Battle of Otterburn, Northumberland

Combined Geophysics and Metal Detecting Report

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Summary

A detailed gradiometer and ground penetrating radar (GPR) survey were conducted over land west-north-west of Otterburn, Northumberland (centred on NGR 386997 593779). The results of the geophysical survey were subsequently used to target areas suitable for Metal Detecting Survey and test pitting.

The project was commissioned by Northumberland National Park Authority with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features associated with the Battle of Otterburn.

The site allocated for geophysical comprises two arable fields located west-north-west of Otterburn, covering an area of 20.2 ha (centred on NGR 386997 593779). The metal detecting survey targeted fields east of Percy Cross (centred on NGR 387818, 593590).

The combination of the gradiometer and GPR survey has generally been successful in determining the presence and nature of archaeological remains across the site. The clearest anomalies of archaeological interest were located immediately adjacent to the scheduled round cairn, where several pit-like features have also been identified.

A series of linear anomalies have been identified across the site, which predominantly relates to ditch-like features. For the most part, these define several former land parcels, which also delineate the extent of ridge and furrow ploughing trends. None of these features are visible on historic mapping for the area but it is probable that these features relate to the medieval and post medieval period.

In the north-east of the site, there are two parallel strong anomalies that correspond with a ditch and bank feature. This correlates with earthwork features in the lidar data and is recorded as a footpath on historic mapping. This feature may, however, have earlier origins or possibly relate to the course of a former channel, which is further suggested by the radar data from Area C. Given that this extends to form the location of the scheduled Roman temporary camp at at Dargues (NHLE 1009376), it may have been active or modified during this period, but this interpretation is highly tentative.

The gradiometer survey has also identified several geomorphological features. Most notably a series of palaeochannels, potentially associated with ridge and swale deposits, were identified in the north-western part of the site. The GPR survey of this area (Area A), also clarified some of the subsurface complexity of these anomalies, revealing the subtle vertical profile of these features.

A series of test pits targeted several of the anomalies identified during the geophysical survey. The test pitting failed to identify any deposits or finds associated with the period of the battle and adds nothing to the discussion of the site. Neither the geophysical survey or subsequent phase of test pitting has identified remnants of a road, which was thought to relate to the battle of Otterburn or any contemporary features/finds associated with the battle.

The metal detecting survey resulted in the recovery of 68 items, comprising 30 items of copper alloy, 25 of iron and 12 of lead/lead alloy. The only items possibly relating to the period around the Battle of Otterburn are a belt buckle dating from the mid-14th to 17th century and a sword pommel recovered from a neighbouring field and recovered by a volunteer after the WA survey work had been completed. The item was recovered at a distance of 312 m from the nearest object (ON 173). The pommel is comprised of five lobes, the central lobe being the longest and the two lobes on either side dropping in height so that the outer lobes are the shortest. Pommels with five simple lobes are known from early medieval (9th / 10th century) swords (for example see NMS X.2001.16), although the more defined moulding and elongated lobes on this example is suggestive of a later date,

probably medieval or post-medieval and no exact parallels have been forthcoming. The centuries long range of these two items is unhelpful in assigning them to battlefield activity and it seems likely that they belong to the period post-dating the Battle of Otterburn.

The overall conclusion of the fieldwork is that the various intrusive and non-intrusive evaluation techniques of the fields available to us at the time of survey have failed to identify any significant evidence that the Battle of Otterburn took place across these land parcels.

Acknowledgements

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The fieldwork was undertaken by Joanne Instone-Brewer, Andres Perez Arana and Ben Saunders. Alexander Schmidt and Brett Howard processed and interpreted the geophysical data and Nicholas Crabb wrote the geophysics report and prepared the illustrations. The geophysical work was quality controlled by Tom Richardson. The finds report was prepared by Katie Marsden. The samples were processed by Jenny Giddins. The flots were sorted and assessed by Ed Treasure. The environmental report was written by Ed Treasure with contributions from Samantha Rogerson and was edited by Megan Scantlebury. Additional graphics were prepared by Rebecca Havard. The project was managed on behalf of Wessex Archaeology by Christopher Swales.

Battle of Otterburn, Otterburn, Northumberland

Combined Geophysics and Metal Detecting Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Revitalising Redesdale Landscape Partnership to carry out a combined geophysical survey, test pitting and metal detecting survey at Garret Shiels, Newcastle upon Tyne, Northumberland (centred on NGR 386997 593779) (**Figure 1**). The geophysical survey forms part of an ongoing programme of a research project being undertaken at the site, which also comprises evaluation trenching and metal detecting (Reported separately).

1.1.2 The research project, *Conflict in A Landscape: The Battle of Otterburn*, is being carried out as part of the Revitalising Redesdale Landscape Partnership Scheme, led by the Battlefields Trust, supported by Northumberland National Park Authority and with funding from the National Lottery Heritage Fund. The current phase of archaeological work is intended to clarify the location of the Battle of Otterburn, fought in 1388 between English and Scottish forces, and identify the position of medieval road between Newcastle and Scotland, which is mentioned in historic documents and the purported location of a camp used by the Scottish army.

1.1.3 As part of this project, volunteers are currently involved in carrying out historic document research to piece together what the sources written at the time can tell us about the battle. This information, along with a review of current topographic information and historic mapping has been used to identify areas of significance relating to the battle, with the current phase of archaeological works intended to identify the position of a medieval road between Newcastle and Scotland, mentioned in historic documents and the purported location of a camp used by the Scottish army.

1.1.4 The site allocated for geophysical comprises two arable fields located west-north-west of Otterburn, covering an area of 20.2 ha (centred on NGR 386997 593779). The metal detecting survey targeted fields east of Percy Cross (centred on NGR 387818, 593590).

1.1.5 All works were undertaken in accordance with a written scheme of investigation (WSI) which detailed the aims, methodologies and standards to be employed in order to undertake the evaluation (Wessex Archaeology 2021a). The Northumberland National Park Authority (NNPA) Archaeologist approved the WSI, on behalf of the Local Planning Authority (LPA), prior to fieldwork commencing.

1.2 Scope of document

1.2.1 The purpose of this report is to provide a detailed description of the results of the evaluation, to interpret the results within a local, regional or wider archaeological context and assess whether the aims of the evaluation have been met.

1.2.2 The presented results will provide further information on the archaeological resource and provide community engagement as part of the wider Battle of Otterburn project designed and run by The Battlefields Trust.

1.3 The site

1.3.1 The survey area is located c. 1 km east of the Village of Otterburn, east and southwest of Percy Cross, which marks the location of the Battle of Otterburn.

1.3.2 The currently registered battlefield site (Registered Battlefield number 1000029) covers a large 227 ha area stretching from west of the village of Otterburn to the River Rede in the west. The survey area is immediately south-west of this, on both sides of the river, immediately adjacent to this.

1.3.3 The site allocated for geophysical comprises two arable fields located west-north-west of Otterburn, covering an area of 20.2 ha (centred on NGR 386997 593779), currently utilised for pasture. The site is bounded by the River Rede to the north, with further agricultural land to the east, west, and south.

1.3.4 The metal detecting survey targeted fields east of Percy Cross (centred on NGR 387818, 593590), currently used as pasture.

1.3.5 The existing ground levels at the site are relatively flat at around 148 m above Ordnance Datum (aOD). However, there are a series of notable undulations visible within the LiDAR data for the area, which may relate to former courses of the River Rede (**Figure 2**). One of these palaeochannels is situated south of the current river channel, although it is a possibility that this may influence the location of a Scottish camp and road.

1.3.6 The underlying geology is mapped as Alston Formation - Limestone, Sandstone, Siltstone and Mudstone, with superficial deposits of Alluvium - Clay, Silt, Sand, and Gravel (BGS 2021). Augering at the site has suggested an average depth of *c.* 1m for these alluvial deposits.

1.3.7 The soils underlying the site are likely to consist of Eutric Stagnosol soils of the 713g (Brickfield 3) association (SSEW SE Sheet 3 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

2 ARCHAEOLOGICAL BACKGROUND

2.1 Introduction

2.1.1 The archaeological and historical background was assessed as part of the Written Scheme of Investigation (WSI; Wessex archaeology 2021). This recorded historic environment resources within the study area of the Otterburn battlefield as well as the surrounding area within the Northumberland National Park. Although not exhaustive, a summary of the information considered relevant to the interpretation of the geophysical survey is presented below.

