had fallen out of use in the early medieval period (Sawyer 1998; Leahy 2007). The canal required major maintenance in the 12th century, but whether that means that the canal was out of use by the 12th century, or if it just required major maintenance is unclear. The canal would clearly require regular maintenance due to its exposure to the silt flowing through the Lower Trent (for example its most recent major maintenance was in the 18th century due to it becoming 'nearly choked up' [White 1856, 106]). The shift in course from north of Hardwick to its current location south of Hardwick insinuates that the new channel was dug in the medieval period, and it may have fallen out of use for some time in the late Anglo-Saxon period. Nevertheless, it may have been maintained throughout some of the early medieval period, albeit at its original location north of Hardwick. When and if the Foss was an active channel during the early medieval period, it would have probably flowed along the original course of the Roman canal (see above).

The River Trent and the Foss Dyke could have also been regularly used for travel, but it remains unclear whether the routes across dry land founded in the Roman period were regularly maintained and used in this period. There are a few other possible route ways in the early medieval period. Torksey Ferry Lane may have origins in the Roman period, but it is also possible that it was used regularly during the early medieval period, with an active ferry providing access to Torksey from the Nottinghamshire side of the River Trent. A 19th century reference that the poor of Torksey were granted the wetlands in Treswell indicates that there was a connection between Treswell and Torksey, and access may have been available via ferry (LA PAR 15/1, 1815; White 1856, 158). There is no direct archaeological evidence for the ferry, as the remains of a long dock into the Trent from the back of Sycamore Quay, just north of post-medieval Torksey Castle, are dated to approximately the 17th-18th centuries (S. Stein in Perry *et al.* 2011). However a possible trackway or road was excavated at Sycamore Quay, Torksey, with a cobbled surface with casts of wheel ruts from a cart (Pre-Construct Archaeology 1996). The excavation dates this trackway to the medieval period based on the excavations done by the University of Sheffield in 2011 of the alluvium just 20 metres west of the earlier excavations (Perry *et al*. 2011). Finally, north of Gainsborough, present-day Front Street may form part of the Anglo-Saxon core of Gainsborough (Clay 2002). This road now forms part of the parish boundary between Marton CP and Gainsborough CP, perpendicular to the River Trent.

These roads will all be mapped on the final map of the early medieval landscape to clarify which roads were formed in this period that are not recorded in any other sources.

The majority of evidence of the Anglo-Saxon period comes from the village of Torksey, south of the winter camp site, where the majority of archaeology features produced from this period were pottery kilns or burials (see chapter 3). In addition to the archaeology from Torksey, the early medieval church at Stow contains standing remains dating to the 10th century, and a royal estate that is historically recorded as early as the 11th century, but may have earlier origins. Other sites that contain trace evidence of early medieval remains are at Gainsborough, Thonock, Saxilby, Ingleby and Kettlethorpe, mainly in the form of early medieval sculpture within ecclesiastic contexts. There is a noticeable dearth of early medieval settlement on the Nottinghamshire side of the study area, possibly due to inaccessibility across much of the area due to higher water levels; however small pieces of sculpture have been found at Laneham, Coates in North Leverton, South Leverton, and Littleborough.

As was demonstrated in chapter 3, Torksey was a major hub of early medieval industry in the 10th and 11th century (Hadley and Richards forthcoming). Torksey was also probably a major settlement as early as the 10th century, and was considered a large town by the 12th century; the industry of the Torksey ware pottery was described in chapter 3. There is no shortage of evidence for this industry, but there is little to no evidence for settlement across the village and surrounding fields. Several types of early medieval and medieval burial practices have been detected at Torksey, but it remains unclear where the population was living. A single possible sunken feature building was detected during excavations in the current village of Torksey (Rowlandson 2005), but overall, the archaeology has only produced evidence of industry and burial. The records discussed earlier in this dissertation will be mapped in this analysis.

The evidence for early medieval activity at Torksey is overwhelming, with multiphase early medieval and medieval deposits across the modern village (considered to be a 'medieval shrunken village' by Everson *et al*. 1991) and surrounding fields. Chapter 5 demonstrated that the surrounding environment of Torksey and the winter camp site created island sites naturally 'defended' by wetlands, which would have provided ideal places for settlement. In addition to these benefits of the natural landscape, the population at or around Torksey were also taking advantage of the major local, regional, and international trade routes along and across the Trent and through the Foss Dyke (Sawyer 1998). With access by water to the Humber Estuary, Northumbria (via the River Ouse), the European mainland and Scandinavia, Mercia further upstream along the River Trent, and Lincoln by way of the Foss, Torksey was very well placed to become an important centre in the early medieval (and later medieval) period.

The early medieval settlement at Stow fulfilled a different purpose from the industrious town of Torksey. Instead, Stow served as a major religious, economic, and administrative centre, with a large minster church (and later a Benedictine abbey and college) (Everson *et al.* 1991, 185; Linc. HER 50262, 1995). The place name of Stow roughly translates to 'holy place', or simply 'place' (Blair 2005, 217). Local historians have postulated that, while the church was very important by middle and late Anglo-Saxon periods, that Stow was always a relatively rural site, and that the minster was utilised by the surrounding estates belonging to the Anglo-Saxon bishops, including the founder of the college, Eadnoth, Bishop of Dorchester (Anon., 2001; Blair 2005, 259). The history and evolution of Stow as a minster church in the 7th century diocese of Dorchester, especially the impressive early church building and associated sculpture, and recorded 'gold, silver, gems, and precious stones' adorning the minster supports the impression that it was clearly an important religious centre from at least the 10th century and quite possibly as early as the 7th century (Blair 2005, 329; 357). A recorded yearly market in 1053 also demonstrates that the minster site would have provided a means of public gathering (Blair 2005, 335).

Many of the improvements and expansions of Stow in the mid-11th century are related to the endowment of St Mary's by the Mercian royal family. Although Stow and Lindsey became part of the diocese under the Bishop of Dorchester under Cnut prior to 1034 (Sawyer 1998, 151), a 1054 to 1057 charter, cites that 'Godgifu, wife of Leofric, to St Mary's Stow; grant of land…at Brampton in Torksey and Marton in Well Wapentake, Lincolnshire., with papal confirmation' (Sawyer 1998, 231). Notes about this charter include that the land granted included land at Marton and at Brampton in Torksey (Sawyer 1998, 234). Godgifu is known as the daughter of Æthelred the Unready and Emma of Normandy, and is perhaps even better known as 'Lady Godiva', a woman of considerable legend[13], and royal Mercian blood. 20 years later, the Royal connection is confirmed in the Davis *Revesta* no. 333 (AD 1070 x 1072) which records that 'Writ of William I addressed to Thomas, archbishop of York, and the sheriffs of Nottinghamshire and Lincolnshire, informing them that he has given to St Mary at Stow…Brampton and Well Wapentake' (Sawyer 1998, 232-4). Consideration of the environment of the endowed areas means that it can be inferred that the land granted was the winter camp site: much of the land at Brampton has been identified as wetlands, with the exception of the Viking camp site. These records also provide a direct link between the winter camp site north of Torksey, the royal Mercian family, and the Bishop of Dorchester's estate at Stow. The royal grant of land, and the presence of an Anglo-Saxon market, would also make it the only estate of any political and ecclesiastic importance within the Danelaw (Stenton 1943, 432). Despite a rich history, and a standing building with early medieval components, very little archaeological work has been completed at Stow, and even less is understood about its relationship with the local population.

At Stow, English Heritage cites excavations that display several tofts with iron working nearby, although the listing does not provide any citations for that excavation (Lincs. HER No. 52439 [no date]). In the grey literature, there is no substantial evidence to support this. What does remain is a large ditch that surrounds St. Mary's, and a (later medieval) moated site west of the church. HER listing for the settlement at Stow states that the road that now runs through the village has largely destroyed the early medieval layout of the settlement (Lincs. HER No. 52439). The market place may have existed to the immediate south of the church. There is no question that the early medieval stone church could have supported a large congregation; however, whether it served only the wealthy estate and manor owners and their workforce, or a more general population who lived in and around Stow is unclear. Building phases on Saint Mary's church at Stow indicates that the earliest phases of standing construction may date from as early as 975 AD, with building occurring under Bishop Aelfnoth (Woolhouse [no date], 3). However, other sources suggest that building began in 1034, with Cnut's decree that Æthelric, bishop of Dorchester, would receive rent from St Mary's (Sawyer 1998, 151; Lincs. HER NO. 52434, 1995). Late Anglo-Saxon remains dating to the 10th century were found north of the church, within a postulated ditch surrounding the contemporary church (J. Young

[13] Lady Godiva (Godfigu) is known from the (13th century?) legend of her protesting her husband's (Leofric, Earl of Mercia) unreasonable taxes by riding naked through the streets of Coventry (Donaghue 2002).

pers. comm), which may relate to the endowment from Godgifu and Leofric. The college and Benedictine Abbey, located to the east of Saint Mary's church, were founded in 1005 and refounded in 1091 (Lincs. HER no. 50262, 1995). A formal market was well-established and recorded by the 12th century, and was probably founded earlier (Lincs. HER No. 52439; Everson *et al.* 1991, 185). While archaeological evidence is limited for the activities that occurred in early medieval Stow, the monastery, bishop, and estates must have required supplies of food and other goods by local commerce where possible. The surrounding area was cultivated in the Roman period, and much of it possibly would have remained arable land. This would have served the major local estate at Stow, and possibly some of the surrounding population, including that at Torksey.

The presence of at least one large early medieval estate and deserted settlement at Stow Park may indicate that early medieval Stow was used as an administrative centre with settlement kept some distance from the 'holy place' (Everson *et al.* 1991, 185). The settlement and moated enclosure at Stow Park is so named because it is located on the northern edge of an established royal deer park. The first historical reference to Bishop's Palace at Stow Park as a separate entity from Stow, and as an established royal estate, is in 1170 by Giraldus Cambrensis (Everson *et al.* 1991, 185); the date of the foundation of Stow Park is not clear, and there have been very few finds from the site, bar a few pits and well-defined earthworks of a moated enclosure (Cope-Falkner 2003). A surrounding medieval deer park at Stow Park may also have been established as part of the early medieval royal centre (Everson *et al.* 1991; 185).

It was the original intention to extend the landscape survey only to sites where there were substantial remains; however only Stow and Torksey have produced archaeological evidence of the early medieval period. Instead of only archaeological or standing remains, the survey was extended to locations where there have been large artefact scatters found or where Anglo-Saxon sculpture has been found (nearly always within parish churches). This extension of survey parametres provided a few more sites that may have been founded in the early medieval period; sites that have artefact scatters that have been recorded by the HER include Gainsborough and Thonock, Ingleby in Saxilby, Kettlethorpe, South Torksey, Laneham, Coates in North Leverton, and Littleborough. Sites with Anglo-Saxon religious iconography include Saxilby, Torksey, and Marton.

At Gainsborough, local records refer to a 'Danes Camp', at Castle Hills, which was considered a potential location for King Swein of Denmark's camp (Clay 2002). Recent topographic survey and documentary research has since determined that the current earthworks represent a late medieval motte and bailey fortification (Everson *et al*. 1991). Castle Hills has later medieval ties to Torksey, as the site was granted to the canons of Torksey in 1218 (Everson *et al.* 1991; Allen 2002, 4). Although there are no large earthworks that survive from the early medieval period elsewhere in Gainsborough, finds from within the parish may provide clues to the location of the Anglo-Saxon activities.

Within the present settlement of Gainsborough, human remains of late Anglo-Saxon or early Norman date, were recorded in 1875 north of Bridge Street and south of Silver Street, which may indicate Anglo-Saxon beginnings in Gainsborough (Lincs. HER No. 52054). Later burials were also uncovered in 2010, with pottery dating to the 11th through to 13th centuries (Pre-Construct Archaeology 2011). This cemetery was potentially quite substantial, with one or even two earlier associated chapels, known as Chapel Staithe and Chapel Garth (Clay 2002). Leland also recorded a chapel on the south side of Gainsborough, which he described as 'where the townspeople say that many Danes are buried' (Chandler 1993, 295). Later sources indicate that one chapel was made of wood and the other of stone, and that the stone church had Danish burials associated (Moor 1904). Although no remains of the buildings referenced have been located in the vicinity of these burials, the medieval burials may indicate that a late Anglo-Saxon church or other religious centre was in close proximity (Clay 2002; Chandler 1993, 295).

All Saxo-Norman remains throughout Gainsborough, including both human remains and pottery, are found just on top of sand (potentially aeolian) contexts. However there is no record of any excavations extending below the level of sand, as the deposit was often dismissed as either alluvium or the 'natural' geology. Considering the excavated geology at Thonock, however, post-Roman period aeolian deposits do occur in this area, and Anglo-Saxon archaeology may be within or beneath the unexplored aeolian contexts. Much of the present town of Gainsborough, however, lies on post-medieval alluvium deposits, which may have been uninhabitable until the 18th century (Clay 2002).

Early medieval metalwork and pottery finds from the areas surrounding the Romano-British settlement at Thonock demonstrates early medieval activity (John Samuels Archaeological Consultants 1993). Additional finds from the 13th century indicate continued activity for up to 1000 years after the foundation of the settlement. Excavations on the site only produced Romano-British pottery and ditches overlain by sand, with early medieval finds on the surface. This demonstrates that although much of the Romano-British settlement had been obscured by an aeolian episode, activity resumed on the same site after the aeolian event. It is not clear if the Anglo-Saxons were aware of the previous presence of the Roman site, or if the re-use of the site was for different reasons. There is no positive evidence of early medieval occupation, but this may be due to the remains being truncated with later ploughing and other erosion in the area.

A scattering of early medieval pottery was found at the North Ingleby Manor (now known as Gables Manor) in the parish of Saxilby, This is site of a later medieval manorial site (Everson *et al*. 1991, 3; Johnson 1997a). Ingleby was recorded as a separate settlement to Saxilby in the Domesday Book, though now, as a DMV, it lies within the parish of Saxilby. The presence of Anglo-Saxon pottery at this location indicates that there may be Anglo-Saxon roots to the settlement of Ingleby, which was later split into two medieval manors. Ingleby is commonly translated as 'hamlet or small settlement (Danish suffix -*by*) of the English (*Ingle*)' (Cameron and Insley 2010, 93), which may also point to an Anglo-Danish influence at the time this settlement was created.

The area around the present settlement of Saxilby has not produced any artefact scatters, however the presence of early medieval carving at the Norman parish church (St Boltoph's) indicates an earlier establishment (Gardner 2006a). There are very few records of the carving, which can only be found in the HER (Lincs. No. 52776). The carving is described as having interlace, and has been dated to the 10th-11th century, with Anglo-Scandinavian influences (Gardner 2006). Place name evidence from Saxilby also incorporates Danish influences, directly translating to '*Saxulfr's* (Scandinavian personal name) small settlement (suffix-*by*). This name contrasts with the settlement of the English to the north, but the juxtaposition of these two places and place names, both with evidence of early medieval activity, as well as a hint of an Anglo-Scandinavian influence, may hint at a complex relationship between Anglo-Saxon and Scandinavian settlers in the area.

An unusually large corpus of Anglo-Saxon and Anglo-Scandinavian sculptural fragments was found within the fabric of St Margaret's Church, Marton. These fragments include small crucifixes on the stone within the church, and a possible grave slab cover, all dating to the early to mid-10th century (Everson and Stocker 1999, 226). Additional evidence for Anglo-Saxon activity in Lincolnshire includes an early carving found outside the Torksey parish church of St Peter's. The carving is well-worn, but the prominent female features on the carving have led to the conclusion that the carving is possibly of a late Anglo-Saxon or later medieval sheela na-gig (Everson and Stocker 2001).

Very few *in situ* early medieval archaeological remains have been excavated on the Nottinghamshire side of the study area. All early medieval evidence in Nottinghamshire consists of stray finds, pottery scatters, and sculpture, with no solid evidence of settlement or other activities (Laneham, Coates [North Leverton], Littleborough, and Sturton-le-Steeple). The early medieval stake found within the peat infill of a Romano-British ditch in Sturton-le-Steeple (see section 2.3 above) provides a very small piece of *in situ* evidence for early medieval activity. Although the function of a single stake cannot be confirmed at this time, there are a plethora of fisheries recorded in the Domesday Book throughout the area. Additionally, the presence of an 8th century stake within peat infill of a Romano-British ditch that was probably abandoned around the 4th century may indicate the continued visibility of Roman sites in the Trent Valley throughout the early medieval period.

In the parish of Laneham, the settlements of Laneham and Church Laneham developed separately. According to a recent desk-based assessment, excavations, and analyses, only Church Laneham, had roots in the Anglo-Saxon period (Budge 2010), while the settlement of Laneham was a later medieval settlement expansion. The 2010 assessment of the area around the parish church of St Peters also determined that the development of these settlements from the early medieval to the later medieval period was possibly due to environmental factors (Budge 2010), a hypothesis that will be explored further in the analysis below. At Church Laneham, Anglo-Saxon pottery sherds have been found within the village and from the margins of the settlement. A recent excavation completed around St. Peter's church also produced early medieval pottery (Budge 2010). All Anglo-

Saxon pottery scatters were found on top of alluvial deposits, suggesting that the build-up of alluvium around these gravel islands occurred prior to or during the Anglo-Saxon period (Budge 2010).

Early medieval finds have also been recorded at the settlement of Littleborough, which may also have been a significant religious centre as far back as the 7th century. Bede recorded that in 628 St Paulinus baptized 'the multitude in the River Trent hard by the city, which in English is called Tiovulfincacester' (a late Roman name of the city, meaning Tiovulf's encampment) (Bede, *Ecclesiastical History of the English People*). The site has historically been linked with Littleborough (Brown 2012), though there is no direct evidence of this link. Anglo-Saxon sculpture and architecture within the village church, however, does confirm an Anglo-Saxon presence in the vicinity (Notts. HER No. 382620). Anglo-Saxon pottery was also found at the settlement of Coates in North Leverton, along with Anglo-Saxon carved stone in a local farm building (Notts. HER No. 342962). Anglo-Saxon stone coffins are also reported at the site (S. Rockcliffe *pers. comm.*; Ford 1975), though no primary record could be found of these carvings.

The location of the study area in the Lower Trent Valley, especially during a period with higher rainfall and cooler climates, means that the study area would have been dominated by wetlands in the early medieval period. The morphology of the underlying bedrock, and low height above sea level of the surrounding floodplain, means that the area was defined by a series of islands (the winter camp site, Torksey, Kettlethorpe, and gravel islands of Littleborough, and Laneham). Wetlands would have provided plenty of opportunities for fishing for these islands. This is corroborated by Domesday which states that there were several fisheries in the study area at the start of the Norman period. Figure 6.14 shows the number of fisheries recorded throughout the area at the time of the Domesday survey in 1086. One of the 5.5 fisheries at Rampton and Leverton may even be at the location of the stake interpreted as part of a fish weir in present day Sturton-le-Steeple parish (Elliott 2004).

Torksey	11 fisheries
Lea	0.5 fisheries

Bole	2 fisheries
West Burton	2 fisheries
North Leverton	2 fisheries
Rampton	3.5 fisheries

Figure 6.14: Number of fisheries recorded at each settlement in the Domesday Book (DB 1086)

Despite widespread clearance in the Trent Valley by the 2nd century, the study area had many areas of woodland by the 12th century; especially on the Lincolnshire side of the area. Figure 6.15 shows the acreage of woodland recorded at the places mentioned in the Domesday Book in 1086. The existing woodlands would have provided a plethora of game and plants that were not available through agriculture; the resources available may have also included rabbit warrens in the naturally forming aeolian deposits. The later medieval landscape was dotted with deer parks, and many of these may have originated in the early medieval woodlands. The woodlands would have provided the perfect areas for later emparkment, especially in areas such as Thonock, Kettlethorpe, and Stow Park.

Torksey	60 acres
Sturton by Stow	80 acres
Lea	100 acres
Gainsborough	80 acres
Ingleby	6 * 3 furlongs
Bransby	50 acres
Normanby	162 acres
Knaith	26 acres
Brampton	10 * 4 furlongs
Treswell	4 * 1.5 furlongs
North Leverton	3 * 1.5 leagues
West Burton	3 * 1.5 leagues
Bole	3 * 1.5 leagues

Figure 6.15: Domesday record of woodland areas in 1086

3.2 Maps and descriptions

Figures 6.16 to 6.19 shows the early medieval sites that were described above superimposed onto base maps. The cluster of early medieval activity at Torksey overshadows the rest of the study area, but the distribution of the rest of the sites discussed show obvious correspondence to many of the features mapped in this analysis. Figure 6.16 shows the sites dispersed across the superficial geology. Most notable is the dearth of early medieval sites on alluvium. Early medieval activity in Nottinghamshire appears on the very edges of the alluvium, along the edge of the gravel terrace, or on gravel islands (at Littleborough). On the Lincolnshire side of the study area, the main body of activity lines the edge of the terrace and mudstone along the eastern edge of the Trent Valley. Sites outside of the centre of the study area do not show very much correlation to superficial geology; Ingleby (Saxilby) may be placed due to the presence of sand and gravels, and Stow may be located due to a nearby small stream, but otherwise does not relate directly to superficial geology. Figure 6.17 shows the sites mapped in relation to the topography of the study area. This map demonstrates a stark difference between site distribution of the Roman period and the early medieval period. There are hardly any sites within the floodplain, and those that are, are located on top of gravel islands that are not visible at this map resolution. No sites are below 5m AOD, and most are located over 10m AOD. Sites on higher ground are no longer located at the highest points in the landscape, but rather are slightly downslope, such as at Ingleby, Saxilby, Stow, Thonock, and Kettlethorpe.

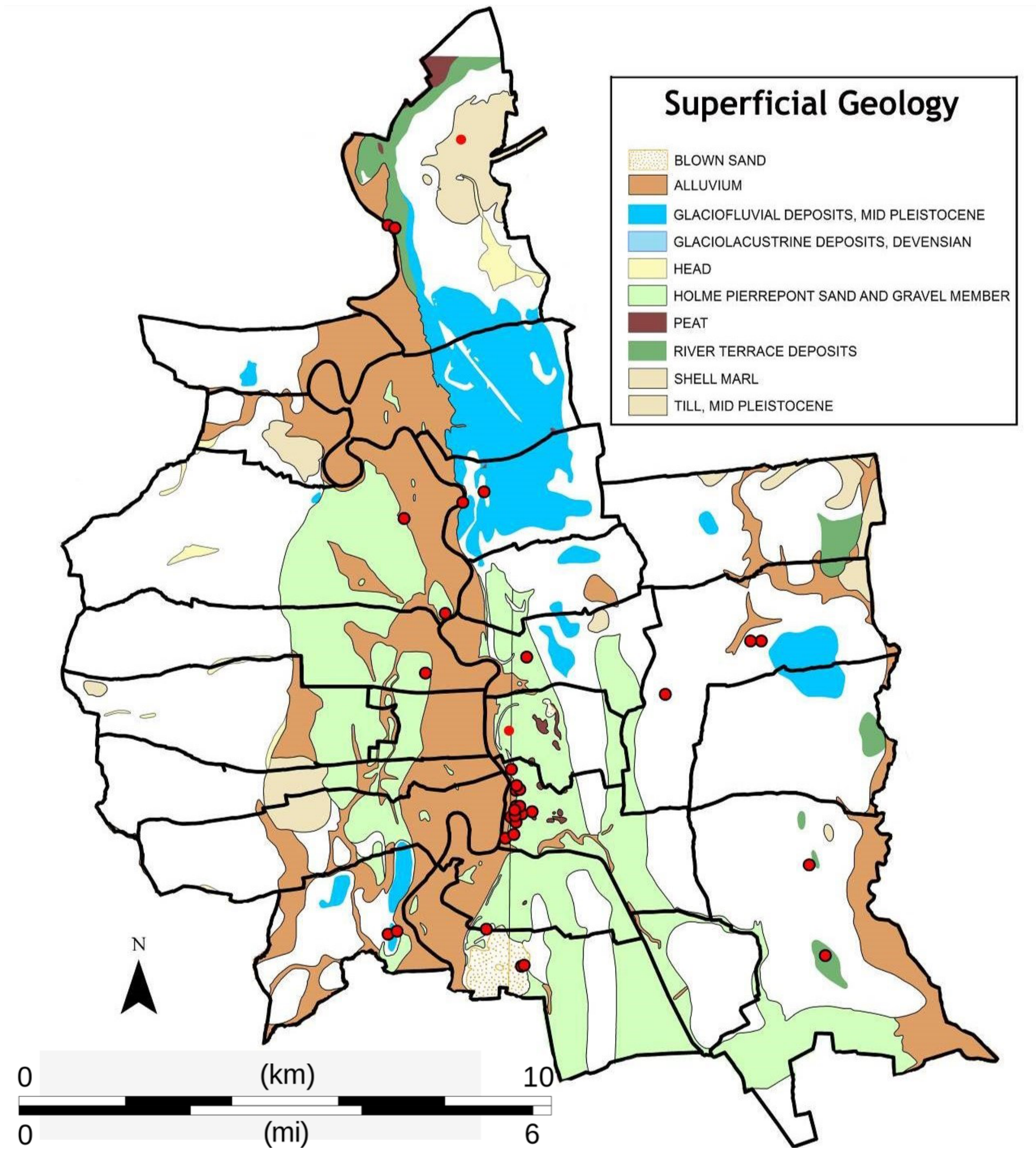


Figure 6.16: Early medieval sites on drift geology.

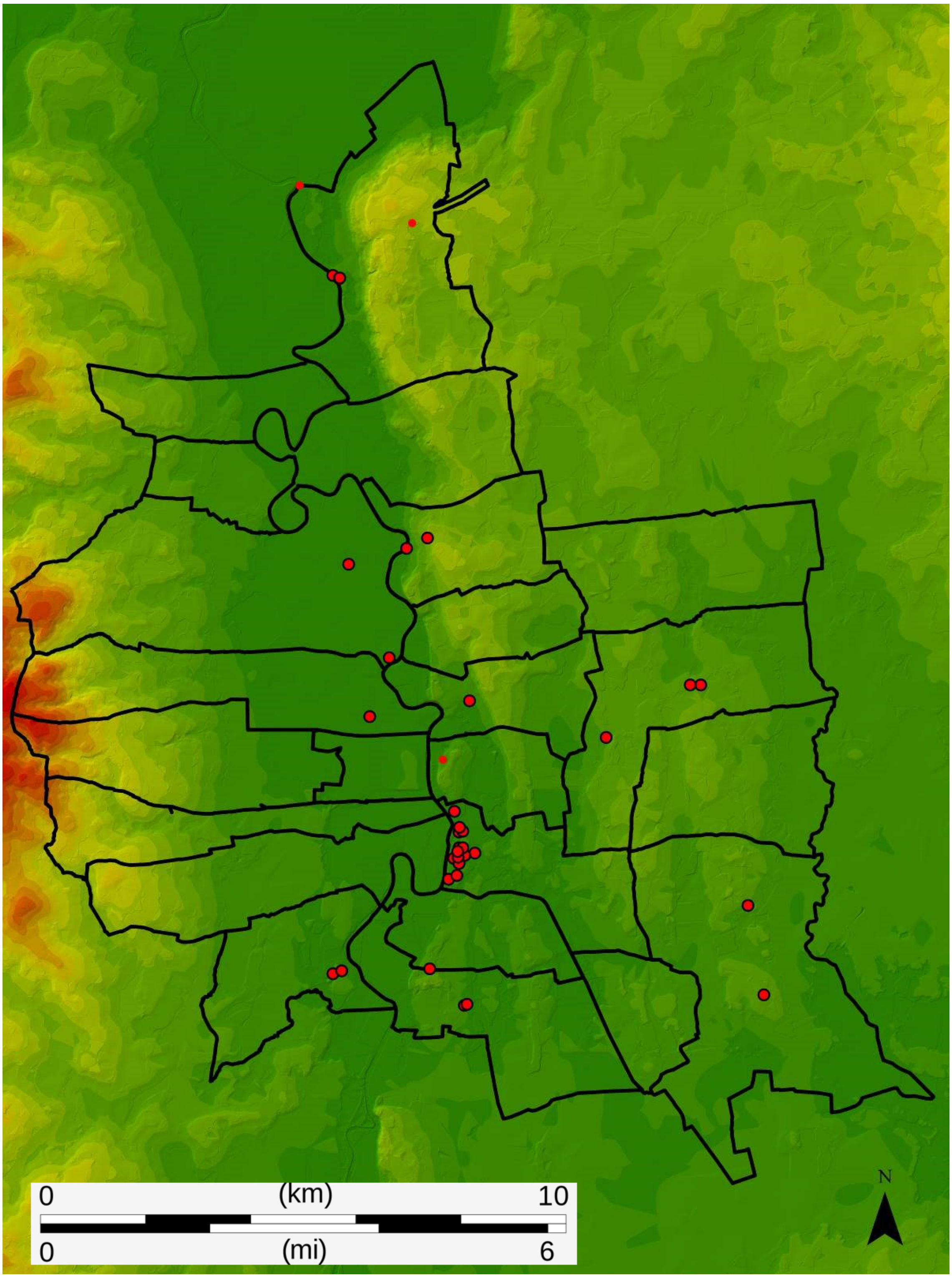


Figure 6.17: Early medieval sites on topography.

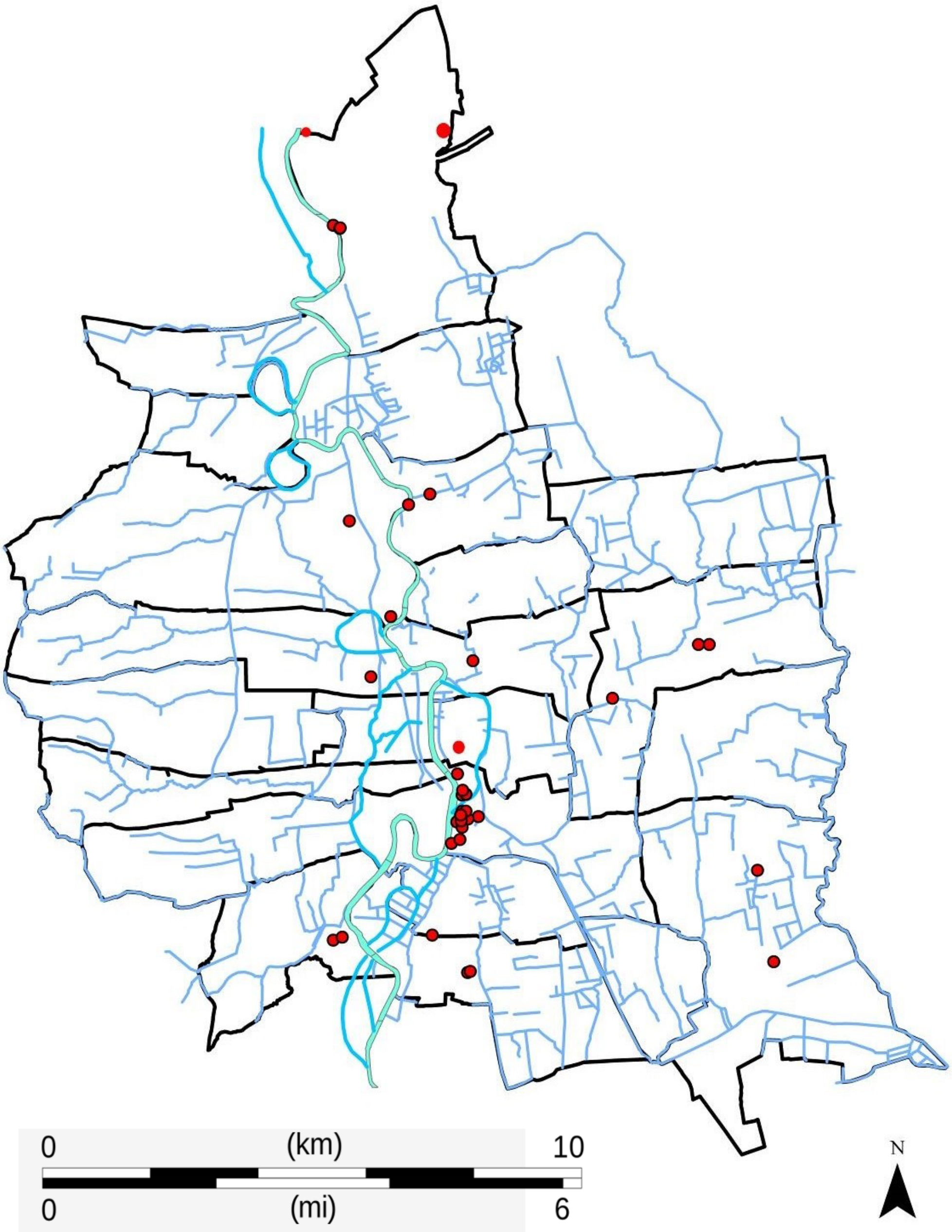


Figure 6.18: Early medieval sites on present rivers, drainage channels, and detected palaeochannels

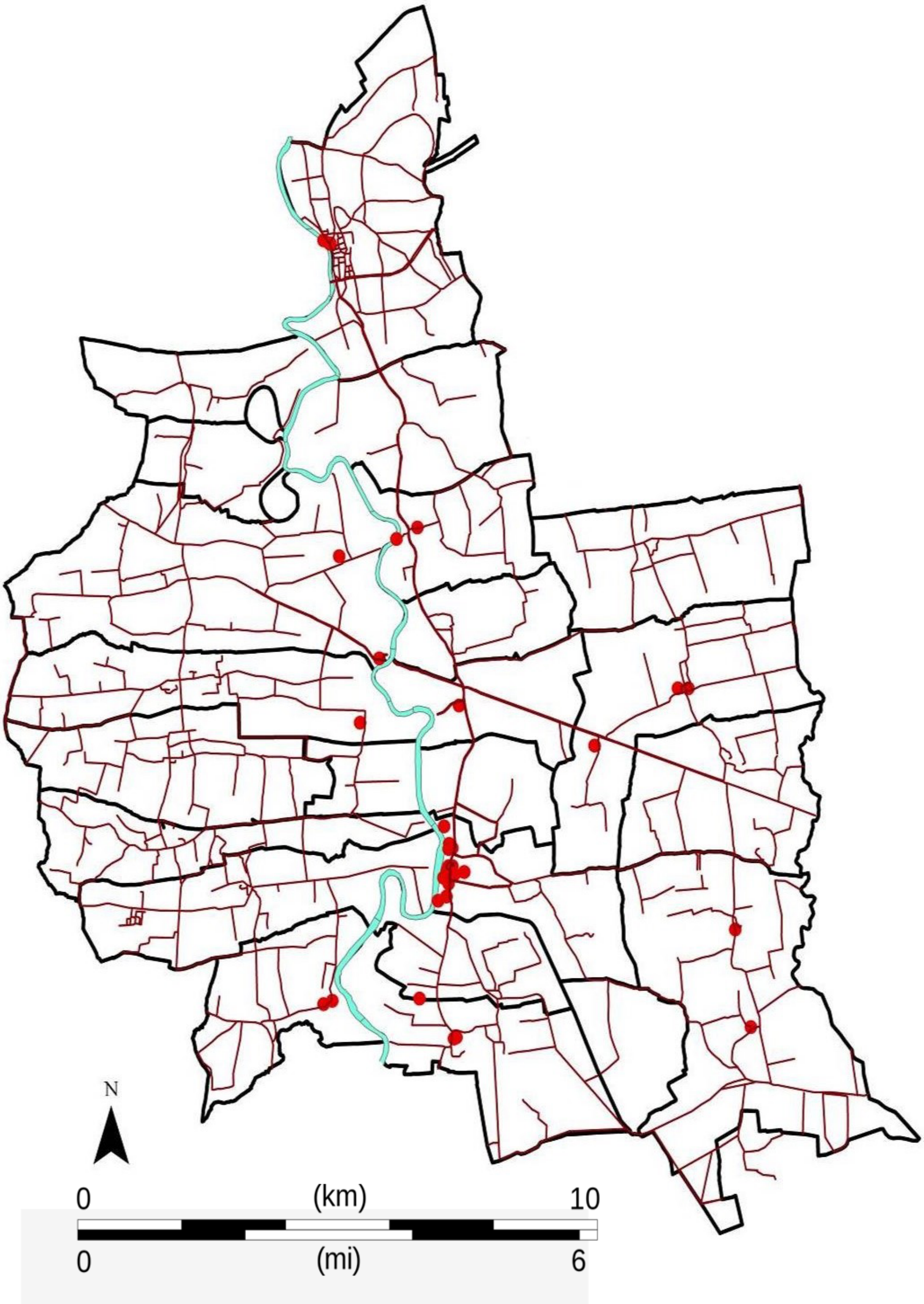


Figure 6.19: Early medieval sites on present day roads and track ways.

Figure 6.18 shows the distribution of sites in relation to the current rivers, drainage channels and known palaeochannels. Besides Littleborough, all early medieval sites in the Trent Valley fall outside of the area between the present River Trent and the Mother Drain. Most sites are located near naturally formed drainage channels: the Trent, the Till or other small tributaries. Exceptions to this are Thonock which is located near a source tributary for the Till, and Saxilby which lies along the Foss. In figure 6.19, all early medieval sites are mapped on the present roadways in the study area. This map shows a clear correlation between early medieval sites and several roads that remain in use today, suggesting that many modern routes were founded in the early medieval period. While there are not as many sites along the major Roman road as there had been in the Roman period, there are several early medieval sites, including Stow Park, Marton, and Littleborough. The A156 connects all of the sites sitting atop the higher ground on the east side of the Trent Valley. Several roads connect early medieval sites that were not present in the Roman period: for example, a north-south road on the east side of the site connects Saxilby with Ingleby and eventually Stow (currently the B1241). Routes across the Trent Valley connect sites on both sides of the Trent, including the road to Church Laneham, a route between Marton and Coates (N. Leverton) (currently called Trent Port Road in Marton, and Broad Lane in South Leverton), and a route between Knaith and the possible fishery in Sturton-le-Steeple, which eventually connects with the Roman Road (currently called Knaith Hall Lane).

3.3 Landscape development in the early medieval period

There is a wide range of evidence for the environmental and social landscape of the Roman period; however, there is limited evidence in the early medieval period, especially during the 4th-8th centuries (Green 2012, 2). The small amount of evidence that does exist mainly dates from the mid to late Anglo-Saxon phases, though the archaeological evidence in the area is often very difficult to place within a concise chronology (Elliott 2004, 153). The paucity of data in the study area means that the 4th-8th centuries are largely missing from the archaeological record. Due to the minimal amounts of available archaeological evidence, greater reliance must be placed on evidence of environmental change.

The most obvious and defining trend across the study area in the early medieval period is the shift of activity from the floodplain to higher ground. This can be attributed to the direct result of environmental change in the Lower Trent Valley. Even though general climate reviews indicated that climatic deterioration took place in the 6th through 10th centuries AD (Dark 2000), Knight and Howard (2004) and Elliott (2004) noted that the climate changes in the Lower Trent Valley began at the end of the Roman period (3rd to

4^{th} century). The environmental transition was contemporaneous with the withdrawal of Roman influence, leaving a landscape with a change in both physical and social constructs.

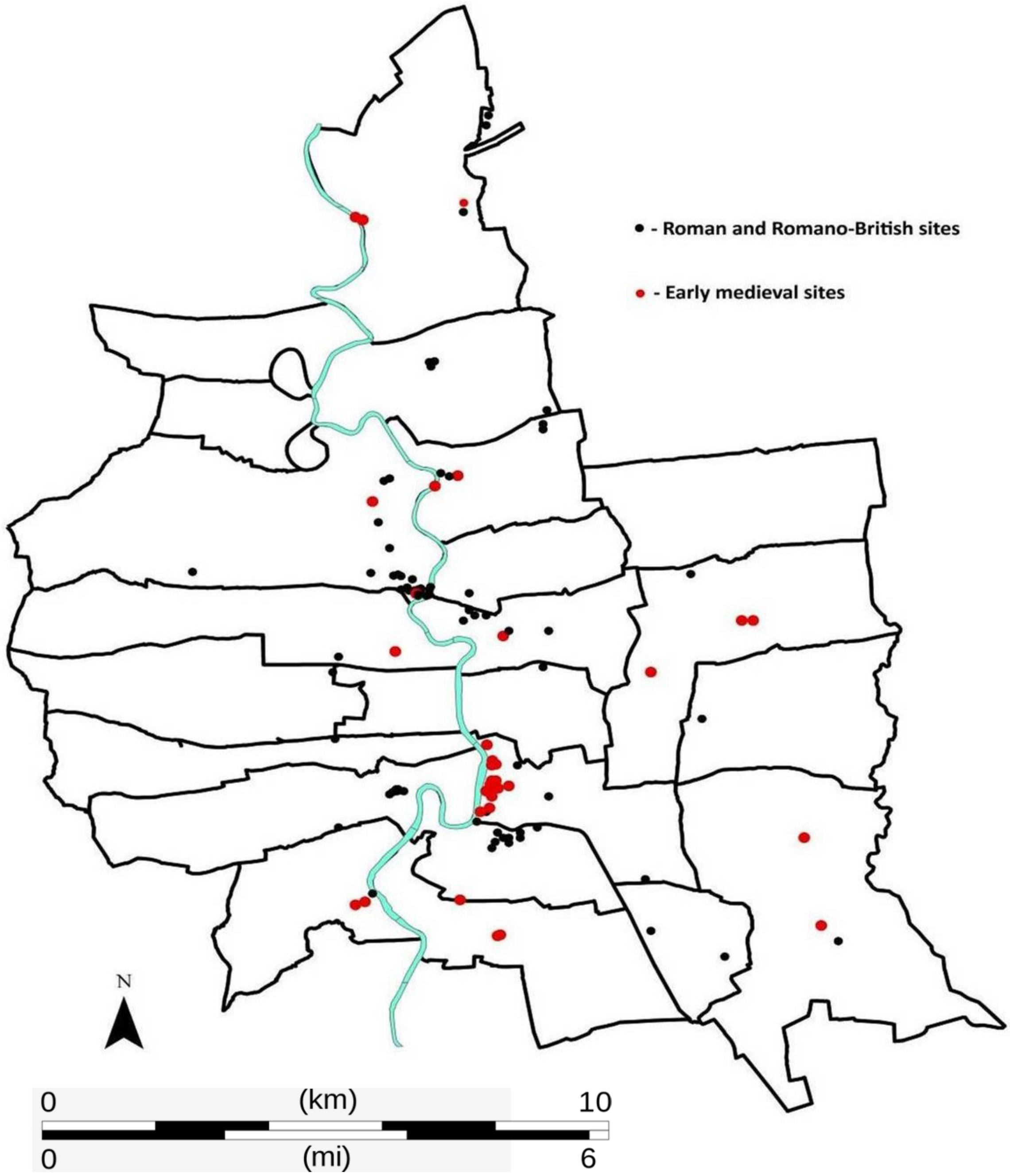


Figure 6.20: Movement of settlement focus from the Roman to early medieval periods.

Despite being the main period of interest in relation to this thesis, the environment of the early medieval period within the study area remains the most difficult to define. Evidence has accrued to indicate a shift in the channel of the Trent, and the relinquishing of floodplain to an area of wetland, in the early 4^{th} century. The development of peat deposits within the Romano-British settlement at Sturton-le-Steeple, and the *in situ* early medieval stake within the peat, and the build-up of alluvium on top of the late 3rd century remains of Littleborough and Rampton provide some evidence within the study area. Unfortunately, the environmental data lacks any information about vegetation in the early medieval period. Pollen that has been sampled from the study area thus far does not include a sequence for the early medieval period, so it cannot be certain if there was any woodland regeneration after the widespread clearance of the Roman period. Lack of vegetation evidence also makes it difficult to confirm the encroaching wetlands of the period through prevalence of aquatic or wetland species.

This climate change is not recorded only in the Lower Trent Valley. Similar processes occur at sites further afield, such as at Mattersey, where peat accumulation dates to the early 5th century (Garton *et al.* 2000). Peat deposits filling features of the recently excavated Roman settlement in Scunthorpe also demonstrate waterlogged conditions in the post-Roman period (M. Allen *pers. comm.*). Rather than direct evidence through pollen or peat analysis or the development of other datable archaeological deposits, indirect evidence based on sediment sequences, and landscape analyses for larger regions (such as this study and analysis) provides the greatest support for climate change in this period. This section will demonstrate a clear shift of site distribution as a result of climate change, and provide examples of climate change adaptation at Littleborough and Laneham.

In figure 6.20, the sites of the Roman period are mapped with the early medieval sites. Despite a dramatically lower number of sites in the early medieval period, the change in the distribution of sites clearly demonstrates the shift from the Roman site concentration around the low elevation of the Trent Valley in Nottinghamshire to the higher elevations along the Lincolnshire side of the Valley. The changes seen in the image, combined with generally deteriorating climate trends and evidence that Roman sites in the floodplain were becoming covered with peat and alluvium, confirms that the water level in the study area (and across the Lower Trent Valley) rose dramatically in the 4th century, and remained high throughout the rest of the 1st millennium. Activity patterns show that the water level was raised from an average of 2-3m AOD in the Roman period to 4-6m AOD in the Anglo-Saxon period; without any formal drainage, this would regularly flood much of the Trent Valley throughout the early medieval period.

The use of the site of Littleborough in both the Roman and Anglo-Saxon periods demonstrates the effect of a 2 metre rise in water level. Littleborough is located within the floodplain, but part of the site is located on top of a gravel island. During the Roman period, the settlement covered a larger area around the island, but these remains are now covered in alluvium. The part of the settlement that survived into the Anglo-Saxon period (and eventually to the present day), is directly on top of the gravel island. The two separate levels of water are clear on the LiDAR image in Figure 6.11. Figure 6.21 shows the hamlet of Littleborough in the 1940s, during a flooding episode. Flooding around Littleborough in the Anglo-Saxon period may have appeared very similar to this flooding, with only the gravel island standing above the water, leading to the shrunken settlement size, and concentration on this area. The Roman remains of Littleborough are completely underwater on the far side of the photo in this image. Frequent flooding of the Trent Valley in the 4th century is the most probable reason why this large settlement, and others along the Trent Valley, became disused. Regular flooding events in the Anglo-Saxon period would have forced the movement of settlements throughout the Trent Valley.

Littleborough may have survived since the Roman period due to the presence of the established fording place, ferry crossing, or bridge over the Trent, and possibly the Mother Drain, at this location. This route conveniently connected Nottingham with Tillbridge Lane into Lincoln. Consequently despite inhospitable conditions and the small size of the island, maintenance of these features associated with the crossing was required for continued use of the route.

Figure 6.21: Photograph of great flood, 18 March 1947 (Photo courtesy of S. Rockcliffe, Sturton-le-Steeple parish council).

The development of the settlement at Church Laneham also demonstrates the use of gravel islands in the Trent Valley in the early medieval period. Archaeological finds from the Neolithic, Roman, and early medieval period indicate that the site was occupied regularly throughout the Holocene (Budge 2010, 18). Budge (2010, 18) stated that the raised islands were used for settlement, where the land was drier than the surrounding area. Figure 6.22 shows the placement of Church Laneham on LiDAR elevation data; the placement of the settlement on the higher elevation (yellow) indicates that the location was indeed dictated by geology and topography. The slight change in elevation, from 2-4m AOD of the surrounding floodplain to 7m AOD of the island, was enough to allow the settlement to survive throughout frequent flooding.

Figure 6.22: Church Laneham and Laneham on the 1st edition OS map (1890s), superimposed onto LiDAR data. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

Constrained to the island, the settlement of Church Laneham was unable to expand outwards, so expansion took place on the next island, skipping over the wetland areas, to form the settlement of Laneham. The medieval linear plan of Laneham, compared with the unplanned settlement of Church Laneham, may indicate that this expansion took place in the later medieval period (Budge 2010, 18). The location of Laneham on a slightly lower elevation shows that the water level may have receded in late medieval period.

This LiDAR plot also shows that the gravel island where Church Laneham is located was once a larger island that has since been cut through by the present course of the River Trent. Any evidence that the settlement of Church Laneham occupied the island prior to the Trent cutting through the area would demonstrate that the Trent flowed through a palaeochannel at this location during the early medieval period; unfortunately there is no evidence of the date that the Trent first occupied this area. Budge (2010, 15) states that there is some disturbance and redeposited Neolithic artefacts on the surface and Romano-British materials in redeposited Mudstone deposits, so it is possible that alluvial processes reworked the site in the later Holocene. Further excavation and survey of Church Laneham may provide more insight into the palaeochannels of the Trent during the Roman and early medieval periods.

The final area that demonstrates the rise in water level is at early medieval Torksey. Chapter 5 demonstrated that the winter camp site was surrounded by water, and the island of Torksey was no different. With water on all sides of the site, space was limited, as expansion in to the wetland areas was not possible. This is corroborated by mapping all archaeological finds across the area today. Figure 6.23 shows the distribution of early medieval archaeology finds on the island of Torksey. No archaeological remains of early medieval activity have been found outside the natural confines of the island. Excavations across the golf course, to the northeast of the modern village (Johnson and Palmer-Brown 1997), revealed peat deposits and aeolian sand, but no evidence of settlement. The only finds within the peat deposits are stray finds on the surface of the peat on the golf course, but these were not *in situ* finds. The peat deposits on the east side of the settlement mark the limits of the early medieval activity. The early medieval settlement of Torksey was located exclusively on land that was slightly higher than the surrounding wetlands (about 8-10m AOD), and would have largely been surrounded by wetland (4-8m AOD). This confirms that the settlement did not occupy areas with peat development. To the north, low lying ground was also frequently flooded, and early medieval settlement probably did not extend north towards the overwintering camp site. To the east, the ground surface remained wet. Nearby early medieval settlement and industry follows a similar pattern, never crossing into the wetland areas.

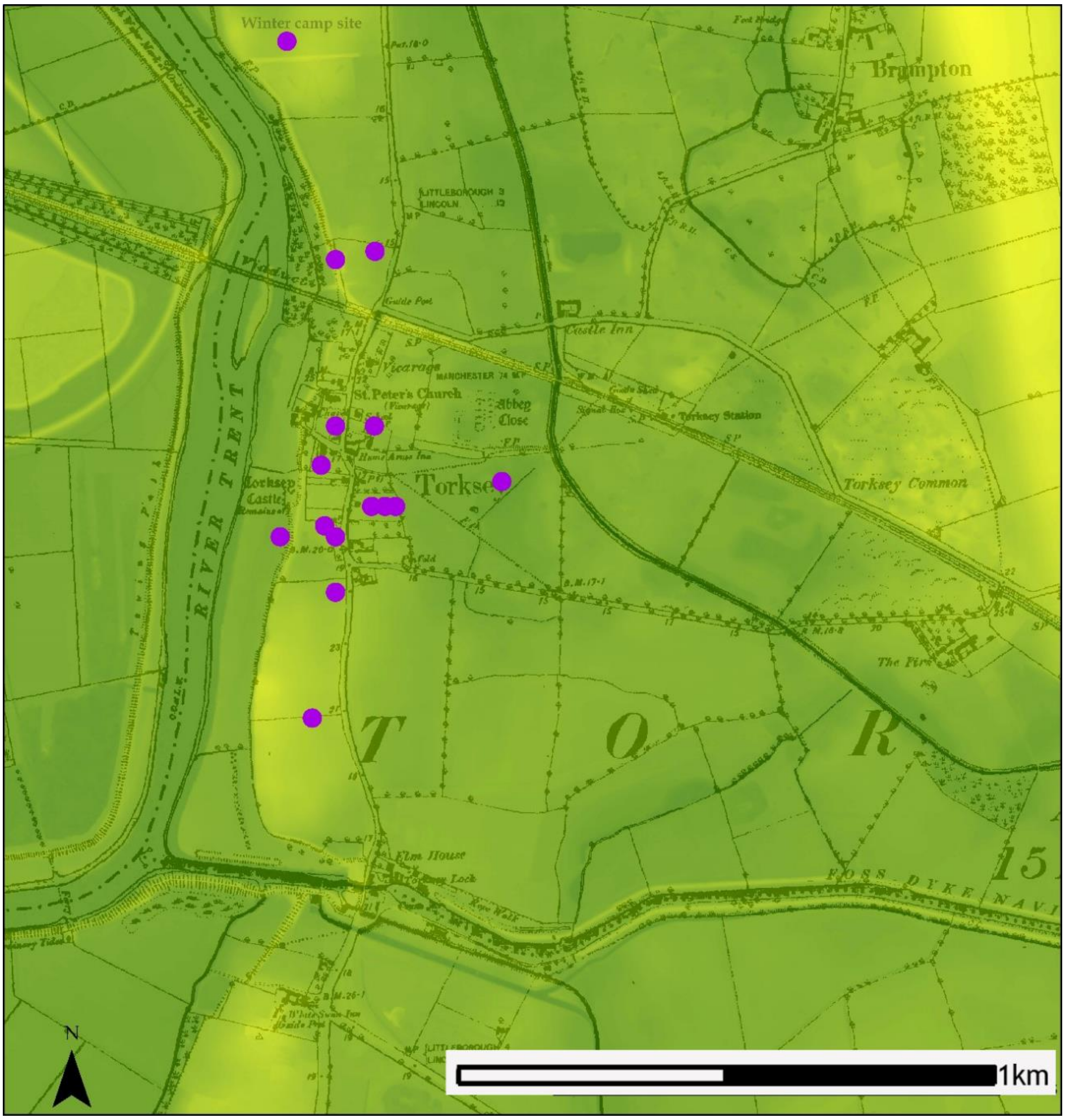


Figure 6.23: Distribution of Anglo-Saxon archaeology from across Torksey (purple) on LiDAR and 1st edition OS mapping. No *in situ* early medieval archaeology has been found at elevations below 5m AOD. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

Colder wetter climate did not only affect water levels; windier conditions also initiated a period with increased aeolian activity across dry land in the study area; the early medieval village and surrounding area at Torksey has the most prevalent aeolian deposits, and although there have been no absolute dates within the area of the village, each deposit is firmly dated by archaeological remains (see chapters 3 and 5). The dated aeolian dune at Bunker's Hill Warren (this study, chapter 5) also falls within this period, and may be a useful indication of when the other large scale aeolian deposits within the village were deposited. Additional aeolian reactivation at Rampton, Kettlethorpe, Fenton, Knaith, Marton, and Gainsborough, may have also occurred during the early medieval period, but there is no archaeological or absolute dating available for these sites. Post-Roman aeolian redistribution can be tracked across much of North Lincs., including at sites in Dragonby and Scunthorpe (Holland 1975; Allen Archaeology *pers. comm.*2014). Figure 6.24 shows two separate phases of post-Roman aeolian reactivation at Scunthorpe. The waterlogged conditions of the post-Roman period are visible in the black layers of peat which are overlying a Roman enclosure. The first aeolian deposit sealed this waterlogged deposit as early as 53 ± 9 AD, with the final aeolian episode occurring in the 1036 ± 8 AD (Bateman in Allen Archaeology report, forthcoming). While no profiles like this one have been dated at Torksey, a similar sediment sequence at Torksey Golf Course (Johnson and Palmer-Brown 1997) suggests that similar processes were occurring across North Lincolnshire. These aeolian deposits range in thickness, and may be obscuring archaeology of the early Anglo-Saxon period within the study area.

Torksey, based on an island within an area of boggy marshland, which also provided access to Lincoln via canal, and York and most of Mercia via the Trent, Humber, and Ouse was undoubtedly the most active site in the early medieval period in the study area. Torksey was recorded by the 12th century as a sizable settlement, with 60 households, and an industrially active population that would have required resources from the surrounding rural populations, including game, fish, livestock, and agricultural resources. In return, it is possible that Torksey would have brought wealth, prestige, and perhaps even some protection to the area. No defences were ever detected at Torksey, but this analysis of the topography and water level demonstrates that little defence would have been required.

Within the landscape of this study area, the raw materials for many industries and provisions for settlements would have been naturally and locally available. By the late 11th century, large areas of woodland, multiple fisheries, and many acres of ploughed land were all available in the study area. Agriculture, hunting, fishing, and perhaps gathering would have supported the local population. The products of food sourcing were mainly concentrated at Torksey, although the location of Torksey on an island would have limited their ability to grow crops. The population at Torksey would have been focused on more craft-related or trading activities by the late Anglo-Saxon period. While fishing was a popular activity, the residents of Torksey, who created the pottery, utilised their landscape to source the materials required for their trade: kilns were constructed from the local mudstone, the pottery from Lias clay, while charcoal was acquired from local woodland (Perry forthcoming).

Figure 6.24: Two phases of post-Roman aeolian activity from Scunthorpe, Lincs.

This analysis has provided ample evidence that the early medieval landscape in and around the Trent Valley was primarily defined by a climate shift that led to rising water levels. Outside of the floodplain, settlement and other activities remained in similar locations to those used in the Roman period, but major development occurred on these higher grounds, especially on the Lincolnshire side of the study area. The early medieval activity on the higher grounds, how the changing environment affected those settlements, and the development of the roads and settlements in the early medieval period will be discussed next.

Given that the remains of Roman activity were certainly visible in the floodplain, remains and persisting boundaries may have been visible across the study area, therefore affecting later activity. This includes the detected Romano-British settlement on the winter camp site. Given that Roman remains on the floodplain were visible until at least the 8th century A.D., there is no reason to believe that Roman remains on the overwintering camp site did not continue to be visible, or even used, into the 8th or 9th century, including when the Vikings were on the site in 872-3. Based on 1st edition OS maps, continued settlement at the Romano-British settlement on the winter camp site may have dictated the location of the field boundaries into the 1890s, as the prehistoric settlement site and the field boundaries recorded on the 19th century map are largely overlapping, and even share the same alignment (figure 6.25). By the 8th or 9th century, it was probably forgotten that the remains were part of a more ancient settlement site, but a small enclosure and settlement may have prevailed into the early medieval period, and throughout the year of the winter camp. If the Roman site had standing features on the winter camp site in the 9th century, they may have been used by the Vikings, however without excavation theories about the use of the space within the winter camp remain speculative.

Overall, settlement in the early post-Roman period is located at higher elevations than during the Roman period. Away from the River Trent the location of early post-Roman settlement is not only located in areas which are not prone to flooding, but also displays a preference for lighter sandy soils. In the 7th to 8th century it has been suggested, from excavations in the Thames Valley, that there is a pattern of settlement shift from light sandy soils to heavier clay soils (Hamerow 2002, 121). The shift to heavier clay soils in the middle Anglo-Saxon period has been named the ‘Mid-Saxon Shift’, a trend that has been corroborated at other sites such as Mucking, Essex (Hamerow 2002, 121). Ian Beckwith’s interpretation of the history of farms in Gainsborough also suggests that ‘heavy, ill-drained clays’ surrounding the Trent Valley were not attractive to early medieval settlers in the immediate post-Roman period (1972, 2).

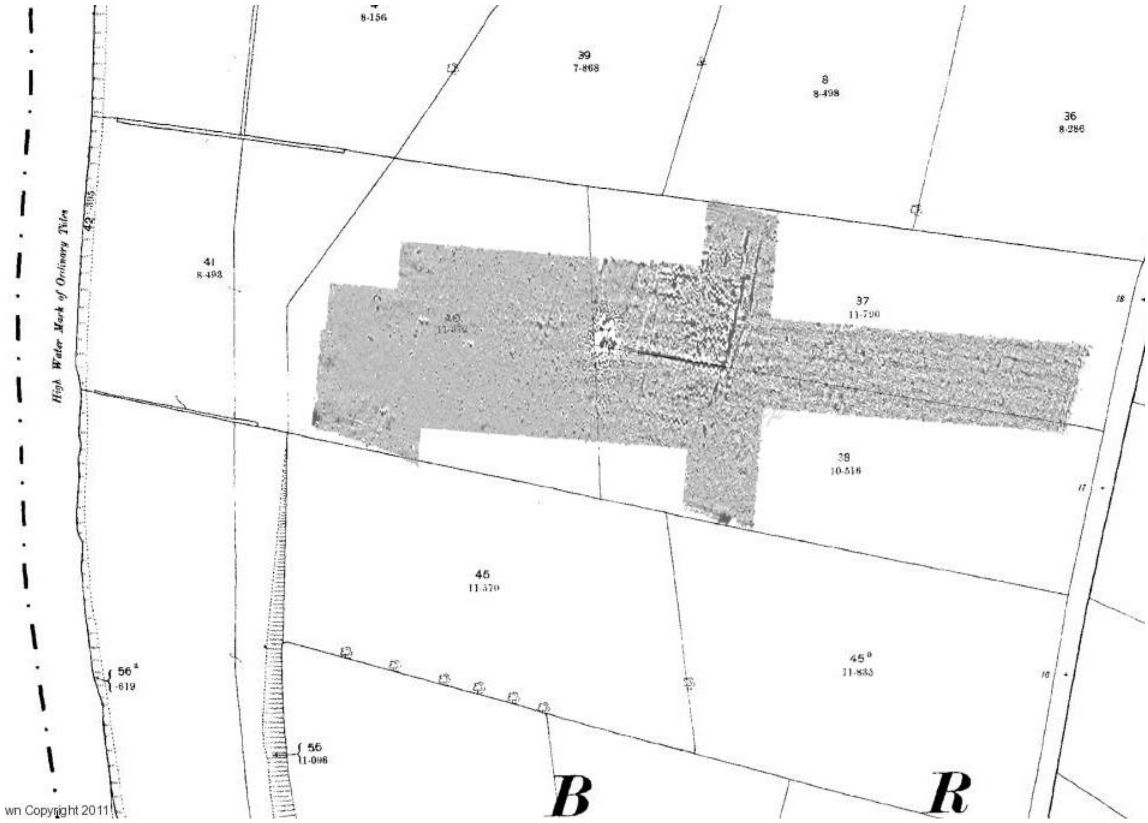


Figure 6.25: Alignment of the enclosure detected by magnetometry survey with the post-medieval field boundaries may support a continuous use of the area of the enclosure from the Roman period (including during the years of the winter camp). (NOTE: image is same as 5.57) © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

The difficulty of dating early medieval sites within the study area limits the clarity with which the question of any settlement shift can be addressed. However this landscape study around Torksey does demonstrate that many of the present day settlements and parishes do have roots in the early Anglo-Saxon period. Rather than moving, the settlements that occupied the sands and gravels expanded on those sites, while new settlements appeared elsewhere, independent of those earlier settlements. Therefore it is possible to suggest that a mid-Saxon shift in the study area is not likely, since many of the sites that are located on sands and gravels maintained occupation from the Anglo-Saxon to later medieval period. Later medieval sites occupied areas within the floodplain, with heavier soils, but this could be due to the construction of drainage channels, the recession of water level, or simply that they took advantage of the emerging roads established in the early medieval period, rather than the change in cultivation technology. Consequently the early medieval period settlement sequence in the study area may perhaps be better described as one of expansion rather than of shift.

At Saxilby, excavation at the nearby Church Farm, Church Lane, has shown that a layer of clean, orange sand underlies the church, which was interpreted as an importation of clean sand dumped on green Mercia Mudstone clay, to level the area (Tann 2003). The 2003 excavation and analysis may not have considered that the clean sand is a natural formation in this area, and may even be obscuring Roman or early medieval remains in the area. It may even be that, as at Torksey, the aeolian deposits are covering early medieval deposits, which have not been examined due to the misinterpretation of the deposit. With this knowledge, further work in Saxilby may provide additional insights into the Anglo-Scandinavian heritage of north-west Lincolnshire.

Just north of Saxilby, and within the same parish, North and South Ingleby are now considered deserted medieval villages (albeit with surviving moated manors, now farmsteads), but prior to the development of the north and south manors, Ingleby was a singular hamlet (Everson *et al*. 1991). Ingleby, is one of only three settlement place names with a Danish root word in the study area (Cameron and Insley 2010) combined with an Anglo-Saxon element. With the possible Viking influence at Torksey, Saxilby (see below), and later at Gainsborough, it does seem likely that the place name is not a transfer (i.e. a reused place name in the later medieval period), but rather stems from an English presence in a Viking landscape. Ingleby does not demonstrate any evidence of changes due to environmental factors.

West of Saxilby, and part of the later medieval Torksey parish is the now-deserted settlement of Hardwick. While there is no archaeological evidence of early medieval activity (although there has not been much opportunity for developer-funded excavations), historical records indicate that Hardwick was taxed with Torksey in the early medieval period, and that by the 11th century, it was a port secondary to Torksey (Cole 1906; DB; Saxilby parish history website). The current location of Hardwick is much further north of the current Foss Dyke, further supporting the hypothesis that the Foss flowed north of the parish of Hardwick. Hardwick may also be affected by aeolian deposition, although lack of any archaeological investigations at this location made it difficult to determine whether this is why no early medieval (or indeed Roman) evidence has surfaced at Hardwick.

Obscuration of archaeology by sand deposits may occur at Kettlethorpe, where a large aeolian deposit is recorded by the BGS, and where early medieval pottery has been recorded both on the surface and during excavation. Kettlethorpe emerged in the medieval period as a 'palatial' residence, similar to Stow Park, but an earlier, albeit small, settlement may have also occupied the area (Everson *et al*. 1991, 111). Within the study area, Kettlethorpe is at an interesting topographic location, as it is the only other place alongside the Trent that would have been potentially surrounded by wetlands to the east and the Trent to the west (with very similar characteristics to the winter camp site). Although there is little hard evidence of early occupation of the site, Kettlethorpe would have also been a large island in the wetlands of the Lower Trent Valley, and settlement would have been ideal on the site in the early medieval period.

Stow is one location that would not have been affected by the rise in water levels as much as the sites that were within and along the floodplain, and the excavations have shown no evidence of post-Roman geomorphological changes. As an administrative and market site, it would not have required some degree of access as the industrial sites along the Trent, although as a high status estate and ecclesiastical site, it was set away from the busier route ways in the landscape. The location within an open estate would have provided ample hunting ground for any high status visitors to the site.

The development of new routes and roads across the landscape can be gleaned from the locations of settlements in the study area; first this section will discuss what roads were already present and how these may have been perceived by the Anglo-Saxon population, and affected by the changing landscape. Tillbridge Lane on the Lincolnshire side of the Trent remained largely unaffected by rising water levels, and remained in regular use since the Roman period. In the early medieval period, there are far fewer sites along the Roman road compared to the Roman period, but settlement at Littleborough, with evidence of activity at Marton and Stow Park, all located directly on this road, indicates that the Road was still in use on the Lincolnshire side of the study area. West of Marton, however, maintenance and travel along the road would have been problematic due to frequent flooding events. The continued occupation of Littleborough may be due to the requirement of the maintenance of the route from Doncaster to Lincoln. The eventual abandonment of a short stretch of the road between the floodplain and Sturton-le-Steeple reflects the decline in use of the road on the Nottinghamshire side of the Trent, but there is no reason be believe that the Anglo-Saxons were not aware of, and maintained, the Roman road on both sides of the Trent (figure 6.28).

The A156 also continued to play a large role in the area. What may have been a smaller trackway in the Iron Age and Roman period almost certainly became a widely used road along the high ground east of the Trent Valley. This road connected the Anglo-Saxon sites of Gainsborough, Knaith, Marton and Tillbridge Lane with Torksey and Kettlethorpe to the south. The road may have shifted slightly at several points, such as at Knaith where it moved to the east of the now deserted village, and at Gate Burton, where it moved west to accommodate the grounds of the post-medieval manor. Other than these local deviations, however, the early medieval A156 followed the same general route as it does today. The road would have been largely protected from flooding; however bridges or causeways would have been required to traverse areas of wetlands, especially around Torksey. No causeways across the wetlands have been previously identified; however an earthwork detected by the hillshade LiDAR data shows a possible raised trackway where the early medieval version of the A156 may have crossed from Marton to the winter camp site (figure 6.26). There is a record of improvement to the drain that currently cuts through this possible track in the 18th century (Wright 1982 81), so the feature is at least 17th century or earlier in date. The track is composed of sand, which was readily available from the dunes across the winter camp site. Coring through the trackway, done as part of the environmental survey in chapter 5, has shown alternating peat and sand layers, which may indicate that the causeway was frequently plagued by flooding (and periodically 'resurfaced'). The possible causeway may have also acted as a berm, keeping flood waters from the Trent from flooding the wetlands to the east of the winter camp site (chapter 5). No similar features have been detected south of the winter camp site.

Figure 6.26: Possible causeway between Marton and the winter camp site. The shape of the feature is still visible on the 1st edition OS map. The feature would have also acted as a berm.

Knaith Hall Lane may have also been present in the early medieval period; a crossing of the Trent at this location may have also been present. A linear pattern of early medieval activity along Knaith Hall Lane traverses the alluvium of the Trent Valley. Unfortunately, with few sampling points it is difficult to determine if this is just a result of excavations along an established road. However, with no records of a crossing, and the route name in Nottinghamshire relating to a medieval (11th century) manor in Lincolnshire, this suggests that this route is at least medieval in date. Knaith Hall Lane, Notts., currently does not connect with Knaith, as it is separated by the present course of the Trent. It may be that the Trent continued to flow in the Mother Drain course into the 7th century and the lane led directly up to Knaith (with the crossing on the west side) until the change of the course of the river, or that there was an early crossing point at this location. With the crossing at Littleborough, and the potential continuation of the crossing at Torksey Ferry Lane from the Roman period, the possible ferry at Knaith may be a locally used crossing point. It is of some note that the activity on the Notts. side of the lane is the early medieval stake or fishing weir; it is possible that the road formed out of the route taken to access the Trent Valley from higher settlement in Lincolnshire.

Although it is clear that the road systems would have been ephemeral across the floodplain, the occupation of the Lincolnshire side of the study area formed the basis for the development of what has become the modern road system. The placement of Saxilby, Ingleby, and Stow led to the creation of a pre-cursor of the present B1241. This road almost certainly did not exist in the Roman period. The route follows the natural ridge on which the settlements are located. The placement of Saxilby and Stow were likely formed prior to the route, and it is possible that activity was also taking place at the junction of the B1241 and Tillbridge Lane (later Sturton by Stow), which led to the creation of a track to connect these settlements on extant east-west route ways.

Despite the changes in its appearance, the River Trent would not have stopped being an important trade and travel route. The navigability of the Trent during the 9th century, at least, is proven by the arrival of the Vikings at the winter camp site in 872 AD. However, it may have more difficult to access in the early medieval period than in the Roman period: while Roman settlements could occupy the floodplain and locate themselves on or near potential ports, the early medieval settlements were often located away from the water, and consequently there may have been fewer locations suitable for docking ships. Torksey and the Foss Dyke would have been one location suitable for a port. The inlet to the north of the winter camp site at Torksey was another location that would have allowed for boats to safely stop along the Trent. There may have been a few more areas where docking was possible along the Lincolnshire side of the Trent, such as at Knaith, Lea, and Kettlethorpe, often where early medieval and later medieval settlements are largely focused. The peat and alluvium build-up on the western side of the Trent would have formed a large wetland between the Trent and any drylands on the Nottinghamshire side of the study area, which would have made docking much more difficult west of the Trent.

There are very few clues about the location of the main course of the Trent during the early medieval period. Several palaeochannels have been detected within the study area, and there are a few examples of channel movement. At Torksey, just west of the post-medieval Torksey Castle, alluvium overlying river-worn medieval and post-medieval remains demonstrates that the channel has moved laterally over the floodplain between the current channel and present berm. Without further excavations on the other side of the river, it is impossible to locate the channel precisely during the early medieval period, but it would not have been located far away, and may have come up to the rise in topography immediately west of the village. Adjacent to the winter camp site at Torksey, the floodplain still occasionally floods up to the point of the Mercia Mudstone outcrop, and the channel may have flowed through this part of the floodplain at any point since the 4th century. Further upstream, similar undated lateral movements of the river can be seen at Kettlethorpe (figure 6.27). The settlement at Littleborough may have continued to be an island between two channels of the Trent (now the Trent and the Mother Drain), and may have shifted to the south east to avoid the rising water levels. Downstream from Torksey, alluvium at Gainsborough with overlying medieval remains shows that the floodplain extended much further east than it presently does. Regardless of the location of the channel of the Trent throughout the early medieval period, the entire floodplain would have been composed of wetland throughout much of the year.

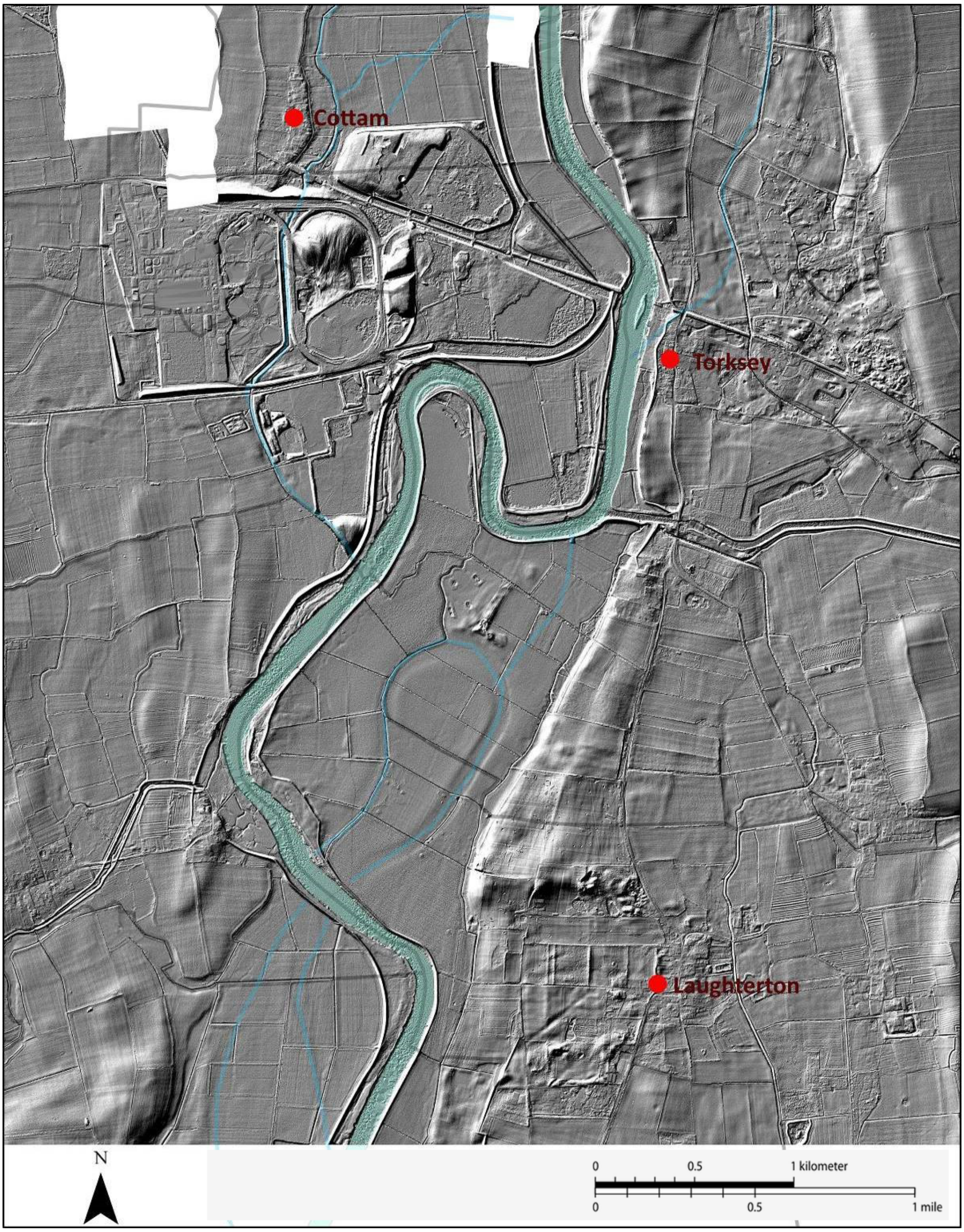


Figure 6.27: Palaeochannels within alluvium are occasionally visible in the Lower Trent Valley with the help of LiDAR. In this case, a hillshade of the LiDAR data clearly shows an undated palaeochannel northwest of Laughterton, east of the present River Trent.

During the early medieval period, the Foss Dyke probably flowed along the original channel (as outlined in the previous section). The canal may have undergone periods of maintenance (especially after the 10th century when Torksey was a major settlement) and boats may have been using the Dyke for regular shipments. There is additional documentary evidence, however, that the channel required major maintenance in 1121, indicating inadequate maintenance before that time (Sawyer 1998, 197). The area would have been wetlands throughout much of the year, while the Foss route would have only remained navigable with regular management. The frequent flooding during this period, however, may have increased the silting up of the original channel, leading to its occasional abandonment during the early medieval period.

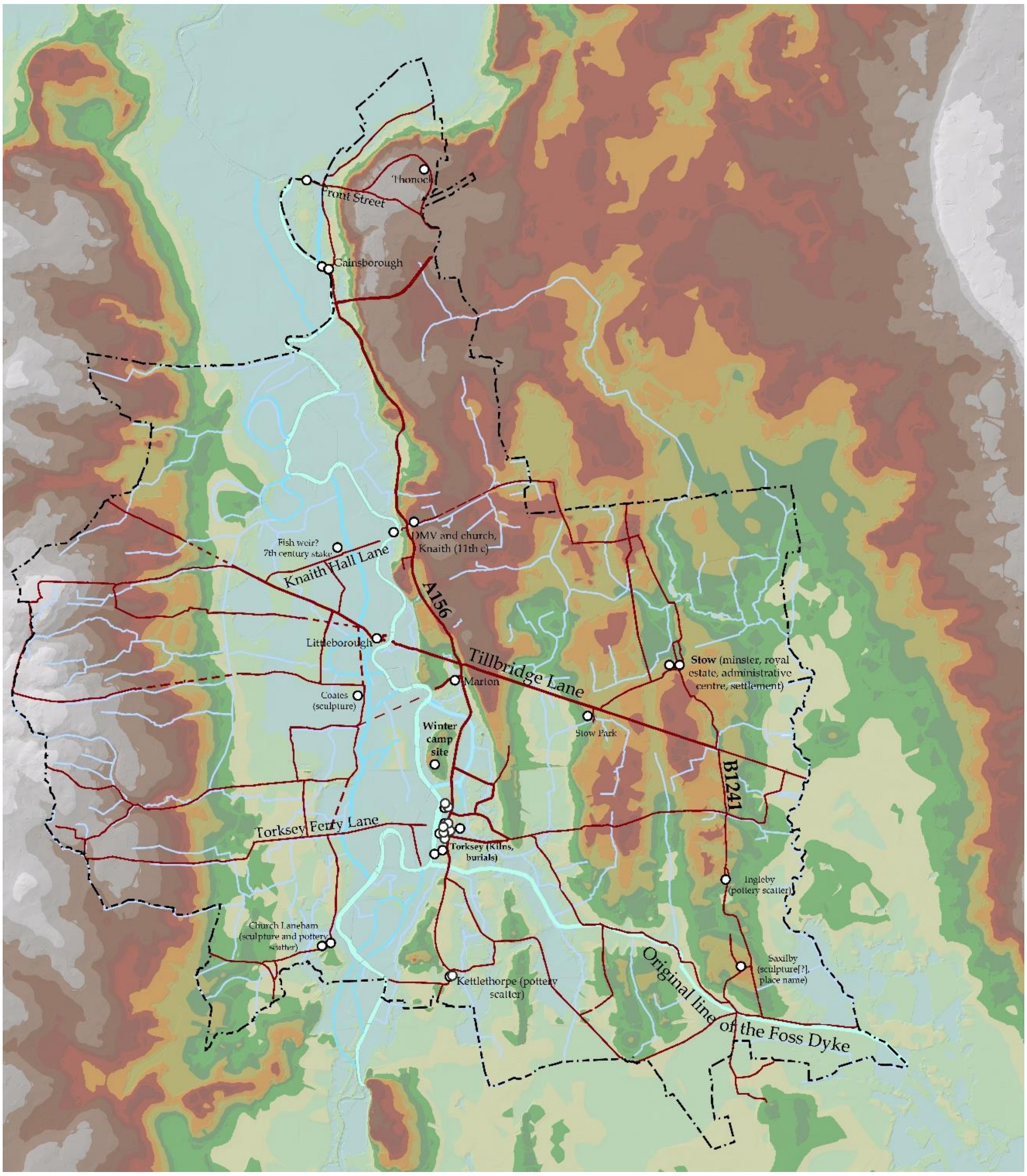


Figure 6.28: Reconstruction of the features that may have defined the landscape of the early medieval period.

3.4 The early medieval landscape: conclusions

This analysis has demonstrated the effect of changing climate and social restructuring at the end of the Roman period. Settlement moved out of the floodplain, and onto higher ground on the Lincolnshire side of the Trent Valley and on gravel islands within the Valley, where it was sill susceptible to aeolian reactivation. The areas of intense activity were sited so as to avoid regular flooding, especially along the ridge to the immediate east of the Trent Valley, as well as on the next ridge, where the current B1241 is located.

For the most part, unfortunately, the evidence available at nearly all of the sites within the study area did not provide detailed enough dating evidence to precisely define chronological progression throughout the early, middle, and late Anglo-Saxon periods. In some cases, historical or even archaeological records did suggest which century a few of the sites were established, and therefore allow a discussion of whether the site existed prior to the Viking arrival. The sites that would certainly have been present prior to the winter camp of 872, were Torksey; Stow; Littleborough; and possibly Marton. Fishing at Sturton-le-Steeple dates back to the 7th century, at least. The Foss Dyke (if only a remnant of the earlier Roman canal that was not always in use), Tillbridge Lane and the Littleborough Ferry would have also certainly been present prior to the Vikings' journey down the Trent. The Romano-British farmstead detected by the Torksey Project geophysical survey may have survived as an earthwork, or even may have survived in use into the early medieval period, as did some of the Romano-British settlements in Nottinghamshire. Early medieval activity that may have existed prior to the Viking winter camp, but without evidence to confirm dating, includes Thonock, Gainsborough and the Front Street route and settlements at Saxilby and Ingleby. Settlements at Laneham, Thonock, and Ingleby may have had continuous occupation since the Roman period; however as this hypothesis is based only on artefact scatters it is impossible to prove this beyond any doubt.

Areas that would reward further study have also been identified such as Saxilby and Hardwick (to determine the settlements' relationships with the Foss), Laneham (to determine the date the Trent incised through the gravel island with Church Laneham), the possible causeway between Marton and the winter camp, and at Marton (to determine the nature of the Trent and crossing to Littleborough). A reconstruction of the early medieval settlement, industry, and route ways through the landscape allows some conclusions to be drawn about the nature of the landscape prior to, and after the Viking winter camp of 872-3. Although this dissertation is addressing questions well outside the realm of the issue of the Vikings at Torksey, the landscape in relation to the winter camp still remains at the heart of the project, so analysis of the early medieval landscape is of particular importance.

Perhaps the most relevant information regarding the winter camp site to emerge out of this analysis is the 11th century charter from St Mary's in Stow. This charter, describing the endowment of land at Marton and Brampton in Torksey, from Godgifu, a woman of Mercian royal wealth and power, may provide evidence of the royal Mercian ownership of the winter camp site throughout the 10th century, and potentially as far back as 872-3 AD. Considering the environmental analysis of the winter camp site, and the description of the land granted, it can be said with confidence that the dry land of value within this described area is the winter camp site. Later 13th century documents describing the winter camp fields as Bishop's Meadow (see section 4.4.1) further confirm this information. This land endowment may also suggest that, prior to 1054, Brampton in Torksey included land that is currently in the parish of Stow, what later became Stow Park. These charters do not include the settlement at Torksey, south of the winter camp, so the fact that the winter camp site remained unoccupied after 872-3 is likely because it belonged to the larger ecclesiastical estate that did not permit settlement growth on the land. There are several other reasons why it may not have been occupied, from political to environmental; however until further excavations are completed, the later medieval nature of the site will have to remain relatively elusive.

It has become clear that during the early medieval period the structure of the modern landscape was beginning to emerge, with the focus of known early medieval settlements near, or within, modern settlements. Whether this is a direct result of sampling patterns, with other early medieval settlements abandoned but not detected, is unclear. However, even if this is the case, the settlements sited in the early medieval period due to their capability of supporting settlement and avoiding flooding have mainly survived, therefore demonstrating the emergence of the later medieval, and eventually modern landscape.

4. THE LATER MEDIEVAL PERIOD

The later medieval period in the study area is characterised by a sharp increase of activity. In the later medieval period, growing populations led to increased agriculture, and the formal establishment of large royal and ecclesiastical estates also altered the landscape considerably with manors and associated deer parks. The medieval landscape was formed largely within the structure of the early medieval landscape, but, according to the data produced in this analysis, was transformed into a much busier and more complex social system. This analysis has also determined that the environment, while still an important factor in dictating the areas of settlement and activity, did not play as active a role in the development of the later medieval landscape. It must also be considered that, just as in the previous two periods covered, the changes during the medieval period were gradual. Where possible, the analysis will consider any dates provided, and will attempt to provide as much of a chronology as possible. Although it post-dates the winter camp site, this section produced a large amount of data, all of which supplements the interpretation of the early medieval period, provides details about environment and landscape changes, and permits an understanding of the archaeological evidence in its modern context; this section is the longest of the three, but nevertheless, the data that it presents will prove most valuable in our understanding of the archaeology of the study area.

The increase in activity in the study area led to a much higher number of records in the HER for the later medieval period. Although this does provide more detail about what was occurring in the study area in this period, it also produced a large volume of records which need to be incorporated in to the discussion. Due to this volume, every site cannot be described in the same detail as they were in previous sections. Some of this detail can be found in the HER listings in the appendix XI.Unlike the previous periods when the records were sparse and held similar amounts of detail, later medieval records hold very different levels of detail and complexity: for example a record of a medieval church building will have very different implications than an area of ridge and furrow or ancient woodland.

One way that this was approached in this analysis was by creating two separate datasets: one dataset of the ‘dynamic’ sites, or sites with constant human activity such as a church, dwelling, or craft site, and another dataset with the ‘static’ sites (those with intermittent activity), such as ridge and furrow, or a deer park. If all these entries were mapped together, the results would show agricultural spaces, woodlands and deer parks, alongside settlement, not producing any results about the areas where the population of the study area was living or working, but rather a confused amalgamation of very different activities in the landscape (as can be seen in figure 6.29). Two subsets of these 'static' categories were also created. Ridge and furrow as an indicator of agriculture in one set, and deer parks and ancient woodland in an additional set, as an indicator of managed land on an estate. Each of these databases were also cross referenced with the same base maps as earlier sections. The database that includes evidence of constant human occupation, settlement or other activity, will be focused on most heavily in this section; however the analysis of deer parks and ridge and furrow was included in this thesis because it demonstrates the post-winter camp environmental changes.