2.1 Archaeological and historical context

2.1.1 There are a series of designated heritage assets within the vicinity of the site. The majority relate to Romano-British settlement and military activity, but a Bronze Age round cairn is located within the eastern part of the site (see Section 2.2), northeast of Dunns Cottage, although this is excluded from this survey. In addition, the recognised area of the Otterburn registered battlefield is located directly to the north-east of the site, on the northern side of the River Rede (see Section 2.3).

2.2 Prehistoric to Romano-British

2.2.1 There are limited early prehistoric activity recorded within the vicinity of the site but A series of Neolithic findspots have been identified within the vicinity of the site, pottery, worked flint,

and a polished stone axe and axehead. In addition, Bellshiel Law Cairns comprises of over 15 cairns in varying states of preservation and Bellshiel Law long cairn.

2.2.2 There are Bronze Age funerary monuments in the area, including the scheduled remains of a round cairn (NHLE 1008995), situated on raised ground in the eastern part of the site. At Todlaw Pike, a round cairn and enclosed cremation cemetery have also been discovered, and another round cairn cemetery stands on Levey Bog. Numerous further round cairns have been discovered across the parish, suggesting there was a great deal of activity here in the Bronze Age.

2.2.3 Iron Age settlement has been recorded in Otterburn including defended settlements on Colwell Hill and Fawdon Hill and an unenclosed hut circle settlement on Todlaw Pike. None of these settlements are thought to continue into Roman period and a series of small farmsteads and other sites are established.

2.2.4 Approximately 200 m to the east of the site is the Roman temporary camp at Dargues (NHLE 1009376), which is situated on a gently sloping plateau immediately to the west of Dere Street, the Roman road from Corbridge to Newstead in Scotland. Also Intersected by Dere Street and 820 m northeast of the site is Blakehope Roman fort and Roman temporary camp (NHLE 1006507). To the south, a Romano-British farmstead is located 430 m southeast of the site. Two Roman roads traverse through this area: the High Rochester to Bridge of Aln road and the aforementioned Dere Street.

2.3 The Battle of Otterburn

2.3.1 The Battle of Otterburn was fought in 1388 between the Scots and the English. The Historic England 2019 listing for the Battle of Otterburn states:

In 1388 the Scots decided to take advantage of the disunity caused in England by the power struggle between King Richard II and the Lords Appellant by mounting a large-scale cross-border raid. James, Earl of Douglas, led a force into Northumberland. As they returned northwards, the Scots paused at Otterburn where, in pursuit of a chivalric challenge to Douglas, Henry Percy ('Hotspur') led an English army into attack.

Arriving near Otterburn at evening, Percy launched a flanking attack with part of his force under the Lords Redmane and Ogyl, hoping to panic the Scots into fleeing straight into the main body of troops under Percy himself. But rather than taking flight, the Scots launched a surprise counterattack on Percy's men. Fighting continued through the night, and eventually the Scots prevailed, although Douglas himself was killed. On the English side Henry Percy and twenty-one other knights were captured, and over 1,000 were killed.

2.3.2 The accounts of the battle are amongst the best descriptions of medieval chivalry and military tactics. The open character of the battlefield in 1388 has been preserved, although the grassland is improved, and scrubby woodland on the upper slopes helped to mask the flanking attacks by both sides.

2.3.3 During this time defensive tower houses were constructed such as at Otterburn Tower Hotel and Greenchesters. There appear to have been few villages in the area although Roman farmsteads on Barracker Rigg and near Shittleheugh were reoccupied at this time.

2.4 Post- medieval

2.4.1 In the 16th and 17th century defensive farmhouses known as bastles, were constructed throughout the region. Some of these buildings have survived, albeit in ruins, at Shittleheugh (NHLE 1044870).

2.4.2 There are a series of Grade II listed properties within the study area dating to the 18th century. Many of these are located within the village of Otterburn or close to the River Rede, for example. the Vicarage (NHLE 1156215) and Otterburn Mill (1156242). In addition there is also a cluster of Grade II listed properties surrounding and associated Otterburn Hall, which also date to this period (NHLE 1156287). Otterburn Hall was built as a county retreat for Lord James Douglas.

2.5 Previous investigations in the area

2.5.1 Very little investigative work has been undertaken. The exact location of the battle remains open to debate and the detailed course of the battle itself is not entirely clear.

2.5.2 A pilot investigation of the 1388 battlefield at Otterburn was undertaken in March 2017 on behalf of the Battlefields Trust with resources from the HLF development funding for the Redesdale project. The project consisted of documentary evidence, a landscape analysis with a test pit and to establish the practicability of large-scale metal detecting survey; to assess actual artefact condition and, through soil sampling, to establish likely condition of both ferrous and non-ferrous medieval artefacts that may have remained in the topsoil since 1388. A total of 7200 m of detecting was undertaken, however, no objects were recovered which are likely to be related to the battle.

2.6 The Battle of Otterburn – Topographical evidence

2.6.1 The core primary sources for the battle of Otterburn (1388) are a series of chronicles, listed here in chronological order based on the approximate dates of composition:

Walsingham - Chronica Maiora c.1388

2.6.2 Thomas Walsingham was a senior monk of St Albans abbey where he would have had access to a wide range of documentary sources and access to the many important people of the period known to have had a connection to the abbey. St Albans, at the time, was second only to Westminster Abbey as a centre of affairs. His chronicle is thought to have been written almost contemporaneously with the events that it covers. He does not name any of his sources. No complete autograph manuscript of Walsingham's chronicle survives. The modern edition and translation by David Preest (2004) which we have used is based on the Latin version published by HT Riley in the Rolls series in 1863 / 64 and on an edition of the later years of the chronicle (1406 – 1420) published by VH Galbraith in 1937. He describes it as 'the fullest and most fully revised text … that is known to have circulated in fifteenth century English manuscripts'. Walsingham's account of the battle of Otterburn is brief and attempts to portray it as an English victory despite the capture of Hotspur. He gives no topographical information of use in locating any element of the battlefield.

Unknown Author - The Westminster Chronicle c.1388

2.6.3 The Westminster Chronicle was written as a near contemporaneous account of events between 1388 and 1392 by an unknown monk of Westminster Abbey. It appears as a continuation of Higden's Polychronicon and was published in Latin by JR Lumby in the Rolls series in 1886. Westminster was at the heart of government and the monks would have had access to the widest range of documents, including many that have failed to survive. They would also have had an opportunity to speak to many important figures of the period. We have used the edition and translation by Hector & Harvey published in Oxford Medieval

Texts (1982). Harvey suggests that the continuation was, in fact, written by several different people. The Westminster Chronicle has no topographical information of use concerning Otterburn but does include an account of the English formation and plan of attack.

Jean Froissart – Chroniques Tome III c.1390/91

2.6.4 The massive chronicle written by the Hainault-born Jean Froissart is too well-known to require much introduction and, despite, its many weaknesses, remains one of the principle sources for much of our knowledge of the period. Froissart wrote at great length about the battle of Otterburn in Book III which survives in 24 manuscripts and a handful of fragments. These present two main versions, the first is thought to have been composed in 1390/91 and the second in 1396 which is found in a single manuscript. These do not show significant differences that would affect the account of Otterburn. In the absence of a modern scholarly translation of the relevant sections from Middle French we have used i) the transcription of the Middle French from MS Besançon 865 (the first version) published by The Online Froissart Project ii) the modern French translation by Kervyn de Lettenhove (1871) iii) the English translation by T Johnes (1806) and iv) the English translation by G Brereton for Penguin Modern Classics (1968). Froissart provides the only specific topographical information on Otterburn that has come down to us, limited though it is. Most of his description is concerned with 'feats of arms' and chivalric episodes as is characteristic of much of his work. The parts of his account of Otterburn relevant to location of elements of the battlefield.

Knighton – Chronicon c.1390/91

2.6.5 Henry Knighton, a canon of St Mary's Abbey, Leicester, wrote his Chronicle between 1378 and 1396. Leicester was a fief of the duchy of Lancaster, and the abbey was closely in touch with the households of Henry of Grosmont and John of Gaunt. The chronicle covers the period 959 – 1395. The last section from 1377-1395 is considered to be of greatest importance as it deals with contemporary events. VH Galbraith has shown that this section was, in fact, written first – probably in or about 1390. The chronicle was first published in Latin in 1652 and again by JR Lumby in the Rolls series (1889). We have worked from the translation by GH Martin published in Oxford Medieval Texts (1995). Knighton's Chronicon has no topographical information of use concerning Otterburn or any detail of the English or Scots attacks but it does state that Hotspur fought with the Scots 'at Elsdon, near Newcastle upon Tyne', rather than at Otterburn.

Wyntoun/Unknown Author - Orygynale Cronykil of Scotland c.1390

2.6.6 The Orygynale Cronykil is usually ascribed to Andrew of Wyntoun, a Scottish prior. However, Wyntoun admits that a large section was, in fact, sent to him by a friend and that he (Wyntoun) was ignorant of the author of that section which includes the account of Otterburn. This leaves us with no knowledge of its provenance, the source(s) of its content or the changes made by Wyntoun in conforming it to the rhyming couplets in which his chronicle is written. The language used (described by Wyntoun as 'Ynglis') is thought by scholars to be the dialect spoken between the Tees and the Tay in the early fifteenth century. There is no reliable modern English translation available and we have worked from the original text as published by D Laing (1879). This edition includes a glossary of dialect words and notes on how to read the language. We have also consulted modern dictionaries of Old Scottish usage. The Orygynale Cronykil has no topographical information of use concerning Otterburn but does include accounts of both the English attack and Scottish counter-attack.

Walter Bower – Scotichronicon c.1440

2.6.7 The Scotichronicon is a 15th-century chronicle by the Walter Bower, Abbot of Inchcolm. It is a continuation of the priest John of Fordun's earlier work Chronica Gentis Scotorum.

Bower began the work in 1440 at the request of a neighbour, Sir David Stewart of Rosyth. The completed work, in its original form, consists of 16 books, of which the first five and a portion of the sixth (to 1163) are Fordun's, or mainly his, for Bower added to them at places. In the later books, down to the reign of Robert I of Scotland (1371), he was aided by Fordun's Gesta Annalia, but from that point to the close, the work is original. The National Library of Scotland has called it "probably the most important medieval account of early Scottish history. Bower's account of Otterburn has similarities to the Orygynale Cronykil and it has been suggested by his most recent translator, DER Watt, that Bower shows no familiarity with Wyntoun's work but that they share some common sources. The Scotichronicon was published complete in Latin by W Goodall in 1759. We have worked from the English version included in English Historical Documents IV (1969). The Scotichronicon has no topographical information of use concerning Otterburn but does give some brief details relevant to the English and Scots attacks.

Hardyng – Chronicle c.1440-1457

2.6.8 John Hardyng (the spelling varies) entered the service of Sir Henry Percy (Hotspur) at the age of twelve in 1390 and was present at the Battle of Homildon Hill (1402) and the Battle of Shrewsbury (1403). He then passed into the service of Sir Robert Umfraville, under whom he was constable of Warkworth Castle, Northumberland, and Kyme Castle, Lincolnshire. He was in Umfraville's retinue at Agincourt in 1415 and later served as a spy for Henry V in Scotland. He was, thus, in close proximity to two of the leading English combatants at Otterburn. He was also the only chronicler of Otterburn who was not a monk and who had real first-hand experience of the realities of medieval warfare. He is known to have been fluent in English, Latin and French and died in 1465 at the age of 87. The chronicle is written in English and in verse. The first version of the chronicle which survives in a single manuscript (probably the presentation copy) was presented by Hardyng to Henry VI in 1457. A second, unfinished, version was later commenced, initially for Richard, Duke of York and subsequently for his son, Edward IV. This survives in twelve manuscripts and two printed editions from 1543. A modern edition of the earlier parts of the first version edited by S Peverley & J Simpson does not cover the section on Otterburn. We have worked from the 1543 printed edition published by H Ellis in 1812. The Chronicle has no topographical information of use concerning Otterburn but does give some brief details relevant to the English and Scots attacks.

3 AIMS AND OBJECTIVES

3.1 General aims

3.1.1 The general aims of the evaluation, as stated in the WSI (Wessex Archaeology 2021a) and in compliance with the CIfA *Standard and guidance for archaeological field evaluation* (CIfA 2014a), were to:

- provide information about the archaeological potential of the site; and
- inform either the scope and nature of any further archaeological work that may be required; or the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource); or a management strategy.

3.2 General objectives

3.2.1 In order to achieve the above aims, the general objectives of the evaluation were to:

- determine the presence or absence of archaeological features, deposits, structures, artefacts or ecofacts within the specified area;

- establish, within the constraints of the evaluation, the extent, character, date, condition and quality of any surviving archaeological remains;
- place any identified archaeological remains within a wider historical and archaeological context in order to assess their significance; and
- make available information about the archaeological resource within the site by reporting on the results of the evaluation.

3.3 Site-specific aims for metal detecting survey

3.3.1 Following consideration of the archaeological potential of the site, the site-specific aims of the metal detecting survey are:

- to identify the location of the Scottish army camp at locations highlighted in the documentary sources; and
- to identify locations of fighting based on topographic descriptions in the documentary sources

3.4 Site-specific aims for the geophysical survey

3.4.1 Following consideration of the archaeological potential of the site, the site-specific aims of the geophysical survey are:

- to identify the location of the medieval road between Scotland and Newcastle; and
- to identify the location of palaeochannels relevant to finding the Scottish army camp

3.5 Site specific aims of the evaluation trenching

3.5.1 Following consideration of the archaeological potential of the site, the site-specific aims of the evaluation trenching are:

- to identify medieval layers contemporary with the Battle of Otterburn within the alluvial deposits on site;
- to expose the surface of the former medieval road, where and if it is identified; and
- to retrieve dating material associated from archaeological deposits and palaeochannels that may be contemporary with the Battle of Otterburn.

4 METHODOLOGY FOR GEOPHYSICAL SURVEY

4.1 Introduction

4.1.1 All works were undertaken in accordance with the detailed methods set out within the WSI (Wessex Archaeology 2021a) and in general compliance with the standards outlined in CIfA guidance (CIfA 2014d). The methods employed are summarised below.

4.2 Fieldwork methods

4.2.1 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between 9 and 13 August 2021. Field conditions at the time of the survey were mostly good, with some areas of waterlogged ground. An overall coverage of 15 ha was achieved with the gradiometer survey, which was complemented by a total of 0.22 ha of GPR data.

4.2.2 The methods and standards employed throughout the geophysical survey conform to that set out in the Written Scheme of Investigation (WSI) (Wessex archaeology 2021), as well

as to current best practice, and guidance outlined by the Chartered Institute for Archaeologists' (CIfA 2014d) and European Archaeologiae Consilium (Schmidt *et al.* 2015).

4.2.3 A detailed gradiometer was carried out over a total area of 15 ha. This was supplemented by a series of X GPR transects, which were targeted over features of interest established by the gradiometer survey and lidar data for the area. The following outlines the specific methodology adopted for each geophysical technique.

4.2.4 The gradiometer survey was conducted using SenSYS FGM650 fluxgate gradiometers, which have a vertical separation of 1 m between sensors, and four of these sensors were attached to a Bartington cart system, with horizontal separations of 1 m.

4.2.5 Data were collected at 0.25 m intervals along transects spaced 1 m apart with an effective sensitivity of 0.03 nT, in accordance with European Archaeologiae Consilium recommendations (Schmidt et al. 2015). In areas where small features, such as pits, are expected or where a high level of detail is required, the horizontal separation can be reduced to 0.5 m if necessary.

4.3 Data processing

4.3.1 Data from the survey were subjected to minimal correction processes. These comprise a 'Destripe' function (±5 nT thresholds), applied to correct for any variation between the sensors, and an interpolation used to grid the data and discard overlaps where transects have been collected too close together.

4.3.2 Further details of the geophysical and survey equipment, methods, and processing are described in **Appendix 1**.

4.4 Ground Penetrating Radar

4.4.1 The GPR survey was conducted using a Malå RAMAC/GPR XV11 monitor and control unit with a 250 MHz shielded antenna. This was mounted on a rough terrain cart, which is fitted with an odometer to measure horizontal distance along the ground surface. This was deployed across all of the GPR areas with data collected along traverses spaced 0.5 m apart. This was collected in the zigzag method, providing three transects of data measuring 4-6 m wide (Area A-C).