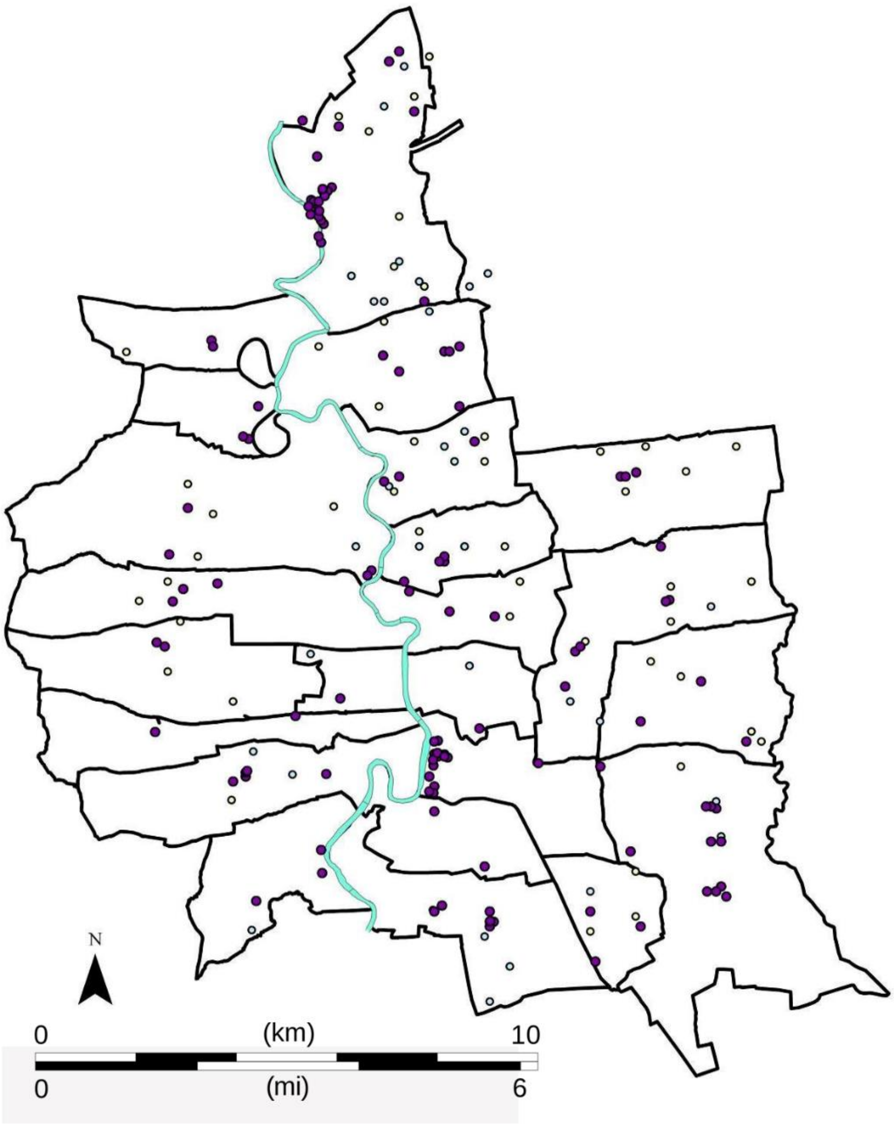


Figure 6.29: All sites in the medieval period. Dark purple is the settlement ('dynamic' sites) and the open circles are deer parks, ridge and furrow, and ancient woodland ('static' sites).

4.1 Archaeological and documentary evidence for later medieval activity

The start of the Medieval Climatic Optimum (AD 950-1250) initiated major environmental changes throughout the Trent flood plain, through major channel stabilisation, and alluvium accumulation (Knight and Howard 2004). Regular drainage systems were also being constructed and, where possible, ridge and furrow field systems were utilised to enhance field drainage (Hooke 2010, 222). The homogeneity and occasional rapid accumulation of alluvium around the newly stabilised and slowly meandering channels make it difficult to date any palaeochannels that have not been mapped in historical sources or were recently abandoned, although some are occasionally visible on LiDAR or aerial photographs (Baker 2002). It is due to this alluvium that so much of the river valley is obscured and palaeochannels are so difficult to chart in the Lower Trent Valley (Baker 2002, 7). Palaeochannels of rounded meanders at Bole and West Burton stand out clearly, as their abandonment was artificially instigated by post-medieval channel straightening. In addition palaeochannels at North Leverton, Littleborough (Mother Drain and round meander), and Kettlethorpe are preserved in field boundaries and LiDAR imagery. It is difficult to date these without supplementary evidence from historical records or maps, and thus difficult to fit them into a chronological discussion.

Unlike the high water and frequently flooded multi-channel Trent Valley of the early medieval period, by the later medieval period the Trent had become a single meandering channel. The main channel of the Trent has been managed heavily in the past two centuries with significant channel straightening in order to create an easy means of shipping of gravels as part of the gravel extraction industry (Cooper 2008). One of these post-medieval changes can be clearly seen at Bole and West Burton, where two round meanders were intentionally cut off from the channel. Parts of the Trent, however, remain quite shallow, and are still approached with some caution, such as at Littleborough (Mosse *et al*. 2014, 189). Despite these modifications, the Trent still follows a very similar route through the valley. Lateral movements have been traced on post-medieval maps in this analysis, and a complete list of palaeochannels of the Trent can be found in appendix X.

In 1121 an act for Lincoln to improve drainage and transport was approved by Henry II, at which time the Foss was cleared of silt and made fit for transport between the Trent and Lincoln (Sawyer 1998, 197). It is possible that this was the point in time when the line of the Foss shifted from its hypothesised original location, north of Hardwick, to the current course, south of Hardwick, which will be discussed in relation to the landscape analysis, below.

As a review, many major roads that traversed the area in the medieval period were already established in the Roman and early medieval period (see above), including the major Roman Road (Tillbridge and Littleborough Lanes), the A156, Knaith Hall Lane, Saxilby and Stow Road (B1241), and possibly Torksey Ferry Lane. The mapping of settlement foci areas in the medieval period confirms that many of these roadways continued to function, and even may have seen increased traffic. Sawyer (1998) has suggested that Roman Roads may have acted as a sort of 'bypass' between medieval settlements, but that newer trackways, such as the B1241, developed independently in order to connect the emerging settlements. In this same analysis, Sawyer (1998) has considered the use of Roman Roads in the Anglo-Saxon period, and has suggested that many of these fell into disuse and disrepair in the post-Roman period. Ones that did survive and were used in the Anglo-Saxon period were fossilised into the parish or other similar medieval boundaries. This can be seen in the boundaries that occurred along the Roman Ermine Street to the east of the study area (Sawyer 1998, 21). There is no reason to believe that Littleborough/Tillbridge Lane fell out of use for any significant period; however it must be considered that at some points during these periods the road may not have been heavily used.

The 'dynamic' or active sites across the medieval study area are mainly focused on the presently existing settlements in the study area. The establishment of nucleated settlements in the later medieval period is clearly traced through the present day settlements, shrunken settlements (such as Torksey), DMVs with surviving earthworks and records of other settlements that have been abandoned, such as manor houses that were part of a large estate, and 'emparked' existing medieval settlements (e.g. Gate Burton, Knaith, North and South Ingleby) (Everson *et al.* 1991, 28). All of the recorded settlements from the early medieval period are also recorded in the later medieval period and many of these settlements had grown significantly, although some are now shrunken or deserted as a result of a range of reasons. The major settlement sites in the later medieval period include Torksey, Gainsborough, and Saxilby. An important fact to remember about the settlements is that they were not all the same size throughout the entire medieval period; for example, Torksey was a large settlement throughout the early part of the first part of the medieval period, while Gainsborough grew into an important settlement later in the medieval and post-medieval period. Similarly, many of the dynamic sites were not occupied at the same time as others. Nevertheless, these sites form the palimpsest that contributed to the emergence of the modern landscape. The 'dynamic' sites can also be separated into 'parish centres,' and 'non parish centres,' corresponding to whether the parish church is in the settlement, or whether they are settlements lying away from the parish church, or are part of an area that relies on another parish and church. This information will be used to determine the relationship between the church and the local populations, and why some settlements may have emerged outside a settlement with an ecclesiastic site. Below is a list of all the medieval settlements, and their current status. This chart also demonstrates whether the settlement was the 'parish centre', or if it was reliant on another settlement within the parish.

Name of settlement	County	Status	Parish centre
Thonock	L	DMV	N
Gainsborough	L	Extant	Y
Lea	L	Extant	Y
Hermit Dam	L	DMV	N
Knaith	L	SMV	Y
Gate Burton	L	DMV	Y
Marton	L	Extant	Y
Brampton-in-Torksey	L	Extant	Y
Torksey	L	SMV	N
Fenton	L	Extant	N
Laughterton	L	Extant	Y
Kettlethorpe	L	Extant	N
Hardwick	L	SMV	N
Drinsey	L	DMV	Y
Saxilby	L	Extant	N

North Ingleby	L	DMV	N
South Ingleby	L	DMV	N
Aldhagh Grange	L	DMV	N
Bransby	L	DMV	Y
Sturton by Stow	L	Extant	Y
Stow	L	SMV	N
Stow Park	L	Extant	N
Normanby-by-Stow	L	SMV	N
Willingham-by-Stow	L	Extant	Y
Gorwick (Sturton by Stow)	L	DMV	N
Havercroft (Gainsborough)	L	DMV	N
Alfletby	L	DMV	N
Laneham	N	Extant	Y
Church Laneham	N	Extant	Y
Fleet Plantation (Rampton)	N	DMV	N
Rampton	N	Extant	Y
Treswell	N	Extant	Y
Cottam	N	Extant	Y
South Leverton	N	Extant	Y
North Leverton	N	Extant	Y
Habblesthorpe	N	Extant	N
Littleborough	N	Extant	N
Sturton-le-Steeple	N	Extant	Y
Fenton	N	Extant	N
West Burton	N	DMV	Y
Bole	N	Extant	Y

Figure 6.30: List of the medieval settlements in the study area, with their county, their status, and whether or not they are a parish centre (status based on Everson *et al.* 1991, 11). The last column lists whether the settlement has the parish church. Of some note is Littleborough, which has a parish church, but is not the parish centre of the parish, Sturton-le-Steeple.

Additional information in the database of later medieval sites that was not present in previous time periods, is the catalogue of 'static' spaces in the medieval period. These are defined as open land that was utilised in the medieval period, but was not inhabited or continuously frequented by people. These sites include: deer parks, ancient woodland, and cultivation fields (as indicated by recorded ridge and furrow). Deer parks were often part of a larger estate. Ancient woodland, or land that has not been cleared, often since at least the medieval period, is common within the study area, and often corresponds with medieval deer parks. Although ridge and furrow may also be post-medieval in date, all HER entries are catalogued as medieval, and will be considered as such in this analysis. Although this is not a perfect representation of medieval cultivated lands, this method will allow for a rough approximation of the location of cultivated lands in relation to dynamic sites in the study area. This section will also consider the distribution of cultivated land, and other static spaces to see if there is a clear distribution that corresponds to any other landscape features, or if the locations merely fill in the spaces between the dynamic areas in the landscape.

Formal deer parks within the study area include those at Stow Park in Stow and Torksey; Thonock in Gainsborough; Hermit's Dam at Lea; Knaith Park in Knaith; Ingleby in Saxilby; and a park at Rampton. There may have been more in Nottingham, though these are not recorded in any detail, and Rampton is only known due to the standing remains of a gate to the manor, similar to a gateway to the park at Kettlethorpe. Many of these parks would have included areas of ancient woodland, and, in some cases, still do. While the ancient woodlands recorded in the HER database are still standing, many of the parks have been completely 'deparked', the land broken into several farmsteads and cultivated fields.

Cultivation in the study area would have been essential not only to the local population, but also to the large estates in the area. In some instances, ridge and furrow does occur in a corner of larger deer parks, as at Stow Park, Kettlethorpe, and Thonock, and these may have served the estate, or perhaps were created when the estate did not own that particular field. Medieval field systems are often preserved in field boundaries across the study area; a most obvious example in the protrusion in the parish boundary on the east side of the Gainsborough parish (figure 6.31). Unfortunately, charting the extent of medieval field systems across an area of this size would be a huge undertaking, and is beyond the scope of this thesis.

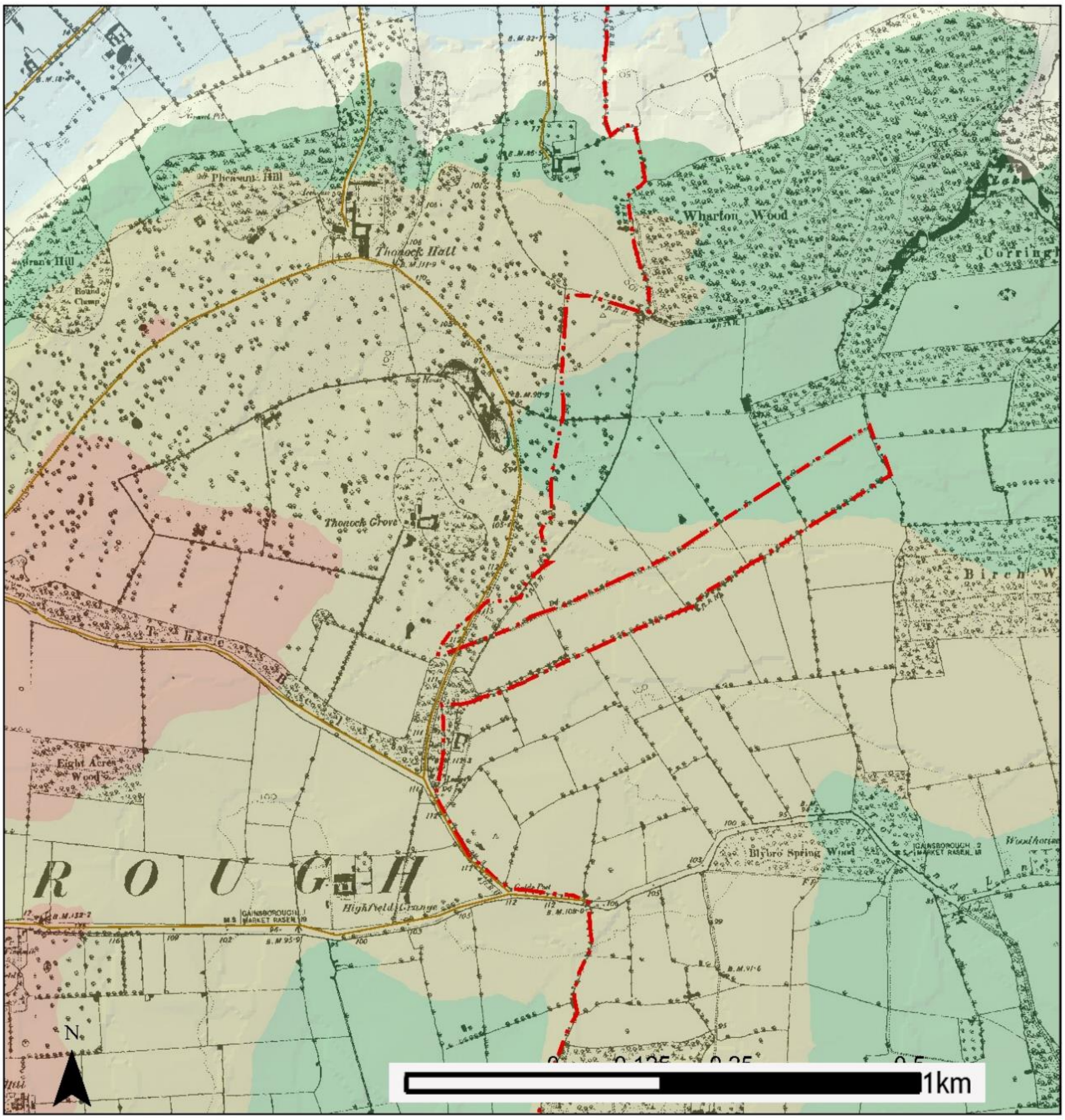


Figure 6.31: Irregular parish boundary at Thonock in Gainsborough is the result of the parish boundary being drawn around a medieval strip field. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

4.2 The later medieval landscape: Maps and descriptions

Figure 6.32 shows the locations of dynamic later medieval sites on the superficial geology. As in the early medieval period, sites are located outside the floodplain. However, there are more instances of sites being located directly on the fringe of the alluvial plain, including the settlements of West Burton, Littleborough, Rampton, Laneham, and Cottam. West of the Trent and floodplain, another linear group of settlements do not correspond to the edge of the alluvial or terrace deposits, but rather are set away from the floodplain completely. East of the Trent, the settlements that were just beginning to emerge in the early medieval period along the edge of the valley persisted into the later medieval period, and even more settlements began developing along the river. Further east of the Trent, there are several settlements that do not correspond to any recorded superficial deposit, however a large number of sites do fall on or at the edges of terrace deposits, or along the alluvium deposited by the River Till.

In figure 6.33, the dynamic sites are mapped in relation to the topography. This map demonstrates that the sites are out of the floodplain, towards areas of higher ground. West of the Trent sites line the river valley, but are all set back from the areas that flooded frequently, and were even located on land that was at 15-20 m AOD. This is a great shift from the sites that would remain as low as possible along the floodplain in the early medieval period. Immediately east of the floodplain, sites are densely packed along the ridge that overlooks the River Trent, and are all located at a height of at least 7-10 m AOD. Sites on the eastern part of the study area are similarly located on a slight ridge which overlooks the Till River Valley.

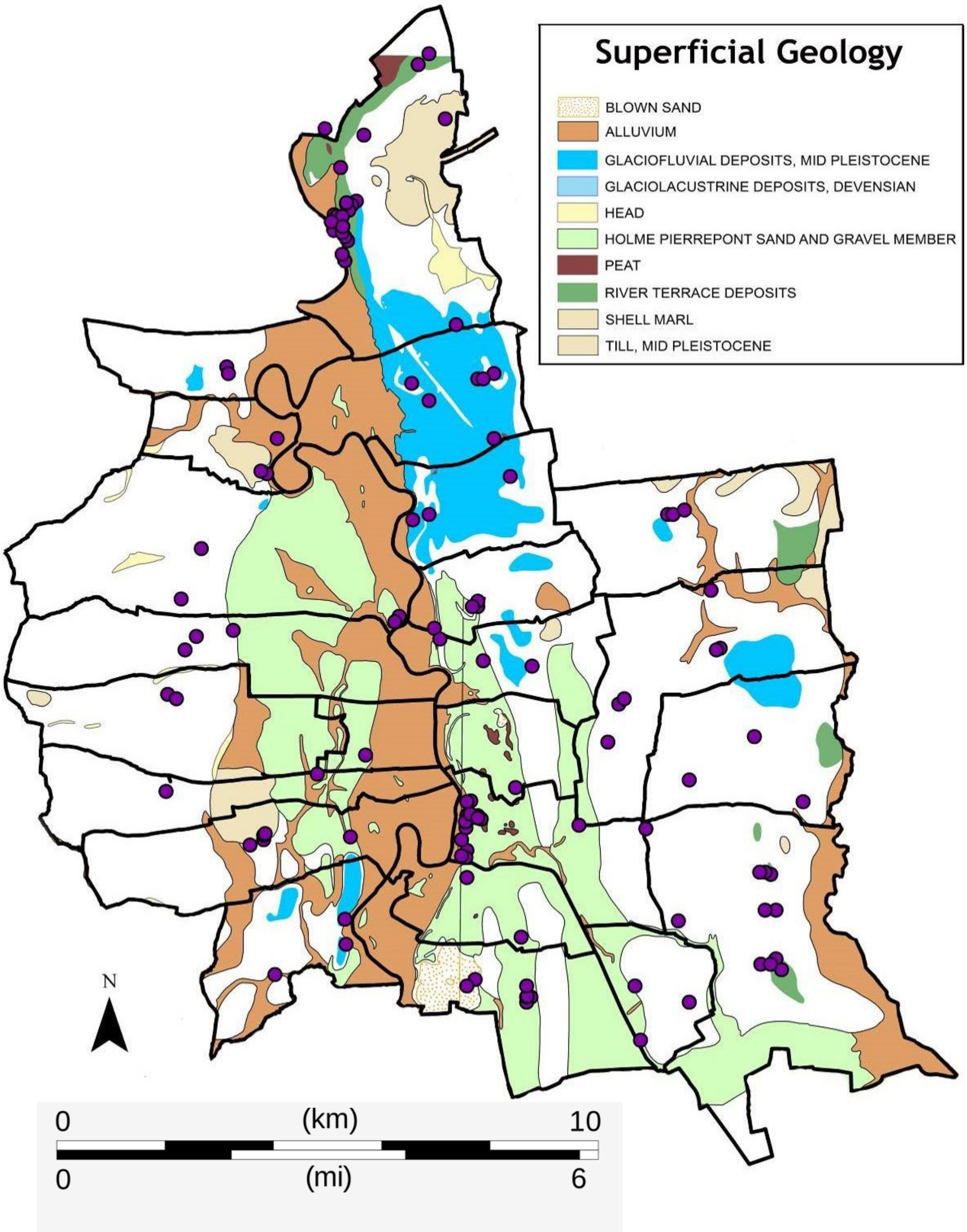


Figure 6.32: Medieval 'dynamic' sites on drift geology

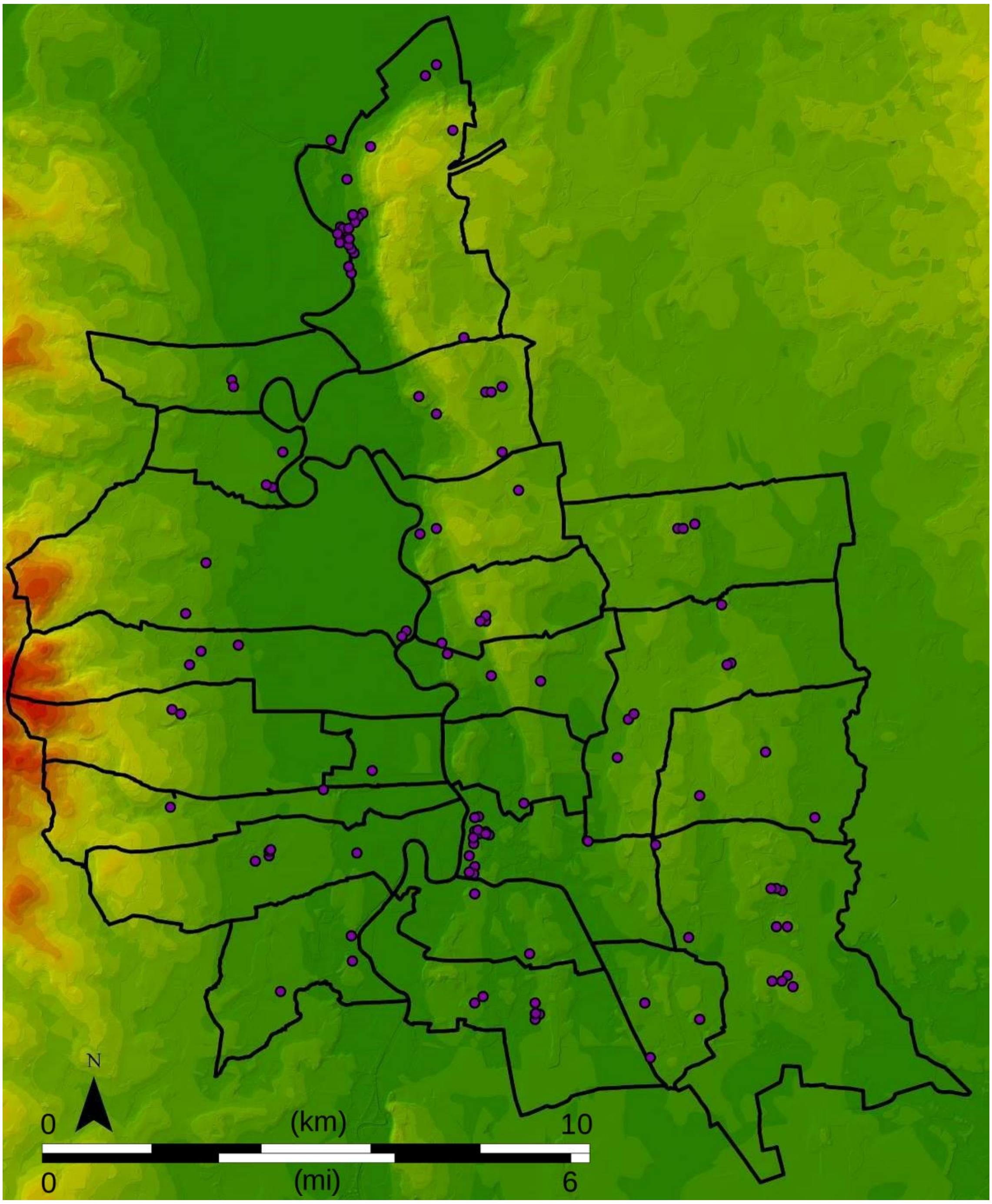


Figure 6.33: Medieval ‘dynamic’ sites on topography.

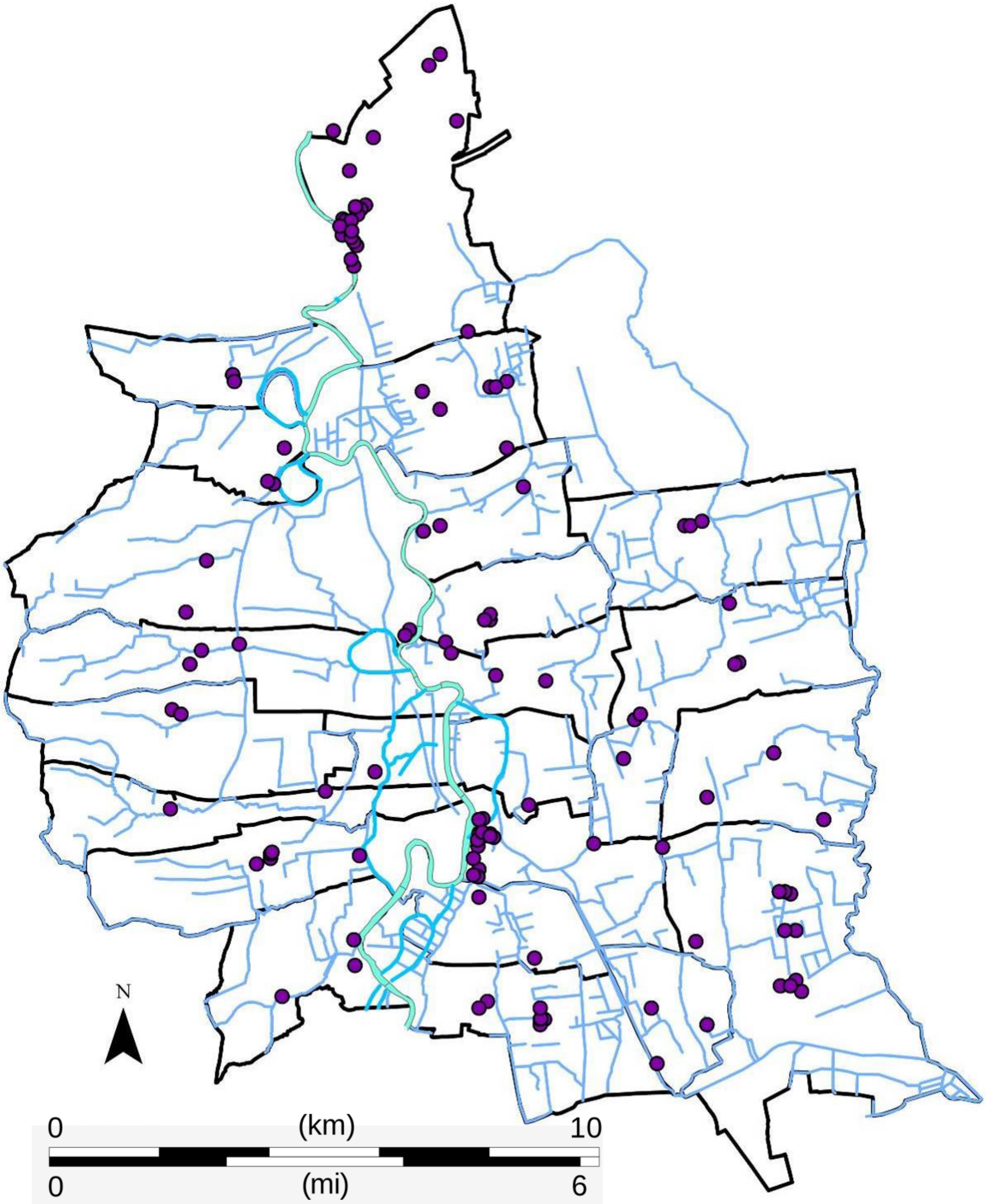


Figure 6.34: Medieval ‘dynamic’ sites on present rivers, drainage channels, and detected palaeochannels

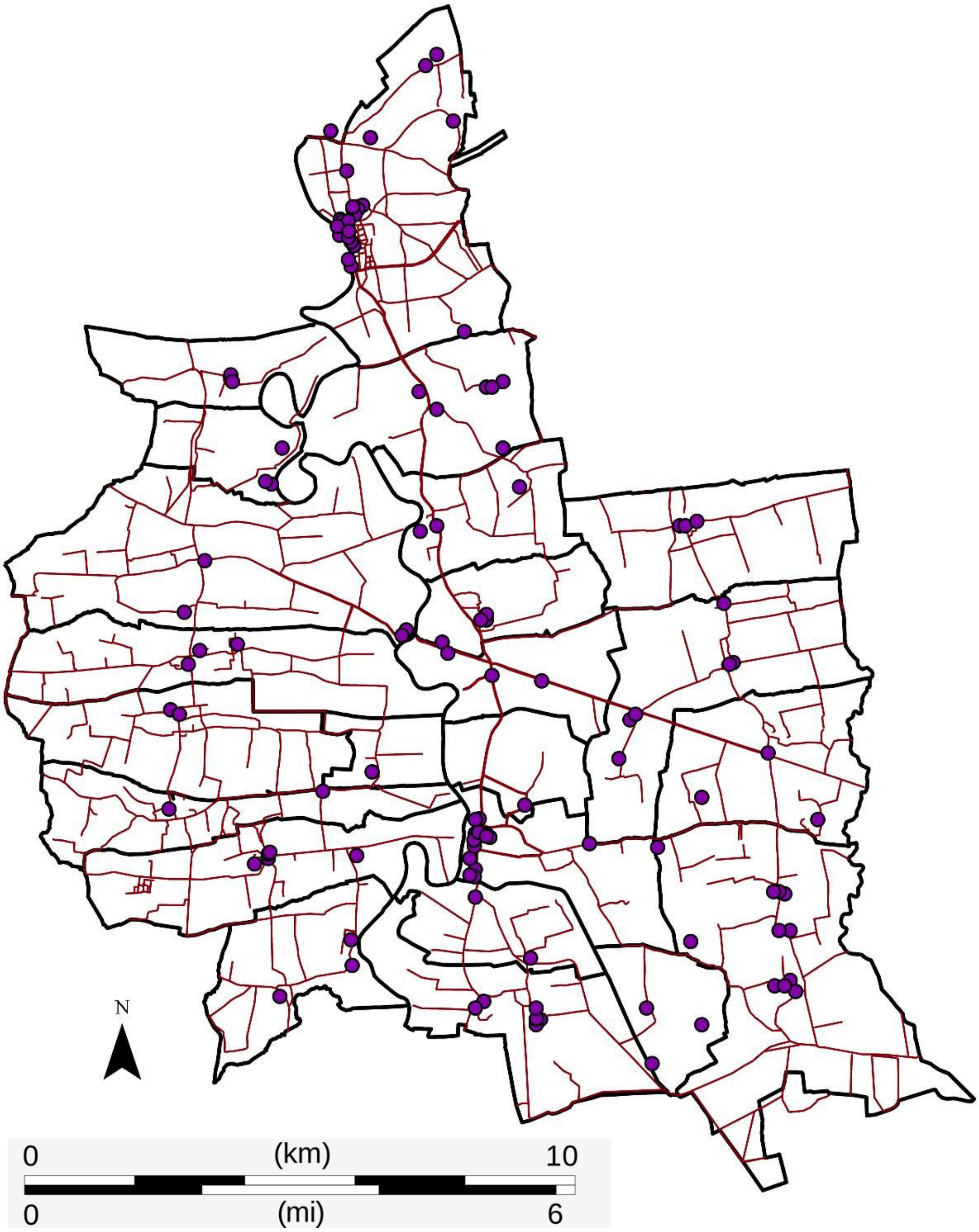


Figure 6.35: Medieval ‘dynamic’ sites on roads

Figure 6.34 shows the dynamic medieval sites along the waterways in the study area. This map demonstrates a clear correlation between those sites outside the area directly surrounding the floodplain with a location on a stream or tributary. Similarly, the sites in the Till catchment are also located directly on a small tributary or modified drainage channel. The mapping of sites along water courses also provides some insight into the drainage channels and tributaries that may have been present in the later medieval period.

On this map, many water courses also correspond to the parish boundaries. The boundaries, which were largely established in the 11th-12th centuries, correspond not only to major channels, but also to smaller 1st and 2nd order streams and drainage channels. Despite the shift of tributaries, and the abandonment of some drainage channels, these parish boundaries have remained and this allows, with some detailed analysis, the mapping of additional smaller palaeochannels in the study area.

Figure 6.35 shows the relationship of the sites with the present road ways in the study area. The main roads through the study area are mainly the same ones that were emerged in the Roman or early medieval periods. The later medieval sites are focused along the Roman road (but only on the east side of the Trent), the A156 and the B1421. A new route also emerged in the later medieval period; this is a road connecting the sites that overlook the Trent Valley on the west side of the study area.

4.3 Analysis of the later medieval landscape

Although the Trent, as always, plays an important part in the social and economic interactions of the period, there is little evidence of the Trent's movements throughout the later medieval period. High water levels in the early medieval period were predicted by regional and national climate records (Knight and Howard 2004; Dark 2000), but the Medieval Climatic Optimum is thought to have led to warmer weather and lower water levels from the 10th to 13th centuries. On the basis of this analysis, however, there is no evidence that the water levels were lower in the later medieval period than they were in the previous centuries. Maps of the above features have determined that, aside from expanding at the sites with early medieval activity, the later medieval activity did not expand onto the floodplain, but rather continued developing on the higher ground to the immediate east of the floodplain, on the higher ground further east, and mostly well away from the floodplain to the west. This is contradictory to the prediction that possibly lower water levels during the Medieval Warm Period would encourage resettlement in the floodplain; instead, settlement moved even further away from the floodplain. There is little evidence that cultivation, or any types of woodland were preserved along the floodplain. While it is clear that all activities were taking place well away from the River Trent, it is unclear what was actually taking place within the floodplain during this period. Settlements in the floodplain did not expand beyond the gravel islands, or below 6-7 m AOD, and roads did not develop, or were later abandoned, within the floodplain. The continued avoidance of the floodplain in the medieval period can be seen clearly by the location of the settlements along the ridge to the west of the Trent Valley. Sites such as West Burton are located on top of a high terrace that overlooks the floodplain. If the channel had completely stabilised by the later medieval period, it is unlikely that the settlements would have avoided the floodplain to this extent. It is more likely that the Trent did not stabilise until the 15th or 16th centuries, when landmarks such as Torksey Castle, and the settlement at Gainsborough, were able to occupy alluvial sediments and the areas at 4 m AOD. The medieval archaeology around Torksey will be explored further in section 5, but the location of medieval sites within the village also demonstrates that the site remained an island into the 13th century.

Figure 6.36: View from West Burton DMV: a sharp drop to the floodplain (and, until the 19th century, the River Trent) protected the settlement from constant flooding.

In the medieval period, Tillbridge Lane has many settlements along either side, including Littleborough, Marton, Stow Park, and Sturton by Stow. Littleborough Lane, the Roman road west of the Trent, however, does not have any settlements along the original line of the route, with the exception of Littleborough. The only other evidence of medieval activity along this route is at Sturton-le-Steeple; however this settlement is set away from the road, along a southern diversion of the route. This may suggest that the crossing of the Trent at Littleborough is no longer active and consequently this factor, along with the difficulties caused by the constantly changing water level across the floodplain (causing frequent flooding of the road) resulted in Littleborough Lane falling out of use by the later medieval period. The medieval activity at Littleborough is the only major activity west of the Trent along this route, which may have big implications for reconstructing the route of the Trent during this period. It seems clear that Littleborough Lane was not an important and functioning road in the later medieval period; so why did Littleborough remain a focus of settlement activity throughout the medieval period? One possible explanation is that the full course of the Trent at this time did not cross between Littleborough and Marton, but rather only a small channel, making it easy to keep it connected with Lincolnshire without any major fords or bridges. Littleborough may have continued functioning as a small landing place, but more closely linked with the Lincolnshire side of the Trent than it was with the settlements in Nottinghamshire. It is possible that the A156 route was a much easier route for the people of Littleborough to reach and use than any roads that were west of the Trent, so the settlement was able to survive relatively isolated on the floodplain.

The map of medieval sites along the A156 suggests that the road continued to act as a major route through the study area in the later medieval period, providing a land-bound substitute for the River Trent. It also connected the settlements along the Trent, including Torksey, Marton, Gate Burton, Knaith, Lea, and Gainsborough. Although it was along the mudstone ridge, the road would have traversed areas of wetland, especially south of Marton. The possible causeway south of Marton was discussed in the previous section, and this track may have had continuous use, or perhaps was constructed at some point in the medieval period. Similar causeways may have occupied other areas that were frequently flooded.

The A156 also provided access to several crossing points of the Trent. The most well-known historical crossing point is at Littleborough, but this analysis has determined that this study area may have had 5 or more crossing points throughout the medieval and post-medieval periods (and Littleborough may have ceased to be a link in to Nottinghamshire by the later medieval period indicated by the decline in the use of Littleborough Lane west of Mother Drain). These crossing points were detected by examining the road ways that would create a single road if connected over the Trent. These connections were detected at Torksey, Marton, Knaith, south of Gainsborough, and within the town of Gainsborough. The crossing point within Gainsborough is the only Trent crossing in the study area that is still in use today. Just as there is only one crossing point in the study area today, not all of these crossing points need to have been in use at the same time, and the use and abandonment of these crossing points would have a significant impact on the importance of the settlements and roads at any location. It is possible that the foundation and growth of several settlements along this stretch of the Trent and the A156 were based on the availability of a landing point or crossing place. Though the A156 largely uses the same route through the landscape as it did during the Roman period, there are several places where the road may have diverged during or since the later medieval period. At Knaith, the route may have previously been slightly to the west, passing through the village itself; a village which is now deserted as a result of the emparkment in the 15th century (Everson *et al*. 1991, 112).

In addition to providing access to the Trent, the floodplain, the Foss Dyke, and several radiating small trackways connected the A156 with the B1241, along which are another linear group of medieval settlements. The (current) B1241 also runs along a higher ridge that corresponds with the Scunthorpe Mudstone. The road may not have intentionally developed along the ridge, but rather developed slowly between the settlements that were on the higher ground. The B1241 is also situated so that it is overlooking the River Till and valley, but it does not traverse any wetlands in the Till river valley (this is similar to the A156 and the Trent Valley). The sites situated on this road (from north to south) are Willingham, the now deserted village of Normanby, Stow, Sturton by Stow (at the junction of Tillbridge Lane), North and South Ingleby and finally Saxilby before the road meets the Foss. Minor divergences may have occurred along this route since the medieval period, and some parts are no longer used. For example, the divergence between Saxilby and South Ingleby may be a post-medieval artefact, and a more direct route was abandoned with the expansion of Saxilby. The modern road, however, largely retains the same route as it had in the later medieval period. On the basis of the spatial distribution of the settlements, and the morphology of the route, it is probable that this road developed and was formalised gradually as the settlements began to grow in size. Unlike the Roman road, this medieval road darts back and forth, connecting the settlements rather than the settlements developing along an established, relatively straight, road.

A similar pattern occurs on the Nottinghamshire side of the Trent, with a linear north-south road connecting the medieval settlements just west of the floodplain. Like the two roads previously discussed, this road retains the names that may have defined it in the medieval period, going by the place names of the villages it connects (Laneham Road, Rampton Road., etc.). This road, although it is not located on top of a topographic ridge, is situated away from the floodplain, and does not fall below 15 m AOD. Like the B1241, this road likely formed by connecting the developing settlements of Sturton-le-Steeple, North Leverton and Habblesthorpe, South Leverton, and Treswell. A linear group of settlements is also located closer to the floodplain; however these settlements are not connected via a single road, or at least one that is still in use. Instead, West Burton, Coates (North Leverton), Littleborough, Cottam, Laneham, and Rampton are connected to the linear road to the west by small trackways. What sets these settlements apart is that they are located within the floodplain on gravel islands, similar to those Roman settlements that were also located in this area. The lack of a road directly connecting these settlements does not necessarily mean that there never was one. Instead, the abandonment of a road connecting the gravel islands/settlements may indicate that frequent flooding in the later medieval period may have made this route impractical.

One obvious trend from this analysis is that most of the route ways formed during the later medieval period run on a north—south alignment. Only one road, now a small track named Cowdale Lane (Sand Lane within the settlement of Torksey) connected the large settlement at Torksey with the B1241. This road connects Torksey to the east via land (rather than the canal), and it was probably a major route in the 12th and 13th centuries. With Torksey being such an important settlement until the 14th century, it is likely that it formed a focus for several land and water routes across the landscape. Torksey was already at a prime location on the A156, the Trent, and the Foss, but the addition, during the early medieval period, of a land route that led eastward enhanced the situation. The road is known to be lined to the north with late-Saxon pottery kilns, so it is likely that it began forming in the early medieval period (Perry *et al.* 2011), perhaps as a major road within the settlement, and as a highway out of Torksey. The road is now a simple trackway; however the connections to the B1241 and eastern routes would have probably made this a very important road in the later medieval period, although there are no historical records to support this theory. This road would have acted as a land replacement of the Foss for periods when it was not available, providing a quick journey between Torksey and Lincoln. It is tempting to associate the road name within Torksey (Sand Lane) with a possible medieval aeolian storm, as the kilns in this part of the village are also covered in an aeolian deposit. Aside from Cowdale Lane, Tillbridge Lane is the only main road that traverses the study area on an east-west alignment, and it is entirely possible that not all of this this road was in use throughout the later medieval period. The only other means of travelling east—west was along the Foss. A similar trend also emerges along the Ermine Way to the east, where the main routes are north to south roads (Sawyer 1998, 21).

There are many historical indications that the Foss was constantly in and out of use; its use being affected by siltation. It has been demonstrated that the canal was open during the mid-late Anglo-Saxon periods, but the 1121 charter to clear the Foss for use may have wider implications than a simple dredging (Sawyer 1998). The Foss was repaired (possibly reinstated) in the 12th century, and at this time, it may have also acquired its present route south of Hardwick. If this is the case then it stopped flowing through the original route that ran next to the settlement of Hardwick. The disuse of the dyke at Hardwick would have led to its eventual decline, as there was no longer any trade occurring there, nor were there any major roads or canals running through the settlement. The movement of the dyke in the 12th century is also supported by several place-names in present-day Kettlethorpe that refer to Hardwick, as well as the abandonment of a road that once stretched from Hardwick to a road that is now south of the Foss (see figure 6.37). A road, now a track through the current shrunken village, connected with Tom Otter Lane on the south side of the Foss (also the parish boundary to Saxilby). Present field boundaries still correspond to where a road once stretched from Hardwick to Tom Otter Lane. The road between Hardwick and the present Foss would have been abandoned because it no longer reached Doddington once the Foss took its new route. It is estimated that the 1121 charter is related to this shift in channel because the line of the present Foss, as well as the original Foss (which is still fossilized in the form of drainage channels), both respect parish boundaries (see below).

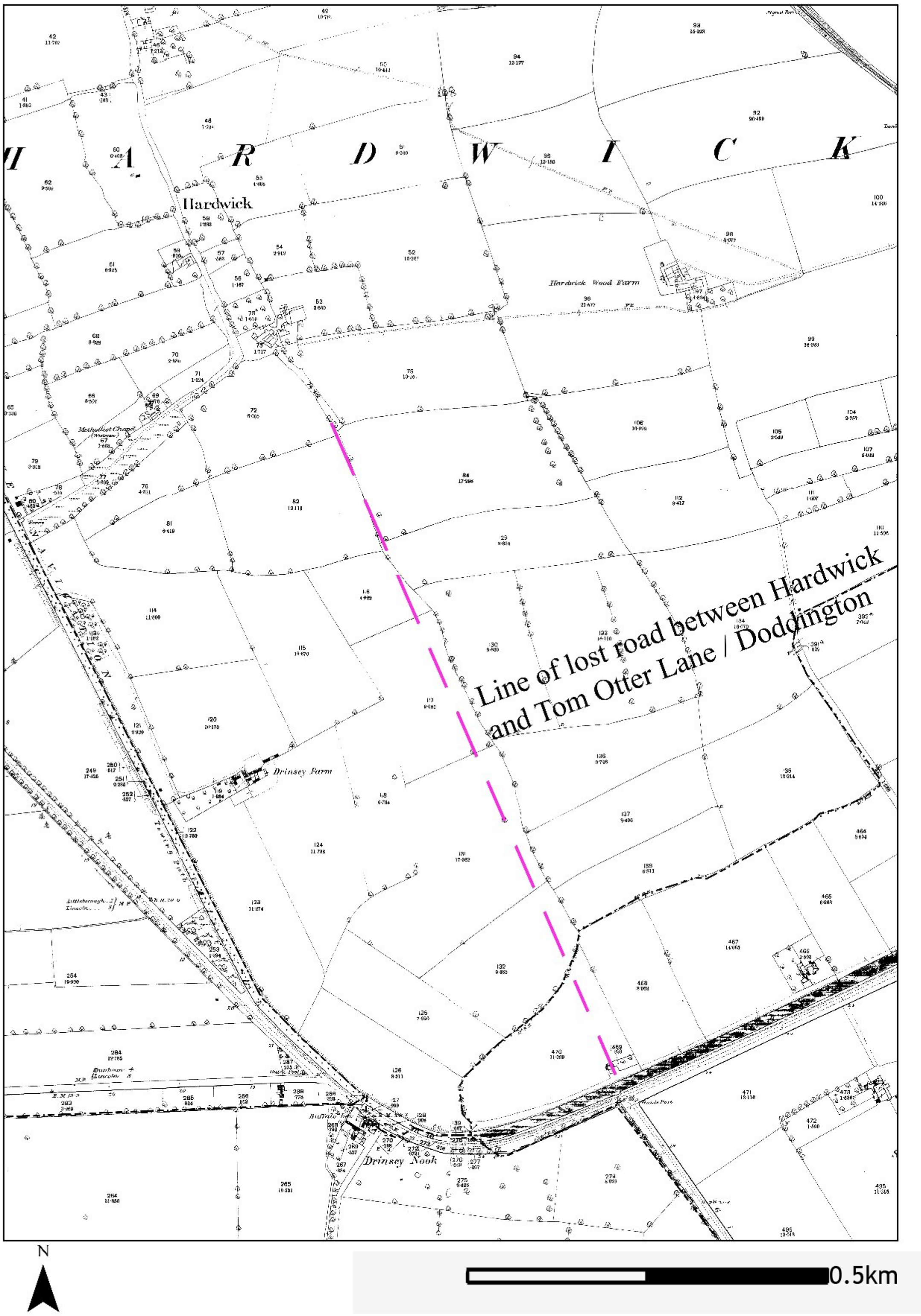


Figure 6.37: Approximate route of the road that was abandoned due to the movement of the Foss Dyke in the later medieval period (possibly 1121). © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

The landscape survey completed using the same methodology as the previous two periods has produced valuable and new interpretations of the landscape. However, due to the overwhelming amount of details available about the medieval period, several areas will be explored in further detail, including: the settlement of Torksey in the later medieval period, the nucleation of settlement and parish formation, place name studies, and a brief examination of the static sites in the area.

4.3.1 Torksey in the later medieval period

Amongst the busy surrounding medieval landscape, Torksey remained the largest settlement in the study area throughout the 12th and 13th centuries. The medieval history of Torksey was presented in chapter 3, additional data about the winter camp and its previous ownership was described in section 3 of this chapter, and the physical environment and superficial geology have been examined in detail in chapter 5. However, by mapping the medieval finds across the settlement, and further examination of documentary sources of the medieval settlement provide even more details of medieval Torksey. This section will explore the landscape of only Torksey in relation to drainage channels, road ways, and other historical sources, including place names around Torksey.

The map in figure 6.38 shows the distribution of medieval sites within Torksey. Similar to figure 6.23 of this chapter, this map demonstrates that the medieval sites continued to be located away from the floodplain and wetlands, all above 4-6 m AOD. The locations are further spread out from the concentration of sites in the early medieval period, indicating either slightly lower water levels, or possibly the installation of early drainage ditches. Sites within lower elevations include the remains of St Leonards Priory on the north east edge of the settlement, the site of the nunnery to the north-west, and the placement of the 16th century manor of Torksey Castle. The distribution of the identified sites with medieval remains within Torksey suggest that there may be two main areas of activity within the village, with kilns, a parish church, and the Fosse nunnery to the south, and two more parish churches, and the priory to the north.

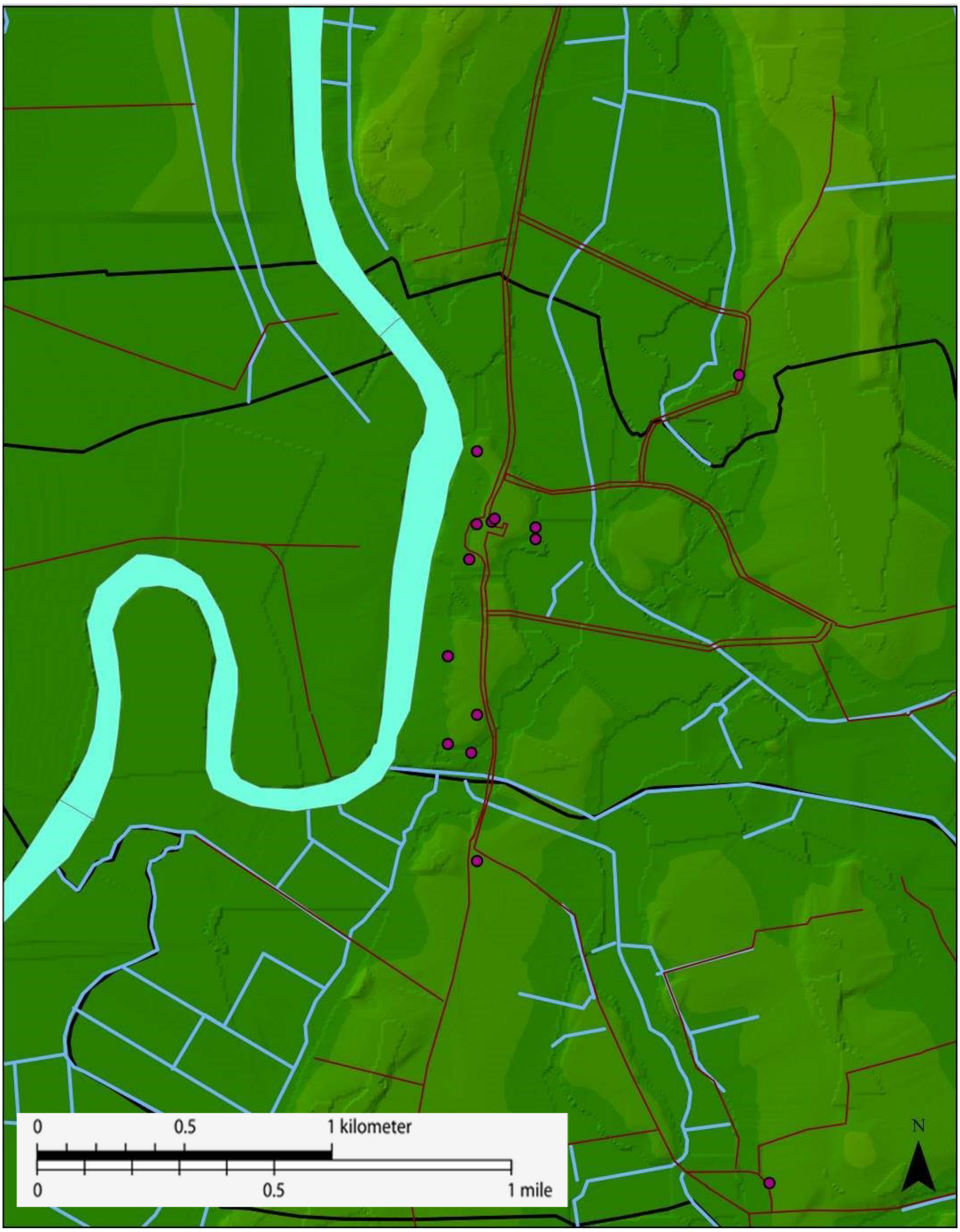


Figure 6.38: Medieval sites and finds within and around Torksey, mapped on topography, with 1st edition OS map roads (red) and water courses (blue).

The confined area of the medieval finds in Torksey is not skewed by a lack of excavation east of the present village, as there have been excavations on both the Lincoln Golf Course and at the Elms. Neither excavation produced finds dating earlier than the post-medieval period. The excavators even hypothesized that both areas were wetlands for long periods, though radiocarbon dating analyses produced dates indicating that the peat may have stopped accumulating in the Roman period (Johnson and Palmer-Brown 1997; Allen

2005). However, based on this analysis, it is probable that Torksey remained a defined island well into the later medieval period. All the medieval and early medieval finds and remains are at 6-7m AOD overlooking the current floodplain at 4m AOD. The continued confined nature of the settlement in the medieval period provides further evidence that the water level in the Trent Valley did not recede until the 16th century, when Torksey Castle was built at a low elevation.

The implications of several documents regarding the medieval history of Torksey has come to light during this analysis. Although many historical documents have been explored by several authors (Cole 1906; Barley 1964; Sawyer 1998; Brown 2012), these reviews often explore the medieval documents exclusively. The review of charters regarding nearby settlements in the early medieval period (such as that at Stow in relation to the winter camp site in the early medieval period) has demonstrated that a wider approach to historical documents can be enlightening. This analysis has taken another look at the medieval and post-medieval historical documents in order to determine if there are any notes on land-use changes, as well as to search for early maps that may hold more information about the landscape. These include:

- 1237 survey charter describing the parish boundary around Torksey (Cole 1906, 473-476)
- the Brampton Inclosure Award of 1778 (LA Lindsey Award/204 1778), which includes the award, but is missing the plan.
- the Lindsey Award of 1804; the accompanying map was missing from this document as well (LA Lindsey Award/72 1804). Unfortunately, no maps pre-dating the 19th century have been uncovered for Torksey during this analysis.
- Act of 1671 under Charles II in order to improve drainage across Lincoln led to the improvement of the Foss Dyke (Wright 1982, 23).
- Documents referring to the installation of Torksey Lock and pump house in the 19th century (NA C 54/1-32, 1848-1890)
- Documents titled 'Torksey embankment satisfactory and complete,' a record of the installation of a steam engine pump house in the mid-late 19th century (NA 16/10/1877)

A closer look at the drainage in the proximity of Torksey has indicated that the separation of the parishes of Brampton and Torksey occurred because of the low ground between Torksey, the winter camp site, and Brampton, corroborating the results of the geoarchaeological survey in chapter 5. This wetland and later drain formed the parish boundary between Brampton and Torksey in the medieval period. It remains unclear when the drainage channel that follows the peat deposits through Torksey and Brampton was constructed. The 1237 charter indicates that a channel between Torksey and the winter camp site already existed by the 13th century: in describing the parish boundary, the charter records that the Burghdyke connected with the Trent and separated the *Denesheyng* (the northern parts of Torksey; see below), with the Bishop's Meadow to the north (the winter camp fields) (Cole 1906, 475). However, this dyke may not have been very effective in draining the marshland, since the 12th century abbey at Abbey Close (on the northeast side of the modern village) and the 13th century settlement at Brampton both are still located above the peat levels.

The place names associated with this charter also provide a tantalising glimpse into the land use of these areas in the later medieval period. While Torksey has been described as one of the 7 boroughs of the Danelaw, associated *burgh* features have never been detected around the settlement. But the linear cropmark, environmental evidence of drained wetlands, and a place name for the drainage channel on the south end of the winter camp site provides promising evidence that there are early or later medieval environment modifications that delineate the northern boundary of Torksey. The field name of Bishop's Meadow also provides further evidence of the ownership and use of the winter camp site in the years following the year 1054, when the land was granted to the Bishop of Dorchester by Godgifu and Earl Leofric; this field name confirms that it was the area of the winter camp that was bestowed to the estate at Stow.

Figure 6.39: The line of the 'burghdyke' as it is described in the 1237 charter, with the Bishop's Meadow to the north, and the fields belonging to Odo at Denesheyng to the south. © Copyright Google Earth

Though it is not specified, the Act of 1671 to improve drainage around Lincoln did improve the Foss at Torksey, and may have also included the improvement of drainage nearby (Wright 1982, 23). This may have led to the abandonment of the burghdyke. If the Inclosure Drain that runs north of Torksey also dates back as far as the 13th century, it may also provide a *terminus post quem* for the date of the use of the causeway that connects the winter camp site with Marton. The Brampton Inclosure Award describes drainage channels around Brampton and the winter camp site by the end of the 18th century. This award also describes a drain south of the winter camp fields. This drain has since been infilled, but was detected using aerial photography and delimits the present parish boundary. The award acts as another clue that the low-lying wetland between Torksey and Brampton was once the burghdyke, and played an important role in delineating the separation between Torksey and the winter camp site and later Brampton. This award also describes three drains at Torksey: Carr Drain, Inclosure Drain, and Public Sewer Drain. Carr Drain ran through the 'Carr', probably referring to the peat bog east of Torksey, as it notes that it runs 'north through stinted common pasture' (LA Lindsey Award/204 1778). A record of a shipyard at Torksey in 1856 (Wright 1982 81) may also involve Inclosure Drain, or perhaps the burghdyke, while the improvement of the drainage and the pump house at Marton, noted in the 1860s (NA 16/10/1877) may correspond to the infilling of the drainage channel between Torksey and Brampton. Drainage continued to be a problem in Torksey until the 19th century, when surveyors for the steam engine pump house and improved drainage in the area interviewed local residents: "Old men in the neighbourhood ascertain it was a 'normal' flood, while they walked down the main road waist-high in water" (NA 16/10/1877; 33/1850).

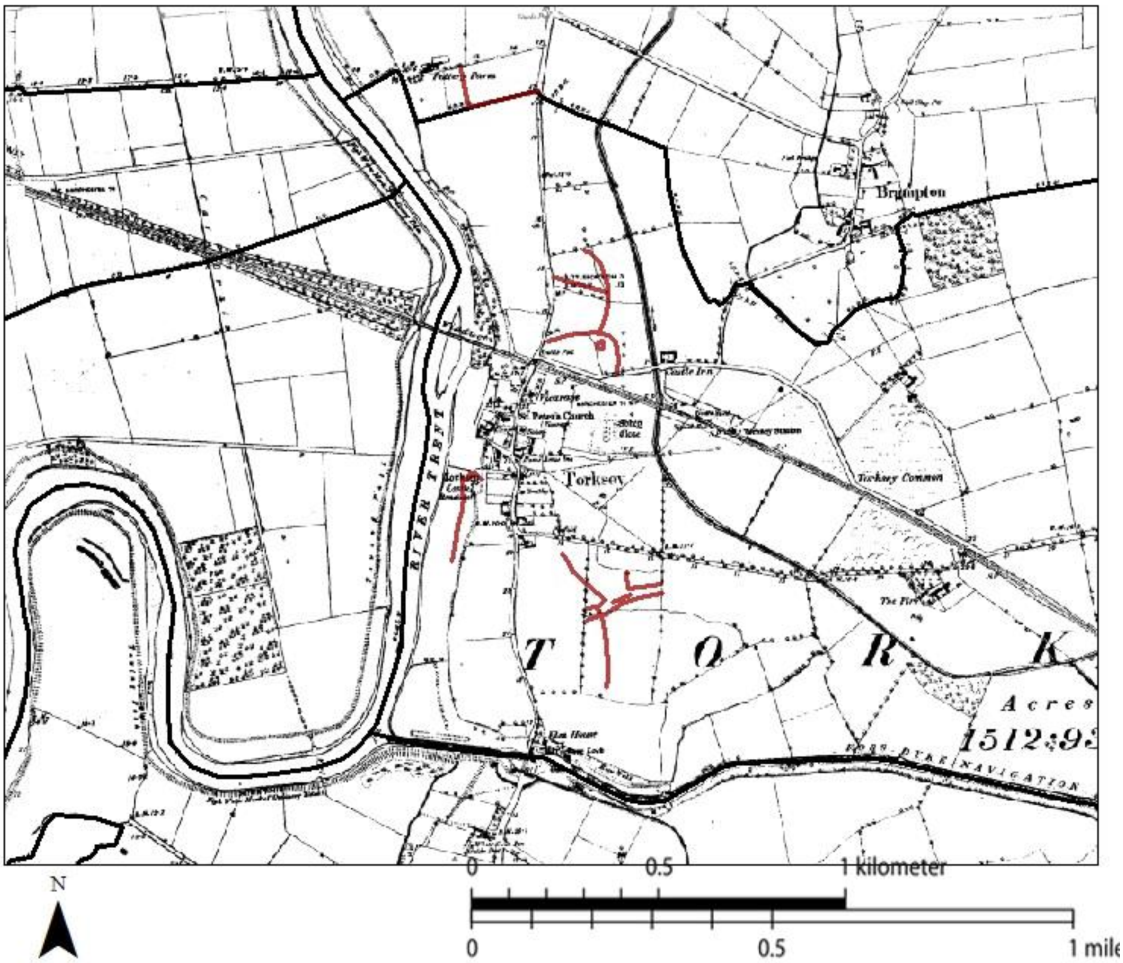


Figure 6.40: Cropmarks within Torksey (on 1st edition OS map) including the parish boundary cropmark of a drainage channel along the northern parish boundary. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

It remains unclear why the winter camp site was not occupied in the medieval or post-medieval periods, especially considering the rarity of higher elevation land with close proximity and access to the Trent. Despite the presence of the winter camp north of Torksey in the 9th century, there is no evidence that there was ever any continued settlement on the winter camp site in the medieval period. The pattern of settlement across the study area suggests that any land above 7m AOD, especially in close proximity of the Trent, was coveted; so for what reason could the site have remained empty? Although this cannot be answered with any certainty, a few potential reasons are that:

1) The site of the winter camp was in royal Mercian control, and later belonged to the Bishop of Dorchester (residing at Stow/Stow Park). The winter camp fields may have been part of the royal estate or deer park throughout parts of the medieval period. This may explain the divide between Brampton and Torksey, the lack of parish church at Brampton, and the reason why people were not

permitted to settle the site both before and after the year of the winter camp.

2) The site continued to have a single farmstead on it in the same place as the Roman enclosure throughout the early medieval and medieval period.
3) The soils were too poor for any agriculture due to the coversands, so the area provided a useful area for animal pasture.
4) The site was inhabited in a casual way, with only temporary housing when it was required, but, with its location between Marton and Torksey, it never was established as a formal settlement

The Scandinavian population preferred to settle on the island further south of the winter camp site, as it may have had a more convenient connections along land and water; the later Scandinavian preference for settlement at Torksey is evidenced by the plethora of Scandinavian place names throughout the *burh* of Torksey (see below).

The archaeological and historical evidence from the winter camp, from the Roman through the later medieval period, indicates that the Viking winter camp of 872-3 was the most activity the site ever saw in a single year during this timeframe, and that its function as an outlying farmstead, remained in place until the eventual abandonment of the farm, at some point prior to the 19th century. This is an unexpected outcome, as most areas of high ground along the Trent in the study area have some form of longer-term settlement on them.

There is no solid evidence of Viking or Anglo-Scandinavian influence on the winter camp, but a disproportionate number of Scandinavian place names around Torksey may indicate that several Vikings returned to Torksey, rather than their winter camp. The concentration of recorded field and boundary names with Danish root words can be found scattered throughout the parish and no similar concentration occurs elsewhere in the study area. Though precise locations for these place names could not usually be located, the English Place Name Society records the following Old Danish names and meanings within the Torksey parish.

Place name	Scandinavian root	Location type	Meaning
Dowsdale (Great and Little)	Personal name	Field	Dusi's share of land
Netherbergh	*bjarg*	Field	Lower hill or precipice
Northekerr	*kjarr*	Field	Northern marsh bog; marsh

			overgrown with brushwood
petkerr' de Tor	*kjarr*	Field	Peat bog of Torksey
Segdale	*dalr*	Field	Sedge valley; sedge, a reed or rush in the valley
Segdalegate	*gata*	Road	Road; path at sedge valley
Stanelegate	*gata*	Road	Boundary stone on a road or path
Wolpitdale	*dalr*	Field	Valley with a wolf pit or trap
Denesheyng	*-ing*	field	Wetland belonging to the Danes (? author's own interpretation). 1237 charter refers to land belonging to Odo in the Denesheyng

Figure 6.41: Place names with Scandinavian roots within the parish of Torksey, as recorded and interpreted by the English Place name Society (Cameron and Insley 2010) and from the 1237 survey (as related by Cole 1906, 472-4), with the exception of Denesheyng.

The place name 'petkerr' de Tor' is especially fitting to the area, and to the results of this survey. Without prior knowledge of the importance of the physical landscape to the Viking population at Torksey, it would not be obvious how important the peat bog was to both the Anglo-Saxon, and especially Scandinavian army in the year of the overwintering. In fact, without the thorough landscape investigation, a peat bog may have gone without detection. The record of this place name with a Scandinavian root solidifies just how central the peat bog at Torksey was to the lives of the local population. The medieval place name *wolfpitdalr* (Cameron and Insley 2010) may indicate that there are plenty of wild species and possibly woodlands in the vicinity. Finally, Denesheyng on the north side of the settlement, just south of the burghdyke, corresponds to a previous wetland or drainage channel, and is also recorded as belonging to Odo, a Scandinavian personal name, so this name can be roughly taken to mean the wetland area belonging to a (the) Dane(s); although this has not been translated by the EPNS, environmental and historical records corroborate part of this translation.

While there is not enough evidence, archaeologically or otherwise to confirm Anglo-Scandinavian settlement elsewhere within the study area there are areas where such influence is suggested. At Saxilby place names, including the personal name, *Saxulfr*, the Danish suffix, *-by*, and the nearby *Ingle-by*, may indicate potential Scandinavian influence. A parallel can be drawn between the presence of Ingleby within the Torksey study area, and the presence of Ingleby, near the Viking cremation cemetery at Heath

Wood, near Repton. Richards *et al*. (2004, 25) describe the place name of the settlement of Ingleby (Derbys.) as probably resulting from a small group of English living in a landscape dominated by Scandinavian settlers. Cameron (1959, 635) corroborates that the place name probably means 'an isolated survival of English inhabitants amongst a prevailing Scandinavian population.' The presence of an Ingleby place name at such close proximity to two winter camp sites is probably not an accident: the conscious decision to name a settlement after a minority Anglo-Saxon population probably indicates a strong Scandinavian presence in the area in the years following the overwintering.

Other settlements in the area, such as Normanby, Gate Burton, Rampton, and Bole may also have Danish word roots (Cameron and Insley 2010), or they may be later perversions on physical descriptors, such as at Somerby (North Lincolnshire), or even in place prior to Scandinavian influence, as at Kettleby (also North Lincolnshire) (Everson *et al*. 1991, 9). A more detailed and systematic approach to the place names around Torksey is required to fully appreciate the Scandinavian influence in the area, which is unfortunately outside the scope of this thesis. A full list of recorded place names, meanings, and known locations can be found in appendix XIII.

4.3.2 Static sites in the later medieval landscape

Figures 6.42 and 6.43 show the distribution of deer parks, ancient woodlands and areas of ridge and furrow in the study area in relation to the topography. The ridge and furrow on the western part of the study area is at a similar elevation as the settlements on this side of the Trent, largely set away from the floodplain. The single recorded site with ridge and furrow within the floodplain may be part of a post-medieval field system, or it may be a small area of medieval ridge and furrow that has not been covered by alluvium, possibly indicating the occasional availability of the alluvium for medieval cultivation. Ridge and furrow on the eastern side of the site lies around the settlements, often at a lower elevation than the settlements. Survival of ridge and furrow may be skewed due to the modern cultivation and destruction of earthworks in fields outside of settlements. There is an obvious dearth of ridge and furrow along in the lowlands south of Marton, land which may have been prone to flooding and not suitable for cultivation.

Deer parks and ancient woodland show a very different pattern. Ancient woodland that may date to the later medieval period survives within the floodplain, indicating that some deciduous forest did exist along the floodplain as well as on higher grounds to the west. A small area of woodland in Cottam defines the north western corner of the parish, as well as corresponding to a small channel on the west side of the parish. Ancient woodland on the east side of the study area often corresponds to the deer parks, of which there are 4 recorded in this part of the study area. These are Thonock, north of Gainsborough; south of Gainsborough; a ‘royal’ deer park at Stow Park, and finally one at Kettlethorpe. A cluster of ancient woodland at Knaith Park also may indicate that a large woodland park once occupied this area; however it is not recorded in Everson *et al*. (1991). The ground covered by these parks differs greatly from the ridge and furrow sites and the dynamic sites, as they often occupy both high and low ground, regardless of soil quality. At Kettlethorpe, although there is little evidence for cultivation, and even settlement was sparse, the deer park occupies land as low as 6 m AOD. At Torksey, this analysis will show that the later medieval Bishop’s estate at Stow included all areas of the wetlands around the winter camp site.

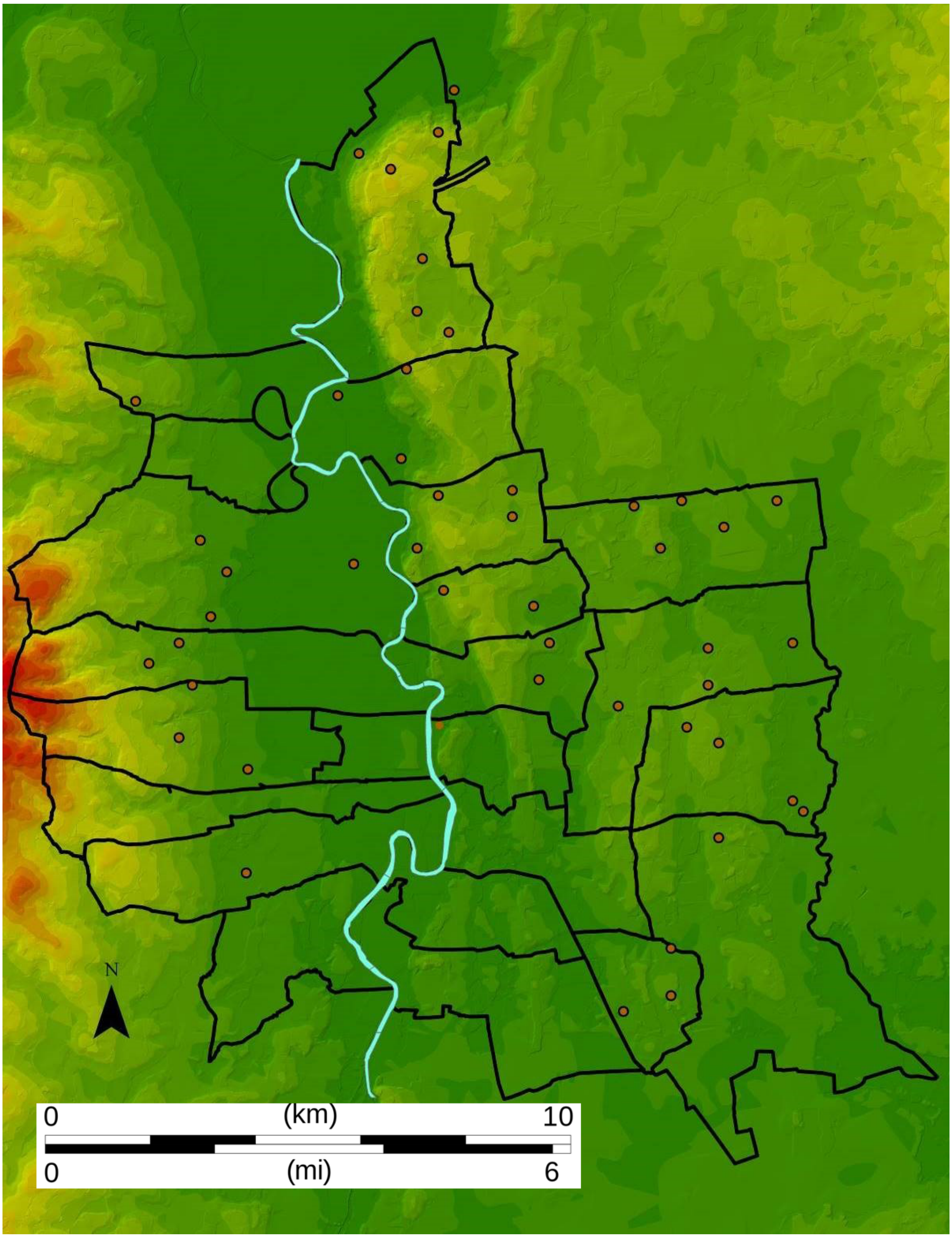


Figure 6.42: Recorded ridge and furrow in the study area on topography. During the analysis, ridge and furrow was mapped against all base maps, and the only one with any correlation was with topography; the other maps in the analysis can be found in appendix XV.

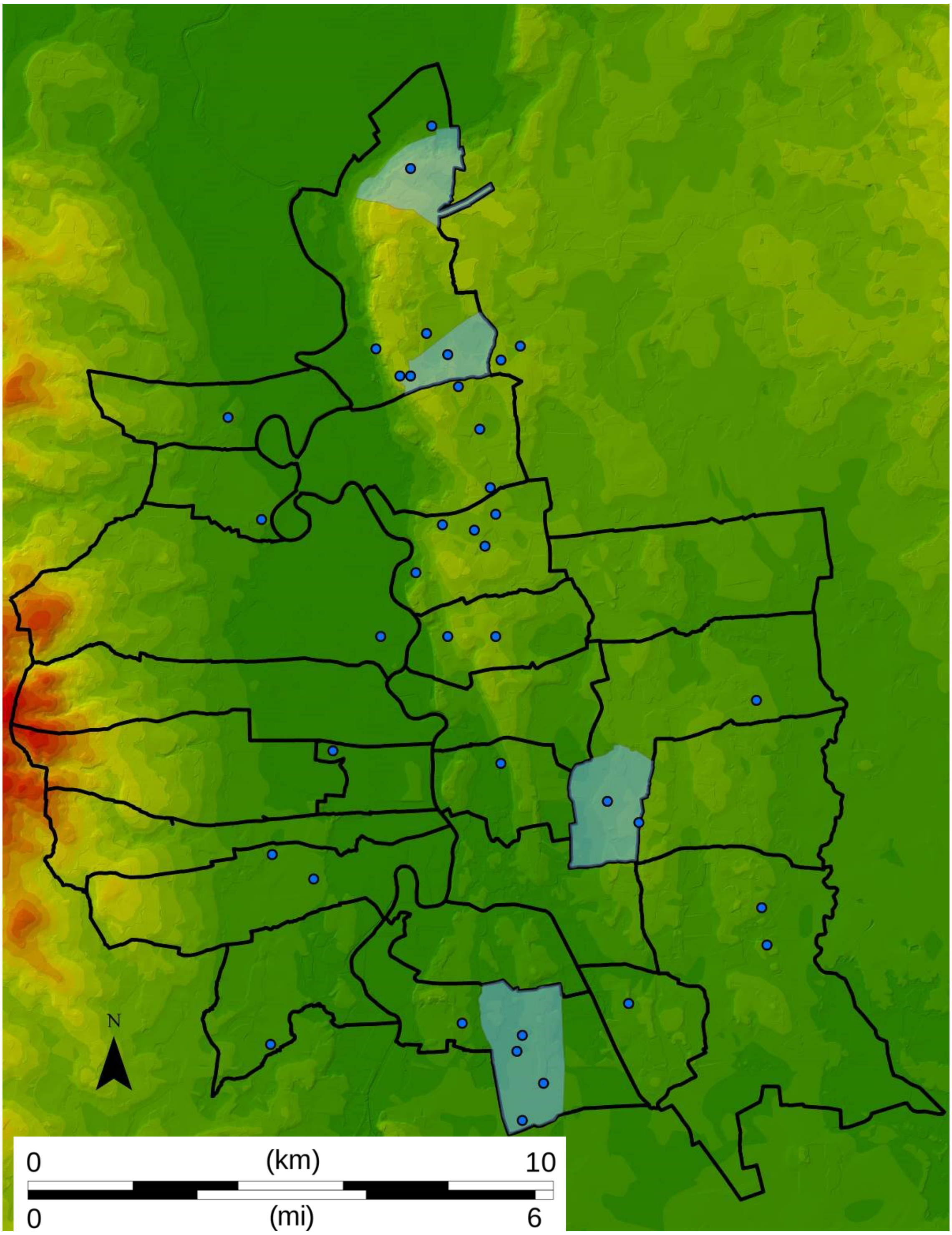


Figure 6.43: Deer parks and ancient woodlands on topography. Clusters of points in Kettlethorpe, Lea, and Gainsborough occur due to the presence of a park allowing the preservation of areas of ancient woodland in these areas. Shaded areas denote confirmed medieval park boundaries (based on Everson *et al*. 1991, 52).

Broadly, the static areas tend to be confined to the spaces between the dynamic areas. The locations for settlement were chosen for the particular advantages offered by the surrounding landscape, whether it was proximity to water, access to a route way, the underlying geology and the resulting soils, visibility to or from the site, the topography and so on. Once the settlement location was established, then the locations of major parks and woodland occupy areas in between the settlements and the cultivated land. Cultivated fields are also outside, but generally near, settlements (which may range from major villages and towns to smaller ancillary farmsteads). Some of the resulting ridge and furrow from arable cultivation, particularly near settlements, is no longer visible as it has been destroyed or obscured as a result of expansion or changes in land use. In addition to cultivated fields and deerparks with open fields and woodland, other open areas would have included wetlands and 'water meadows,' and other woodlands that were not associated with a parkland. These may not leave any surviving evidence of medieval use and so are not recorded, and will not be discussed in this research.

Deerparks across the study area were associated with large manors and, in many cases, the formation of a formal parkland resulted in the desertion of the surrounding settlement; as is recorded at Kettlethorpe in the 14th century, as well as Thonock, and probably also at Lea. At Stow Park, the manor, settlement, and deer park may have co-existed throughout the early parts of the medieval period. The main characteristic of these parks is that they all include a large manor and 'dynamic' area, and their boundaries were delimited based on what areas were owned by the estate. Within the study area the settlement/manor was always located along a road, with a park apparently 'behind' the main residence. These parks do not include any detected deserted medieval settlements, besides the ones often associated with the manor, and so they were established where they would not have any major impact on other settlements. Park boundaries often coincide with parish boundaries, but this does not provide solid dating evidence for their establishment, as this is probably based on ownership, rather than park foundation date.

Ancient woodlands are also included in the map of parks, due to the fact that woodlands were more likely to survive into the post-medieval and present day when they were owned and protected by a single owner. At Kettlethorpe, Stow Park, and south Gainsborough, the fields were sold in the late medieval and post-medieval periods, and the boundaries of the park are fossilised based on place-names, historical records, field boundaries, and local memory. In contrast, in the case of Thonock, because the manor and park were used until the 18th century, large areas of ancient woodland still occupy the area. Areas of ancient woodland may also help to identify areas of parkland; a cluster of ancient woodland sites in the parish of Lea may represent a park that was once associated with the moated site at Hermit's Dam. This possible park is not recorded and, unlike the other four parks, does not appear in Everson *et al*. 1991.

The very small number of ancient woodlands and complete lack of recorded deer parks west of the Trent may not mean that there were no manors or parks, but perhaps due to the constantly changing environments, they did not survive for long, or it is possible the land was not deemed valuable enough for a high status residence and estate. There are several possible unrecorded areas of medieval parkland away from the floodplain, but there is little supporting evidence for this at this time.

Also missing from the floodplain is any evidence of ridge and furrow. The dearth of evidence for cultivation in the floodplain may be a result of alluviation covering any ridge and furrow evidence. However, it is possible that there was simply little or no arable cultivation in the frequently flooded areas. If the floodplain ever was cultivated, deep ridge and furrow would have aided drainage (Hooke 2010, 222). Faint ridge and furrow which remains along the floodplain west of the winter camp site demonstrates that the earthworks would have been largely obscured by alluvium (see chapter 5).

Some ridge and furrow occurs immediately outside settlements, as at the Inglebys, Willingham, Stow Park, Knaith, and Kettlethorpe. There is also a concentration of static sites along the B1241 and the north-south Nottinghamshire. road. On the basis of this distribution, it is possible that the cultivated fields in the medieval period were often located close to the route ways in these areas. This data may be slightly skewed, however, if modern ploughing has erased any earthworks in those areas between settlements. Apart from this possible bias, the locations do follow a pattern, as they take up the spaces between activity centres, but also correspond to the topography (keeping towards the higher ground and away from the floodplain). The ridge and furrow along the Nottinghamshire floodplain edge indicates that this topographic ridge was possibly favoured due to the presence of some alluvial silts mixed with terrace sand and gravel, but also that it had less risk of flooding than the rest of the floodplain.

The reasons why some areas were chosen for cultivation and others were allowed to have woodland and open parkland remains unclear from the analysis maps. Everson *et al.* (1991, 53) states that deer parks in north-west Lincolnshire occupied the areas of clayland and other poor soils, however there is no supporting evidence of this hypothesis within the study area. Overall, deer parks occur across the entire study area with little apparent regard for topographic location, underlying drift geology, or proximity to road or water. Since the settlements were placed in the most ideal locations, by default, the deer parks were not on the prime settlement areas. Upon first inspection, the parks seem to have avoided any wetland or other uninhabitable areas. For example, the western boundary of Stow Park is also the wetland that delineates the settlement of Torksey. The wetland is not included in the park, despite being an unoccupied piece of land. Nevertheless, the recent information regarding the winter camp site belonging to the Bishop suggests that the wetlands between Stow Park and the winter camp site were all encompassed by the park, and only later, the boundary of the park was moved east of Brampton. The most plausible explanation for the distribution of deer parks is that they grew organically from the more strategically placed settlements and manor houses. The land that was not already in close proximity to a manor or estate and claimed for a deer park was used for cultivation, again with little notice taken of the type of soils present at the locations.

4.3.3 Nucleation, deserted villages, and parish formation

The nucleation of settlements in the medieval period is visible through these maps, where activity clusters around settlements, with open deer park, cultivated fields, wetlands, or roads taking up the spaces between. The most obvious medieval feature of many of these nucleated settlements is the parish church. Settlements that did not include parish churches do exist in the study area, and play a very different role in the landscape. The parish church acted as a central ecclesiastical focus for the entire population of a parish. Parishes acted as both political and ecclesiastic territorial units, acting under a larger diocese. Parishes were spatially defined around the 11th and 12th centuries, though the boundaries were often chosen based on earlier ownership or established physical features (Pounds 2000). While some Christian communities may have survived the fall of the Roman Empire and into the Anglo-Saxon period, Christianity really became widespread across England only by the end of the 7th century AD (Pounds 2000, 15). Much of the study area fell into the diocese of Dorchester within the episcopal organisation founded by Archbishop Theodore (AD 668-90) (Pounds 2000, 17) and at this time, the Bishop of Dorchester had a base at Stow and Stow Park. The establishment of minster churches across England, often corresponding to pre-existing royal land, was the basis for divisions of parishes (Pounds 2000, 17). As has been established, Stow's St Mary's church acted as a minster church until the 13th century. During the early medieval period, landholders began setting up private churches, allowing the population easy access to churches within their districts, which often eventually corresponded to the modern parish systems (Pounds 2000, 22). The parish churches would act as a means of revenue for the landowner, and the centre of parish life. Nucleation of settlements in the later medieval period often centred around parish churches, though this is not always the case. In this study, the settlements in the study area that have parish churches will be referred to as 'parish centres', while those without parish churches will be referred to as 'non-parish centres.'

1) **Parish centres**: These settlements often have roots in the early medieval period. These villages grew or stabilised in the medieval period, with some shrinking or stabilising in the late medieval or post-medieval period. These settlements survived due to their use as a parish administration centre. In the cases of a shrunken or deserted village which was a parish centre, such as Knaith and Gate Burton, their demise is often due to emparkment related to a manorial estate, in these cases, in the post-medieval period. Parish centres include: Torksey, Gainsborough, Saxilby, Knaith, Lea, Marton, Gate Burton, Kettlethorpe, Sturton by Stow, Stow and Willingham in Lincolnshire, and Church Laneham, Rampton, Treswell, Cottam, South Leverton, North Leverton, Littleborough, Sturton-le-Steeple, West Burton, and Bole in Nottinghamshire.
2) **Non-parish centres**: Non-parish centres do not have associated parish churches, and many are now DMVs. In the case of Brampton and Hardwick, their close proximity and relationship to the many parish churches at Torksey allowed them to develop without a parish church. Instead they paid taxes into Torksey (White 1856, 158; Brown 2006). With the exception of Brampton, Fenton, and Hardwick, these non-parish centres are located within parishes with a parish centre. They include: Hardwick, Brampton, Thonock (Gainsborough), Hermit Dam (Lea), Fenton, Laughterton (Kettlethorpe), Hardwick, Drinsey (Hardwick),

Bransby (Sturton by Stow), Normanby (Stow), Fenton, Stow Park (Stow), Gorwick (Sturton by Stow), Havercroft (Gainsborough), Alfletby (Willingham), and North and South Ingleby (Saxilby) in Lincolnshire, and Habblesthorpe and Fenton (North Leverton), and Coates (North Leverton) in Nottinghamshire.

The analytical maps have determined that there is a complexity of parish and settlement dispersion in Lincolnshire that does not occur in Nottinghamshire. The large number of small farmsteads and villages spread across the Lincolnshire side of the study area demonstrate the complicated structure that emerged out of the activity in the early medieval period. This is best illustrated by the percentage of settlement centres that have become parish centres. 57% of the settlements in the Lincolnshire part of the study area are non-parish centres, representing a complex social structure, and the growth of nucleated settlements away from a parish church. In contrast only 4% of the settlements in Nottinghamshire are non-parish centres, and these were mostly small settlements within the later medieval period. This disparity in levels of complexity on the parish level further supports the hypothesis that settlement on either side of the Trent is closely related to changes in the physical environment

Settlements turned manorial estates are common across the study area, including some at parish centres. Settlement sites which turn into manorial estates includes: Thonock, Hermit Dam, North and South Ingleby, Stow Park, Kettlethorpe, Knaith, Gate Burton (although Gate Burton may have been shrunken in the medieval period, and turned into an estate in the post-medieval period) in Lincolnshire, and possibly Bole in Nottinghamshire. In addition, the construction of Torksey Castle may have initiated the abandonment of the field south of present Torksey, as it is now titled 'Castle Field.' Many of these deserted settlements were not parish centres; however when parish centres were turned into a deserted village with associated manor, the parish church would often continue to function, serving the estate and surrounding community. This process occurred at Knaith, Gate Burton, and Kettlethorpe. Occasionally, a previously existing parish church was lost, such as at Ingleby, and possibly at Hardwick in the late medieval period, but this is the exception rather than the norm. In the case of West Burton, the site was abandoned with no apparent replacement manor, but the church continued to be used until the 19th century, and the cemetery is still used today (figure 6.44). Although the process of abandonment and/or emparkment of settlements in the study area appears archaeologically similar, formation of manorial sites was not all contemporaneous, but rather a process that occurred over the medieval and post-medieval periods.

Figure 6.44: 19th to 21st century gravestones on a platform associated with the deserted medieval village and church at West Burton; although the village, and eventually the church, disappeared, the place where the settlement once was continues to act as a parish centre by offering consecrated burial ground (photo author's own, 2014).

Stow remained a large ecclesiastical centre until the first centuries of the later medieval period, when it slowly fell in to decline as ecclesiastical activities became increasingly focused on Lincoln (National Heritage monument listing 1146624). Saxilby continued as a major settlement, perhaps due to its location near the Foss; but the Inglebys were converted to outlying settlements of Saxilby, and eventually into two separate moated sites. Marton also continued its use as the other side of the Trent crossing with Littleborough, and the proposed crossing point at Knaith may have also continued until the settlement was deserted to create parkland for the local manor. A motte and bailey castle was built on Castle Hills, near Thonock, which would have had a good vantage point looking across the valley to the north.