4.4.2 Data with the 250 MHz antenna were resampled to provide 25 scans per unit (1 unit = 1 m) with an effective time window of 110 ns. The GPR survey was undertaken in accordance with European Archaeologiae Consilium recommendations (Schmidt *et al.* 2015).

4.5 Data processing (GPR)

4.5.1 Data from the survey were subjected to common radar signal correction processes. These comprise amplitude and wobble correction of the radar profile to correct for variance in temperature and soil moisture content, background and bandpass filtering to remove noise in the data from the surrounding area, and a Hilbert transform to convert the radargram sinusoidal pulses to positive domain envelopes. These steps were applied to all datasets collected across the Scheme.

4.5.2 The approximate depth conversion for the 250 MHz antenna is shown in **Table 1**. These have been calculated on the assumption that the GPR pulse through the ground is 0.063m/ns for the 250 MHz antenna. It is possible to determine more precisely the average velocity of the GPR pulse through the ground is excavated features at a known depth can be identified in the data. Radargrams were analysed for suitable hyperbolic reflections, which can be used to determine the velocity of the GPR pulse through the subsurface deposits.

4.5.3 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 2**.

Table 1: Relative velocity to depth conversion based on a dielectric constant of 23.01 for the 250 MHz antenna

Time Slice	Time (ns)	Depth (m)
1	0.-3.2	0.-0.1
2	3.17-6.37	0.1-0.2
3	6.34-9.54	0.2-0.3
4	9.5-12.7	0.3-0.4
5	12.67-15.87	0.4-0.5
6	15.84-19.04	0.5-0.6
7	19.01-22.21	0.59-0.69
8	22.18-25.38	0.69-0.79
9	25.34-28.54	0.79-0.89
10	28.51-31.71	0.89-0.99
11	31.68-34.88	0.99-1.09
12	34.85-38.05	1.09-1.19
13	38.02-41.22	1.19-1.29
14	41.18-44.38	1.29-1.39
15	44.35-47.55	1.39-1.49
16	47.52-50.72	1.49-1.59
17	50.69-53.89	1.59-1.69
18	53.86-57.06	1.68-1.78
19	57.02-60.22	1.78-1.88
20	60.19-63.39	1.88-1.98
21	63.36-66.56	1.98-2.08
22	66.53-69.73	2.08-2.18
23	69.7-72.9	2.18-2.28
24	72.86-76.06	2.28-2.38
25	76.03-79.23	2.38-2.48

5 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

5.1 Introduction

5.1.1 The detailed gradiometer survey has identified magnetic anomalies across the site, many of which relate to former agricultural activity and alluvial landforms. Results are presented as a series of greyscale plots, and archaeological interpretations at a scale of 1:1000 (**Figures 3** to **10**). The data are displayed at -2 nT (white) to +3 nT (black) for the greyscale image.

5.1.2 Numerous ferrous anomalies are visible throughout the dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

5.1.3 Gradiometer survey may not detect all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

5.1.4 The GPR survey has identified several point reflectors, planar returns, and linear responses, along with anomalous areas of high and low amplitude in each area. This has helped to

clarify some of the anomalies identified in the gradiometer survey and provided further information regarding the nature of subsurface material within the three surveyed areas. Results are presented as a series of greyscale timeslices, and archaeological interpretations at a scale of 1:1750 for Area A (**Figure 11**) and 1:1000 for Area B and C (**Figure 13** and **15**). These are presented with the gradiometer survey results underlain for reference, together with representative radargrams, which are taken from the centre of each area providing vertical cross-sections through the data. This is followed by archaeological interpretations of the timeslices and annotated radargrams (**Figure 12**, **14**, and **16**).

5.1.5 The interpretations of the gradiometer dataset highlight the presence of potential archaeological anomalies, ferrous responses, burnt or fired objects, and magnetic trends. The interpretation of the GPR data also highlights the presence of potential archaeological features and high amplitude responses alongside a series of linear trends Full definitions of the interpretation terms used in this report are provided in **Appendix 3**.

5.1.6 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. Moreover, small features and waterlogged features may produce responses that are below the detection threshold of the GPR antenna. It may therefore be the case that more archaeological features may be present than have been identified through these geophysical surveys. It is also important to stipulate that all the depths referred to in this report are approximate levels below the current ground surface.

5.2 Gradiometer survey results and interpretation

5.2.1 The gradiometer survey has identified several features that may be associated with archaeological remains. However, given the floodplain setting of the site, it is difficult to confirm this based on these results alone. Many of the anomalies are equally likely to have a natural origin, possibly being associated with subsurface alluvial landforms or variations in sediment sequence. Moreover, in areas where the depth of alluvium exceeds 1 m, any features will fall below the detection threshold and, therefore, be undetected by this gradiometer survey.

5.2.2 The clearest example of anomalies associated with possible archaeological remains are in the north-east of the site, immediately adjacent scheduled remains of a round cairn (NHLE 1008995; **Figure 4**). Directly to the north and west of this are a cluster of small (c. 0.5 – 3 m) positive anomalies (**4000**), which are circular in form. These could relate to pit-like features and given that this area is situated on higher ground adjacent to a known funerary monument, they may be archaeological in origin. However, if this upstanding part of the floodplain relates to a topographic high point such as a gravel island, it is equally possible that it relates to variations within such material.

5.2.3 To the west of the round cairn (**4001**), there are five larger more irregular anomalies that may also relate to archaeological remains. These are orientated in a north-east to south-west alignment and are subcircular in form, measuring between 4 m and 9 m in diameter. The largest is located in the south, closest to the round cairn. These could relate to further, albeit larger pit-like features but the strong, dipolar nature of the response suggests that they could contain burnt material. This could potentially relate to activity associated with the round cairn, but further investigation would be required to ascertain the precise nature of this.

5.2.4 Extending from the eastern boundary of the site is a linear positive (**4002**). This is slightly sinuous but is broadly east to west aligned, covering a total distance of 130 m. It measures 3 m wide but does not appear as a topographic feature in the lidar data and is also not visible on any historic mapping of the area. This relates to a ditch-like feature of probable archaeological origin. As the trajectory of the anomaly is heading towards the Roman road

and south-eastern corner of the temporary camp at Dargues (NHLE 1009376), it is possible that it may be associated with such activity.

5.2.5 To the south-west of the western extension of **4002**, there is a further linear positive anomaly, which also measures 3 m wide (**4003**). It curves from the south to a north-easterly position and extends for a total distance of 43 m. This is probably also a ditch-like feature but it is not clear if it is associated with the nearby Romano-British activity as it is equally likely that it may relate to subsequent agricultural activity, which is recorded extensively across this area.

5.2.6 In the south-eastern corner of the site, a small number of further possible archaeological features have been identified (**Figure 10**). This includes a fragmented penannular anomaly at **4004**, which is characterised by a weakly positive anomaly. This has an internal diameter of 9.5 m and is approximately 2 m wide, with breaks on the eastern and western edges. This is associated with a poorly defined ditch-like feature and could be associated with a Bronze Age round barrow or an Iron-Age to Romano-British roundhouse. However, the fragmented nature of the anomaly suggests that any remains are heavily ploughed down, and this is interpretation is, therefore, considered tentative.

5.2.7 Approximately 35 to the west of **4004** is a north-west to the south-east aligned positive linear anomaly (**4005**). This is likely associated with a ditch that extends for 75 m and is 2 m wide. It is not apparent on the lidar data and or any of the available historic mapping and could be archaeological in origin. However, it is also probable that it may relate to a drainage ditch and further investigation would be required to clarify the precise nature of this anomaly.

5.2.8 Across the entirety of the site, numerous linear anomalies intersect the area. In the western part of the site, this comprises a sinuous parallel positive and negative response, which is situated on a roughly south-west to north-east alignment that turns towards a more easterly trajectory after approximately 120 m, continuing for a further distance of 290 m (**4006**). This is most likely associated with a drainage ditch feature with an associated bank, which is clearly upstanding in the lidar data for the area (**Figure 2**). It also corresponds with a footpath visible on historic mapping of the area dating to 1888, but the strong nature of the magnetic response suggests that it may relate to a larger earthwork feature. The sinuous form likely also suggests that this may have been reworked from a former channel, but it is not clear if this is natural or anthropogenic in origin.

5.2.9 Directly south of **4006** and elsewhere within the north-western part of the site are numerous further linear anomalies. Many of these are more regular or straight in form and are probably associated with further drainage ditches. This comprises the roughly orthogonal arrangement of linear anomalies at **4007 - 4009**, which are positioned slightly askew to a north-south to east-west alignment (**Figure 4**). These are not visible within the lidar data but are likely associated with former drainage ditches. Collectively they may have defined a former land parcel, albeit not recorded on any of the available historic mapping.

5.2.10 Within the area defined by **4007** - **4009** are numerous closely spaced (*c.* 5 m) parallel anomalies, which are perpendicular to this alignment. These are characteristic of ridge and furrow ploughing and are also apparent as such within the corresponding lidar data. Such activity is typically of medieval and post-medieval date.

5.2.11 In the central and southern portion of the site, a series of further positive linear anomalies are also interpreted as drainage ditches that define former land parcels (**Figure 10**). For example, at **4010** there is south-west to north-east aligned anomaly, which curves towards the west in the western extent. This extends for a total distance of 345 m and is approximately 2 m wide. To the south of this are a series of more closely spaced (*c.* 3 m) linear anomalies that. It is probable that these relates to ploughing trends, but the closer

spacing suggests that they may not relate to ridge and furrow, perhaps being more recent in origin.

5.2.12 To the north-east of **4010**, there are several more poorly defined positive linear anomalies (**4011**; **Figure 6**). These also appear to define the extent of ridge and furrow ploughing and may also relate to former field boundaries. However, as none of these linear anomalies are visible on the available historic mapping for the area, it is perhaps more likely that they relate to former drainage ditches that previously divided the area into different parcels.

5.2.13 In addition to drainage ditches, there are also several linear trends recorded within this area that also likely relate to the historic cultivation of the site. However, these are extremely poorly defined and are not considered to be archaeological in origin. In addition, in the south-east of the site, there is north to south aligned weakly negative response, which corresponds to a modern trackway that traverses the area (**4012**).

5.2.14 Across the northern portion of the site, towards the River Rede, the gradiometer data is generally quieter; with fewer anomalies being recorded (**Figure 8**). This probably corresponds with a lower-lying, wetter or more frequently flooding part of the site where there may be an increased thickness of alluvium. However, a series of anomalies that likely relate to geomorphological features have been identified. This is clearest in the north-eastern part of the site where numerous amorphous, weakly positive anomalies have been identified (**4013**). These likely relate to palaeochannels or ridge and swale, where a series of alternating ridge and marshy depressions record the migration of the present river meander. Although there is a limited archaeological potential associated with such features, there is potential for the recovery of paleoenvironmental material should any organic-rich deposits be preserved in this location.

5.2.15 Elsewhere in the north-western part of the site, there are several further weakly positive linear and curvilinear anomalies (**4014**). Some of these may also be related to palaeochannels, but their narrower form may suggest that they are related to drainage (**Figure 4**). Indeed, numerous weak linear features across the site are likely associated with drainage.

5.2.16 In the south-east of the site, there is a strong dipolar linear anomaly, forming part of **4010** (**Figure 10)**. This extends for 75 m on a south-west to north-east alignment and is most likely associated with a modern service such as a buried pipe or cable.

5.2.17 Close to the western boundary of the site, there is a larger ferrous response, which is associated with the location of a pylon supporting overhead cables that traverse this part of the site on a south-east to north-west trajectory.

5.3 GPR survey results and interpretation

5.3.1 The GPR survey was undertaken across three areas of varying size (Area A-C). Each area is approximately 5-8 m wide consisting of a series of linear GPR transects separated by 0.5 m. They were each positioned in potential locations where the medieval road between Scotland and Newcastle has potential to be located, and also where paleochannels relevant to locating the Scottish army camp were identified in the gradiometer survey.

5.3.2 In general, the limited lateral extent of the GPR areas has made the interpretation of this data challenging as it is difficult to provide contrast within the surrounding background material in each area. However, numerous anomalies of interest have been identified. In addition, high amplitude response has also been identified widely across the site, which is not thought to be associated with any archaeological or geomorphological features of interest. These likely relate to random variations in the subsurface such as the presence of stones or other items.

Area A

5.3.3 The largest GPR area is Area A, which covers 200 x 5 m. It is situated on a north-south alignment and is in the eastern part of the site. The time slices for the area revealed several high and low amplitude responses that correlate well with the gradiometer survey results. For example, many of the ploughing trends identified in the gradiometer survey are apparent within the uppermost timeslices as a high amplitude linear response (**Figure 12a**).

5.3.4 Within the northern part of Area A, numerous amorphous anomalies were identified in the gradiometer survey. These were attributed to variations in the superficial alluvial deposits that cover the area, and some were thought to potentially relate to the course of former channels or ridge and swale. The GPR survey has also shown an equally complex range of responses, which are difficult to define within these timeslices. For example, there are a series of high and low amplitude anomalies in Timeslice 7 (0.59 – 0.69 m; **Figure 12b**) that likely relate to variations in the composition of the underlying alluvial sediment. The high amplitude responses may indicate coarser-grained/gravel-rich material, whereas the surrounding low amplitude response may represent finer-grained silt-clay.

5.3.5 In the southern part of Area A, there is a consistently visible moderate-high amplitude anomaly (**5000**). This correlates with the presence of a drainage ditch that traverse the area, but within the timeslices located at around 1 m below the ground surface (which augering has indicated represents the approximate depth of alluvium), some poorly defined responses likely relate to variations in the thickness of the alluvial sediment sequence. This is most clearly visible in Timeslice 11 (0.99 – 1.09 m; **Figure 12c**), where a slightly denser concentration of higher amplitude response is apparent in the southern part of Area A (**5001**), with a lower amplitude response recorded towards the north. This suggests that the thickness of alluvium extends below 1 m towards the north of Area A, nearest the River Rede. This is supported by the corresponding representative radargram for the area (**Figure 12d**), which shows a slight decline in the subsurface topography.

5.3.6 In the northern part of the radargram for Area A, there are a series of hyperbolic point reflectors located between 150 m and 170 m along with the profile. These may represent some more isolated, and deeply buried, gravel ridge deposits. Either side of this is quieter areas (with no hyperbolae) that likely indicate former channel courses. These broadly relate to those identified by the gradiometer survey, but they are very poorly defined by both survey methods, suggesting that they may be very poorly defined, most likely relating to a very thin deposit measuring *c*. 0.1 – 0.3 m thick.

5.3.7 Between 0.6 and 1.1 m, it is possible to identify several high amplitude planar returns, which most likely relate to the interface between the alluvium and the underlying solid geology. This dips laterally across the radargram and is shallower towards the south, gradually increasing in depth towards the River Rede in the north. However, between approximately 110 m and 170 m along the profile, a slight depression is apparent that likely corresponds with a possible paleochannel. Since this is predominantly located below 1 m, it is not particularly clear within the gradiometer survey results, but it does correspond with an area where a series of palaeochannels were identified.

Area B

5.3.8 Area B is located to the west of Area A in the approximate centre of the site. It covers a 67 x 6 m area and is the smallest covered by the GPR survey. It is orientated on a north-east to south-west alignment.

5.3.9 Within the uppermost timeslices, the ridge and furrow identified by both the lidar and gradiometer data can be visualised as high amplitude linear responses. These are also apparent in the representative radargram as a series of regularly spaced point-source hyperbolae close to the surface (**Figure 13d**). Many of these are also visible within the

deeper timeslices, but this is caused by a 'ringing' of the radar signal as the pulse is returned to the antenna, as opposed to the presence of these features below 1 m.

5.3.10 In the northern part of Area B there is a north-south aligned linear high amplitude anomaly which does not correlate with any features visible in the gradiometer survey. This can be identified at **5002** in Timeslice 2 (0.1 – 0.2 m; **Figure 14a**). Given the small proportions of the survey area, it is not clear precisely what this may represent but its relatively shallow depth may suggest that it is modern in origin, possibly relating to a drainage feature. However, it is not possible to rule out an archaeological origin.

5.3.11 In the south-western part of Area B at **5003**, there is a concentration of high amplitude anomalies, which are persistent through timeslices up to 1 m below the ground surface. This likely relates to coarse-grained/gravel-rich deposits. Either side of this is poorly defined lower amplitude responses, which may relate to shallow depressions within the subsurface topography of the area. However, these are very difficult to define.