The changes occurring across these settlements were not contemporary and ranged from the 12th century to the 19th century. The analysis of these changes requires much more investigation. In *Change and Continuity: Rural settlement in north west Lincolnshire*, Everson *et al*. (1991) laid the foundations of a full survey of several settlements within the study area, mainly on a parish by parish basis, describing the evolution of the settlements, from hamlet, to village, or manorial estate, complete with several earthwork surveys of the deserted and shrunken villages. The volume covers the settlements of: Saxilby, Stow, Lea, North and South Ingleby, Knaith, Gate Burton, and Kettlethorpe, and the deer parks at Gainsborough, Kettlethorpe, and Stow, with special focus on shrunken and deserted settlements, and moated sites. The landscape survey and analysis of the timeline of many deserted villages provides a wonderfully detailed summary of the changes occurring throughout the late medieval period. It also details the locations of many of the deer parks mentioned in this volume. Despite its detailed plans and informed background information, the survey does not, however, consider factors such as topography and there is considerable scope for building on the basis offered by this survey with further detailed work. Unfortunately the survey by Everson *et al* (1991) does not cover the Nottinghamshire side of the Trent. A survey of the medieval settlement of the Nottinghamshire part of the study area, as well as those settlements not explored in the volume is an area that the author hopes to examine in the future.

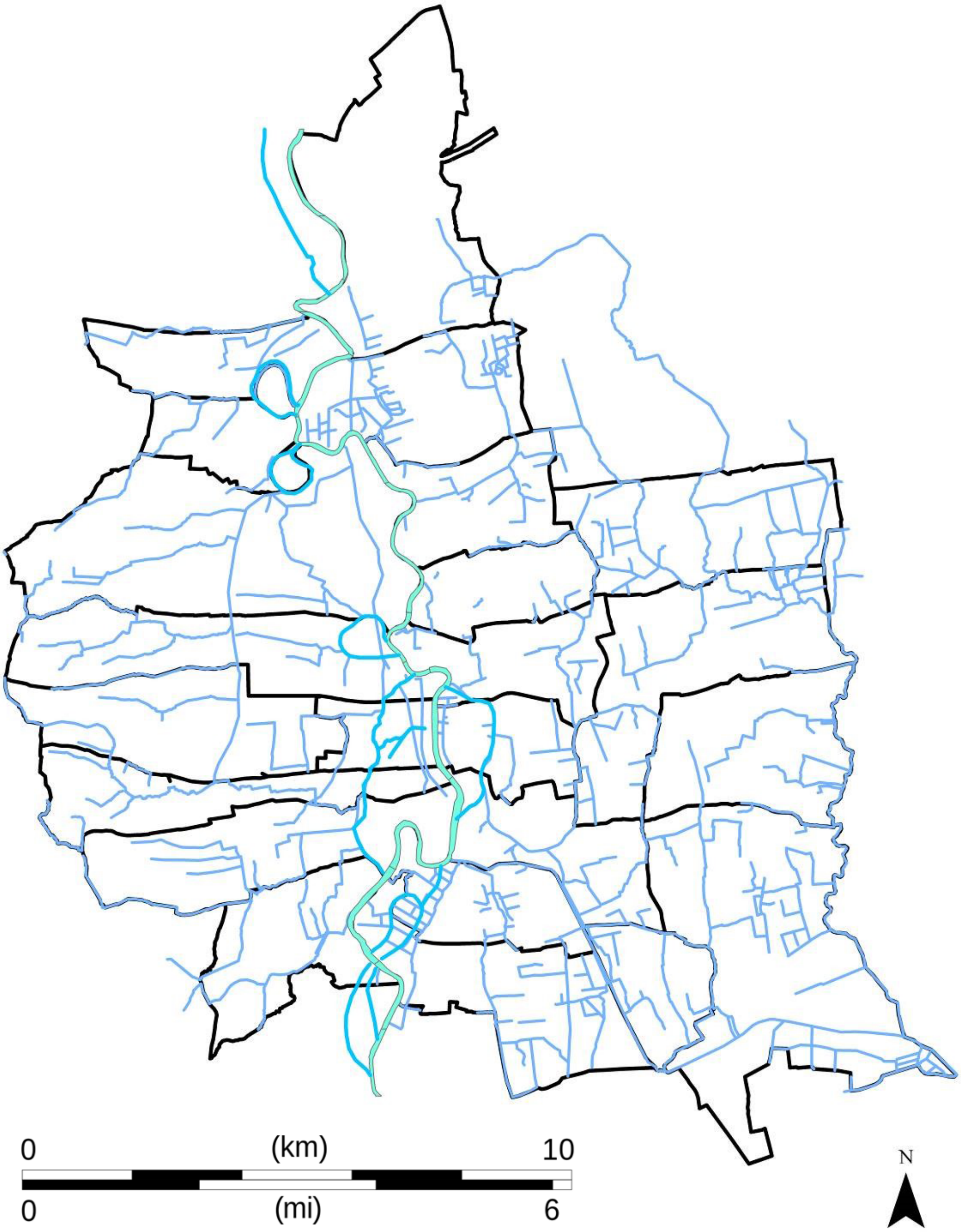


Figure 6.45: Parish boundaries in relation to water channels in the study area.

As noted in previous sections, parish boundaries often represent important administrative, political, social, and physical boundaries and territories. For the most part the parish boundaries within this study area were established in the medieval period. However, many of these features were important boundaries that were initiated in, or even before, the early medieval period. The boundary of each parish was based on several factors. The aim of this brief survey is to determine the main reasons for the establishment of boundaries of parishes within the study area, and any deviations from these reasons.

At first glance, it is clear that water boundaries create the majority of parish boundaries in this part of the Trent Valley. This is not surprising, considering that wetlands, water channels, and a floodplain are associated with the majority of the physical environments in the study area (and within the Lower Trent Valley). The correlation between the water and parish boundaries also indicates that many drainage channels existed as tributaries or as drainage by the 11th and 12th centuries.

The River Trent as a parish boundary presents an interesting study in itself. The channel always acts as the main parish and county boundary, however, as the channel shifted throughout the medieval and post-medieval periods, the parish boundaries did not always move with it. The most obvious and recent examples are the abandoned channels at Burton Round and Bole. These channels were only abandoned in the early 19th century, and today are only used when the Trent breaks it banks. However, the parish boundaries were not adjusted to reflect this change, and parts of Lea parish are now on the west side of the Trent. Another abandoned channel in North Leverton, just south of Littleborough, also demonstrates a palaeochannel with a parish boundary adhering to it to the north, indicating its presence when field boundaries were instated. This curve, however, was cut off by the Trent earlier than those at Bole and Burton, thus the curve, which may have once been part of Gate Burton, has since been reapportioned as part of North Leverton.

The Foss Dyke creates a boundary between Torksey/Fenton and Kettlethorpe/Hardwick, but not at Saxilby, where it crosses through the parish. As was hypothesised in previous sections, this may indicate a shift of the original course of the Foss Dyke in the 12th century, with possibly another channel shift during the 1621 improvements. The previous course of the Foss acts as the northern parish boundary of Hardwick. The straight boundary between Hardwick and Kettlethorpe may be a later medieval change, when the course of the Foss was changed in the 12th century. The change in route of the canal probably occurred around the same time that parish boundaries were starting to take shape, and the parish boundaries reflect both routes of the Foss (thus supporting the hypothesis that the change of the route of the Foss occurs in the 12th rather than the 17th century).

At a more local scale, parish boundaries occasionally have small discrepancies, where, in the middle of a field, a parish boundary may suddenly twist and turn before returning to a straight line. Many boundaries do not adhere to any present day boundaries, whether field boundaries, roadways, or water courses. Upon closer inspection, however, within this study area many of these discrepancies can be attributed to the straightening of drainage channels and tributaries, which was never translated to the parish boundary. One example is on the boundary at Laneham, which is illustrated in figure 6.46

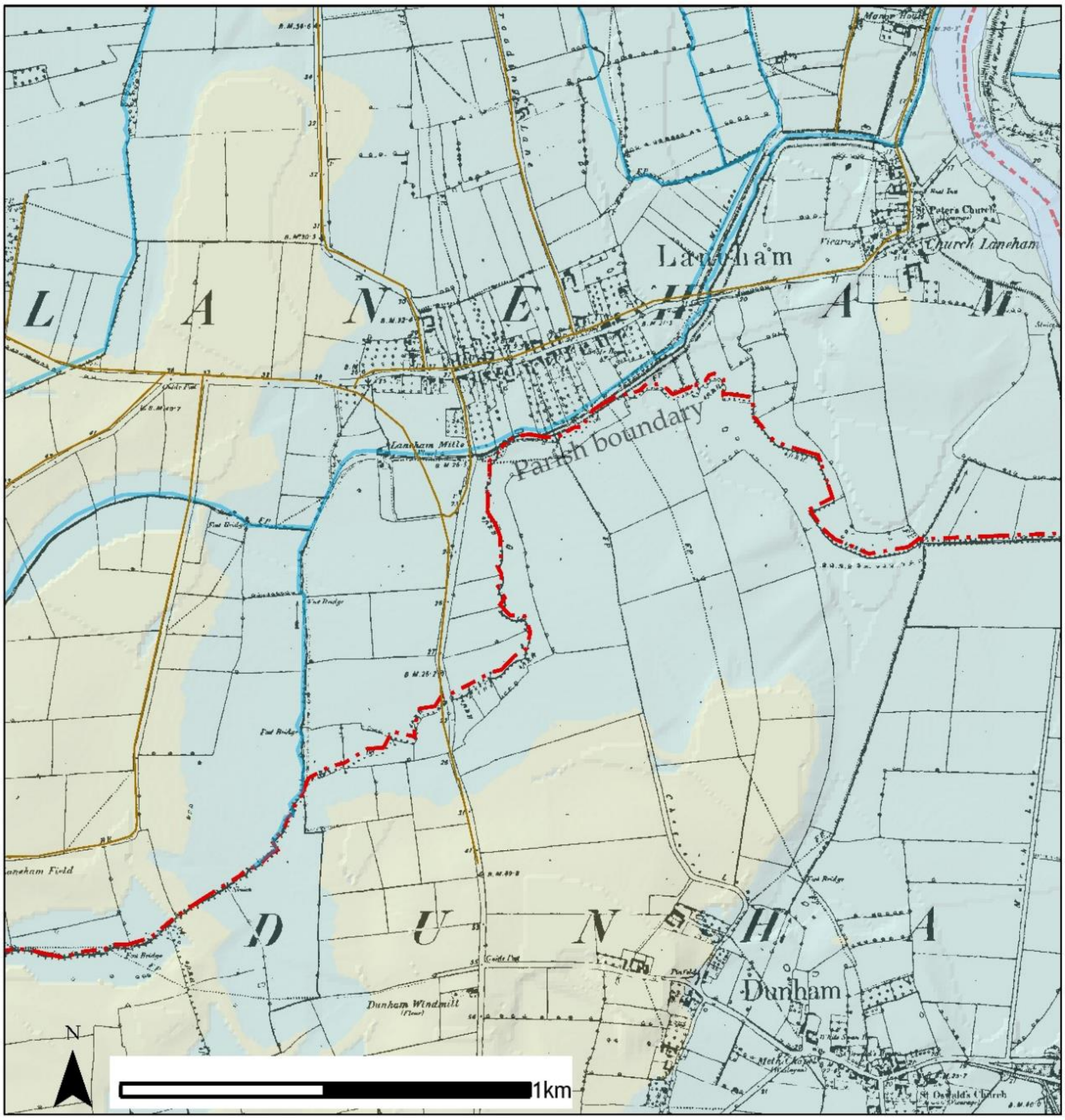


Figure 6.46: 1st edition OS map showing the line of the parish boundary between Laneham and Dunham (outside study area). By the time this map was drawn, the watercourse that flowed between the two parishes had already been diverted in order to create the millstream in Laneham, but the parish boundary still follows the line of the original stream between the two parishes. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

There were also several examples of turns in boundaries that may be caused by intentionally created or man-made features, rather than natural features. These discrepancies often occur along straight edged boundaries. On present maps, small diversions from the straight edged boundaries have been preserved as small copses of trees, often because the land ownership still often corresponds to parish boundaries. These may correspond to early medieval estate ownership, but often other significant landscape features, such as a gallows site, Anglo-Saxon assembly place, or existing prehistoric features would be placed on medieval boundaries (Whyte 2009; Pantos 2003; Hoskins 1955). Reasons for placing boundaries on significant pre-existing features may be abstract in that the medieval population were making a connection with the past landscape, or straightforward in that these features were simply easy to describe in documentation. Although there are several unique diversions in boundaries within the study area, there has only been one identified feature that corresponds with an irregular boundary. A gallows site is preserved in place name at Gallow's Dale, which also corresponds to a junction in a Roman road, the edge of Stow deer park, and most importantly, just along the edge of the parish boundary, where it bends around Sturton by Stow (figure 6.47). There are relatively few examples of these landscape 'memories' within the study area, and there is not enough data in this present thesis about these locations to make an informed hypothesis.

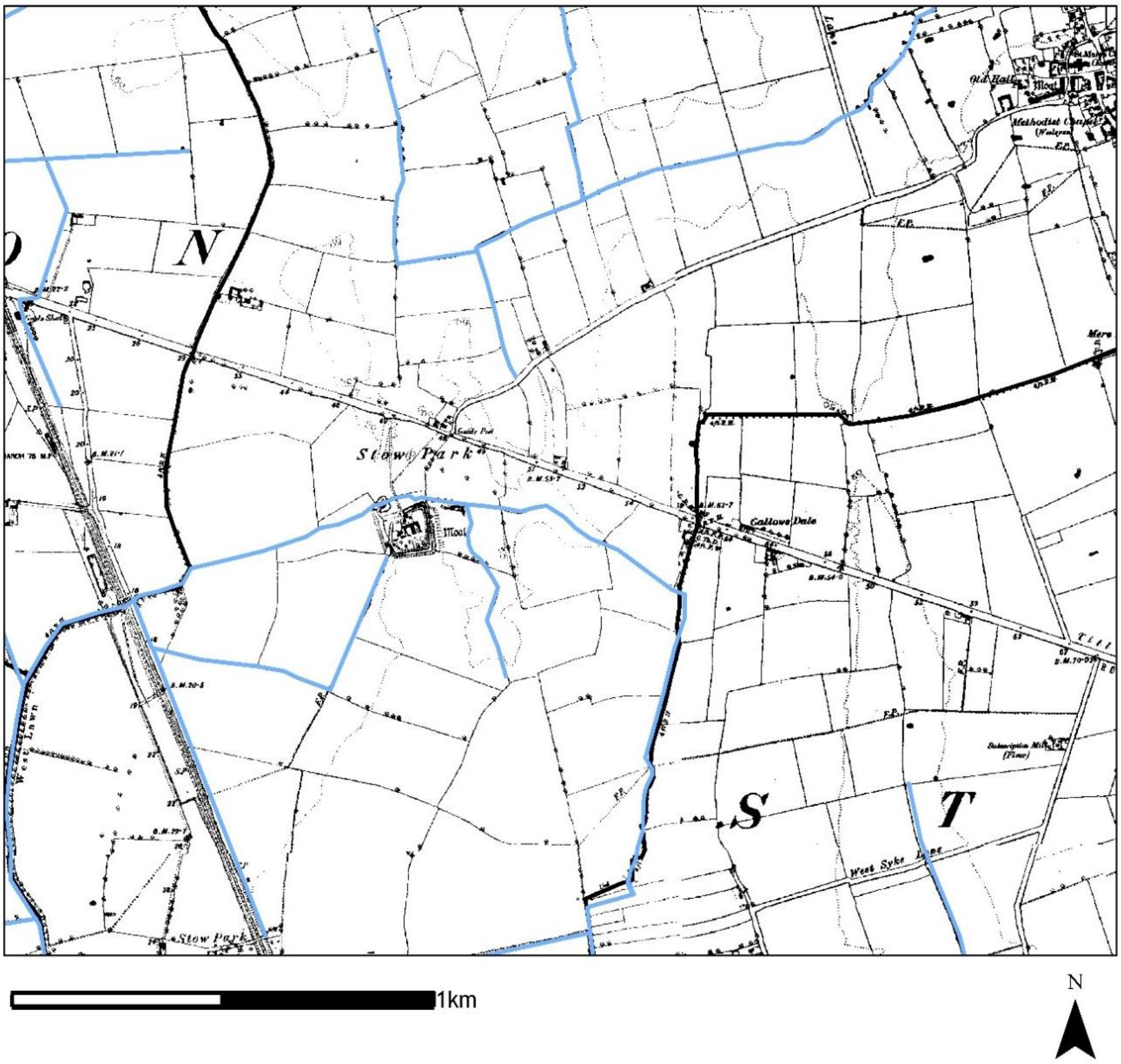


Figure 6.47: The parish boundary east of Stow Park at the boundary of Stow and Sturton by Stow does not follow a water course, and there is no evidence of a water course previously flowing at this location. Instead, the boundary crosses the Roman road at 'Gallow's Dale.' This is not a coincidence, although whether the boundary or the gallows came first is still unresolved. If the gallows were there prior to the drawing of the parishes, the boundary may have been drawn there because it was easy to describe the location of the boundary; alternatively the gallows site may have been placed there at the edges of both parishes. There is, however, some historical suggestion that the gallows were already present in the late Anglo-Saxon period (Adam Daubney, *pers. comm.*). It is also of some note that the gallows are specifically outside of the ecclesiastical parish of Stow, seat of the Bishop of Dorchester. © Crown Copyright and Database Right 2014. Ordnance Survey (Digimap Licence)

Aside from watercourses, boundaries of large estates, deer parks, or other parcels of land under one owner commonly formed boundaries to the parish systems. Fields as part of a block of land, and the boundaries of a deer park or ancient woodland, create parish boundaries in nearly every parish in Lincolnshire, although these also often correspond with water courses. One example of this is at Saxilby, with land ownership on both sides of the Foss Dyke. Saxilby serves several nucleated settlements, and perhaps at one point also served Broxholme in the south. The parish of Broxholme may have separated at a later date, during which time Saxilby acquired the lands around the independent manor, creating an odd, hook-shaped parish boundary around the Broxholme estate.

In Nottinghamshire, where deer parks and estates were less prevalent, a very different pattern emerges. West of the Trent, linear parishes all include a large part of the floodplain, as well as a portion of habitable higher grounds. As was mentioned earlier in this chapter, the settlements in Nottinghamshire do not appear to have the same complex relationships with the landscape as those in the Lincolnshire part of the study area. Within the floodplain, the landscape would have been changing constantly, unlike the higher grounds in Lincolnshire, and boundaries may not have been as firmly established as they were east of the Trent, where they had emerged from Roman and early medieval landmarks. Another pattern that emerges from the Nottinghamshire parishes is that the linear parishes are largely delimited by east-west drainage channels, and the settlements within the parishes also include water channels. Copious drainage would no doubt have been essential for life on and around a floodplain; however the requirement for low order streams through the settlements may have also been a driving factor in the locations of settlements and placement of boundaries.

Previous studies of parish boundaries in northwest Lincolnshire have shown that the Roman Road of Ermine Street (now the A15) had a significant effect on parish boundaries, with the parishes aligned on either side of the road and using the straight side as a common boundary (Sawyer 1998, 20). Contrary to Sawyer's analysis, the parish boundaries within the study area of this analysis seem to actively avoid roads, even those that were clearly established and active in the early medieval and Roman periods. Although Sawyer (1998, 21) attests that Roman roads may well have been abandoned after the Roman withdrawal, although perhaps were always visible in the landscape, this analysis has determined that, while activity on Littleborough Lane had decreased, activity on Tillbridge Lane had certainly not ceased. Trackways did emerge along boundaries, as it would have been essential for land owners to access their outlying fields, but main roads that date or pre-date the formation of parishes do not form boundaries. It is understandable that the roads connecting the medieval settlements, such as the B1421, the track between settlements in Nottinghamshire, and even the A156 do not follow the lines of boundaries, since the settlements are set within the parish. This also occurred further to the east, where the parishes set along Ermine Street also had trackways connecting the settlements along the edge of the High Dyke cliff (Sawyer 1998, 21). However, the boundaries within this study area are drawn as if the pre-existing Tillbridge Lane did not even exist. A short area of Tillbridge Lane between Marton and the Trent is the only space where the parish boundary between Marton and Gate Burton follows the road. This may be due to the much later recession of wetlands across the floodplain and foundation of the new parish boundary was not part of the original formation of boundaries; in any case, the boundary on the east and west sides of Marton were certainly established at different times. The minimal role of Tillbridge and Littleborough Lanes in the making of parish boundaries may indicate that the road was not very important in the medieval period and only picked up again later in the medieval or post-medieval periods, or that it never played any role at all in the boundaries of land ownership, and perhaps was just a minor route way at the time of formal parish establishment.

4.5 Conclusions: the later medieval landscape

The combination of the wider landscape study, and the details of certain settlements and features in the landscape have produced a well-rounded and comprehensive history of the modern landscape. In the study area, on the basis of settlement and land-use patterns, there is little evidence of the drier climate that is generally associated with the Medieval Climatic Optimum, and for this reason, topography played an important role in the later medieval period. Flooding across the Trent Valley and alluvial accumulation across the floodplain dominated the medieval landscape, forcing settlement in Nottinghamshire to the fringes of the floodplain, and keeping settlement at higher elevations in Lincolnshire. Weirs and bank reinforcements were constantly changing, and a 14th century document indicates that many measures were constantly taken in order to keep the Trent and Foss open and adapt to the shifting environment (Cole 1906, 497). Settlements at the east and west margins of the study area developed along ridges formed by bedrock, and roadways connecting these settlements developed contemporaneously. A few settlements survived within the floodplain, but they remained strictly within the gravel islands that they occupied. Throughout the later medieval period, many settlements became dominated and eventually taken over by manorial estates, leading to a modern landscape that is covered with shrunken and deserted medieval villages and medieval high status or moated sites (i.e. Knaith, Littleborough, Ingleby [north and south], Gate Burton, and Kettlethorpe).

On the east side of the study area, the linear patterns of settlements correspond strongly with the topography caused by the underlying geology. The Mercia Mudstone ridge along the Trent does not present high vantage points, but the proximity to the Trent, along with views over the Trent Valley, allowed these settlements, including Torksey, Marton, Knaith, Lea, and Gainsborough, to continue to prosper. Settlements also developed along the top of the Scunthorpe Mudstone, including Sturton by Stow, Stow, Ingleby, and Saxilby, which, at a higher level, would have provided views of the Till Valley, and of those settlements along the Trent. Settlements at lower elevations within this pattern, mainly around Torksey and Kettlethorpe, continued to develop, but only over 6 to 8 m AOD, probably indicating that flooding in this area was still a problem, and efficient drainage was still not available. The Lincolnshire settlements tended to be located on terrace sands and gravels, even on small pockets that are not part of larger deposits. Again, this may correspond to sediment type; however it is more likely the topographic elevation would have been the major attraction. The settlements that were present within the early medieval period, that expanded in the later medieval period were more likely to be located on the smaller areas of terrace deposits, while settlements that began emerging in the later medieval period are located where there is no drift geology, but may have been founded due to convenient placement along an emerging trackway.

Settlement in Lincolnshire reflects a complex and long landscape history, often based on prehistoric features that were initially defined by natural features. This is reflected in the large number of settlements scattered throughout the area, but with only about half of these settlements acting as parish centres. This complexity and longevity of landscape is in sharp contrast with the simple settlement patterning on the Nottinghamshire side of the study area. This primarily medieval landscape is the result of the floodplain being 'wiped clean' by periods of flooding, resulting in the loss of any underlying prehistoric landscape structure.

Along the floodplain west of the Trent, the settlements were mainly founded in the medieval period, as there is little evidence of earlier occupation at these sites. They are mainly located along the very edge of the valley, set away from the floodplain (Sturton-le-Steeple to Treswell). The settlements set away from the floodplain are located at an almost identical height, from 16 to 18 m AOD. Although there is no indication that the Mother Drain was still an active river in the later medieval period, the location of these settlements may be related to the flooding and movement of this channel, prior to its use as a drainage channel. The location of these settlements may have also been related to tributaries of the Mother Drain. The settlements within the linear group along the western part of the study area are also each associated with a smaller tributary that is flowing towards the floodplain. The small first and second order streams that these settlements are associated with may be the main reason that the villages are located this far from the floodplain. Frequent flooding and increased siltation in the medieval period may have made the waters of the River Trent not very appealing for use as a fresh water source, these smaller tributaries would have also been much more predictable and manageable during periods of flooding. (Similarly, all of the settlements across the eastern part of the study area are associated with a small tributary, or present drainage channel, even those located near the Trent or the Till.)

The sites within the floodplain (Laneham, Rampton, and Littleborough) are still set above the alluvial plain, and are situated *only* on sands and gravels. This could be a product of early medieval settlement patterns, but considering that these settlements did not expand beyond the islands in the medieval, or even through much of the post-medieval, periods further confirms that flooding was still a factor. There is a possibility that these settlements may have been located at this location due to the type of underlying sediment if it was useful for cultivation, but, considering the islands were mainly taken up by domestic structures and spaces, it is more likely that they were located at the edge of the floodplain and on terrace deposits because these deposits correspond to the rise in elevation. The development of the settlements at Church Laneham and Laneham provides a clear case of the obvious avoidance of the floodplain in the medieval period. Church Laneham includes evidence of early medieval activity, and when the early medieval settlement could not expand into the floodplain it expanded onto the next gravel island. It should be noted that this second gravel island is lower than the island of Church Laneham and this may indicate that the water level, though still high, may have receded slightly by the 12^{th} and 13^{th} centuries (Budge 2010) In Domesday, fisheries are recorded at West Burton, Rampton, and Cottam, further demonstrating that this landscape was defined by the resources of the Trent Valley. Although none of the sites on gravel islands within the floodplain have recorded fisheries (figure 6.14), this does not mean that the industry did not emerge later. Other than fishing, these sites may have been used to access wetlands, or even as minor landing places for small boats.

Even though proxy records indicate that water levels may have been lower, there is little evidence that the floodplain in the medieval period was occupied as it had been in the Roman period, and settlement patterns are closely linked with wet environmental conditions. Floodplain stability in the area today has only been achieved through drainage and modern engineering. Prior to the installation of pump houses across the area, settlements were limited to the edges of the floodplain and to gravel islands, and growth in the later medieval period continued to be dictated by flooding. The avoidance of the flood plain and alluvial deposits by settlements in the later medieval period is perhaps one of the more obvious, yet surprising results of this survey. Alluvium accumulation across the floodplain as a result of intermittent flooding made this area impossible to settle for long periods, although it may have led to archaeological preservation within alluvium.

The analysis of the roadways across the study area demonstrates that there were several main roads that became well-travelled in the medieval period, and which have survived into the present day: the B1421, A156, Tillbridge Lane/Littleborough Lane, Cowdale Lane, and the Nottinghamshire north-south road. Like settlements and wetlands, settlements and roads in the study area also have a complex spatial and temporal relationship. Some main roads had already been established in the area in the Roman period, and these influenced the locations of several settlements that were established in the later medieval period. The B1421 and the A156 both date to the early medieval period; however, their placement along the Mercia Mudstone and Scunthorpe Mudstone formations encouraged the development of several later medieval sites along this route, including Gate Burton, Gainsborough, and Kettlethorpe on the A156, and Sturton by Stow and Normanby on the B1241. Later developments are notable as they are not occupying terrace gravel outcrops, or the highest topographic elevations.

The settlements established along Tillbridge Lane indicate that the road was probably utilised for at least some, and perhaps all, of the medieval period. Littleborough and Marton were important for the connection between the Trent and the A156. The connection of Tillbridge Lane to Littleborough, but the disuse of the Roman Road in Nottinghamshire, may even demonstrate that medieval Littleborough was further integrated into and related to Lincolnshire and not Nottinghamshire, with the settlement relying on the A156, the Trent, and Tillbridge Lane for communication. Also along Tillbridge Lane, Stow Park, Sturton by Stow, as well as cropmarks of additional settlement east of Marton, may indicate that the road was used for much of the medieval period and may have maintained its importance as an access to Trent quay facilities. Sturton by Stow holds a particularly interesting position at the junction of Tillbridge Lane and the B1241. Detailed investigation of the history and archaeology of the foundations of Sturton by Stow may be able to decipher when Tillbridge Lane was in use in the later medieval period, and therefore enabled a settlement to grow up around it. Unlike the region east of the study area, the Roman road did not act as a ‘bypass’ road similar to Ermine Street to the east, as hypothesized by Sawyer (1998, 21), but rather as a trackway and alternative land route from the Trent to Stow, the B1421, and eventually Ermine Street and Lincoln.

The road leading from Torksey to Lincoln was probably a much larger road than the track of Cowdale Lane now suggests, and was probably more important than Tillbridge Lane in the medieval period, due to the importance of Torksey. Cowdale Lane would have provided a land route to Ermine Street and Lincoln for the large medieval population of Torksey, and would have been a land-bound alternative to the Foss Dyke.

Late medieval settlement in the western part of the study area appears to be wholly responsible for the foundation of the road connecting Sturton-le-Steeple with Treswell. This road, winding through each of these settlements, was probably established around the same time as each of the late medieval settlements along it. Littleborough Lane, on the Nottinghamshire side of the study area, however, appears to have become almost completely unused throughout the later medieval period, which is confirmed by the abandonment of the road in the modern landscape. Within and along the edge of the floodplain, there is no present evidence of a route that connected the settlements that were on gravel islands or on the gravel terrace. In the medieval period, there may have been trackways that connected the settlements of West Burton and Coates with Cottam and Laneham, but the flooding and channel changes had erased these routes from the landscape. The settlements on the floodplain appear to have relied on small tracks that connected to the road west of the floodplain, as well as crossing points to get to the A156.

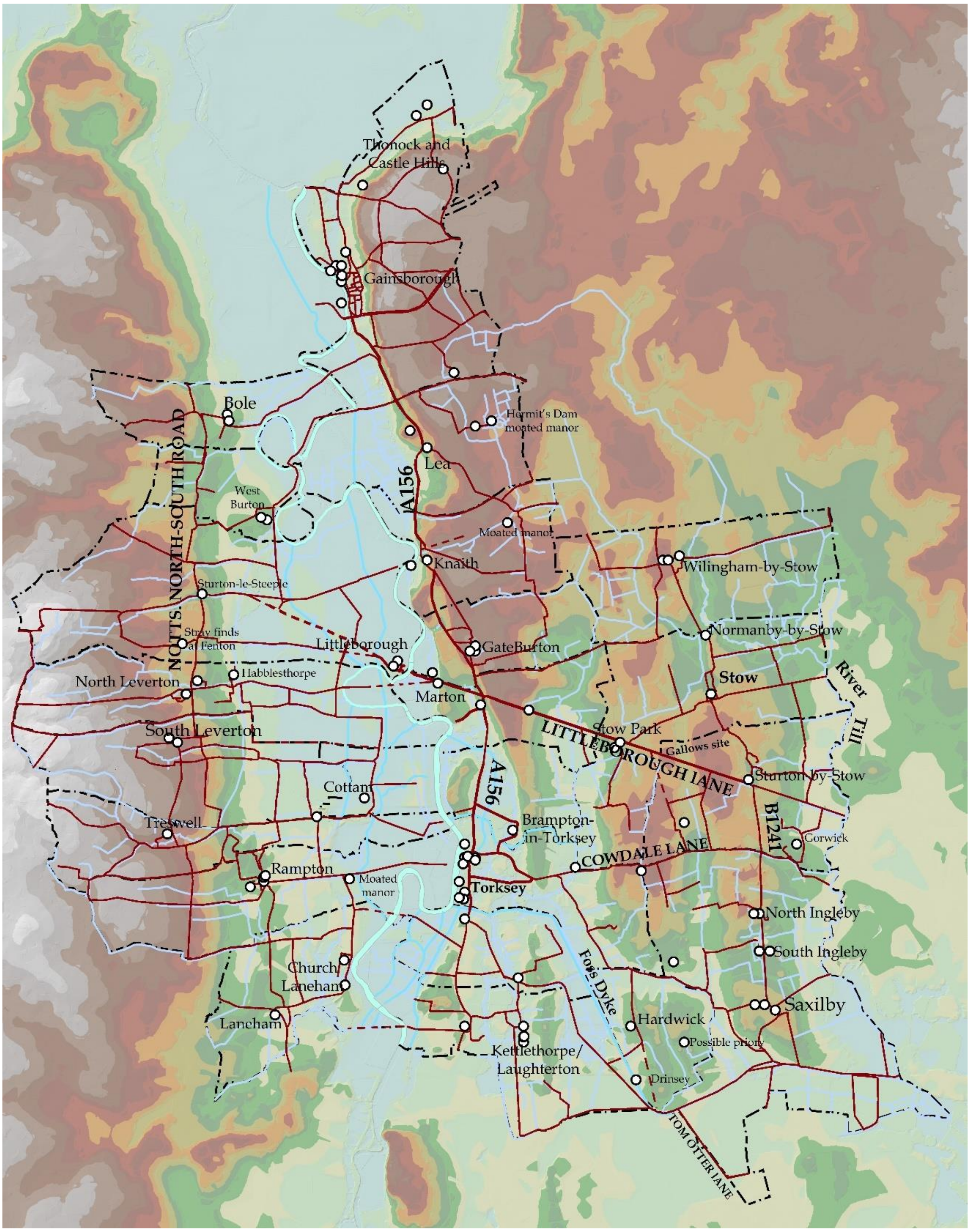


Figure 6.48: Map showing the sites, roads, and water courses that would have been present in the medieval period.

Throughout the medieval period, settlement and estates were becoming nucleated throughout the study area, and parish foundations formed the underlying political and social structure. Lincolnshire contained a number of settlements that did not have parish churches associated with them, and they usually relied on another settlement within the same parish for ecclesiastical provision. Conversely the settlements in Nottinghamshire were primarily composed of parish centres, with a single nucleated settlement in nearly every parish. One possible reason for this difference is that settlement on the Lincolnshire side of the study area was not as disrupted by changing environments. Although continuous occupation since the Roman period is unlikely across the entire study area, there is evidence at Thonock, Lea, Marton, and even on the winter camp site, that Roman sites were reoccupied in the early medieval and later medieval periods. Settlements established in the early medieval period expanded in the medieval period. Torksey, in particular, flourished in the first centuries of the medieval period, with three parish churches, a priory, a nunnery, and large settlement (according to Domesday), until the 13th century (Sawyer 1998).

The parish boundaries across the study area have also been shown to mainly correspond to water, including drainage channels, tributaries, the River Trent, and Foss Dyke. Water may have also acted as a boundary to different estates or areas of ownership, which, in turn, led to it acting as a parish boundary. In the places where water did not delineate the parish boundaries, land holdings and park boundaries also acted as parish boundaries. Within each parish in Nottinghamshire the linear pattern allowed each parish to include both habitable uplands, as well as a portion of the valley lowlands. The locations of Lincolnshire parish boundaries is much more complex, and does not always adhere to physical boundaries, and is often associated with drainage channels, deer parks, estate holdings, and perhaps earlier features in the landscape, such as the gallows site at Stow.

Previous hypotheses about the formation of deer parks across the study area suggested that park land was confined to poor soils and uninhabitable land; however this analysis has shown that this is not the case. Instead, deer parks and ancient woodland were located where it was convenient for the associated manor and/or settlement even if they were on good soils and had good access to route ways and other resources. The deer parks associated with the estates occupied the surrounding areas, with little to no regard to the quality of the land. The map of cultivated areas only includes the ridge and furrow recorded in the HER, so is hardly representative of all the medieval cultivated areas in the study area. Modern cultivation and alluvium accumulation means that many of the cultivated areas of the medieval periods were not able to be included in this brief analysis. However, some patterns can be gleaned from this study. Cultivation was often found just at the boundaries to the settlements, which may demonstrate that agriculture did not occupy areas that were not easily accessible from the settlements.

While the landscape survey has provided many details about the study area, it was the brief analysis of place names in the area that provided some idea of the Scandinavian characteristics of the landscape. Apart from proving that the winter camp site had indeed become part of the Bishop of Dorchester's estate and providing a good indication of why the site was never settled, recorded place names have demonstrated that there were a large number of Scandinavian personal and descriptive names within Torksey. Place name distribution has also highlighted that additional Scandinavian activity may be centred around Saxilby, also along the Foss Dyke, even after the Foss shifted in the 12th century.

This analysis has delved further into the medieval landscape than originally intended, although it has provided valuable detail about the landscape after the winter camp. This survey has clearly demonstrated the evolution of the study area from the early medieval period into the later medieval period, and explored the effects of settlement, topography, and most importantly, environment. Several additional databases were created for this analysis, but unfortunately were not able to be fully analysed, including a list and analysis of cropmarks in the area, a map of detected palaeochannels in the study area, a list of aeolian deposits recorded in archaeological reports, and finally a list of recorded place names, meanings, and possible origins. These lists can all be found in the appendices IX, X, XIV, and XIII.

5. Conclusions

This landscape analysis has allowed for an overall view of the Roman and medieval periods in the vicinity of the Viking winter camp site, and has also provided some details of the transitions that occurred over time. Mapping of sites across the topography, drift geology, and in relation to roads and water in the study area has clarified the importance of many features that are commonly ignored by archaeologists and historians. Analysis of the movement of settlements has also determined that many of the changes in the landscape were caused by environmental factors, and that the development of the parish structure also aided in the nucleation of settlements across the study area. It has also provided some insight into the progression of the landscape of the settlement at Torksey.

Environmental change has proven to be one of the major factors in the placement and movement of settlements throughout the analysed period within the study area. The warm and dry period of the Roman period is reflected in the presence of settlement on the floodplain. The subsequent movement of settlement out of the river valley and to higher ground, with the exception of Littleborough and Laneham on higher gravel islands, demonstrates a major environmental shift. Water level is demonstrated to remain high throughout the medieval period, despite the onset of the Medieval Warm Period, and settlement remains away from the frequently flooded floodplain, prior to drainage construction in the late medieval and post-medieval periods.

The solid geology of the area created a dynamic topographic pattern of high ridges and low valleys, which dictates the habitable areas, which is, in turn, limited by climatic changes. Settlement also does tend towards particular drift geologies, especially in the Roman and early medieval periods, with settlement in the floodplain preferring gravel islands. Early medieval settlement also tends towards sand and gravels, which provide both a topographical and an agricultural advantage. There is little evidence of a 'Mid-Saxon Shift' towards clays; however with increasing nucleated settlement in the medieval period settlements do begin to form on clay soils overlying the mudstone bedrock.

The Roman period can be defined as having settlements focused on the floodplain, with farmsteads covering the low ground along the River Trent, mainly on the Nottinghamshire side of the study area. Industrial sites were concentrated on the Lincolnshire side, including pottery kilns at Little London, south of Torksey. The Roman Road and crossing point at Littleborough was established during this period, and settlements and other Roman activities lined both sides of the road on both sides of the Trent. The A156 may have roots in a trackway that mirrored the Trent, although a similar route along the floodplain may also be lost under alluvium. The Foss Dyke was also established in the Roman period, although the current route does not follow this original Roman course.

Torksey in the Roman period was largely unoccupied, at least according to excavations from the site of the settlement; a farmstead was located on the later winter camp site, but there is negligible evidence of any sort of settlement in the Roman period north of the

Foss Dyke. Instead, the strategic location at the confluence of the Foss and Trent may have been taken advantage of from the south side of the Foss, in the present day parish of Fenton, where pottery kilns were producing ceramics not so different from those produced in early medieval Torksey (Jane Young *pers. comm.*). The winter camp site would have been bounded by wetland and accumulating peat, but the upland site may have been grazed or even cultivated, as may have the site of the Torksey.

The settlements across the floodplain were abandoned by the 4rd century; the enclosures that have been excavated have been found beneath later organic silts, recent alluviums, and at Rampton possibly aeolian sand, denoting two or three environmental changes within the floodplain after the Roman period. This major environmental change and climatic deterioration led to the complete restructuring of settlement in Nottinghamshire and some major changes in the settlement patterns in parts of Lincolnshire. Nearly all the settlements within the floodplain were completely abandoned, as the valley was largely taken over by wetlands and active accumulation of organic silts and peats. Littleborough survived in the floodplain due to its location on a particularly high gravel island. The early medieval site at Church Laneham also occupied a higher gravel island, the only other site to successfully survive within the post-Roman Trent Valley floodplain. Other sites are established at locations above the floodplain. A possible fishing site in Sturton-le-Steeple, along Knaith Hall Lane, may provide some clues about the connection between the settlements in Lincolnshire and the wetland resources of the uninhabited floodplain.

The Roman Road may have survived into the early medieval period, but at that time may have not been maintained or used very frequently. Throughout the early medieval period, there is also evidence for the development of the A156, which would have provided local transportation for the population. Longer journeys as far as the Humber Estuary and York were carried out over the Trent, or possibly further east on the A15. The development of the B1421 also began in the early medieval period; however this may have begun to emerge due to the placement of settlements on the ridge that runs north to south from the parishes of Willingham to Saxilby

.

Along the Lincolnshire side of the Trent Valley in the early medieval period, the settlements along the Mercia/Lindsey border remained within areas that rose over 6-7 m AOD, thus avoiding the floodplain. At the eastern end of the study area along the B1421, settlement was sited at higher elevations, which could be due to a higher water table and increased proneness to flooding, or possibly due to the better visibility from these sites. Continuation of settlements at Thonock, Lea, Marton, and the movement of Torksey from the south side to the north side of the Foss means that this corridor remained a heavily active one from the Roman through the early medieval period, with the settlement at Torksey becoming the main urban focus of the region. Although Stow formed a major administrative centre, Torksey evolved into a large production centre, settlement, and eventually, ecclesiastic centre. It may have also acted as a port, controlling the Foss Dyke, with the possibility for docking ships to the north and/or south of the settlement. The morphology and topography of the settlement location, bounded on all sides by open water or wetlands, may be behind the place name, Torksey, where *–ey* is an Old English suffix for island, and Tork is from the personal name Turoc, Turc, or British for *torco*, or 'boar' (Cameron 1998, 128; Richards and Hadley forthcoming).

The development of the island settlement at Torksey possibly began prior to 872-3 AD, and the presence of a prosperous settlement may have been a draw for the Viking army. It is clear from this landscape analysis that the choice to overwinter in this location was multifaceted, based on physical characteristics of the site, a sparsely occupied space, the physical surrounding landscape, the visibility of the emerging settlement at Torksey, the proximity of royal estates, royally controlled land and administrative centres, and the ability to control, and possibly take advantage of, movement through the landscape, both along the Trent, along the A156, at the crossing point at Marton, as well as at the confluence of the Foss and Trent.

In the later medieval period, Torksey continued to grow, and the winter camp site remained largely unoccupied. Torksey was one of the first and largest nucleated settlements within the study area at the start of the medieval period, but the development of parishes across the study area made way for the nucleated structure of the later medieval settlement. One surprising conclusion of the survey of medieval sites is the continued avoidance of the floodplain. The Medieval Warm Period, recorded in regional climate studies (e.g. Dark 2000) had little effect on the settlement of the floodplain. The suggested lower water levels did not allow full drainage of the Trent Valley, but rather a very slow recession of water, followed by more systematic implementation of drainage channels. By the time the flood plain was available for occupation in the late medieval and post-medieval periods, nucleated settlements had already rooted themselves outside and above the floodplain.

Roadways that currently run through the landscape were already largely established in the early medieval and Roman periods; however the increase in population in the medieval period in the area led to the formalisation of these roads, as well as the foundation of the medieval trackway overlooking the floodplain on the west side of the study area. The roads that were established also allowed several more settlements to be formed and remain connected throughout the area. Littleborough Lane on the west side of the Trent, however, was largely abandoned in the medieval period. There is some evidence that Tillbridge Lane was also not always in use throughout the medieval period, although the memory of its location was clearly retained as it remains a major road through the region today.

The Foss Dyke underwent large changes in the 12th century; it was recut, and was moved to south of the parish of Hardwick from its original course north of the parish. This change affected the parish boundaries that were forming at the time, and also led to the discontinuance of a trackway through Hardwick, and possibly the desertion of the settlement. While water often dictated where settlements could *not* be placed within the floodplain and low lying areas, the locations of low order streams across the area dictated where new medieval settlements were located, as each settlement would have had access to fresh water. Parish boundaries were also located based on the natural tributaries, although the boundaries also were sited with regard to local land ownership and other small landmarks.

Deer parks and cultivated areas added another dimension to the analysis of the later medieval study area. Mapping of these areas demonstrates that deer parks do not occupy poor soil areas, but are rather composed of available dry land surrounding the high status estates to which they belong. Additionally, cultivation is recorded near to the settlements, although this could be a result of skewed data availability due to the impact of modern farming obscuring ridge and furrow outside settlement proximity. There is no ridge and furrow on the floodplain, or around Torksey, indicating that cultivation would not have been practiced in these areas.

In hindsight, the analysis of a study area that includes two separate counties has made this analysis more difficult, but the results were more informative than could ever have been hoped. The study has particularly highlighted the difference in landscape development that occurs due to environmental factors. In Nottinghamshire, major restructuring took place at the end of the Roman period, due to the rise in water level, and parishes were later set up in a linear fashion to accommodate the population of the settlement, providing upland, habitable land and frequently flooded low lying areas. The early medieval and medieval settlements developed at the fringes of the floodplain, able to take advantage of both environments available to them. In Lincolnshire the ability for continuous occupation has created a much more complex social structure, where settlements developed on lands above flooded areas, but also adhered to manors and estates that have had the chance to develop since the early medieval and even prehistoric periods.

The analysis of the study area above has not only answered the questions set out at the start of the analysis, but has also delved even further into the historic and prehistoric landscapes and environment of this part of the Lower Trent Valley. It has also identified areas of study where work is still required in the area. Although it was hoped that full place name survey and cropmark analysis could be completed as part of this analysis, and it is obvious that these lines of investigation would add to the landscape survey presented here, these analyses could not be fit within the current framework. Additionally, although some palaeochannels have been addressed within this work, more detailed survey along the Trent Valley would bring even more to light, and by applying a similar methodology as used here these could be investigated and perhaps even dated. Another area of study that requires further investigation is the detailed analysis of the medieval nucleated settlements of Nottinghamshire and increased investigation of the settlements in Lincolnshire in a similar format as the work done by Everson *et al.* in 'Change and Continuity, but with more emphasis on the effects of topography and geology. Finally, a detailed study of the progression of landholdings, estates, and estate holdings should be completed based on historical documents.

With a completed landscape analysis in this chapter, and environmental analysis in chapter 5, it is clear that the junction of environment and human activity is blurred throughout the evolution of the study area. The following chapters will combine the data and analyses presented in the studies in chapter 5 and 6, as well as the data from the additional facets of the Torksey Project to present a multi-disciplinary analysis of a Viking winter camp.

CHAPTER 7

DISCUSSION OF RESULTS

1. Introduction

The previous two chapters aimed to produce data which might fill in a gap in the ongoing discussion about Viking overwintering camps in the late 9th century, and to provide a sound basis on which to start a new discussion about the physical attributes and surrounding landscape of Viking winter camps. Chapters 5 and 6 have presented the results of the analysis of the environment and surrounding landscape of Torksey from prehistory to the present day, with specific focus on the Roman to medieval periods. In this chapter, the conclusions drawn in previous chapters will be directly related to the Vikings and their winter camps, and following this discussion, chapter 8 will discuss how this reconstruction contributes to the discussions and understandings of Viking winter camps.

2 Relationship of environmental and landscape survey

The surveys of the environment and landscape, utilising different methods of reconstruction, complement each other to produce a detailed view of the winter camp site and the surrounding region. The environmental changes in this part of the lower Trent Valley have greatly affected the human population in the study area, creating an inseparable link between social and environmental changes. Although the landscape and geoarchaeological surveys were presented as two separate surveys, human and environmental changes are inevitably entwined within the Trent Valley. Without the analysis of the movement of settlements across the landscape, the effects of environment changes in the post-Roman period would not have been detected. This was possible because the changes in settlement patterns across this landscape, especially within the Trent Valley, have been primarily driven by the human response to these environmental changes.

2.1 Pre-Viking camp environment of the island

In chapter 5, the physical environment throughout the Holocene was uncovered through this analysis, which involved a combination of several methods of geoarchaeological, palaeoenvironmental, and dating methodologies. Archaeological investigations are rarely concerned with geological depositions that occur before and after the period(s) in question. This thesis has demonstrated the value of geoarchaeology in all periods of archaeology, including periods prior to the timeframe that encompasses the research question, and periods that have associated historical documentation. By analysing the sediments and their modes of deposition, the geoarchaeological survey was able to reconstruct the Holocene environment of the winter camp site. The analysis of the environment of the first 8,000 years of the Holocene has shown that the landscape morphed from a barren, post-glacial environment with a braided channel across the sand and gravel deposits, into a stabilising environment with pine, and eventually deciduous vegetation. Throughout the early Holocene, a steady open channel flowed freely on both sides of the site north of Torksey, creating an island. In the wider study area, the Trent slowly receded from a braided channel to a stabilising meandering channel, with alluvial accumulations throughout the river valley. By the Bronze Age, the channel to the east of the site was abandoned and transformed into wetlands, not because it had completely filled with alluvium, but because alluvial build-up had stopped the accessibility to the areas. This occurred throughout the Lower Trent Valley, but the low areas around Torksey and the Foss Dyke were more prone to peat development, rather than the alluvium that accumulated within the Trent Valley. Slow and steady vegetation clearance throughout the Iron Age provides evidence for the establishment of the farmsteads and settlements emerging across the landscape. Lower water levels permitted the occupation and agricultural practices on the alluvial floodplain, though occupation stayed mainly on the gravel islands formed by the braided channel of the early Holocene.

While this early Holocene environment does not appear to have had a direct effect on the Vikings, the development of the landscape, environment, and climate *does* have a direct effect on the Vikings' reasons for choosing the site, and on the landscape features that defined the early medieval period. The physical morphology of the site, as well as a detailed understanding of how and when all present sediments were deposited, all contribute to the landscape that the Vikings encountered in their campaign along the Trent Valley. Without an understanding of the pre-Holocene and early Holocene, the more recent millennia would not be as clear.

2.1.1 The Romano-British period landscape and environment

The Roman landscape of the study area was characterised by low water levels (1-2m AOD), a dry and habitable floodplain, and fast, widespread clearance in the 2nd century AD of most or all tree species. This clearance represents the end of any extensive woodlands in the study area. The woodlands clearance is a direct result of more temperate climate and lower water levels, which, in turn, allowed for access to alluvium along the Trent Valley for use in agriculture and settlement. The available agricultural land and fishing and wetland resources also brought an influx of Roman and Romano-British populations to the area. The winter camp site during the Roman period remained surrounded by the wetland, though lower water levels until the 4th century means that the site may have been drier around the margins during summer seasons. The open waters of the Trent and the peat bog that surrounded the island site were lined by low shrubs, such as *Corylus*, while grasses and cereals grew across the higher grounds, including across the winter camp site. An enclosure on the fields in the middle of the site probably dates to the Romano-British period, perhaps with foundations in the Iron Age. Continuous low vegetation and cultivation led to the accumulation of sandy loam soils across the site.

Settlement in the study area during the Roman period is defined by farmstead enclosures on and around gravel islands across the floodplain to the west of the Trent, with additional craft centres lying along the Mercia Mudstone ridge to the east of the Trent. The larger settlements, such as those at Littleborough and Rampton, are focused around gravel islands, similar to other sites throughout the lower Trent Valley (Knight and Howard 2004), but due to low water levels and temperate climate, settlement and agriculture spread out across the alluvial plain, taking advantage of the fertile silts. Evidence of craft activity discovered on higher ground reflects the use of the less fertile aeolian and glacial sand and bedrock clays for craft production, although clearance across these fields suggests that some agriculture took place on the east of the Trent as well. Since no excavations have been undertaken on the enclosure on the winter camp site, it is difficult to determine if the detected enclosure on the site is indeed Romano-British in date, however, the morphology of the enclosure, and a concentration of Roman pottery and metalwork found during field walking and metal detecting, does suggest a small settlement was focused on the site in the Roman period. Orientation of present field boundaries and their relationship to the detected enclosure indicate that the boundaries of the Romano-British enclosure were probably used continuously throughout the early medieval and medieval periods, and into the present day.

In the Roman period, the River Trent, the Foss Dyke, and Tillbridge Lane connected the large, important centres of Lincoln and Doncaster with smaller but still important settlements at Littleborough and Bawtry/Scaftworth. The Foss Dyke may have also been lined by small Roman settlements. The canal in the Roman period appeared slightly different to the present Foss, as it flowed along the low ground north of the present parish of Hardwick. The survival of prehistoric trackways in the area allowed a multi-tier economy to develop, with a division between the large national route ways and more locally used roads with prehistoric roots. The larger settlements, such as Littleborough, would have been dependent on the smaller local farmsteads and production sites at Little London (Torksey), Knaith, Thonock, Lea, and Rampton, as well as several Iron Age/Romano-British enclosures dotted across the floodplain and higher ground (including the enclosure on the winter camp site) for food and craft resources; at the same time, the small settlements would have relied on the larger trading centres for other resources.

2.1.2 The end of the Roman period

Deteriorating climates and rising water levels coincide with the end of the Romano-British period in the 4th century AD. Environmental downturn at the end of the Roman period led to a waterlogged floodplain across the Trent Valley, forcing the farmsteads to move to higher ground. This change has been dated by the abandonment of Roman settlements in the late 3rd century (Knight 2000; Riley *et al*. 1995). On the basis of where early medieval sites are located, and the accumulation of alluvium and peat at abandoned Roman sites, the average water level rose to an annual average of about 3-4 m AOD. Sand deposits overlying Roman remains at Thonock, Rampton, Torksey Lock, Knaith, and Lea, also indicates that colder climates may have initiated high winds and aeolian reactivation throughout the area.

On the basis of the distribution of known sites in the late Roman and early medieval periods, it appears that the population largely relocated to, or moved into, the Lincolnshire side of the study area, where archaeological evidence indicates intensification of Anglo-

Saxon occupation in the post-Roman period. There is little evidence of occupation on the west side of the study area, with the exception of series of small hamlets on the higher ground west of the floodplain. Despite a dramatic topographic incline on the western extremity of the study area, this higher ground remained largely unoccupied, perhaps due to the lack of rich agricultural soils and far distance from any important trade routes or settlements. Some of the Roman route ways continued to be used despite the abandonment of many ancillary settlements. The Foss would have required frequent maintenance, and may have fallen out of use occasionally, although when it was cleared, it would have continued to occupy the course used by the Romans, north of Hardwick. The ford at Littleborough and possibly the detected crossing site at Torksey Ferry Lane remained in use, and small trackways, such as the current A156 became more intensely used, however it is possible that many of these smaller roads moved laterally slightly in reaction to changing environment and settlement patterns (chapter 6, section 2.4).

Roman sites across the floodplain were still visible in the early medieval period; though peat accumulation slowly swallowed the ditched enclosures, the ditches were only part filled at Sturton-le-Steeple even by the 7th century (Howard 2004). This may indicate that early medieval populations were still aware of the previous landscape, and were even using it to their advantage. The wetlands along the floodplain, and even those associated with Roman monuments, were probably reused for wetland resources such as fishing, plant gathering, or even as a means of traversing a largely marshy floodplain. Meanwhile, agricultural fields were forced to the fields at higher elevations, often where there was little topsoil over bedrock, on aeolian sand deposits with very few nutrients, or occasionally on pockets of terrace sands and gravels.

There is no evidence that the environment on the winter camp site changed very much during this transition at the start of the early medieval period. Water levels may have encroached further up the sides of the island, but there still would have been a large area of dry land, since most of the island is well over 5m AOD. The enclosure on the island may have had continuous occupation, or was perhaps being used sparingly for grain storage or animal penning after the Roman period; without extensive excavations, a complete understanding of the use of the enclosure and dating of activities is not possible.

2.2 The early medieval landscape and environment

Settlement dispersion away from the alluvial plain in the early medieval period was a result of reactions to rising water levels in the Trent Valley in the 3rd to 4th century. A permanently waterlogged floodplain led to the abandonment of Romano-British field systems across the low-lying alluvial plain, and focus of settlement onto the higher outcrops of Mercia Mudstone along the eastern side of the river valley. The region would have remained largely cleared of vegetation after the Roman period, though some patches of woodland would have developed, or continued to exist, within the large estates throughout the area. The shift to wetter and colder climate also may have led to the increase of aquatic plant types in the area, though this can only be confirmed with further palynological studies in the area.

While some hamlets and farmsteads remained on the gravel islands, such as Laneham and Littleborough, the settlements above the floodplain in Lincolnshire became more intensely occupied, including Torksey, Stow, Saxilby, Marton, and later in the early medieval/later medieval period, Gainsborough. Large estates were also beginning to emerge across the area, occupying lands surrounding established manors sited near administrative centres, such as at Stow. Small hamlets were established throughout the study area, but the settlements that were clearly established in the early medieval period are Torksey, Littleborough, Laneham, Stow and Stow Park, Saxilby, and Ingleby, as these are well-defined by early medieval archaeological and sculpture finds.

The early medieval settlements still relied heavily on primary and secondary Roman routes, including Tillbridge Lane, the Foss Dyke, and a version of the current A156 which saw an increase in activity in the early medieval period. Additional routes were also established to connect the newly established settlements on either side of the Trent Valley route ways, including north-south routes on the eastern and western sides of the study area. The Trent, Foss, and Roman road would have continued to be used for trading on a national scale, whereas newer roads connecting newly settled hamlets, would have been used for terrestrial and local travel and trade. The Foss Dyke continued to flow along its earlier Roman route north of Hardwick throughout the early medieval period, however, frequent siltation, especially during periods of flooding in already high water levels would have caused many issues with navigation and siltation.

The settlement structure during the early medieval period would have involved co-dependent relationships between larger settlements and small hamlets and farmsteads, as was the case in the Roman period. In addition to this co-dependence, the ecclesiastical and administrative centre at Stow would have acted as a separate entity, relying on its own lands at Stow and Stow Park around Bishop's Palace, a site of regional importance and the centre of an important political estate by the 10th century. At Torksey, the population was making the most of the slightly higher ground at the edge of the province of Lindsey on the River Trent, and at a natural geological break in the Mercia Mudstone, allowing for access to Lincoln via the Foss Dyke.

Population increase at Torksey during the Anglo-Saxon period was a result of several advantages in the physical and inherited human landscape. Considering that the authors of the *Anglo-Saxon Chronicle* took the time to mention Torksey specifically (see section 3.2, below), it is probable that Torksey was a moderately sized settlement (i.e. not a hamlet) during the overwintering of the Vikings. Without more precise dating of the archaeological remains within Torksey (e.g. kilns and pottery, dates of pottery export with dating of sites where Torksey ware is recovered, precise dating of burial remains), however, it remains unclear whether the production of Torksey ware began before or after the winter of 872-3.

The location of the early medieval village at Torksey provides a clear example of how settlement was restricted by the encroaching wetlands along the Trent in the early medieval period. Figure 7.1 shows the locations of all recorded early medieval and medieval finds from Torksey. The distribution of the archaeological evidence from Torksey demonstrates that the main settlement would have been bounded on all sides by wetlands and open water. The early medieval settlement, and eventually medieval town, was likely situated on this particular island due to the access to the break in the Mercia Mudstone and Scunthorpe Mudstone, allowing access to Lincoln and inland Lincolnshire via canal. The convenient access to travel and trade routes at Torksey (the Trent and the Foss Dyke), as well as its connections with the local area (via the present A156, Cowdale/Sand Lane, and possible ferry across Torksey Ferry Lane) would have kept the production centre well connected and prosperous, and allowed it to grow into an important early medieval town.

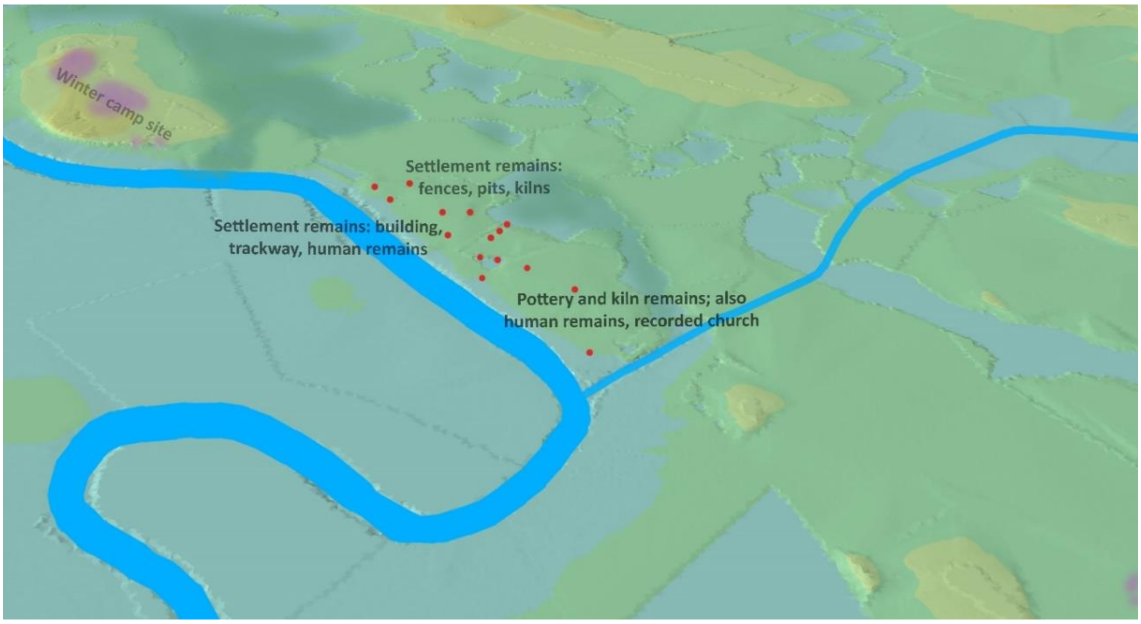


Figure 7.1: Location of findspots of archaeological remains across the island of Torksey, demonstrating that all finds are confined to the land that is over 7m AOD, and the rest of the surrounding area would have been occupied by wetlands prior to drainage.

In the early medieval period, less than a mile north of Torksey, just across a break in the Mudstone and a small wetland, the winter camp island had only open fields, perhaps with a small farmstead on the site of the Roman enclosure, or possibly with no activities at all. The winter camp would have been a clearly defined island site in a large wetland landscape, completely encompassed by open water to the north and south (and possibly the Burghdyke to the south), the tidal River Trent, and the wetlands to the east. The island remained in isolation, as the peat bog rose with higher water levels in the early medieval period. Unlike the settlement at Torksey, the winter camp site did not provide immediate access to the navigable break in the Scunthorpe Mudstone and Mercia Mudstone geology, although detection of an undated causeway north of the winter camp site may provide some indication of how this site was connected to the surrounding landscape. Aeolian drift from the Pleistocene sand deposits plagued the islands across the wetlands in the lower Trent Valley throughout the Holocene, and area around Torksey, experienced an aeolian storm intensification throughout cold climate shifts throughout the 10^{th}-12^{th} centuries.

There is very little evidence for Viking impact on the early and later medieval landscape of the study area, but place names provide some insight into the longer-term presence of

Viking populations in the area. A full survey was not conducted throughout the larger study area, but place names around Torksey were examined in some detail. Place name evidence within the settlement of Torksey and its surroundings, as well as at the nearby settlement at Saxilby, demonstrates that there were several areas of land with Scandinavian namesakes until the 11th century. At Torksey, a large number of place names with Danish origins, including the description of a peat bog with Old Scandinavian origins (*petkerr' de Tork*), indicates a strong Scandinavian presence in the area in the post-winter camp years. 11th century charters regarding the ownership of the fields at Brampton in Torksey indicate that prior to 1054, the site and surrounding area were likely in the possession of the royal Mercian family, which may also indicate why the site was not densely populated. A 13th century charter naming the fields of the winter camp site as 'Bishop's Meadow' provides some insight into why the fields were not settled in the centuries after the winter camp: they were part of a larger parkland for the Bishop of Dorchester at Stow. South of the Burghdyke in the same charter, the land belonging to Odo (Scandinavian personal name) within the *Denesheyng* suggesting that Vikings lived within the *burgh* of Torksey in the centuries following the winter camp, when Torksey was part of the Danelaw. Outside of Torksey, Saxilby presents the strongest evidence for Viking habitation in the early medieval to later medieval years; a *–by* place name, Scandinavian personal name (Saxulf) (Ekwall 1960), and several surrounding Anglo-Danish place names, including Ingleby (Scandinavian meaning: 'outlying settlement of the English' [Cameron and Insley 2010]), may indicate a strong Danish linguistic presence at Saxilby. There are very few additional place names that strongly indicate the presence of Vikings within the study area (as opposed to place name, including street and field name evidence as an indicator of Viking occupation in the settlements of Lincoln [Vince 2001] or York [Fellows-Jensen 2010; 1990]). However, this does not mean that Viking settlement did not occur during the 10th and 11th centuries, as Scandinavian settlement in this area may have simply blended into the pre-existing Anglo-Saxon landscape. Kettlethorpe, also incorporates a Scandinavian element (*-thorpe*). Another possible settlement with a Scandinavian place name that has not been previously considered is at Gate Burton; although translated as *gait* as a Danish word for goat (Ekwall 1960; Cameron and Insley 2010), it may also have roots in the Danish *gata* for street. Landscape evidence demonstrates that the A156 once ran through the settlement at Gate Burton, possibly accounting for the *gata* place name. It has been suggested that additional place names the study area also may have Scandinavian origins (Bole, meaning smooth, rounded hill [Ekwall 1960]; Rampton, meaning Raven farm [Mutschmann 1913];

Broadholme and Broxholme (south of Saxilby) meaning ‘island with an expansive wetland’ [Saxilby parish council]). However, these names also have possible OE origins, and the surrounding place names have not been examined closely. Parallels can also be made between Ingleby near Torksey and Ingleby near Repton; Richards (2004) concludes that the presence of this place name may indicate the predominantly Scandinavian population’s desire to describe the presence of Anglo-Saxons in the area, and a similar interpretation may be applicable to Torksey and Ingleby.

While observations about place names in the study area provide interesting results regarding the Viking presence in the area, it is difficult to determine whether this is due to the winter camp being located nearby in 872-3, or if it is simply due to later Scandinavian influence since the site is within what is later defined as the Danelaw. The landscape analysis did not provide very much evidence about the Viking influence in the area in the immediate post-winter camp years, however other recent studies may provide more effective means of understanding the early medieval Viking presence in the area. The application of current methodologies being used to examine the spatial distribution of Viking small finds in the Portable Antiquities Scheme database may be more successful in determining the influence of the Vikings in the area outside of the winter camp site (Leonard, forthcoming).

2.3 The medieval landscape and environment

The use of water management techniques in the medieval and post-medieval periods across the landscape of the Lower Trent Valley led to the gradual emergence of the managed landscape we see today. Channel stabilisation, extensive drainage ditches, increased agriculture, and channel manipulation and management allowed settlements to expand slightly, although flooding remained a problem until the 19th century (NA, C 54/1-32 1848). Increasing alluvium accumulation and drainage channel management along the floodplain led to the stabilisation and eventual formation of the current single channel Trent, which allowed for activities to take place closer to the flood plain, including building Torksey Castle in the 16th century. Stabilisation of the Trent can also be attributed to a lower water level throughout the Climatic Optimum, though possibly not as low as water levels had been in the Roman period. The climate shifts pushed the local populations to manage the landscape on a larger scale, including digging drainage ditches across the low-lying areas. Although some drains may have roots in earlier periods (including Seymour and Mother Drain replacing the palaeochannel to the west of Littleborough, and the Foss Dyke), and many are simply defined by existing channels (such as the Tillbridge tributary), the drainage channels that are spread across the study area were mainly founded in the medieval period.

The formation of drainage channels in the medieval period is further confirmed by their use in the establishment of medieval parish boundaries. On present maps, where there is no drainage channel currently corresponding to a parish boundary, closer inspection of maps or aerial photography and cropmarks usually reveals infilled channels or small abandoned streams, such as the boundary between Torksey and Brampton parishes. There are very few boundaries that do not correspond to drainage; roads were rarely utilised as parish boundaries. Just as the Viking encampment utilised wetlands as a natural boundary and defensive system, when the parishes were established, natural wetlands or drains required little to no alteration to act as boundaries.

Multiple attempts were made to dry out the wetlands that surround the winter camp island, but this was not achieved until the 19th century, so throughout the medieval and post-medieval periods, any activity on the site continued in relative isolation. The drainage ditches around the winter camp site, especially the Inclosure Drain, which follows the line of the palaeochannel and peat deposits around the site, remain largely undated, except for some references to improvement in the 17th and 19th century. Despite a recession of water levels and implementation of drainage systems during the Middle Ages, there is no evidence at Torksey to suggest that flooding stopped being a great local problem. To remedy the continuous flooding, several features were built and rebuilt around the island. A combination trackway/berm may be visible in the form of a sand bank, connecting the island to both Marton and Bunker's Hill Warren over the wetlands; this feature acted as both a berm to keep water from flooding the area east of Torksey, as well as a causeway between Marton and the winter camp site. Although undated, the feature likely was present in the medieval period, and may even date to the early medieval period. The open water to the south of the island was consolidated into a drainage ditch, forming the Torksey/Marton boundary, and the Burghdyke (dated as early as the 13th century). Water management in the medieval period may also have affected the movement of the Foss Dyke to its current location south of Hardwick. The northern boundary of Hardwick parish is defined by the original course of the canal, which suggests that the canal at this location and the parish boundary were created at the same time. The channel of the Foss that exists today may correspond to the period of improvements made to the Foss Dyke, as ordered by a charter dated 1121 issued by King Henry I (Wright 1982). Prior to the shift, DB mentions that Hardwick acted as a small port, but it was abandoned, probably after the canal moved away from the settlement. Evidence for the movement of the dyke lies in the desertion of several early road ways between Hardwick and the current Foss, as well as a few Hardwick place names south of the present Foss in Kettlethorpe (chapter 6, section 4.3).

The nucleation of settlements, especially around parish churches, is another main change that occurred during the medieval period. With the establishment of at least one church in every parish by the end of the medieval period (excluding only Brampton in Torksey), small hamlets and villages began forming across the landscape. From the medieval period to the 19th century, many of the settlements (including Torksey) in the study area shrank substantially, or were deserted, due to the typical range of reasons, including emparkment, nucleation of larger settlements nearby, or even plague (Dyer and Jones 2010, 8). Land owned by larger estates were consolidated into formal parklands, woodlands, and gardens in the late medieval period, also causing the abandonment of many settlements, such as that at Knaith, and Kettlethorpe (Everson *et al*. 1991). There is no evidence that environmental change directly led to the shrunken or deserted status of any of the medieval settlements throughout the area. Even the large medieval town of Torksey was susceptible to shrinking; the need for a much larger port along the Trent led to the establishment of the later wealthy medieval centre at Gainsborough. Gainsborough had completely replaced Torksey as the primary port along the Lower Trent Valley by the 16th century, when Leland recorded only ruins across the area of the former medieval settlement in Castle Field, Torksey (Chandler 1993).

The landscape that was encountered by the Vikings during the Great Army campaign is drastically different today, largely due to modern drainage engineering. The wetlands surrounding Torksey and the island in Brampton have been completely drained, and the low alluvial plain across Nottinghamshire is now available for farming and grazing. The Trent follows an established and straightened route, with a slightly narrower channel due to the digging of a deeper channel in the early 20th century (Cooper 2008). Nearly all the settlements within the study area have shrunk, with the exceptions of Saxilby and Gainsborough. High- status estates were slowly dismantled in the post-medieval period, and gardens and parks have since become agricultural fields, including the parks at Stow and Kettlethorpe. Present day settlement locations still mirror those of the medieval settlements, however, lower water levels and drainage engineering have created a vastly different landscape.

3 The Viking winter camp of 872-3: survey interpretation

The main aim of this work was to define the environment and physical features on the Viking winter camp site of 872-3 and how the camp may have fit into the surrounding landscape, and this was achieved successfully. Not only was the landscape and environment defined, but, with the help of the information produced by the other aspects of the Torksey project, this landscape analysis has even identified areas where the Vikings may have been living, where they may have kept their ships, where the Great Army may have built or used existing trackways to access the surrounding land, what resources may have been exploited as food sources, and even that the Army may have been controlling important national and international route ways.

3.1 Torksey: early medieval hub and industrious island

On the basis of present evidence, it is impossible to confirm if the settlement of Torksey emerged as a major settlement prior to or after the winter of 872-3. Dating of archaeological deposits confirms that the settlement began to take off in the late 9th century, though it remains unclear if it is a cause or effect of the Viking encampment. The appearance of a named reference to Torksey in the *ASC* may be an indication that it was a known settlement in the Anglo-Saxon period prior to the foundation of the Viking winter camp. There is no definitive evidence, but there is no reason to believe that there was no settlement at Torksey prior to the Viking overwintering. The presence of the Viking army in the 9th century may have sparked a later population increase.

By the early 10th century, Torksey was a hub of industrial activity, and, although it is not archaeologically visible, settlement also began to focus at Torksey. Through analysis completed as part of this thesis, it has been confirmed that Torksey was actually an island settlement, similar to the winter camp site, bounded to the north and east by wetlands and the west and south by the Foss and the Trent, and separate from the island of the winter camp site. All evaluations that have unearthed early medieval remains, as well as most artefact scatters, have been confined to the island bounded by peat and/or alluvium to the north and east, the Foss to the south, and the Trent to the west. A single findspot within the peat deposits consists of an artefact scatter, with broken decorated Torksey ware pottery, which may have constituted later household waste and may be medieval or post-medieval deposition (Myers 1951). Excavations into the peat, now occupied by the golf course, show that there was no activity in this area during the early medieval or later medieval periods (Johnson and Palmer-Brown 1997). The locations of the finds plotted against topographic and drift geology confirm that the early medieval settlement of Torksey was a separate island from the winter camp island, bounded and separated by open waters, the Burghdyke, and eventually, the Brampton-Torksey parish boundary. Expansion of the village was hindered by the surrounding wetlands, however the population of Torksey took advantage of the access to the trade routes of the Trent and the Foss.

3.2 The island camp site

When the Viking Great Army landed north of Torksey in the autumn of 872 AD, the island that hosted the winter camp was a large, open area with grasses, possibly supporting a small number of farmsteads, and some crops and/or grazing fields. The enclosure on the site, established in the Romano-British period, would have been visible, and may even have remained occupied, though it may have shifted in form or function since the Roman period.

Situated on top of the tall Mercia Mudstone outcrop, the isolated island where the Vikings stopped had a unique vantage point across the Trent Valley and across the wetlands surrounding the site. The peat that replaced the tributary or channel to the east of the site in the Bronze Age, would have remained a deep wetland during the winter of the Viking occupation, and would have regularly appeared as open water or marshland. Higher annual rainfall and cooler temperatures meant that the wetlands encroached on the dry island, creating a smaller island than was available in the warmer and dryer Roman period, however the site still had a very large habitable area. The areas to the north and south remained open to the Trent and surrounding wetlands. These wetland areas would have remained flooded year-round, with fluctuating levels associated with tidal influx. The open water on the north and south sides of the island allowed a steady accumulation of an organic alluvial silty clay, in a low energy, almost lacustrine, environment, while the peat to the east remained more sheltered from slow moving water, and accumulated plant matter and other sediment debris.

On the island camp site during the early medieval period, aeolian sands were also starting to react to the cleared field systems as well as the faster wind speeds associated with the cooler climate of the post-Roman period. At Torksey, the archaeological and OSL dating evidence suggests that the reactivation of aeolian dunes across the site, within the settlement at Torksey, and at Bunker's Hill Warren, post-date the winter camp by approximately 100 years, possibly a reaction to the increase in intensive activity around Torksey in the early medieval period. It is unlikely that this was an isolated event, and aeolian sands may have been active in the area since the early 5th century, constantly altering the surface of the island and surrounding areas.

As the Vikings sailed the Trent, they would have encountered a wide, flooded river valley. The Trent would have been largely confined to one wide channel, possibly with secondary channels in several places including the remnants of the Mother Drain on the west side of the valley. Many of these channels have since been replaced by drainage channels. Outside of the fluvial channels, the valley would have been lined by standing wetlands, covered and surrounded with wetland vegetation. Abandoned Roman earthworks framed the valley, occupying the marshlands surrounding the Trent; however, during high tides and high water levels, these remains would have been invisible amongst the flooded valley. Along their way upstream on the Trent, the Vikings would have also encountered several small existing hamlets emerging above the wetlands to the west, and along the Mercia Mudstone outcrop to the east. The ferry crossing at Littleborough, the active trade route of the Foss Dyke, and even nearby settlement activity at Stow, Laneham, Hardwick, and Torksey, may have been especially alluring features near the winter camp, leading to the Viking overwintering at Torksey.

From the winter camp site, Torksey and Marton would have remained in the Great Army's field of view throughout the winter. Even settlements as far as Lincoln may have remained visible throughout the season, depending on vegetation. The Great Army would have had a large area to set up camp, and a docking area for keeping and repairing ships on both the north and south edges of the area. The use of ground transportation by the Viking Army is not apparent on the basis of this survey alone, although it is possible that a trackway was already in use, or was built, in order to connect the site to Torksey and/or Marton.

3.3 The winter of 872-3

The physical reconstruction of the landscape on the island north of Torksey has determined that the Viking Great Army was making an informed decision when choosing the island north of Torksey for their overwintering. The political and physical specifications would have been to the advantage of the Viking Great Army in 872. When the Vikings first viewed the site, it would have appeared as a large island looming above surrounding wetlands, and upon closer inspection, the Vikings would have quickly realised that it met many specific requirements to create a camp that could take full advantage of local and distant resources.

The physical advantages of choosing the islands north of Torksey include:

1) The site was naturally defended on all sides by wetlands, marshes, and open water. The surrounding wetlands may have been the first advantage that was noticed by the Great Army. Instead of requiring constructed fortifications, the wetlands and open waters surrounding the site would have provided a natural defensive system.
2) The island had an area where boats could be brought up to the site. The open water to the north and south of the site would have been naturally occurring tidal ports, with gently sloping sand banks leading up to the higher ground.
3) The island had a vantage point overlooking the river, and had clear views of the nearby settlements of Torksey and Marton. The wetland separating the winter camp from the existing settlement would have been to the advantage of both the Torksey population, as well as the Vikings; inter-site visibility, but physical separation, was ideal for the potentially tentative peace agreement made between populations. One reason for choosing the site may have been because of the great visibility from this vantage point of both travellers on the Trent, as well as the

local populations in Torksey and Marton. Alternatively, it was well-recorded that the Vikings would break a peace treaty if it so suited them, and the ability to see the Great Army during their time on this site must have been appreciated by the Torksey and Marton residents.

4) There were local resources for food and other goods, such as woodlands for hunting, farmland for foraging from, and the wetlands for gathering. Nearby woodlands, such as those just across the wetland at Stow Park, or even some small woodlands on the site, may have also been hunted and foraged by the Vikings during their stay. The aeolian dunes across the site and surrounding area also made naturally forming rabbit warrens; these warrens were often owned by local estates, but hunting on these warrens would have provided another source of food for the army. The farmstead(s) that occupied the island, or even the surrounding area, may have given the Vikings an additional source of food.
5) The island was largely unoccupied. The constantly shifting sands would not have created the most ideal site for farming in the Trent Valley, but a small farmstead or perhaps a community that relied on grazing livestock, rabbit warrens, and local deer populations, may have survived permanently on the site. The sparsely occupied island would have been a perfect place to land; the Great Army could easily control a very small population, while still reaping the benefits of being on a farmstead site with a small supply of food.
6) A trackway over the wetlands may have connected the island to the island of Torksey, and another one to the settlement of Marton. These narrow trackways would have been easily defended from the perspective of both the local population and the Great Army.
7) There may have been pre-existing structures on the site, either occupied or used farm buildings, or ruins from the Roman farmstead (detected by Brown 2012). This may have played a part in the internal structure of the winter camp, perhaps not as the living quarters, but instead as a built, indoor base for the Army. A concentration of Viking-age metalwork finds from around the area of the enclosure indicates that this may have been a major hub of activity (A. Woods, *pers. comm.*; section 4.1, figure 7.3).

In addition to the physical advantages of this particular island, the location of the site also provided several social and political advantages:

1) The location along the river, and on a Roman trackway would have provided easy

land transport throughout the midlands, and into Lincoln. It is assumed that the Vikings travelled exclusively by sea, but at an inland location along a river system, travel exclusively by ship would have been impractical. The Great Army's proximity to the Roman road would have provided inland access into both Mercia and Lindsey, and their ability to travel by water led them to their next camp site at Repton.

2) The proximity to nearby settlements would have provided the Great Army with several resources. Although it is unclear when a concentrated population moved into Torksey, local settlements may have included specialist crafts-people by 872. Specialist crafts-people require local farming communities that would produce crops for both the farming community and crafts-people. The Great Army may have taken advantage of the food surpluses of the nearby settlements that served the residents of the local settlements.
3) The winter camp site was also in close proximity to the established crossing at Littleborough, and trade routes along the Foss, Trent, Roman road, and other emerging route ways. The influx of resources coming down the Trent, to, from, and through Torksey would have been visible to the Vikings, and thus likely under their control, or even at their discretion.
4) As well as taking advantage of the food and other resources going into Torksey, the Army also had access to, and possibly control of, the goods moving from Mercia to Lindsey at the major crossing of the Trent for several miles in each direction. The cooperation of the minor populations at Littleborough and Marton, may have been part of the peace agreement, with the Vikings taxing (or simply taking) those shipments across the Trent for the winter.
5) The winter camp site was in the hands of the Royal Mercian family at the time of the Viking overwintering, which may have also had some influence over the choosing of this site. The site may have been chosen because it held some local or regional political importance, which the Vikings were looking to exploit, or perhaps this area was offered to them as a means of keeping a peaceful relationship for the winter. The proximity and easy route to the administrative centre at St Mary's Stow, which may have been present as early as the 7th century, may have also been involved in the transactions between the local population and the Vikings. The winter camp site, as well as land around Marton and what is now Stow Park, was gifted to the Bishop of Dorcester in the 11th century, but it is possible that the land was used as a royal hunting estate as early as the 9th century.

The estate would have required large amount of food from local and regional resources, and would have produced much of its own; it is very possible that the Vikings also exploited these incomes.

6) The location of the site on the border of Mercia and Lindsey, especially on the crossing point between the two regions, would have given the Vikings a unique insight into the relationship and interaction between the two territories. Although the relationship between Mercia and Lindsey is unclear, the *Anglo-Saxon Chronicle* does make a distinction, so perhaps the Vikings would have exploited this relationship, influencing the exchange of goods and information between the territories.

Overall, during their encampment on the island north of Torksey, the Vikings took control of a moderately successful trade route for a winter, avoiding any existing settlements or *burhs*. This site provided the opportunities for continued raiding from a camp, rather than their typical campaigns across Britain. The surrounding landscape of the site, and the site itself, also provided several sources for food and other resources. It would have been an ideal place for the Vikings to make their presence known, and to take a commanding position, physically, socially and politically.

The surrounding populations may have survived in some fear and slight hunger for the winter, however the placement of their village on an island provided protection from the Viking Army. Any surplus of resources in the area, along with the cooperation of the local population with the Viking army, meant that the winter of 872-3 may not have been as deadly and unpleasant as other overwintering years. The years following the overwintering may have been profitable for the Torksey population, as the Vikings dropped several valuable and beautiful items on their time on the island, and any large pieces may have been foraged by the population of Torksey for several years to come (and indeed are still being foraged by metal detectorists today!).

3.3.1 Choosing a temporary physical and political fortress

The physical, social, and political attributes of the site have been successfully determined through the analysis presented here, and there were clearly many benefits to choosing the site north of Torksey. Although this is clearly an ideal camp site, what were the main reasons for choosing this particular piece of land within this landscape? In the immediate area, there are several other islands and gravel terraces available for a Viking encampment, so what was the specific draw of the island of Torksey?

To illustrate that the site north of Torksey was chosen due to a distinctive combination of physical and social reasons, this section will present a comparison of Torksey with another site with similar physical characteristics in the local area: Kettlethorpe (figure 7.2). Kettlethorpe also forms a large island like Torksey, with wetlands on almost all sides, also on an aeolian sand and terrace gravel outcrop. The total area is slightly greater than the site at Torksey, though much of it is at a slightly lower elevation. Kettlethorpe is not recorded in Domesday, but excavations at Home Farm have produced a number of Torksey ware sherds (Clay 2004; Albone 1998). The Historic Environment Record also attributes the moated manor site to the 12th century; however there is no clear archaeological evidence that suggests this date (Lincs. HER no. 50091). The site overlooks the River Trent, but the access is by a sloping ground on all sides, rather than a sharp drop as at Torksey. If it was simply an island site that the Vikings were after, Kettlethorpe also fits this mould.

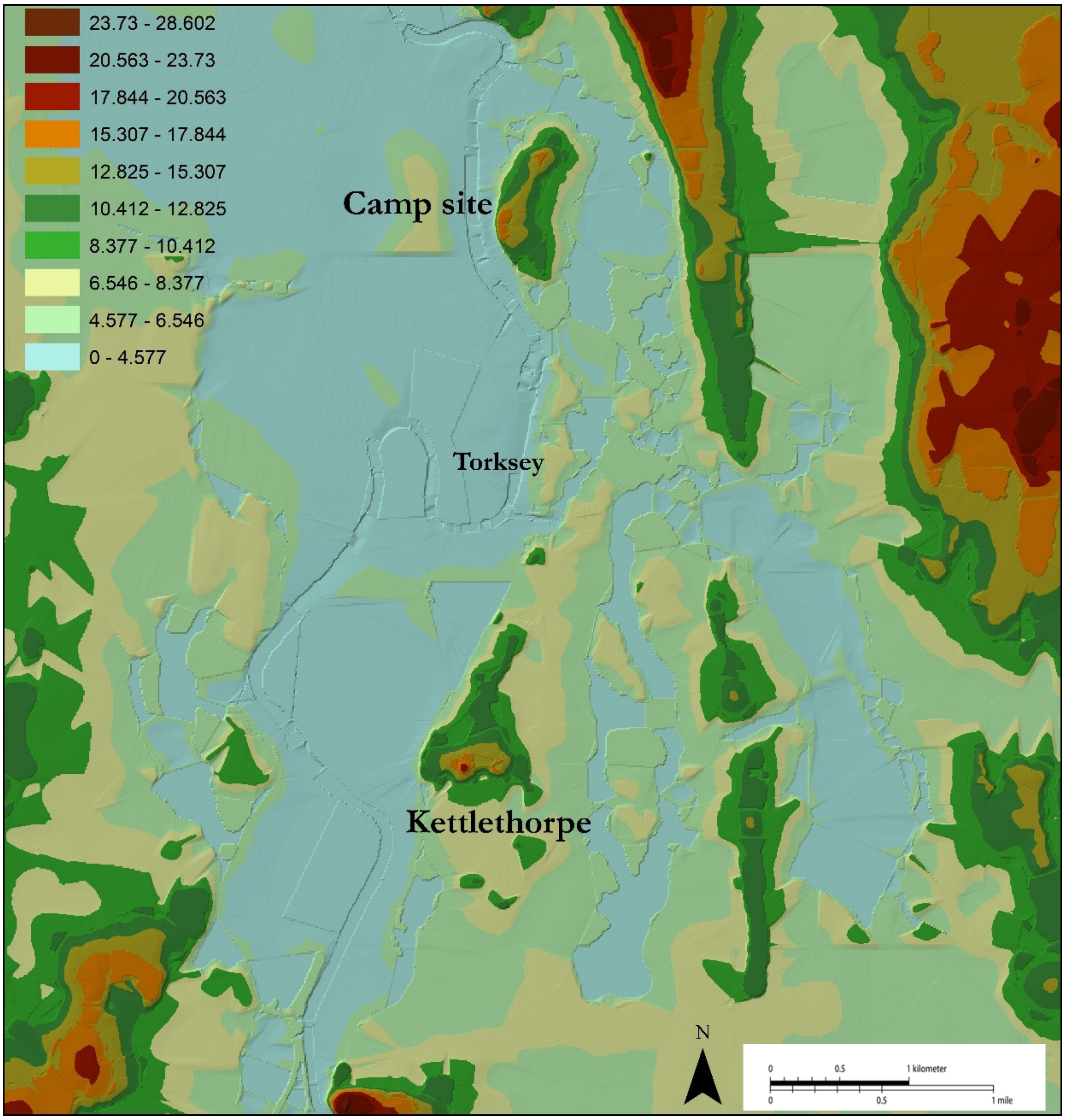


Figure 7.2: Comparison of the topography of both Torksey and Kettlethorpe islands along the Trent Valley

Some physical differences may have given the island north of Torksey an edge over other potential sites for overwintering, such as appropriate docking capabilities, and sharper slopes on all sides. Perhaps Kettlethorpe was not ideal due to: the slightly longer distance from the settlement at Torksey, or the distance from other important centres in the landscape (e.g. Stow); the Foss Dyke at the time formed an unrecorded political boundary that prevented their landing at Kettlethorpe; the site was slightly too large for their needs, or didn't offer the same degree of protection; or perhaps the site did not offer the same degree of visibility, and the Vikings wished to keep the surrounding populations within view. The island of Torksey itself may have made another appropriate overwintering site, but perhaps it was not used because it was already occupied by an early settlement. Although the physical landscape played a large role in the Great Army's decision to camp on the site north of Torksey, there were clearly other socio-political reasons at play.