5.3.12 Within the representative radargram for Area B, numerous planar responses indicate the interface between the alluvium and the underlying solid geology. In the south-western part of the area, this is visible at approximately 0.4 m bellow the ground surface, steadily increasing in depth towards the north-east. In the centre of the profile, between 30 and 40 m, there is a slight depression, which may indicate a very slight channel (**Figure 14d**). This located at around 1 m below the ground surface, which explains why it is not identifiable in the gradiometer survey, as this is below the detection threshold of this instrument.

Area C

5.3.13 Area C is the most westerly of the GPR survey areas. It measures 100 x 8 m and is orientated north-east to south-west. Within the uppermost timeslice of the area, a series of high amplitude linear anomalies correlate with the position of ridge furrow identified by the lidar and gradiometer survey (**Figure 15a**). These are also visible as a series of regularly spaced point source hyperbolae in the corresponding radargram for the area (**Figure 15d**).

5.3.14 In the north-eastern part of Area C, three parallel linear high amplitude anomalies (**5004**). These broadly correspond with a drainage ditch recorded by the gradiometer survey, but. extend beyond this. The larger extent indicated by the GPR survey may be indicative of an underlying palaeochannel, potentially suggesting that the drainage ditch may have reworked the former channel within this location. However, this is poorly defined and further investigation would be required to confirm this.

5.3.15 Within the deeper timeslices (below 0.6 m) there are numerous randomly distributed high amplitude responses in the south-west of Area C (**5005**; **Figure 16**). Such variations may relate to the presence of coarse-grained/gravel-rich material, possibly suggesting that the alluvial sediment sequence is relatively thin here. Indeed within the corresponding radargram, the interface between the alluvium and solid geology is likely indicated by a series of planar returns from around 0.6 m below the ground surface. This declines gradually towards the River Rede in the north-east.

5.3.16 In the northeast of the representative radargram for area C, between approximately 60 and 80 m along the profile, there is a slight depression in the interface between the alluvium and the solid geology. This extends to a depth of approximately 1 m and may indicate the presence of a palaeochannel. However, it is equally possible that there is simply a decline in the overall subsurface topography here, which may not contain any channel deposits as such.

6 METHODOLOGY FOR TEST PITTING

6.1 Introduction

6.1.1 26 test pits, each measuring 2.5 m in length and 1.1 m wide, and one trial trench measuring 20 m in length and 1.1 m wide, were excavated in level spits using a 360º excavator equipped with a toothless bucket, under the constant supervision and instruction of the monitoring archaeologist. Machine excavation proceeded until either the archaeological horizon, the natural geology was exposed or a depth of 1.2 m was reached.

6.1.2 In addition to these test pits a 11.5 m in length and 1.1 m wide trench was excavated across a double set of parallel ditches identified on the geophysics. This trench was machined to a depth of 0.3 m to remove the turf and topsoil layer, and then two alluvium filled ditches were hand excavated.

6.1.3 Where necessary, the base of the trench/surface of archaeological deposits were cleaned by hand. A sample of archaeological features and deposits was hand-excavated, sufficient to address the aims of the evaluation.

6.1.4 Spoil from machine stripping and hand-excavated archaeological deposits was visually scanned for the purposes of finds retrieval. Artefacts were collected and bagged by context. All artefacts from excavated contexts were retained, although those from features of modern date (19th century or later) were recorded on site and not retained.

6.1.5 Trenches and test pits completed to the satisfaction of the client were backfilled using excavated materials in the order in which they were excavated, and left level on completion. No other reinstatement or surface treatment was undertaken.

6.2 Recording

6.2.1 All exposed archaeological deposits and features were recorded using Wessex Archaeology's pro forma recording system. A complete record of excavated features and deposits was made, including plans and sections drawn to appropriate scales (generally 1:20 or 1:50 for plans and 1:10 for sections) and tied to the Ordnance Survey (OS) National Grid.

6.2.2 A Leica GNSS connected to Leica’s SmartNet service surveyed the location of archaeological features, the location of trenches and the location of metal detecting transects and finds. All survey data is recorded in OS National Grid coordinates and heights above OD (Newlyn), as defined by OSTN15 and OSGM15, with a three-dimensional accuracy of at least 50 mm.

6.2.3 A full photographic record was made using digital cameras equipped with an image sensor of not less than 16 megapixels. Digital images have been subject to managed quality control and curation processes, which has embedded appropriate metadata within the image and will ensure long term accessibility of the image set.

6.3 Finds and environmental strategies

6.3.1 Strategies for the recovery, processing and assessment of finds and environmental samples were in line with those detailed in the WSI (Wessex Archaeology 2021a). The treatment of artefacts and environmental remains was in general accordance with: Guidance for the collection, documentation, conservation and research of archaeological materials (CIfA 2014b), Environmental Archaeology: A Guide to the Theory and Practice of Methods, from Sampling and Recovery to Post-excavation (English Heritage 2011), and CIfA’s Toolkit for Specialist Reporting (Type 2: Appraisal).

7 TEST PITTING RESULTS

7.1 Introduction

7.1.1 Detailed descriptions of individual contexts are provided in the trench summary tables (**Appendix 4**). The location of all test pits is shown across **Figures 3-16.** Two north-south transects of test pits were completed with the shorter western one containing TP1 – 12 and the longer eastern one containing TP13 – 26. These transects were laid out to overlap and cover as much of the width of the floodplain of the Rede as possible, in order to attempt to locate any deposits relating to the medieval road. Test pits were limited to the southern side of the river, although the eastern line extended as far north as possible within a meander.

7.2 Soil sequence and natural deposits encountered in the test pitting

7.2.1 Within the flood plain of the River Rede the natural substrate was a mottled mid yellow to pale yellow sand and gravel mix, with occasional patches of mid yellow sandy clay. This was up to 1.2 m below ground level (bgl) although it was not encountered in all test pits and so will have been deeper below either the palaeochannel fills or the gravel banks encountered. The depth at which it was encountered became shallower within the four test pits (TP09 – TP12) that approached the southern edge of the flood plain. The depth at which it was encountered within the northern three test pits in the western transect (1.1 – 1.2 m bgl) with no overlying palaeochannel deposits demonstrates the quantity of alluvial material that has infilled the floodplain throughout the centuries.

7.2.2 Above this were either mottled mid to dark grey and greyish brown sandy clays with occasional charcoal flecks which had the appearance of waterlain deposits, or mid greyish brown sand and gravel bank deposits. The clays were encountered in 10 test pits at a depth of 0.9 – 1.1 m bgl, while the gravels were encountered in 14 test pits at a depth of 0.55 – 0.7 m bgl, and in one below the palaeochannel clays at a depth of 1.1 m bgl. A 20 litre sample was recovered for the clay fill 2304 for dating material.

7.2.3 One palaeochannel was identified within TP04 – 08 in the western transect and a further one in the eastern transect. These were not likely to be of the same date, with the palaeochannel identified in the eastern transect appearing to turn north over the earlier palaeochannel in the western transect. The palaeochannel in the eastern transect was identified in TP21 – 25, with gravel bank deposits to the north of it in TP13 – 20 and to the south of it in TP26.

7.2.4 Above the palaeochannel deposits within TP21 – TP24 was a banded layer of mid yellowish brown alluvial material and pale yellow sand which was interpreted as a series of flood deposits overlying the former infilled palaeochannel. These were not present above the palaeochannel found in TP04 – 08, suggesting again that these two palaeochannels have different time periods when they were flowing.

7.2.5 Every test pit contained a layer of mid yellowish brown sandy silt with occasional charcoal flecks which was interpreted as alluvium. This layer was 0.3 – 0.8 m thick and the top of the layer was below the topsoil layer at 0.15 – 0.3 m bgl. The variation in thickness of this layer is likely to be due to the migration of the river through time, with it being thickest above the palaeochannel suspected to be oldest and shallowest in the areas thought to be most recently infilled.

7.2.6 Over the top of every test pit was a layer of turf and topsoil of mid greyish brown sandy silt with rooting, up to 0.3 m thick from 0 m bgl.

7.3 Trench 30 soil sequence and results

7.3.1 Trench 30, measuring 11. 5 m in length and 1.1 m in width contained a layer of mid yellowish brown sandy silt 3002 identified as alluvial material within its base at 0.3-0.5 m bgl, similarly to the test pits around it. Cut into this material were two parallel shallow ditch cuts 3003 and 3005 aligned south-west – north-east identified on the geophysical survey and visible on the surface as slight linear depressions. These cuts, measuring 1.2 m in width and 0.2 m in depth were filled with further alluvial material 3004 and 3006 which made their exact shape very difficult to fully identify. A sherd of modern ceramics was found within the base of one ditch, demonstrating the two to be of recent date.

7.3.2 Overlying the alluvial material and ditches was a layer of turf and topsoil of mid greyish brown sandy silt with rooting, up to 0.3 m thick from 0 m bgl.

8 ENVIRONMENTAL EVIDENCE

8.1 Introduction

8.1.1 Two bulk sediment samples were taken from palaeochannel fills in Test Pits 7 and 23. The samples were processed for the recovery and assessment of environmental evidence.

8.2 Aims and methods

8.2.1 The aim of this assessment is to determine the nature and significance of the environmental remains preserved at the site, and their potential to address project aims. This assessment follows recommendations from Historic England (Campbell *et al*. 2011).

8.2.2 A waterlogged sample from palaeochannel fill 703 in Test Pit 7 was 100 ml in volume and processed by manual flotation; the sample was washed gently through a 0.25 mm mesh and stored in water. A bulk sediment sample from palaeochannel fill 2304 in Test Pit 23 was 15 litres in volume and processed by standard flotation methods on a Siraf-type flotation tank; the flot retained on a 0.25 mm mesh, residues fractionated into 4 mm and 1 mm fractions.

8.2.1 The coarse residue fractions (>4 mm) were sorted by eye for artefactual and environmental remains. The fine residue fractions and the flots were examined using a stereomicroscope at up to x40 magnification for uncharred and charred environmental remains (eg, plant macroremains, charcoal, wood, invertebrates). Different potential indicators of bioturbation were noted where present, including the percentage of modern roots and abundance of modern seeds, alongside the presence of mycorrhizal fungi sclerotia (eg, *Cenococcum geophilum*), burrowing snails (eg, *Cecilioides acicula*), earthworm eggs and modern insects.

8.2.1 Plant remains were identified through comparison with modern reference material held by Wessex Archaeology and relevant literature (Cappers *et al*. 2006). Selected wood and charcoal fragments were identified through examination of the transverse (TS), tangential longitudinal (TLS) and radial longitudinal (RLS) sections at up to x400 magnification using a Kyowa ME-LUX2 microscope. Wood and charcoal identifications were assisted by the descriptions of Gale and Cutler (2000), Hather (2000) and Schweingruber (1990), together with modern reference material held by Wessex Archaeology. Nomenclature follows Stace (1997) for wild taxa.

8.2.2 Remains within flots and residues were recorded semi-quantitatively on an abundance scale: C = <5 (‘Trace’), B = 5-10 (‘Rare’), A = 10-30 (‘Occasional’), A* = 30-100 (‘Common’), A** = 100-500 (‘Abundant’), A*** = >500 (‘Very abundant/Exceptional’).

8.3 Results

8.3.1 The results are presented in Appendix 5, Table 4.

Test Pit 7

8.3.2 Palaeochannel fill 703 produced a moderate-sized flot containing environmental remains preserved through waterlogged (anoxic) conditions. The flot is dominated by wood fragments, with a selection of these identified as alder (*Alnus glutinosa*). Plant remains are restricted to a single sedge (*Carex* sp.) seed. Other remains include frequent water flea (*Daphnia* sp.) ephippia and caddis fly (Trichoptera) larval cases.

Test Pit 23

8.3.3 Palaeochannel fill 2304 produced a very small flot containing frequent small diameter charred heather-type (*Calluna vulgaris* tp.) stems, together with a trace of ash (*Fraxinus excelsior*) charcoal. There is no evidence for waterlogged preservation. Coal and clinker/cinder are common within the sample residue and flot.

8.4 Conclusions

8.4.1 The samples vary in composition, although they indicate that waterlogged preservation conditions are likely to be present in other palaeochannel deposits across the site. There is also potential for the preservation of charred plant remains and charcoal within these features.

8.4.2 The evidence recovered from Test Pit 7 indicates that alder was growing in the local environment, with this species being a common component of wet woodland habitats adjacent to rivers. Sedges can similarly grow in these wet/damp conditions. Remains of water fleas and caddis flies provide strong evidence for areas of standing or slow-moving water, possibly due to seasonal flooding or high ground water levels. Overall, these lines of evidence suggest that the palaeochannel was predominantly infilled with sediment, although it still retained shallow pools of standing, or slow-moving water. This would be consistent with the local context of the site on the River Rede floodplain.

8.4.3 No evidence for waterlogged preservation was identified in palaeochannel fill 2304, with the sample instead containing small quantities of fuel debris. This is likely to reflect background 'noise' associated with nearby settlement activity, with this material potentially being discarded onto fields before becoming worked into the palaeochannel. Whilst the evidence recovered is slight, the remains provide some information on the nature of the local environment. Ash tolerates seasonally waterlogged soils, and it is often found in association with alder in relatively open scrub or woodland habitats (Preston *et al.* 2002). Heathland vegetation is indicated by heather-type stems, with heather moorland habitats occurring extensively across this area of Northumberland (Preston *et al.* 2002). The presence of coal and clinker/cinder could indicate a later medieval/post-medieval date for the deposit, although coal does appear to have been used as a fuel source on a small-scale from the later prehistoric/Romano-British periods onwards in northern England (Claughton *et al.* 2016).

Recommendations for future sampling

8.4.4 Waterlogged palaeochannel deposits may have potential to provide further information on the nature of the local environment at the time of the Battle of Otterburn, although obtaining close dating evidence for the deposits could be challenging.

8.4.5 If further fieldwork is undertaken at the site, monolith samples could be taken through palaeochannel fills to record the sediments present and to assess their potential for the preservation of pollen and other microfossils. This should be supplemented by bulk sampling for the recovery of wood, plant macroremains and other remains (eg, insects).

9 METHODOLOGY FOR METAL DETECTING SURVEY

9.1 Methods

9.1.1 The metal detecting survey was undertaken between 16 and 20 August. The survey was carried out using Garrett Euroace metal detectors, which are capable of several modes of operation, including motion with discrimination and non-motion all metal-detection.

9.1.2 The equipment set up is listed below. The set up remained consistent through the whole survey to avoid bias.

- Frequency of operation: 8.25Khz
- Search mode: all metal non-motion (with ferrous and non-ferrous objects identified by use of the integrated meter)
- Coil size: 28 cm x 22cm

9.1.3 The survey was carried out along transects spaced at 2.5 m intervals, which were established with an RTK GNSS unit capable of survey grade accuracy and marked with bamboo canes with flags.

9.1.4 Metal detecting progressed along each transect by sweeping the search head as close to the surface as possible and allowing for approximately 30% overlap in order to produce a consistent sample. Each sweep will cover a width of 2.5 m (1.25 m each side of the centre of the transect).

9.1.5 Metal detectors were set to discriminate against ferrous to create the best environment for identifying high status objects associated with a medieval battlefield site.

9.1.6 One transect per field was surveyed without any discrimination to allow for an assessment of the background ferrous materials

9.1.7 A 100% recovery policy was used for all recovered artefacts with no on-site discard.

9.1.8 All recovered artefacts were labelled with a unique ID number. All artefacts were surveyed in relation to the OS Grid with each survey point tagged with the corresponding find ID number. They were stored in breathable plastic bags or wrapped in acid-free tissue and placed in plastic cases, as appropriate.

9.1.9 Spoil derived from excavated areas will be visually scanned for the purposes of finds retrieval and will also be metal-detected by trained personnel. Artefacts and other finds will be collected and bagged by context.

10 RESULTS OF METAL DETECTING SURVEY

10.1 Introduction

10.1.1 The metal detecting survey resulted in the recovery of 68 items, comprising 30 items of copper alloy, 25 of iron and 12 of lead/lead alloy. One item is of uncertain white metal, probably pewter. A further item was recovered by metal detecting outside of the scope of

the project. This item has been included in the report (see section **9.13**). Although much of the assemblage consists of objects that are not chronologically distinctive, a small number of items are of medieval to post-medieval date but the likelihood is that the majority is of post-medieval/modern date. The battle of Otterburn took place in August 1388 but few items are dateable to period.

10.1.2 A finds distribution plot is shown within **Figure 17**.

10.1.3 The assemblage is summarised by material type and by object type in Table 2 and discussed by functional group below.