Social and political advantages may have been related to the decisions about the location of the winter camp. At Kettlethorpe, there would not have been such immediate access to the multiple trade routes at Littleborough and along the Trent. It would have, however, provided some access to the Foss Dyke. The proximity of the site to an important royal or ecclesiastical estate may have also influenced the decision to land at the winter camp site; Kettlethorpe is not as near to any large estates, including Stow, which was close to the winter camp site eventually chosen.

A research strategy where islands or simply 'D-shaped' enclosures along rivers are identified and subsequently investigated as possible Viking winter camps is proven invalid by this comparison: there are many islands, D-shaped areas, and water bounded sites along rivers, but not all of them are Viking winter camps. Whatever reasons the Vikings had for choosing Torksey over Kettlethorpe, the availability of both of these sites with physical similarities, should act as a warning against the formation of a 'standardisation' of the physical appearances of Viking winter camps and a warning against allowing Viking winter camps to become a 'type site'. While the Torksey winter camp is an island site along a navigable body of water, there are other details that led to the occupation of the site, and it does not mean that all winter camps are island sites on water, nor that all island sites on water are Viking winter camps.

The Viking's proclivity for choosing riverine sites drew them to sites that may occasionally have been D-shaped sites, or were easily modified into D-shaped enclosures, but the shape was not the important factor. At Torksey the associated features of a previous wetland and naturally created fortification features drew the Great Army to this location, and, in any other circumstances, adjustments would have been made. Island sites and D-shaped sites within this landscape are hardly rare, as was proven by the close proximity of another site with similar specifications within this small study area. A D-shape is created by the centripetal force of a river, and later cutting off of the curved channel, just as was done at Torksey in the Bronze Age, and Kettlethorpe at another unidentified period in pre-history; it is NOT and can never be attributed to the Vikings digging D-shaped ditches everywhere they went. Instead, it was a combination of political boundaries, controllable roads and route ways, proximity of administrative and industry centres, size of the site, physical attributes and built-in defences of a site, and several other features that led to the Vikings choosing the site at Torksey.

The combination and balance of desirable features at Torksey may have differed slightly from other sites that the Vikings had encountered, and the choosing of Torksey was likely both strategic as well as opportunistic. While a site with the same physical specifications *and* social advantages was not always available, a blend of these characteristics would have been desirable for each year of overwintering.

Physical and social differences between the two sites may have influenced the decision over which site to choose. Had the site north of Torksey not been available, it is entirely likely that Kettlethorpe would have been used for the winter camp instead. But the use of the camp site rather than any other site in the vicinity indicates that the Vikings were clearly looking for something more specific, and/or were limited by social and political boundaries.

3.4 After the winter camp

Theories about what happened to the camp site after the winter of 872-3 are based on very little evidence, due to a general dearth of evidence from the site relating to the years after the overwintering. The concentration of early medieval metal work and coinage dating up to 872, with a smaller percentage of total finds from the site dating to the medieval period, indicate that there was not a lot of later activity on the site. Records of the fields in the 11th century state that the land was held by the Bishop, most plausibly the Bishop of Dorchester who held the seat at Stow and who also controlled the nearby Stow Park (Sawyer 1998). The 1271 charter that describes the parish boundary indicates that the field on the south end of the site was transected by a channel titled 'Burgh Dyke'; the fields to the north were titled Bishop's meadow', while the fields to the south were called 'Denesheyng.' These field names, separated by a dyke, imply that activities were kept within the bounds of the settlement of Torksey in the 13th century (Cole 1906), with open meadow on the winter camp site. By the 18th century, the fields were largely cleared, with the exception of Pottery Farm on the southern end of the winter camp site. The A156 may have moved several times up and down the slope along the east end of the site, depending on periods of flooding, leading to the present location of the road at the boundary between peat and aeolian sand/terrace deposits. With no evidence at present of later occupation, it can be assumed that the winter camp site resumed its use as the location of single or multiple farmsteads and life in the surrounding area resumed some normality after the departure of the Great Army. The local population may have resumed their life as it was prior to the overwintering, possibly making the most of their previous hardships by plundering any trinkets the Vikings dropped during their time on the site.

The only evidence that the Viking occupation may have had larger environmental implications comes from what is now Bunker's Hill Warren. Clearance on the winter camp island in the years after the overwintering has been suggested by the early medieval aeolian activities that occurred at Bunker's Hill Warren, and by the aeolian covering of Anglo-Saxon archaeology in the settlement of Torksey. An OSL date within the undisturbed dune indicates that the deposit is the result of a large scale aeolian event within 100 years after the Viking occupation. This environmental event may possibly by related to the intensive clearance on the sandy island during the winter camp, during which all vegetation was stripped off for temporary settlement, followed by a particularly windy period.

Archaeological and historical evidence demonstrates that the settlement at Torksey continued to grow throughout the late Anglo-Saxon and medieval periods, though there is minimal evidence of later Viking occupation in the study area (with the exception of Torksey and Saxilby, mainly on the basis of place name evidence). Both the winter camp island and the island of Torksey remained bounded by water on all sides throughout the rest of the early medieval periods. The region immediately surrounding Torksey, as well as in areas near Gainsborough, and possibly throughout Kettlethorpe and Lea, experienced another phase of aeolian redeposition, covering features from the 10th-14th centuries, and later again in the post-medieval period at Torksey Lock. Despite the shifting of sands and changes in water levels the pottery industry, an early medieval settlement (and later town) and the establishment of multiple ecclesiastical centres was not deterred by the unpredictable landscape.

4 TORKSEY: CONCLUSIONS

During their campaign throughout England in the late 9th century, the Vikings would have chosen their wintering sites for a variety of reasons, including physical attributes, local social relationships, political advantages, and available nearby resources, and their activities at the camp were related to each of these features. On the winter camp site north of the Anglo-Saxon settlement of Torksey, there was a unique combination of physical and social factors that drew the Vikings to that particular location. These include the ready-made fortification features of wetlands surrounding a large area. These wetlands permitted the wintering army to monitor all dryland access points, and provided an area for docking and/or repairing their ship assets. The site was also cleared of any intensive occupation, unlike the nearby settlements of Marton and Torksey, although it may have provided some structures from an existing farmstead.

The topography of the island means that it would have remained dry throughout the higher water levels in the post-Roman period, another benefit to a camp occupying the site throughout the winter. The topography would have also provided a unique vantage point, allowing the Great Army to view the settlements at Torksey and Marton, the River Trent, and also to monitor the surrounding area, including Lincoln. Despite being adjacent to a possibly pre-existing settlement at Torksey, and settlement at Marton, the island was still largely isolated within the *pettker' de Tor*, or the peat bog between the two settlements. Interactions and transactions with the local population, were inevitable, so it is possible that there was a bridge or walkway connecting the winter camp with Torksey, and even with Marton. A similar 'gateway' has been suggested at Repton by Gareth Williams, where the excavated enclosure was, in fact, a sort of gateway from the settlement at Repton to the actual winter camp on an island within the Trent floodplain (*pers. comm.* 2014).

The social surroundings of the site provided another distinctive aspect to the site. With important trade routes traversing the landscape around the site, there was no shortage to the available goods and information trade. Along the Trent, Foss, and Roman Road, at this site the Vikings may have monitored, taxed, or merely collected information travelling along these routes providing a supplementary income to their summer raiding exploits. These routes, especially the Roman Road throughout the winter, would have provided another means of travelling to and from the winter camp in quests for food or other resources at the local hubs of Marton, Stow and Stow Park, or other large farmsteads. Acquiring food may have also provided some issues for the Viking army during the winter, although control of major route ways may have supplemented the food available to the army. The site may have supported a small farmstead, which could have provided livestock or grain for consumption, but the proximity of a royal estate, meant that a constant supply of food was never far; fishing, hunting, livestock, and crops would have all been available in the already-dynamic landscape, and by speaking to and 'making peace' with the local population, food in the area would not have been an issue.

One theory that has not been explored here, as there is no solid evidence for it in the present research, is that the Vikings did not choose that site, but were rather temporarily granted it by the royal Mercian estate, who probably already owned this land and the surrounding fields. So far, it has been assumed that the Vikings would have landed in an area that suited them, and, that the Anglo-Saxons would have needed to accommodate their choices. However, this location may have also been negotiated between the Mercian royal landowners with the Vikings upon their arrival; in fact, Mercian landownership almost guarantees that there would have been discussions about the terms of agreement of the Vikings overwintering in this location. The location of the army in these fields may have politically suited both parties; for the Mercians, the Vikings would have been kept away from the ecclesiastical centre at Stow and other royal holdings and not displaced any residents of Torksey or Marton, and the site would have also suited the Great Army for all the reasons listed above. On the basis of the evidence presented in this thesis, and the general historical impression that the Vikings forced their way onto land throughout their 9th century campaign, a civil and pre-negotiated agreement seems unlikely, but may be a theory worth revisiting with additional excavation on the site and further historical document research.

With all these local features, during their time on the island, the Vikings probably took part in a range of activities throughout the winter of 872-3. The surrounding wetlands would have provided not only protection from any small incursions and a place to dock, but would have also provided food resources, including fish and plants. The winter camp site had acted as a farmstead since at least the Roman period, and would have provided food for the army members during their winter stay. Additional food sources may have come from the local centres that were already providing a wealth of food; as a burgeoning town, Torksey must have had some larger source of food for the population that were mainly crafts people, and Stow Park would have had a large reserve as well to serve the administration centre at Stow. Additional royal and ecclesiastic estate centres lined much of the Trent Valley, and other further estates may have also been tapped for additional food sources (D. Hadley, *pers. comm.*). In addition to the foraging and food gathering activities, the presence of hundreds of Viking game pieces implies that they had a lot of free time to play games during their stay.

Within the site, mapping of the locations of metal detected finds has demonstrated that finds dated to the years up to the winter camp are found mainly in the northern fields, at the highest point on the site, overlooking the tidal wetland to the north, and north and east of the detected farmstead (figure 7.3; Woods *pers. comm*. 2014). This provides further evidence that the sandy bank north of the site would have provided the most convenient docking location for ships, and their camp could be set within a previous or contemporary farmstead up slope from their ships. From this location, any existing settlement at Torksey, the crossing point of the Trent at Marton, and the areas across the Trent Valley and into Mercia would have been visible. Access to Torksey, Marton, and the rest of the dry land east of the Trent Valley and into Lindsey would have been available via causeways across the wetlands, which would have also been easily defendable.

Figure 7.3: Map of early medieval findspots overlain onto results from an interpreted geophysical survey. Image by Andy Woods, York Museums Trust.

After they left, the Vikings left behind a field cleared of all vegetation. There is no evidence of later intensive occupation, or that the Vikings came back to occupy the space, though it is probable that the existing local population resumed the farming activities on the site. Clearance across the site, however led to the reactivation of aeolian deposits, leading to redeposition across Torksey and at Bunker's Hill Warren. It remains unclear why the site was not occupied after the Great Army sailed away. The farmstead may have carried on, and life may have carried on as normal on the site. The settlement at Torksey, south of the winter camp, may have seen a population boom after 872-3, and, on the basis of place names, Vikings did come and settle within Torksey. It is possible that the owner of the field, if it was the Bishop of Dorchester by the 9th century, asked the population to move south of the winter camp and onto Torksey, however there is no solid evidence to support this, or any other theory as to why the winter camp site was not occupied after the winter of 872-3. The fields were in the control of the Bishop by the 11th century, going by the name of Bishop's Meadow (Cole 1906).

This story that has emerged through geoarchaeological and landscape analysis provides a view of overwintering camp sites of the Viking Great Army with details that have not been recorded or analysed in past evaluations. With this as a template, the application of landscape studies to Viking sites across the UK will help to characterise the actions of the Vikings outside of the few available historical sources. In the concluding chapter, the potential outcome of the application of these methods to other known overwintering camp sites will be briefly explored. The conclusions will also explore the results of this survey that require even more detailed analysis that do not directly apply to Viking overwintering camp sites.

CHAPTER 8

CONCLUSIONS

1 Conclusions in respect to the primary aims and objectives

The aim of this thesis was to provide the first formal palaoenvironmental and landscape reconstruction of the site using geoarchaeological and landscape approaches. These targets were reached with great success; landscape and environmental data about the site during the Viking encampment demonstrated that the site was an island site within an active wetland and alluvial setting, and that the site would have provided inlets from the River Trent, but the site would have been protected by water throughout the winter. The reconstruction also demonstrated that the landscape had been cleared of most of the woodland by the 2nd century AD, and that the aeolian deposits throughout the region would have likely been reactivated due to this clearance and windy conditions throughout the early medieval period. Further landscape analysis has established that the early medieval landscape around Torksey provided a prosperous and active area for the Vikings to stay for the winter, providing access to water and land transport, access to goods and information that were constantly travelling through the landscape, a site that was clear of focused settlement aside from a probable farmstead, but easy access to the possibly emerging town at Torksey, and the settlement at Marton, and possibly access to resources available at the nearby royal estate at Stow. The landscape survey also successfully proved that the changes in settlement locations that occurred throughout the area around Torksey from the Roman through the early medieval period were largely dictated by environmental changes in relation to the underlying geology and topography. Mapping of the archaeological evidence throughout the area from the Roman through the early medieval period also showed the continuity and discontinuity of landscapes throughout the early medieval period, and how much of the medieval landscape was inherited from the pre-historic landscape, and how much was re-created based on environmental changes and human movement in the landscape.

In addition to these results regarding the Viking winter camp, the survey also provided a plethora of valuable environmental and landscape information about the archaeology of this area of the Lower Trent Valley, including:

- a map of aeolian deposits and identification of other potential aeolian outcrops throughout this study area;

- a pollen sequence from the Bronze Age through Roman period;
- analysis of the peat deposits around Torksey than had been previously completed;
- a landscape analysis that determined that environment in this part of the Trent Valley contributed to the settlement shifts within the area, and how this formed the modern landscape in this part of the Trent Valley.

This thesis has also highlighted several areas and research aspects where more research is necessary, which will be discussed further in section 3.2.

Palaeoenvironmental surveys in archaeology have been utilised more frequently on pre-historic sites, and are not often used on early medieval or medieval sites arguably due to the presence of historical maps or documents, and the focus on analysis of small finds and burials. However, in the case of this survey of the winter camp at Torksey and surrounding region, the application of geoarchaeological, palaeoenvironmental, and landscape techniques have proven to be extremely effective in providing a landscape and environmental reconstruction of an early medieval site that may not have any uncovered archaeological deposits, or any archaeological deposits at all. Without this survey, the finds on the fields at Torksey would have remained without contextualisation.

2 Conclusions in relation to ongoing discussions of Viking winter camps

In Chapter 2, a review of the known Viking winter camp sites in England, and to a lesser extent Ireland, demonstrated that with very few known winter camps having been located in the British Isles (in England, only at ARSNY and Repton), there was little to no information available about the physical existence of the overwintering camps. Prior to this survey and the evaluation of Torksey, the setting of the overwintering camps of the Great Army campaign through England in the late 9th century remained largely uninvestigated, with little to no evidence about the circumstances and surrounding landscapes of the recorded camps. Despite the tenuous evidence, it has, nonetheless, been hypothesised that these sites were comprised of a small, D-shaped ditched enclosure, with the straight side open to a body of water (Biddle and Kjølbye-Biddle 1992; Richards 2004; Sheehan 2008; Raffield 2010). It has since remained the assumption that this was a template for the Viking fortified encampments during the Viking Great Army campaign, and the search for sites with similar physical characteristics to Repton and Woodstown at the sites mentioned in the Anglo-Saxon Chronicle. This led to the 'identification' of sites along rivers at locations mentioned in the Chronicle, such as the identification of the site at Tempsford based on mapping vague D-shapes along the River Great Ouse in

Edgeworth 2008. The notion that there was a 'template' for a winter camp has, however, been thoroughly disproven by a series of geoarchaeological and landscape analyses that were detailed in chapters 5 - 7.

Prior to this study, a D-shaped enclosure was thought to be the best indication of a Viking overwintering site, and one thing that this survey has proven is the *non*-existence of a D-shaped enclosure at Torksey. Geophysical survey did not detect any earthworks that would suggest a constructed fortification on the site, and, furthermore, this survey of the site showed that the winter camp would have been naturally fortified by wetlands and open water on all sides. What would be the purpose of constructing earthworks for an occupation that only lasted a few years, when the 'fortifications' existed ready-made in the landscape? The use of naturally formed features in the landscape to create an enclosure also places some doubt on the idea that the Vikings sought to create D-shaped enclosures in the landscape; the winter camp site of Torksey is not a D-shape, but since it was formed by the abandonment of Bronze Age alluvial channels, if the mudstone outcrop had not interfered, these may have appeared as a naturally formed D-shaped enclosure. Closer inspection of Woodstown, ARSNY, and even at some Scandinavian sites such as Hedeby, may demonstrate that natural features created a curvilinear and straight edge, which was later exploited to create a site fortified by water and wetland. The application of the methodology used in this thesis will only further demonstrate that D-shaped enclosures were not 'created' but rather may have been pre-existing as a result of natural features and used by Vikings to create convenient sites at any location.

In addition to dispelling the argument that Viking winter camps are composed of man-made D-shaped enclosures, the landscape analysis has brought to light several features that provide insight into the purposes and daily functions of the winter camp site at Torksey. The proximity of winter camp sites to river crossings is another hypothesis that has surfaced during speculation about Woodstown and Tempsford (Wall 2010; Edgeworth 2008) although Torksey does fit into this model, with Trent crossings at several nearby points, there is a tremendous likelihood that there will be a crossing 'near' to any point along an alluvial system. What is more interesting is how the army may have *used* the crossing at Littleborough and the Roman Road during their time at Torksey. The route way may have provided a means for political and trading control, as well as another means of raiding from traders and travellers. Similarly, the idea that winter camps were located near to the confluence of two rivers (Arthur 2009; Edgeworth 2008) can possibly be loosely applied to the Trent and Foss at Torksey. This is not categorised as a confluence of two natural channels, but is rather the confluence of the Trent with a created canal. Yet again, however, similar to there being a crossing point near to any other point along a river course, confluences of a tributary and a major drainage outlet like the Trent are not difficult to find, and this is hardly a reason to classify a site as a winter camp site.

While other features of the site of Torksey may be referenced during the consideration of identified sites and sites that will be identified in the future, at this point in the research on Viking winter camp sites, no features should be considered as standard. Aspects of the Torksey winter camp site, such as its proximity to a large royal estate like Stow that would provide food and political influence, or to a large settlement like Torksey, or along a navigable and successful trade route like the Trent, may be applicable to other sites, but it must be remembered that there are no sites that will be an exact match to Torksey. Since the landscape varies based on environmental factors, locations of human settlement and influence, and route ways through the landscape, there will be no two sites that are alike, and future analyses should reflect this and modify outcome expectations accordingly.

The landscape reconstruction of Torksey has not provided an alternative to earlier hypotheses about other tentatively identified winter camp sites, but rather has contributed additional evidence that must be considered when discussing the physical landscape of the Great Army campaign. Due to the location of the winter camp at Torksey on an active and major river channel, environmental aspects such as climate change, water level and sedimentology changes, and anthropogenic landscape changes such as settlement shift provided invaluable insight into aspects of the winter camp that would not have been recorded if it were not for this survey. Alternatively, looking at the archaeological features in the landscape between the Roman and medieval periods has produced evidence about the changing environment throughout these time periods. Future investigations of Viking winter camp sites must consider palaeoenvironmental and landscape evidence prior to determining the character of the site. The author also proposes that the other sites that have been identified as location of winter camps should undergo similar detailed landscape analysis before any further conclusions about the Viking overwintering in England are conclusively drawn.

A secondary and broader aim of this thesis was to reconsider the ways in which archaeologists approach Viking winter camp sites, and to initiate a new methodological approach that will prove to be more effective in establishing the nature of Viking sites in England and further afield. The general success of the palaeoenvironmental survey and its relationship with the Viking winter camp at Torksey has undoubtedly demonstrated that geoarchaeological and landscape approaches will be beneficial to any future studies of, not only Viking winter camps, but a wide array of studies of settlement by early medieval archaeologists more broadly.

2.1 Athelney

In stark contrast with previous research drawing comparisons with other recorded Viking sites, surprisingly it was the analysis of the not Viking, but Anglo-Saxon site of Athelney in Somerset that can, on an environmental and landscape level, be closely paralleled with Torksey. Like the winter camp sites, Athelney is also mentioned in the Anglo-Saxon Chronicle: 'And afterwards at Easter, King Alfred with a small force made a stronghold at Athelney' (Whitelock 1965)[14] Although controlled by King Alfred and not the Vikings, this fortified site is mentioned in the *ASC* in 878 (only 5 years after the occupation of Torksey), and it has not previously been considered in discussions of Viking winter camps as a possible defensive site of similar date and potentially similar features. The description of the site as a *geweorc* indicates that this was considered a fortified site. Athelney occupies a ridge of higher ground, overlooking the Somerset Levels. Throughout the early medieval period, it may have been surrounded by marshy ground, creating a naturally fortified site; Asser's *Life of King Alfred* describes the monastery that Alfred founded on the site in 893, describing the site as

> 'surrounded by swampy impassable and extensive marshland and ground water on every side. It cannot be reached in any way except by punts or by a causeway which has been built by protracted labour between two fortresses. A formidable fortress of elegant workmanship was set up by the command of the king at the western end of the causeway' (Keynes and Lapidge 1983, 84).

[14] þæs on Eastron worhte Ęlfred cyning lytle werede geweorc æt Ęþelingaeigge. This passage was also included in the summary and analysis of the mentions of Viking winter camps in the *Anglo-Saxon Chronicle*, chapter 2.

Although this site was under the control of the Anglo-Saxons, rather than the Vikings, a similar methodology for choosing sites may have been utilised by both parties for choosing fortified sites in the late 9th century. The site was built as a defence against the army, and was eventually the site where Guthrum was baptised, so the Vikings were clearly aware of the site prior to their overwintering at Torksey. Although it does appear very similar to the reconstructed site at Torksey, Athelney also has many features that differ from Torksey, namely the smaller size, possible constructed fortification features around the outside, as well as the later re-use of the site as a Benedictine Abbey (Richardson 2003). The site is in need of geoarchaeological and landscape investigation to determine the circumstances of the site in the early medieval period, and if it does yield similar landscape results as Torksey.

The similarity in method of fortification by making use of natural features, yet a difference in controlling party and surrounding landscape, demonstrates the potential similarity in choosing sites between the English and Viking armies in this period, while also insinuating that the Viking winter camp sites were not 'Danish' in nature, but were universally standard forms in the 9th century English landscape. The exploration of the similarities between Torksey, which is described as a *wintersetl*, and Athelney, described as a *geweorc*, may also aid in defining these terms in relation to their physical manifestations. This conclusion only solidifies the inefficacy in the methodology of identifying exclusively Viking sites based on one single identified Viking site. Further consideration of the landscape on these two nearly-contemporary sites will determine not only the similarities between the sites, but also the differences; the main difference is that one site was utilised by the Vikings, while the other was constructed by the English, and characterising Athelney, as well as any additional contemporary sites that come to light, will help determine more about the requirements of both armies.

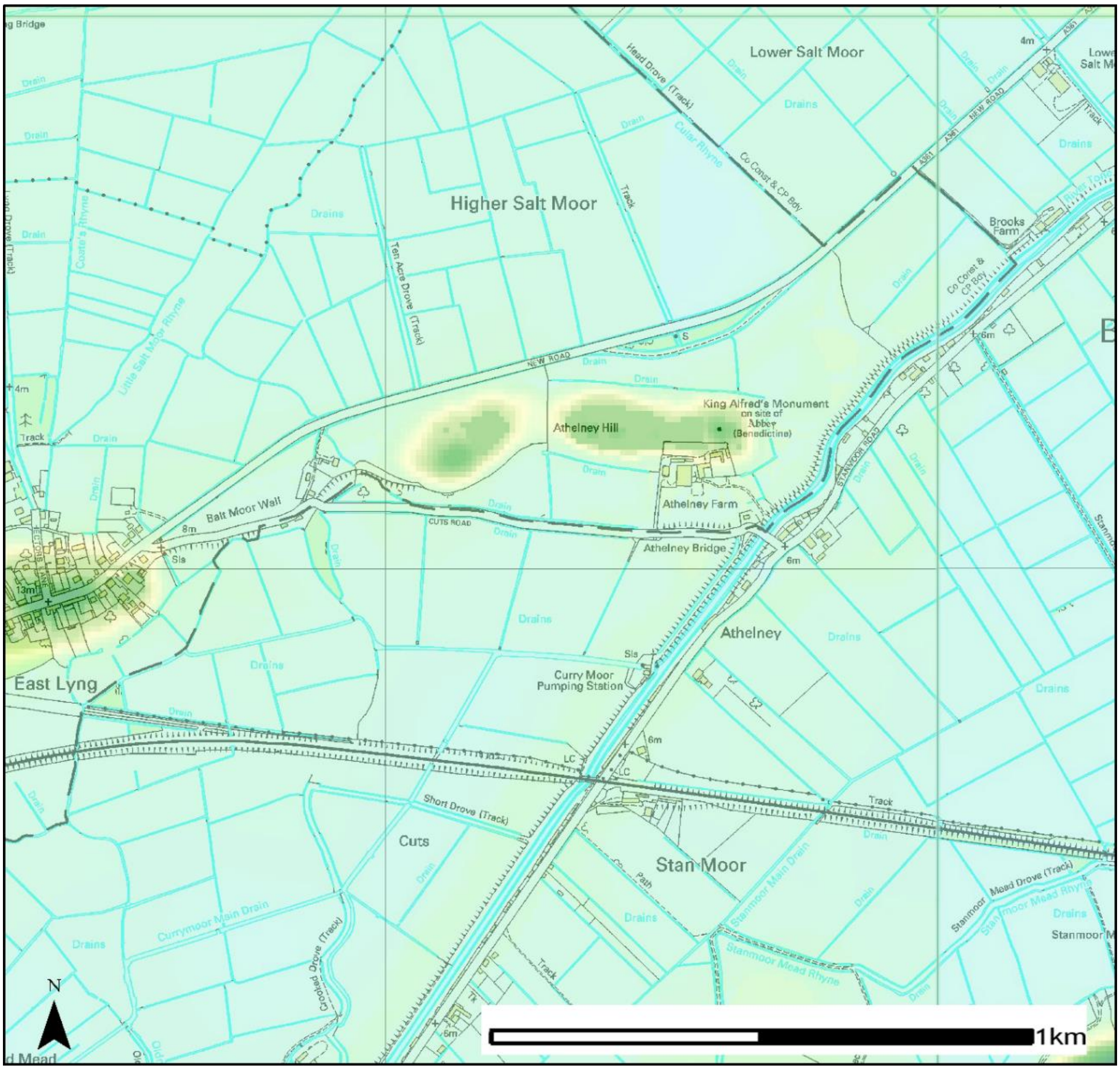


Figure 8.1: The site of King Alfred's *geweorc*, or fortress site at Athelney

2.2 Results within the Torksey Project: the landscape of a Viking winter camp

In addition to fitting into the wider discussion of the landscape of Viking winter camps, and temporary early medieval encampments, this study was also required to fit into the larger Torksey Project. To date, several smaller publications have incorporated the conclusions of the palynological analysis, radiocarbon dating, OSL dating, and preliminary observations about the palaeoenvironment of the winter camp site (Hadley and Richards forthcoming). As yet, the Torksey Project has utilised several outcomes of this project to further enrich their view of the Viking overwintering at Torksey. The conclusion that the landscape was largely cleared in the 2nd century AD is based on the pollen analysis that was presented in chapter 5. Excavations and survey has been led by the conclusions from OSL dating that have proven that the aeolian deposits were indeed active in the years after the winter camp. Excavations that took place in the field at the south end of the winter camp site produced no obvious archaeological stratigraphy, but portable OSL methodology has aided in making sense of the sediments encountered in that field session. Mapping of the aeolian deposits in relation with the small finds analysis and geophysical survey has also presented an interesting correlation; poor results in the magnetometry, as well as a lack of metal work finds, clearly is related to the presence of aeolian deposits across the site. Finally, perhaps most importantly, this survey has demonstrated that the winter camp site looks extremely different to the site present today, and was, in fact, related to islands. Prior to this survey, it was assumed that the place name of Torksey was referring to the winter camp site, however this thesis has determined that there are, in fact, two islands at Torksey, the one of the winter camp site, and the one of the early medieval settlement. Final publication of this project is still well in the future, so it remains unclear what aspects of this research will be utilised in the final write-up of Torksey by the Torksey Project.

3 Critique of methodology and proposed future work

Overall this thesis has been successful in producing new information about Torksey, and opening up new conversations about Viking winter camp sites in general. While the results of this work have been successful, as always, there are many areas where more data or time or both could have been contributed to certain areas of the research. One issue that was met was the use of two different scales for two different analyses, and then tying them together again. The use of two different sizes of study area, with the area of only the winter camp site used for palaeoenvironmental analysis, and the parishes surrounding Torksey for the landscape analysis, was incredibly useful and insightful for the scales of analysis pursued here, however it was often difficult to create a balanced relationship between the two study areas, especially since the landscape analysis provided environmental data that could not always be supported by ground truthing, as well as the disparity between different records offices. The correlation between the landscape analysis and environmental analysis of the winter camp site would have been completed with more ease if some environmental sampling and characterisation was possible throughout the larger study area. However, time constraints and permissions did not permit this detailed environmental sampling and analysis across the entire site. More detailed sampling may have also aided in providing more acute dating evidence for the palaeolandscapes proposed in chapter 6.

The lack of extensive excavations across the site also created some hindrance to this survey, as the multi-phased enclosure on the site was not accurately datable. A solid date on the enclosure within the winter camp site at Torksey would have provided invaluable information about the activities on the site throughout the Romano-British and early medieval periods. Unfortunately, large-scale excavation was not completed by the Torksey Project during the course of this research, so all hypotheses about the continuity of the use of the enclosure on the site will not be tested until after submission of this PhD thesis.

Lack of time presented an additional obstacle: several lines of research could not be thoroughly researched due to time constraints, and, although in some cases the datasets were retrieved (and are presented in the appendices, including place names, palaeochannels, and cropmarks), they were often not able to be considered for inclusion into the conclusions of this thesis. Additional data were also not included because there was no appropriate outlet to discuss it in relation to the study of Torksey or Viking winter camps. This included: further analysis of sediment data; the dating and analysis of cropmarks; detailed place name analysis; and historical analysis.

The sediment analyses completed as part of this thesis provided some very interesting information about the palaeoenvironment, but further sense could potentially be made of the coversands and other sediments, including the peat and alluvium, even using just the data collected during this research. With more detailed analyses and sampling, and further consideration of the analyses completed as part of this thesis, additional conclusions could be made about the floodplain, as well as the origins of the peat bog and palaeochannel on the east end of the site. Coring across the alluvium may be able to help confirm the different courses of the Trent within the valley directly adjacent to the site. Analysis of the alluvial deposits across the wider study area may be able to identify additional palaeochannels, as well as dating evidence for them. Further research on the peat may even provide further evidence of Bronze Age through early medieval human-environment interactions, as well as a potential undisturbed sequence of pollen. Unfortunately this was not possible as part of this thesis due to the limitations of time, equipment, and work force.

The coring of aeolian deposits across the winter camp site provided a useful mapping tool, and particle size analysis was a useful tool in differentiating between aeolian and terrace deposits, but further particle size analysis and more detailed sampling may have also determined even more about the dunes, including wind direction, the effects of post-depositional ploughing, and even temporal differences in wind strength; this, however would be a huge undertaking in itself, requiring a large time and monetary budget. In addition, more detailed analysis, including OSL dating, on the sand that comprises the causeway on the north end of the site may provide more details about the importance of this site in relation to the winter camp. Finally, understanding the Pleistocene terrace deposits was not the aim of this thesis, however, with further mapping and sampling, including continuing with OSL dating, the braided channel environment of the last ice age may also be better understood at Torksey.

The geoarchaeological survey also highlighted some more detailed analyses that should be completed in the larger study area in relation to the wider landscape. There were several dunes across the winter camp site that had been previously unidentified, and, based on the brief descriptions of sediments in some of the archaeological reports within the wider study area, it is clear that there are additional unmapped aeolian deposits. None of the excavations recorded in grey or published literature were able to identify the source of the deposit, or the implications for the palaeoclimate and environmental changes. Several reports of medieval archaeology deposits on top of and below sand deposits in Torksey, Kettlethorpe, and as far north as Thonock, indicate that there are unmapped aeolian sediments throughout the larger region. Further research in mapping and dating the coversands throughout this area of the Trent Valley will help to define the palaeoenvironment and its relationship to the archaeology.

Micromorphology could also eventually feed into understanding of the archaeology on Torksey and the winter camp site. Originally, plans to create thin sections of the *in situ* deposits were going to aid in the descriptions of the sediments overlying the site. Due to time constraints perceived by supervisors, these thin sections were not created. Although these thin sections may not have provided many details about the Viking overwintering camp, the creation of slides as a part of future studies of the area will help to provide an accurate mineralogical assessment of the sediments, and the formation of soil profiles and palaeoenvironments across the region. If archaeological strata are identified and excavated in the coming years as part of the Torksey Project, micromorphological analyses may provide additional insights into the activities and uses of space that took place on the camp site. In recent studies by Karen Milek (2012a; 2012b; 2009; Simpson *et al*. 2005) on temporary and long-term Viking *sheilings* and dwellings in Iceland and across the Hebrides, micromorphological studies have provided unique insight into the areas where domestic activities that were taking place, areas within dwellings with high activity, reuse of domestic dwellings as refuse pits, and phases of abandonment. Earlier works by Milek (2006) have also utilised these methods on urban contexts. It was the original intention of this thesis to complete similar studies on the Torksey winter camp site, and it is hoped that as the Torksey Project moves forward, these analyses will inform any future excavations of *in situ* remains.

Time constraints also limited the amount of analysis that could be completed on the earthworks and cropmarks detected across the larger landscape study area. The cropmarks within the area of the landscape study were catalogued, mapped and described, but they were not analysed in regards to this landscape study, and lack of precise dating evidence meant that they were omitted from the analysis altogether. The cropmarks detected and catalogued should be analysed, dated, and even excavated as part of future research programmes. Similarly, earthworks that were not already recorded or immediately visible on the ground in the larger study area were also not analysed, but where LiDAR data was available, any detected earthworks were also noted, and should be recorded and analysed in more detail in the future.

Place names have the potential to not only provide details about linguistic origins of places, but also can provide some information about the palaeoenvironment; unfortunately many place name studies do not provide the locations of the recorded names, making it difficult to determine where the individual field names originated. In the Torksey area, this has proven useful in determining that there was a Viking presence in the post-winter camp years in the settlement of Torksey, that the winter camp fields belonged to the Bishop by the 11th century, and that the peat bog at Torksey was important enough to receive a recorded Scandinavian place name. Detailed analysis of the fields across the entire study area in regards to records that provide environmentally relevant place names may also provide similarly successful results. Cataloguing and mapping all of the place names within this study area would have taken several additional years to complete, and within a smaller study area, this type of analysis would have been more effective.

An additional means of analysis of the Viking influence in the landscape is the study of small finds and their place in the landscape. A survey of early medieval finds catalogued in the PAS in relationship to the Lincolnshire landscape that is currently being completed by Alison Leonard at the University of York has determined that concentrations of finds with Scandinavian characteristics can demonstrate the areas that would have had Viking influence. It is hoped that a similar methodology will be used within the study area of this thesis in the future.

On the basis of these observations about additional information that could be produced in the study area, as well as the conclusions of the present study, a list has been compiled below of a few areas of targeted future research at Torksey:

- Additional dating of aeolian deposits on the winter camp site, including on the potential causeway from the winter camp island to Marton
- Excavations on the proposed area of the original Foss, especially around Hardwick, to test the hypothesis proposed in this research, and whether Hardwick may have had an Anglo-Saxon port
- Excavations on Torksey to determine the sedimentation overlying the enclosure, and if there are any remains of the winter camp site, and to continue geoarchaeological analyses on the archaeological deposits (including as micromorphological analyses to determine if the archaeological sediments can demonstrate further details)
- Continued analysis of the peat deposits around Torksey and Torksey Lock to determine if the abandonment of the channel was facilitated by human interference or by natural shifting of the Trent
- Further mapping of the peat may to attempt to identify an area of peat where it has not been too dried to identify pollen grains in the top 50 cm of the accumulation.
- Completion of a comprehensive place name survey that includes the location of place names containing environmental indicators
- Survey of palaeochannels within the study area using invasive survey techniques such as coring.

Mapping of some of the palaeochannels of the Trent Valley is a project that was started as part of the Trent Valley Geoarchaeology group in 2002, and several of the main aims of the project, including formal mapping of all potential palaeochannels and determining the effects on climate change on the alluvial plain of the Trent Valley, have been addressed for this study area in this thesis. In the past year, a proposal by Trent and Peak Archaeology Unit has been approved by English Heritage for the mapping and analysing all of the Trent Valley palaeochannels in relation to the archaeological record. Due to the direct relevance of the palaeochannels of the Trent project to the geoarchaeology completed during this dissertation, is hoped that some of the aims outlined above can be incorporated into the Palaeochannels of the Trent Catchment project.

Overall, the methodology utilised in this thesis did have the desired output. Due to not having a pre-existing, tried and tested methodological template, the application of this particular combination of techniques was experimental in nature; however the results of applying a range of techniques from sediment analysis to OSL dating to GIS mapping of archaeological sites was effective, and, aside from the site specific changes listed above, this methodology will be useful for future studies in geoarchaeology and landscape analysis. The research presented in this dissertation has highlighted several areas where further research is required, in early medieval and Viking archaeology, as well as the geoarchaeology of the Lower Trent Valley. It is hoped that the primary outcome of this research will be that future research on Viking winter camps will formally consider the landscape. With the application of detailed and formal landscape and environmental studies (as opposed to brief observations that were completed on earlier Viking winter camp studies), analysis of the archaeology of Viking sites will finally be supported by accurate landscape representations. Reconsideration of Repton and the surrounding landscape as a winter camp site will be the next step in creating a catalogue of the landscapes of Viking winter camps of the late 9th century, and future work is planned at the site through the Torksey Project, and separately through the Derbyshire County Council, which will incorporate the methodology used in this thesis. Utilising geoarchaeology and landscape archaeology at ARSNY, as well as sites outside of England, at sites such as Woodstown, and even Hedeby and Birka will add to this catalogue, so that archaeologists can at last begin to determine the contemporary environment and the preferred landscapes of the Viking Great Army in 9th century England. The winter camp at Torksey has served as a useful starting point, but the reconstruction of a single site does not bring archaeologists any closer to understanding winter camp sites in general. Only with the future application of geoarchaeology, palaeoenvironmental and climate change analysis, and landscape studies will the natural and human landscape of the early medieval period be thoroughly understood.

BIBLIOGRAPHY

PRIMARY:

LA, EXLE4 32/2/69. Torksey Castle Engraving

LA, MON 2/18. Croft Title Deeds 1650-70

LA, LDP 1/26 Sheet 4. Rail Extension Plan, 1845.

LA, Torksey Par. 15/1. 1815, Treswell relegated to the poor

LA, BNLW 1/1/59/1. Will of Jermyn Hume, 1751.

LA, Lindsey Award/72. 1804, no plan.

LA Lindsey Award/204. "Brampton Inclosure [sic] Award 1774," no plan.

LA 10-Nott/1/31. 1860 Apportionment map annotation.

LA 10-Nott/1/32. 1869 Tithe Award.

LLSL, 1/3/1824. 1824, Tower of London Ordnance Map Office.

LLSL, Ref. 717. 1769. Grundy, J. and Kell, G. "Flooding of Nottinghamshire." County of Notts.

LLSL, 19/4/1828. 1828. A. Bryant. "County of Lincoln divided into three divisions."
LLSL. Jessop (cartographer). August 1782. "Profile of the River Trent from mouth of Lincoln navigation to Cavendish Bridge"

North Lincolnshire Council "Contaminated Land Inspection Strategy."

NA, AT 107/29. 1839 Tithe map and award.

NA, C 54/1-32. Documents 1848-1920s, relating to the draining of the lands around Torksey Lock.

NA, DD 1350/1. 1153 Torksey charter.

NA, DD 2030/1/15/1-2. 1953 copy of early C19 enclosure.

NA, DD 2480/1. William Stukeley. 1724 map of Littleborough,

NA, EA 10/1. 1841 map of Treswell

NA, EA 124/2/1-2 1796/1801 Cottam tithe map

NA, EA 140/2/2-3. 1828 Sturton tithe map

NA, EA 153/2/1. 1845 Rampton tithe map and award.

NA, LA/2/S. 1769 plan of Ings Meadow Marshes

NA, PAC 123/10/3 1828 Littleborough tithe award and map

NA 16/10/1877/33

Abbott, C., Alvey, B., Kinsley, G., Vince, A., and Young, J. 2005. *Pottery from a watching-brief at Kirkgate Co-op, Newark*. Nottingham: Trent and Peak Archaeological Unit. Unpublished report.

Aberth, J. 2013. *An Environmental History of the Middle Ages*. London: Routledge.

AC Archaeology. 2007. *Proposed West Burton gas pipeline: Results of fieldwalking survey at Knaith Park, Lincolnshire*. Hindon: AC Archaeology. Unpublished report.

Albone, J. 1998. *Archaeological field evaluation: land at Home Farm, Laughterton, Lincolnshire*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Albone, J. 1999. *Archaeological watching brief report: Plot 3, Main Street, Torksey*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Albone, J. 2002a. *Desk-based assessment of the archaeological implications of the Gainsborough to Caenby Corner gas pipeline, Lincolnshire*. Lincoln: Archaeological Project Services. Unpublished report.

Albone, J. 2002b. *Desk-based assessment of the archaeological implications of the Gainsborough to Caenby Corner gas pipeline, Lincolnshire (western section)*. Lincoln: Archaeological Project Services. Unpublished report.

Albone, A., and Field, N. 2002. Archaeology in Lincolnshire 2001-2002. *Lincolnshire History and Archaeology*. 37: 44-61

Allcroft, A. H. 1908. *Earthworks of England: Prehistoric, Roman, Saxon, Danish, Norman, and Medieval.* London: Macmillan.

Allen Archaeological Associates. 2009. *Report on an archaeological scheme of works: Ingleby Grange Farm, Saxilby, Lincolnshire*. Branston: Allen Archaeological Associates. Unpublished report.

Allen, M. 2002. *Archaeological desk-based assessment and metal detector survey; land off Foxby Lane, Gainsborough, Lincolnshire*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Allen, M. 2005. *Archaeological evaluation on land at Fossdyke Canal, Fenton, Lincolnshire*. Sleaford: Archaeological Project Services. Unpublished report.

Allen, T. 1833. *A History of the County of Lincoln*. Vol. II. London: John Saunders Junior.

Ambrosiani, B. 1998. Ireland and Scandinavia in the Early Viking Age: an Archaeological Response. In H. Clarke, M. Mhaonaigh and R. O Floinn. eds. *Ireland and Scandinavia in the Early Viking Age.* Dublin: Four Courts Press. pp. 405-420.

Ambrosiani, B. 2008 Birka. In S. Brink and N. Price. eds. *The Viking World*. London: Routledge. pp. 92-100.

Anderson, M., and Glenn, J. 2013. *Torksey Castle Appraisal*. Anderson and Glenn Architectural Surveyors, Boston, Lincolnshire. Unpublished Report.

Archaeological Project Services. 1995a. *Archaeological watching brief of a water mains relay between Stubton and Fenton, Linconshire*. Sleaford: Archaeological Project Services. Unpublished report.

Archaeological Project Services. 1995b. *Archaeological watching brief for a development at The Beckett School, Gainsborough, Lincolnshire*. Sleaford: Archaeological Project Services. Unpublished report.

Armitage, E. S. 1900. Anglo-Saxon Burhs and Early Norman Castles. *Proceedings of the Society of Antiquaries of Scotland*. Vol. 34: 260-288.

Arnold, L. and Roberts, R. 2009. Stochastic modelling of multi-grain equivalent dose distributions: Implications for OS dating of sediment mixtures. *Quaternary Geochronology*. 4: 204-230

Arnold, L., Roberts, R., Galbraith, R., and DeLong, S. 2009. A revised burial dose estimation procedure for optical dating of young and modern-age sediments. *Quaternary Geochronology*. 4: 306-325

Arthur, N. 2009. The enigma of the Viking *longphort*: a landscape archaeological perspective. *Journal of the Medieval Settlement Research Group*. No. 24. pp. 84-86.

Aspinall, A. 1984. *Repton Magnetometer and Earth Resistance Survey*. Bradford: University of Bradford. Unpublished survey report.

Aston, M., Austin, D., and Dyer, C., eds. The *Rural Settlements of Medieval England*. Oxford: Blackwell.

Auden, G. A. 1909. Excavations in Repton. *Yearbook of the Viking Club*, 1909-1910. Vol. II. London. pp. 26.

Ayala, G., Canti, M., Heathcote, J., Sidell, J., and Usai, R. 2007. *Geoarchaeology: Using earth science to understand the archaeological record.* Swindon: English Heritage.

Bailey, R. 1980. *Viking Age Sculpture*. London: Collins Archaeology

Baillie, M. 1995. *A Slice through Time: Dendrochronology and Precision Dating*. London: Routledge.

Baker, C. Bateman, M., Bateman, P., and Howard, J. 2013. The aeolian sand record in the Trent Valley. *Mercian Geologist*. 18(2): 108-118

Baker, S. 2002. *The Trent Valley: palaeochannel mapping from aerial photographs*. Advancing the Agenda in Archaeology and Alluvium. York: Trent Valley Geoarchaeology.

Ball, D. F. 1964. Loss-on-ignition as an estimate of organic matter and organic carbon in non-calcareous soils. *Journal of Soil Science* 15: 84-92

Barber, K., and Langdon, P. 2007. What drives the peat-based palaeoclimate record? A critical test using multi-proxy climate records from northern Britain. *Quaternary Science Reviews*. 26: 3318-3327

Barber, K., Chambers, F., and Maddy, D. 2003. Holocene palaeoclimates from peat stratigraphy: macrofossil proxy climate records from three oceanic raised bogs in England and Ireland. *Quaternary Science Reviews*. 22: 521-539

Barber, K., Battarbee, R., Brooks, S., Eglinton, G., Haworth E., Oldfield, F., Stevenson, A., Thompson, R., Appleby, P., Austin, W., Cameron, N., Ficken, K., Golding, P., Harkness, D., Holmes, J., Hutchinson, R., Lishman, J., Maddy, D., Pinder, L., Rose, N., Stoneman, R. 1999. Proxy records of climate change in the UK over the last two millennia: documented change and sedimentary records from lakes and bogs. *Journal of the Geological Society*. 156: 369-380

Barber, K., Chambers, F., Maddy, D., Stoneman, R., and Brew, J. 1994. A sensitive high-resolution record of late-Holocene climatic change from a raised bog in northern England. *The Holocene*. 4: 198-205.

Barber, K., Maddy, D., Rose, N., Stevenson, A., Stoneman, R., and Thompson, R. 2000. Replicated proxy-climate signals over the last 2000 years from two distant UK peat bogs: new evidence for regional palaeoclimate teleconnections. *Quaternary Science Reviews*. 19: 481-487

Barley, M. W. 1964. The Medieval Borough of Torksey: Excavations, 1960-2. *The Antiquaries Journal*. Vol. XLIV: 165-187.

Barley, M. W. 1981. The medieval borough of Torksey: excavations 1963-8. *Antiquaries Journal*. Vol. 61: 263-291.

Barrett, D. 2006. An archaeological resource assessment of Anglo-Saxon Derbyshire. *East Midlands Archaeological Research Framework: Resource Assessment of Anglo-Saxon Derbyshire*. Leicester: ULAS.

Bateman, M. 1995. Thermoluminescence dating of the British coversand deposits. *Quaternary Science Reviews*. 14: 791-798

Bateman, M. 1998. The origin and age of coversand in North Lincolnshire, UK. *Permafrost and Periglacial Processes*. 9: 313-325

Bateman, M. 2001. Black Walk Nook. In M. Bateman, P. Buckland, C. Frederick and N. Whitehouse. eds. *The Quaternary of East Yorkshire and North Lincolnshire*. London: Quaternary Research Association. 135-138

Bateman, M. 2008. Luminescence dating of periglacial sediments and structures. *Boreas*. 37: 574-588.

Bateman, M., Boulter, C., Carr, A., Frederick, C., Peter, D., and Wilder, M. 2007. Detecting post-depositional sediment disturbance in sandy deposits using optical luminescence. *Quaternary Geochronology*. 2: 57-64

Bateman, M., Bristow, C., and Livingstone, I. 2001a. Twigmoor Woods. In M. Bateman, P. Buckland, C. Frederick and N. Whitehouse. Eds. *The Quaternary of East Yorkshire and North Lincolnshire*. London: Quaternary Research Association. 127-134

Bateman, M. and Buckland P. 2001. Late Quaternary record from beyond the icesheets. In M. Bateman, P. Buckland, C. Frederick and N. Whitehouse. eds. *The Quaternary of East Yorkshire and North Lincolnshire*. London: Quaternary Research Association. 13-20

Bateman, M., Buckland, P., Carpenter, R., Davies, S., Frederick, C., Gearey, B., and Whitehouse, N. 2001b. Cove Farm Quarry. In M. Bateman, P. Buckland, C. Frederick and N. Whitehouse. eds. *The Quaternary of East Yorkshire and North Lincolnshire*. London: Quaternary Research Association. 141-160

Bateman, M., Frederick, C., Jaiswal, M., and Singhvi, A. 2003. Investigations into the potential effects of pedoturbation on luminescence dating. *Quaternary Science Reviews*. 22: 1169-1176.

Bateman, M., Garton, D., Priest, V., and Sainty, D. 1997. The dating of linear banks found at Tiln, Nottinghamshire, using thermoluminescence. *East Midland Geography*. 20: 42-49

Bateman, M., and Godby, S. 2004. Late Holocene inland dune activity in the UK: a case study from Breckland, East Anglia. *The Holocene*. 14(4): 579-588

Bateman, M., Hannam, J., and Livingstone, I. 1999. Late Quaternary dunes at Twigmoor Woods, Lincolnshire, UK: a preliminary investigation. *Seitschrift für Geomorphologie*. 116: 131-146.

Bateman, M., Murton, J., and Crowe, W. 2000. Late Devensian and Holocene depositional environments associated with the coversand around Caistor, North Lincolnshire, UK. *Boreas*. 29: 1-15

Bateman, M., Stein, S., and Ashurst, R. In press. Instant Luminescence Chronologies? Use of high resolution luminescence profiles using a portable luminescence reader. *Quaternary Geochronology*.

Beckwith, I. 1972. *The History of Fields and Farms in Gainsborough*. Gainsborough: Gainsborough Urban District Council.

Bede. *Ecclesiastical History of the English people*. Edited and translated by Sherley-Price, L. 1990. London: Penguin.

Bell, M., and Brown, A. 2009. *Southern Regional Review of Geoarchaeology: Windblown Deposits*. Report 5/2009. Swindon: English Heritage

Bell, M., and Walker, M. 2005. *Late Quaternary Environmental Change*. Second edition. Harlow: Pearson

Bennett, K. 1994. *Annotated catalogue of pollen and pteridophyte spore types of the British Isles.* Cambridge: University of Cambridge. Unpublished report

Bewley, R. 1998. England's National Mapping Programme: A Lincolnshire Perspective. In R. Bewley. ed. *Lincolnshire's Archaeology from the Air.* Lincoln: Society for Lincolnshire History and Archaeology. pp. 9-17

Benton, M., Cook, E., and Turner, P. 2002. *Permian and Triassic Red Beds and Penarth Group of Great Britain*. Geological Conservation Review Series, No. 24. Peterborough: Joint Nature Conservation Committee

Beresford, M., and Hurst, J. 1989. *Deserted Medieval Villages*. Stroud: Sutton Publishing Ltd.

Beuselinck, L., Govers, G., Poesen, J., Degraer, G., and Froyen, L. 1998. Grain-size analysis by laser diffractometry: comparison with sieve-pipette method. *Catena*. 32: 193-208

Biddle, M. and Kjølbye-Biddle, B. 1985a. The Repton Stone. *Anglo-Saxon England*. Vol. 14. Cambridge: Cambridge University Press.

Biddle, M. and Kjølbye-Biddle, B. 1985b. Repton, St Wystan's Church. In *Medieval Archaeology*. Vol. 29: 168.

Biddle, M. and Kjølbye-Biddle, B. 1992. Repton and the Vikings. *Antiquity*. Vol. 66. pp. 36-51.

Biddle, M. and Kjølbye-Biddle, B. 2001. Repton and the 'great heathen army', 873-4. In J. Graham-Campbell, R. Hall, J. Jesch and D. Parsons. eds. *Vikings and the Danelaw: select papers from the proceedings of the thirteenth Viking congress. 21-30 August 1997. Nottingham and York*. Oxford: Oxbow Books. pp. 45-96.

Biddle, M., Kjølbye-Biddle, B., Northover, J. P., and Pagan, H. 1986. A parcel of pennies from a mass-burial associated with the Viking wintering at Repton in 873-4. In: M. Blackburn. ed. *Anglo-Saxon Monetary History*. Leicester: University of Leicester Press. pp. 111-123.

Birks, H. 1989. Holocene isochrone maps and patterns of tree-spreading in the British Isles. *Journal of Biogeography*. 16(6): 503-540

Blackburn, M. 1993. Coin finds and coin circulation in Lindsey, *c*. 600-900. In Vince, A. *Pre-Viking Lindsey*. Lincoln: Lindsey Archaeological Studies. pp. 80-90.

Blackburn, M. 2002. Finds from the Anglo-Scandinavian site of Torksey, Lincolnshire. *Moneta Mediaevalis: Studia numizmatiyczne I historyczne ofiarowane Profesorowi Stanislwowi Suchodolskieum w 64.* Roxcnice erodzin. 89-101: Pp 526-7.

Blackburn, M. 2007. The Kaupang Finds. In D. Skre. ed. *Means of Exchange: Dealing with Silver in the Viking Age.* Kaupang Excavation Project Publication Series, Volume 2. Norske Oldfunn XXIII. Aarhus: Aarhus University Press. Pp 27-72.

Blackburn, M. 2011. *Viking Coinage and Currency in the British Isles*, British Numismatic Society Special Publication 7. London: Spink

Blair, J. 2005. *The Church in Anglo-Saxon Society.* Oxford: Oxford University Press.

Blundell, A., and Barber, K. 2005. A 2800-year palaeoclimatic record from Tore Hill Moss, Strathspey, Scotland: the need for a multi-proxy approach to peat-based climate reconstructions. *Quaternary Science Reviews*. 24: 1261-1277

Boulter, C. 2007. *Landscape dynamics since the Last glacial maximum in East Central Texas, USA.* Sheffield: University of Sheffield, Department of Geography. Unpublished PhD thesis.

Brandon, A., and Sumbler, M. 1988. An Ipswichian fluvial deposit at Fulbeck, Lincolnshire and the chronology of the Trent terraces. *Journal of Quaternary Science.* 3: 127-133

Brandon, A., and Sumbler, M. 1991. The Balderton sand and gravel: pre-Ipswichian cold stage fluvial deposits near Lincoln, England. *Journal of Quaternary Science.* 6: 117-138

Brayshay, B. 1994. *Palynological assessment of a sediment sample from Shardlow, Derbyshire.* ARCUS report No. 11. Sheffield: ARCUS. Unpublished report.

Brayshay, B., and Dinnin, M. 1999. Integrated palaeoecological evidence for biodiversity at the floodplain-forest margin. *Journal of Biogeography*. 26(1): 115-131

Brett, A. 2003. *The Old School House, Stow. Archaeological watching brief report*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Brett, A. 2005. *Bole Corner to Rampton Gas Pipeline, Nottinghamshire. Lincoln: Pre-Construct Archaeology*. Unpublished report.

Briant, R.M., and Bateman, M. 2009. Luminescence dating indicates radiocarbon age underestimation in late Pleistocene fluvial deposits from eastern England. *Journal of Quaternary Science*. 24(8): 916-927

Briant, R.M., Coope, G.R., Preece, R.C., Keen, D.H., Boreham, S., Griffiths, H.I., Seddon, M.B. and Gibbard, P.L. 2004. Fluvial system response to Late Devensian (Weichselian) aridity, Baston, Lincolnshire, England. *Journal of Quaternary Science*. 19: 479-495

Bridgland, D., Howard, A., White, M., and White, T. 2006. *The Trent Valley: Archaeology and Landscapes of the Ice Age*. Durham: Durham University.

Bridgland, D., Howard, A., White, M., and White, T. 2014. *Quaternary of the Trent*. Oxford: Oxbow.

Bridgland, D., Innes, J., Long, A., and Mitchell, W. 2011. *Late Quaternary Landscape Evolution of the Wale-Ure Washlands, North Yorkshire*. Oxford: Oxbow.

Brink, S., and Price, N., eds. 2008. *The Viking World*. London: Routledge.

British Geological Survey Lexicon. Open Source. Available at <http://www.bgs.ac.uk/lexicon>

Brooks, I. P. 2003. *Land at Littleborough Lane, Marton: Geophysical survey*. Bleinau Ffestinniog: Engineering Archaeological Services Ltd. Unpublished report.

Brown, A. 1997. *Alluvial Geoarchaeology*. Cambridge: Cambridge University Press

Brown, A., Cooper, L., Salisbury, C., Smith, D. 2001. Late Holocene channel changes of the Middle Trent: channel response to a thousand-year flood record. *Geomorphology*. 39: 69-82

Brown, H. 2006. *History and Archaeology of Torksey*. York: University of York. Unpublished MA dissertation.

Brown, H. 2012. *Geophysical Survey of Torksey, Lincolnshire*. York: University of York. Unpublished report.

Buckland, P. 1977. *Archaeology and Environment in the Vale of York: Studies in the use of insect remains in the interpretation of archaeological environments*. Birmingham: University of Birmingham. Unpublished PhD thesis.

Buckland, P. 1982. The cover sand of north Lincolnshire and the Vale of York. In B. Adlam, C. Fenn and L. Morris. eds. *Papers in Earth Studies*. Norwich: Norwich Geoabstracts. 171-236

Buckland, P., and Dolby, M. 1973. Mesolithic and later material from Misterton Carr, Nottinghamshire-an interim report. *Transactions of the Thoroton Society Nottinghamshire*. 77: 5-33

Buckland, P., and Edwards, K. 1984. The longevity of pastoral episodes of clearance activity in pollen diagrams: the role of post-occupation grazing. *Journal of Biogeography*. 11(3): 243-249.

Budge, D. 2010. *Report on a watching brief on drainage replacement works at St. Peter's Church, Church Laneham, Nottinghamshire*. Nottingham: Nottinghamshire County Council. Unpublished report.

Bugge, A. 1921. The Norse Settlements in the British Islands. *Transactions of the Royal Historical Society*, 4th Ser., Vol. 4: 173-210.

Bunn, D. 2004. *Resistivity Survey: Land at Torksey, Lincolnshire*. Lincoln: Pre-Construct Geophysics. Unpublished report.

Bunn, D., and Gardner, R. 2005. *Geophysical and surface collection surveys: Land at the western end of the proposed Caenby Corner to Gainsborough gas pipeline, Lincolnshire*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Cameron, E. 1986. Viking Sword at Repton. *Rescue News*. Issue 41: 7.

Cameron, K. 1998. *A Dictionary of Place Names*. Nottingham: English Place-name Society.

Cameron, K. 2001. *The Place-Names of Lincolnshire Part Six: The Wapentakes of Manley and Aslacoe*. The Survey of English Place-Names. Nottingham: English Place-Name Society.

Cameron, K., and Insley, J. 2010. *The Place-Names of Lincolnshire Part Seven: Lawress Wapentake*. The Survey of English Place-Names. Nottingham: English Place-Name Society.

Canti, M. 1993. *Soil Particle Size Analysis: a revised interpretative guide for excavators*. Ancient Monuments Laboratory Report 1/91. Swindon: English Heritage

Canti, M. 2009. *A Review of Geoarchaeology in the Midlands of England*. Report 17/2009. Swindon: English Heritage

Carnap-Bornheim, C., Kalmring, V., and Schultze, J. 2010. Hedeby, the settlement and the harbour: old data and recent research. in J. Sheehan, and D. O Corrain. eds. *The Viking Age: Ireland and the West*. Dublin: Four Courts Press. pp 511-523.

Cavanagh, C. 1998. *An archaeological evaluation, Station Road, Knaith Park, Knaith, Lincolnshire*. London: AOC Archaeology. Unpublished report.

Chadwick, A. 2008. *Fields for Discourse: Landscape and Materialities of Being in South and West Yorkshire and Nottinghamshjire during the Iron Age and Romano-British Periods. A study of people and Place.* University of Wales, Newport. Unpublished PhD thesis.

Chalkley-Gould, I. 1901. Early Defensive Earthworks. *Journal of the British Archaeological Association* Vol. 7: 15-38

Challis, K. 2002. *Component 3: Alluvium Depth and Character Modelling*. York: Trent Valley Geoarchaeology

Challis, K. 1990. Rampton Quarry Site: Preliminary Site. Nottingham: Trent and Peak Archaeological Trust. Unpublished report.

Challis, A. and Howard, A. 2006. A Review of Trends within Archaeological Remote sensing within Alluvial Environments. *Archaeological Prospection* (13): 231-240

Chandler, J. 1993. *John Leland's Itinerary: Travels in Tudor England.* Frome: Sutton Publishing Limited.

Chapman, H., and Gearey, B. 2013. *Modelling Archaeology and Palaeoenvironment in Wetlands: the hidden landscape archaeology of Hatfield and Thorne Moors, eastern England*. Oxford: Oxbow.

Chiverrell, R. 2001. A proxy record of late Holocene climate change from May Moss, northeast England. *Journal of Quaternary Science* 16(1): 9-29

Clarke, G. T. 1884. *Medieval Military Architecture in England*. London: Woman.

Clark, G.T. 1889. Contribution towards a complete list of moated mounds or burhs. *The Archaeological Journal* Vol. 46: 197-217

Clarke, H. 1998. Proto-Towns and Towns in Ireland and Britain in the Ninth and Tenth Centuries. In H. Clarke, M. Mhaonaigh and R. O'Floinn. eds. *Ireland and Scandinavia in the Early Viking Age*. Dublin: Four Courts Press

Clay, C. 2002. *Archaeological watching brief/rescue excavation report; Silver Street/Bridge Street, Gainsborough, Lincolnshire*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Clay, C. 2004. *Archaeological watching brief report: Home Farm, Laughterton, Lincolnshire*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Clay, C. 2007. *Archaeological evaluation by trial trenching: The Becket School, Gainsborough, Lincolnshire*. Lincoln: Allen Archaeology. Unpublished report.

Clay, C. 2011. *Archaeological watching brief report; Plot 2, Main Street, Torksey, Lincolnshire*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Cole, R. E. G. 1906. The royal borough of Torksey, its churches, monasteries and castle. *Associated Architectural Societies Reports and Papers*. Vol 29: 451-530.

Coles, B. 1992. Further thoughts on the impact of beaver in temperate landscapes. IN S. Needham and M.G. Macklin, eds. *Alluvial Archaeology*. 93-99.

Conway, M. 2001. Stow Park Farm, Stow, Lincolnshire: An archaeological desk-based assessment. Birmingham: Birmingham University Field Archaeology Unit. Unpublished report.

Conway, V. 1954. Stratigraphy and pollen analysis of southern Pennine blanket peats. *Journal of Ecology*. 42(1): 117-147

Coople, G., and Lemdahl, G. 1995. Regional differences in the Lateglacial climate of northern Europe based on coleopteran analysis. *Journal of Quaternary Science*. 10: 391-395.

Cooper, T. 2008. *Laying the Foundations: A history and archaeology of the Trent Valley sand and gravel industry*. CBA Research Report 159. York: Council for British Archaeology.

Cope-Faulkner, P. 2000. *Archaeological watching brief of development adjacent at Plot 2, Old Hall Farm, Fenton, Lincolnshire*. Sleaford: Archaeological Project Services. Unpublished report.

Cope-Faulkner, P. 2003a. *Archaeological watching brief on land at the former Bishop's Palace, Stow, Lincolnshire*. Lincoln: Archaeological Project Services. Unpublished report.

Cope-Faulkner, P. 2003b. *Desk-based assessment of the archaeological implications of proposed development at land at Littleborough Lane, Marton, Lincolnshire*. Lincoln: Archaeological Project Services. Unpublished report.

Cope-Faulkner, P. 2003c. *Desk-based assessment of the archaeological implications of proposed development on land at Main Road, Laughterton, Kettlethorpe, Lincolnshire*. Lincoln: Archaeological Project Services. Unpublished report.

Cope-Faulkner, P. 2004. *Archaeological watching brief at Main Street, Fenton, Lincolnshire*. Lincoln: Archaeological Project Services. Unpublished report.

Cope-Faulkner, P. 2005. *Archaeological watching brief of water and drainage works at St Helen's Church, Willingham by Stow, Lincolnshire*. Lincoln: Archaeological Project Services. Unpublished report.

Cope-Faulkner, P., and Taylor, G. 2003. *Building appraisal and desk-based assessment of the archaeological implications of proposed flood defence works on land at Morton Corner, Gainsborough, Lincolnshire*. Lincoln: Archaeological Project Services. Unpublished report.

Cope-Faulkner, P., and Taylor, G. 2004 *Archaeological watching brief and building recording at the river edge and former Floss Laundry, Morton Corner, Gainsborough, Lincolnshire*. Lincoln: Archaeology Project Services. Unpublished report.

Copley, G. 1986. *Archaeology and Place-Names in the Fifth and Sixth Centuries*. Oxford: British Archaeological Report British Series 147.

Courty, M., Goldberg, P., and Macphail, R. 1989. *Soils and Micromorphology in Archaeology*. Cambridge Manuals in Archaeology. Cambridge: Cambridge University Press.

Cowley, D., Standring, R., and Abicht, M., eds. 2010. *Landscapes through the Lens: Aerial Photographs and Historic Environment*. Occasional Publication of the Aerial Archaeology Research Group No. 2. Oxford: Oxbow Books.

Cox, B. 1994. The Pattern of Old English *burh* in early Lindsey. *Anglo-Saxon England*. Vol. 23: 35-56.

Crowther, J. 2003. Potential magnetic susceptibility and fractional conversion studies of archaeological soils and sediments. *Archaeometry*. 45(4): 685-701

Crutchley, S. and Crow, P. 2009. *The Light Fantastic: Using airborne laser scanning in archaeological survey.* Swindon: English Heritage.

Dark, P. 2000. *The Environment of Britain in the First Millennium AD*. London: Duckworth.

Davies, G. 2007. *Identification and Quantification of Projects Arising from Aggregates Extraction: Pilot Study, Derbyshire Nottinghamshire, Oxfordshire*. Aggregates Levy Sustainability Fund. ARCUS Repot 1069.1. Sheffield: ARCUS. Unpublished report.

Dincauze, D. 2000. *Environmental Archaeology: Principles and Practice*. Cambridge: Cambridge University Press.

Dinnin, M. 1997. Holocene beetle assemblages from the Lower Trent floodplain at Bole Ings, Nottinghamshire, UK. In A. Ashworth, P. Buckland and J. Sadler. eds. *Studies in Quaternary Entomology. An inordinate fondness for insects*. 83-104.

Doherty, C. 1998. The Vikings in Ireland: A Review. In H. Clarke, M. Mhaonaigh and R. O'Floinn. eds. *Ireland and Scandinavia in the Early Viking Age.* Dublin: Four Courts Press.

Dolley, R. H. M., and Strudwick, J. S. 1956. A note on the mint of Torksey and on some early finds of English coins from Nottinghamshire. *Numismatic Chronicle*. 16: 293-302.

Donoghue, D. 2002. *Lady Godiva: A Literary History of the Legend*. Hoboken: Wiley-Blackwell.

Douglas, T. 1982. Periglacial involutions and the evidence for coversands in the English Midlands. *Proceedings of the Yorkshire Geological Society.* 44: 131-143

Duller, G.A.T. 2004. Luminescence dating of Quaternary sediment: recent advances. *Journal of Quaternary Science*. 19(2): 183-192

Duller, G.A.T. 2008a. *Luminescence Dating: guidelines on using luminescence dating in archaeology.* Swindon: English Heritage

Duller, G.A.T. 2008b. Single-grain optical dating of Quaternary sediments: why aliquot size matters in luminescence dating. *Boreas*. 37: 589-612

Dyer, J. 1972. Earthworks of the Danelaw Frontier. In P. Fowler. ed. *Archaeology and the Landscape*. London: John Baker.

Dyer, J., and Jones, R. eds. 2010. *Deserted Villages Revisited*. Explorations in Local and Regional History, Vol. 3. Hatfield: University of Hertfordshire Press.

Edgeworth, M. 2008. The Tempsford Project: An Interim Report. *South Midlands Archaeology*. CBA South Midlands Group. Vol 38: 8-16.

Edmondson, G., and Mudd, A. 2004. Medieval occupation at "Danish Camp", Willington. *Bedfordshire Archaeology*. Vol 25: 208-221.

Edwards, K., and Borthwick, D. 2010. Peaceful wars and scientific invaders: Irishmen, Vikings and palynological evidence for the earliest settlement of the Faroe Islands. In J. Sheehan and D. O Corrain. eds. *The Viking Age: Ireland and the West*. Dublin: Four Courts Press. pp. 66-79.

Ekwall, E. 1960. *Studies on English Place-Names*. 4th edition. Oxford: Oxford University Press.

Elliott, L. 2004. *Archaeological Evaluation at Sturton le Steeple, Nottinghamshire*. Nottingham: Trent and Peak Archaeological Unit. Unpublished report.

Elliott, L and MacIntosh, A. 2005. *Fieldwalking and Geophysical survey of the proposed plant site at Sturton le Steeple, Nottinghamshire*. Nottingham: Trent and Peak Archaeological Unit. Unpublished report.

Eminson, T. 1934. *The Place-names of the West Riding of Lindsey, Lincolnshire*. Lincoln: J.R. Ruddock and Sons.

Evans, J. G. 1975. *The Environment of Early Man in the British Isles*. London: Book Club Associates.

Everson, P., and Stocker, D. 1999. *Corpus of Anglo-Saxon Sculpture: Volume V: Lincolnshire*. Oxford: Oxford University Press.

Everson, P., and Stocker, D. 2001. Baldwin Brown's 'sheels' at Great Hale (Anglo-Saxon Sculpture). *Lincolnshire Past & Present*. No. 42.

Everson, P.L., Taylor, C.C., and Dunn, C.J. 1991. *Change and Continuity: Rural Settlement in North-West Lincolnshire*. London: Royal Commission on the Historical Monuments of England.

Exley, C. L. 1970. *A History of the Torksey and Mansfield China Factories.* Lincoln: Keyworth and Fry Limited.

Fellows-Jensen, G. 1975. The Vikings in England: a review. *Anglo-Saxon England*. Vol 4: 181-206.

Fellows-Jensen, G. 1990. Place-names as a reflection of cultural interaction. *Anglo-Saxon England*. Vol. 19: 13-21.

Fellows-Jensen, G. 2001. In the steps of the Vikings. In J. Graham-Campbell, R. Hall, J. Jesch and D. Parsons. eds. *Vikings and the Danelaw: select papers from the proceedings of the thirteenth Viking congress, 21-30 August 1997. Nottingham and York.* Oxford: Oxbow Books. pp. 279-288.

Fellows-Jensen, G. 2010. Place-names as evidence for urban settlements in Britain in the Viking Period. In J. Sheehan and D. O Corrain. eds. *The Viking Age: Ireland and the West*. Dublin: Four Courts Press. pp. 89-96.

Field, N. 1989. *Castle Farm Torksey Geophysical Survey and Evaluation*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Field, N. 1990. *Castle Farm Torksey Exploratory Excavations*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Field, N. 1997a. *Land off Main Street, Torksey, Lincolnshire: Desk top study*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Field, N. 1997b. *Land to the rear of the Old Post Office, Main Street, Torksey, Lincolnshire: Desk top study*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Foot, S. 1999. Remembering, Forgetting and Inventing: Attitudes to the Past in England at the End of the First Viking Age (in Oral History, Memory and Written Tradition). *Transactions of the Royal Historical Society*, 6th Ser., Vol. 9: 185-200.

Ford, Rev. J. 1975. *The Town on the Street: Sturton-le-Steeple*. Retford: Whartons Ltd.

Frederick, C., Bateman, M., and Rogers, R. 2002. Evidence for eolian deposition in the sandy uplands of east Texas and the implications for archaeological site integrity. *Geoarchaeology*. 17(2): 191-217

Gainsborough Public Library. 1967. *Village History: Notes on some sources for the study of Lindsey villages*. Gainsborough: Local History Hand-List No. 2.

Galbraith, R., Roberts, R. 2012. Statistical aspects of equivalent dose and error calculation and display in OSL dating: an overview and some recommendations. *Quaternary Geochronology*. 11: 1-27

Gale, S., and Hoare, P. 2011. *Quaternary Sediments: Petrographic methods for the study of unlithified rocks*. 2nd edition. Caldwell, NJ: The Blackburn Press.

Gardiner, M., and Rippon, S. eds. 2007. *Medieval Landscapes: Landscape History after Hoskins*. Macclesfield: Windgather.

Gardner, R. 2003. *Wheelhouse Restaurant, Torksey: archaeological watching brief report*. Lincoln: Pre-Construct Archaeology. Unpublished Report.

Gardner, R. 2005a. *Land off Tillbridge Lane, Sturton by Stow, Lincolnshire*. Archaeological desk-based assessment. Lincoln: Pre-Construct Archaeology. Unpublished report.

Gardner, R. 2005b. *Land at Bridge Street/Hickman Street, Gainsborough, Lincolnshire*. Archaeological desk-based assessment. Lincoln: Pre-Construct Archaeology. Unpublished report.

Gardner, R. 2006a. *Land adjacent to the Bridge Hotel, Saxilby, Lincolnshire: Archaeological Assessment*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Gardner, R. 2006b. *Land adjacent to the Bridge Hotel, Saxilby, Lincolnshire: Archaeological Assessment*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Gardner, R., and Masters, P. 2003. *Caenby Corner to Gainsborough Pipeline: Archaeological watching brief and geophysical survey report*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Garrett, M. 2004. *Church End Farm, Stow, Lincolnshire: Archaeological watching brief*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Garrett, M., and Rowlandson, I. 2005. *Land to the rear of Rose Cottage, Main Road, Laughterton, Kettlethorpe, Lincs.: Archaeological watching brief*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Garton, D., Howard, A.J. and Pearce, M. 1996. Neolithic riverside ritual? Excavations at Langford Lowfields, Nottinghamshire. In R.J.A. Wilson ed. *From River Trent to Raqqa*. Nottingham: University of Nottingham. 9-11

Garton, D., Howard, A. J., and Priest, V. 2008. Archaeological Investigations at Langford Quarry, Nottinghamshire 1995-6. *Tarmac Papers*. 1: 29-40

Garton, D., and Kinsley, G. 1996. Highlights from Trent and Peat Archaeological Trust, 1996. *Transactions of the Thoroton Society of Nottinghamshire*. 100: 157-159

Garton, D., Priest, V., Ward, A. 2000. Besthorpe Quarry. *Transactions of the Thoroton Society of Nottinghamshire*. 104: 151-152

Gaunt, G., Loveluck, C., and Cameron, K. 2007. Environment and Landscape in the Anglo-Saxon Period. In C. Loveluck. ed. *Rural Settlement, Lifestyles and Social Changes in the Later First Millennium AD: Anglo-Saxon Flixborough in tis Wider Context*. Excavations at Flixborough Volume 4. Oxford: Oxbow.

Gelling, M. 1997. *Signposts to the Past*. 3rd edition. Chichester: Phillimore.

Geophysical Surveys of Bradford. 1995. *Report of geophysical survey: Torksey Lincolnshire*. Bradford: Geophysical Surveys of Bradford. Unpublished report.

George, L. 1992. *A study of some Quaternary periglacial fluvio-aeolian sands and their modern analogues*. Unpublished PhD thesis. University of Nottingham.

Gerrets, D. 1995. The Anglo-Frisian relationship seen from an archaeological point of view. In Faltings, V., Walker, A., and Wilts, O., eds. *Friesische Studien III*. Odense: Odense University Press. 119-128.

Gibbons, M. 2004. The Longphort Phenomenon: In Early Christian and Viking Ireland. *History Ireland*. Vol 12, No. 3: 19-23.

Gilbert, D. J. 1996a. *Report on the watching brief conducted at Rampton, North Nottinghamshire March-July 1996*. Nottingham: Trent and Peak Archaeological Trust. Unpublished report.

Gilbert, D. J. 1996b. *Report on the archaeological watching brief on the line of two pipelines across the late Iron-Age and Romano-British site at Rampton, Nottinghamshire, March-June 1996*. Nottingham: Trent and Peak Archaeological Trust. Unpublished report.

Goddard, A. 1902. The Danish Camp on the Ouse near Bedford. *Saga book of the Viking Club*. Vol. 3: 331-337.

Goldberg, P., and Macphail, R. 2006. *Practical and Theoretical Geoarchaeology*. Malden: Blackwell.

Golding. K., Simpson, I., Schofield, E., and Edwards, K. 2011. Norse-Inuit Interaction and Landscape Change in Southern Greenland? A Geochronological, Pedological, and Palynological Investigation. *Geoarchaeology*. Vol 26. No. 3: 315-345.

Goudie, A., Livingstone, I., and Stokes, S. eds. 1999. *Aeolian Environments, Sediments and Landforms*. Chichester: John Wiley and Sons

Graham-Campbell, J. 1980. *The Viking World*. London: Book Club Associates.

Graham-Campbell, J., Hall, R., Jesch, J., and Parsons, D. eds. 2001. *Vikings and the Danelaw: select papers from the proceedings of the thirteenth Viking congress. 21-30 August 1997. Nottingham and York.* Oxford: Oxbow Books.

Green, F.M.L., 1996. *Pollen analysis from an infilled meander of the River Trent, Girton Quarry, Nottinghamshire*. Trent and Peak Archaeological Trust. Unpublished report.

Green, T. 2012. *Britons and Anglo-Saxons: Lincolnshire AD 400-650*. Studies in the History of Lincolnshire. Lincoln: History of Lincolnshire Committee

Grierson, P., Harvey, Y., Metcalf, D., and Pagan, H. 1986. Other coins of the Anglo-Saxon period from Repton. In: M. Blackburn. ed. *Anglo-Saxon Monetary History*. Leicester: University of Leicester Press. pp. 124-132.

Grimm, E. 1993. *Tilia and Tilia*Graph programmes*. Springfield: Illinois State Museum.

GSB Prospection. 2001. *Stow Park Farm, Stow, Lincolnshire: Geophysical survey report 2001/118*. Bradford: GSB. Unpublished report.

Hadley, D. 2000, *The Northern Danelaw: Its Social Structure,* c. *800-1100*. Studies in the Early History of Britain. London: Leicester University Press.

Hadley, D. 2006. *The Viking in England: Settlement, Society and Culture*. Manchester: Manchester University Press.

Hadley, D., and Richards, J. D. eds. 2000. *Cultures in Contact: Scandinavian Settlement in England in the ninth and Tenth Centuries*. Studies in the Early Middle Ages, 2. Turnhout: Brepols.

Hadley, D., and Ten Harkel, L. eds. 2013. *Everyday Life in Viking-Age Towns: Social Approaches to Towns in England and Ireland,* c. *800-1100.* Oxford: Oxbow.

Hall, R. 1989. The Five Boroughs of the Danelaw: a review of present knowledge. *Anglo-Saxon England*. Vol 18: 149-206.

Hall, R. 2001. Anglo-Scandinavian urban development in the East Midlands, in J. Graham-Campbell, R. Hall, J. Jesch and D. Parsons. eds. *Vikings and the Danelaw: select papers from the proceedings of the thirteenth Viking congress*. *21-30 August 1997. Nottingham and York*. Oxford: Oxbow Books. pp. 105-124.

Hall, R. 2012. *Exploring the World of the Vikings*. London: Thames and Hudson.

Hall, R. and Williams, G. Forthcoming. *ARSNY.* Monograph for Medieval Archaeology.

Hamilton, L. 2008. *Archaeological field evaluation report: Land north of disused railway, Torksey, Lincolnshire*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Halpin, A. 2010. Weapons and warfare in Viking-Age Ireland in J. Sheehan, and D. O Corrain. eds. *The Viking Age: Ireland and the West*. Dublin: Four Courts Press. pp. 124-135.

Hamerow, H. 1993. *Excavations at Mucking, Vol. 2: The Anglo-Saxon Settlement.* English Heritage Archaeological Report 21. Swindon: English Heritage.

Hamerow, H. 2002. *Early Medieval Settlement: The Archaeology of Rural Communities in North-West Europe 400-900.* Oxford: Oxford University Press.

Harris, L.E. 1953. *Vermuyden and the Fens*. London: Cleaver-Hume.

Harrison, S. 2013. Beyond *Longphuirt*? Life and Death in Early Viking-Age Ireland, in D. Hadley and L. Ten Harkel eds. *Everyday Life in Viking-Age Towns: Social Approaches to Towns in England and Ireland,* c. *800-1100.* Oxford: Oxbow.

Havelock, G., Carrot, J., Geary, B., Howard, A., Hall, A., Kenward, H., Marshall, P. 2002. *Component 11a: Extending and Protecting Palaeoenvironmental Data: Deposit Sampling*. Advancing the Agenda in Archaeology and Alluvium. York: Trent Valley Geoarchaeology.

Herbert, N. 1996. *Archaeological watching brief for a development at Old Hall Farm, Fenton, Lincolnshire*. Sleaford: Archaeological Project Services. Unpublished report.

Hicks, S. 1971. Pollen-Analytical Evidence for the Effect of Prehistoric Agriculture on the Vegetation of North Derbyshire. *New Phytologist*. Vo. 70. No. 4: 647-667.

Higham, N., and Ryan, M., eds. 2010. *The Landscape Archaeology of Anglo-Saxon England.* The Manchester Centre for Anglo-Saxon Studies. Woodbridge: Boydell.

Higham, N, and Ryan, M., eds. 2011. *Place-Names, Language and the Anglo-Saxon Landscape*. The Manchester Centre for Anglo-Saxon Studies Vol. 10. Woodbridge: Boydell.

Hilberg, V. 2008. Hedeby: an outline of its research history. In Brink, S., and Price, N., eds. 2008 *The Viking World*. London: Routledge. pp. 101-111.

Hill, L. 2007. *Land at 51-53 North Street, Gainsborough, Lincolnshire*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Hill, L. 2008. *Land at Carlisle Street, Gainsborough, Lincolnshire: archaeological evaluation*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Hines, J., Lane, A. and Redknap, M. eds. 2004. *Land, Sea, and Home: Settlement in the Viking Period*. Society for Medieval Archaeology Monograph 20. Leeds: Maney.

Hodgson, J. 1978. *Soil sampling and soil description*. Oxford: Clarendon Press.

Holland, S. 1975. Pollen analytical investigations at Crosby Warren, Lincolnshire, in the vicinity of the Iron Age and Romano-British settlement of Dragonby. *Journal of Archaeological Science*. Vol. 2, Issue 4: 353-363.

Hooke, D. 2010. *Trees in Anglo-Saxon England*. Woodbridge: The Boydell Press.

Hosfield, R., and Chambers, J. 2005. Pleistocene geochronologies for fluvial sedimentary sequences: an archaeologist's perspective. *Journal of Quaternary Science*. 20(3): 285-296.

Hoskins, W. 1955. *The Making of the English Landscape*. London: Hodder and Stoughton.

Howard, A. 2001. The Regional Fluvial Record. In M. Bateman, P. Buckland, C. Frederick and N. Whitehouse. *The Quaternary of East Yorkshire and North Lincolnshire Field Guide*. London: Quaternary Research Association.

Howard, A. 2004. Geoarchaeological analysis, in Elliott, 2004, *Archaeological Evaluation at Sturton le Steeple, Nottinghamshire*. Nottingham: Trent and Peak Archaeological Unit.

Howard, A. 2005. The contribution of geoarchaeology to understanding the environmental history and archaeological resources of the Trent Valley, UK. *Geoarchaeology*. 20(2): 93-107

Howard, A.J., Bateman, M.D., Garton, D., Green, F.M.L., Wagner, P., and Priest, V. 1999. Evidence of Late Devensian and early Flandrian processes and environments in the Idle Valley at Tiln, North Nottinghamshire. *Proceedings of the Yorkshire Geological Society*. 52: 383–393

Howard, A., Carney, J., Greenwood, M., Keen, D., Mighall, T., O'Brien, C. and Tetlow, E. 2011. The Holme Pierrepont sand and gravel and the timing of Middle and Late Devensian floodplain aggradation in the English Midlands. *Proceedings of the Geologists' Association*. 122: 419-431

Howard, A., Bridgland, D., Knight, D., McNabb, J., Rose, J., Schreve, D., Westaway, R., White, M., and White, T. 2007. The British Pleistocene fluvial archive: East Midlands drainage evolution and human occupation in the context of the British and NW European record. *Quaternary Science Reviews*. 26: 2724-2737

Howard, A., and Knight, 2001. *South Ings Close, Rampton, Nottinghamshire: Auger survey of the floodplain deposits for LaFarge Aggregates Ltd.* Nottingham: Trent and Peak Archaeological Unit. Unpublished report.

Howard, A., and Macklin, M. 1999. A generic geomorphological approach to archaeological interpretation and prospection in British river valleys: a guide for archaeologists investigating Holocene landscapes. *Antiquity*. 73: 527-541

Howard, A S., Warringon, G., Ambrose, K., and Rees, J. 2008. *A formational framework for the Mercia Mudstone Group (Triassic) of England and Wales*. National Geoscience Framework Programme. Research report RR/08/04. Keyworth: British Geological Survey.

Howard, A. S. 2003. The Permo-Triassic rocks of Nottingham. *The geology of the East Midlands.* Geologists' Association Guide. No. 63: 80-91

Hudson-Edwards, K., Havelock, G., and Howard, A. J. 2002. Extending and Protecting Palaeoenvironmental Data: The Sourcing of Alluvial Sediment within the Trent Valley. In *Advancing the Agenda in Archaeology and Alluvium. Component 11c*. York: Trent Valley Geoarchaeology.

Hughes, P., Mauquoy, D., Barber, K., and Langdon, P. 2000. Mire-development pathways and palaeoclimatic records from a full Holocene peat archive at Walton Moss, Cumbria, England. *The Holocene*. 10(4): 465-479

Hunter, J., and Ralston, I. 1999. *The Archaeology of Britain: an Introduction from the Upper Palaeolithic to the Industrial Revolution*. London: Routledge

Hurley, M. 2010. Viking elements in Irish towns: Cork and Waterford. In J. Sheehan and D. O Corrain. eds. *The Viking Age: Ireland and the West*. Dublin: Four Courts Press. pp. 154-164.

Insley, J. 2002. The study of Old English personal names and anthroponymic lexika. In D. Geuenich, W. Haubrichs, and J. Jarmut, eds. *Person and Name*. Berlin: Walter de Gruyter and Co. 148-76.

James, N. D. G. 1981. *A History of English Forestry*. Oxford: Basil Blackwell.

James, T. 2000. Place names, saints, and the Saxon landscape. *East Midland Historian*. Vol. 10: 23-30.

Jarvis, M. 1999. *St. Helen's Church, Lea, Nr Gainsborough, Lincolnshire: Archaeological watching brief*. Lincoln: City of Lincoln Archaeology Unit. Unpublished report.

John Samuels Archaeological Consultants. 1993. *An archaeological assessment of land for proposed golf course at Thonock, Gainsborough, Lincolnshire*. Newark: John Samuels Archaeological Consultants. Unpublished report.

John Samuels Archaeological Consultants. 1995a. *A watching brief at Gainsborough Golf Club, Thonock Hall, Lincolnshire*. Newark: John Samuels Archaeological Consultants. Unpublished report.

John Samuels Archaeological Consultants. 1995b. *An archaeological evaluation of the area of proposed new lakes at Gainsborough Golf Course Thonock, Gainsborough, Lincolnshire*. Newark: John Samuels Archaeological Consultants. Unpublished report.

John Samuels Archaeological Consultants. 1998. *An archaeological desk-based assessment of Land off Ropery Road, Gainsborough*. Newark: John Samuels Archaeological Consultants. Unpublished report.

Johnson, A. E. 1998. *Land at Lea, Gainsborough, Lincolnshire: Topsoil magnetic susceptibility and gradiometer survey*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Johnson, A. E. 2000. *Land at Torksey, Lincolnshire: Topsoil magnetic susceptibility and magnetometer survey*. Oxford: Oxford Archaeotechnics. Unpublished report.

Johnson, S. 1996a. *Archaeological watching brief report: Rectory Farm, Lea, Lincolnshire.* Lincoln: Pre-Construct Archaeology. Unpublished report.

Johnson, S. 1996b. *Archaeological watching brief report: Saxilby to Sturton by Stow Pipeline Project, Lincolnshire*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Johnson, S. 1997a. *Archaeological watching brief report: Gables Manor, Ingleby, Lincolnshire*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Johnson, S. 1997b. *Monitoring of excavation near and irrigation lagoon, Lincoln Golf Club, Torksey, Lincolnshire, Archaeological Watching Brief*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Johnson, S., and Palmer-Brown, C. 1997. *Archaeological watching brief report: Lincoln Golf Club, Torksey, Lincolnshire*. Lincoln: Pre-Construct Archaeology. Unpublished Report.

Jones, D. ed. 2002. *Environmental Archaeology: A guide to the theory and practice of methods, from sampling and recovery to post-excavation*. Swindon: English Heritage.

Jones, H., and Knight, D. 2002. An Anglo-Saxon Seax from Rampton, Nottinghamshire. *Transactions of the Thoroton Society of Nottinghamshire*. 106: 41-47

Jones, R., and Page, M. 2006. *Medieval Villages in an English Landscape: Beginnings and Ends*. Macclesfield: Windgather Press.

Kelly, E. 1995. Vikings on the Barrow: Dunrally Fort, a possible Viking *Longphort* in County Laois. In *Archaeology Ireland*. Vol. 9. No. 3. Issue No. 33: 30-33.

Kelly, E. 1998. A Viking *longphort* near Athlunkard, Co. Clare. In *Archaeology Ireland*. Vol 12. No. 4. Issue No. 46: 13-16

Kendrick, T. D. 1937. Maps Illustrating the Viking Invasions of England. In *Saga Book of the Viking Society*. Vol. XI: 61-70.

Kent, P. K. 1980. *Eastern England from the Tees to The Wash*. London: Her Majesty's Stationery Office

Ketteringham, J. 1993. Theses and Dissertations based on Lincolnshire Research Subjects. *East Midlands Historian*. Vol. 3. pp. 45-53

Keynes, S. and Lapidge, M. eds. and trans. 1983. *Alfred the Great, translation of Asser's Life of King Alfred*. London: Penguin.

Kinsley, G. 1998. Interim report on archaeological watching-briefs and excavations at Girton Quarry extension 1997-8. *Tarmac Papers*. 2: 41-49

Knight, D. 2000. *An Iron Age and Romano-British Settlement at Moor Pool Close, Rampton, Nottinghamshire.* Nottingham: Trent and Peak Archaeological Unit. Unpublished report.

Knight, D., and Beswick, P. 2000. A possible beaker burial at Rampton, Nottinghamshire. *Transactions of the Thoroton Society of Nottinghamshire*. 104: 14-20

Knight, D., and Howard, A. 1995. *Archaeology and Alluvium in the Trent Valley*. Revised ed. Nottingham: Trent and Peak Archaeological Trust.

Knight, D., and Howard, A. 2004. *Trent Valley Landscapes*. Trent Valley Geoarchaeology Group. Norfolk: Heritage Marketing and Publications Ltd.

Knight, D., and Spence, U. 2013. *Aggregates and Archaeology in Nottinghamshire*. York: York Archaeological Trust.

Knight, D., and Vyner, B. 2006. *Making Archaeology Matter: Quarrying and Archaeology in the Trent Valley*. York: York Archaeological Trust.

Knight, D., Vyner, B., and Allen, C. 2012. *East Midlands Heritage: An Updated Research Agenda and Strategy for the Historic Environment of the East Midlands*. University of Nottingham and York Archaeological Trust. Buxton: Buxton Press.

Langdon, P., Barber, K., Hughes, P. 2003. A 7500 year peat-based palaeoclimatic reconstruction and evidence for an 1100 year cyclicity in bog surface wetness from Temple Hill Moss, Pentland Hills, southeast Scotland. *Quaternary Science Reviews*. 22: 259-274

Lapwing Consultants. 2010. *Ecological Survey: Proposed Green Burial Ground, Marton, Gainsborough*. Horncastle: Lapwing Consultants. Unpublished report.

Large, A., and Petts, G. 1996. Historical channel-floodplain dynamics along the River Trent: implications for river rehabilitation. *Applied Geography*. 16(3): 191-209

Leahy, K. 1993. The Anglo-Saxon Settlement of Lindsey. In A. Vince ed. *Pre-Viking Lindsey*. Lincoln Archaeological Studies: No. 1. Lincoln: City of Lincoln Archaeology Unit.

Leahy, K. 2007. *Anglo-Saxon Kingdom of Lindsey*. Stroud: Tempus.

Leahy, K., and Paterson, C. 2001. New light on the Viking presence in Lincolnshire: the artefactual evidence. In J. Graham-Campbell, R. Hall, J. Jesch and D. Parsons. eds. *Vikings and the Danelaw: select papers from the proceedings of the thirteenth Viking congress*. *21-30 August 1997*. *Nottingham and York*. Oxford: Oxbow Books. pp. 181-202.

Leonard, A. Forthcoming. *Nested Negotiations: Landscape and portable material culture in Viking-Age England*. University of York. Unpublished PhD thesis.

Lewin, J. 2010. Medieval environmental impacts and feedbacks: the lowland floodplains of England and Wales. *Geoarchaeology*. 25(3): 267-311

Lewin, J., Macklin, M., and Johnstone, E. 2005. Interpreting alluvial archives: sedimentological factors in the British Holocene fluvial record. *Quaternary Science Reviews*. 24: 1873-1889

Lewis, C., Mitchell-Fox, P., and Dyer, C. 1997. *Village Hamlet and Field: Changing Medieval Settlements in Central England*. Manchester: University of Manchester Press.

Lillie, M. and Neumann, H. 1998. Introduction to the palaeoenvironmental survey. In R. Van de Noort and S. Ellis. eds. *Wetland Heritage of the Ancholme and Lower Trent valleys*. Hull: Humber Wetlands Project, University of Hull.

City of Lincoln Archaeology Services. 2001. *Plot 1, Crowgarth Lane, Lea, Nr Gainsborough, Lincolnshire: Archaeological watching brief.* Lincoln: City of Lincoln Archaeology Unit. Unpublished report.

Lindsey Archaeological Services. 1990. *Hume Arms Caravan Park Torksey Geophysical Survey and Evaluation*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Lindsey Archaeological Services. 1992. *Gainsborough watermains relay, Gladstone St, Morley St, Cobden St, Bright St, and Lord St archaeological watching brief*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Lindsey Archaeological Services. 1995a. *Land off Knaith Hill, Knaith: Archaeological watching brief.* Lincoln: Lindsey Archaeological Services. Unpublished report.

Lindsey Archaeological Services. 1995b. *Manor Farm, High Street, Marton: Archaeological watching brief*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Lindsey Archaeological Services. 1995c. *Land adjacent to Corner House Farm, Knaith: Archaeological watching brief*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Lindsey Archaeological Services. 1996. *Compak Systems Site, Trinity Street, Gainsborough: archaeological desk top study*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Lindsey Archaeological Services. 1999a. *New Medical Centre, Torksey, Lincolnshire: Archaeological evaluation.* Lincoln: Lindsey Archaeological Services. Unpublished report.

Lindsey Archaeological Services. 1999b. *Land to the rear of 35 Gainsborough Road, Lea, Lincolnshire: Archaeological evaluation.* Lincoln: Lindsey Archaeological Services. Unpublished report.

Lindsey Archaeological Services. 2000. *Land adjacent to 27 Gainsborough Road, Lea, Lincolnshire.: Archaeological watching brief.* Lincoln: Lindsey Archaeological Services. Unpublished report.

Livingstone, I., and Warren, A. 1996. *Aeolian Geomorphology*. Harlow: Addison Wesley Longman Limited

Lomax, J., Hilgers, A., Twidale, C., Bourne, J., and Radtke, U. 2007. Treatment of broad palaeodose distributions in OSL dating of dune sands from the western Murray Basin, South Australia. *Quaternary Geochronology*. 2: 51-56

Lord, J., and MacIntosh, A. 2011. *The Historic Character of the County of Lincolnshire*. English Heritage Project No. 4661 Main. Lincoln: English Heritage and Lincolnshire County Council

Losco-Bradley, S., and Kinsley, G. eds. 2002. *Catholme: An Anglo-Saxon Settlement on the Trent Gravels in Staffordshire*. Nottingham: University of Nottingham

Losco-Bradley, S., and Salisbury, C. R. 1979. A medieval fish weir at Colwick Nottinghamshire. *Transactions of the Thoroton Society Nottingham*. Vol. 83: 15-22.

Losco-Bradley, S., and Wheeler, H.M. 1984. Anglo-Saxon Settlement in the Trent Valley: some aspects. In M. Faull. *Studies in Late Anglo-Saxon Settlement*. Oxford: Oxford University. Pp.101-114.

Lowe, J., and Walker, M. 1984. *Reconstructing Quaternary Environments*. Harlow: Addison Wesley Longman Limited.

Loyn, J. 1977. *The Vikings in Britain*. London: Batsford.

Lucy, S. 1998. *The Early Anglo-Saxon Cemeteries of East Yorkshire*. Oxford: British Archaeological Reports British Series No. 272.

Maarleveld, G. 1960. Wind direction and coversands in The Netherlands. *Biuletyn Peryglacjalny*. 8: 49-58

Maas, J. 2008. Longphort, Dun, and Dunad in the Irish Annals of the Viking Period. *Peritia* Vol. 20: 257-275.

Macklin, M., Jones, A., and Lewin, J. 2010. River response to rapid Holocene environmental change: evidence and explanation in British catchments. *Quaternary Science Reviews*. 29: 1555-1576

Macklin, M., Passmore, D., and Rumsby, B. 1997. Climatic and cultural signals in Holocene alluvial sequences. In A. G. Brown. *Alluvial Geoarchaeology*. Cambridge: Cambridge University Press

Macphail, R. 2010. Dark earth and insights into changing land use of urban areas. In Speed, G., Sami, D., eds. *Debating Urbanism: Within and Beyond Walls c. AD 300 to c. AD 700*. Leicester: Leicester Archaeology.

Maull, A., and Chapman, A. 2005. *A Medieval Moated Enclosure in Tempsford Park*. Bedford Archaeology Monograph 5. Northampton: Northampton Archaeology, Northamptonshire County Council, and Bedfordshire Archaeological Council.

Mauquoy, D., and Barber, K. 1999. A replicated 3000 year proxy-climate record from Coom Rigg Moss and Felecia Moss, the Border Mires, northern England. *Journal of Quaternary Science*. 14(3): 263-275.

Mawer, A., and Stenton, F. 1924. *Introduction to the Survey of English Place-Names Part I*. English Place-Name Society. Vol. 1 Part 1. Cambridge: University of Cambridge Press.

McDaid, M. 2007. *St Mary's Church, Stow, Lincolnshire: Archaeological watching brief*. Lincoln: Lindsey Archaeological Services. Unpublished report.

McDaid, M., and Young, D. 2005. *Torksey Common: Land forming part of the Hume Arms Caravan Park, Torksey, Lincs. Archaeological watching brief*. Lincoln: Lindsey Archaeological Services. Unpublished report.

McDonnell, G., and McIlwaine, J. 2006. *North Lincolnshire Coversands Research Project*. ASLF/PD 3548. Bradford: University of Bradford. Unpublished report.

McElearney, G. 1991. *Pollen Analysis from Scaftworth Roman Road Excavations, 1991*. Sheffield: University of Sheffield Archaeological Services. Unpublished report.

McIlwaine, J. and McDonnell, G. 2006. *North Lincolnshire Coversands Research Project*. University of Bradford. Final project report for English Heritage.

McLeod, S. 2006. Feeding the *micel here* in England c. 865-878. *Journal of Australian Early Medieval Association*. Vol. 2. Accessed online 4 May 2012.

McLeod, S. 2014. *The Beginnings of Scandinavian Settlement in England: The Viking 'Great Army' and Early Settlers,* c. *865-900*. Turnhout: Brepols.

Middleton, R., Wells, C.E., and Huckerby, E. 1995. *The Wetlands of North Lancashire*. Lancaster University Archaeological Unit. Lancaster: Lancaster Imprints.

Mike Jarvis Archaeological Services. 2005. *Land between North Street and Church Street, Gainsborough. Archaeological Watching Brief*. Lincoln: Mike Jarvis Archaeological Services. Unpublished report.

Milek, K. 2006. *Houses and Households in Early Icelandic Society: Geoarchaeology and the interpretation of Social Space*. University of Cambridge. Unpublished PhD Thesis.

Milek, K. 2009. Micrmorphological analysis. In S. Lucy, J. Tipper, and A. Dickens eds. *The Anglo-Saxon Settlement and Cemetery at Bloodmoor Hill, Carlton Colville, Suffolk.* East Anglian Archaeology Reports. Vol. 131: 152-161.

Milek, K. 2012a. The roles of pit houses and gendered spaces on Viking-Age farmsteads in Iceland. *Medieval Archaeology*. Vol. 56: 85-130.

Milek, K. 2012b. Floor formation processes and the interpretation of site activity areas: an ethnoarchaeological study of turf buildings at Thverá, northeast Iceland. *Journal of Anthropological Archaeology*. Vol. 31, 2: 119-137

Moor, C. Rev. 1904. *A History of Gainsborough*. Gainsborough: C. Caldecott.

Moore, P., and Taylor-Wilson, R. 2008. *Archaeological Watching brief on land at West Burton Power Station, District of Bassetlaw, Nottinghamshire.* Durham: Pre-Construct Archaeology. Unpublished report.

Moore, P.D., Webb, J.A. & Collinson, M.E. 1991. *Pollen Analysis* (2nd. ed). Oxford: Blackwell.

Morgan, P., and Thorn, C., eds. and trans. *Domesday Book 31: Lincolnshire*. Chichester.

Morley, C. 1919. A Norse Camp at Brandon, Suffolk'. In *Saga Book of the Viking Society*. Vol. X: 264-266.

Mosse, J., Oliver, C., and Malcolm, A. 2014. *Waterways Guide: Nottingham, York and the North East*. Glasgow: Nicholson.

Muñoz-Salinas, E., Bishop, P., Zamorano, J., and Sanderson, D. 2012. Sedimentological processes in lahars: Insights from optically stimulated luminescence analysis. *Geomorphology*. 136: 106-113

Munyikwa, K., Brown, S., Kitabwalla, Z. 2012. Delineating stratigraphic breaks at the bases of postglacial eolian dunes in central Alberta, Canada using a portable OSL reader. *Earth Surface Processes and Landforms*.

Murray, A., and Wintle, A. 2000. Luminescence dating of quartz using an improved single-aliquot regenerative-dose protocol. *Radiation Measurements* 32: 57-73

Murton, J., Bateman, M., and Dinnin, M. 2001. Yarborough Quarry. In M. Bateman, P. Buckland, C. Frederick and N. Whitehouse. eds. *The Quaternary of East Yorkshire and North Lincolnshire*. London: Quaternary Research Association. 113-126

Mutschmann, H. 1913. *The Place-Names of Nottinghamshire, their Origin and Development.* Cambridge: Cambridge University Press.

Myers, J. 1951. The Anglo-Saxon Pottery of Lincolnshire. *Archaeological Journal*. Vol. 108. pp 88-99.

Needham, S., and Macklin, M. eds. 1992. *Alluvial Archaeology in Britain*. Oxford: Oxbow Books

Nottinghamshire County Council. 2005. *Minerals and Waste Planning: Local development framework*. <http://www.nottinghamshire.gov.uk/thecouncil/democracy/planning/local-development-framework/> Accessed March 2013. Nottingham.

Oswald, A. 1937. *The Roman Pottery Kilns at Little London, Torksey*. Wellow, Notts.: Published by the author.

Page, W. ed. 1906. *Victoria History of the County of Lincoln*. Vol. II. London: Constable.

Page, M., and Jones, R. 2003. Characterizing Rural Settlement and Landscape: Whittlewood Forest in the Middle Ages. *Medieval Archaeology*. 47:53-83.

Palmer-Brown, C. 1994. *Bridge Street, Gainsborough: an archaeological watching brief*. Sleaford: Pre-Construct Archaeology. Unpublished report.

Palmer-Brown, C. 1995. *Castle Farm, Torksey: An archaeological excavation report*. Sleaford: Pre-Construct Archaeology. Unpublished report.

Palmer-Brown, C. and Allen, M. 2001. *Archaeological evaluation on proposed residential development: Castle Farm, Main Street, Torksey*. Lincoln: Pre-Construct Archaeology. Unpublished Report.

Pantos, A. 2003. 'On the edge of things': the boundary location of Anglo-Saxon assembly sites. *Anglo-Saxon Studies in Archaeology and History* 12. Oxford: Oxford University School of Archaeology. pp. 38-49.

Parker, A., Goudie, D., Anderson, E., Robinson, M., and Bonsall C. 2002. A review of the mid-Holocene elm decline in the British Isles. *Progress in Physical Geography*. 26(1): 1-45

Peachey, M. 2006. *Archaeological watching brief, Kettlethorpe-Hardwick overhead line, Lincolnshire.* Lincoln: Archaeological Project Services. Unpublished report.

Perry, G. Forthcoming. Torksey Pottery Industry.

Perry, G., Young, J., and Stein, S. 2012. *Torksey Test Pits 2011*. Sheffield: University of Sheffield. Unpublished report.

Pietsch, T. J. 2009. Optically stimulated luminescence dating of young (<500 years old) sediment: testing estimates of burial dose. *Quaternary Geochronology*. Vol. 4. Pp. 406-422.

Ponsford, M. W. 1992. A late Iron Age and Romano-British settlement at Rampton, Nottinghamshire. *Transactions of the Thoroton Society of Nottinghamshire*. 96: 91-119

Pounds, N. J. G. 2000. *A History of the English Parish*. Cambridge: Cambridge University Press.

Powlesland, D. 2003. *25 Years of Archaeological Research on the Sands and Gravels of West Heslerton, Yorkshire*. Colchester: Palladian Press.

Powlesland, D. 2014. Landscape Research Centre website. www.landscaperesearchcentre.org. Accessed 2/11/2014.

Pre-Construct Archaeology. 2011. *Land at the Junction of Bridge Street and Silver Street, Gainsborough.* Lincoln: Pre-Construct Archaeology. Unpublished report.

Pre-Construct Archaeology. 1996. *Archaeological field evaluation report: 'Verity', Church Lane, Torksey*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Preece, R., and Robinson, J. 1984. Late Devensian and Flandrian Environmental History of the Ancholme Valley, Lincolnshire: Molluscan and Ostracod Evidence. *Journal of Biogeography*. 11(4): 319-352.

Price, D. 1975. *The sand and gravel resources of the country around Newton on Trent, Lincolnshire*. Institute of Geological Sciences, Natural Environment Research Council. Mineral Assessment Report 15. London: HMSO.

Priest, V. 1998. *Generating Station Cottam: A report on Archaeological Investigations on behalf of Powergen.* Nottingham: Trent and Peak Archaeological Trust. Unpublished report.

Pullen, R. 2006. *Sandars Yard, Bridge Street, Gainsborough, Lincolnshire: Archaeological Watching Brief*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Rackham, J. ed. 1994. *Environment and Economy in Anglo-Saxon England*. York: Council for British Archaeology

Raffield, B. P. 2009. Plundering the Territories in the Manner of the Heathens: Identifying Viking Age battlefields in Britain. *Rosetta*. Vol 7: 22-34

Raffield, B. P. 2010. *Inside that fortress sat a few peasant men, and it was half-made: A Study of Viking Fortifications in the British Isles AD793-1066*. Unpublished MPhil dissertation, University of Birmingham.

Raffield, B. P. 2012a. *The Land of Hope and Glory: Assessing the Materiality of Viking-Age Conflict in England.* International Medieval Congress, 9 July. Leeds: University of Leeds.

Raffield, B. P. 2012b. Landscapes of Conflict: The Scandinavian Occupation of England. *Newsletter of the Society for Medieval Archaeology*. Issue 47: 9.

Raffield, B. P. 2013. Antiquarians, Archaeologys, and Viking Fortifications. *Journal of the North Atlantic*. No. 20: 1-29.

Recent work in Lincolnshire. 1997. *Lincolnshire History and Archaeology*. Vol. 32: 45-60.

Redmond, A. 2007. *Viking Burial in the North of England*. Oxford: British Archaeological Reports British Series No. 429.

Reynolds, A. 2003. Boundaries and Settlements in later Sixth to Eleventh-Century England. *Anglo-Saxon Studies in Archaeology and History* 12: 98-136. Oxford: Oxford University School of Archaeology.

Reineck, H. E., and Singh, I. B. 1980. *Depositional Sedimentary Environments.* Second edition. Berlin: Springer-Verlag.

Richards, J. D. 2004. Excavations at the Viking Barrow Cemetery at Heath Wood, Ingleby Derbyshire. *The Antiquaries Journal*, 84: 23-116.

Richards, J. D. 2000. *Viking Age England*. Stroud: Tempus.

Richards, J. D., and Naylor, J. 2010. The metal detector and the Viking Age in England. In J. Sheehan and D. O Corrain. eds. *The Viking Age: Ireland and the West. Papers from the Proceedings of the Fifteenth Viking Congress. 18-27 August 2005*. Cork. Dublin: Four Courts Press. pp. 338-352.

Richards, J. D., Jecock, M., Richmond, L., and Tuck, C. 1995. The Viking barrow cemetery at Heath Wood, Ingleby, Derbyshire. *Medieval Archaeology*. 39: 51-70.

Richardson, M. 2003. *Lyng and Athelney, Archaeological Assessment*. Somerset Extensive Urban Survey. Somerset County Council.

Riley, D., Buckland, P., Wade, J., Dearne, M., Hartley, B., Hartley K., Kinsley, T., O'Connor, T., Clarke, W., and Dickinson, B. 1995. Aerial reconnaissance and excavation at Littleborough-on-Trent, Notts. *Britannia*. 26: 253-284

Rivet, A., and Smith, C. 1979. *The Place Names of Roman Britain*. London: Batsford.

Roberts, B. 1987. *The Making of the English Village*. London: Longman

Roberts, B. 2007. The Village: Contexts, Chronology and Causes. In M. Gardiner and S. Rippon. eds. *Medieval Landscapes: Landscape History after Hoskins*. Macclesfield: Windgather. Pp. 73-88.

Rodnight, H. 2006. Developing a Luminesence Chronology for Late Quaternary Fluvial Change in South African Floodplain Wetlands. Unpublished PhD thesis. University of Wales

Roesdahl, E. 1987. *The Vikings*. London: Penguin Books.

Rose, J. 2010. The Quaternary of the British Isles: factors forcing environmental change. *Journal of Quaternary Science*. 25(4): 399-418

Rotherham, I. 2013. *The Lost Fens*. Stroud: The History Press.

Rowe, E. 2008. *Land to the north of the railway, Torksey, Lincolnshire*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Rowe, M. 2011. *Land off Main Street, Torksey, Lincolnshire*. Lincoln: Pre-Construct Archaeology. Unpublished.

Rowlandson, I. 2003. *Heapham Rd, Gainsborough, Lincolnshire: Archaeological watching brief*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Rowlandson, I. 2005. *Main Street, Torksey Lincolnshire: Archaeological watching brief*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Rowley, T. ed. 1974. *Anglo-Saxon Settlement and Landscape*. Oxford: British Archaeological Reports British Series No. 6

Russell, I. 2003. *Archaeological Excavation of Woodstown 6. N25 Waterford Bypass Archaeological Investigation Contract 1*. Archaeological Consultancy Services Limited.

Salisbury, C.R. 1992. The archaeological evidence for palaeochannels in the Trent Valley. In S. Needham and M. Macklin. eds. *Alluvial Archaeology in Britain*. Pp. 155-182.

Salisbury, C.R., Whitley, P.J., Litton, C.D., and Fox, J.L. 1984. Flandrian courses of the River Trent at Colwick, Nottinghamshire'. *Mercian Geologist*. 9(4): 189-207

Sanderson, D., and Murphy, S. 2010. Using simple portable OSL measurements and laboratory characterisation to help understand complex and heterogeneous sediment sequences for luminescence dating'. *Quaternary Geochronology*. 5: 299-305

Savage, S., and Brett, A. 2004. *Sure Start Centre, Heaton Street, Gainsborough. Archaeological Evaluation Report*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Savage, S., and Palmer-Brown, C. 2003. *Gainsborough Guildhall, Gainsborough, Lincolnshire: Archaeological trial excavation report*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Sawyer, P. 1998. *Anglo-Saxon Lincolnshire*. *A History of Lincolnshire, Vol. III*. Lincoln: Society of Lincolnshire History and Archaeology.

Sawyer, P. H. 1971. *The Age of the Vikings*. 2nd edition. London: Edward Arnold.

Saxilby Parish History. 2014. Saxilby and District History Group. <www.saxilbyhistory.org> Last accessed 30/11/2014.

Scaife, R., and Allen, M. 1999. A prehistoric vegetational history from the Trent Valley, near Cottam, Nottinghamshire. *Transactions of the Thoroton Society of Nottinghamshire*. 103: 15-23.

Schwenninger, J. L., Bridgland, D., Howard, A., and White, T. 2007. *Pleistocene Sediment from the Trent Valley: Optically Stimulated Luminescence Dating*. Research Department Report Series no. 57/2007. Swindon: English Heritage.

Selley, R. 1988. *Applied Sedimentology*. London: Academic Press.

Sheehan, J. 2008. The Longphort in Viking Age Ireland. *Acta Archaeologica*. Vol. 79: 282-295.

Shennan, I, and Horton, B. 2002. Holocene land- and sea-level changes in Great Britain. *Journal of Quaternary Science*. 17(5-6): 511-526

Sheehan, J. and O Corrain, D., eds. 2010 *The Viking Age: Ireland and the West. Papers from the Proceedings of the Fifteenth Viking Congress. 18-27 August 2005*. Cork. Dublin: Four Courts Press.

Sherlock, S., and Cox, P. 2009. *Results of archaeological evaluation by trial trenching at Knaith Park and Blyborough, Lincolnshire*. Hindon: AC Archaeology. Unpublished report.

Sindbaek, S. 2012. *Ring-Fenced Vikings: Scandinavian Army Camps and Defensive Tactics from Torksey to Trelleborg*. International Medieval Congress. 12 July. Leeds: University of Leeds

Simmons, I. 1969. Pollen diagrams from the North York Moors. *New Phytologist*. 69: 807-827

Simpson, L. 2010. The first phase of Viking activity in Ireland: archaeological evidence from Dublin. In J. Sheehan and D. O Corrain. eds. *The Viking Age: Ireland and the West. Papers from the Proceedings of the Fifteenth Viking Congress. 18-27 August 2005*. Cork. Dublin: Four Courts Press. pp. 418-429.

Simpson, I. A., Barrett, J. H., and Milek, K. B. 2005. Interpreting the Viking Age to Medieval Period Transition in Norse Orkney through Cultural Soil and Sediment Analyses. *Geoarchaeology*. Vol. 20 (4): 355-377.

Smart, P., Wheeler, A., and Willis, A. 1986. Plant and Peat Cuttings: Historical Ecology of a Much Exploited Peatland- Thorne Waste, Yorkshire, UK. *New Phytologist*. 104(4): 731-748

Smith, A. 1958 Post-Glacial deposits in South Yorkshire and North Lincolnshire. *New Phytologist*. 57(1): 19-49

Smith, B. 1910. Some recent changes in the course of the Trent. *The Geographical Journal*. 35(5): 568-577

Smith, C. 2007. *Cottam Wind Farm, Nottinghamshire: DBA and Field Walkover*. Llanidloes: Cambrian Archaeological Projects Ltd. Unpublished report.

Smith, E. G., Rhys, G. H., and Goossens, R. F. 1973. *Geology of the Country around East Retford, Worksop, and Gainsborough*. Memoirs of the Geological Survey of Great Britain. London: H.M.S.O.

Snee, J. 1999. *Archaeological watching brief report: Plot 1, Main Street, Torksey*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Snee, J. 2000a. *Archaeological watching brief on land adjacent to Terrace House Farm, Knaith, Lincolnshire.* Lincoln: Archaeological Project Services. Unpublished report.

Snee, J. 2000b. *Archaeological watching brief on land between Bridge Street and the River Trent, Gainsborough, Lincolnshire*. Lincoln: Archaeological Project Services. Unpublished report.

Soil Survey Staff. 1999. *Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys*. United States Department of Agriculture. Agriculture Handbook No 436.

Stamper, P. 2011. *Introduction to Heritage Assets: Medieval Settlements*. Swindon: English Heritage.

Stang, D., Rhodes, E., Heimsath, A. 2012. Assessing soil mixing processes and rates using a portable OSL-IRSL reader: preliminary determinations. *Quaternary Geochronology*. 10: 314-319

Stein, J. 1984. Organic matter and carbonates in archaeological sites. *Journal of Field Archaeology*. 11: 239-246

Stein, J. 1992. Organic matter in archaeological contexts. In Holliday, V. (ed) *Soils and Landscape Evolution*. Washington D. C.: Smithsonian Institution Press. 193-216.

Stein, S. 2013a. The geoarchaeology of Viking overwintering camps in England: preliminary results of a radiocarbon dated palynological sequence at Brampton in Torksey, Lincolnshire. *QN: Quaternary Newsletter*. Quaternary Research Association. 131: 51-54

Stein, S. 2013b. *Geoarchaeological report from Torksey, Lincolnshire, October 2011*. Sheffield: University of Sheffield. Unpublished report.

Stein, S. 2013c. *Geoarchaeological report from Torksey, Lincolnshire, 2012*. Sheffield: University of Sheffield. Unpublished report.

Stenton, F. M. 1943. *Anglo-Saxon England*. Oxford: Oxford University Press.

Streatfield, G. S. 1894. *Lincolnshire and the Danes*. London: Kegan Paul, Trench and Co.

Styles, T. 2001. Scandinavian elements in English place-names: some semantic problems. In J. Graham-Campbell, R. Hall, J. Jesch, and D. Parsons. eds. *Vikings and the Danelaw: select papers from the proceedings of the thirteenth Viking congress*. *21-30 August 1997. Nottingham and York*. Oxford: Oxbow Books. pp. 289-298.

Swanton, M. 2000. *The Anglo-Saxon Chronicles*. 2nd edition. London: Phoenix Press.

Swinnerton, H. H. and Kent, P.E. 1976. *The Geology of Lincolnshire* (2nd edn). Lincoln: Lincolnshire Naturalists' Union

Symonds, L. A. 2003. Territories in Transition: The Construction of Boundaries in Anglo-Scandinavian Lincolnshire. *Anglo-Saxon Studies in Archaeology and History* 12. Oxford: Oxford University School of Archaeology. pp. 28-37.

Tallis, J. 1964. Studies on Southern Pennine Peats: I. The general pollen record. *Journal of Ecology*. 52(2): 323-331

Tallis, J., and Switsur, V. 1973. Studies on Southern Pennine Peats: VI. A radiocarbon-dated pollen diagram from Featherbed Moss, Derbyshire. *Journal of Ecology*. 61(3): 743-751

Tann, G. 2003a. *20-32 Bridge Street, Gainsborough, Lincs.: Archaeological Desk-Based Assessment*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Tann, G. 2003b. *Development at Church Farm, Church Lane, Saxilby: Archaeological watching brief*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Taylor, C. 2010. The origins and development of deserted village studies. In C. Dyer, and R. Jones. *Deserted Villages Revisited*. Hatfield: Hertfordshire. Pp 1-7.

Taylor, H. M. 1987. St. Wystan's Church, Repton, Derbyshire: A Reconstruction Essay. *The Archaeological Journal*. Vol 144. pp. 205-145.

Taylor, H. M. 1989. *St. Wystan's Church, Repton: A guide and history*. Repton: St. Wystan's Church.

Ten Harkel, L. 2011. Land or Gold? Changing Perceptions of Landscape in Viking Age Lincolnshire. *Assemblage* Vol. 11: 15-33.

Thompson, S. 2002. *An archaeological watching brief during overhead line rebuild, Torksey-Newton on Trent, Lincolnshire*. Lincoln: Archaeological Project Services. Unpublished report.

Thompson, R., and Oldfield, F. 1986. *Environmental Magnetism*. London: Allen and Unwin.

Tilley, C. 1994. *A Phenomenology of Landscape*. Oxford: Berg.

Tipping, R. 2010. *Bowmont: An Environmental History of the Bowmont Valley and the Northern Cheviot Hills, 10,000 BC—AD2000*. Edinburgh: Society of Antiquaries of Scotland.

Todd, M. 1967. The Early Course of the Fosse Way: Kneeton to East Stoke. In *Transactions of the Thoroton Society of Nottinghamshire*. Vol. LXX: 11-13.

Tony Sumpter Archaeological Consultancy. 2002. *Land off Northolme, Gainsborough Lincolnshire: Archaeological Evaluation*. Retford: Tony Sumpter Archaeological Consultancy. Unpublished report.

Tony Sumpter Archaeological Consultancy. 2009a. *The Farm (plot 3), Main Street, North Leverton, Nottinghamshire: Archaeological Watching Brief*. Retford: Tony Sumpter Archaeological Consultancy. Unpublished report.

Tony Sumpter Archaeological Consultancy. 2009b. *The Farm (plot 5), Main Street, North Leverton, Nottinghamshire: Archaeological Watching Brief*. Retford: Tony Sumpter Archaeological Consultancy. Unpublished report.

Tony Sumpter Archaeological Consultacy. 2011 *Lea Beck, Brookside Farm, Treswell, Nottinghamshire: Watching Brief*. Retford: Tony Sumpter Archaeological Consultancy. Unpublished report.

Tooley, M., and Shennan, I. eds. 1987. *Sea Level Changes*. Oxford: Blackwell.

Torksey Project website. 2014. University of York. <www.york.ac.uk/archaeology/current-projects/torksey/> Accessed 12 November 2014.

Townend, M. 2000. Viking Age England as a bilingual society. In Hadley, D., and Richards, J. D. eds. *Cultures in Contact: Scandinavian Settlement in England in the ninth and Tenth Centuries*. Studies in the Early Middle Ages, 2. Turnhout: Brepols. pp. 89-106.

Trimble, R. 2001. *Land at Little London Caravan Park, Torksey Lock, Torksey, Lincolnshire*. Lincoln: City of Lincoln Archaeological Unit. Unpublished report.

Turner, S. 2003. Boundaries and religion: the demarcation of early Christian settlements in Britain. *Anglo-Saxon Studies in Archaeology and History* 12. Oxford: Oxford University School of Archaeology. pp. 50-57.

Tweddle, J. 2001. Regional Vegetational History. In M. Bateman, P. Buckland, C. Frederick and N. Whitehouse. eds. *The Quaternary of East Yorkshire and North Lincolnshire Field Guide*. London: Quaternary Research Association

Tweddle, J., and Edwards, K. 2010. Pollen preservation zones as an interpretive tool in Holocene palynology. *Review of Palaeobotany and Palynology*. 161: 59-76

Ulmschneider, K. 2000. Settlement, Economy, and the ‘Productive’ Site: Middle Anglo-Saxon Lincolnshire A.D. 650-780. *Medieval Archaeology*. Vol. 44: 53-79.

Ussher, W. 1889. *The Geology of the Country around Lincoln*. Memoirs of the Geological Survey. London: Eyre and Spottiswoode.

Ussher, W., Jukes-Browne, A., and Strahan, A. 1888. *The Geology of the Country around Lincoln*. Memoirs of the Geological Survey. London: Eyre and Spottiswoode.

Van de Noort, R. 2004. *The Humber Wetlands*. Macclesfield: Windgather Press.

Van de Noort, R. and Ellis, S., eds. 1997. *Wetland Heritage of the Humberhead Levels: An archaeological survey*. Humber Wetlands Project. Hull: University of Hull.

Van de Noort, R. and Ellis, S., eds. 1998. *Wetland Heritage of the Ancholme and Lower Trent Valleys: An archaeological survey*. Humber Wetlands Project. Hull: University of Hull.

Vince, A. 2001. Lincoln in the Viking Age. In J. Graham-Campbell, R. Hall, J. Jesch, and D. Parsons, eds. *Vikings and the Danelaw: select papers from the proceedings of the thirteenth Viking congress. 21-30 August 1997. Nottingham and York*. Oxford: Oxbow Books. pp. 157-180.

Vince, A. 2006. The Anglo-Saxon Period. In Cooper, N. ed. *The Archaeology of the East Midlands: And Archaeological Resource Assessment and Research Agenda.* Leicester Archaeology Monographs No. 13. Leicester: University of Leicester Archaeological Services. Pp. 161-184.

Wacher, J.S. 1961. *A Matter of Time: an Archaeological Survey of the River Gravels of England*. London: RCHME.

Walden, J. 1999. Sample collection and preparation. In Walden, J., Oldfield, F., Smith, J., eds. *Environmental Magnetism: a practical guide*. Technical guide, No. 6. London: Quaternary Research Association.

Walker, J., and Challis, K. 2002. *Component 7: Review the effectiveness of field evaluation in the Trent Valley: whole risk reduction*. York: Trent Valley Geoarchaeology.

Wall, R. 2010. Woodstown and Urbanization: Interpretations, Models and Questions. *Journal of the American Society of Irish Medieval Studies*. Vol 4: 26-52.

Wallace, P. 2010. Plot-use and access in an eleventh-century Dublin building level. In J. Sheehan, and D. O Corrain, eds. *The Viking Age: Ireland and the West*. Dublin: Four Courts Press. pp 525-544.

Watts, V. 2005. *The Cambridge Dictionary of English Place-names*. Cambridge:

Ward, I., Smith, B., and Lawley, R. 2009. Mapping the archaeological soil archive of sand and gravel mineral reserves in Britain. *Geoarchaeology.* 24.1: 1-21

Warrington, G. 2007. Palynomorphs from the Penarth Group (Rhaetian, Late Triassic) an outcrop in north-west Lincolnshire, England. *Proceedings of the Yorkshire Geological Society*. 56(3): 209-214.

Wentworth, C. 1922. A scale of grade and class terms for clastic sediments. *Journal of Geology*. 30: 377-392.

Wessex Archaeology. 1996. *Proposed pipeline to Cottam (Lincs. and Notts.).* Salisbury: Wessex Archaeology. Unpublished report.

Wessex Archaeology. 1997. *Blyborough, Lincs., to Cottam, Notts. Pipeline. Report on the Archaeology.* Salisbury: Wessex Archaeology. Unpublished report.

West Yorkshire Archaeology Service. 1996. *39-43 Silver Street, Gainsborough: archaeological evaluation*. Wakefield: WYAS. Unpublished report.

White, T., Bridgland, D., Howard, A., and White, M. 2007. *The Quaternary of the Trent Valley and Adjoining Regions Field Guide*. London: Quaternary Research Association.

White, W. 1856. *Lincolnshire*. Newton Abbot: David and Charles Reprints (1969).

Whitelock, D. 1965. *The Anglo-Saxon Chronicle*. London: Eyre and Spottiswoode.

Whitelock, D. 1979. *English Historical Documents 500-1041*. Second edition. London: Routeledge

Whitehouse, N. 2004. Mire ontogeny, environmental and climatic change inferred from fossil beetle successions from Hatfield Moors, eastern England. *The Holocene*. 14: 79-93.

Whyte, N. 2009. *Inhabiting the Landscape: Place, Custom and Memory, 1500-1800*. Oxford: Windgather Press.

Williams, G. 2008. Raiding and warfare. In S. Brink, and N. Price, eds. *The Viking World*. London: Routledge. pp. 193-203.

Williams, M., and Field, N. 2002. *Main St, Torksey, Lincolnshire: New Medical Centre and Housing Development Archaeological Evaluation*. Lincoln: Lindsey Archaeological Services. Unpublished report.

Williams, S. 2007. *Gainsborough Old Hall: archaeological watching brief*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Williams, S. 2008. *Kettlethorpe Hall, Kettlethorpe, Lincolnshire: Archaeological watching brief report*. Lincoln: Pre-Construct Archaeology. Unpublished report.

Williamson, T. 2006. *The Archaeology of Rabbit Warrens*. Princes Risborough: Shire Archaeology Press.

Williamson, T. 2007a. *Rabbits, Warrens, and Archaeology*. Stroud: Tempus.

Williamson, T. 2007b. The Distribution of 'Woodland' and 'Champion' Landscape in Medieval England. In M. Gardiner and S. Rippon, eds. *Medieval Landscapes: Landscape History after Hoskins*. Macclesfield: Windgather. Pp 89-104.

Williamson, T. 2010. '*At Pleasure's Lordly Call': the archaeology of emparked settlements*. In Dyer, C., and Jones, R. *Deserted Villages Revisited*. Hatfield: University of Hertfordshire Press. Pp. 162-181.

Williamson, T. 2012. *Environment, Society and Landscape in Early Medieval England: Time and Topography*. Woodbridge: Boydell Press.

Wintle, A., and Murray, A. 2006. A review of quartz optically stimulated luminescence characteristics and their relevance in the single-aliquot regeneration dating protocols. *Radiation Measurements*. 41: 369-391

Wood, A.C. 1951. The History of Trade and Transport on the River Trent. In *Transactions of the Thoroton Society Nottinghamshire.* Vol. LIV: 1-44.

Wood, M. 2006. *Archaeological watching brief on land adjacent to the Fossdyke Canal, Torksey Lock, Lincolnshire*. Sleaford: Archaeological Project Services. Unpublished report.

Woods, A. 2012. *Metalwork from the Torksey Viking Site*. International Medieval Congress. 12 July. Leeds: University of Leeds.

Woolhouse, R. No date. *Saint Mary's Stow-in-Lindsey*. St. Mary's historical guide. Unpublished.

Wragg, K. 1999. *Tesco Store, Beaumont Street/Trinity Street, Gainsborough, Lincolnshire: archaeological watching brief*. Lincoln: City of Lincoln Archaeology Unit. Unpublished report.

Wragg, K. 2000. *New offices, Wembley Street/Bridge Street, Gainsborough, Lincolnshire: Archaeological watching brief*. Lincoln: Lincoln Archaeology. Unpublished report.

Wrathmell, S. 2012. *Wharram XIII: A History of Wharram Percy and its Neighbours*. Oxford: Oxbow.

Wright, N. 1982. *Lincolnshire Towns and Industry 1700-1914*. Lincoln: Lincolnshire History Society

Yorke, L., McManus, K., and Howard, A. J. 2002. Development of a Geomorphological Risk Map for the Valley Floor Deposits of the River Trent. In *Advancing the Agenda in Archaeology and Alluvium*. York: Trent Valley Geoarchaeology.

Young, J., and Vince, A. 2005. *A Corpus of Anglo-Saxon and Medieval Pottery from Lincoln*. Lincoln Archaeological Studies No. 7. Oxford: Oxbow Books.

APPENDIX I: Procedures

Pollen sample preparation

Add 20ml 10% HCl and Lycopodium tablet(s), to remove any carbonates and organics. Leave for 4 hours and decant.

↓

Add 20 ml 10% potassium hydroxide, to remove any additional organics. Heat in water bath for 30 minutes, stirring frequently. Centrifuge and decant.

↓

Add 20 ml hydrofluoric acid to all samples to remove any mineral content in sample. Leave for 72 hours. Centrifuge and decant.

↓

Check under microscope, and sieve with 180 µ mesh.

↓

Dehydrate the pellet with glacial acetic acid, centrifuge, and decant. Add 5 ml acetolysis mixture, stir, heat in boiling bath for 2 minutes, centrifuge and decant. Add glacial acetic acid, stir, centrifuge, and decant.

↓

Add potassium hydroxide, two drops safanin to stain pollen grains, top up with filtered water, centrifuge and decant.

↓

Wash with ethanol, centrifuge and decant.

↓

Add silicon oil of same volume as sample. Mount on slides and cover with cover slip.

Steps involved in preparation of sediment for pollen analysis (modified from Moore *et al*. 1991, and Boulter 2007).

OSL sample preparation

The processing of the samples prior to equivalent dose measurement includes several steps. The samples are soaked in hydrochloric acid (HCl) for a few days in order to remove any organic materials. The sediment is then dried and roughly sieved to sand size (90µm- 250µm). Heavy minerals are extracted by mixing the sample with sodium phosphatungstate solution ($Na_3O_{40}PW_{12}$), which allows any heavy minerals to sink, while quartz and feldspars float; the heavy minerals are solidified in liquid nitrogen until the lighter minerals can be extracted. This remaining sample is subsequently subjected to hydrofluoric acid etching, in order to remove any feldspars. Finally, the sample is sieved into narrowly bracketed sand sizes; larger sand grains (180-250µm) allow for fewer grains on the aliquot and better chance of regularly trapped isotopes, but if there is not enough of this particle size, the sample can also include grain sizes as small as 90µm. The particle size will also be considered during equivalent dose analysis.

The gamma spectrometer detects the rate of accumulation of all radioactive isotopes, including the naturally accumulating K, U, and Th isotopes. ^{40}K isotope decays into ^{40}Ca, while U and Th are part of a decay series where ^{238}U decays into ^{234}Th, which eventually decays into a stable ^{206}Pb (Duller 2008a, 16).

Before OSL measurement, all unstable natural radiation must be removed from each sample; this is completed using a 'preheat' (Murray and Wintle 1999; 2000, 58). A preheat test is completed by subjecting aliquots of the sample to different preheat temperatures and deducing the temperature that yields the most stable results (highest consistency of results after each preheat temperature, and most consistent recycling values) (Murray and Wintle 2000, 58). The four samples from Torksey demonstrated that a preheat temperature of 160 C provided the most consistent results.

Each sample must also be checked for remaining feldspars; this can be done by subjecting the sample of infrared light. IR light releases signals from feldspar grains due to the different formation of the grain and thus different way of trapping (and releasing) radiation. Despite HF etching, the samples from Torksey still included feldspar grains, which, if left in during OSL measurement, would skew the data and subsequent recycling values, so each sample was subjected to IR light before the results were exposed to blue diodes. An OSL test-dose signal was also applied to each sample, which provided a single number of OSL counts. From these counts, respective stimulation times were chosen in order to bracket the potential OSL counts of each aliquot.

A sequence was written for each aliquot, which included preheating the sample, exposing the sample to IR light, and stimulating the sample with blue diodes for the times as determined by the test-dose. Data from each aliquot was accepted if the measurements from the sample were within their stimulation times, and if the recycling values were at a 1:1 ratio. The accepted aliquots must then be corrected for the dose rate applied by the Risø machine, which differs from machine to machine, based on single grain and IR light capabilities; the samples from Torksey were run at a dose rate of 6.23 D_y.

The stimulation times were different for each sample, as each sample had counts respective of age: SHFD 12016 originally produced 11, 7, and 7 OSL counts, so the TL-DA-18 was set to measure the sample at 10 beta, 50 beta, and 100 beta. SHFD 12017 produced 1600, 2200, and 1200 OSL counts, and was measured at 1000, 2000, and 3000 beta. SHFD 12017 produced 85, 107, and 91 OSL counts, and was measured at 50, 100, and 150 beta. SHFD 12018 produced 84, 54, and 100 OSL counts, and was measured at 50, 100, and 150 beta. Out of up to 28 aliquots, 22 were accepted for 12016, 24 were accepted for 12017, 25 were accepted for 12018, and 19 were accepted for 12019.

SCIDR LUMINESCENCE LABORATORY AGE CALCULATOR

Sample	Depth (m)	De (Gy)	±	Dose Rate (uGy/a)	±	Age (ka)	±	Alpha (uGy/ka)	±	Beta (uGy/ka)	±	Gamma (uGy/Ka)	±	Cosmic (uGy/ka)	±
Shfd12106	1	1.25	0.04	1209	55	**1.030**	**0.060**	6	1	673	52	346	16	184	9
Shfd12107	1	136.81	4.64	1230	55	**111.190**	**6.270**	10	2	686	52	350	16	184	9
Shfd12108	0.8	10.04	0.44	1344	67	**7.470**	**0.500**	7	2	752	62	395	25	189	9
Shfd12109	0.95	9.9	0.57	1969	86	**5.030**	**0.360**	18	4	1123	81	643	29	185	9
Shfd12106	1	1.25	0.04	1209	55	**1.030**	**0.060**	6	1	673	52	346	16	184	9
Shfd12107	1	124.5977	4.996	1230	55	**101.270**	**6.110**	10	2	686	52	350	16	184	9
Shfd12108	0.8	8.376	0.36	1344	67	**6.230**	**0.410**	7	2	752	62	395	25	189	9
Shfd12109	0.95	10.05	0.43	1969	86	**5.100**	**0.310**	18	4	1123	81	643	29	185	9
Shfd12106	1	1.25	0.04	1064	52	**1.180**	**0.070**	6	1	673	49	346	13	184	9
Shfd12107	1	120.56	30.26	1069	52	**112.730**	**28.820**	10	2	686	50	350	13	184	9
Shfd12108	0.8	9.46	1.36	1150	58	**8.230**	**1.250**	7	2	752	55	395	17	189	9
Shfd12109	0.95	10.76	1.689	1592	80	**6.760**	**1.110**	18	4	1123	76	468	22	185	9
Shfd13080	0.95	2.54	0.51	1186	54	**2.140**	**0.440**	9	2	658	51	333	15	185	9
Shfd13081	1.3	11.82	0.5	1093	49	**10.810**	**0.670**	7	2	598	46	311	14	177	9

This table shows the dose rate information of each sample, along with the background radiation readings. The first group is the probability (common age) calculation, the second group is the finite mixture model, and the third group is the minimum age model (not completed on samples 13080 and 13081, which both show probability/common age model).

Portable OSL procedures

As pOSL is a relatively new method, there is not set procedure; all procedures and analysis were completed as per the advice of Mark Bateman, and by making gradual improvements by utilising the method at multiple sites, such as at Holkham, Norfolk (Bateman *et al*. forthcoming).

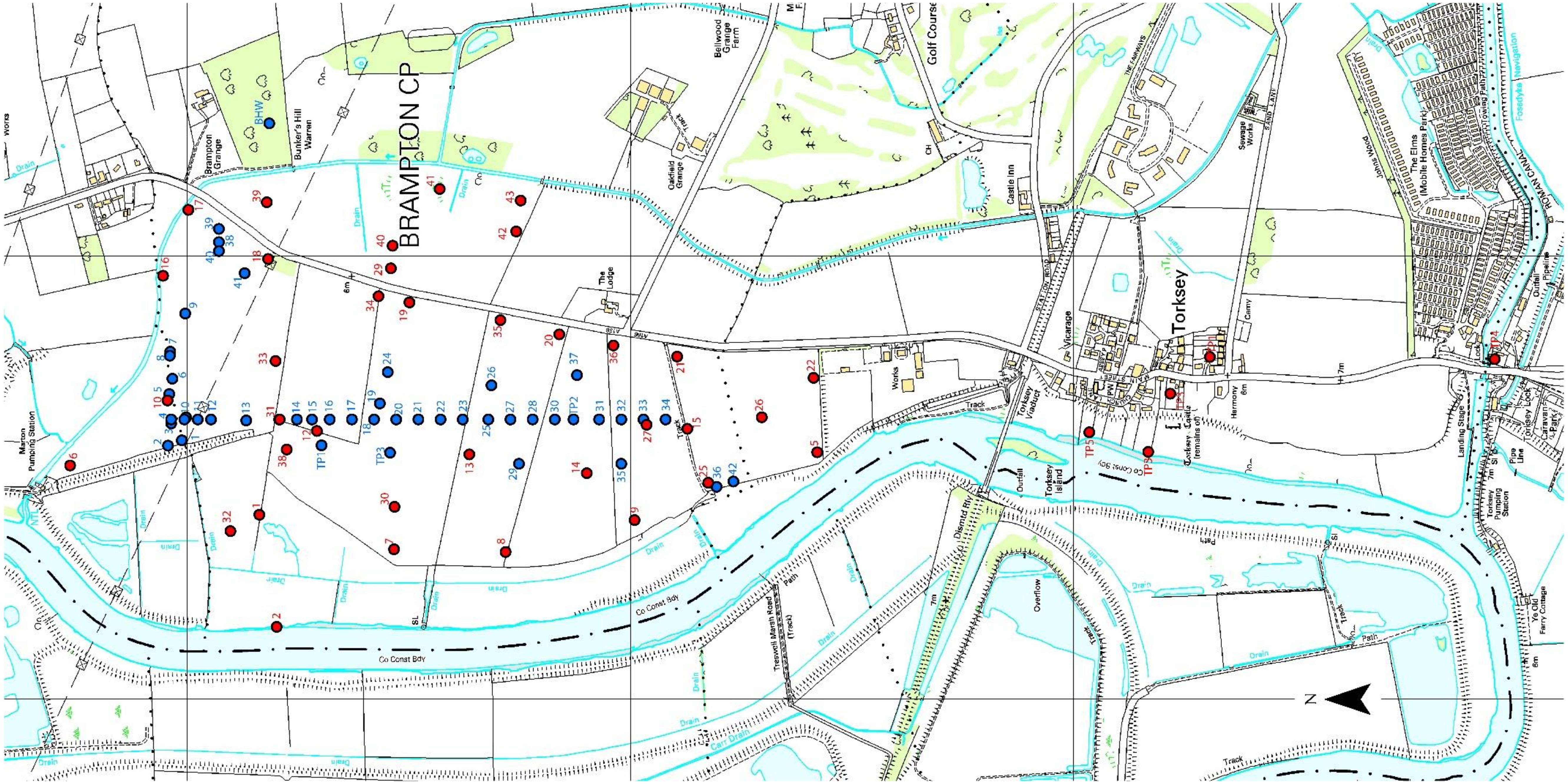
Within profiles, samples were collected at intervals of 10-20 cm, and within cores samples were taken every 50-100cm. Samples were collected in a light-tight container, with the sample completely filling the container so the sediment did not move in transit. In the laboratory, both ends of the sample were removed to avoid any potential contamination. The ends were also used to calculate moisture percentages in the samples for later analysis. The sample used for pOSL were dried at 30^{o}C for 24 hours to remove moisture.

The SUERC portable OSL reader consists of a small (5cm diameter) plastic dish that is placed under the blue and IR light stimulators; the computer simultaneously records the response to the light. A very thin layer of sediment was placed within the dish for each sample; based on repeated measurements in earlier studies, the reproducibility is much better using as close to a depth of 2-3 grains across the dish. Each sample was placed within the reader for 60 seconds (s) IR stimulation, followed by 60s blue light stimulation. The final numbers of 'count's is the sum of the signal given off by the sample throughout the 60 s stimulation. IR was completed first on every sample, as it was determined that IR stimulation will deplete some of the feldspar signal; however recent studies determined that the pOSL reader does not have enough power to deplete the feldspar signal in a single 60s cycle, and thus the final counts may be slightly affected by the feldspars (Sanderson and Murphy 2009; Bateman *et al*. forthcoming).

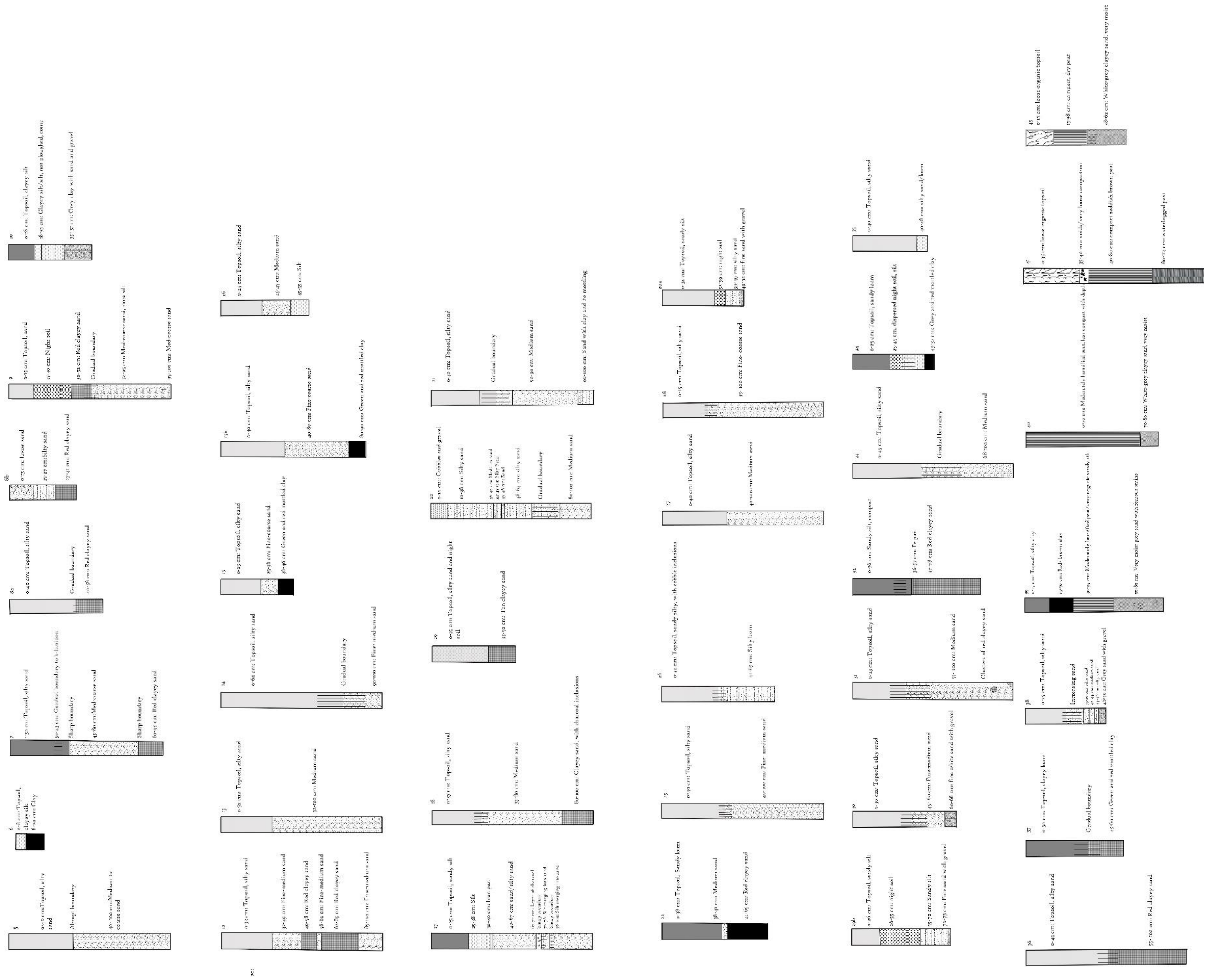
The results were corrected for moisture, which did not affect the readings very much. They were also corrected for feldspars; it was determined that not every sample required feldspar corrections, while others did not produce comparable data without the IR corrections. This is likely partly due to differences in feldspar percentages, and the effectiveness of bleaching those feldspars with a single IR cycle. Samples at Holkham were shown to have better results without IR corrections; investigation into standard means of correcting pOSL data is ongoing.

APPENDIX II: Coring programme

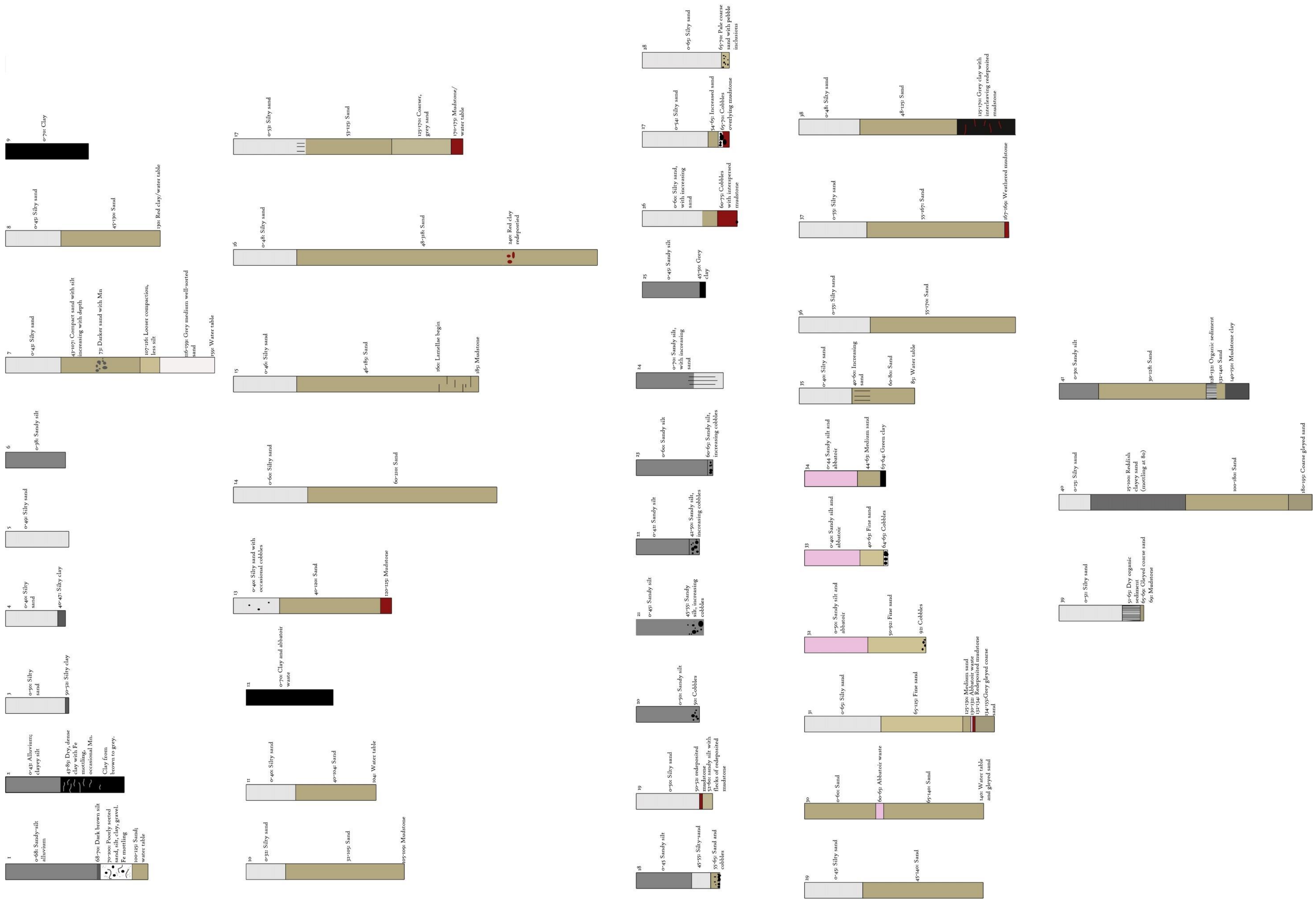
Summary of 2011-2012 coring programme



2011 cores



2012 cores



Descriptions of Sediments

Auger survey, Oct. 2011

Core 2

83163 80798

No core taken; present floodplain, with exposed section.

Alluvial silt in this location is dark reddish brown with very fine sand fraction. Monic with weakly columnar peds (based on exposed section near river).

Core 5

83557 79578

0-40 cm: Silty sand, dark brown topsoil

Compacted and cohesive with high silt fraction (40%)

40-100 cm: Medium to coarse quartz aeolian sand: 7.5YR 4/6, no inclusions. (Same description for every aeolian sand deposit, unless otherwise stated)

Core 6

83527 81264

0-15 cm: Topsoil

Sandy silt

15-20 cm: Compacted topsoil

20-30 cm: Compact alluvial silty clay, no inclusions. Greyish brown.

Core 7

83338 80533

1-37 cm: Silty sand topsoil 10YR 3/4

50% sand (medium), 50% very fine sand-silt

37-43 cm: Coarser aeolian sand, decreasing silt

43-80 cm: Aeolian sand, no inclusions

80 cm: Gradual boundary to:

80-95 cm: Red (Mercia Mudstone) sandy clay, 5YR 4/4

Cores 8a and 8b

8a

83306 80271

On present trackway

0-5 cm: O horizon

5-40 cm: A horizon, brown silty sand

Very compact

10YR 3/4

Medium quartz sand

40 cm: Sand is lighter, 5YR 3/4, gradual boundary

40-58 cm: Reddish clayey sand (similar to [core 7], though with more sand)

8b

Further from cliff, nearer to hedge

83332 80281

0-15 cm: Very loose sand (<10% sand)

10YR 4/3

15-27 cm: As above, 7.5YR 4/6

27-41 cm: Reddish clayey sand (as at [7] and [8a])

Core 9

83399 79970

0-15 cm: Silty sand topsoil, with higher silt content than previous coring sites. 7.5 3/4

15-30 cm: Remains of abattoir waste injection- chemical layer with burnt plant material

30-52 cm: Reddish sandy clay (as in [7 and 8]), though with higher clay content

Gradually decreasing clay content into sand

52-95 cm: Clay and silt disappear into aeolian sands

Core 10

83674 381044

0-15 cm: Topsoil

Brown silt, 10% sand, <1% pebbles-cobbles

15-18 cm: Compacted topsoil

18-20 cm: Iron pan

20-35 cm: Fe and Mn mottling in clay

35-55 cm: Grey clay with sand and gravel inclusions.

Munsell: Gley I, 5/N (grey), with Fe mottling.

50% Clay, 45% Sand, 5% Gravel

Rounded gravel (pebbles), some broken abraded pebbles (sub-angular)

Core 12

83605 80707

This core begins at the *bottom* of the hedgerow exposure, as to get the deepest profile available. These depths are an additional 70cm below the surface level when the hedges were originally planted.

0-31 cm: Silty sand, <25% silt; 10YR 3/4

31-50 cm: Lighter aeolian sand; light brown silty sand

<15% silt; 7.5YR 4/6

Clear boundary

50-58 cm: Clayey reddish sand

30-40% clay; 5YR 4/4

Charcoal inclusions

50-62 cm: Same as 31-50 cm

62-86 cm: Clayey reddish sand (same as 50-58 cm), gradually changes to less clay, and with increasing sand

86-100 cm: Light brown fine to medium sand, 7.5YR 4/6 (Same as 31-50cm; 58-62 cm)

Core 13

83552 80363

0-32 cm: Sitly sand topsoil; 10YR 3/4

32-100 cm: Abrupt boundary

Fine to coarse tan sand, <20% silt; 7.5YR 5/6

Slightly ligher in colour towards last 10cm

Core 14

83510 80098

0-100 cm: Sand, with slightly silty topsoil, though only up to 40%. At 60cm, becomes aeolian sand

Cores 15a and 15b

15a

83610 79871

0-25 cm: Silty sand topsoil (as [22])

25-35 cm: Well sorted very fine orange brown sand

35-45cm: Mottled red clay, dry very compact, with green gley amongst red clay.

15b

83605 79889

0-40 cm: Silty sand topsoil

Clear boundary

40-80 cm: medium brown fine to coarse sand

Lighter in colour with increasing depth

Large stone inclusion at 78 cm; 7.5 4/6

80-90 cm: Clear boundary to green grey clay

Core 16

83955 81054

0-25 cm: Very sandy top soil (40-50%), with 50% silt

25-43 cm: Aeolian sand.

43-54 cm: Dark brown silty clay

Alluvial deposit

Core 17

84104 80997

0-25 cm: Silty sand topsoil

25-40 cm: Sub-soil with Fe mottling

40 cm: Iron pan

40-68 cm: Aeolian sand

Clean sand, no inclusions, no mottling. Slightly brighter orange than [16]

68-70 cm: Charcoal layer (surface deposit?)

70-74 cm: Aeolian sand, blackened towards the top

Gradual boundary, cleaner with depth

74-75 cm: Aeolian sand, blackened towards the top

Abrupt above boundary, gradual boundary below

75-100 cm: Aeolian sand/ dark brown silt and sand

Both phases about 5 cm with abrupt boundaries to the top and blackened top merging into dark/black silt with 80% quartz sand. Between these layers is a thin film of dense orange clay.

Core 18

83993 80817

0-30 cm: Silty sand topsoil

30% silt with some pebble inclusion (<1%)

30-47 cm: Silty sand, no inclusions

47-81 cm: Abrupt boundary at 47cms to medium brown fine- medium sand

81-100 cm Clayey sand with flecks of charcoal

Core 19

83895 80498

0-35 cm: Topsoil, abattoir waste, as before

35-55 cm: Sand with 30-40% medium to tan brown clay, with occasional pebble inclusions

Gravel (HPSG) at 55 cm

Core 20

83823 80160

0-10 cm: Limestone flecked clay, calcite rich, clearly artificial fill

10-39 cm: Silty sand topsoil, as before (though with lighter moisture with brick inclusions)

Clearly a disturbed area (brick at 24cm)

39-41 cm: Thin band of pure, medium brown sand

41-44 cm: Silty sand *as above*

44-46 cm: Pure sand *as above*

46-62 cm: Silty sand *as above*

62-80 cm: Diffuse boundary to tan/medium brown fine to medium sand, no inclusions

80-100 cm: Tan medium sand mixes at 85 with light tan fine sand with <20% clay content

Core 21

83773 79894

0-30 cm: Silty sand topsoil <30% silt

30-50 cm: Gradual boundary to sand at 50 cm with decreasing brown silt, and increasing tan sand

50-90 cm: Medium brown to light tan sand, medium to fine

90-100 cm: Clear ferrous concretion (secondary?)

Evidence of burning? Darker silt throughout this portion of profile

Core 22

83725 79586

0-40 cm: Silty sand topsoil with moderate, well rounded cobbles and pebbles. Noticeable difference in topsoil from rest of the site, from silty sand (and sandy silt) into silty with moderate rounded pebbles and cobbles. All smaller inclusions are well rounded, and any pottery picked up has been abraded. The sediment has clearly formed in at least two, possibly three phases, from a thick silt, adding rounded pebbles and cobbles, finally adding a very small sand fraction and some angular inclusions (especially post-medieval/industrial pottery).

40-41 cm: Diffuse boundary over 1 cm with bright tan sand

40-65 cm: Reddish sandy clay (25-50% sand)

2.5 YR 4/4

Less sand with increasing depth

Impenetrable from 60-65 due to depleted moisture and/or gravel inclusions

Clay at depth was bright red interspersed with greenish gray gley, pockets of orange sand (coarse as in sandstone, *not* aeolian), and pebbles, gravel from HPSG

Core 25

83488 79824

0-40 cm: Silty sand, dark brown topsoil

Compacted and cohesive with high silt fraction (40%)

40-45 cm: Diffuse boundary to tan sand; 7.5 YR 4/3

45-100 cm: Medium aeolian sand; 7.5YR 5/6

Core 26

83636 79703

0-35 cm: Sandy silt topsoil with few cobbles

Diffuse boundary, few changes, lighter colour, less silt

40-70 cm: Sandy with silt, distinctly not aeolian. Cobbles of HSPG at bottom.

Core 27

0-40 cm: Silty sand topsoil

40-100 cm: Aeolian sand

Core 29

29a

83972 80540

0-33 cm: Sandy silt topsoil

30% sand (different from fields to south); 10YR 2/2

33-39 cm: abattoir waste, with limestone cobble inclusion

39-50 cm: Silt, lighter colour than waste above, but with same consistency and smell

Directly overlying terrace gravels.

29b

83706 80517

0-18cm: sandy silt topsoil

18-43 cm: abattoir waste

43-60cm: Sandy silt (as [29a])

60 cm: Terrace gravels.

Core 30

83434 80532

0-30 cm: Silty sand, with moderate pebble inclusions

Rounded, water-worn pebbles

Lighter colour than [29]

10YR 3/4

30-48 cm: Gradual into lighter coloured sand, less silt

10YR 4/4

48-57 cm: Fine to medium sand

7.5YR 4/6

<10% silt

Abrupt boundary

57-65 cm: Bright white sand, very fine to medium with occasional to moderate pebble inclusions

10YR 7/3

Core 31

83631 80791

0-40 cm: Silty sand topsoil

40-100 cm: Light brown sand

7.5YR 4/6

At 100cm depth is the start of gradual boundary to reddish clayey sand, into a sandy clay, as in [12]

Core 32

83379 80902

Despite location on alluvial plain, and being listed as alluvium, this point is located on a slight rise in the topography, with local evidence of natural and archaeological features, including nearby ridge and furrow.

0-2 cm: O horizon- vegetation and roots

2-30 cm: Alluvial silt and sand

Very compact

30-37 cm: B horizon, hint of increased iron.

37-89 cm: Reddish brown clayey sand- mixture of aeolian sediments with underlying degraded mudstone

Core 33

83763 80800

0-44 cm: Sandy silt topsoil

50% sand 50% silt fine fraction

Dark brown, occasional pebble to cobble sized inclusions

44-70 cm: gradually to medium brown sand with <30% silt

70-100 cm: Tan to medium brown sand, very fine to medium

Core 34

83909 80568

0-35 cm: Sandy loam topsoil

30% sand, 40% silt 30% clay

Artificial/import, not locally derived, with abattoir contamination

35-45 cm: Sandy clay with mudstone and grey clay pellet inclusions

Boundary with inclusions: coarse sand (30%)

Occasional pebbles and gravel

45-51 cm: Mottled red and green clay

Gley 1 6/5GY

Core 35

83855 80293

0-47 cm: Silty sand topsoil

As before in beets, towards bottom, compact, up to 40% silt

Gravel at 47 cm

Core 36

83798 80038

0-45 cm: Silty sand topsoil

(28-30 cm, abattoir waste)

45-57 cm: Merging boundary to reddish tan sand

57-100 cm: Reddish tan sand with silt fraction <30%

Moderately compact

No inclusions

Core 37

83761 79754

0-30 cm: Loamy clay topsoil with pebble inclusions

30-45 cm: Gradual boundary between clayey topsoil and red clay subsoil

Decreasing sand with increasing depth

45-60 cm: Red clay with green gley, as [22]

Core 38

83563 80775

0-25 cm: Silty sand topsoil

25-36 cm: beginning of merging boundary;

at 36 cm, thin facies of dark organic material

36-40 cm: Continued mixture of silty topsoil and sand

40-43 cm: Pure sand, medium grains

7.5 4/4 with sharp above boundary

43-45 cm: Silty sand, as above, with slightly more silt

45-49 cm: Light brown fine sand

10YR 5/4

Frequent pebble inclusions; large gravel

Likely same group as [30]

Core 39

84121 80820

0-15 cm: silty clay topsoil, dark brown, <1% sand

15-30 cm: Silty clay, gradually turning to just reddish brown ferrous clay

30-35 cm: Pure reddish brown/ dark brown clay

Some organic inclusion

Very compact

35-55 cm: Moderately humified, very moist organic clay.

55-85 cm: Bright tan and red ferrous medium sand

<5% silt/fine sand

Moisture held in sand

Silt in sand due to silt and clay illuviation

Core 40- PEAT

*Difficult to assess the validity of the depths of cores 40 and 41, due to numerous voids, the very dry nature of the organic material, and the nature of the instrument. For more accurate peat profile, see peat core extraction, Appendix 4.

0-70 cm: Poorly to moderately humified peat

70-80 cm: Bright white sand, very moist

Core 41- PEAT

0-30 cm: Very dry, crumbly, loose organic material.

30- 80 cm: Compact reddish brown humified peat

80-112 cm: Dark peat, very waterlogged.

Core 42

84055 80257

0-30 cm: sandy silt with minute clay fraction

60% silt, 30% sand <5% clay, 5% other

At 30 cm, silt becomes impenetrable.

Core 43

84125 80247

0-36 cm: Dark organic-rich silt with sand, increasing compaction with depth

36-39 cm: White sand, with silt, both bright, same as previous basal sands

39-63 cm: White sand, with less and less inclusions with depth, very moist

Descriptions of Sediments

Auger survey, Nov. 2012

Core 1

83584 81012

0-70 cm: Alluvium, sandy silt, 40% sand. Mixed with abattoir. Dark-medium brown. Layer of dark brown silt at 70cm

70-102: Iron mottling, between clumps of sand, silt, and clay (both red and green, separately)

102-134: Sharp boundary, also corresponds to water table, to sand (described above)

Core 2

83572 81043

0-43: Top soil is dark brown clayey silt, compact

43-85: Very dry, compact clay with iron mottling, occasional Mn nodules

85-94: Mottling decreasing, clay turning grey with increasing depth. No sign of sand, impossible to core any further through clay

Core 3

83622 81036

0-52: Silty sand, colluvium, with abattoir waste at 40-52cm

52-55: Silty clay, red mottling, increasingly grey with depth

Core 4

83631 81036

0-40: Silty sand as above

40-45: Silty clay as above

Core 5

83688 81040

0-49: Silty sand as above

Core 6

83723 81033

0-37: Silty sand as above

Core 7

83784 81038

0-43: Topsoil, silty sand with occasional cobbles and pebbles, mixed with abattoir waste

43-107: Sand, compact, with increasing brown silt with depth. At 73 cm, dark sand with Fe precipitates.

107-116: Sand, loose, with 5% silt.

116-159: Sand becomes grey with same particle size. Sand to water table at 159, with increasing red clay; MM just below 159.

Core 8

83775 81039

0-45: Silty sand topsoil, with abattoir

45-130: Sand

[sand is overlying MM with later silt build up from pre-drainage of the Trent. shallowness of the silt on the north side of the site shows extent of the pooled water]

Core 9

83870 81004

0-70: Dark brown clay, lacustrine

Core 10

83635 81006

0-32: Silty sand topsoil

32-105: Sand

105-109: Sand with increasing red clay of the MM

Core 11

83635 80976

0-40: Silty sand topsoil. At 40cm, boundary between topsoil and underlying sand is post-medieval pottery

40-104: Sand; water table at 104. No MM clay

Core 12

83635 80946

0-70: Clay and abattoir waste

Core 13

83635 80792

0-40: Silty sand topsoil

40-120: Sand

120-122: MM clay

Core 14

83631 80752

0-60: Silty sand topsoil

60-120: sand

[posl measurement taken at 1m, 2m]

Core 15

83631 83718

0-46: Silty sand topsoil

46-185: Sand, lamellae at 160cm

185-190: MM

[posl taken at 1m]

Core 16

83631 83678

0-48: Silty sand topsoil

48-318: Sand. Redeposited MM at 230cm. MM at 318cm.

[posl taken at 1m, 2m, 3m]

Core 17

83631 83628

0-53: Silty sand topsoil

53-125: Sand; very gradual boundary between topsoil and sand

125-170: Sand; not as above. Whitish grey in colour, coarser particle size

170-180: Water table, with Mn nodules

Core 18

83631 80578

0-45: Silty sand topsoil

45-55: Silty sand, with occasional angular and well-rounded pebble inclusions

55-65: Medium-fine sand, 10% clay occasional inclusions. At 65 cm, frequent cobble sized inclusions (preventing further coring)

Core 19

83667 80565

0-50: Sandy-silt topsoil

50-52: Band of red clay (redeposited MM)

52-60: Sandy silt with flecks of green clay, frequent cobble inclusions (possibly within Romano-British enclosure)

Core 20

83631 80528

0-50: Silty sand topsoil

50-51: Cobbles prevent further coring

Core 21

83631 80478

0-55 Sandy silt (as cxt 2 in TP3).

55: Large well-rounded pebbles-cobbles

Core 22

83631 80428

0-50: Sandy silt, as above

50: Cobbles

Core 23

83631 80378

0-65: Sandy silt, as above

65: Cobbles

Core 24

83538 80547

0-70: Sandy silt topsoil gradually becoming lighter in colour with increasing sand with depth; cobbles at 70.

Core 25

83631 80320

0-45: Silty sand topsoil with sand up to 70%, frequent rounded pebbles/cobbles

45-50: Greenish-grey MM clay

Core 26

83708 80313

0-60: Sand topsoil with some silt, increasing sand with depth, no colour changes

60-75: Increasing MM red clay, at 75, clay.

Core 27

83631 80270

0-54: Silty sand topsoil

54-65: Slight increase in sand with depth, lighter in colour, still with sand

65-70: MM red clay, some rounded inclusion overlying MM clays

Core 28

83631 80220

0-45: Silty sand topsoil

45-65: Increasing sand at 45 cm (up to 80%). Lighter in colour. Few rounded pebble inclusions. Clean sand fine sand with some soil formation at 55cm.

65-70: Sand in pale tan, with occasional pebble-sized inclusions onto level of large well-rounded cobbles at 70cm

[posl sample taken at 70cm]

Core 29

83531 80251

0-45: Silty sand topsoil

45-140: Abrupt boundary to sand. At 120cm, lamellae with red clay. Interspersed fine white sand, with white clay. MM at 140cm

Core 30

83631 80170

Much post-medieval debris on surface of field

0-60: Silty sand topsoil, abattoir

60-65: Gradual boundary to sand

65-140: Sand to gleyed clayey sand. Greyish white sand at 140cm.

Core 31

83631 80070

0-65: Silty sand topsoil, with abattoir waste at 25 cm

65-125: Sand, not as above; fine to medium particle size, pale tan colour.

125-130: Same sand with high moisture content. Small piece of bone found within sediment

130-132: Redeposited MM red clay

132-134: Greyish-black silt, abattoir waste

134-155: Grey gleyed sand, coarse particle size. Also with occasional flecks of green clay, red clay, brown silt. Possibly contaminated by abattoir waste.

[posl at 1m]

Core 32

83631 80020

0-50: Silt topsoil with abattoir waste

50-92: Light tan sand as above.

92: cobbles/pebbles

[posl sample at 90cm]

Core 33

83631 79970

0-40: Sandy silt and abattoir waste

40-63: Sand

63-64: Pebbles and cobbles

Core 34

83631 79805

0-44: Sandy silt and abattoir waste

44-63: Sand

63-64 Green clay

Core 35

83731 80020

0-40: Silty sand

40-60: Sand increasing with depth

60-80: Sand

80-85: Water table (sand)

Core 36

83479 79805

0-55: Silty sand topsoil

55-170: Sand to MM red clay

[posl sample at 1m]

Core 37

83731 80120

0-55: Silty sand and abattoir

55-167: Fine-medium sand

176-169: MM red clay- unweathered

Core 38

84031 80928

0-48: Silty sand topsoil

48-125: Clear boundary above, to sand

125-170: Change in colour of sand to light grey with red clay facies.

170-171: Change from grey to mid black sand (Mn precipitation?)

171-172: Light tan sand. No particle size changes obvious.

Core 39

84061 80928

0-51: Sandy topsoil

51-65: Peaty organic sediment; very dry.

65-68: Gradually increasing sand, with boundary between peat and sand over 5cm,and a more distinct boundary at 68 cm.

69: MM red clay

Core 40

84011 80928

0-25: Silty sand topsoil, very shallow

25-100: Gradual boundary onto red clayey sand, very thick deposit, with roots at 80cm depth.

100-180: Change to sand

180-195: Coarse grey sand to water table at 195.

Core 41

83961 80870

0-30: Sandy silt topsoil

30-35: Red clayey sand

35-120: Sand

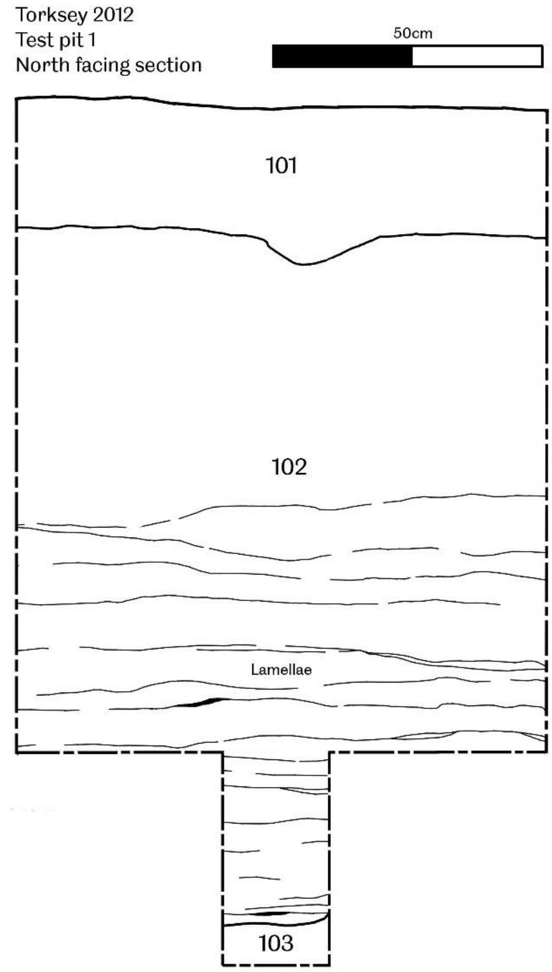
120-140: Organic humic mixture, very moist

140: Tan clay and MM with rounded pebbles

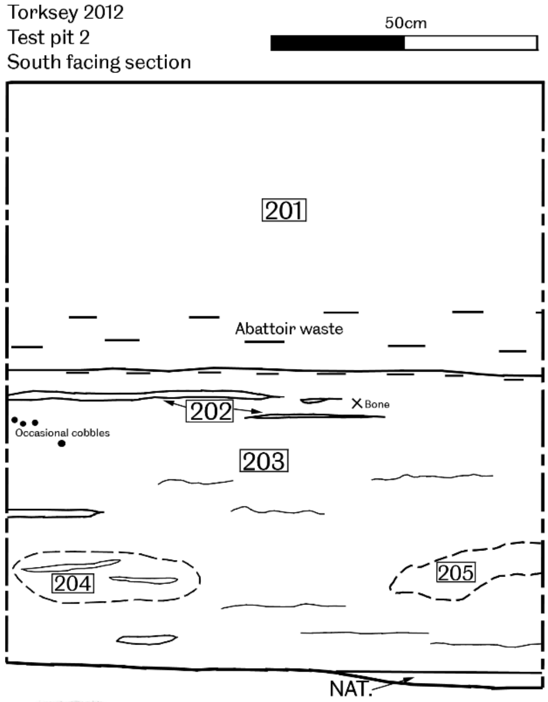
APPENDIX III: Test pitting programme

Context index- 2012 test pitting programme

Trench	Context	Description
1	101	Mid-brown silty sand topsoil
1	102	Orangey-brown well-sorted medium sand with reddish brown clay lamellae increasing with depth
1	103	Red clay, weathered Mercia Mudstone
2	201	Silty sand topsoil
2	202	Thin lamina of dark brown/black organic silt; clear boundaries with surrounding orangey-brown sand.
2	203	Well-sorted orangey brown medium sand
2	204	Light brown-tan well-sorted medium sand
2	205	Light brown-tan well-sorted medium sand
2	206/Nat	Natural red clay Mercia Mudstone
3	301	Mid/dark brown sandy silt top soil
3	302	Compacted dark brown sandy silt
3	303	Monic tan-brown silty medium sand, with rare cobbles that increase in frequency with depth
3	304	Layer of rounded cobbles
3	305	Red clay mixed with fine sand
3	306	Reddish brown silty clay with occasional coarse sand inclusions
3	307	Green clay
3	308	Fine, well sorted sand within and around the ice wedge within the red marl (306)


Torksey 2012
Test pit 1
North facing section
50cm
101
102
Lamellae
103

Torksey 2012
Test pit 2
South facing section



Torksey 2012
Test pit 3
North facing section

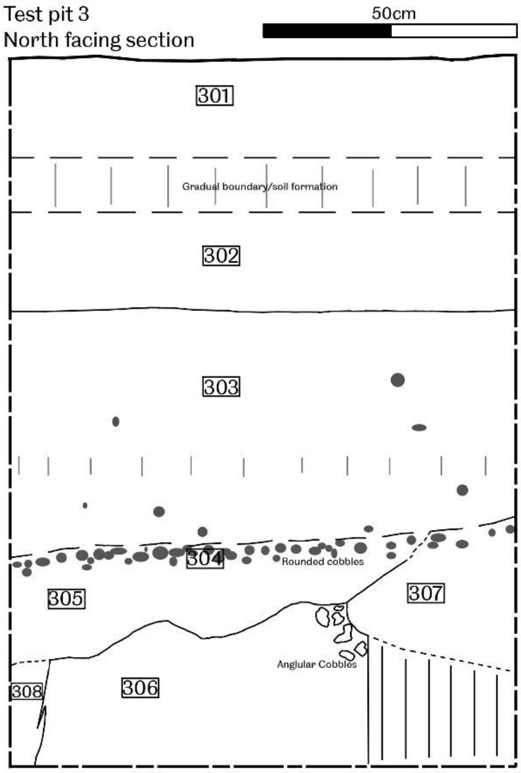


Plate 1: Section through Bunker's Hill Warren Test pit 1. There are no obvious features or changes throughout this massive-structured sand deposit. The corer completed the section; final sand depth reached 3.5 m, overlying Mercia Mudstone.

Plate 2: First 30-40 cm of Torksey 2012 Test pit1, clearly showing a (current) plough scar.

Plate 4: Final photo of Torksey 2012 Test pit 2, showing the deep abattoir deposit overlying aeolian sands.

Plate 5: Test pit 2, showing lamellae in the lower parts of the aeolian sand, as well as natural fissure with gleyed sand fill.

Plate 6: Test pit 2 lower section, showing various post-depositional features, including lamellae, manganese precipitation, root casts, and possible trampling layer (dark brown/black layer near the top).

Plate 7: Scale = 140 cm. Test pit 3. This test pit demonstrates the complexity of the underlying terrace deposits. This test pit also presents a possible archaeological accumulation.

Plate 8: Test pit 3. Devensian terrace deposits and glacial formations, including possible ice wedge (8b)

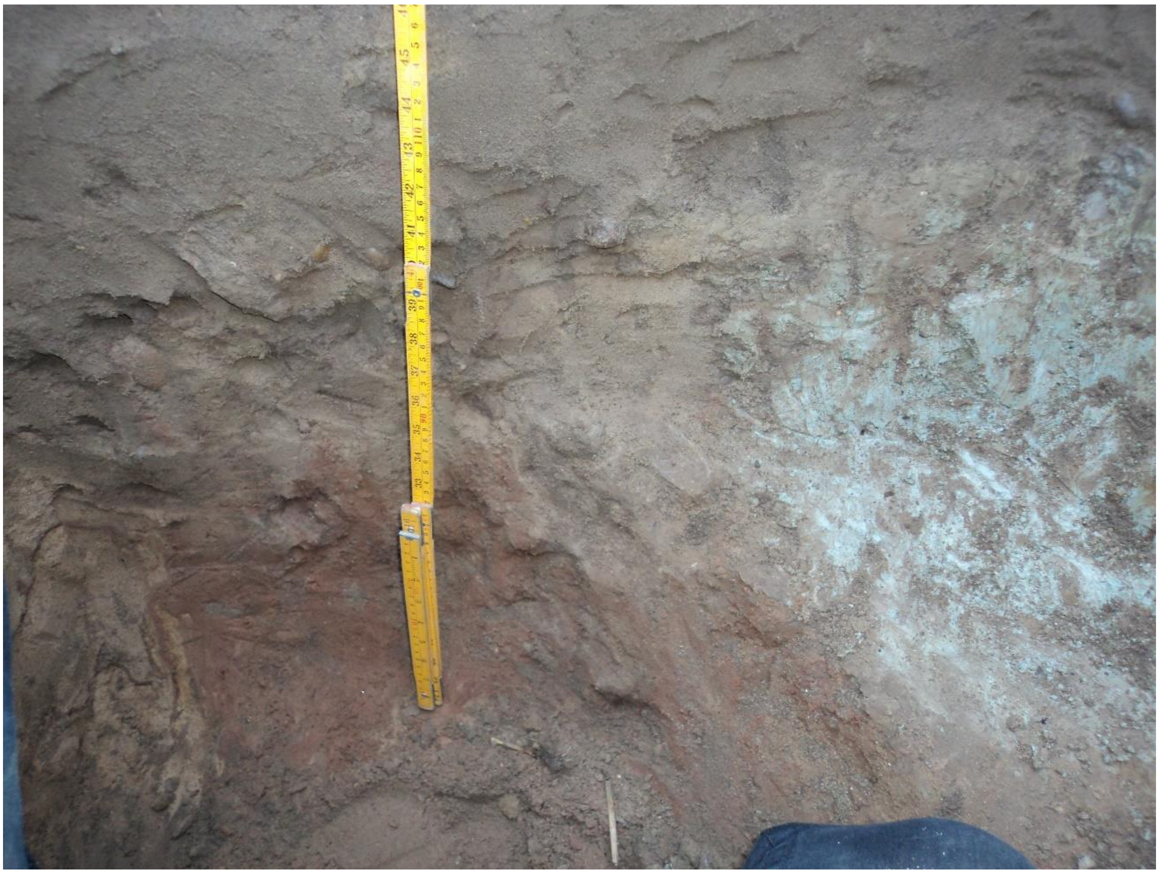


Plate 9: Scale: each ruler segment = 20cm (total 60cm). Test pit 3. This photo shows more clearly the undecipherable terrace accumulations, with redeposited Mercia Mudstone mixed with alluvial sand, next to green clay, all sealed by well-rounded well-sorted cobbles.

APPENDIX IV: Sediment data

All sediment data, 2011-2012

Easting	Northing	EAR take	Core/TP	Depth	Unit	CaCO3	LOI (%) Sand	Mag sus (XLF)l	Median	Mean (Mz) Sand (phi)	Sorting (σ1) Sand	Meanxsort	Skewness (SK1)Sand	Kurtosis (KG) Sand	Coarse Sand (%) Sand	Medium sand (%) Sand	Fine sand (%) Sand	Silt (%) Sand	Clay (%) Sand
483557	379578	2011	Core 5	0-40	Topsoil														
483557	379578	2011	Core 5	40-100	Sand		0.45	4.7	1.84	1.89	-0.82	-1.5498	-0.26	1.54	7.4	52.6	34.8	5	0.1
483338	380533	2011	Core 7	37-80	Sand		0.3	2.3	1.42	1.51	-1.25	-1.8875	-0.46	3.27	20.3	59.6	11.4	8.1	0.6
483338	380533	2011	Core 7	80-95	Red marl	0	0.99	5.79											
483332	380281	2011	Core 8	27-41	Red marl		1.13	7.8											
483404	379990	2011	Core 9	0-30	Topsoil														
483404	379990	2011	Core 9	40-52	Red marl		1.16	8.39											
483404	379990	2011	Core 9	52-64	Sand		0.74	4.7	1.79	1.93	-1.16	-2.2388	-0.44	2.16	8.8	53	29.5	8.6	0.1
483674	381044	2011	Core 10	40-50	Mottled clay	0	2.43	5.4											
483605	380707	2011	Core 12	30-50	Sand	0	0.42	2.34	1.43	1.5	-1.24	-1.86	-0.44	3.19	20.4	59.5	12.1	7.5	0.5
483605	380707	2011	Core 12	50-58	Sand and charcoal	0	0.78	3.33	1.36	1.48	-0.95	-1.406	-0.37	1.7	27.1	51.3	16.1	5.5	0
483605	380707	2011	Core 12	58-62	Sand	0	0.44	1.43	1.4	1.48	-0.88	-1.3024	-0.36	1.95	21.9	58.6	14	5.6	0
483605	380707	2011	Core 12	62-86	Sand and charcoal	0	0.44	3.56	1.46	1.62	-0.92	-1.4904	-0.38	1.45	21.3	52.9	20.9	4.9	0
483605	380707	2011	Core 12	86-100	Sand	0.11	0.33	1.84	1.41	1.45	-0.84	-1.218	-0.32	1.99	21.4	60.9	12.5	5	0.1
483552	380363	2011	Core 13	32-100	Sand		0.61	12.31	1.63	1.7	-0.95	-1.615	-0.34	1.96	13.2	57.5	23.4	5.6	0.3
483510	380098	2011	Core 14	0-100	Sand														
483610	379871	2011	Core 15	35-40	Marl	0.21	1.49	10.02											
483610	379871	2011	Core 15	40-80	Sand		0.58	9.86	1.69	1.73	-0.7	-1.211	-0.21	1.41	10.3	59.6	26	3.7	0.4
483610	379871	2011	Core 15	80-90	Marl	0	2.35	7.94											
483955	381054	2011	Core 16	25-43	Sand		0.66	4.93											
484104	380997	2011	Core 17	40-68	Sand		0.52	3.79	1.56	1.58	-0.58	-0.9164	-0.12	1.27	13.1	66.1	18.2	2.6	0
484104	380997	2011	Core 17	68-70	Sand and charcoal		19.35	6.1	1.69	2.04	-1.53	-3.1212	-0.49	1.82	18.1	44.9	24	12.8	0.3
484104	380997	2011	Core 17	72-80	Sand		2.84	3.27	1.45	1.52	-0.8	-1.216	-0.33	1.82	18.3	61.9	15.1	4.8	0
483993	380817	2011	Core 18	47-81	Sand		0.99	2.21	1.61	1.69	-0.86	-1.4534	-0.33	1.77	12.9	59.6	21.9	5.5	0.1
483993	380817	2011	Core 18	81-100	Marl		1.09	2.06											
483823	380160	2011	Core 20	80-100	Sand		0.8	2.41	1.73	1.82	-0.89	-1.6198	-0.33	1.66	10	55.5	28.7	5.6	0.2
483773	379894	2011	Core 21	30-90	Sand	0.23	0.48	8.83	1.81	1.92	-0.98	-1.8816	-0.38	1.76	5.8	56.8	30.7	6.6	0.1
483773	379894	2011	Core 21	90-100	Sand with ferrous inclusions		0.96	7.22											
483725	379586	2011	Core 22	40-65	Red Marl	0.23	1.37	6.61	2.24	3.23	-2.38	-7.6874	-0.53	0.74	14.6	29.9	24.9	28.4	2.3
483488	379824	2011	Core 25	45-100	Sand		0.47	1.4	1.7	1.76	-0.8	-1.408	-0.27	1.61	10.4	57.8	26.8	4.5	0.5
483972	380540	2011	Core 29	39-50	Silty sand (just above HPSG.	0	1.34	40.86	1.85	2.1	-1.3	-2.73	-0.47	1.76	9.7	48.3	32.5	10.2	0.3
483434	380532	2011	Core 30	40-57	Sand	0	0.92	9.06	2	2.22	-1.42	-3.1524	-0.43	1.73	9.9	40.3	37.7	11.7	0.4
483434	380532	2011	Core 30	57-65	HPSG sand	0	0.2	1.14	2.18	2.17	-0.81	-1.7577	-0.02	1.06	7	34.1	55.6	3.2	0
483379	380902	2011	Core 32	37-89	Red marl		1.66	5.5											
483763	380800	2011	Core 33	70-100	Sand		0.11	1.66	1.77	1.83	-1	-1.83	-0.38	2.39	7.4	57.9	28.2	6.3	0.1
483909	380568	2011	Core 34	35-51	Grey/green clay	0	3.09	14.73	6.69	7.23	-2.48	-17.93	-0.27	1.94	0	2.4	5.4	69.4	22.8
483798	380038	2011	Core 36	57-100	Silty sand		0.29	5.69											
483761	378754	2011	Core 37	45-60	Clay	0	2	9.1											
483563	380775	2011	Core 38	45-49	Sand		0.48	6.55											
484121	380820	2011	Core 39	35-50	Organic silt		46.51	0											
484121	380820	2011	Core 39	50-55	Peat	0	28.15	3.59											
484121	380820	2011	Core 39	55-70	Sand		1.04	0.27											
484121	380820	2011	Core 39	70-85	Sand		0.77	0.68	1.7	1.83	-1.17	-2.1411	-0.45	2.35	10.7	55.6	25.2	8.1	0.3
484023	380536	2011	Core 40	0-80	Peat														
484023	380536	2011	Core 40	80-100	Sand	0	0.7	0.65	2.1	3.14	-2.18	-6.8452	-0.63	0.88	8.1	38.8	24.8	26.5	1.8
484151	380430	2011	Core 41	112	Peat														
484125	380247	2011	Core 43	0-36	Peat														
484125	380247	2011	Core 43	36-62	Sand		1.28	2.44	1.92	2.2	-1.42	-3.124	-0.49	1.79	8.8	44.5	34.3	12.1	0.3
484311	380813	2011	Bunker s Hill	25	Sand		0.92	2.63	1.48	1.51	-0.58	-0.8758	-0.12	1.18	17	64.5	16.4	2	0.1
483758	378864	2011	TP1	30	Sand														
483758	378864	2011	TP2	50	Sand														
483758	378864	2011	TP3	70	Sand														
483758	378864	2011	TP4	90	Sand														
483758	378864	2012	2011 tp1	90.00	Sand				1.91	2.84	-2.02	-5.7505	-0.63	1.12	11.26	41.81	24.35	22.07	0.51
483631	380752	2012	core 14	100.00	Sand														
483631	380752	2012	core 14	200.00	Sand														
483631	380718	2012	core 15	100.00	Sand														
483631	380678	2012	core 16	100.00	Sand				1.43	1.46	-0.57	-0.8376	-0.15	1.28	15.42	70.72	10.04	3.82	0.00
483631	380678	2012	core 16	200.00	Sand														
483631	380678	2012	core 16	300.00	Sand				1.61	1.63	-0.55	-0.8985	-0.09	1.15	8.04	71.04	18.56	2.25	0.11
483631	380628	2012	core 17	100.00	Sand														
483631	380628	2012	core 17	148.00	Sand				1.66	2.24	-1.70	-3.8114	-0.63	1.92	14.50	49.62	19.77	15.55	0.57
483631	380220	2012	core 28	70.00	Sand				1.97	2.94	-2.05	-6.042	-0.65	1.34	8.74	42.43	27.60	20.32	0.91
483531	380251	2012	core 29	100.00	Sand														
483631	380170	2012	core 30	100.00	Sand														
483631	380070	2012	core 31	100.00	Sand														
483631	380020	2012	core 32	90.00	Sand				2.07	2.31	-1.43	-3.3035	-0.48	1.97	6.24	40.41	40.43	11.99	0.93
483631	379970	2012	core 33	69.00	Sand														
483631	379920	2012	core 34	59.00	Sand														
483479	379805	2012	core 36	100.00	Sand														
483731	380120	2012	core 37	100.00	Sand				1.77	1.89	-1.26	-2.3777	-0.46	2.66	8.80	54.74	27.02	8.47	0.97
483731	380120	2012	core 38	100.00	Sand														
483731	380120	2012	core 38	128.00	Sand														
484031	380928	2012	core 38	175.00	Sand				1.69	2.13	-1.52	-3.2229	-0.59	2.21	12.73	52.34	20.42	14.35	0.15
484061	380928	2012	core 39	51.00	Sand														

484023	380536	2011	Core 40	0-80	Peat														
484023	380536	2011	Core 40	80-100	Sand	0	0.7	0.65	2.1	3.14	-2.18	-6.8452	-0.63	0.88	8.1	38.8	24.8	26.5	1.8
484151	380430	2011	Core 41	112	Peat														
484125	380247	2011	Core 43	0-36	Peat														
484125	380247	2011	Core 43	36-62	Sand		1.28	2.44	1.92	2.2	-1.42	-3.124	-0.49	1.79	8.8	44.5	34.3	12.1	0.3
484311	380813	2011	Bunkers Hill	25	Sand		0.92	2.63	1.48	1.51	-0.58	-0.8758	-0.12	1.18	17	64.5	16.4	2	0.1
483758	378864	2011	TP1	30	Sand														
483758	378864	2011	TP2	50	Sand														
483758	378864	2011	TP3	70	Sand														
483758	378864	2011	TP4	90	Sand														
483758	378864	2012	2011 tp1	90.00	Sand				1.91	2.84	-2.02	-5.7505	-0.63	1.12	11.26	41.81	24.35	22.07	0.51
483631	380752	2012	core 14	100.00	Sand														
483631	380752	2012	core 14	200.00	Sand														
483631	380718	2012	core 15	100.00	Sand														
483631	380678	2012	core 16	100.00	Sand				1.43	1.46	-0.57	-0.8376	-0.15	1.28	15.42	70.72	10.04	3.82	0.00
483631	380678	2012	core 16	200.00	Sand														
483631	380678	2012	core 16	300.00	Sand				1.61	1.63	-0.55	-0.8985	-0.09	1.15	8.04	71.04	18.56	2.25	0.11
483631	380628	2012	core 17	100.00	Sand														
483631	380628	2012	core 17	148.00	Sand				1.66	2.24	-1.70	-3.8114	-0.63	1.92	14.50	49.62	19.77	15.55	0.57
483631	380220	2012	core 28	70.00	Sand				1.97	2.94	-2.05	-6.042	-0.65	1.34	8.74	42.43	27.60	20.32	0.91
483531	380251	2012	core 29	100.00	Sand														
483631	380170	2012	core 30	100.00	Sand														
483631	380070	2012	core 31	100.00	Sand														
483631	380020	2012	core 32	90.00	Sand				2.07	2.31	-1.43	-3.3035	-0.48	1.97	6.24	40.41	40.43	11.99	0.93
483631	379970	2012	core 33	69.00	Sand														
483631	379920	2012	core 34	59.00	Sand														
483479	379805	2012	core 36	100.00	Sand														
483731	380120	2012	core 37	100.00	Sand				1.77	1.89	-1.26	-2.3777	-0.46	2.66	8.80	54.74	27.02	8.47	0.97
483731	380120	2012	core 38	100.00	Sand														
483731	380120	2012	core 38	128.00	Sand														
484031	380928	2012	core 38	175.00	Sand				1.69	2.13	-1.52	-3.2229	-0.59	2.21	12.73	52.34	20.42	14.35	0.15
484061	380928	2012	core 39	51.00	Sand														
484011	380928	2012	core 40	55.00	Sand														
484011	380928	2012	core 40	100.00	Sand														
484011	380928	2012	core 40	180.00	Sand														
484011	380928	2012	core 40	195.00	Sand				1.73	1.86	-1.11	-2.0671	-0.42	2.09	10.72	53.86	27.89	7.10	0.43
483961	380870	2012	core 41	100.00	Sand				1.95	2.27	-1.48	-3.3514	-0.55	2.17	6.13	46.23	33.28	13.53	0.83
483582	380705	2012	TP1	50.00	Sand		0.60	2.41	1.49	1.54	-1.16	-1.7805	-0.42	3.33	15.84	64.15	13.04	6.66	0.30
483582	380705	2012	TP1	100.00	Sand		0.40	1.49	1.50	1.54	-0.68	-1.0456	-0.21	1.46	16.58	62.90	16.41	3.83	0.28
483582	380705	2012	TP1	125.00	Sand		0.40	1.65	1.51	1.58	-1.20	-1.8941	-0.42	2.91	17.68	58.76	16.51	6.53	0.51
483631	380128	2012	TP2	50.00	Sand		1.57	18.63	1.56	1.61	-0.92	-1.4781	-0.35	2.30	13.75	63.07	17.33	5.85	0.00
483631	380128	2012	TP2	60.00	silt facies		0.81	7.73	1.44	1.46	-0.53	-0.7676	-0.06	1.13	18.11	67.27	12.90	1.72	0.00
483631	380128	2012	TP2	70.00	Sand		0.41	3.33											
483631	380128	2012	TP2	80.00	Sand				1.64	1.65	-0.52	-0.8526	-0.07	1.15	9.21	67.49	21.59	1.72	0.00
483631	380128	2012	TP2	90.00	Sand		0.41	3.05											
483631	380128	2012	TP2	100.00	Sand		0.40	0.97	1.72	1.77	-0.77	-1.3635	-0.27	1.64	9.01	59.06	27.05	4.63	0.25
483631	380128	2012	TP2	110.00	Sand		0.59	2.51	1.57	1.58	-0.53	-0.8378	-0.09	1.19	11.86	68.61	16.63	2.37	0.54
483631	380128	2012	TP2	120.00	Sand		0.40	1.68											
483556	380542	2012	TP3	30.00	Sub-soil		2.51	45.59											
483556	380542	2012	TP3	40.00	Sub-soil		1.48	47.74	2.29	3.31	-2.25	-7.4501	-0.57	0.74	8.38	33.60	27.31	29.36	1.34
483556	380542	2012	TP3	50.00	Silty-sand		0.99	52.95											
483556	380542	2012	TP3	60.00	Silty-sand		0.87	58.57	2.23	3.30	-2.30	-7.6014	-0.59	0.75	8.94	34.48	26.73	27.95	1.90
483556	380542	2012	TP3	70.00	Silty-sand		4.21	49.76											
483556	380542	2012	TP3	80.00	Silty-sand		4.48	57.05	2.60	3.40	-2.16	-7.328	-0.49	0.80	6.33	29.29	31.98	31.01	1.38
483556	380542	2012	TP3	90.00	Silty-sand		0.00	47.08											
483556	380542	2012	TP3	100.00	Silty-sand		0.71	18.47	2.52	3.43	-2.21	-7.5751	-0.52	0.84	6.77	27.81	35.97	28.05	1.40
483556	380542	2012	TP3	105.00	Silty-sand														
483556	380542	2012	TP3	120.00	HPSG sand		0.60	10.24											
483556	380542	2012	TP3	120.00	Mercia Mudstone		1.68	6.74											
483556	380542	2012	TP3	135.00	HPSG sand		0.65	7.48	2.10	2.16	-0.88	-1.9028	-0.22	1.33	5.12	39.13	50.11	5.51	0.12

Appendix V: Portable OSL data

Year taken	Test pit/core no.	depth	Blue	err	Moisture %	IR	err	Counts	err	Blue	err	Counts	err	Normalised corrections(to TP3 2011) OSL	err
2011.00	Tork Sand lane TP1	30.00	2808.00	86.00	2.00	1735.00	80.00	37.00	11.00	2808.00	86.00	43.00	11.00	20356.51	312.94
	Tork Sand lane TP2	50.00	1993.00	81.00	1.90	1014.00	75.00	16.00	10.00	1993.00	81.00	7.00	9.00	16668.97	139.25
	Tork Sand lane TP3	70.00	4359.00	95.00	2.20	4494.00	95.00	57.00	12.00	4359.00	95.00	97.00	13.00	20832.52	467.67
	Tork Sand lane TP4	90.00	16405.00	145.00	0.90	10899.00	125.00	165.00	16.00	16405.00	145.00	245.00	18.00	49772.20	309.36
2012.00	14.00	100.00	18739.00	155.00	0.60	13024.00	135.00	138.00	15.00	18739.00	155.00	262.00	19.00	36230.82	223.98
	14.00	200.00	8342.00	16.00	3.90	6123.00	106.00	66.00	12.00	8342.00	16.00	84.00	13.00	99270.28	-1314.62
	15.00	100.00	37156.00	206.00	3.20	20902.00	161.00	261.00	19.00	37156.00	206.00	588.00	26.00	473367.66	1604.90
	16.00	100.00	16177.00	146.00	1.30	11233.00	128.00	177.00	16.00	16177.00	146.00	203.00	17.00	142357.60	1284.80
	16.00	200.00	32054.00	193.00	4.60	17253.00	150.00	231.00	18.00	32054.00	193.00	508.00	24.00	334952.05	1913.13
	16.00	300.00	16614.00	148.00	6.10	13700.00	137.00	160.00	16.00	16614.00	148.00	199.00	17.00	103527.88	1054.38
	17.00	100.00	12281.00	132.00	2.00	9420.00	121.00	111.00	14.00	12281.00	132.00	114.00	14.00	71717.49	620.78
	17.00	148.00	38314.00	209.00	10.20	24852.00	173.00	290.00	19.00	38314.00	209.00	502.00	24.00	1349374.05	5331.23
	28.00	70.00	102949.00	329.00	8.00	84259.00	299.00	1115.00	35.00	102949.00	329.00	1478.00	40.00	2253701.99	6407.40
	29.00	100.00	36839.00	205.00	2.70	24646.00	173.00	296.00	20.00	36839.00	205.00	571.00	26.00	332974.92	1369.26
	30.00	100.00	24397.00	172.00	5.10	16813.00	148.00	223.00	18.00	24397.00	172.00	-	-	404367.60	2143.32
	31.00	100.00	24190.00	171.00	2.00	16340.00	147.00	242.00	18.00	24190.00	171.00	372.00	21.00	160408.81	825.37
	32.00	90.00	82990.00	297.00	1.60	60130.00	256.00	809.00	30.00	82990.00	297.00	1250.00	37.00	410448.66	1190.51
	33.00	65.00	60266.00	256.00	5.80	48832.00	232.00	618.00	27.00	60266.00	256.00	917.00	32.00	966154.88	3618.19
	34.00	59.00	227207.00	482.00	6.80	186148.00	437.00	2495.00	51.00	227207.00	482.00	3183.00	57.00	4223499.92	8004.73
	36.00	100.00	30041.00	188.00	4.20	16742.00	148.00	212.00	17.00	30041.00	188.00	472.00	24.00	507048.22	1867.35
	37.00	100.00	14074.00	139.00	6.40	8096.00	115.00	73.00	13.00	14074.00	139.00	233.00	18.00	350689.78	1952.17
	38.00	100.00	4025.00	96.00	7.80	1945.00	84.00	29.00	11.00	4025.00	96.00	49.00	12.00	145507.47	709.00
	38.00	128.00	3546.00	93.00	8.80	2594.00	88.00	20.00	10.00	3546.00	93.00	81.00	13.00	95536.36	1775.67
	38.00	175.00	2292.00	86.00	9.60	1391.00	81.00	-10.00	10.00	2292.00	86.00	38.00	11.00	81199.22	1398.04
	39.00	51.00	35681.00	94.00	11.70	2294.00	86.00	12.00	10.00	35681.00	94.00	70.00	12.00	14542699.15	-451539.80
	40.00	55.00	1397.00	81.00	10.10	676.00	76.00	15.00	10.00	1397.00	81.00	14.00	10.00	65304.94	404.98
	40.00	100.00	4182.00	97.00	5.50	2829.00	89.00	11.00	10.00	4182.00	97.00	63.00	12.00	76151.13	1141.93
	40.00	180.00	49876.00	235.00	12.80	31940.00	193.00	408.00	22.00	49876.00	235.00	670.00	27.00	2232733.18	7552.33
	40.00	195.00	95384.00	317.00	18.60	58670.00	253.00	810.00	36.00	95384.00	317.00	1350.00	38.00	6459909.81	15087.35
	41.00	100.00	41480.00	216.00	13.30	35624.00	202.00	443.00	22.00	41480.00	216.00	594.00	26.00	1438682.60	6825.88
	TP1	50.00	17673.00	151.00	2.90	12074.00	131.00	165.00	16.00	17673.00	151.00	301.00	20.00	168014.17	1049.03
	TP1	100.00	29231.00	85.00	4.70	15460.00	143.00	200.00	17.00	29231.00	85.00	392.00	22.00	581773.92	-1974.59
	TP1	125.00	39365.00	211.00	6.40	21865.00	164.00	306.00	20.00	39365.00	211.00	602.00	26.00	1015849.90	3275.26
	TP2	50.00	14902.00	141.00	6.20	8099.00	114.00	101.00	14.00	14902.00	141.00	211.00	17.00	380739.51	1853.75
	TP2	60.00	24278.00	171.00	5.40	17013.00	148.00	211.00	17.00	24278.00	171.00	291.00	19.00	419003.07	2258.56
	TP2	70.00	17186.00	149.00	6.70	11998.00	130.00	154.00	15.00	17186.00	149.00	263.00	19.00	369397.62	2404.48
	TP2	80.00	32124.00	193.00	3.70	23674.00	169.00	330.00	20.00	32124.00	193.00	473.00	24.00	361216.73	1762.22
	TP2	90.00	28776.00	184.00	6.40	20800.00	161.00	270.00	19.00	28776.00	184.00	442.00	23.00	570631.87	2881.60
	TP2	100.00	43429.00	220.00	5.40	29052.00	184.00	377.00	21.00	43429.00	220.00	610.00	26.00	785155.94	2983.28
	TP2	110.00	35533.00	201.00	7.60	18134.00	152.00	319.00	20.00	35533.00	201.00	514.00	24.00	1185119.84	3482.77
	TP3	40.00	2016.00	84.00	8.80	859.00	76.00	19.00	10.00	2016.00	84.00	17.00	10.00	2016.00	84.00
	TP3	50.00	3342.00	91.00	8.10	2024.00	84.00	18.00	10.00	3342.00	91.00	33.00	11.00	10147.65	595.45
	TP3	60.00	4096.00	95.00	7.40	2598.00	87.00	18.00	10.00	4096.00	95.00	-	-	8978.87	525.46
	TP3	70.00	3726.00	93.00	11.20	2696.00	88.00	43.00	11.00	3726.00	93.00	40.00	11.00	10046.95	633.47
	TP3	80.00	6697.00	108.00	8.40	4767.00	99.00	43.00	11.00	6697.00	108.00	126.00	14.00	1898.92	108.16
	TP3	90.00	26975.00	179.00	9.20	16814.00	148.00	215.00	17.00	26975.00	179.00	388.00	22.00	21351.26	1059.26
	TP3	100.00	68171.00	270.00	8.20	49257.00	233.00	648.00	27.00	68171.00	270.00	966.00	32.00	330069.20	15932.75
	TP3	105.00	226906.00	482.00	7.40	182684.00	433.00	2384.00	50.00	226906.00	482.00	3129.00	57.00	176969.54	8299.64
	TP3	110.00	54277.00	43.00	7.00	39600.00	211.00	495.00	24.00	54277.00	43.00	821.00	30.00	398734.14	16366.17
	TP3	120.00	100630.00	325.00	6.10	70392.00	275.00	935.00	32.00	100630.00	325.00	1442.00	39.00	722651.14	34400.92
	TP3	135.00	43101.00	219.00	4.80	27524.00	180.00	434.00	23.00	43101.00	219.00	588.00	26.00	284557.49	13864.61
	BHW	10.00	1076.00	99.00	1	401.00	96.00	-6.00	12.00	1076.00	99.00	7.00	12.00	6466.34	-244.80
	BHW	30.00	778.00	98.00	1.5	442.00	96.00	-6.00	12.00	778.00	98.00	2.00	12.00	4600.52	191.25
	BHW	40.00	1015.00	99.00	1.5	555.00	97.00	-13.00	13.00	1015.00	99.00	19.00	13.00	6236.04	158.25
	BHW	50.00	1562.00	102.00	1.5	1318.00	100.00	32.00	13.00	1562.00	102.00	47.00	14.00	6218.94	341.00
	BHW	60.00	1693.00	102.00	1.5	724.00	97.00	-4.00	12.00	1693.00	102.00	13.00	13.00	13299.80	-115.55
	BHW	70.00	3350.00	110.00	1.5	1626.00	102.00	17.00	13.00	3350.00	110.00	67.00	15.00	23186.70	87.69
	BHW	80.00	1837.00	103.00	3.2	706.00	97.00	-1.00	12.00	1837.00	103.00	29.00	13.00	34256.43	-665.93
	BHW	90.00	5355.00	119.00	3.2	2579.00	106.00	14.00	13.00	5355.00	119.00	115.00	16.00	79688.59	293.70
	BHW	100.00	1812.00	103.00	3.2	244.00	95.00	0.00	12.00	1812.00	103.00	47.00	14.00	96439.53	-18910.14

Appendix VI:

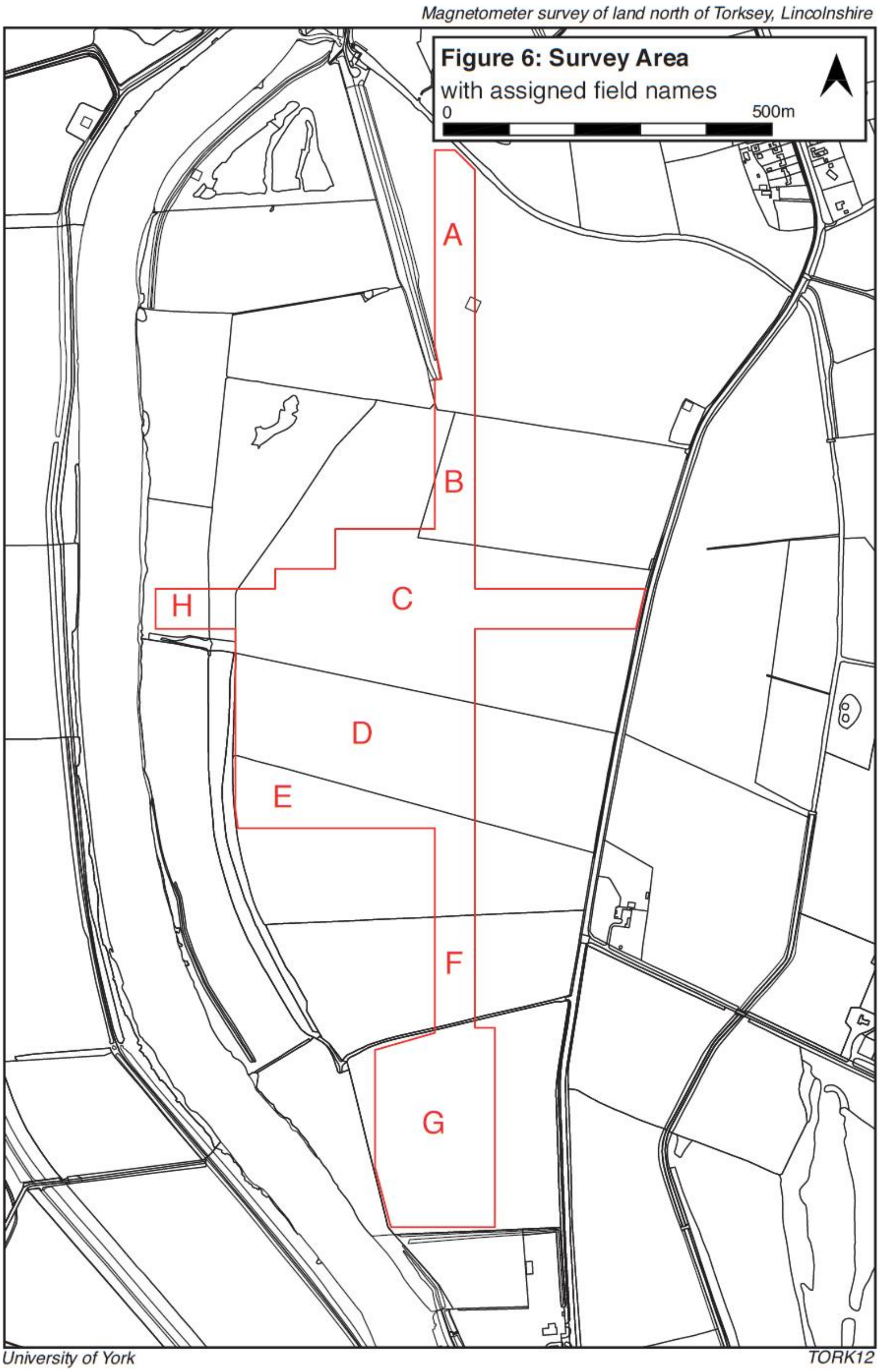
Pollen Taxa Dictionary

Latin name	Common name
Alnus glutinosa	Black alder
Quercus	Oak
Tilia	Lime
Fagus	Beech
Taxus	Yew
Ulmus	Elm
Corylus avellana-type	Hazel
Salix	Willow
Calluna vulgaris	Heather
Plantago lanceolata	Ribwort plantain
Poaceae	Grass
Graminae	Grain
Ranunculus	Buttercup, spearwort
Rumex	Sorrel
Urtica diotica	Nettle
Betula	Birch
Fraxinus excelsior	Ash
Pinus sylvestius	Pine
Ilex	Holly
Ribes Rubrum	Redcurrent
Artemesia-type	Wormwood
Asteraceae	Aster
Chenopodiceae	Goosefoot
Daphne	Genus: shrub
Cyperaceae	Sedge
Filipendula	Dropwort
Primula veris-type	Cowslip
Polygonum	Knotweed
Potentilla	Cinquefoils
Rosaceae	Rose
Saxifraga	Saxifrages
Taraxacum	Dandelion
Caryophyllaceae	Carnation family
Lactuceae	Family
Valeriana	Valerian
Centaurium	Centaurium
Silene diotica	Red campion
Pteripopsida	Fern
Hedera helix	Ivy
Polypodium	Fern (exotic)
Cirisium	Thistle

Appendix VII:

Magnetometry Survey results

All images from Brown 2012



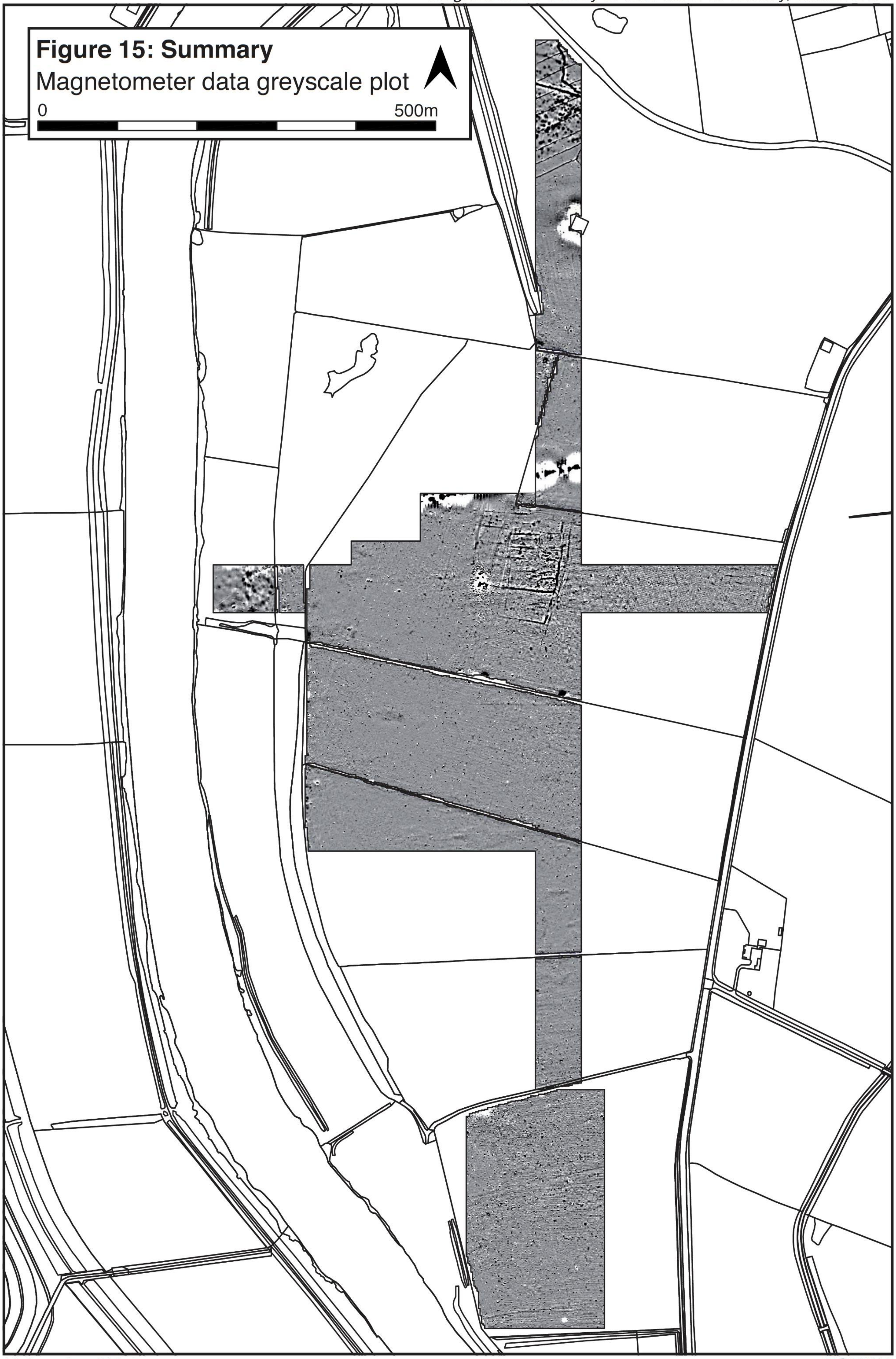


Figure 15: Summary
Magnetometer data greyscale plot

Appendix VIII: Historic maps

Rights have not been obtained for the use of this image in electronic media

Torksey enclosure map (LA 10-Nott/1/32. Tithe award 1869)

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Plan of fields in Torksey prior to the implementation of the rail line (LA, LDP 1/26 Sheet 4, 1845)

Map of the River Trent and flooding elevations (LLSL. Jessop (cartographer). August 1782. “Profile of the River Trent from mouth of Lincoln navigation to Cavendish Bridge”)

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“Profile of the River Trent from mouth of Lincoln navigation to Cavendish Bridge” cont.

Lincolnshire map (LLSL, 1/3/1824. 1824 Tower of London Ordnance Map Office).

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Amendment to 1824 Tower of London Ordnance Survey Lincolnshire map, with topography.

Flooding around Torksey and Littleborough (LLSL, Ref. 717. 1769. Grundy, J., and Kell, G. 'Flooding of Notthinghamshire'. County of Notts. [original LA 2S])

1828 Tithe award from Littleborough. Award missing from archive. (NA, PAS 123/10/3. 1828. Littleborough tithe award and map)

Tithe map and award (NA, EA 153/2/1/ 1845 Rampton tithe map and award)

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Eastern half of Sturton le Steeple parish (NA, EA 140/2/2-3. 1828. Sturton tithe map)

Selections from the Cottam tithe map (NA, EA 124/2/1-2 1796/1801. Cottam tithe map)

Rights have not been obtained for the use of this image in electronic media

Eastern part of the tithe award of Treswell parish (NA, EA 10/1. 1841 map of Treswell)

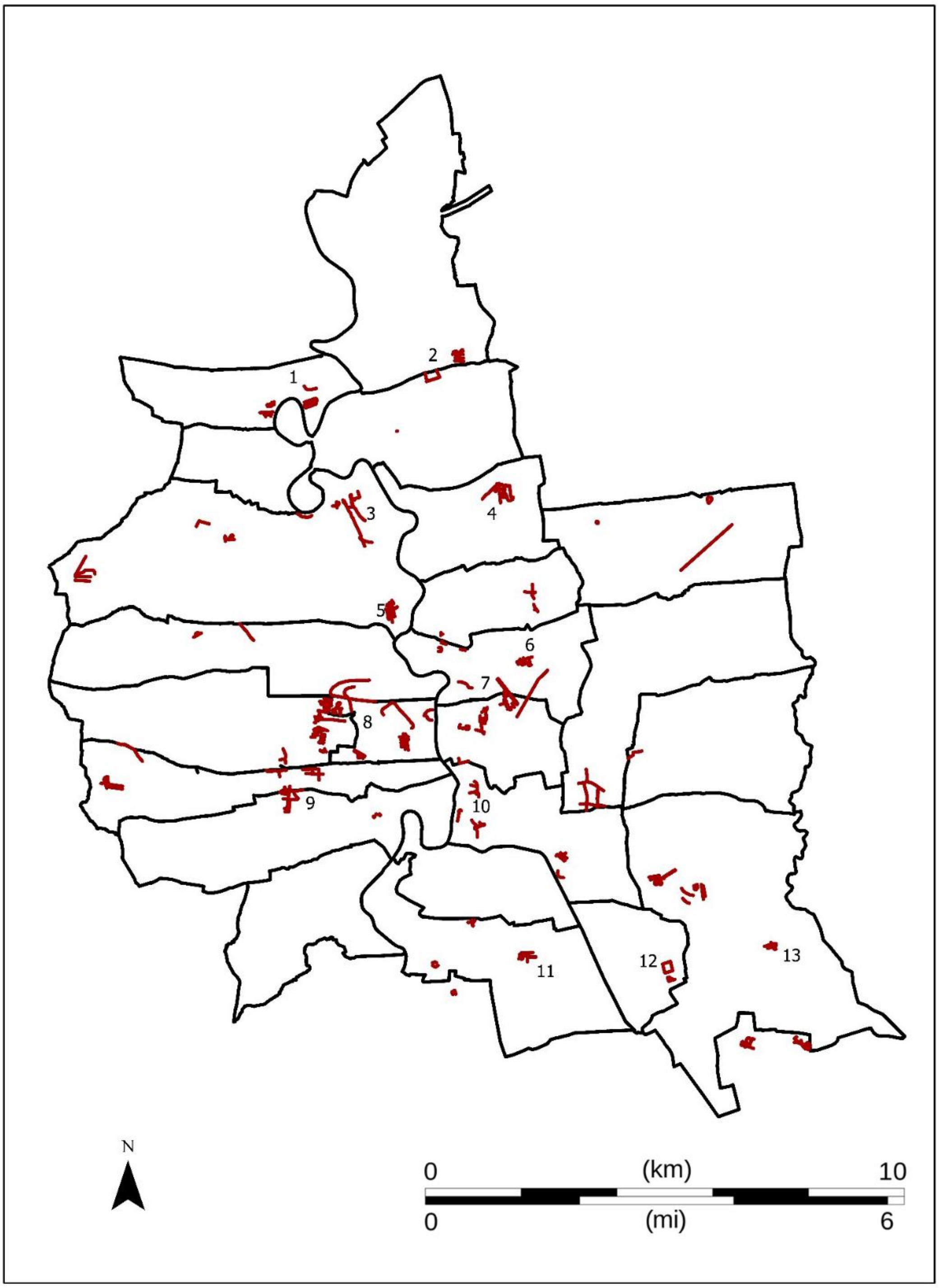
Rights have not been obtained for the use of this image in electronic media

1724 map of Littleborough (drawn by memory?) (NA, DD 2480/1. William Stukeley. 1724 map of Littleborough)

Map drawn prior to the installation of the pump house at Torksey Lock. (NA, C 54/75. Documents 1848-1920s, relating to the draining of the lands around Torksey Lock.)

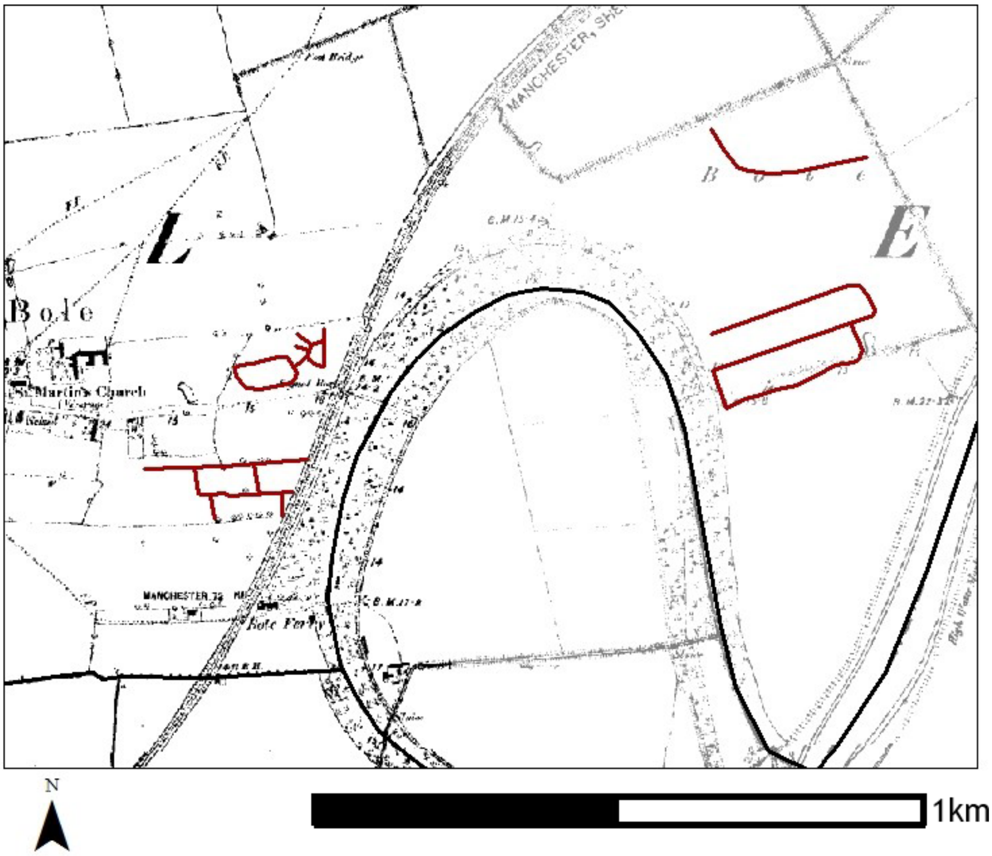
NA, EA 153/2/1. 1845 Rampton tithe map and award.

Appendix IX: Cropmarks

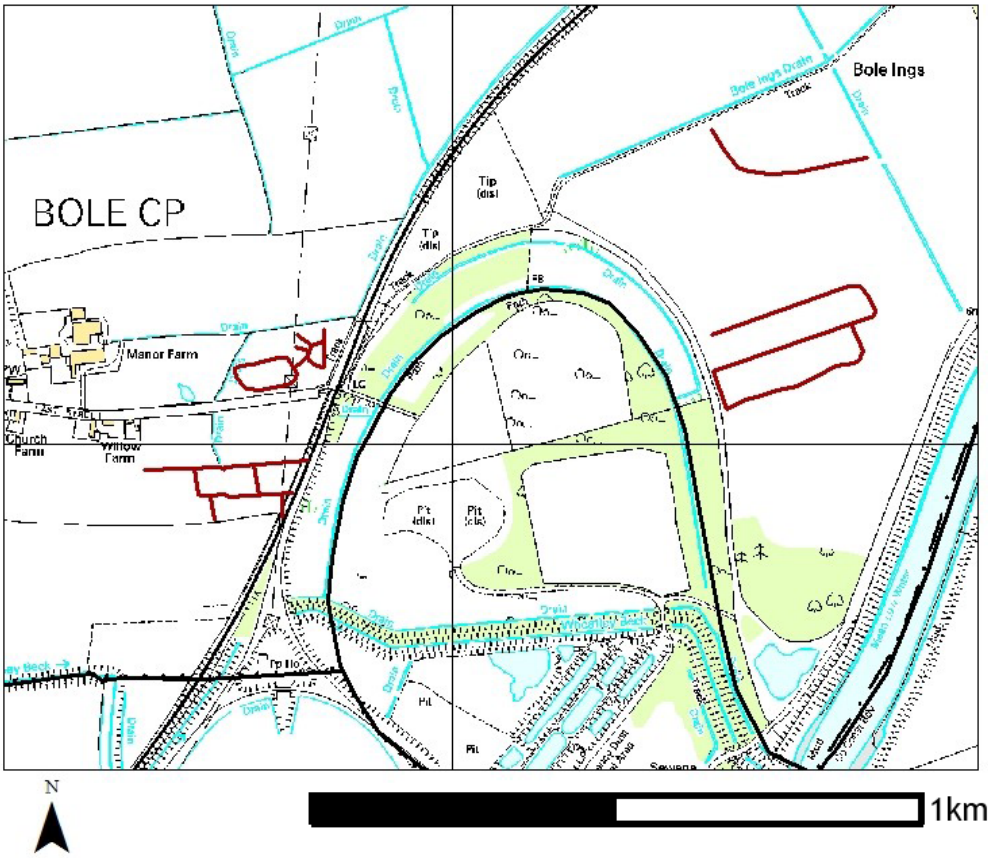


Area number refer to this initial map; all cropmarks will be shown on an OS 1st edition map, a modern OS map, and, where available, on LiDAR.

Area 1

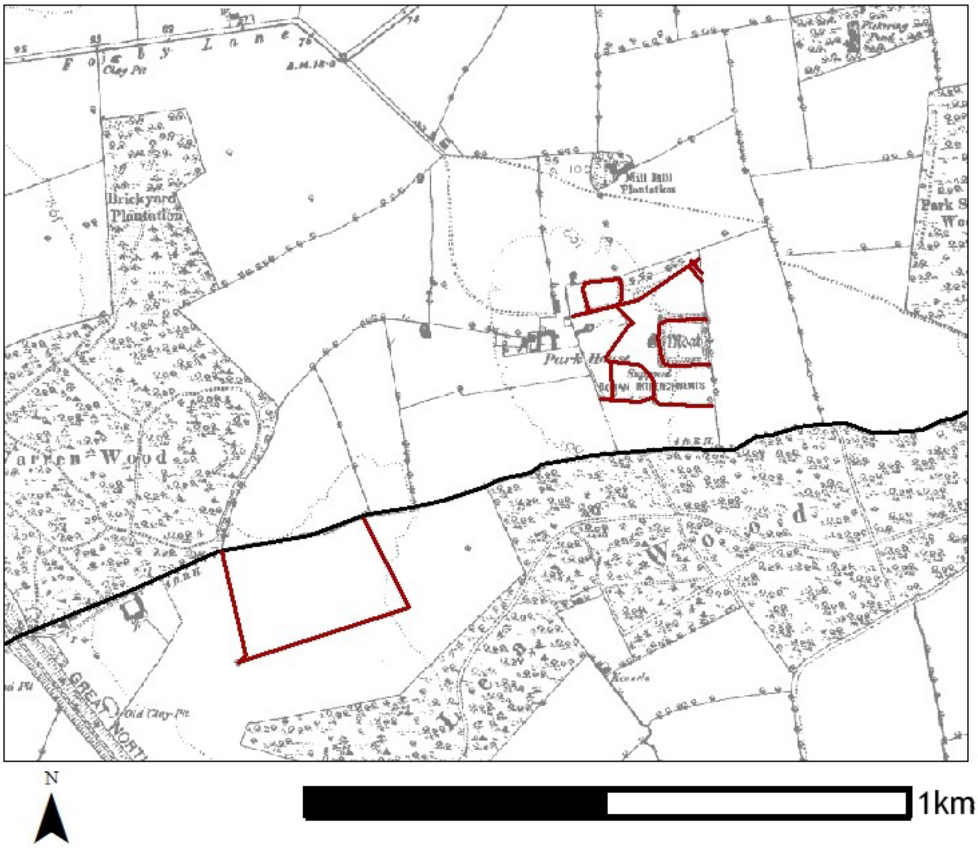


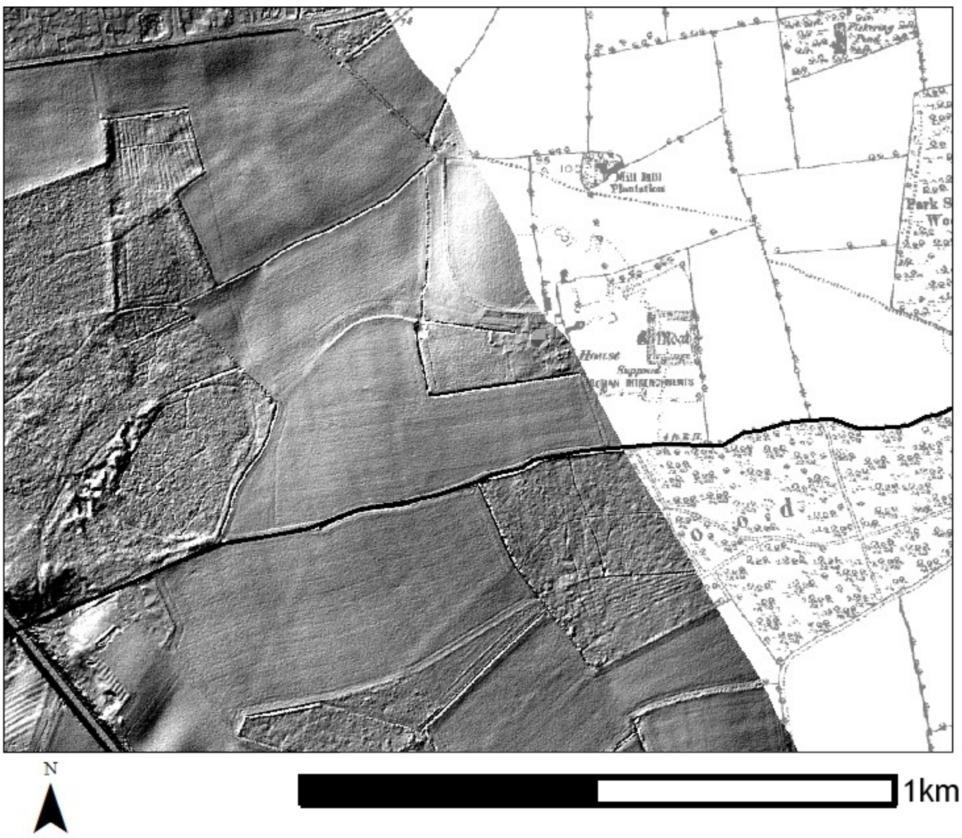
MANCHESTER, SHE
B o l e
E
L
Bole
St Martin's Church
MANCHESTER
Bole Farm
N
1km

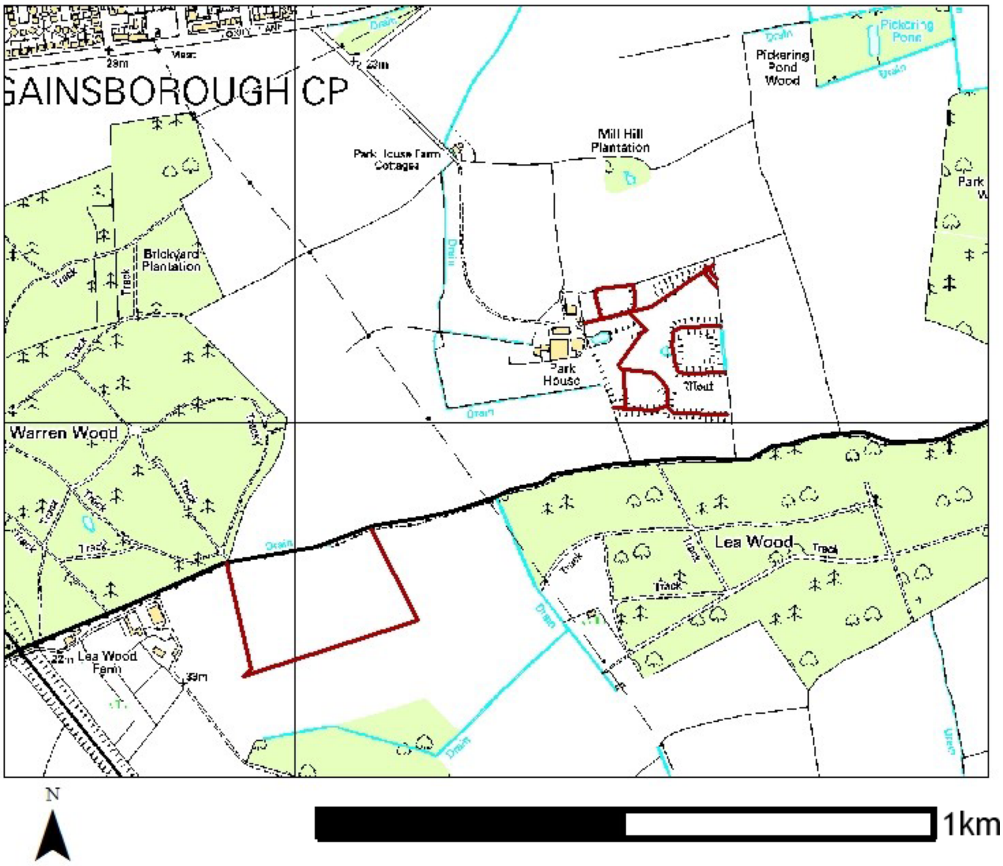


Bole Ings
Bole Ings Drain
Track
BOLE CP
Tip (dis)
Manor Farm
Church Farm
Willow Farm
Pit (dis)
Pit
Drain
N
1km

Area 2

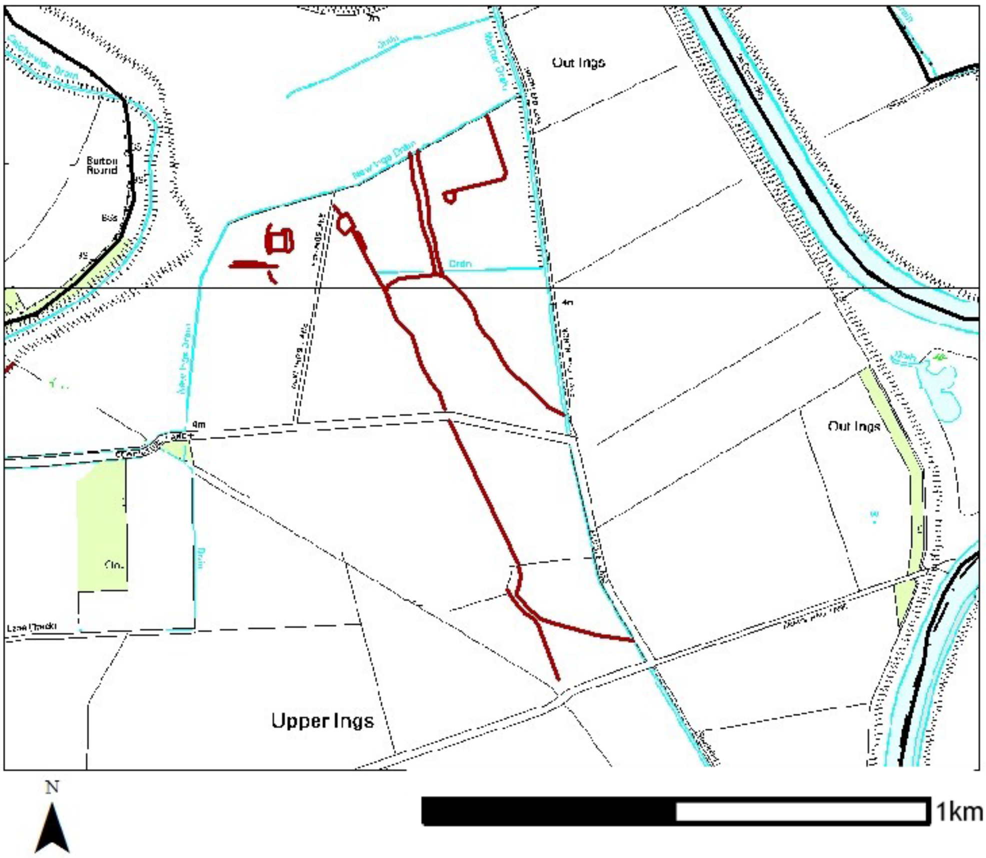

Foxby Lane
Clay Pit
Brickyard Plantation
Mill Hill Plantation
Pickering Pond
Park House
Supposed ROMAN INTRENCHMENTS
Warren Wood
Wood
Old Clay Pit
N
1km


Mill Hill Plantation
Pickering Pond
House
Supposed ROMAN INTRENCHMENTS
N
1km

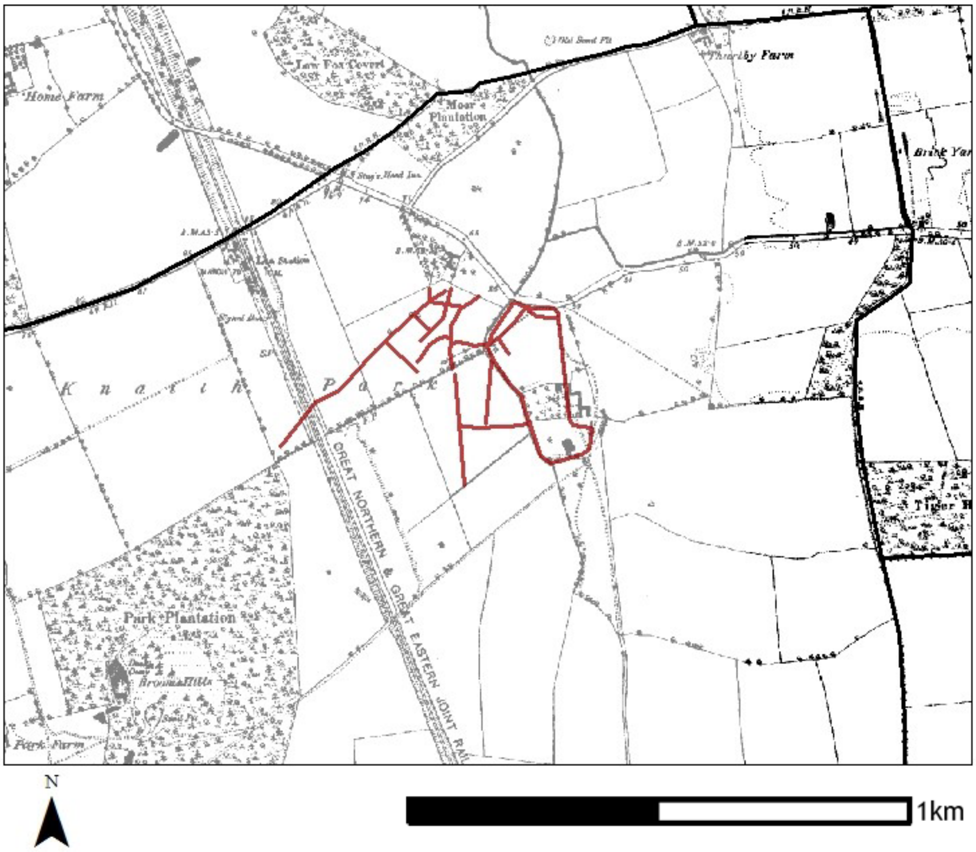

GAINSBOROUGH CP
Pickering Pond Wood
Pickering Pond
Mill Hill Plantation
Park House Farm Cottages
Brickyard Plantation
Park House
Moat
Warren Wood
Lea Wood
Lea Wood Farm
Track
Drain
28m
22m
39m
N
1km

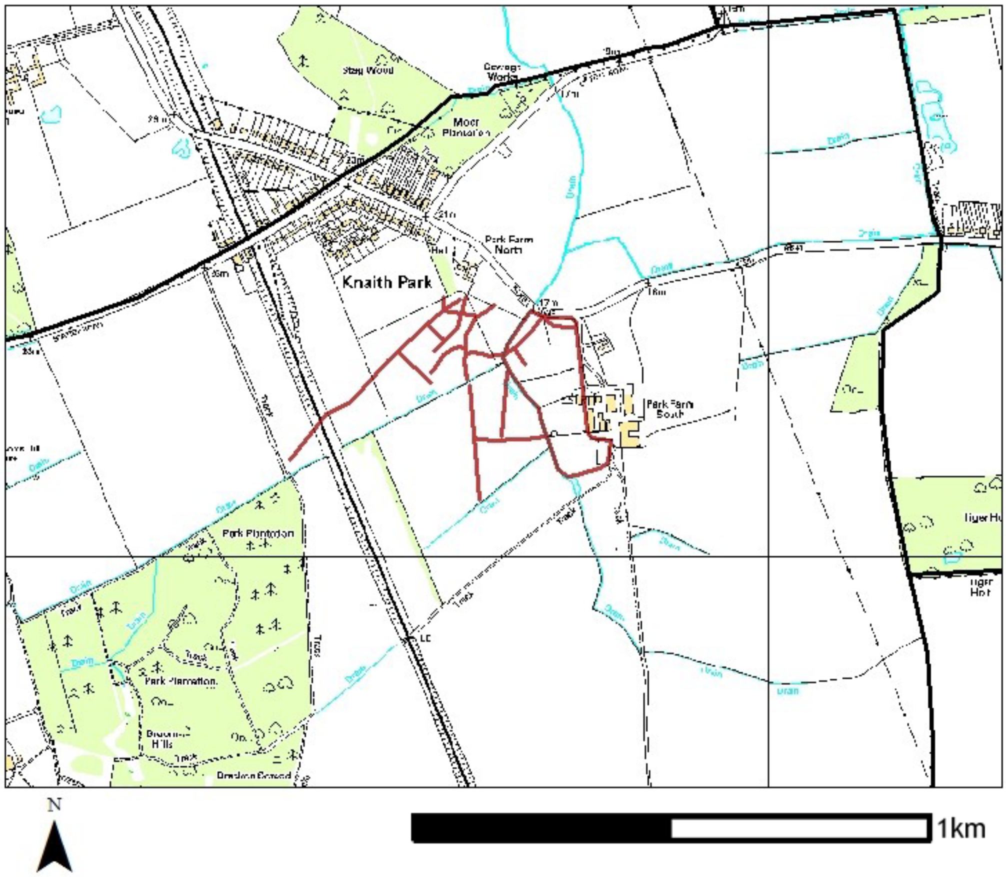
Area 3


Out Ings
New Ings Road
N
1km

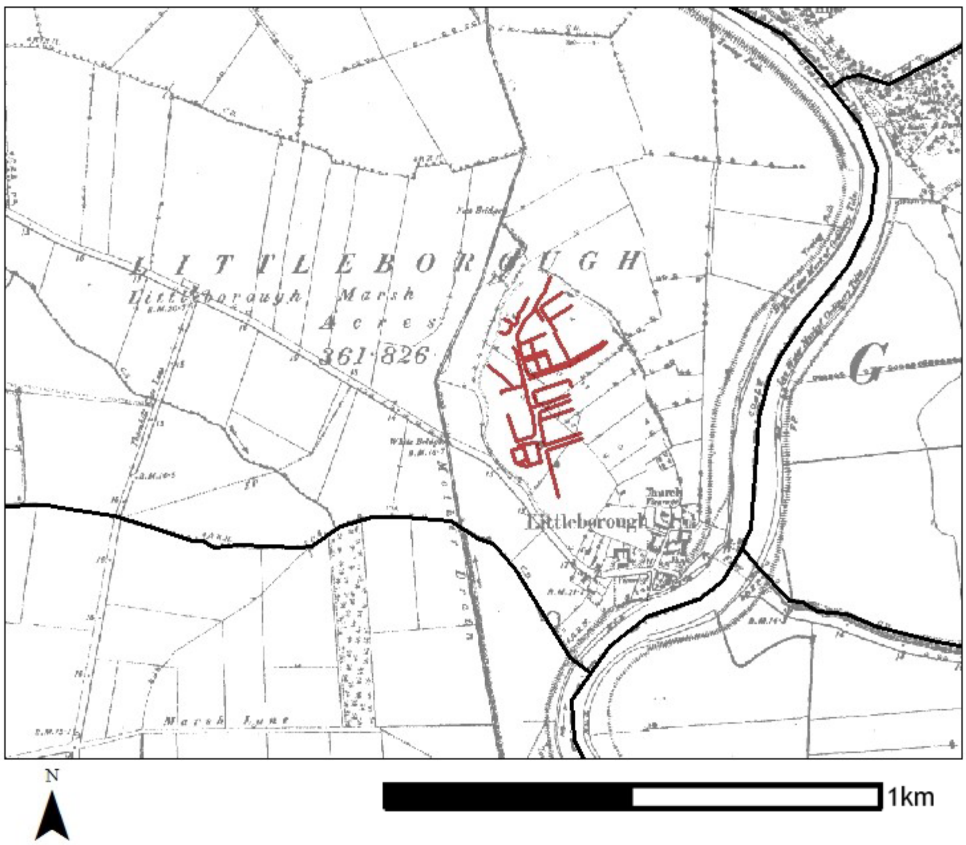


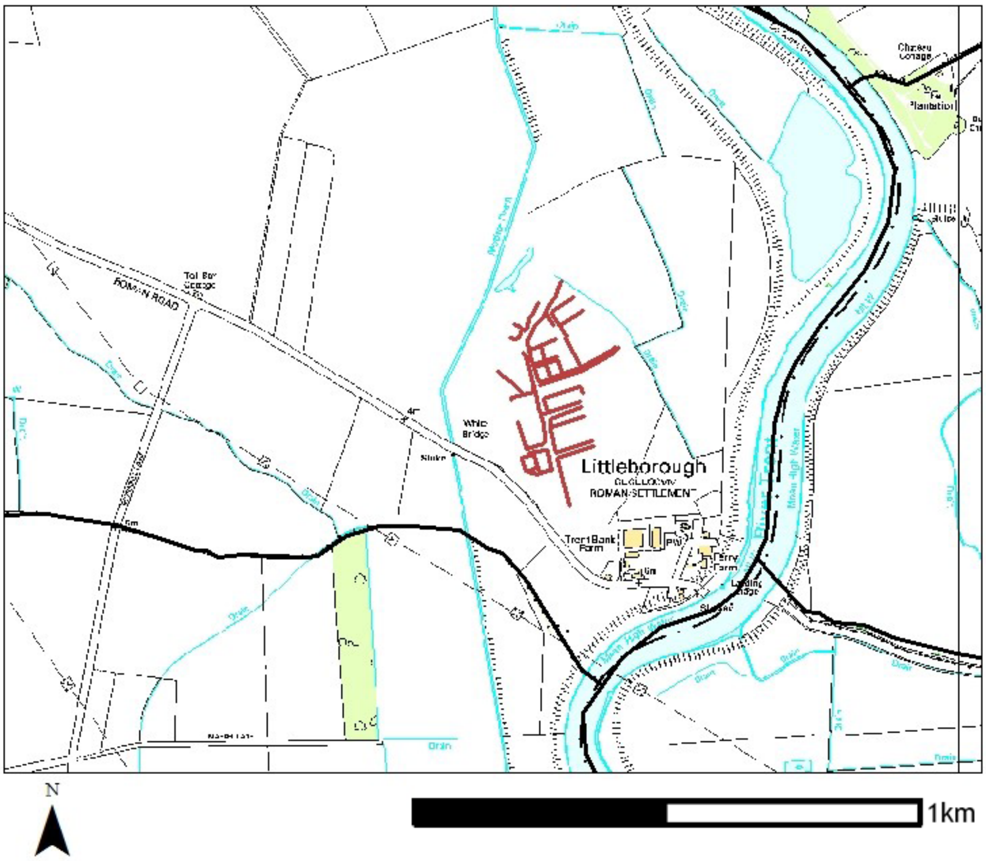
Area 4



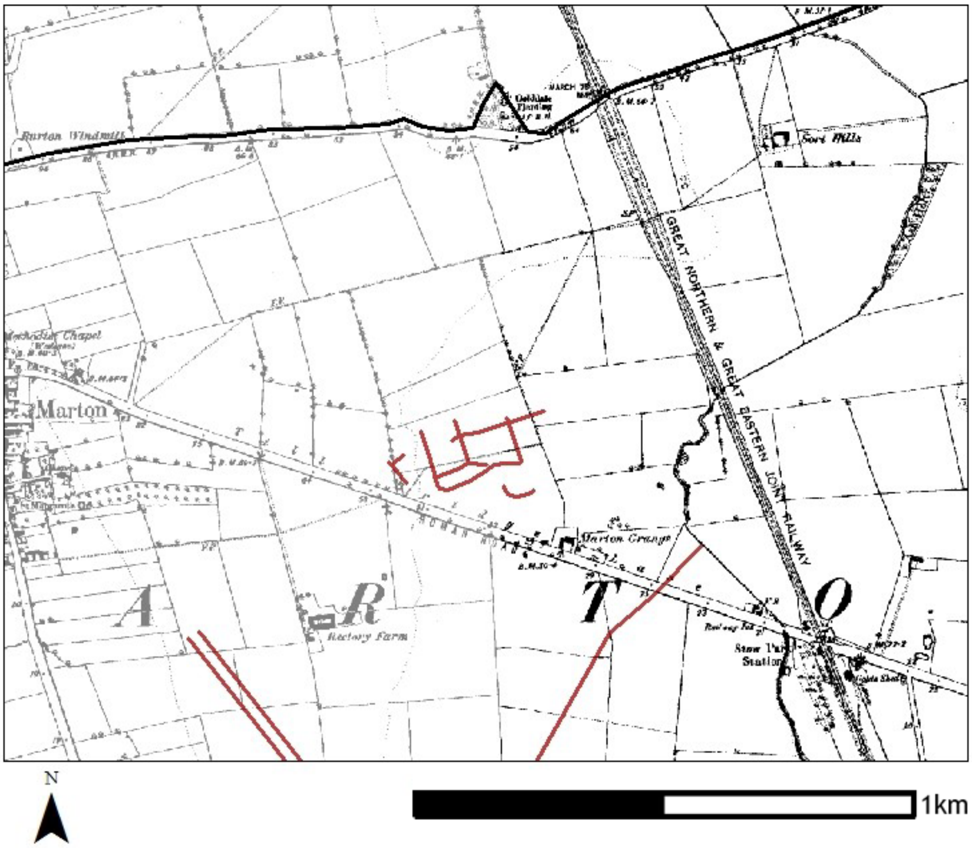

Stag Wood
Sewage Works
Moor Plantation
Knaith Park
Park Farm North
Park Farm South
Park Plantation
1km

Area 5

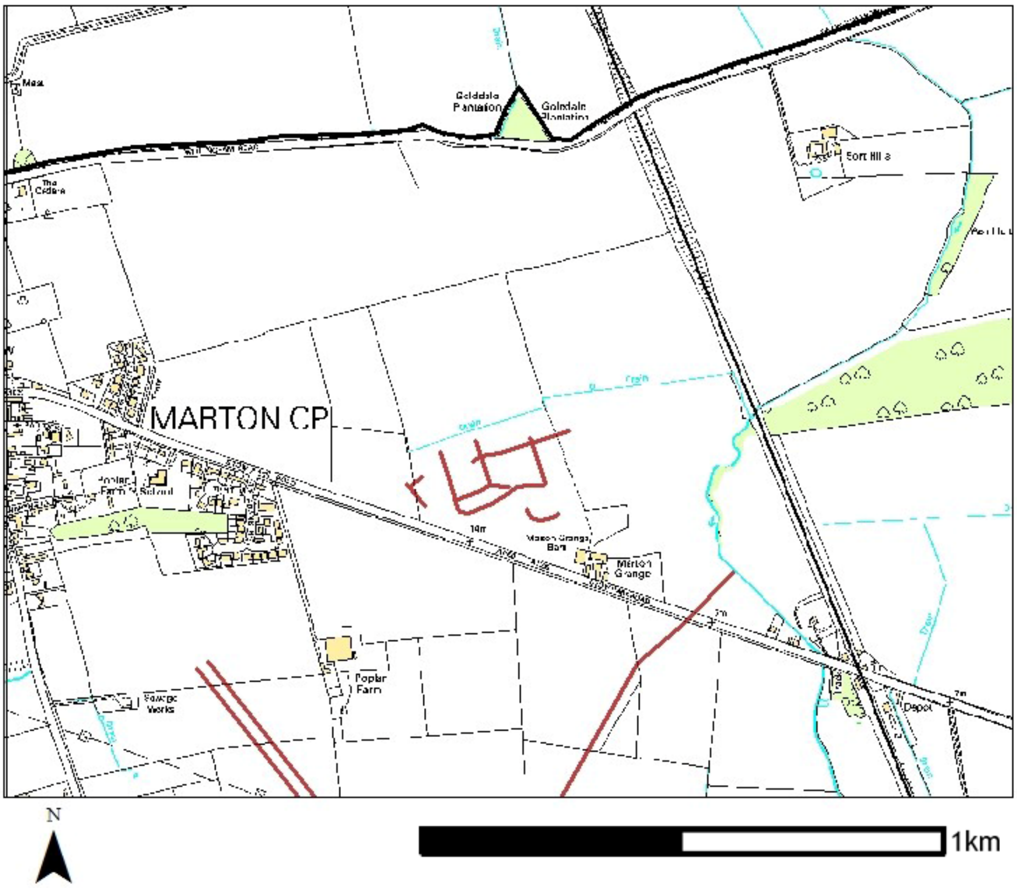

LITTLEBOROUGH
Littleborough Marsh
Acres
361·826
Littleborough
Marsh Lane
1km


ROMAN ROAD
Toll Bar Cottage
White Bridge
Littleborough
ROMAN SETTLEMENT
Trent Bank Farm
Ferry Farm
Landing Stage
N
1km

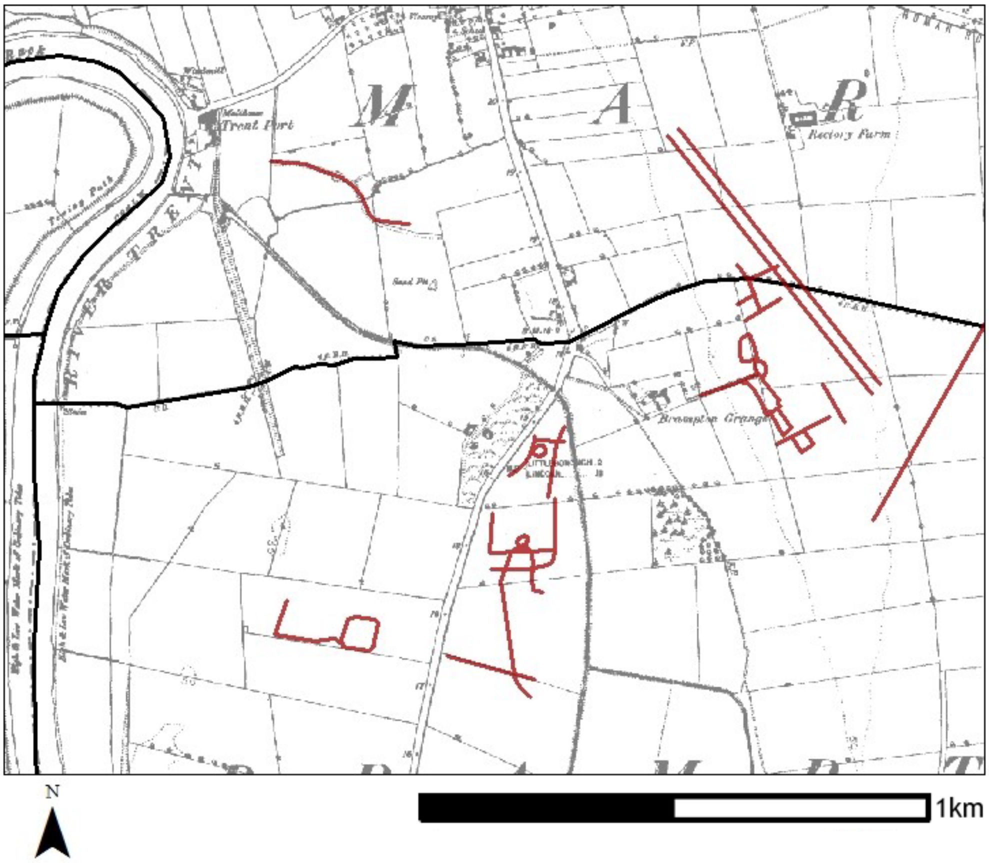
Area 6

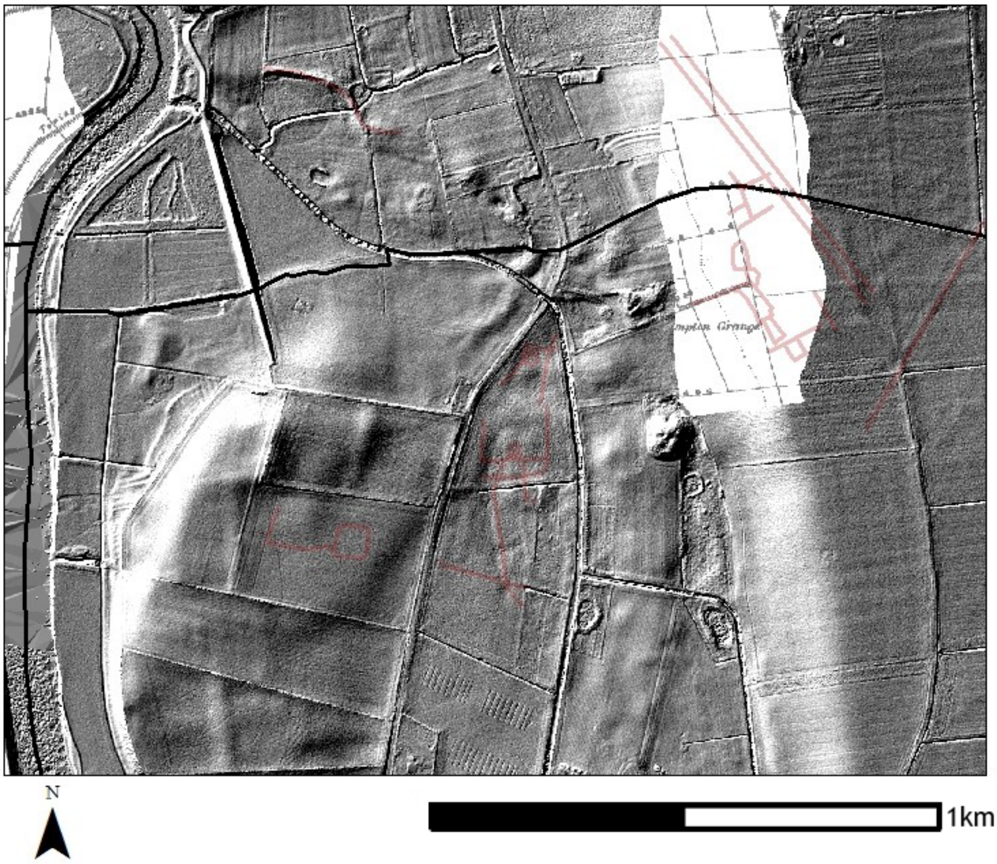

Marton Windmill
Marton
Marton Grange
Rectory Farm
GREAT NORTHERN & GREAT EASTERN JOINT RAILWAY
A R T O
N
1km

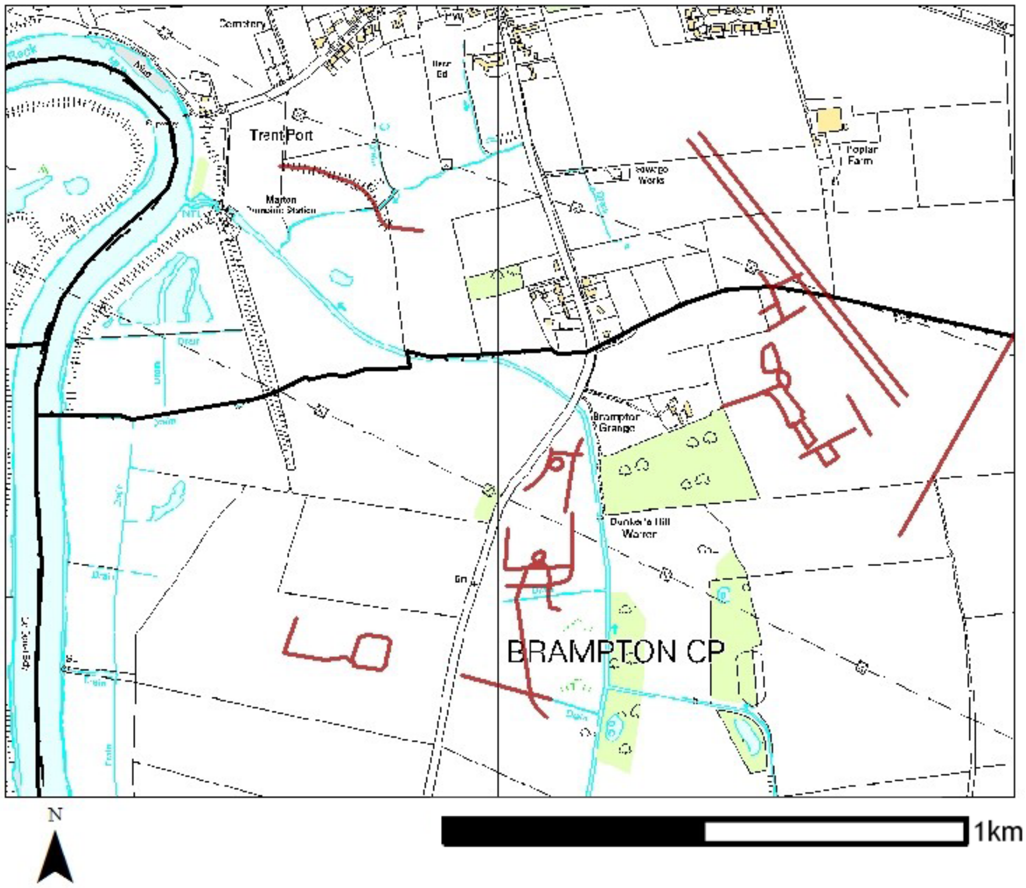

Burton Windmill
N
1km


Goldale Plantation
MARTON CP
Poplar Farm
Sewage Works
Marton Grange
Depot
N
1km

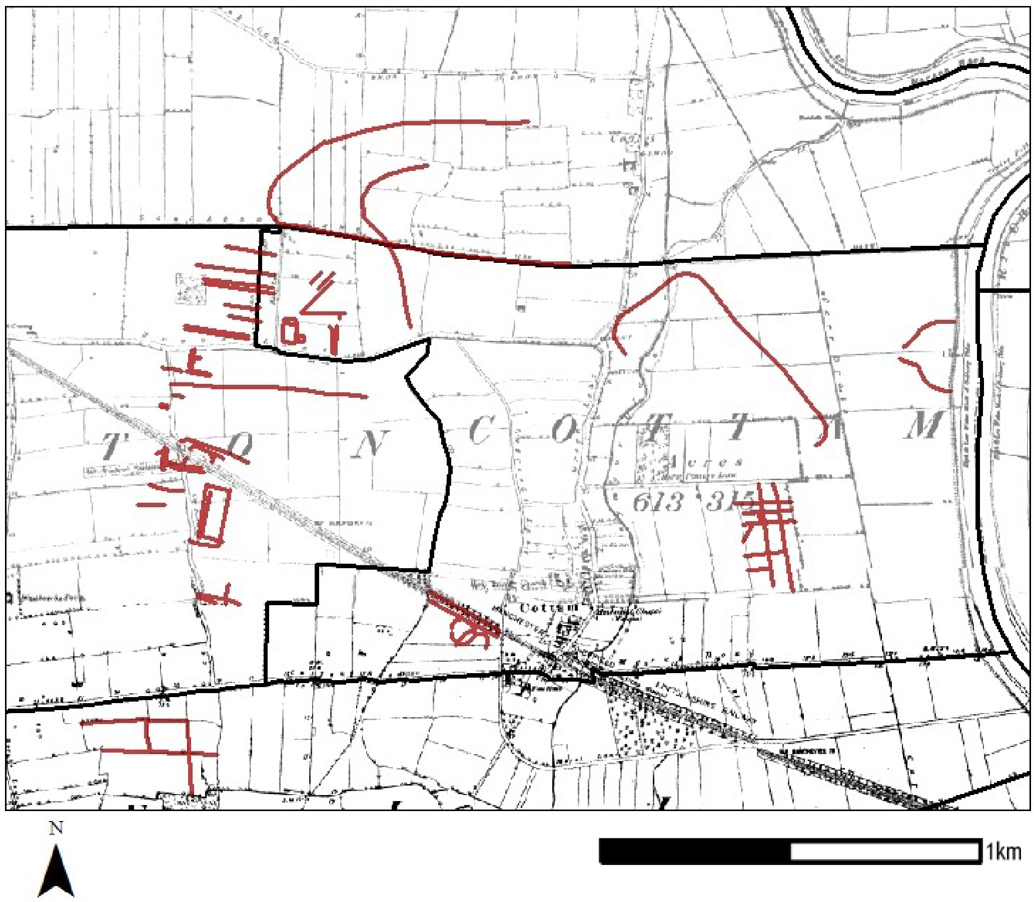
Area 7

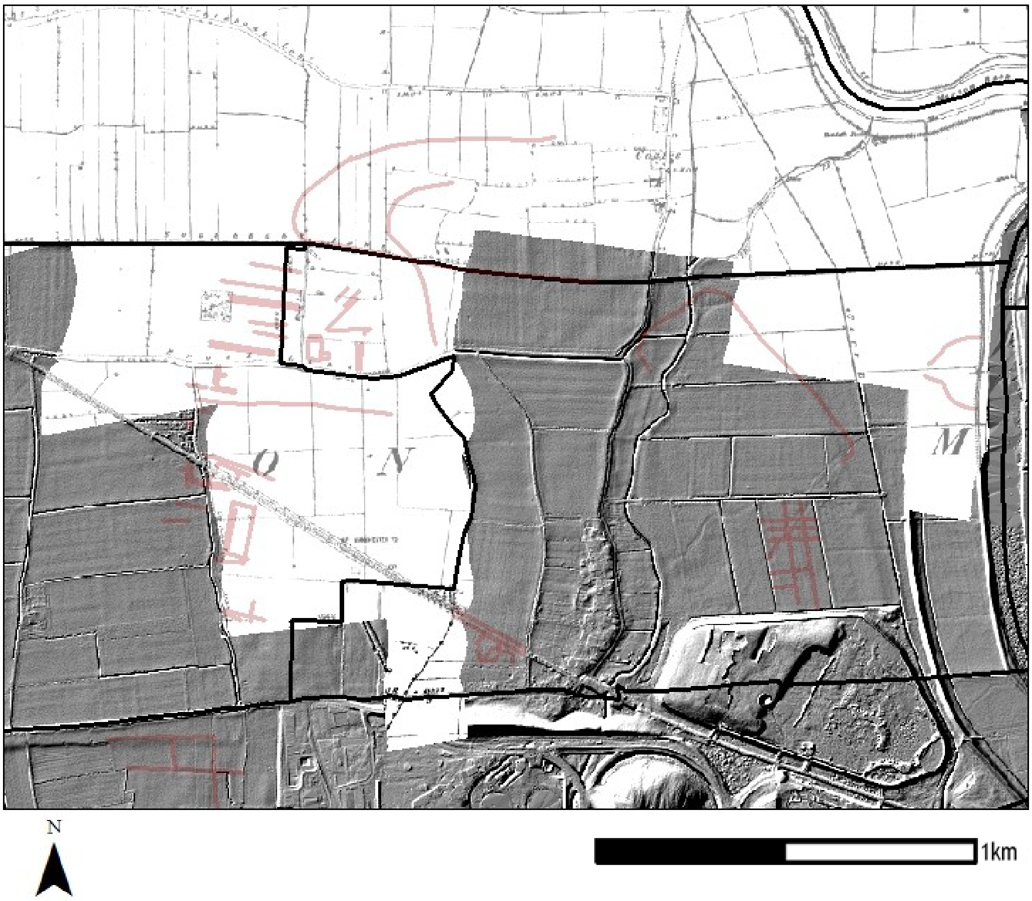


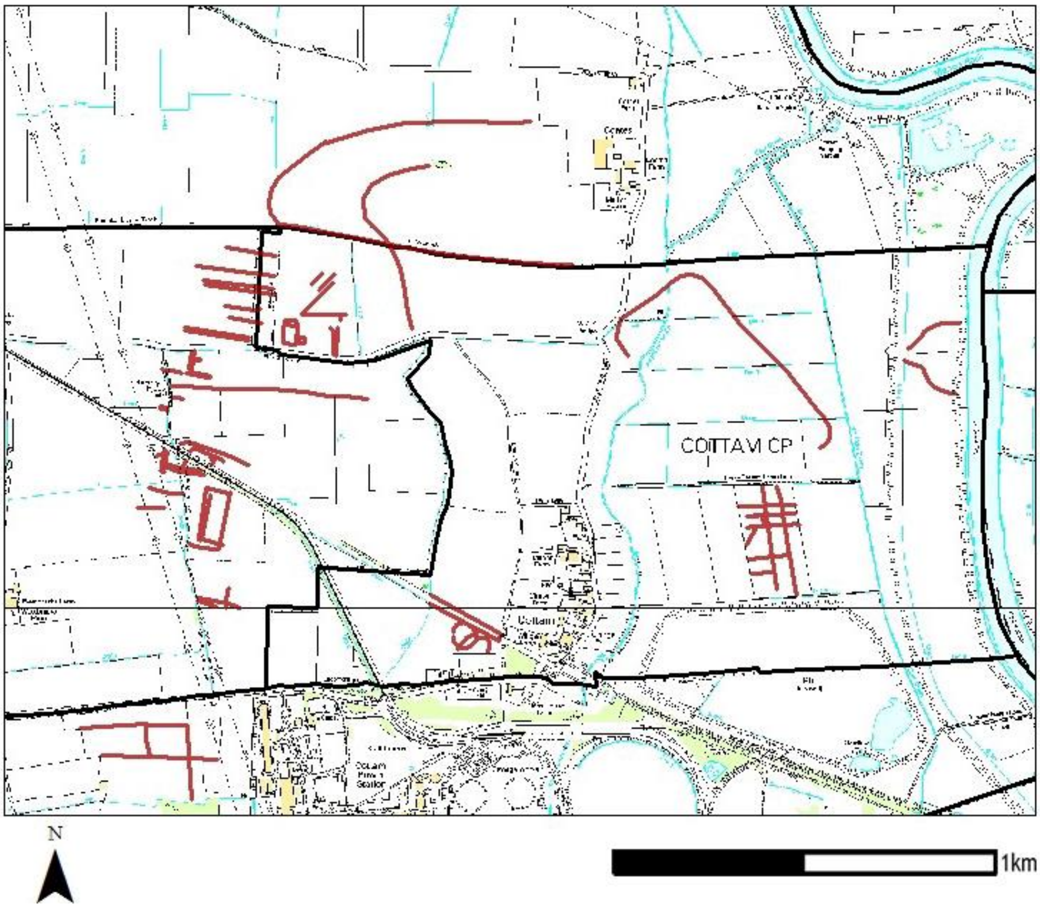



Cemetery
Trent Port
Marton
Pumping Station
Sewage
Works
Poplar
Farm
Brampton
Grange
Dunker's Hill
Warren
BRAMPTON CP
N
1km

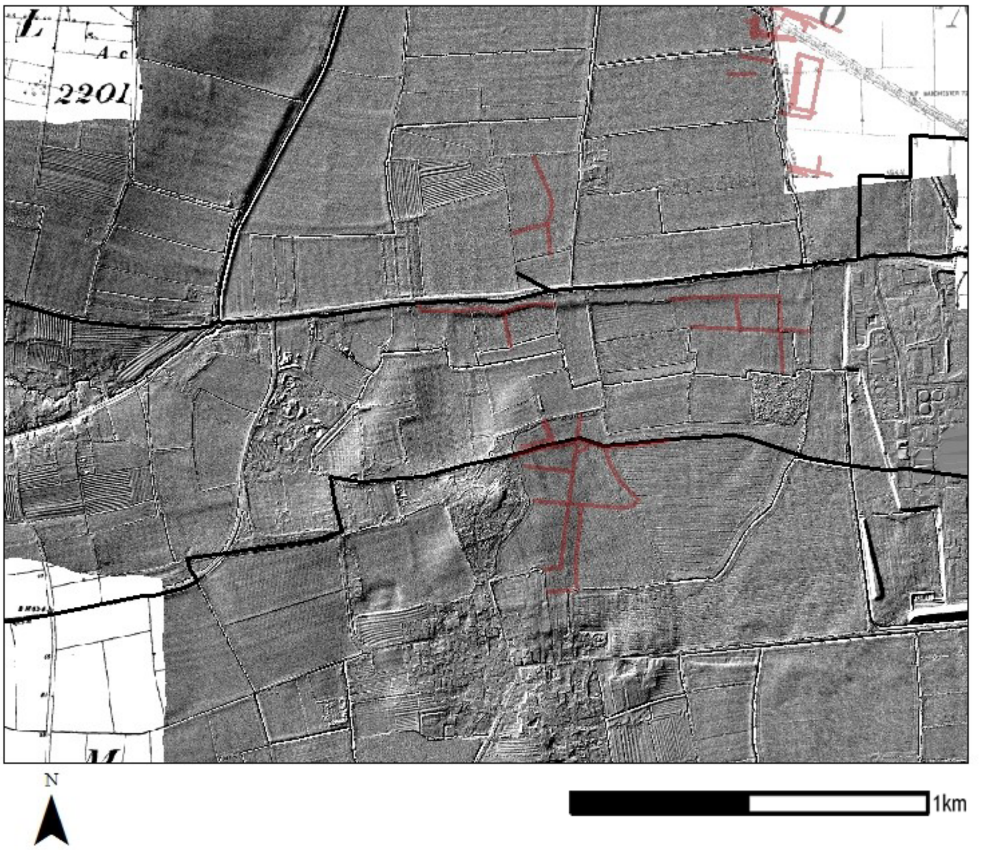
Area 8

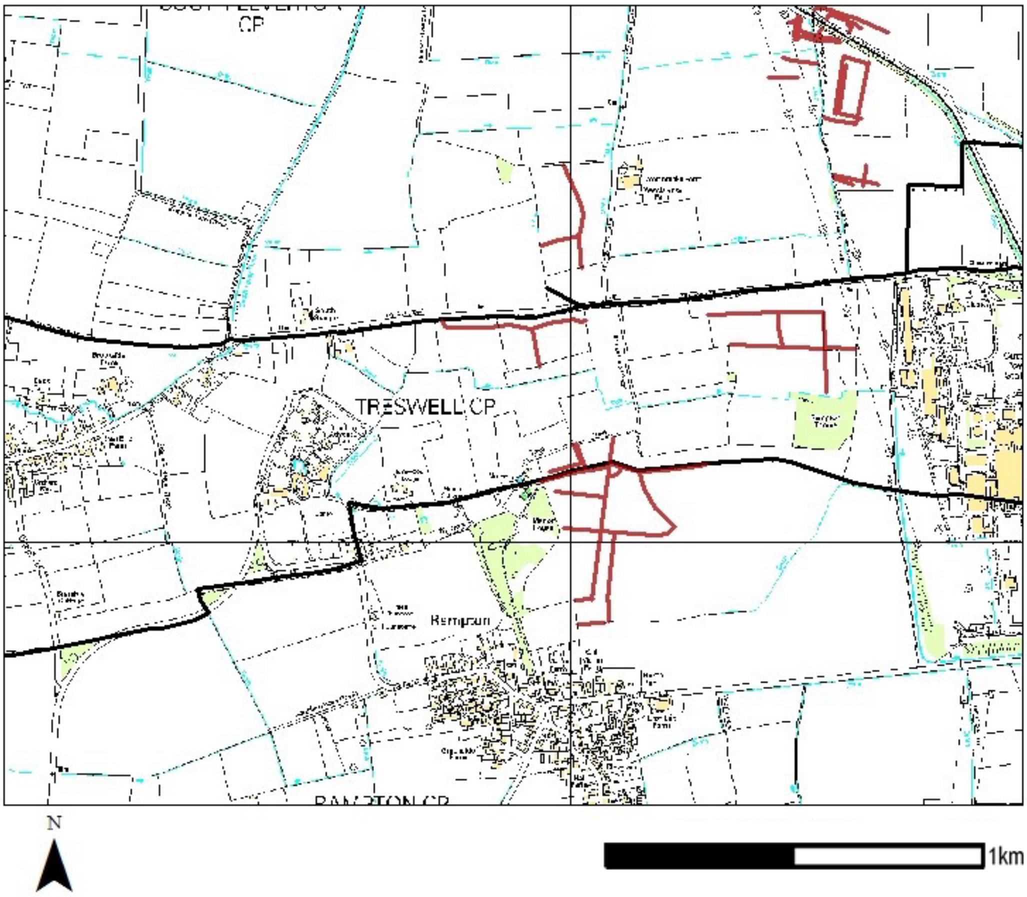

T O N C O T T I M
Acres
613 31
N
1km


Q
N
M
N
1km

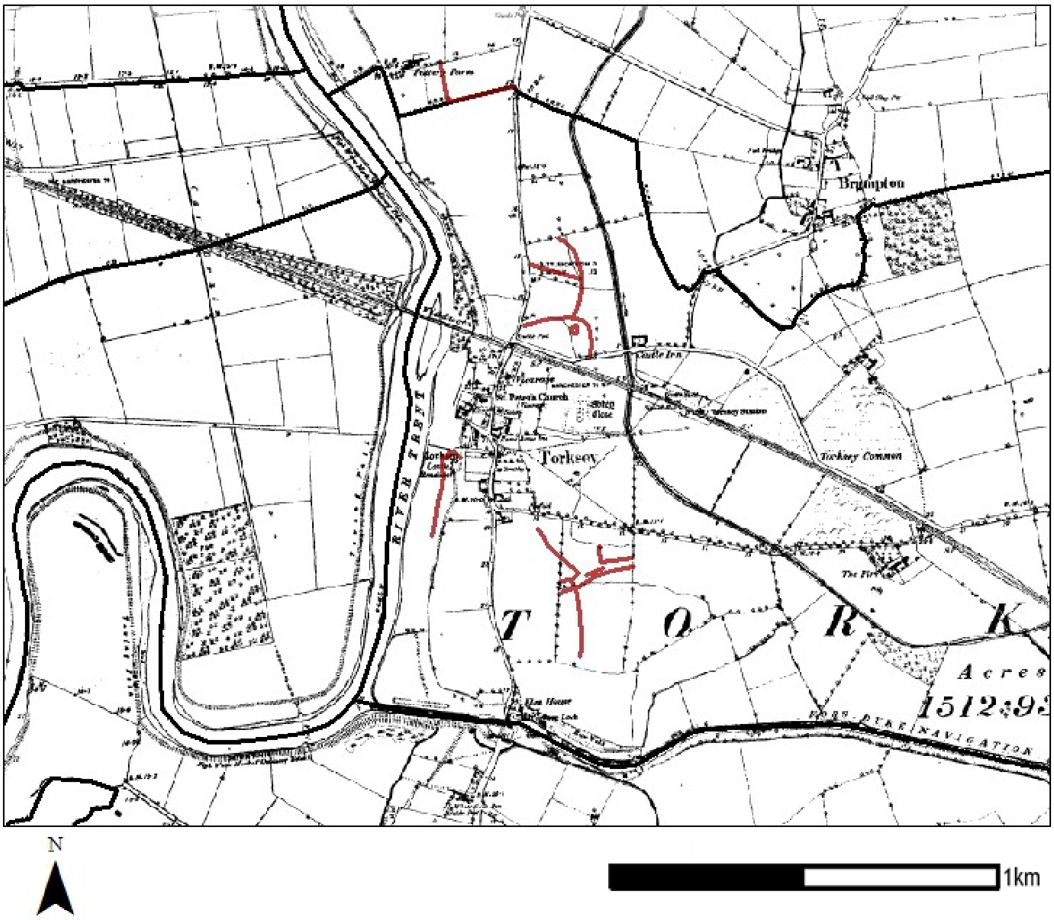

COTTAM CP
N
1km

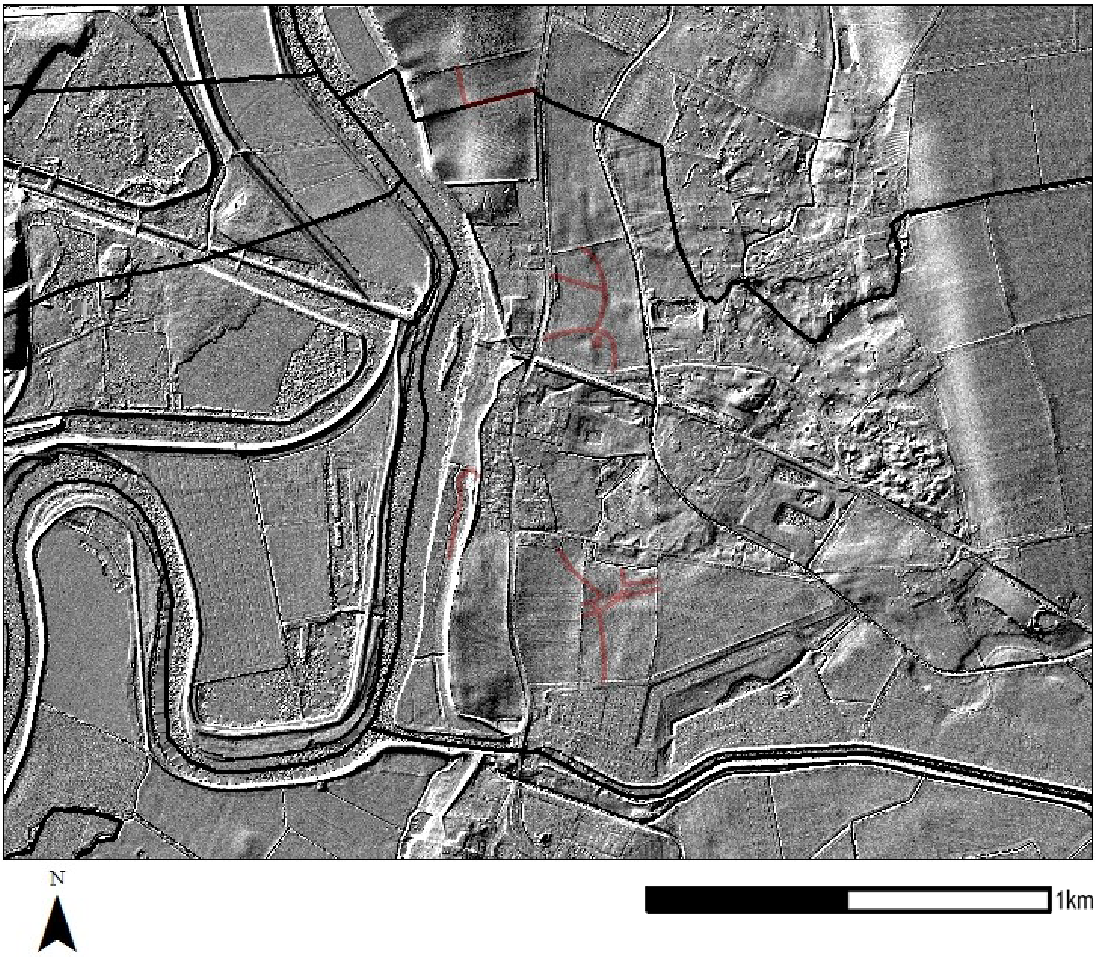
Area 9

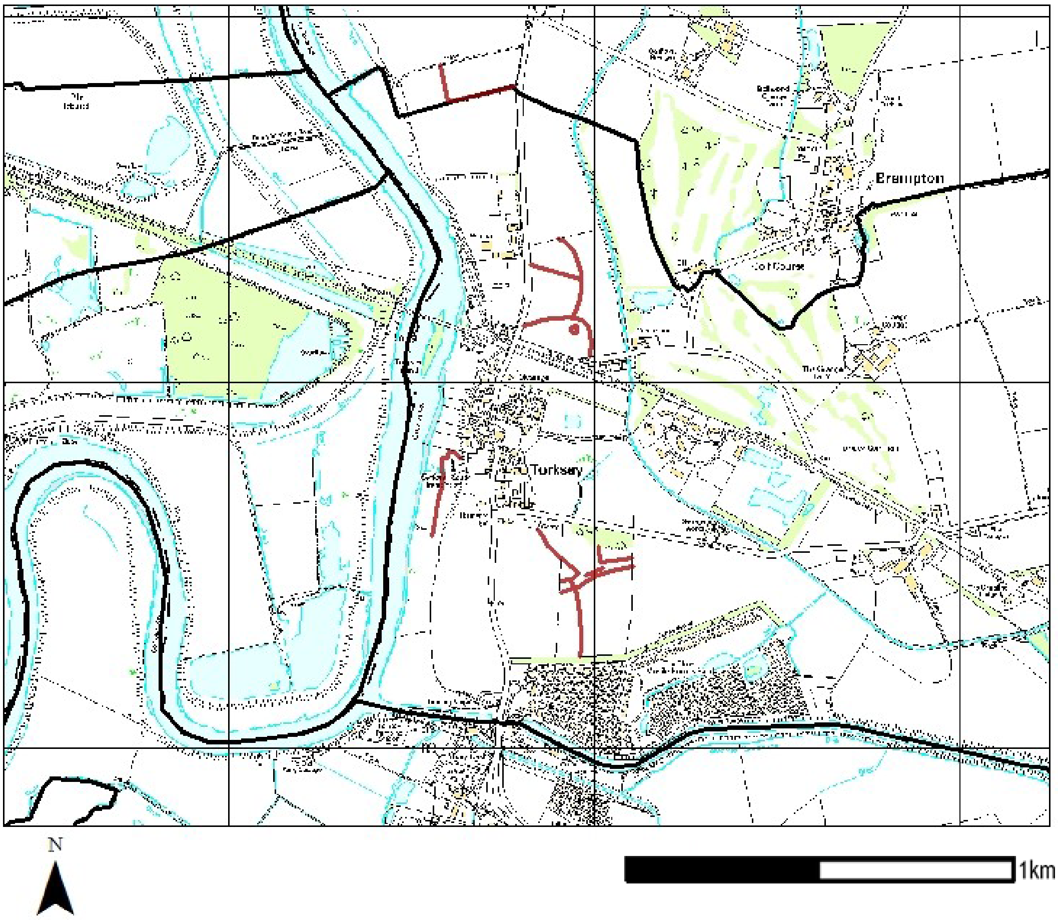



TRESWELL CP
Rampton
1km
N

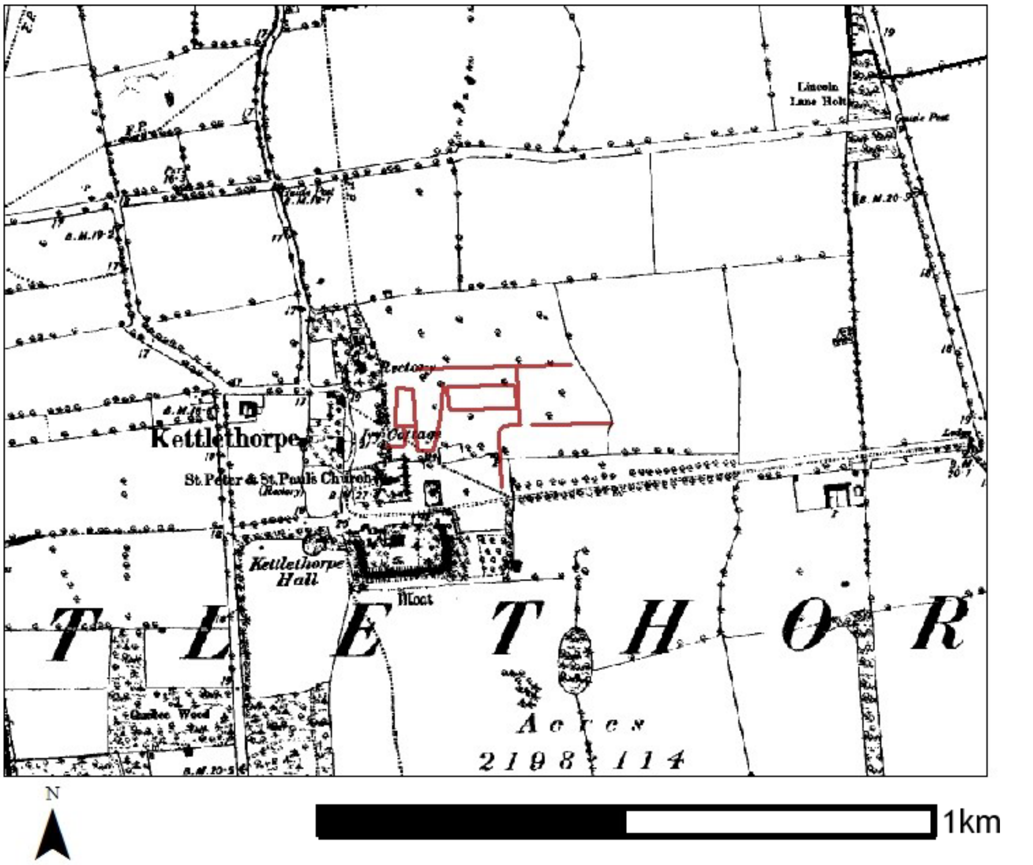
Area 10

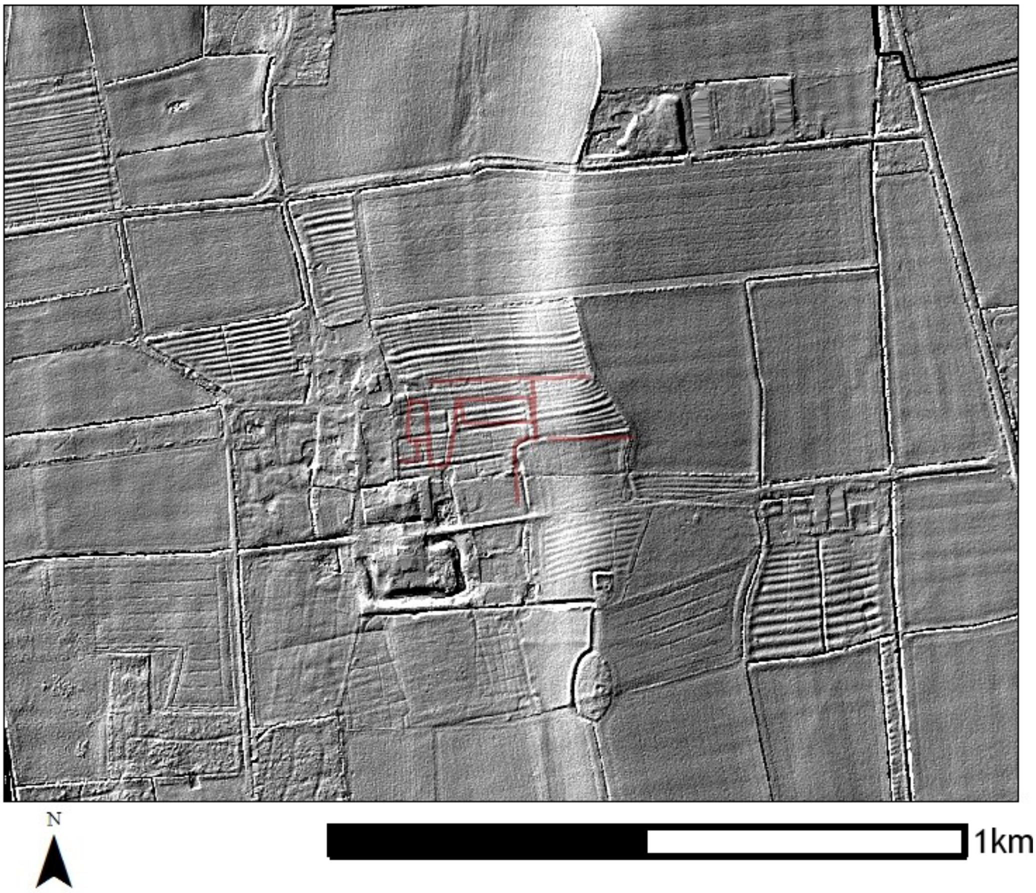

Brampton
Torksey
RIVER TRENT
Torksey Common
T O R K
Acres
FOSS DYKE NAVIGATION
1km
N

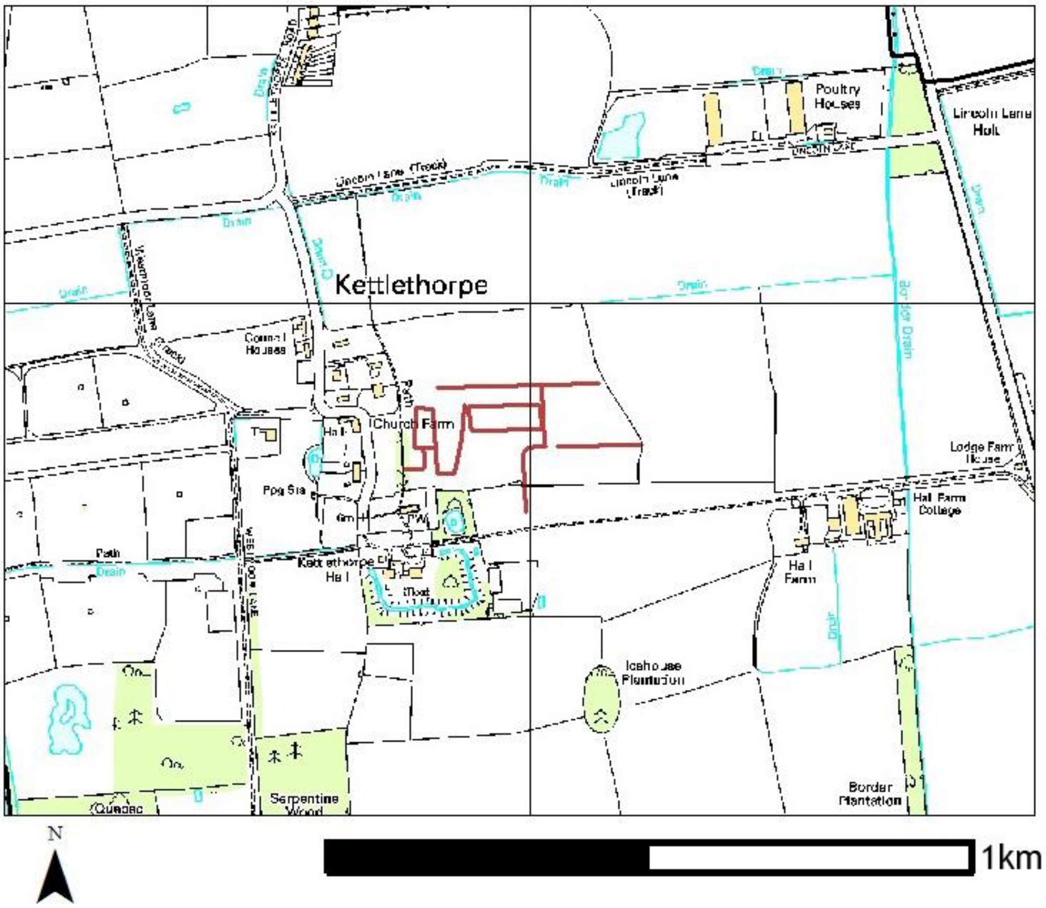

N
1km


Brampton
N
1km

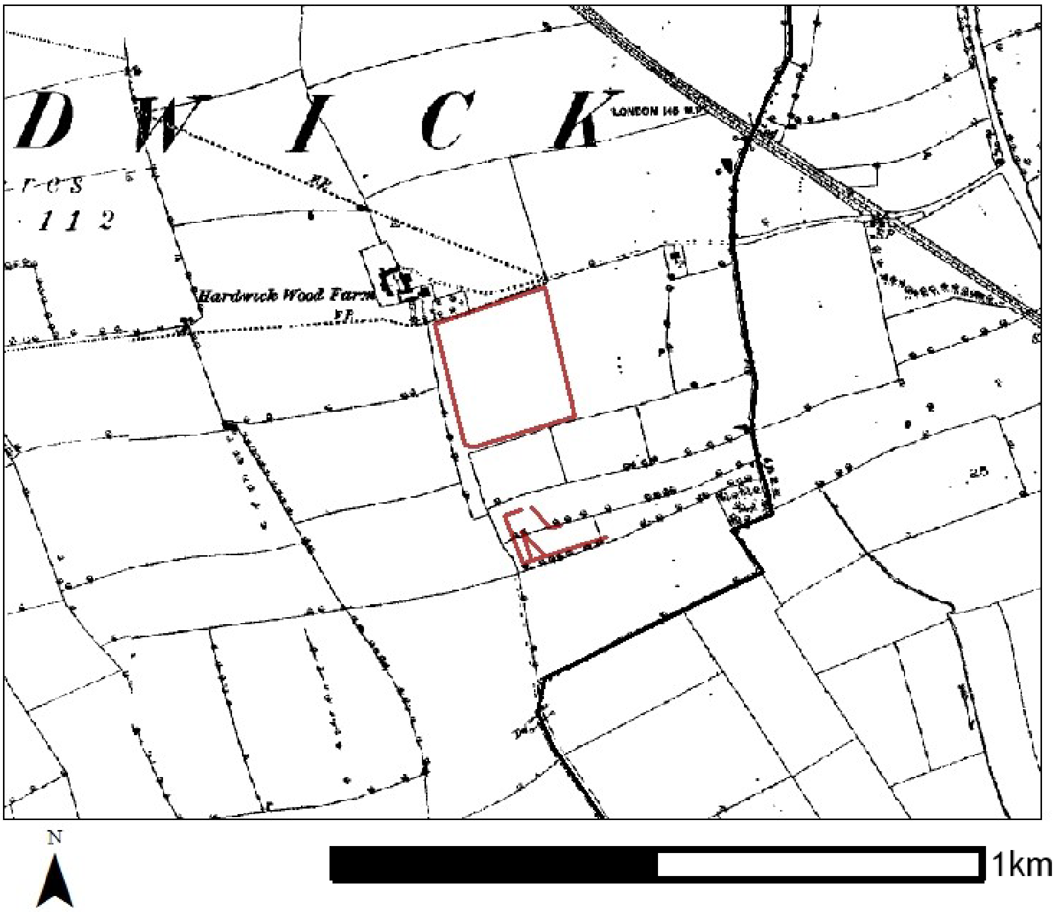
Area 11

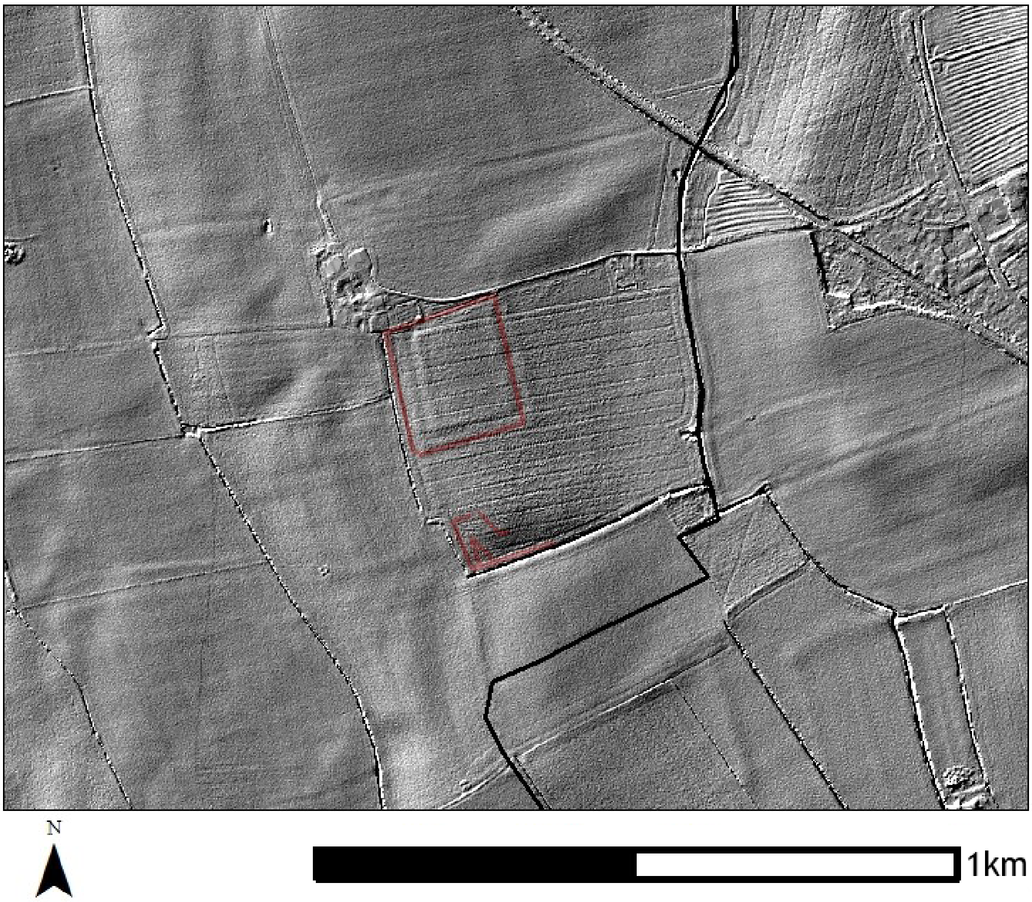

Lincoln Lane Holt
Kettlethorpe
St. Peter & St. Pauls Church
Rectory
Kettlethorpe Hall
Moat
Acres
2198·114
Cottage
N
1km

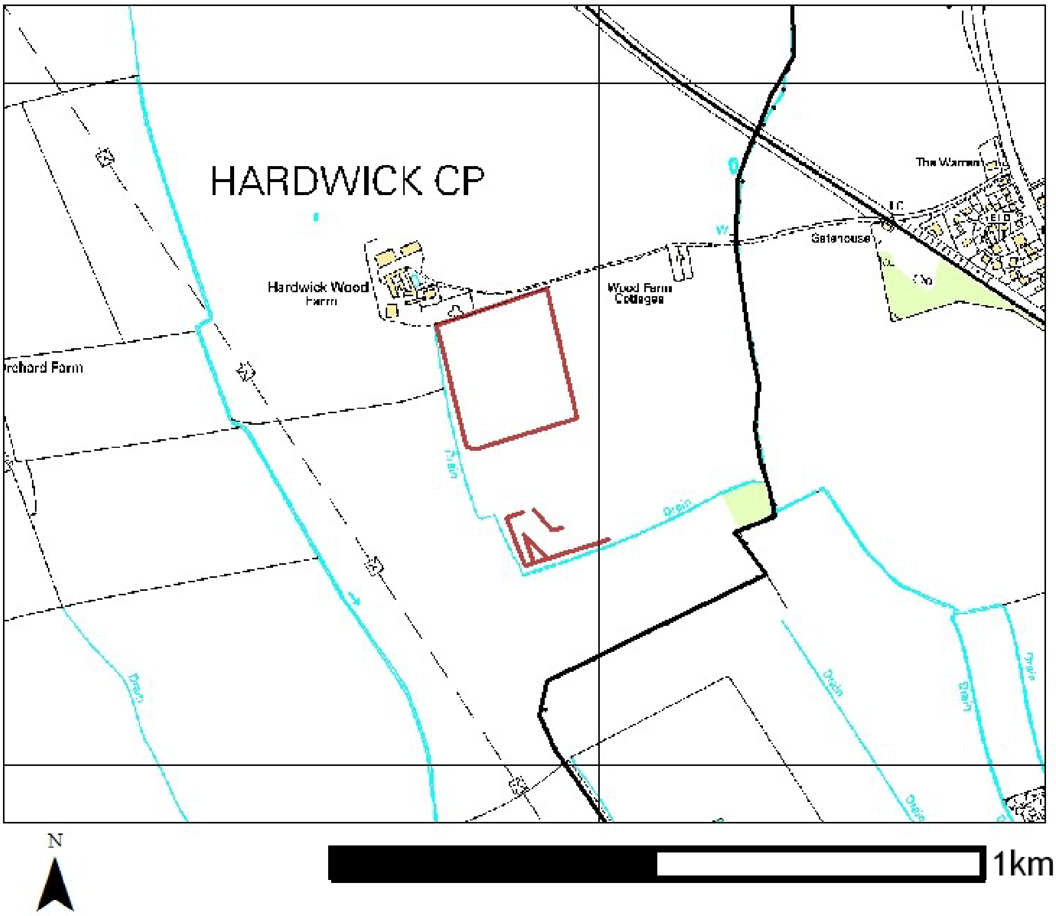

N
1km


Kettlethorpe
Poultry Houses
Lincoln Lane Holt
Lincoln Lane (Track)
Drain
Council Houses
Church Farm
Hall
Pmg Sta
Lodge Farm House
Hall Farm Cottage
Hall Farm
Kettlethorpe Hall
Moat
Icehouse Plantation
Border Drain
Border Plantation
Serpentine Wood
N
1km

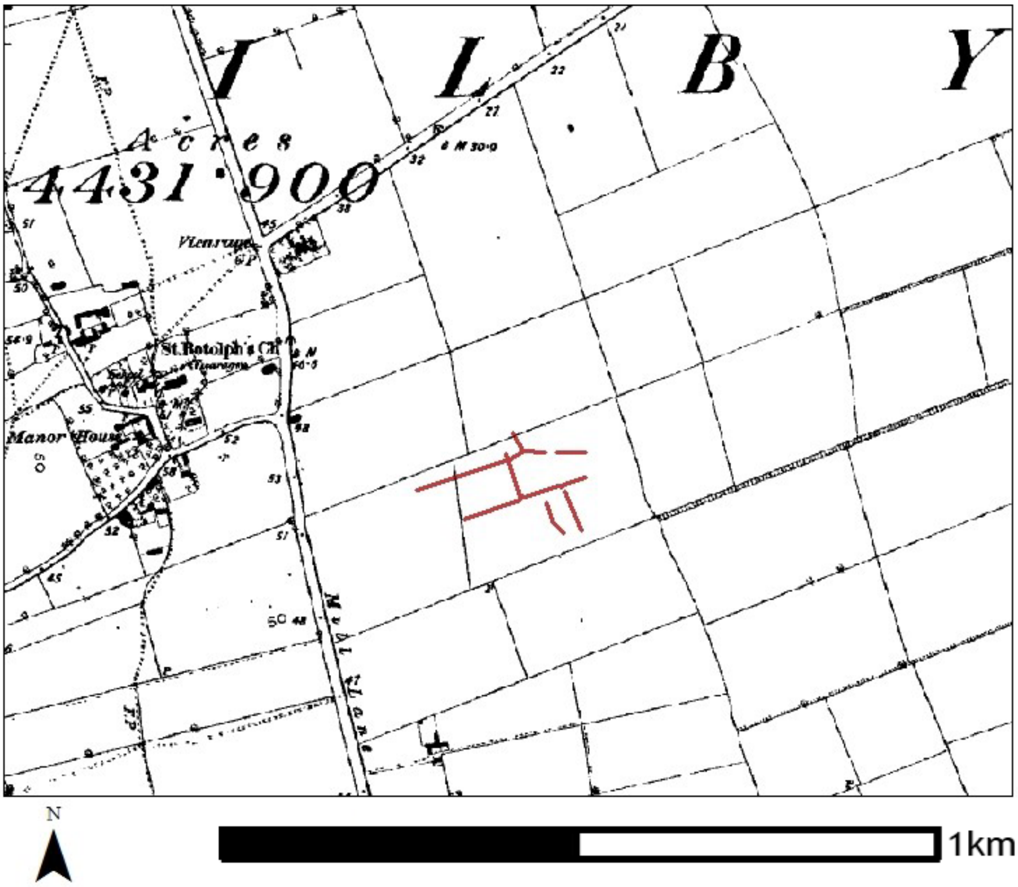
Area 12

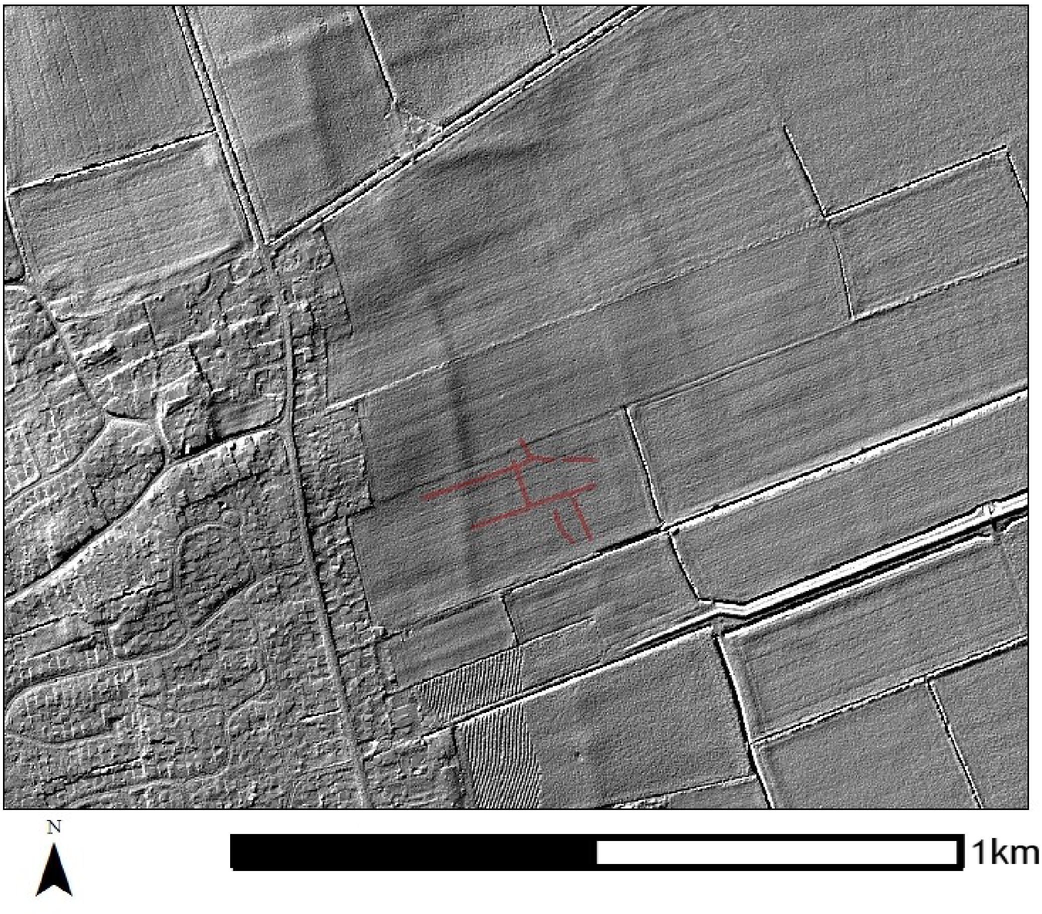

D W I C K
LONDON 146 M
Hardwick Wood Farm
F.P.
N
1km

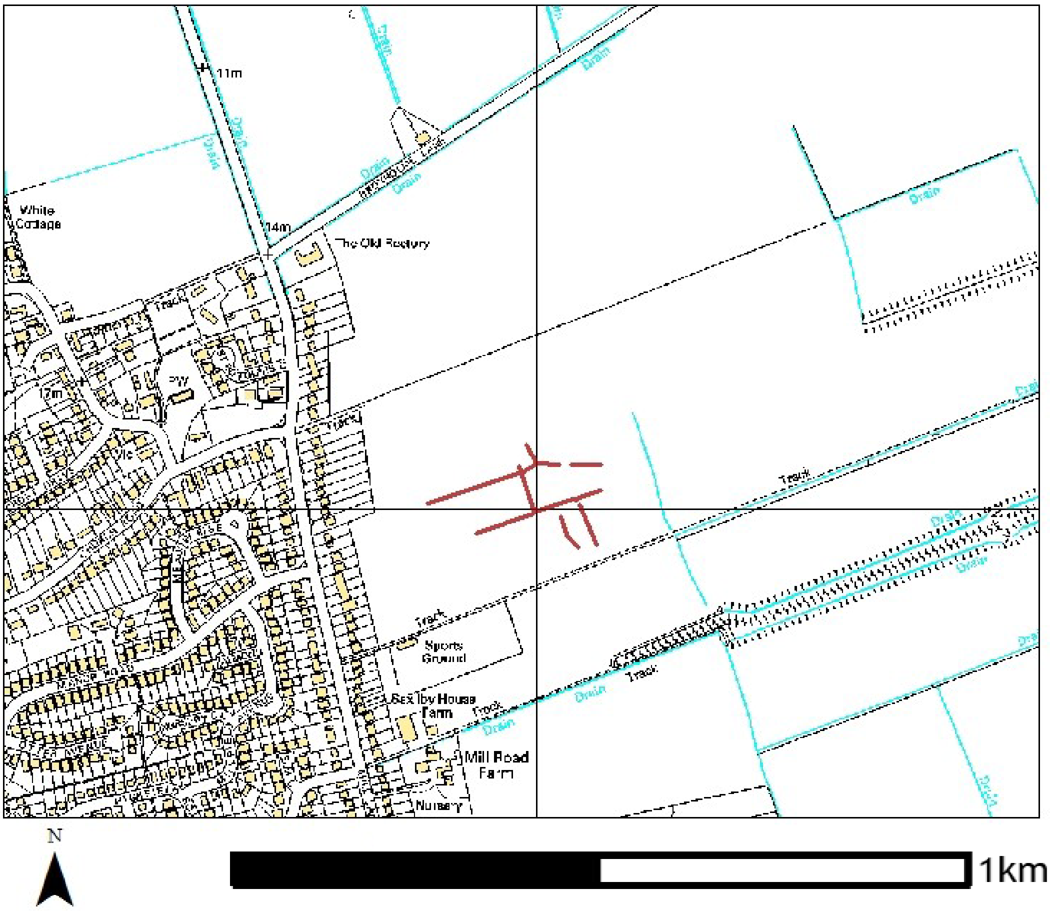

N
1km


HARDWICK CP
Hardwick Wood Farm
Wood Farm Cottages
The Warren
Gatehouse
Drain
N
1km

Area 13

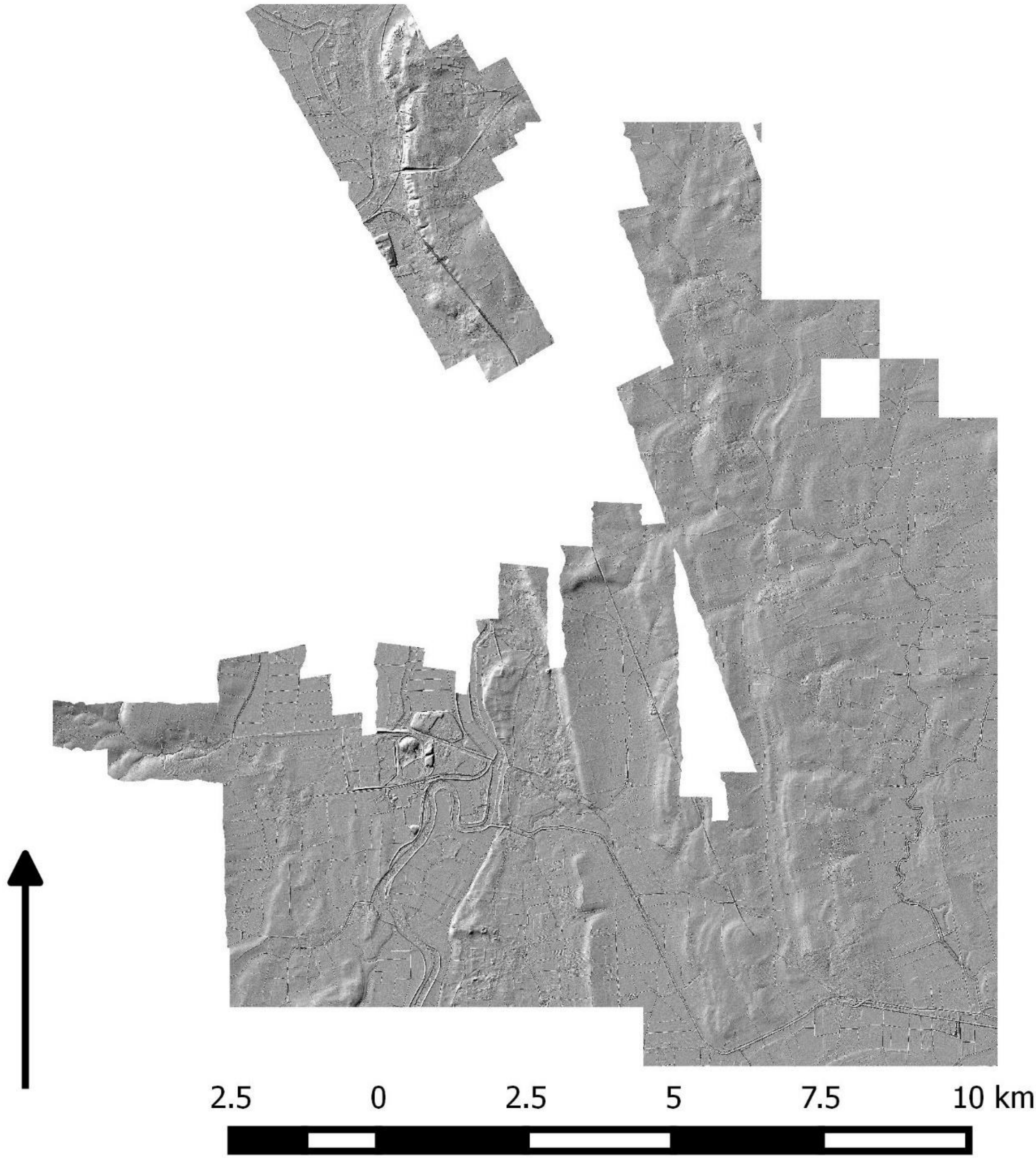

I L B Y
Acres
4431·900
Ulceby
St. Botolph's Ch.
Manor House
1km


1km

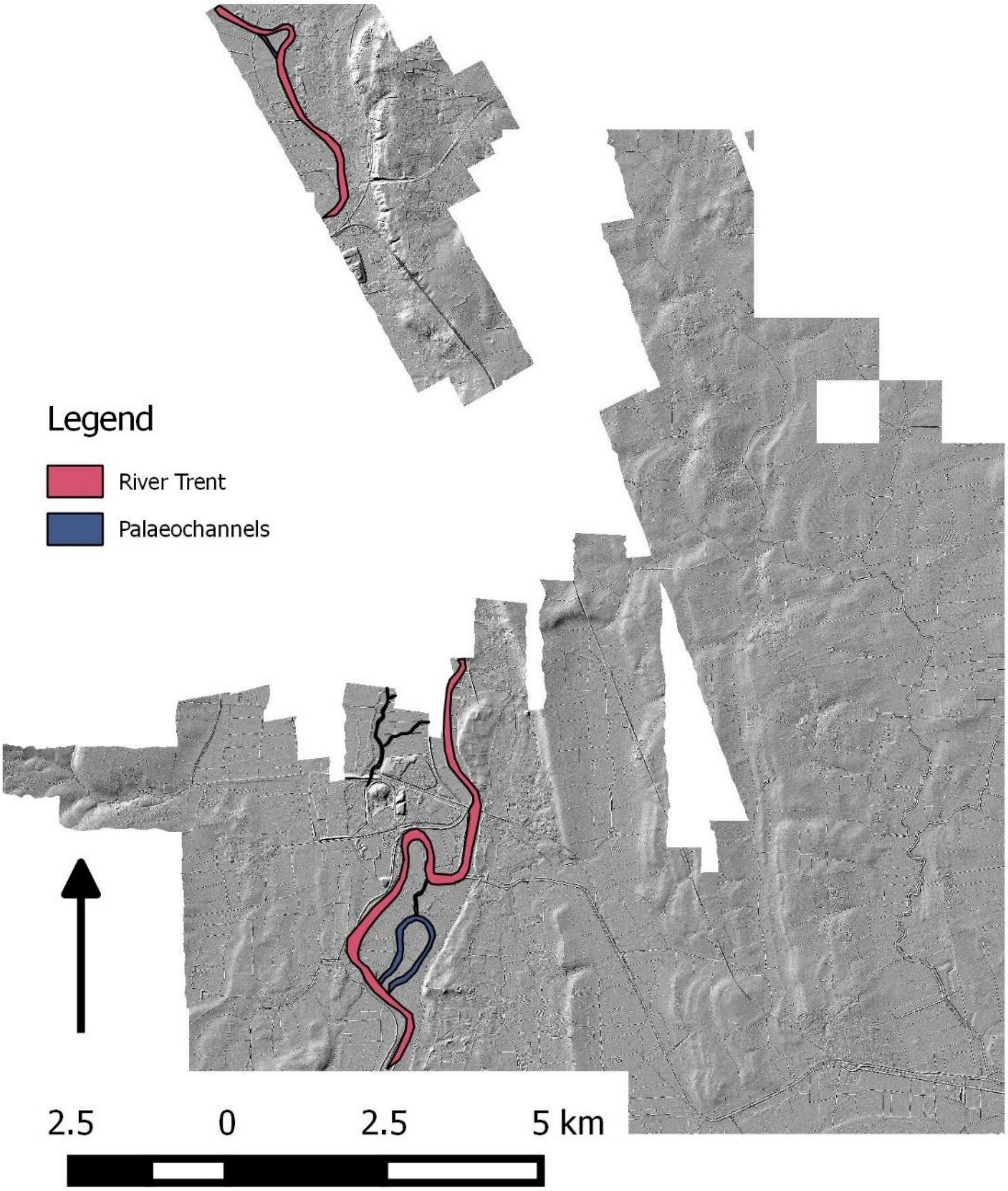

11m
Drain
White Cottage
14m
The Old Rectory
Track
17m
Sports Ground
Saxilby House Farm
Mill Road Farm
Nursery
N
1km

Appendix X: LiDAR coverage and mapped palaeochannels

Unfortunately, to date, there is no publically available 1m LiDAR data of large areas of the study area. All LiDAR is courtesy of the Geomatics Group, Environment Agency.



Total LiDAR coverage of the study area



Palaeochannels detected on the LiDAR within the study area. NOTE: Not all detected palaeochannels are mapped here, only those that are visible through LiDAR data.

Appendix XI: Historic Environment Record database entries

Easting	Northing	HER	Site	Parish	Period	Century?	Type general (Building, town...)	Type, specific	Evidence (excavation, AP...)
483699	378951	50791	Church of St. Peter	Torksey	medieval	13th	Ecclesiastic	Parish church	Standing
483658	378373	54237	Medieval settlement of Torksey	Torksey	Early medieval	10th	Settlement	Existing village	Excavation
486619	378759	SAM 1005056	Torksey Castle	Torksey	Post-medieval	17th	Settlement	High status residence	Standing
485767	378765	SAM 1019229	Medieval bishops palace and deer park	Torksey	medieval	11th	Settlement	High status residence	Earthworks
486627	380926	SAM 1019229	Medieval bishops palace and deer park	Torksey	medieval	11th	Landscape feature	Deer park	Earthworks
486992	379603	1019229	Medieval bishops palace and deer park	Torksey	medieval	11th	Landscape feature	Deer park	Earthworks
483435	378112	52273	Fosse Dyke (coordinates at start)	Torksey, Fenton, Kettlethorpe, Hardwick, Saxilby, Burton	Roman	5th	Landscape feature	Deer park	existing
483600	378300	50570	Site of Roman Building	Torksey	Roman	5th	artefact scatter		surface finds
483800	377800	56466	Undated finds from excavation	Torksey	U		Landscape feature	ditch and pits	Excavation
486400	377000	52550	Romano-British stray finds	Torksey	Roman	4th	artefact scatter		surface finds
484700	378600	52534	Romano-British stray finds	Torksey	Roman	4th	artefact scatter		surface finds
483142	376595	56525	Hoard of late Saxon finds	Torksey	Early medieval	10th	artefact scatter		detector finds
484000	378800	50789	Torkseyware found of Torksey Golf course	Torksey	Early medieval	10th	artefact scatter		surface finds
483612	379594	50042	Torksey detectorist finds	Torksey	Early medieval	9th	stray finds		detector finds
483700	378600	52545	Early medieval settlement remains	Torksey	Early medieval	10th	Settlement	shrunken village	Excavation
483700	378600	52561	Pottery kilns	Torksey	Early medieval	10th	industry	kiln	Excavation
483700	378700	52263	Pottery kilns	Torksey	Early medieval	10th	industry	kiln	Excavation
483700	379200	52535	Pottery kilns	Torksey	Early medieval	10th	industry	kiln	Excavation
483700	379200	56519	Burials	Torksey	medieval	13th	human remains		Excavation
483770	378900	55406	Saxon occupation east of Main Street	Torksey	Early medieval	10th	Settlement	village	Excavation
483600	378700	52548	Early medieval cemetery	Torksey	Early medieval	10th	human remains		Excavation
483500	378300	55365	Human remains	Torksey	Early medieval	11th	human remains		Excavation
483700	378900	54158	Human remains possibly related to ecclesiastical site	Torksey	Early medieval	10th	human remains		Excavation
483700	378900	54158	Possible site of Church (in relation to human remains)	Torksey	Early medieval	10th	Ecclesiastic	Parish church	Excavation
483750	378960	54812	St. Leonard's Torksey	Torksey	medieval	12th	Ecclesiastic	Priory	Excavation
483750	378960	55403	Human remains north of the railway	Torksey	medieval	12th	human remains		Excavation
483673	378831	52538	Multi-period remains at Verity House	Torksey	medieval	12th	Settlement		Excavation
483760	378970	50794	Settlement remains- Reported as Medieval marketplace, but remains of buildings casts doubt on that theory	Torksey	medieval	12th	Settlement	marketplace	Excavation
483700	378300	52529	later medieval pottery kiln	Torksey	medieval	12th	industry	kiln	Excavation
483680	378170	52529	later medieval pottery kiln	Torksey	medieval	12th	industry	kiln	Excavation
483600	378200	52540	Fosse Nunnery	Torksey	medieval	12th	Ecclesiastic	Nunnery	Excavation
483658	378373	52533	Medieval cemetery at Torksey	Torksey	Early medieval	10th	human remains		Excavation
483500	378300	55214	Human remains on bank of the trent	Torksey	U		human remains		surface finds
483490	378969	55214	Human remains on bank of the trent at Water's Edge house	Torksey	U		human remains		surface finds
483900	378940	50795	Possible site of St. Mary's church and earthworks	Torksey	medieval	13th	Ecclesiastic	Parish church	Excavation
483600	378500	54582	Site of All Saint's church	Torksey	medieval	13th	Ecclesiastic	Parish church	associated finds
483780	373750	54556	Post-medieval settlement features	Torksey	Post-medieval	16th	Settlement	post-holes	Excavation
483800	378900	54159	Post-medieval remains	Torksey	Post-medieval	16th	Settlement	post-holes	Excavation
483760	378970	50794	Possible location of marketplace	Torksey	medieval	13th	Settlement	marketplace	Landscape
483900	378900	50788	Earthworks at Abbey Close	Torksey	medieval	13th	Ecclesiastic	Abbey	Landscape
484398	380714	52756	Bunker's Hill Warren	Brampton	Post-medieval		Landscape feature	Warren	Natural
484294	381094	52497	Undated mound	Brampton	U		Landscape feature		Earthworks
484596	379461	52499	Medieval settlement of Brampton	Brampton	medieval	13th	Settlement	Existing village	historical
483531	379862	52469	Torksey Porcelain Factory at Pottery Farm	Brampton	Post-medieval	19th	industry	kiln	Excavation
484300	350900	52496	Brampton Grange	Brampton	Post-medieval		Settlement	Farm	building
487300	384400	50922	Willingham House	Willingham	Post-medieval	18th	Settlement	High status residence	Standing
487400	384500	50920	St. Helen's Church, High Street	Willingham	medieval	12th	Ecclesiastic	Parish church	building
487100	384700	52045	Ridge and Furrow	Willingham	medieval		RF		Landscape
487500	384500	54013	Settlement of Willingham	Willingham	medieval	14th	Settlement	Existing village	map evidence
487500	384200	52046	Ridge and Furrow	Willingham	medieval		RF		Landscape
487000	385000	50927	Ridge and Furrow northwest of the fox and hounds inn	Willingham	medieval		RF		Landscape
489700	385100	50925	Ridge and Furrow north of Magin Moor farm	Willingham	medieval		RF		Landscape
487710	384580	50924	Medieval settlement of Alfletby	Willingham	medieval		Settlement	DMV	historical
487900	385100	50926	Ridge and Furrow east of beggars lane	Willingham	medieval		RF		Landscape
488700	384600	54014	Ridge and Furrow	Willingham	medieval		RF		Landscape
488600	380500	52505	Ridge and Furrow	Sturton	medieval		RF		Landscape
488000	380800	52506	Ridge and Furrow	Sturton	medieval		RF		Landscape
489900	379200	50315	Settlement of Bransby, Sturton	Sturton	medieval	11th	Settlement	DMV	historical
487400	380100	50566	Site of a Roman Building, West Syke Lane	Sturton	Roman	4th	Settlement	Roman settlement	Excavation
489000	380400	52504	Settlement of Sturton	Sturton	medieval		Settlement	Existing village	Landscape
490000	379400	52513	Ridge and Furrow	Sturton	medieval		RF		Landscape
487800	379600	52514	Settlement of Gorwick	Sturton	medieval	13th	Settlement	DMV	historical
490200	379200	52515	Ridge and Furrow	Sturton	medieval		RF		Landscape
488100	382000	52434	Church of St Mary the Virgin, Stow	Stow	Early medieval	11th	Ecclesiastic	Parish church	building
488300	382000	50246	SITE OF A COLLEGE AND BENEDICTINE ABBEY, ST MARY'S CHURCH	Stow	Early medieval	11th	Ecclesiastic	Abbey	Scheduling
488000	381900	56216	Manor Farmhouse	Stow	Post-medieval	17th	Settlement	High status residence	building
490800	383000	52429	St. Edith's Church, Coates by Stow	Stow	medieval	12th	Ecclesiastic	Parish church	building
486500	381000	54199	Medieval bishops palace and water features, Stow Park	Stow	Early medieval	11th	Settlement	High status residence	Landscape
490900	383300	50538	Coates by Stow village	Stow	medieval	11th	Settlement	DMV	Landscape
490800	383000	50313	Moated manorial complex, Coates Hall	Stow	medieval	13th	Settlement	High status residence	Landscape
487200	382900	54815	Romano-British settlement, Marton Road	Stow	Roman	3rd	Settlement	Roman settlement	Excavation
486400	380000	50418	Stow Park medieval deer park	Stow	medieval	12th	Landscape feature	Deer park	Landscape
486500	381000	52443	Cropmark features, possibly related to Bishops palace	Stow	medieval	12th	Settlement	High status residence	Cropmark
488200	383100	52445	Normanby shrunken medieval village remains	Stow	medieval		Settlement	Existing village	Earthworks
488400	382300	54501	Medieval ridge and furrow and earthworks	Stow	medieval		RF		Earthworks
486600	381100	52444	Deserted settlement of Stow Park	Stow	medieval		Settlement	DMV	historical
488400	381600	54270	Medieval earthworks and ridge and furrow	Stow	medieval		RF		Landscape
488300	382000	54808	Medieval rubbish pits at the Old School House	Stow	medieval	12th	Settlement	pits	Excavation
488100	382000	54262	Late Saxon remains north of Stow Minster	Stow	Early medieval	10th	Settlement	house	Excavation
486700	381200	52447	Ridge and Furrow	Stow	medieval		RF		Landscape
489200	381900	52448	Boundary and enclosure	Stow	medieval		Landscape feature	Field Boundary	Cropmark
490000	382400	52430	Ridge and Furrow	Stow	medieval	14th	RF		Landscape
491400	384100	52432	Ridge and Furrow	Stow	medieval	14th	RF		Landscape
491600	383300	52431	Ridge and Furrow	Stow	medieval	14th	RF		Landscape
481300	390000	54153	Gainsborough Old Hall	Gainsborough	medieval	14th	Settlement	High status residence	building
481400	389800	55528	Pre-industrial core of Gainsborough	Gainsborough	medieval	12th	Settlement	Existing village	historical
481400	389300	55531	Riverside quarter	Gainsborough	medieval	14th	Settlement	Existing village	historical
481300	389800	55527	Settlement of Gainsborough	Gainsborough	Early medieval	11th	Settlement	Existing village	Excavation
481420	389740	52049	Early medieval cemetery, Silver/Bridge st.	Gainsborough	Early medieval	12th	human remains		Excavation
481400	390000	52069	All Saints church and churchyard	Gainsborough	medieval	14th	Ecclesiastic	Parish church	building
483500	388000	50289	Moated site at Park House	Gainsborough	medieval	14th	Settlement	High status residence	Earthworks
481700	390700	52070	Pitt Hills Plantation gypsum quarries	Gainsborough	Post-medieval	17th	industry	quarry	Earthworks
481200	389900	51469	Undated steep feature cut on Morley Street	Gainsborough	medieval		Landscape feature	ditch	Earthworks
481480	390250	50269	Possible site of Thomas Burgh's almshouse	Gainsborough	medieval	15th	building	almshouse	historical
481400	389700	52061	Site of medieval Guilds Chapel	Gainsborough	medieval		building	chapel	historical
483400	388400	50405	Medieval deer park to the south of Gainsborough	Gainsborough	medieval	13th	Landscape feature	Deer park	Landscape
481400	389500	52059	Dug out canoe found near trent	Gainsborough	Iron Age	1st	stray finds		surface finds
483000	388800	55526	Medieval hedgerows off Foxby Lane	Gainsborough	medieval	13th	Landscape feature	Field Boundary	survey

481430	389750	52054	3 possible A-S inhumations	Gainsborough	Early medieval	12th	human remains		Excavation
481800	391700	52075	Ridge and Furrow near the leisure centre	Gainsborough	medieval		RF		Landscape
481410	389810	52064	Camera of the Knights Templar	Gainsborough	medieval		Ecclesiastic	manor	building
484400	388300	50652	Bass Wood with Park Springs Wood	Gainsborough	medieval	13th	Woodland	Ancient woodland	Landscape
482700	388000	52063	Possible site of medieval rabbit warren to the south of Gainsborough	Gainsborough	medieval	13th	Landscape feature	Warren	Landscape
483000	389700	54305	Ridge and Furrow and possible trackway	Gainsborough	medieval		RF		aerial photos
482500	388000	50647	Warren Wood	Gainsborough	medieval		Woodland	Ancient woodland	Landscape
483190	391545	52065	Possible site of medieval rabbit warren to the north of Gainsborough	Gainsborough	medieval	13th	Landscape feature	Warren	Landscape
483200	389900	52074	Possible Roman kiln ring to the south of White's Wood Lane	Gainsborough	Roman	4th	industry	Kiln	Excavation
483500	388300	54116	Medieval ridge and furrow near park house	Gainsborough	medieval		RF		aerial photos
484200	387100	54222	Hermit Dam Moated site	Lea	medieval	12th	Settlement	High status residence	Earthworks
482600	387000	51390	Roman pottery production evidence, Green Lane	Lea	Roman	4th	industry	Kiln	Excavation
484670	386070	51381	Romano-British pottery kiln complex southeast of Lea grange farm	Lea	Roman	4th	industry	Kiln	Excavation
482680	386920	51393	Medieval settlement of Lea	Lea	medieval	12th	Settlement	Existing village	historical
484200	387100	54025	Unscheduled parts of Hermit Dam	Lea	medieval	12th	Settlement	High status residence	Earthworks
483000	386600	51389	St. Helen's Church	Lea	medieval	13th	Ecclesiastic	Parish church	building
482900	386600	54030	Post-medieval settlement	Lea	Post-medieval	18th	Settlement	Existing village	historical
483900	387000	50297	Moated site NEAR Hermit Dam	Lea	medieval		Settlement	residence	Earthworks
484000	387000	50411	Medieval deer park	Lea	medieval		Woodland	Deer park	Landscape
481400	387100	54026	Ridge and Furrow	Lea	medieval		RF		Landscape
482700	387600	54029	Ridge and Furrow	Lea	medieval		RF		Landscape
482600	385900	54028	Ridge and Furrow	Lea	medieval		RF		Landscape
484200	385900	50650	Stag Wood	Lea	medieval		Woodland	Ancient woodland	Landscape
483600	387800	50648	Lea Wood	Lea	medieval		Woodland	Ancient woodland	Landscape
482700	384600	51373	St. Mary's Church	Knaith	Early medieval	11th	Ecclesiastic	Parish church	building
484500	385200	50244	Site of Heynings Priory at Park Farm South	Knaith	medieval	12th	Ecclesiastic	Nunnery	Earthworks
482800	384600	51377	Knaith Hall	Knaith	Post-medieval	16th	Settlement	High status residence	building
483100	384800	50529	Deserted settlement of Knaith	Knaith	Early medieval	11th	Settlement	DMV	Earthworks
482800	384850	51347	Romano-British pottery and tile kiln complex at Knaith	Knaith	Roman	3rd	industry	Kiln	Excavation
482800	384300	50409	Post-medieval deer park and garden south of Knaith Hall	Knaith	Post-medieval	16th	Landscape feature	Deer park	Landscape
484600	385800	56325	Iron age or Romano-British Iron working site at Knaith Park	Knaith	Roman	1st	industry	Iron working	Excavation
483000	384500	51378	Building remains and pottery scatter, Dutch Cottage	Knaith	medieval	16th	Settlement	residence	survey
484700	385300	54016	Medieval field system	Knaith	medieval		RF		Landscape
483900	385100	50408	Medieval deer park	Knaith	medieval	14th	Woodland	Deer park	Landscape
483300	385200	50485	Conney Green, East of Stephenson's Hill	Knaith	medieval	16th	Woodland	Warren	Landscape
482900	384200	54020	Ridge and Furrow	Knaith	medieval		RF		Landscape
483700	384700	50392	Duck decoy pond, Park Plantation	Knaith	Post-medieval	18th	Landscape feature	pond	Landscape
483400	384700	54017	Prehistoric cropmarks	Knaith	Iron Age	1st	Settlement	enclosure	Cropmark
482700	384400	54021	Medieval platform	Knaith	medieval		Settlement	residence	Landscape
484300	385400	50916	Undated enclosure	Knaith	medieval		Landscape feature	enclosure	Cropmark
484700	384800	54022	Ridge and Furrow	Knaith	medieval		RF		Landscape
483300	385200	50914	Ridge and Furrow	Knaith	medieval		RF		Landscape
484100	384800	54019	Medieval field boundary	Knaith	medieval		Landscape feature	Field Boundary	Cropmark
483900	382800	50512	Settlement remains, Gate Burton Hall	Gate Burton	medieval	12th	Settlement	DMV	Earthworks
483400	383100	56485	Parkland associated with Gate Burton Hall	Gate Burton	Post-medieval	18th	Landscape feature	Formal parkland	Landscape
483300	382530	50596	Finds from site of a possible Roman fort	Gate Burton	Roman	4th	Settlement	Military	Cropmark
483400	383400	54010	Ridge and Furrow	Gate Burton	medieval		RF		Earthworks
483900	382900	51371	Site of medieval parish church of Gate Burton	Gate Burton	medieval	12th	Ecclesiastic	Parish church	historical
485100	383100	54012	Ridge and Furrow	Gate Burton	medieval		RF		Earthworks
483600	383000	51372	Gate Burton Hall	Gate Burton	Post-medieval	18th	Settlement	High status residence	Standing, earthwork
484300	383100	50651	Burton Wood	Gate Burton	medieval		Woodland	Ancient woodland	Landscape
483800	382800	51370	St. Helen's church Gate Burton	Gate Burton	medieval	19th	Ecclesiastic	Parish church	Standing
483100	382400	54011	Medieval Trackway	Gate Burton	medieval		Landscape feature	Trackway	Cropmark
484000	382400	55404	Site of Burton Windmill	Gate Burton	Post-medieval	19th	industry	Mill	Earthworks
492900	379000	50575	Tillbridge Lane	Marton	Roman	2nd	Landscape feature	Trackway	Landscape
483300	382200	51369	Romano-British settlement on both sides of Tillbridge Ln in Marton and Gate Burton	Marton	Roman	4th	Settlement	Roman settlement	Cropmark
483300	382220	56534	Roman altar fragment from near Marton	Marton	Roman	4th	stray finds	Altar	Findspot
483900	381700	50631	Anglo-Saxon sculptural fragments, St. Margaret's Church	Marton	Early medieval	10th	stray finds	Religious items	Findspot
484000	381800	52481	Medieval village of Marton	Marton	medieval	11th	Settlement	Existing village	Landscape
484900	381700	52468	St Margaret's Church, Marton	Marton	medieval	11th	Ecclesiastic	Parish church	building
483200	382000	54200	Roman fort, Marton	Marton	Roman	4th	Settlement	Military	Cropmark
484000	381800	52462	Paving, part of Tillbridge lane	Marton	Roman	4th	Landscape feature	Trackway	Excavation
484700	381800	52472	Romano-British cropmarks	Marton	Roman	4th	Settlement	enclosure	Cropmark
484000	381900	52139	Manor Farmhouse	Marton	Post-medieval	18th	Settlement	Farm	building
482600	382500	52485	Former ford across the Trent	Marton	Roman	4th	Landscape feature	Trackway	historical
483400	382100	50257	Copper alloy objects from Littleborough Lane	Marton	Roman	2nd	stray finds		Findspot
484600	381100	52489	Roman cropmarks	Marton	Roman	4th	Landscape feature	Field Boundary	Cropmark
483200	382200	52486	Windmill and mound	Marton	medieval		industry	Mill	Earthworks
483600	382100	52487	Roman cropmarks	Marton	Roman		Landscape feature	Field Boundary	Cropmark
485200	381700	52492	Ridge and furrow	Marton	medieval		RF		Earthworks
484100	381000	52488	Post medieval flood defences	Marton	Post-medieval		Landscape feature	flood defences	Earthworks
485400	382400	52493	Ridge and furrow	Marton	medieval		RF		Earthworks
489200	377900	54225	Deserted village of North Ingleby	Saxilby	medieval	11th	Settlement	DMV	Earthworks
489400	377200	50306	Moated site at Ingleby Grange, South Ingleby	Saxilby	medieval		Settlement	High status residence	Earthworks
489200	377200	50535	DMV earthworks, South Ingleby	Saxilby	medieval		Settlement	DMV	Earthworks
487600	377000	50307	Moated site near Sykes Farm	Saxilby	medieval	13th	Ecclesiastic	Monastic grange	Excavation
489120	376200	52790	Saxilby medieval settlement	Saxilby	medieval		Settlement	Existing village	historical
489500	376100	51474	St Boltolphs Church, Saxilby	Saxilby	medieval	12th	Ecclesiastic	Parish church	building
489100	377900	52783	Settlement remains, North Ingleby	Saxilby	medieval	13th	Settlement	DMV	Earthworks
487000	378700	52793	Medieval monastic grange	Saxilby	medieval		Ecclesiastic	monastic grange	historical
489800	375800	52767	Roman pottery	Saxilby	Roman	4th	stray finds		Findspot
489400	377300	50488	Possible pillow mound, South Ingleby	Saxilby	medieval		Landscape feature	Warren	Landscape
489300	376200	54824	Possible medieval or post-medieval hollow way	Saxilby	medieval	15th	Landscape feature	Trackway	Excavation
489500	376100	52776	Carved stone in St Botolphs church	Saxilby	Early medieval		stray finds		Findspot
489200	377800	54228	Post medieval remains, Gables Manor, Ingleby	Saxilby	Post-medieval		Settlement	residence	Excavation
489200	377800	54227	Late Saxon pottery sherds, Gables Manor, Ingleby	Saxilby	Early medieval	11th	stray finds		Findspot
484780	378005	52769	Roman statuette of Mars	Saxilby	Roman	2nd	stray finds		Findspot
489100	375600	55797	Old Hall, Saxilby	Saxilby	Post-medieval	16th	Settlement	High status residence	building
489400	376000	56086	Manor House	Saxilby	Post-medieval	16th	Settlement	High status residence	building
489300	378000	50391	Late medieval deerpark at Ingleby Hall	Saxilby	medieval	14th	Landscape feature	Deer park	Landscape
490100	375800	55440	Cropmark prehistoric or Romano-British enclosure, Saxilby	Saxilby	Iron Age	1st	Landscape feature	enclosure	Cropmark
487700	376600	52789	Ridge and furrow	Saxilby	medieval		RF		Earthworks
488600	378700	52794	Ridge and furrow	Saxilby	medieval		RF		Earthworks
484800	375500	50091	Kettlethorpe Hall moated site	Kettlethorpe	medieval	12th	Settlement	High status residence	building
484800	375600	56046	Gateway to Kettlethorpe hall	Kettlethorpe	medieval	14th	Landscape feature	garden features	building
483700	375800	53810	Medieval settlement of Laughterton	Kettlethorpe	medieval		Settlement	Existing village	historical
484800	375600	50098	St Peter and St Paul's church	Kettlethorpe	medieval	15th	Ecclesiastic	Parish church	building
484700	375300	50099	Medieval Deer Park	Kettlethorpe	medieval	14th	Landscape feature	Deer park	Landscape
484810	375610	50100	Cross, St Peter and St Paul's church	Kettlethorpe	medieval	14th	stray finds		Findspot
484800	375800	53808	Medieval settlement of Kettlethorpe	Kettlethorpe	medieval		Settlement	Existing village	Earthworks

483800	375900	54278	Late Anglo-Saxon remains on land at Home Farm, Laughterton	Kettlethorpe	Early medieval		stray finds		Excavation
482800	375700	50096	Late Iron Age coin and early Romano-British pottery	Kettlethorpe	Iron Age	1st	stray finds		Findspot
484800	375600	50092	Katherine's Arch	Kettlethorpe	medieval	14th	Landscape feature	garden features	building
484800	374000	50640	Plot Wood	Kettlethorpe	medieval		Woodland	Ancient woodland	Landscape
485200	374700	50646	Blackthorn Wood	Kettlethorpe	medieval		Woodland	Ancient woodland	Landscape
484700	376700	56044	4 Maltkiln Rd, Fenton	Fenton	Post-medieval	17th	Settlement	High status residence	Standing, derelict
483900	377800	50113	Romano-British pottery kiln site, Little London	Fenton	Roman	3rd	industry	Kiln	Excavation
484500	478000	55251	Post medieval ditch on land at Fossdyke Canal	Fenton	Post-medieval	18th	Landscape feature	ditch	survey
484700	376700	53794	Medieval settlement at Fenton	Fenton	medieval	12th	Settlement	DMV	Earthworks
484000	377800	50111	Romano-British finds from SE of Little London	Fenton	Roman	2nd	stray finds		Findspot
484000	377700	50114	Romano-British settlement site	Fenton	Roman	4th	stray finds		Findspot
484200	377900	53798	Romano-British pottery	Fenton	Roman	4th	stray finds		fieldwalking
483700	377600	54742	Romano-British pottery and coin near Torksey Lock	Fenton	Roman	4th	stray finds		survey
484500	378000	55250	Romano-British pottery scatter on land at Fossdyke canal	Fenton	Roman	4th	stray finds		Findspot
484300	377600	55434	Cropmark prehistoric enclosure and maculae	Fenton	Iron Age	1st	Landscape feature	enclosure	Cropmark
485200	376700	53801	Bronze Age Barrow	Fenton	Bronze Age		Landscape feature	mound	Cropmark
483700	377800	56467	Medieval pottery sherds, Lincoln Road	Fenton	medieval	13th	stray finds		Findspot
484200	377800	53799	Roman Trackway	Fenton	Roman		Landscape feature	Trackway	Landscape
479950	378580	M4677	CHURCH OF ALL SAINTS AT RAMPTON	Rampton	medieval	13th	Ecclesiastic	Parish church	building
478150	379390	M4678	CHURCH OF ST JOHN THE BAPTIST AT TRESWELL	Treswell	medieval	12th	Ecclesiastic	Parish church	building
481550	378550	M4697	MOAT AT FLEET PLANTATION, RAMPTON	Rampton	medieval		Settlement	High status residence	Landscape
482030	378740	M4698	LATE IRON AGE AND ROMANO-BRITISH SETTLEMENT AT RAMPTON	Rampton	Roman		Settlement		Excavation
480160	376010	M4735	LANEHAM MILLS	Laneham	medieval		industry	Mill	building
481470	376570	M4740	CHURCH OF ST PETER AT LANEHAM	Laneham	medieval		Ecclesiastic	Parish church	building
479270	387220	M4945	FISHPOND AT BOLE	Bole	medieval		Landscape feature	pond	Landscape
479900	385300	M4946	DESERTED VILLAGE AT WEST BURTON	West Burton	medieval		Settlement	DMV	Earthworks
478500	382000	M4985	SITE OF THE VILLAGE OF HABBLESTHORPE AT NORTH LEVERTON	North Leverton	medieval		Settlement	DMV	Standing
479390	382360	M4987	HABBLESTHORPE CHURCH AND CHURCHYARD AT NORTH LEVERTON	North Leverton	medieval		Ecclesiastic	Parish church	building
479300	387100	M5013	CHURCH OF ST MARTIN AT BOLE	Bole	medieval	12th	Ecclesiastic	Parish church	building
478340	381100	M5020	CHURCH OF ALL SAINTS AT SOUTH LEVERTON	South Leverton	medieval	11th	Ecclesiastic	Parish church	building
478710	382250	M5021	CHURCH OF ST MARTIN AT NORTH LEVERTON	North Leverton	medieval	11th	Ecclesiastic	Parish church	building
478800	383870	M5022	CHURCH OF ST PETER AND ST PAUL AT STURTON LE STEEPLE	Sturton le Steeple	medieval		Ecclesiastic	Parish church	building
482300	382800	M5033	ROMAN TOWN OF SEGELOCUM	Littleborough	Roman		Settlement	Roman settlement	Excavation
481830	380060	M5046	CHURCH OF THE HOLY TRINITY AT COTTAM	Cottam	medieval	11th	Ecclesiastic	Parish church	building
482450	382620	M5047	CHURCH OF ST NICHOLAS AT STURTON LE STEEPLE	Sturton le Steeple	medieval	11th	Ecclesiastic	Parish church	building
481450	377030	M5854	MANOR HOUSE AT LANEHAM	Laneham	medieval	14th	Settlement	High status residence	Earthworks
479700	378400	M6168	SHRUNKEN VILLAGE AT RAMPTON	Rampton	medieval		Settlement	shrunken village	building
481530	380500	M6241	? IA/Ro settlement, Cottam	Cottam	Iron Age		Settlement	Roman settlement	Excavation
482140	383100	M6244	Site of Windmill, Littleborough	Littleborough	Post-medieval		industry	Mill	Landscape
478180	381180	M6818	THE PRIORY AT SOUTH LEVERTON	South Leverton	medieval	12th	Ecclesiastic	Priory	building
480010	385250	M8760	CHURCH OF ST HELEN AT WEST BURTON	West Burton	medieval		Ecclesiastic	Parish church	building
482400	382600	M17737	Roman Road, RR28, Lincoln-Doncaster	Littleborough	Roman		Landscape feature	road	Landscape
479980	378610	M18139	MANOR HOUSE AT RAMPTON	Rampton	Post-medieval	16th	Settlement	High status residence	Earthworks
478600	379360	M18149	FORD AND STEPPING STONES AT TRESWELL	Treswell	U		Landscape feature	Ford	Landscape
482100	382860	M18200	CREMATION CEMETERY AT SEGELOCUM	Littleborough	Roman		human remains		Excavation
482550	382480	M18201	ROMAN FORD AT SEGELOCUM	Littleborough	Roman		Landscape feature	Ford	historical
481900	383400	M18387	Ro settlement at Site D, Sturton le Steeple	Sturton le Steeple	Roman		Settlement		Excavation
481600	384300	M18388	Ro settlement at Site B, Sturton le Steeple	Sturton le Steeple	Roman		Settlement		Excavation
481700	383900	M18389	Ro settlement at Site C, Sturton le Steeple	Sturton le Steeple	Roman		Settlement		Excavation
479950	378580	L4677	C13 ELEMENTS OF THE CHURCH OF ALL SAINTS AT RAMPTON	Rampton	medieval	13th	building		building
478150	379390	L4678	C13 ELEMENT OF THE CHURCH OF ST JOHN THE BAPTIST AT TRESWELL	Treswell	medieval	13th	building		building
478050	379900	L4688	ENCLOSURE AT SOUTH LEVERTON	South Leverton	U		Settlement	enclosure	Cropmark
478300	379400	L4696	EARTHWORK COMPLEX AT TRESWELL	Treswell	U		Landscape feature		Earthworks
481550	378550	L4697	MOAT AT RAMPTON	Rampton	medieval		Landscape feature	High status residence	Earthworks
482030	378740	L4698	ROMAN FINDS FROM RAMPTON	Rampton	Roman		stray finds		Findspot
481600	376300	L4700	CROPMARK COMPLEX AT LANEHAM	Laneham	U		Landscape feature	enclosure	Cropmark
480160	376010	L4735	SITE OF WATERMILL AT LANEHAM	Laneham	Post-medieval		industry	Mill	historical
481470	376570	L4740	NORMAN ELEMENTS OF THE CHURCH OF ST PETER AT LANEHAM	Laneham	medieval	11th	building		building
479270	387220	L4945	EARTHWORK AT BOLE	Bole	medieval		Landscape feature		Earthworks
479900	385300	L4946	EARTHWORK COMPLEX AT WEST BURTON	West Burton	medieval		Landscape feature		Earthworks
478500	382000	L4985	DOCUMENTARY REFERENCE TO HABBLESTHORPE AT NORTH LEVERTON	North Leverton	medieval		Settlement	shrunken village	historical
478430	382940	L4986	ROMAN FINDS FROM STURTON LE STEEPLE	Sturton le Steeple	Roman		stray finds		Findspot
479390	382360	L4987	SITE OF CHURCH AT NORTH LEVERTON	North Leverton	medieval		Ecclesiastic	Parish church	Landscape
482100	382600	L5001	ROMAN ALTAR AND CARVED STONE FROM LITTLEBOROUGH	Littleborough	Roman		Settlement	Altar	Findspot
479300	387100	L5013	COMPONENTS OF CHURCH OF ST MARTIN AT BOLE	Bole	medieval		building	Parish church	standing
478340	381100	L5020	NORMAN ELEMENTS OF THE CHURCH OF ALL SAINTS AT SOUTH LEVERTON	South Leverton	medieval	11th	building		building
478710	382250	L5021	C13 DOORWAY AT CHURCH OF ST MARTIN, NORTH LEVERTON	North Leverton	medieval	13th	building		building
478800	383870	L5022	NORMAN ELEMENTS OF THE CHURCH OF ST PETER AND ST PAUL AT STURTON	Sturton le Steeple	medieval	11th	building		building
482050	382700	L5032	LINEAR FEATURES AT STURTON LE STEEPLE	Sturton le Steeple	U		Landscape feature		Cropmark
482370	382520	L5033	BUILDINGS AT SEGELOCUM: SITE II	Littleborough	Roman		Landscape feature		Excavation
482400	382480	L5034	ROMAN COINS FROM STURTON LE STEEPLE	Sturton le Steeple	Roman		stray finds		Findspot
482600	382600	L5035	ROMAN POTTERY FROM STURTON LE STEEPLE	Sturton le Steeple	Roman		stray finds		Findspot
481100	382050	L5036	ENCLOSURES AT NORTH LEVERTON	North Leverton	U		Settlement	enclosure	Cropmark
480900	381800	L5037	CROPMARKS AT NORTH LEVERTON	North Leverton	U		Landscape feature		Cropmark
481100	381400	L5038	CROPMARKS AT NORTH LEVERTON	North Leverton	U		Landscape feature		Cropmark
480800	380900	L5039	LINEAR FEATURES AT SOUTH LEVERTON	South Leverton	U		Landscape feature		Cropmark
480500	380300	L5040	CROPMARKS AT SOUTH LEVERTON	South Leverton	U		Landscape feature		Cropmark
482000	381400	L5042	EARLY MEDIEVAL FINDS FROM COATES, NORTH LEVERTON	North Leverton	Early medieval		stray finds		Findspot
481830	380060	L5046	CHURCH OF THE HOLY TRINITY AT COTTAM	Cottam	medieval	11th	Ecclesiastic	Parish church	building
482450	382620	L5047	CHURCH AT STURTON LE STEEPLE	Sturton le Steeple	medieval	11th	Ecclesiastic	Parish church	building
477850	379400	L5739	HOLLOWAY AT TRESWELL	Treswell	U		Landscape feature	Trackway	Earthworks
480120	376300	L5792	Earthwork at Laneham	Laneham	U		Landscape feature		Earthworks
481450	377030	L5854	DOCUMENTARY REFERENCES TO MANOR HOUSE AT LANEHAM	Laneham	medieval	13th	Settlement	High status residence	historical
482450	382530	L5884	ROMAN COINS FROM STURTON LE STEEPLE	Sturton le Steeple	Roman		stray finds		Findspot
481300	376500	L5954	E MED/MEDIEVAL POTTERY FROM LANEHAM	Laneham	Early medieval		stray finds		Findspot
479700	380000	L6052	RIDGE AND FURROW AT SOUTH LEVERTON	South Leverton	medieval		RF		Landscape
481550	376650	L6056	DITCH/WATERCOURSE AT LANEHAM	Laneham	U		Landscape feature		Earthworks
479000	382900	L6069	RIDGE AND FURROW AT STURTON LE STEEPLE	Sturton le Steeple	medieval		RF		Landscape
478400	380600	L6070	RIDGE AND FURROW AT SOUTH LEVERTON	South Leverton	medieval		RF		Landscape
478800	379500	L6162	EARTHWORKS AT BROOKSIDE FARM, TRESWELL	Treswell	U		Landscape feature		Earthworks
478000	379000	L6163	EARTHWORKS AT WEST END FARM, TRESWELL	Treswell	U		Landscape feature		Earthworks
480400	378400	L6166	EARTHWORKS AT EAST END FARM, RAMPTON	Rampton	U		Landscape feature		Earthworks
479900	378300	L6167	EARTHWORKS AT HALL FARM, RAMPTON	Rampton	U		Landscape feature		Earthworks
479700	378400	L6168	EARTHWORK COMPLEX AT RAMPTON	Rampton	medieval		Settlement		Earthworks
478600	381200	L6169	EARTHWORKS AT SOUTH LEVERTON	South Leverton	U		Landscape feature		Earthworks
478550	381100	L6170	EARTHWORKS AT SOUTH LEVERTON	South Leverton	U		Landscape feature		Earthworks
479100	383800	L6171	EARTHWORKS AT STURTON LE STEEPLE	Sturton le Steeple	U		Landscape feature		Earthworks
479400	384000	L6172	MOUNDS AND HOLLOWS AT STURTON LE STEEPLE	Sturton le Steeple	U		Landscape feature		Earthworks
479700	384000	L6173	EARTHWORKS AT STURTON LE STEEPLE	Sturton le Steeple	U		Landscape feature		Earthworks
478500	384000	L6174	EARTHWORK COMPLEX AT STURTON LE STEEPLE	Sturton le Steeple	U		Settlement		Earthworks
478480	384550	L6175	EARTHWORKS AT STURTON LE STEEPLE	Sturton le Steeple	U		Landscape feature		Earthworks
479200	387150	L6176	HOLLOW AT BOLE	Bole	U		Landscape feature	Trackway	Earthworks
479400	386800	L6177	EARTHWORK COMPLEX AT BOLE	Bole	U		Landscape feature		Earthworks
479500	387100	L6178	EARTHWORK COMPLEX AT BOLE	Bole	U		Landscape feature		Earthworks
480900	376300	L6209	BANK AT LANEHAM	Laneham	U		Landscape feature	flood defences	Landscape
480070	375430	L6228	Field boundaries, Laneham	Laneham	medieval		Landscape feature	Field Boundary	Landscape
480880	378540	L6229	Field boundary, Rampton	Rampton	medieval		Landscape feature	Field Boundary	Landscape
480100	379000	L6230	Field boundaries, Rampton	Rampton	medieval		Landscape feature	Field Boundary	Landscape
481070	385070	L6237	Enclosure and linear features, Sturton le Steeple	Sturton le Steeple	U		Settlement		Cropmark
481120	380160	L6239	Sub-circular enclosure, South Leverton	South Leverton	U		Settlement		Cropmark
481240	380950	L6240	Linear features, Cottam/North Leverton	Cottam	medieval		Landscape feature		Cropmark
481530	380500	L6241	Curvilinear enclosure and trackway, Cottam	Cottam	U		Settlement	enclosure	Cropmark
481800	380420	L6242	Linear features, Cottam	Cottam	U		Landscape feature		Cropmark
481080	381620	L6243	Trackway, North Leverton	North Leverton	Post-medieval		Landscape feature	Trackway	Landscape
482140	383100	L6244	Cross-shaped cropmark, Littleborough	Littleborough	medieval		Landscape feature		Cropmark
482240	382580	L6245	Road surface, Littleborough	Littleborough	Roman		Landscape feature	road	Landscape
481570	382920	L6246	Trackway, pits and linear features, Littleborough	Littleborough	Roman		Landscape feature	Trackway	Landscape
479860	379000	L6779	EARTHWORK AT RAMPTON	Rampton	Post-medieval		Landscape feature		Earthworks
479570	378770	L6780	EARTHWORK AT RAMPTON	Rampton	Post-medieval		Landscape feature		Earthworks
479820	377590	L6782	MAP DEPICTION OF FLOODBANKS AT RAMPTON	Rampton	Post-medieval		Landscape feature	flood defences	historical
479550	376520	L6783	BANK AT LANEHAM	Laneham	Post-medieval		Landscape feature	flood defences	Landscape
478180	381180	L6818	MEDIEVAL BUILDING AT SOUTH LEVERTON	South Leverton	medieval	12th	building	residence	building
478300	384400	L6917	CROPMARKS AT STURTON LE STEEPLE	Sturton le Steeple	U		Landscape feature		Cropmark
478800	384350	L6964	RIDGE AND FURROW AT STURTON LE STEEPLE	Sturton le Steeple	medieval		RF		Landscape
479300	383750	L6965	RIDGE AND FURROW AT STURTON LE STEEPLE	Sturton le Steeple	U		RF		Landscape
478400	382400	L6966	RIDGE AND FURROW AT NORTH LEVERTON	North Leverton	medieval		RF		Landscape
478650	381600	L6967	RIDGE AND FURROW AT NORTH AND SOUTH LEVERTON	South Leverton	medieval		RF		Landscape

479010	386850	L6968	DITCH AT BOLE	Bole	U		Landscape feature		Earthworks
481400	375900	L8723	PIT ALIGNMENTS AT LANEHAM	Laneham	U		Landscape feature		Cropmark
481600	376720	L8727	ROMAN POTTERY FROM LANEHAM	Laneham	Roman		stray finds		Findspot
480010	385250	L8760	SITE OF CHURCH AT WEST BURTON	West Burton	medieval		Ecclesiastic	Parish church	Excavation
481000	381300	L8769	ROMAN POTTERY FROM NORTH LEVERTON	North Leverton	Roman		stray finds		Findspot
480900	381000	L8770	ROMAN FINDS FROM SOUTH LEVERTON	South Leverton	Roman		stray finds		Findspot
482450	382620	L8771	ROMAN TILES AT CHURCH OF ST NICHOLAS, STURTON LE STEEPLE	Sturton le Steeple	Roman		stray finds		Findspot
479670	378030	L9987	RIDGE AND FURROW AT RAMPTON	Rampton	U		RF		Landscape
479230	376220	L9989	ENCLOSURE AT LANEHAM	Laneham	U		Settlement	enclosure	Cropmark
479950	378500	L10030	Early C14 ELEMENTS OF THE CHURCH OF ALL SAINTS AT RAMPTON	Rampton	medieval	14th	building		building
479950	378580	L10031	C14 û C15 ELEMENTS OF THE CHURCH OF ALL SAINTS AT RAMPTON	Rampton	medieval	14th	building		building
478150	379390	L10032	EARLY C14 ELEMENT OF THE CHURCH OF ST JOHN THE BAPTIST AT TRESWELL	Treswell	medieval	14th	building		building
478150	379390	L10033	C14-15 ELEMENTS OF THE CHURCH OF ST JOHN THE BAPTIST AT TRESWELL	Treswell	medieval	14th	building		building
479980	378610	L10043	DOCUMENTARY REFERENCE TO MANOR HOUSE AT RAMPTON	Rampton	medieval		Settlement	High status residence	historical
478600	379360	L10106	MAP DEPICTION OF A FORD & STEPPING STONES AT TRESWELL	Treswell	U		Landscape feature	Ford	historical
479100	379880	L10109	SCARP AT TRESWELL	Treswell	U		Landscape feature		Landscape
479780	378170	L10110	MAP DEPICTION OF PINFOLD AT RAMPTON	Rampton	U		Landscape feature		historical
478260	385430	L10194	FIELD SYSTEM AT STURTON LE STEEPLE	Sturton le Steeple	U		Landscape feature	Field Boundary	Landscape
478340	381100	L10233	C13 ELEMENTS OF THE CHURCH OF ALL SAINTS AT SOUTH LEVERTON	South Leverton	medieval	13th	building		building
478340	381100	L10234	C14 ELEMENTS OF THE CHURCH OF ALL SAINTS AT SOUTH LEVERTON	South Leverton	medieval	14th	building		building
479900	385300	L10237	DOCUMENTARY EVIDENCE FOR VILLAGE AT WEST BURTON	West Burton	medieval		Settlement	DMV	historical
477580	386990	L10244	RIDGE AND FURROW AT BOLE	Bole	medieval		RF		Landscape
477830	382010	L10249	RIDGE AND FURROW AT NORTH LEVERTON	North Leverton	medieval		RF		Landscape
478430	382940	L10262	MEDIEVAL-MODERN POTTERY FROM STURTON LE STEEPLE	Sturton le Steeple	medieval		stray finds		Findspot
478710	382250	L10265	C14 ELEMENTS OF CHURCH OF ST MARTIN, NORTH LEVERTON	North Leverton	medieval	14th	building		building
478710	382250	L10266	TOWER AT CHURCH OF ST MARTIN AT NORTH LEVERTON	North Leverton	medieval		building		building
478800	383870	L10270	C14 ELEMENTS OF THE CHURCH OF ST PETER AND ST PAUL AT STURTON	Sturton le Steeple	medieval	14th	building		building
482012	378730	L10636	FEATURES AT RAMPTON: AREA 1	Rampton	Roman	1st	Landscape feature		Excavation
482014	378735	L10637	STRUCTURE AT RAMPTON: AREA 2	Rampton	Roman	1st	building		Excavation
482019	378720	L10638	FEATURES AT RAMPTON : AREA 3-5	Rampton	Roman	1st	Landscape feature		Excavation
482036	378719	L10639	DITCHES AT RAMPTON: AREA 6	Rampton	Roman	3rd	Landscape feature		Excavation
482035	378713	L10640	DITCHES AT RAMPTON: AREA 7	Rampton	Roman	3rd	Landscape feature		Excavation
482030	378740	L10641	ROMAN FINDS FROM RAMPTON	Rampton	Roman	3rd	stray finds		Excavation
482030	378740	L10642	DITCHES AT RAMPTON (1965 EXCAVATION)	Rampton	Roman	3rd	Landscape feature		Excavation
481470	376570	L10643	C13 ELEMENTS OF THE CHURCH OF ST PETER AT LANEHAM	Laneham	medieval	13th	building		building
481470	376570	L10644	C14 ELEMENTS OF THE CHURCH OF ST PETER AT LANEHAM	Laneham	medieval	14th	building		building
482330	382580	L10649	EXCAVATION AT SITE I, SEGELOCUM	Littleborough	Roman		Settlement		Excavation
482370	382520	L10650	MEDIEVAL FINDS FROM SEGELOCUM, SITE II	Littleborough	medieval		stray finds		Findspot
482370	382520	L10651	E MED POTTERY FROM SEGELOCUM, SITE II	Littleborough	Early medieval		stray finds		Findspot
482210	382640	L10652	COBBLED SURFACE AT SEGELOCUM, SITE 2	Littleborough	Roman		building		Excavation
482100	382860	L10653	CREMATIONS AT SEGELOCUM, SITE 3	Littleborough	Roman		human remains		Excavation
482050	382890	L10654	PIT AT SEGELOCUM, SITE 4	Littleborough	Roman		Landscape feature		Excavation
481970	382870	L10655	ROAD SURFACE AT SEGELOCUM, SITE 5	Littleborough	Roman		Landscape feature	road	Excavation
482550	382480	L10656	ROMAN STRUCTURE AT SEGELOCUM	Littleborough	Roman		building		Excavation
482620	382650	L10658	ROMAN PATERA FROM STURTON LE STEEPLE	Sturton le Steeple	Roman		stray finds		Excavation
482300	382800	L10665	Antiquarian finds at Segelocum	Littleborough	Roman		stray finds		historical
482400	382500	L10666	Finds after bulldozing at Segelocum	Littleborough	Roman		Settlement		Excavation
482300	382800	L10667	Cropmarks at Segelocum	Littleborough	Roman		Landscape feature		Cropmark
480940	379710	L11797	Romano - British pottery from Cottam Power Station, Treswell	Treswell	Roman		stray finds		Findspot
480940	379710	L11798	Medieval pottery from Cottam Power Station, Treswell	Treswell	medieval		stray finds		Findspot
482010	378700	L11818	Romano-British pottery from pipeline, Rampton	Rampton	Roman		stray finds		Findspot
482150	378700	L11819	Ditch at Phase 1, Rampton Quarry	Rampton	Roman		Landscape feature		Excavation
481900	378640	L11823	Field system ditches (Phase 2) at Rampton Quarry	Rampton	Iron Age		Landscape feature	Field Boundary	Excavation
481950	378680	L11824	Romano-British ditches and features (Phase 3) at Rampton Quarry	Rampton	Roman		Landscape feature		Excavation
482030	378700	L11825	Romano-British ditches and features (Phase 4), at Rampton	Rampton	Roman		Landscape feature		Excavation
482050	378740	L11826	Romano-British ditches (Phase 5) at Rampton	Rampton	Roman		Landscape feature	enclosure	Excavation
482000	378700	L11827	Iron Age and Romano-British finds from Rampton Quarry	Rampton	Iron Age		stray finds		Excavation
482000	378700	L11829	Unphased Romano-British occupation levels at Rampton	Rampton	Roman		Settlement		Excavation
482060	378710	L11830	Romano-British ditches and finds from Rampton	Rampton	Roman		Settlement		Excavation
481900	378640	L11831	Romano-British ditches at Rampton	Rampton	Roman		Landscape feature		Excavation
481600	384300	L12075	Ro features at Site B, Sturton le Steeple	Sturton le Steeple	Roman		Settlement		Excavation
481600	384300	L12077	Early medieval stake from Site B, Sturton le Steeple	Sturton le Steeple	Early medieval		stray finds		Findspot
481700	383900	L12079	Romano-British features and finds at Site C, Sturton le Steeple	Sturton le Steeple	Roman		Settlement		Excavation
481700	383900	L12080	Medieval ridge and furrow from Site C, Sturton le Steeple	Sturton le Steeple	medieval		RF		Landscape
481900	383400	L12081	Ro features at Site D, Sturton le Steeple	Sturton le Steeple	Roman		Landscape feature		Excavation
481800	384700	L12083	Ro pottery from Site E, Sturton le Steeple	Sturton le Steeple	Roman		stray finds		Findspot
487800	375500	52598	Rectangular cropmark and earthwork enclosure known as busdyke	Hardwick	medieval	13th	building	High status residence	Cropmark
486800	375800	52611	Settlement remains, Hardwick, shrunken village	Hardwick	medieval		Settlement	shrunken village	Earthworks
486800	376200	52615	Medieval linear feature and enclosure	Hardwick	medieval		Landscape feature	enclosure	Cropmark
486500	376000	55437	Cropmark prehistoric or Romano-British enclosure, boundaries and ditches	Hardwick	Roman		Landscape feature	enclosure	Cropmark
486900	374800	52617	Settlement or farmstead of Drinsey	Hardwick	medieval	13th	Settlement	Farm	Findspot
486800	375400	52614	Ridge and furrow	Hardwick	medieval		RF		Landscape
		52612	Grange of Augustinian Priory at Torksey	Hardwick	medieval	12th	Ecclesiastic	monastic grange	historical
487800	375500	52599	Romano-British pottery	Hardwick	Roman		stray finds		Findspot
487700	375700	52616	Ridge and furrow	Hardwick	medieval		RF		Landscape
481800	391500	54187	Castle Hills Wood ringwork and bailey	Thonock	medieval	10th	Settlement	High status residence	Earthworks
483300	391800	51329	Roman settlement southeast of Thonock Hall	Thonock	Roman	2nd	Settlement	Kiln	Excavation
483300	393000	50376	Prehistoric cropmarks north of Thonock lane	Thonock	Iron Age	1st	Settlement		Cropmark
483300	391800	51330	Medieval finds from southeast of Thonock Hall	Thonock	medieval	13th	stray finds		Findspot
483000	393000	50401	unlocated site of dmv at Havercroft	Thonock	medieval	14th	Settlement	DMV	historical
483300	391700	50697	Anglo-Saxon finds from Romano-British site, Thonock	Thonock	Early medieval		stray finds		Findspot
482700	391900	50420	Thonock Park medieval deer park	Thonock	medieval	13th	Landscape feature	Deer park	Landscape
483100	392700	54045	Medieval boundaries	Thonock	medieval		Landscape feature	boundaries	Landscape
482800	392800	50402	Unlocated site of dmv of Thonock	Thonock	medieval	11th	Settlement	DMV	historical
483600	392900	54307	Cropmark ridge and furrow	Thonock	medieval		RF		Cropmark
482400	391400	54048	ridge and furrow	Thonock	medieval		RF		Landscape
483300	392100	54049	ridge and furrow	Thonock	medieval		RF		Landscape

Appendix XII: Grey Literature

Parish	HER ref	Author	Date	Title	Unit	Easting	Northing	period	Feature type	feature	aeolian sand	alluvium	archaeology over or under sand deposits	Notes
Gainsborough	92/3		1992	Watermains relay, Cobden, Gladstone, Bright, Lord, Morley Street	LAS	481250	390030	Medieval	E	Moat infill around Old Hall	0	0		
Gainsborough	M4/26	Cope-Faulkner; Taylor	1994	Watching brief former Floss Laundry, flood defences at Morton's corner	APS	480650	391410	post-medieval	Env	post-medieval siltation	1	1		did not dig into "natural" sands
Gainsborough	99/13	Wragg	1999	Tesco store Beaumont street	CLAU	481800	389650	industrial	E	20th c fills	0	0		
Gainsborough	M4/13	Savage; Brett	2004	Sure Start Centre	PCA	481500	389700	industrial	E	18th c	0	1		post-med dumping over alluvium. Claims inhabitable prior to 18th c, but unproven.
Gainsborough	M7/6	Jacklin	2007	Photo record St. Andrews	KANE	481913	388650	industrial	B	post-medieval brick building	0	0		
Gainsborough	M2/23	Clay	2002	Sliver/Bridge Street watching brief/rescue	PCA	481240	389740	Medieval	E	12th century articulated and disarticulated human remains	1	0		Skeletons within aeolian deposit- however deposit not recognised as such. Location of Chapel Staithe?
Gainsborough	M6/9	Pullen	2006	Sandar Yard Bridge Street	PAS	481450	389180	medieval	L	medieval raised road? Only post-medieval remains, with medieval material culture	0	1		
Gainsborough		Menuge	1992	Rchme Sandars Maltings, 94-110 Bridge Street	RCHME	481479	389250	post-medieval	E	18th c kiln	0	0		
Gainsborough	M5/14		2005	Sandars Yard building survey		481479	389250	post-medieval	B	post-medieval brick building	0	0		
Gainsborough	00/12	Wragg	2000	Offices Wembly street/bridge street	LAS	481500	389550	Medieval	Env	post-medieval siltation	0	0		alluvial deposits within town ditch?
Gainsborough	M2/25		2002	Land off Northolme	Tony Sumpter Consultancy	481660	390280	Medieval	E	Medieval materials within aeolian deposits	1	0		Some medieval material culture within top part of sand, but did not excavate into sand because it was 'natural'
Gainsborough	M2/22	Allen	2002	DBA and Mag survey of Foxby Lane	PCA	482900	388700	post-medieval	L	ridge and furrow	0	0		Medieval boundary NNE-SSW of the site?
Gainsborough	M5/3		2004	Land between North and Church Street	Mike Jarvis archaeological service	481480	390220	Medieval	E	undated pits and medieval pottery, aeolian sand	1	0		12-13th century chelly ware, sand sealing the deposits. However, sand was considered natural, and not excavated any more.
Gainsborough	00/6	Snee	2000	Land between Bridge St and Trent	APS	481470	389440	post-medieval	E	20th c fills	0	1		alluvium
Gainsborough	MS/11	Bunn; Gardner	2005	Geophys and walkover on land at western end of the proposed Caenby Corner to Gainsborough	PCA	484762	388560	post-medieval	G	ploughing and possible medieval field boundaries	0	0		Deer Park field boundary?
Gainsborough	MS/11	Bunn; Gardner	2005	Geophys and walkover on land at western end of the proposed Caenby Corner to Gainsborough	PCA	482051	388511	post-medieval	L	ploughing and possible medieval field boundaries	0	0		Deer Park field boundary?
Gainsborough	5/5	Gardner	2005	Land at Bridge street and Hickman street	PCA	481477	389639	post-medieval	L	RIVER COURSE IN 1748	0	1		
Gainsborough	08-451	Albone	2002	DBA for Caenby to Gainsborough pipeline		484250	388550	post-medieval	L	arable land, but potentially on aeolian	0	0		A-S remains at Heapham
Gainsborough	M3/6	Cope-Faulkner; Taylor	2003	Building appraisal and DBA Morton Corner	APS	480650	391410	post-medieval	B	arable land, along Front Street	0	0		Front street was military highway in Saxon times??
Gainsborough	M3/23	Rowlandson	2003	Heapham Road	LAS	483716	389070	industrial	ENV	Lagoon with environmental potential	0	0		Within an infilled 'lagoon', which may be medieval wetlands, but environmental dismissed.
Gainsborough	93/1		1993	Old Hall path renewal	LAS	481355	389943	Medieval	E	Aeolian sand above and below clay	1	0		
Gainsborough	Misc 8		2003	Old Hall conservation plan	Oxford Arch	481355	389943	post-medieval	B		0	0		Good post-medieval record, but not of any archaeological interest
Gainsborough	90/1		1991	Old Hall Dais window excavation	LAS	481355	389943	Medieval	E	pottery pre-dating present hall	0	0		Confirmation of earlier medieval activity on site- 13th century
Gainsborough	95/3		1995	Old hall dais window survey	LAS	481355	389943	no archaeology	B		0	0		
Gainsborough	M3/15	Savage; Palmer-Brown	2003	Gainsborough Guildhall	PCA	481370	390900	Medieval	E	Occulation deposits	0	0		
Gainsborough	95/15		1995	Thonock Hall watching brief	John Samuels	481780	391000	post-medieval	E	medieval settlement northwest of site	0	0		
Gainsborough	96/2		1996	Compak systems site, Trinity Street	LAS	481780	389650	post-medieval	E	near to kiln at lea	0	0		No remains
Gainsborough	M3/27	Gardner; Masters	2003	Caenby Corner to Gainsborough	PCA	484762	388560	Iron Age/Romano-British	C	U-shaped ditch	0	0		on Gboro boundary
Gainsborough	M5/15	Collins	2005	Building record, Brittania Iron Works		481757	389843	post-medieval	B		0	0		Post-med history
Gainsborough	89/1		1989	Baltic Mill	LAS	481406	389700	post-medieval	Env	Trent movement	0	1		Trent realigned in 17th century
Gainsborough	95/15		1995	Area of Proposed new lakes, golf course, Thonock	John Samuels	483640	391770	Iron Age/Romano-British	E	Roman settlement and pottery	0	0		Settlement is confined to south facing hillside hollow; 2-4th century pit and ditches and trackway
Gainsborough	95/10		1995	Beckett School Watching brief	APS	483010	389940	post-medieval	E	post-medieval fills over natural	0	0		
Gainsborough	07/66	Clay	2007	Beckett School trenches	Allen	483010	389940	post-medieval	E	undated features	0	0		
Gainsborough	94/9	Palmer-Brown	1994	Bridge Street	PCA	481473	389562	post-medieval	E	post-medieval building and alluvium	0	1		
Gainsborough	98/25		1998	Land off Ropery Road DBA	John Samuels	481081	390100	post-medieval	E	under concrete, not completely excavated- within medieval core	0	0		In albion works
Gainsborough	93/5		1993	Assessment of Golf Course, Thonock	John Samuels	483600	391580	Iron Age/Romano-British	E	Complex settlement/farmstead visible	0	0		Near DMV of Havercroft (SK830930?)? Aps show cropmarks (see notebook)
Gainsborough	M3/14		1996	39-43 Silver Street	WYAS	481500	389700	post-medieval	E	Alluvium with animal bone	0	1		
Gainsborough		Tann	2003	20-32 Bridge Street	LAS	481450	389620	Medieval	Env	On the 'causey', datable environmental evidence?	0	1		
Gainsborough	M5/16	Gardner	2005	12-14 Silver Street	PCA	481400	389810	post-medieval	E	Post-medieval disturbance	0	0		
Gainsborough	08/75	Hill	2008	Land at Carlisle St	PCA	481577	390206	Medieval	E	medieval remains in aeolian sand	1	0		Aeolian called 'alluvial', and considered natural
Gainsborough	07/166	Hill	2007	51-53 North Street	PCA	481520	390110	Medieval	E	medieval walls, post-medieval walls and fill	1	1		made ground, rubble, due to increased flooding?
Gainsborough	07/83	Williams	1007	Old Hall	PCA	481355	389943	post-medieval	E	post-medieval brick foundations	0	0		
Lea	M1/17		2001	Plot 1, Cowgarth Lane, Lea	CLAU	482680	386920	Medieval	E	pits with 12th-16th c pottery in the fills	1	0		Also post medieval deposits in subsoil; aeolian sand likely exposed during medieval period, indicating recent reactivity.
Lea	99/25		1999	Land to the rear of 35 Gainsborough Road	LAS	482691	387013	Roman	E	remains of 2-4th c pottery kiln	1	0		Pottery kiln with clay lined feature, burnt bone, cereal grains, and 3rd c pottery
Lea	98/12	Johnson	1998	Land at Lea	LAS	482627	386913	Roman	E	pottery kilns beneath layers of aeolian sand	1	0		This study concludes that there is sand masking archaeology, not that it is just natural
Lea	00/13		2000	Land adjacent to 27 Gainsborough Rd.	LAS	482758	386900	no archaeology	E	only sand underlying topsoil	1	0		
Lea	97/8	Jarvis	1997	St. Helen's church	CLAU	483100	386700	post-medieval	E	no medieval burial remains, only p-m disturbance	0	0		
Lea	96/15	Johnson	1996	Rectory farm watching brief	PCA	482630	386640	no archaeology	E		1	0		
Knaith	M9/7	Sherlock; Cox	2009	Trial trenchinga Knaith Park and Blyborough	AC Arch	484600	385700	Roman	E	Iron working site	1	0		more romano-british industry in the area
Knaith	M7/5		2007	Fieldwalking at Knaith Park	AC Arch	484790	385870	undated	C	cropmarks and 6 sherds romano-british and 2 medieval pottery	0	0		MAP THESE CROPMARKS
Knaith	95/9		1995	Land off Knaith Hill	LAS	482970	384800	industrial	E	19th and 20th c material in test pit	0	1		Road recorded in everson 1993, 3 at right angles to river
Knaith	95/8		1995	Land adjacent to Corner House Farm	LAS	482950	384790	Roman	E	Roman pottery in alluvial silt, pre-medieval flooding	0	1		Alluvium dates to romano-british period, prior to medieval, so this area was relatively stable in the medieval period
Knaith	00/20	Snee	2000	Watching brief on land adjacent to Terrace House	APS	482980	384570	post-medieval	E	17th century remodelling of Knaith Hall	0	0		
Knaith	98/3	Cavanagh	1998	Station Road, Knaith Park	AOC	484150	385700	undated	E	claims to be natural feature in sand, but appears to be small gully in photos	1	0		Good background section
Marton	95/7		1995	Manor farm High Street watching brief	LAS	483994	382005	post-medieval	E	aeolian sand over mudstone, under 17th century farm	1	0		
Marton	M3/11	Cope-Faulkner	2003	DBA Littleborough Ln	APS	483800	381900	undated	C	Map of cropmarks	0	0		Martone: farmstead by the pool
Marton	M3/19	Brooks	2003	Land at littleborough lane geophysics	EAS	483715	381973	undated	G	VERY faint anomolies, they think are proof for further evidence. Meh	0	0		poorly executed geophysics
Torksey	M5/20	Rowlandson	2005	Main St. Watching brief	LAS	483770	378900	Saxon	E	Grubenhaus building and skeletons	1	0		A-S above sand deposits
Torksey	M5/20	Rowlandson	2005	Main St. Watching brief	LAS	483770	378900	Medieval	E	High status medieval buildings, part of St. Leonards. Skeletons up to 16th century; road	1	0		One of lost parish churches? Medieval remains on high ground in the east. NEVER SWITCHED FROM WATCHING BRIEF???!
Torksey	97/5	Field	1997	Land to the rear of the Post Office DBA	LAS	483790	378750	undated	L	Highly sensitive area'	0	0		
Torksey	97/5		1997	Land off Main St	LAS	483750	378960	Medieval	E	Medieval stone structure, hearths, pits, post holes	1	0		Hypothesized Anglo-Saxon remains BENEATH the sand- not excavated
Torksey	97/4	Field	1997	Land off Main St DBA	LAS	483750	378960	undated	L	Hypothesized to be part of market square	0	0		
Torksey	M7/01	Trimble	2001	Land at Little London Caravan park	CLAU	483920	377800	undated	E	Floor' of green clay' actually MM	0	0		
Torksey	00/8	Johnson	2000	Land at Torksey- geophysics	LAS	483950	378180	undated	G	Few features, few squares	1	0		Sand may be obscuring relevant features
Torksey	M8/5	Hamilton	2008	Field evaluation of Land north of disused railway	PCA	483729	379459	undated	E	No results over sand, did not excavate below sand	1	0		
Torksey	90/1		1990	Hume Arms caravan park geophysics	LAS	483964	378879	Medieval	L	Possible earthworks of fishponds	1	0		
Torksey	97/1		1997	Blyborough Pipeline	Wessex	483600	380655	Iron Age/Romano-British	C	Cropmarks, linear features, pits, 1-4th century	1	0		Site 43, near Brampton Grange
Torksey	96/17		1996	Blyborough Pipeline proposal	Wessex	483600	380655	Roman	L	Ermine Street, place names, gravel islands listed	0	0		
Torksey	M4/15		2004	Resistivity on Land at Torksey	LAS	484035	378944	no archaeology	x	North of wetland park near castle, environmental?	0	0		Sand listed as glaciofluvial
Torksey	M7/17	Palmer-Brown	2001	Arch Eval Castle Farm, Main St Torksey	Allen	483700	378600	Saxon	E	Post medieval pits within sand that overlies Saxon pottery	1	0		POST-SAXON SAND
Torksey	99/11	Albone	1999	Watching brief Plot 3 Main St	PCA	483765	378755	Saxon	E	Saxon ABOVE sand	1	0		PRE-SAXON SAND
Torksey	M1/10	Clay	2001	Watching brief Plot 2 Main St	PCA	483789	378755	Saxon	E	Pottery with nearby kiln?	1	0		
Torksey	99/10	Snee	1999	Watching brief Plot 1 Main St	PCA	483808	378755	Saxon	E	Pottery below sand	1	0		Post medieval above sand, saxon below
Fenton	M2/8	Thomson	2002	Watching brief overhead line rebuild Torksey to Newton	APS	483759	377721	Iron Age/Romano-British	E	Romano-British remains at Torksey Lock, potential for environmental	0	0		
Torksey	95/6		1995	Geophys 'Torksey'	LAS	484300	379200	no archaeology	G	?	0	0		
Torksey	99/23		1999	New Medical Centre	LAS	483800	378190	post-medieval	E	PM features over sand, no features under sand	1	0		
Torksey	M2/34	Williams; Field	2002	Main Street New Medical Centre and housing development	LAS	483770	378900	Medieval	E	Medieval stone structure, multi-phase medieval buildings	1	0		
Torksey	M2/34	Williams; Field	2002	Main Street New Medical Centre and housing development	LAS	483770	378900	Saxon	E	10th-11th century building features, skeletons	1	0		Sand proposed to have been redeposited between the 10th and 13th century
Torksey	M6/14	Wood	2006	Watching brief on land adjacent to fossdyke canal torksey lock	APS	483800	377900	undated	Env	Complex stratigraphy of MM, aeolian, alluvial/lacustrine, palaeosols; no dating evidence	1	1		
Torksey	90/1	Field	1990	Castle Farm, Torksey excavation	LAS	483680	378720	Saxon	E	Kiln, burials associated with lost All Sts. Church?	1	0		Post medieval ploughing
Torksey	89/1	Field	1989	Castle Farm, geophysics	LAS	483680	378720	undated	G	Features excavated in 1990 90/1	0	0		
Torksey	95/3	Palmer-Brown	1995	Castle Farm excavation 2	PCA	483680	378720	Saxon	E	2 kilns, 3 possible kilns, lime kiln, cemetery (of All Sts church?)	1	0		Saxon remains under sand
Torksey	95/3	Palmer-Brown	1995	Castle Farm excavation 2	PCA	483680	378720	Medieval	E	Structures associated with Torksey Castle; later medieval dug into sand	1	0		Medieval remains dug into sand
Torksey	97/13	Johnson	1997	Watching brief irrigation lagoon, Torksey golf club	PCA	484150	379200	Iron Age/Romano-British	Env	Environmental stratigraphy: Sand over peat over sand. Peat began in Bronze age, ended neolithic. Evidence for channel cutting into sand, then silting with peat and clay, standing water in Roman period.	1	0		
Torksey	96/8		1996	Arch eval 'Verity', Church Ln	PCA	483674	378829	Saxon	E	Road track with ruts, with materials from 11th-12th c sealing it. Roat from Main st, towards river, out of use by 12th c.	1	0	beneath	Road along river side?
Torksey	96/8		1996	Arch eval 'Verity', Church Ln	PCA	483674	378829	Medieval	E	13-14th c, road lost, but pits, with later medieval rubbish pits	1	0	above	
Torksey	08/63	Rowe	2008	Land north of railway	PCA	483771	379215	Saxon	E	9-11th c fence line, parallel ditches, pits, kiln, possible structure and palaeosol	1	0	beneath	features cut into MM
Torksey	08/63	Rowe	2008	Land north of railway	PCA	483771	379215	Medieval	E	12th-13th c dumping, levelling, then graves. Inactivity between phases, with sand	1	0	above	part of St. Leos?
Torksey	11/101	Rowe	2011	Land off main Street	PCA	483710	379290	Saxon	E	9-10th c pit, 11th c iron pick	1	0	above	not as complex as east side of site, Saxon above sand
Kettlethorpe/Laughterton	M5/19	Garrett; Rowlandson	2005	Land to rear of Rose cottage, Main road, Laughterton	LAS	483670	375920	no archaeology	E	Only sand deposits	1	0		
Kettlethorpe/Laughterton	M3/1	Cope-Faulkner	2003	DBA Land at Main Road laughterton	APS	483670	375830	no archaeology	L	Deer park, medieval village, medieval-pm earthworks	0	0		Tofts longer on east side, due to flooding on west side of village?

Kettlethorpe/Laughterton	M8/9	Sumpter	2008	Church farm Barns, Kettlethorpe	Tony Sumpter Consultancy	484600	375800	post-medieval	B	18th c barn	0	0		
Kettlethorpe/Laughterton	M6/15	Peachey	2006	Watching brief Kettlethorpe/Hardwick	APS	484800	375800	industrial	E	18th-20th c pottery	1	0	above	Sand interpreted as glacio-fluvial
Kettlethorpe/Laughterton	M8/9	Williams	2008	Watching brief Kettlethorpe Hall	PCA	484880	375593	Medieval	E	Lime slaking pit with medieval pottery; otherwise post med construction	1	0	above	post medieval potttery above thin layer of sand
Kettlethorpe/Laughterton	M4/12	Clay	2004	Watching brief home farm Laughterton	PCA	483850	375920	post-medieval	E	Pottery within sand, increase in building rubble to east	1	0	within	buildings covered by another layer of sand
Kettlethorpe/Laughterton	M3/1	Albone	1998	Field evaluation of Home Farm Laughterton	PCA	483850	375920	Roman	E	Buildings? Evidence of Roman settlement and building materials	1	0	beneath	
Kettlethorpe/Laughterton	M3/1	Albone	1998	Field evaluation of Home Farm Laughterton	PCA	483850	375920	Saxon	E	Saxon pottery in gully	1	0	beneath	
Kettlethorpe/Laughterton	M3/1	Albone	1998	Field evaluation of Home Farm Laughterton	PCA	483850	375920	Medieval	E	14-16th stone structures; 12th century flood evidence	1	1	beneath	
Kettlethorpe/Laughterton	M3/1	Albone	1998	Field evaluation of Home Farm Laughterton	PCA	483850	375920	Medieval	Env	14-16th stone structures; 12th century flood evidence	1	1	beneath	Post medieval features above sand and medieval subsoil. Flooding around gravel island
Saxilby/Ingleby	M6/10	Gardner	2006	DBA Land adjacent to Bridge Hotel	PCA	489080	375070	no archaeology	L	On river terrace deposits, next to Foss Dyke, potential for environmental	0	0		
Saxilby/Ingleby	09/5	Allen	2009	Ingleby Grange Farm	Allen	489560	377130	no archaeology	E	Within medieval moated manor, DMV S ingleby to immediate west, but only clays	0	0		
Saxilby/Ingleby	M3/10	Tann	2003	Church Farm, Church Lane	LAS	489400	376300	medieval	Env	Possible medieval pond benieath sand, post medieval features	1	0	beneath	claims clean sand was imported for levelling, but more likely natural aeolian
Saxilby/Ingleby	97/9	Johnson	1997	Gables Manor, Ingleby	PCA	489303	377860	Medieval	E	13th c laminated floors. 16th c shoes	0	0		16th c moat fills
Fenton	96/17	Herbert	1996	Watching brief Old Hall Farm Fenton	APS	487900	350620	Medieval	E	Context with brown clay and 13th c pottery	0	0		Cropmarks 800m north of Fenton- find
Fenton	00/2	Cope-Faulkner	2000	Watching brief plot 2 old hall farm	APS	487900	350620	no archaeology	E	Within medieval village, but no archaeology	0	0		
Fenton	M4/13	Cope-Faulkner	2004	Watching brief main street	APS	487950	350810	no archaeology	E	Onto natural clay	0	0		
Fenton	M5/15	Allen	2005	Arch eval on land at Fossdyke canal, Fenton	APS	483800	377900	Roman	E	Ditch filled with Roman pottery	1	0	beneath	Dug into sand, filled with later sand
Fenton	M5/15	Allen	2005	Arch eval on land at Fossdyke canal, Fenton	APS	483800	377900	undated	Env	20 cm clay with PM bricks above, used as evidence of presence of lake prior to Foss Dyke, but could have begun after area was drained? More potential	0	1		
Fenton	M6/14	Wood	2006	Watching brief foss dyke canal	APS	483800	377900	undated	Env	Waterlogged grey clay, overlain by sand, with alternating silt and sand-changes in use of surrouding land?	1	1	above	
Fenton	M3/16	Gardner	2003	Wheelhouse Restaurant watching brief	PCA	483890	377990	post-medieval	E	Sand underlying post-medieval brick-lined well	1	0	above	
Sturton by Stow	96/14	Johnson	1996	Saxilby-Sturton pipeline WB	PCA	489290	377775	no archaeology	E	No results even within medieval manor	0	0		
Sturton by Stow		Gardner	2006	Land off Tillbridge Ln	PCA	491400	379750	no archaeology	Env	Silt-clay alluvium	0	1		
Willingham by Stow	M5/18	Cope-Faulkner	2005	Water drainage at St. Helen's, Willingham	APS	487420	384510	no archaeology	E	post-medieval finds within disturbed context	0	0		
Stow	M3/2	Brett	2003	Old School House	PCA	488370	382030	Medieval	E	Pits with 12th c waste	0	0		
Stow	M4/17	Squires	2004	Weslyan Chapel		488235	381881	industrial	B	1824 building	0	0		
Stow	01/118		2001	Stow Park Farm	GSB prospection	486300	380300	undated	E	pits and drainage	0	0		
Stow	M1/17	Conway	2001	Stow Park Farm DBA	BUFAU	486300	380300	Medieval	L	High status Roman buildings at Sturton, 12th c palace, moat, ponds	0	0		Other granges in area: Marton, Brampton, Saxilby, Stow. Other deer parks: Stow, kettlethorpe, Gainsborough; population decreases in late medieval; Deer park de-parked 18th c
Stow	M7/1	McDaid	2007	St. Mary's Church	LAS	488190	382000	no archaeology	E	only modern pipes, but not extensive excavation	0	0		
Stow	M3/23	Cope-Faulkner	2003	Watching brief of former Bishop's Palace	APS	486700	380900	post-medieval	E	post holes (medieval?) with post-med fills; accumulation of post-medieval agricultural soil. Thicker subsoils comprises the earthworks	0	0		
Stow	M4/6	Garrett	2004	Church End Farm WB	LAS	488200	382000	no archaeology	E	Within moated site, but all medieval evidence removed with building of present buildings	0	0		See own observations about this site and earthworks: cobbles beneath topsoil, potential medieval.
Cottam		Priest	1998	Generating station Cottam: report on investigations on behalf of Powergen	TPA	482800	378900	no archaeology	E	Although moated site nearby, this trench showed only alluvium overlying terrace deposits	0	1		Terrace deposits
Cottam		Smith	2007	Cottam Wind Farm, Notts: DBA and field walkover	Cambrian	481080	391620	Medieval	C	Romano-British pottery around the site, and medieval activity based on cropmaked defuct field system and some RF	0	0		
Rampton		Challis	1990	Rampton Quarry site: Preliminary site	TPA	481000	378000	Roman	AS	1st-2nd centry pottery and Romano-British site on gravel terrace. Ancient channel crosses western edge of site. "Lobe of sand and gravel surrounded by alluvium"	0	1		Terrace island surrounded by alluvium
Rampton		Gilbert	1996a	Report on watching brief at Rampton	TPA	481000	378000	Roman	E	Settlement did go onto the flood plain prior to alluvium deposition; burial of R-B sites on edges of gravel island	0	1		Terrace island surrounded by alluvium
Rampton		Gilbert	1996b	report on archaeological watching brief on the line of two pipelines across the late IA and RB site at Rampton, Notts	TPA	481000	378000	Roman	E	in situ pottery	0	1		Peat layers of channel fills, silted up prior to 1-3rd c AD; archaeology sealed by two layers of alluvium. Village rather than settlement
Rampton		Ponsford	1992	Not grey lit: IA RB settlement at Rampton	Thoroton	481000	378000	Roman	E	Excavation report; Torksey ferry road may be R-B, as it is roadway to the south of settlement. Also, aeolian infillings	1	1	beneath	Sand infill of post-holes
Sturton le Steeple		Elliott	2004	Archaeological eval at Sturton	TPA	481900	384750	Roman	E	Romano-British settlements, multiple enclosures, filled with peat. Early Medieval stake driven through peat, possibly part of a weir?	0	1		Peat infills Romano-British, with early med evidence of wetland
Sturton le Steeple		Elliott; MacIntosh	2005	Fieldwalking and Geophysical survey of the proposed plant site at Sturton le Steeple	TPA	481900	384750	Roman	AS	Romano-British finds, enclosure features on geophys	0	0		
Sturton le Steeple		Moore; Taylor-Wilson	2008	Watching brief on land at West Burton Power Station	PCA	480200	385900	Medieval	E	At West Burton DMV. Layers of fuel ash, overlying red MM and some HPSG	0	0		
Laneham		Budge	2010	WB on drainage replacement works at St. Peter's Church, Church Laneham	N CC	481468	376557	Early medieval	E	Saxon pot sherds, medieval human remains, Roman brick	0	0		Redeposited MM, overlying sand and gravel; On gravel island
Treswell		Sumpter	2011	Lea Beck, Brookside Farm, Treswell WB	Tony Sumpter	478729	379405	no archaeology	E	Hollow way marks pre-conquest boundary b/w wapentake divisions?	0	0		
North Leverton		Sumpter	2009	The Farm (plot 5) Main St, North Leverton, WB	Tony Sumpter	478499	382215	no archaeology	E	medium dark brown humic topsoil, with green mm	0	0		
North Leverton		Sumpter	2009	The Farm (plot 3) Main St, North Leverton, WB	Tony Sumpter	478494	382173	no archaeology	E	strata of dark grey clay	0	0		
Bole		Brett	2005	Bole Corner to Rampton Gas Pipeline	PCA	479153	387078	no archaeology	E	truncated grey clay overlying sandy clay with cobbles, truncated soil horizon?	0	0		
Bole		Walker	1994	Bole Ings report on archaeological eval stages 1.1-1.2	TPA	480500	387500	no archaeology		nothing found in fieldwalking	0	0		

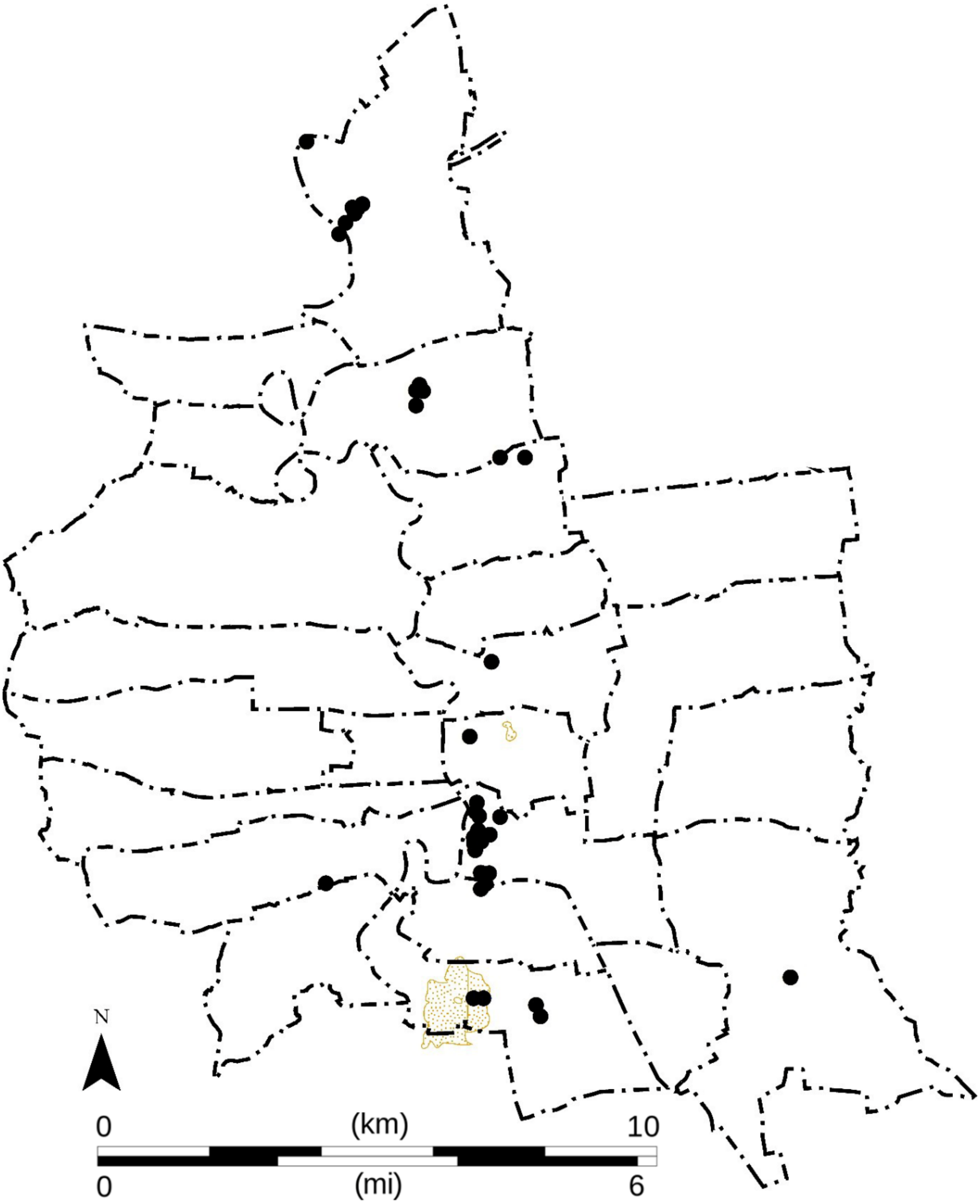
Entries with 0 or 1 were created for ease of mapping in GIS; 0 is no/not present/not available, 1 is yes/present/available.

Appendix XIII: Placenames

County	Placenames	Parish	Other forms	Known suffix	Category: Parish/main village, settlement, field, road, water, other	Linguistic origin	Meaning	Personal name	Settlement indicator	Environmental or landscape indicators	Wetland	Dryland	Woodland	First appears	Other	Refs
Lincolnshire	Brampton	Brampton	Brantune, Brantuna	ton	Parish	OE	Tun where Broom grew	0	0	1	0	0	1	1086		PNS; Eckwall
Lincolnshire	Marton	Marton	Martone; Martuna	ton	Parish	OE	Tun by a lake	0	0	1	0	1	0	1086	Often appear where there is/once was a lake	Eckwall
Lincolnshire	Gate Burton	Gate Burton		ton	Parish	OScand	Combination of Gait, or goats, and Burton, fortified manor or burg, so burg where the goats were kept	0	1	0	0	0	0	1086		Eckwall
Lincolnshire	Knaith	Knaith	Cheneide; Kneia; Keneya; Cneie; Cnaythes		Parish	OE	Landing-place by the kniee or bend (in the Trent	0	1	1	0	1	0	1086		Eckwall
Lincolnshire	Lea	Lea	Le; Lee		Parish	OE	Wood or clearing	0	0	1	0	0	1	1086		Eckwall
Lincolnshire	Gainsborough	Gainsborough	Gegnesborough; gaeignesburh; gainesburg; gleinesburc	burgh	Parish	OE	Gegn's fort	1	1	0	0	0	0	1013	Gaegn's fort	Eckwall
Lincolnshire	Willingham by Stow	Willingham	Wilingeham; Welingeham; Uiflingeheim; Wiflingham; Wiuelingham; Wivelingeham et Stowe	ham	Parish	OE	Village/estate/manor/homestead of Wifel's people	1	0	0	0	0	0	1086	Definitely the village version of Ham	Eckwall
Lincolnshire	Stow	Stow	Estou; Stoue; Stowe		Parish	OE	In various senses including Holy Place; Place; inhabited place; church; most likely church	0	1	0	0	0	0	1086	Definitely exists before 1086	Eckwall
Lincolnshire	Sturton by Stow	Sturton by Stow	Stratone; Strettuna	ton	Parish	unknown	Enclosure, toft, homestead, village, townon a Roman Road	0	1	0	0	0	0	1086	As at Sturton le steeple, just a small outlying hamlet on a roman road	Eckwall
Lincolnshire	Saxilby	Saxilby	ad Saxebi; Saxlabi; Saxlebi; Saxelebi; Saxolebi; Saselby; Saxelbi	by	Parish	Odanish	Saxulf's village or homestead	1	0	0	0	0	0	1086		Eckwall
Lincolnshire	Mill Hill	Saxilby	Millfeild; Miln field; milfeild		Field	English	Place where Mill is	0	1	0	0	0	0	1667		PNS
Lincolnshire	Cockload	Saxilby	Cockleas meadow; cockload Bridg; cocklod; cockload close; Cockload Lain		Field	English	Open space in a forest where the woodcock was caught	0	0	1	0	0	1	1753	various place names	PNS
Lincolnshire	Asfordecroft	Saxilby			Settlement	ON	Croft of Asrodr	1	0	0	0	0	0	1200		PNS
Lincolnshire	Driholm	Saxilby			Field		Dry, well-drained piece of raised land in a marsh	0	0	1	0	1	0	unknown		PNS
Lincolnshire	Eggedalewellam	Saxilby			Field		Spring or stream at a Valley at an escarpment	0	0	1	1	0	0	1200		PNS
Lincolnshire	Ellouerygges	Saxilby			Field		Flat topped ridge wit convex shoulder marked by elder-trees	0	0	1	0	1	0	1200		PNS
Lincolnshire	Homeld	Saxilby			Field	m18	Slope adjacent to a raised piece of land in a wet area	0	0	1	1	1	0			PNS
Lincolnshire	Middle Carr	Saxilby		kjarr	Field	Odanish	Bog or marsh	0	0	1	1	0	0	1667		PNS
Lincolnshire	Over Clake	Saxilby		Ofer	Field	Middle English	piece of barren land or some sort of blot on the landscape	0	0	1	0	0	0	1667		PNS
Lincolnshire	Steynhill	Saxilby			Field		Stony hill	0	0	1	0	0	0	1318		PNS
Lincolnshire	Thorney Furthe	Saxilby			Field	m18	Thorney C, land overgrown with brushwook, scrubland on the edge of forest	0	0	1	0	0	1			PNS
Lincolnshire	North/South Ingleby	Saxilby	Englebi; Englabi; Engelbi; Ingelby; Englesby; Henhelbi; Anglebi; Angliby	by	Settlement	Odanish	Village of the English	0	1	0	0	0	0	1086	isolated village of englishment in area populated by danes.	PNS
Lincolnshire	Ingleby Grange	Saxilby			Settlement	English	Grange, an outlying farm belonging to a religious house or a feudal lord where crops were stored	0	1	0	0	0	0	1383	Named after the village of Ingleby was named	PNS
Lincolnshire	Ingleby Wood Farm	Saxilby	in bosco de Engelby		Settlement		A wood	0	0	1	0	0	1	1271		PNS
Lincolnshire	Great Orday Close	Saxilby	Wheate Olday (North Ingleby); The greate olde Haie; Wheate old day		Field	English	Large old enclosure where wheat was grown	0	1	1	0	0	0	1572		PNS
Lincolnshire	Aple Garth	Saxilby	applegarth		Field	English	orchard	0	0	1	0	0	0	1633		PNS
Lincolnshire	Torksey	Torksey	Tureces iege; Turkes ege; Turcesiege; Turesigge; Dorchesyg; Torchesyg; Thorkesye; Torkeseie	ey	Parish	OE	Turec's island, or the Tun of Turec's people	1	0	1	0	1	0	872	no evidence of personal use of Turoc, may be derived from Goth 'to distinguish'; or 'boar'.	Eckwall
Lincolnshire	High Wood	Torksey	Highwode		Woodland		Stretch of woodland in a high place	0	0	1	0	0	1	1536		PNS
Lincolnshire	Hardwick	Torksey	Herewyke; herwik; herwike; hardwicke	wic	Farm	OE	herd farm, or part of the estate devoted to livestock rather than to arable farming	0	1	0	0	0	0	1237	in well wapentake	PNS
Lincolnshire	All Saints Church	Torksey	ecclesiam Omnium Sanctorum		Ecclesiastical	English	Church name	0	1	0	0	0	0	1254	lost	PNS
Lincolnshire	Fosse Priory	Torksey	Sanc. De Fossebrigg; Kirkst, nuns of Fossbrig; Monial de Torkeseia		Ecclesiastical	English	Cistercian prior of nuns of St Mary and St Nicholas of Fosse	0	1	0	0	0	0	1187		PNS
Lincolnshire	St Leonard's Priory	Torksey	ecclesia sancti Leonardi de Torkesei; Domus Sancti Leonari de Torkeseya;		Ecclesiastical	English	Augustinian priory of St Leonard at Torksey	0	1	0	0	0	0	1210	lost	PNS
Lincolnshire	St Martin Church	Torksey	Toft in the parish of S.C.I. Martini de Torkess		Ecclesiastical	English	Church name	0	1	0	0	0	0	1239	lost	PNS
Lincolnshire	St Mary Church	Torksey	ecclesiam Beati Marie		Ecclesiastical	English	Church name	0	1	0	0	0	0	1274	lost	PNS
Lincolnshire	St Peter's Church	Torksey	ecclesiam Sancti Petri		Ecclesiastical	English	Church name	0	1	0	0	0	0	1233		PNS
Lincolnshire	Bugdyke	Torksey	east; middle; south west; west; le burghdike		Field	English	Ditch belonging to the fenced estate	0	1	0	0	0	0	1237		PNS
Lincolnshire	Great Carr	Torksey	Sams Carr; Carr fields		Field	English	Wetlands	0	0	1	1	0	0	1874		PNS
Lincolnshire	Catley Close	Torksey			Field	English	Named afterl ost village of Catley which was formerly the site of a Gilbertine priory in Billinghay, Langoe	0	0	0	0	0	0	1648		PNS
Lincolnshire	Great and Little Dowsdale	Torksey			Field	Odanish	Dusi's share of land	1	0	0	0	0	0	1648	Dusi as personal name	PNS
Lincolnshire	Island Grass	Torksey			Field	English	Grassy field on an island	0	0	1	1	1	0	1845		PNS
Lincolnshire	Sand field	Torksey			Field	English	Sand on a field- aeolian?	0	0	1	0	0	0	1874		PNS
Lincolnshire	Treswell Marsh	Torksey			Field	English	Marsh	0	0	1	1	0	0	1815		PNS
Lincolnshire	Willow Holt Island	Torksey			Field	English	Island with willow?	0	0	1	0	1	1	1845		PNS
Lincolnshire	Le barkehouse	Torksey			Field	French	House where tanning was carried out	0	1	0	0	0	0	1535		PNS
Lincolnshire	del Breckes	Torksey	le breckes		Field	ON	Slope, a hill; possibly a brec, or land broken up for cultivation	0	0	1	0	1	0			
Lincolnshire	le Causey	Torksey	causee		Road	French	Causeway, road	0	1	0	0	0	0	1535	not of settlement, but of a road	PNS
Lincolnshire	Chenínggeswong	Torksey			Field	OE	Chening's garden or in-field	1	0	0	0	0	0	1276	Cening	PNS
Lincolnshire	le Conygarthe	Torksey			Field	French	Rabbit warren	0	1	1	0	0	0	1535	aeolian sand?	PNS
Lincolnshire	Conigwonge	Torksey			Field	French	Garden or infield frequented by rabbits	0	1	0	0	0	0	1535	aeolian sand?	PNS
Lincolnshire	le Cryftinges de Brampton	Torksey			Field	French	A small croft in Brampton	0	1	0	0	0	0	1693		PNS
Lincolnshire	Cuningeswaud	Torksey			Field	English	Tract of woodland or high-lying forest belonging to the king	0	0	1	0	1	1	1239	Poss part of Stow deer park?	PNS
Lincolnshire	Denesheng	Torksey	pratum del denesheyng		Field	OE	Dene's meadow or pasture	1	0	0	0	0	0		name is OE, possibly for Deneswulf, ie Danish man	PNS
Lincolnshire	Harnes	Torksey			Field		Grey headland or promontory	0	0	1	0	1	0	1276		PNS
Lincolnshire	Haldehaghe	Torksey			Field	Hy2	Old grazing enclosure/pasture	0	0	0	0	0	0			PNS
Lincolnshire	del Hill' de Torkeseye	Torksey			Field		Torksey hill	0	0	1	0	1	0	1311		PNS
Lincolnshire	Holmer	Torksey			Field	Middle English	Pool in a hollow, or possibly, a boundary	0	0	1	1	0	0			PNS
Lincolnshire	Home Rands	Torksey			Field	English	A border, an edge a bank, a boundary	0	1	0	0	0	0	1648		PNS
Lincolnshire	Hullemere	Torksey		mere	Field	Middle English	Pool/boundary belonging to Hulle	1	0	1	1	0	0			PNS
Lincolnshire	Kyngesmer	Torksey		mere	Field	Middle English	Pool/boundary belonging to person named King	1	0	1	1	0	0			PNS
Lincolnshire	Kyng golde mere	Torksey		mere	Field	Middle English	Boundary strip or pool where marigold grew, associated with a person named King	1	0	1	1	0	0			PNS
Lincolnshire	le Launddedike	Torksey		dike	Field	English	ditch belonging to a piece of woodland or to a forest glade	0	0	1	0	0	1			PNS
Lincolnshire	Luuedennos	Torksey			Field	Middle English	a headland, a promontory, possibly of Luuede	1	0	1	0	0	0			PNS
Lincolnshire	de la More	Torksey	More	mere	Field	English	Marshland	0	0	1	1	0	0	1327		PNS
Lincolnshire	Moredale	Torksey		mere	Field	English	Barren valley	0	0	1	1	0	0	1536		PNS
Lincolnshire	Munkeswong	Torksey	Munechewang		Field	English	Garden, in-field of the monks	1	0	0	0	0	0	1237	Of St. Leonards	PNS
Lincolnshire	Netherbergh	Torksey		bjarg	Field	Oscand	Lower hill or precipice	0	0	1	0	1	0			PNS
Lincolnshire	Northekerr	Torksey		kjarr	Field	Oscand	northern marsh bog, marsh overgrown with brushwood	0	0	1	1	0	0			PNS
Lincolnshire	petkerr' de Tork	Torksey		kjarr	Field	Oscand	peat bog of Torksey	0	0	1	1	0	0			PNS
Lincolnshire	Toft in Thorkes	Torksey			Field	English	a building-site, a curtilage, a messuage	0	1	0	0	0	0	1239		PNS
Lincolnshire	Segdale	Torksey		dalr	Field	Oscand	sedge valley; sedge, a reed a rush in the valley	0	0	1	1	0	0		Scandinavian influence on OE with dalr for valley	PNS
Lincolnshire	Segdalegate	Torksey		gata	Road	Oscand	road, path at sedge valley	0	1	0	0	0	0			PNS
Lincolnshire	staneledale	Torksey		dalr	Field	Old french	boundary stone in the valley	0	0	0	0	0	0		landscape marker?	PNS
Lincolnshire	stanelegate	Torksey		gata	Road	Oscand	boundary stone on a road or path	0	1	0	0	0	0			PNS
Lincolnshire	Swynfforde	Torksey			Field	English	field belonging to prominent local family, the swynfords	1	0	0	0	0	0	1550		PNS
Lincolnshire	Werkmancroft	Torksey		croft	Field	Middle English	croft belonging to the weak/infirm or labourer or craftsman	0	1	0	0	0	0			PNS
Lincolnshire	West laundde	Torksey			Field	English	western forest glade or woodland pasture	0	0	1	0	0	1			PNS
Lincolnshire	Wolpitdale	Torksey		dalr	Field	Oscand	valley with a wolf pit or trap	0	0	1	0	0	0			PNS
Lincolnshire	wynde Mille Hille	Torksey			Field	English	windmill hill	0	1	0	0	0	0	1535		PNS
Lincolnshire	Tiln	Marton	Tille; tilne; tilnea; tilney		Road	OE	Excellent, useful river	0						1086	in contrast to 'idle'	PNS
Nottinghamshire	Bole	Bole	Bolun; Bolum; Boole		Parish	OScand	Smooth rounded hill; or tree trunk	0	0	1	0	0	0	1086		Eckwall; PNS
Nottinghamshire	Cottam	Cottam	Cotun; Northcotom		Parish	OE	At the cottages	0	1	0	0	0	0	1280		PNS
Nottinghamshire	South Leverton	South Leverton	Cledretone; Legretone;Leertona; Leirton; Suthleyrton; Lerton	ton	Parish	unknown	Gore with a shelter	0	1	0	0	0	0	1086	Perhaps OE? Perhaps from stream name of Legre	Eckwall; PNS
Nottinghamshire	Cowsland Farm	South Leverton	Colleslund		Farm	OScand	Wood of a man called Kollr	1	0	0	0	0	1	1276		PNS
Nottinghamshire	North Leverton	North Leverton	Cledretone; Legretone;Leertona; Leirton; Northleyrton; Lerton	ton	Parish	unknown	Gore with a shelter	0	1	1	0	0	0	1086	Perhaps OE? Perhaps from stream name of Legre	Eckwall; PNS
Nottinghamshire	Coates	North Leverton	Cotes		Settlement	unknown	Cottages	0	1	0	0	0	0	1200	OE?	PNS
Nottinghamshire	Habblesthorpe	North Leverton	Happelesthorp; Appelestorp; Hapelesthorp	thorp	Settlement	OE	Haeppel (lucky one)'s village	1	1	0	0	0	0	1153		PNS

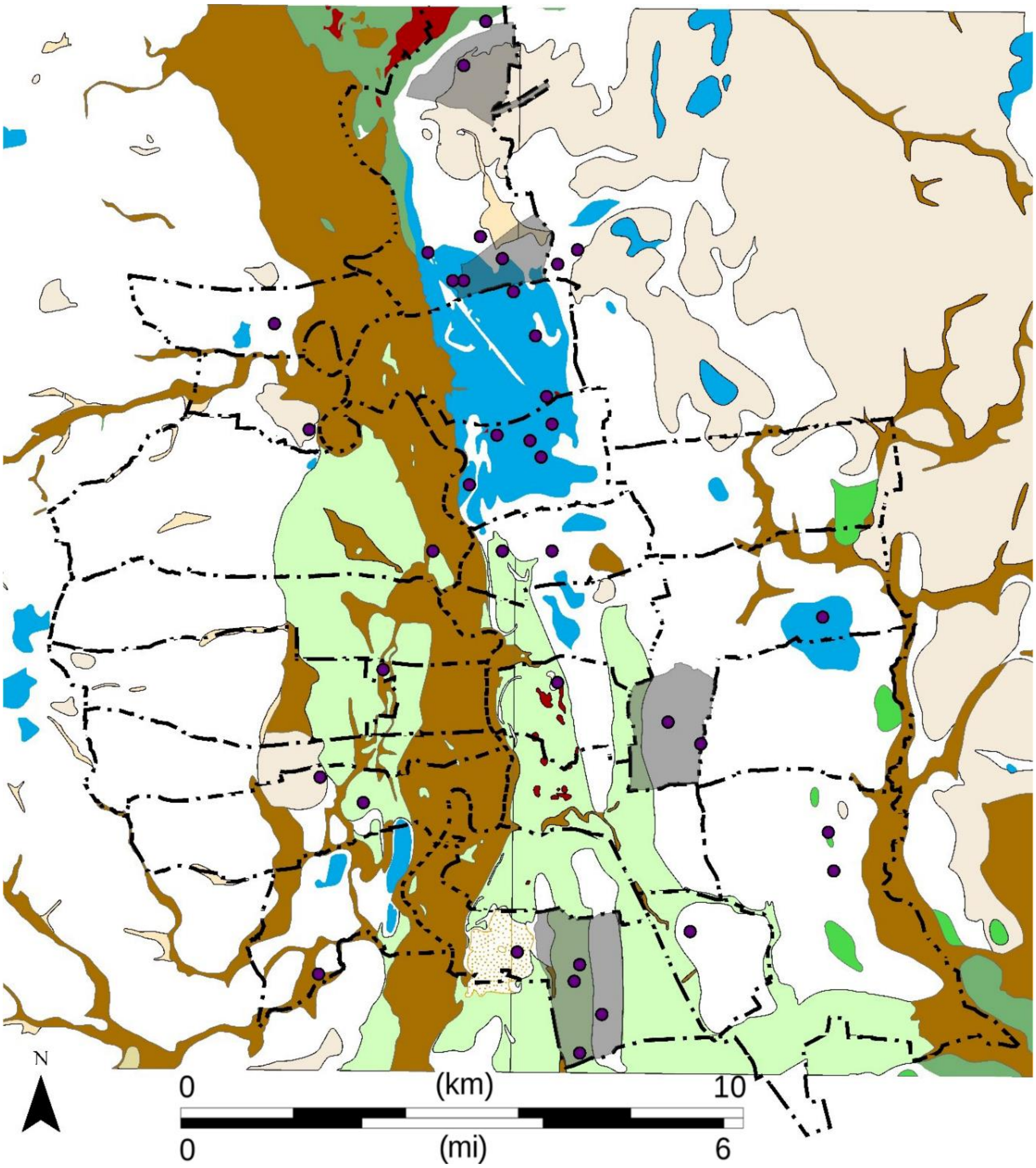
Nottinghamshire	Littleborough	Littleborough	Tiouulfingacaestir; Teofinaceastre; Litelburg; Lutilburg; Little Brough	burgh	Parish	OE	Small Roman fort belonging to Tiowulfs people	1	1	0	0	0	0	8th c	civitas; Tiowulf not recorded elsewhere; Place is 'at' not 'near-to' L'boro	PNS
Nottinghamshire	Littleborough bridge	Littleborough	Staffordebrig		Ford	OE	Ford by the landing-place	0	1	0	0	0	0	1330		PNS
Nottinghamshire	Sturton le Steeple	Sturton le Steeple	Estretone; Stratton; Stryton; Stretuna	ton	Parish	unknown	ton on a streat or Roman road	0	1	0	0	0	0	1086	le steeple is 18th c. In the Clay is from Wapentake division	PNS
Nottinghamshire	Fenton	Sturton le Steeple	Fentune juxta Stretton	ton	Settlement	OE	Farm in the fen or marsh	0	0	1	1	0	0	1086		PNS
Nottinghamshire	Church Farm	Sturton le Steeple			Farm		at the church path	0	1	0	0	0	0	1366	home of William Kirkestile	PNS
Nottinghamshire	Blackburn lane	Sturton le Steeple	Blakebergh		Road		Black-hill	0	0	1	0	0	0	1316		PNS
Nottinghamshire	Catchwater Drain	Sturton le Steeple	Catch Water Drain		Water			0	0	0	0	0	0	1775		PNS
Nottinghamshire	Holmefield	Sturton le Steeple	Holmefeud		Field		Holmr	0	0	0	0	0	0	1236		PNS
Nottinghamshire	Church Laneham	Laneham														
Nottinghamshire	Laneham	Laneham	Lanun; Lanum; Lanom	ham	Parish	OE	At the lanes. Several tracks and roads meet here	0	1	0	0	0	0	1086		PNS
Nottinghamshire	Broading Farm	Laneham	Brodinge		Farm	English		0	0	0	0	0	0	1357		PNS
Nottinghamshire	Rampton	Rampton	Rametone; Ramet; Ramentona; Ravenston; Ramton; Ranton; Rempton	ton	Parish	ODanish	Raven farm	0	1	0	0	0	0	1086	inconsistent forms	PNS
Nottinghamshire	Wranglands Lane	Rampton	Wrang		Road	OE	Crooked land	0	0	0	0	0	0	1840	earlier, but first noted in 19th c	PNS
Nottinghamshire	Night Leys Close	Rampton			Field		Pasture used at night	0	0	0	0	0	0	1840		PNS
Nottinghamshire	Stanhill Close	Rampton	Stanhill		Field	English	boulders stick out from the clay	0	0	1	0	0	0	post-medieval		PNS
Nottinghamshire	Town end close	Rampton			Field	English	borders the village	0	1	0	0	0	0	post-medieval		PNS
Nottinghamshire	Hunger Hill	Rampton			Field	English	poor soil	0	0	1	0	0	0	post-medieval		PNS
Nottinghamshire	Treswell	Treswell	Tireswelle; Tirreswelle; Tyrswell; Tereswelle; Tresswelle	well	Parish	OE	Tir's spring or wielle	1	0	1	1	0	0	1086	Tirweald or Tirwulf personal name	PNS
Nottinghamshire	Stanhope	Treswell	Stanhopp closse	hop	Settlement	English	with no hop or valley nearby, likely a manorial or personal name	1	0	0	0	0	0	1524		PNS
Nottinghamshire	Beck Farm	Treswell	Beckinge	bekkr	Farm	English	bekkr	0	0	0	0	0	0	1606		PNS
Nottinghamshire	Ellen Tree	Treswell			Field	English	Elder Tree	0	0	0	0	0	1	unknown		PNS
Lincolnshire	Warren Wood	Gainsborough			Woodland	English	Wood with (rabbit) warrens	0	0	1	0	0	1	1824		OS map
Lincolnshire	Norbury Hills	Lea			Woodland	English		0	0	1	0	1	1	1869		OS map
Lincolnshire	Stephenson's Hill	Knaith			Woodland	English		0	0	1	0	1	1	1869		OS map
Lincolnshire	Red Hills	Knaith			Field	English	Hills with red soils	0	0	1	0	1	0	1869	Have red mercia mudstone exposed	OS map
Lincolnshire	Park Plantation	Knaith			Field	English	Planatation within a park	0	0	1	0	0	1	1869	Also with park farm	OS map
Lincolnshire	Golddale Planting	Marton			Field	English		0	0	1	0	0	1		Cut out of Gate Burton	OS map
Lincolnshire	Clay Farm	Gate Burton			Farmstead	English	Farm on clay	0	0	1	0	0	0	1869	Farm situated on clay bedrock- no sand	OS map
Lincolnshire	High Pasture Farm	Gate Burton			Farmstead	English	Farm on a raised pasture	0	0	1	0	1	0	1869	Next to Clay Farm, likely on clay	OS map
Lincolnshire	Oak Hole	Gate Burton			Woodland	English	Lowlying land where Oak grows	0	0	1	1	0	1	1869	Edge of parish	OS map
Lincolnshire	Burton Gorse	Gate Burton			Woodland	English	Woodland	0	0	1	0	0	1	1869	Edge of parish	OS map
Lincolnshire	Marton Moor Farm	Marton			Farmstead	English	Farm on a Moor	0	0	1	1	0	0	1869	Cut out of Brampton, on edge of Stow Park	OS map
Lincolnshire	Laughterton Marsh	Kettlethorpe			Field	English	Wetland	0	0	1	1	0	0	1869		OS map
Lincolnshire	Laughterton	Kettlethorpe		tun	Settlement	OE	Hill or tun where the lettuce grows	0	0	1	0	1	0	1869		Eckwall
Lincolnshire	Sandfield Farm	Kettlethorpe			Farmstead	English	Farm on a hill of sand	0	0	1	0	1	0	1869	Sand	OS map
Lincolnshire	Broom Hills	Kettlethorpe			Woodland	English	Hill where the broom grows	0	0	1	0	1	1	1869		OS map
Lincolnshire	Kettlethorpe	Kettlethorpe			Settlement											
Lincolnshire	Naylor's Hill	Kettlethorpe			Woodland	English	Hill belonging to Naylor	0	0	1	0	1	1	1869		OS map
Lincolnshire	Rough Wood	Kettlethorpe			Woodland	English	Unmanaged woodland	0	0	1	0	0	1	1869		OS map
Lincolnshire	Deborah Wood	Kettlethorpe			Woodland	English	Deborah's woods	1	0	1	0	0	1	1869		OS map
Lincolnshire	Blackthorn Wood	Kettlethorpe			Woodland	English	Wood where blackthorn grows	0	0	1	0	0	1	1869		OS map
Lincolnshire	Park Farm	Kettlethorpe			Farmstead	English	Farm within an emparkment	0	0	1	0	0	1	1869	Likely on south east side of kettlethorpe park	OS map
Lincolnshire	Hardwick	Hardwick			Settlement											
Lincolnshire	Hardwick Busdike	Hardwick	Hardwick Wood Farm		Farmstead	English	Farm in the wood	0	0	1	0	0	1	1869		OS map
Lincolnshire	Five lane ends	Saxilby			Road	English	Where five lanes meet	0	0	0	0	0	0	1869		OS map

Appendix XIV: Potential aeolian deposits in study area

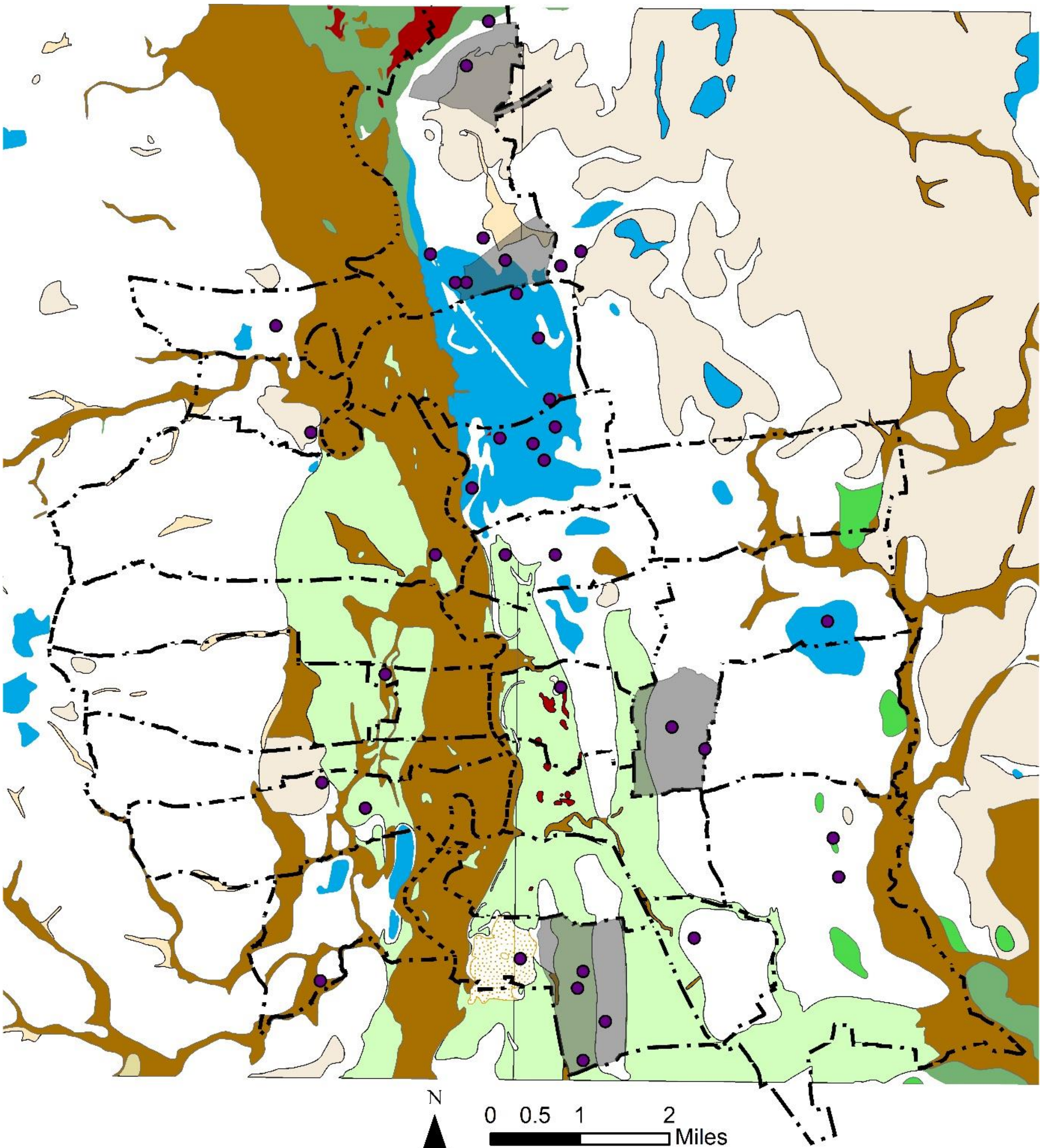


Possible aeolian contexts throughout the study area are marked in black dots. This is based on the descriptions and photos provided in grey literature reports. Recorded aeolian deposits are marked in tan dots.

Appendix XV: Ridge and furrow on drift geology; deer parks and ancient woodland on drift geology



Ridge and furrow on drift geology within the study area



Locations of deer parks (grey) and ancient woodland (purple dots) on drift geology (key to drift geology on previous page) in the study area.

Appendix XVI: Results of the walkover survey