Table 2: Finds by type and material

Object Type	Grand Total	Functional Group	Copper Alloy	Iron	Lead Alloy	Other Metal
BAR	1	Miscellaneous		1		
BOLT	1	Structural		1		
BUCKLE	3	Personal	3			
BUTTON	5	Personal	4			1
COINS	8	Coins	7			
		Miscellaneous	1			
FILE	1	Tools		1		
FRAGMENT	4	Militaria	3			
		Miscellaneous	1			
HANDLE	1	Household	1			
HORSESHOE	10	Transport		10		
KNIFE	1	Tools		1		
LUMP	3	Miscellaneous		2	1	
NAIL	2	Structural		2		
OBJECT	13	Household	2			
		Miscellaneous	2	5	4	
PLATE	1	Miscellaneous		1		
SHELL	1	Militaria	1			
STRIP	3	Miscellaneous	2	1		
THIMBLE	1	Textile	1			
VESSEL	1	Household	1			
WASTE	4	Metalworking			4	
WEIGHT	4	Measuring	1		3	
Grand Total	**68**		**30**	**25**	**12**	**1**

10.2 Numismatics

10.2.1 A small group of seven coins were recovered, all copper alloy. One coin, ON 163, is highly corroded but is possibly Roman on the basis of the thickness and alloy. The remainder are of post-medieval or modern date. The group includes a probable penny of William III (1694-1702 AD, ON 182), halfpenny of George III (1760-1820 AD, ON111) and a probable halfpenny of Victoria (1837-1901 AD, ON 181) from early in her reign. The latest dated coins are a halfpenny of George VI (1939 AD, ON 162) and a threepence of Elizabeth II (1945 AD, ON 157).

10.3 Personal items

10.3.1 Personal items amount to eight, seven of copper alloy and one of other metal (probably pewter) and the group is limited to buckles (three) and buttons (five). Of the buckles, ON 125 is the earliest, dateable from the mid 14th to mid 17th centuries (Whitehead 1996, no. 257). The frame is annular, with a copper alloy plate attached. The earlier end of the date range overlaps with the date of the Battle of Otterburn, but the long range means it cant be attributed with any confidence. ONs 103 and 170 are two-piece type buckles with separate, drilled, spindles. ON 103 dates to the period 1660-1720 AD and ON 170, a knee buckle with decorative moulded frame, dates to 1720-1790 AD.

10.3.2 The buttons are mostly of a post-medieval date, with three (ONs 101, 179 and 150) taking the form of a flat disc with loop on the reverse from which the attachment loop protrudes. The other two are two piece buttons; ON 176 is missing the back piece and the design is illegible and ON 177 is a uniform button of the royal household, probably of 19th or 20th century date.

10.4 Household items

10.4.1 Three objects are tentatively identified as fragments of cast copper alloy cooking vessels, broadly of medieval to post-medieval date. ON 175 is a rim fragment, 104 is a curved strip, likely to be a posnet or skillet handle and ON 114 is a probable body fragment. A decorative pressed metal object, ON 126, is likely to be of modern date. It comprises a disc of metal with a lace-effect edge and two attachment holes.

10.5 Textile items

10.5.1 One textile item was recovered, a copper alloy thimble fragment. The square indentations mark it as a post-medieval type, but the fragmented nature means it is not more closely dated.

10.6 Transport

10.6.1 Ten iron horseshoes were recovered, eight are complete and two are fragments. Six have toe clips (ONs 110, 112, 116, 124, 15 and 186) and ON 172 has side clips. ON 124 contains the nails through the attachment holes and a corrective bar across the toe. Whilst horseshoes are difficult to precisely date, it is likely that these are post-medieval or modern.

10.7 Structural or other fittings

10.7.1 Only two iron nails (ON 105 and 156) and one iron bolt (ON 108) were recovered. The nails are a standard form, with square shank and flat head, introduced in the Roman period and which continue largely unchanged until industrialisation in the post-medieval period. They cannot be closely dated, but the bolt is of modern date.

10.8 Tools

10.8.1 Two iron tools were recovered; ON 158, a file or rasp and ON 183 a knife with broken tip. Neither are closely dated but are in generally good condition, suggesting they are probably post-medieval or modern in date.

10.9 Metalworking

10.9.1 Two items of indeterminate lead alloy waste (ONs 109 and 167), probably from metalworking are present in the group, but are undatable.

10.10 Militaria

10.10.1 Whilst items of militaria are present in the assemblage, they are of modern date and not relatable to the Battle of Otterburn. ONs 115, 166 and 173 are copper alloy items of fragmentation; pieces of shell casing of modern date (sometimes referred to as 'shrapnel'). ON 161 is a copper alloy modern artillery shell case with a base diameter of 1.2 inches (31 mm).

10.11 Weighing and measuring

10.11.1 ON 119 is a copper alloy trade weight, weighing 0.5 oz (13 g). The trade weight is stamped with a crowned C, indicating it dates to the reign of Charles I (1625 to 1649 AD) or Charles II (1660 to 1685 AD). It is also stamped with the sword of St. Paul and an ewer, the marks of the London Guildhall and London Founders Company respectively.

10.11.2 Three lead alloy weights are also recorded: ONs 154, 159 and 168. Two are annular with a central circular hole, although use as a spindle whorl is also possibly. They are undecorated and could be medieval or later in date. ON 158 is triangular in shape, with iron corrosion at the wide end and isn't dateable.

10.12 Miscellaneous

10.12.1 The remaining objects are grouped together in a miscellaneous category. This includes fragments of bar, strip, rod, unidentifiable lumps and objects (or parts of objects) that are unidentifiable and cannot be assigned to any other functional categories. Also included in one copper alloy item (ON 153) which is either a coin or a button. Nothing in this category is dateable, with the exception of ON 185, an iron plate. The plate has raised lettering, identifying it as belonging to the North Eastern Electric Board, who were operational from the late 19th century until nationalisation in 1947.

10.13 Item recovered outside the scope of work

10.13.1 A copper alloy probable sword or dagger pommel was recovered by metal detecting in an adjacent field. The item was recovered at a distance of 312 m from the nearest object (ON 173). The pommel is comprised of five lobes, the central lobe being the longest and the two lobes on either side dropping in height so that the outer lobes are the shortest. Pommels with five simple lobes are known from early medieval (9th / 10th century) swords (for example see NMS X.2001.16), although the more defined moulding and elongated lobes on this example is suggestive of a later date, probably medieval or post-medieval and no exact parallels have been forthcoming.

10.14 Retention of finds

10.14.1 Evidence of a medieval to post-medieval household in the vicinity could be inferred, but no evidence can be attributed to the Battle of Otterburn from the survey undertake by Wessex Archaeology. The sword or dagger pommel, recovered outside the scope of this work, is possibly the closest in date to the battle, although swords and daggers were common affects outside of military use, so the link cannot be made with confidence. The modern and undated finds have little or no archaeological significance.

11 DISCUSSION

11.1.1 The combination of the gradiometer and GPR survey has generally been successful in determining the presence and nature of archaeological remains across the site. The clearest anomalies of archaeological interest were located immediately adjacent to the scheduled round cairn, where several pit-like features have also been identified.

11.1.2 A series of linear anomalies have been identified across the site, which predominantly relates to ditch-like features. For the most part these define several former land parcels, which also delineate the extent of ridge and furrow ploughing trends. None of these features are visible on historic mapping for the area but these features probably relate to medieval and post-medieval period.

11.1.3 In the north-east of the site, there are two parallel strong anomalies which correspond with a ditch and bank feature. This correlates with earthwork features in the lidar data and is recorded as footpath on historic mapping. This feature may, however, have earlier origins or possibly relate to the course of a former channel, which is further suggested by the radar data from Area C. Given that this extends form the location of the scheduled Roman temporary camp at at Dargues (NHLE 1009376), it may have been active or modified during this period, but this interpretation is highly tentative.

11.1.4 The gradiometer survey has also identified several geomorphological features. Most notably a series of palaeochannels, potentially associated with ridge and swale deposits, were identified in the north-western part of the site. The GPR survey of this area (Area A), also clarified some of the subsurface complexity of these anomalies, revealing the subtle vertical profile of these features.

11.1.5 Neither the gradiometer or GPR surveys have identified remnants of a road, which was thought to relate to the battle of Otterburn. Although some paleochannels and alluvial landforms have been identified, there are no anomalies that clearly relate to the presence of a Scottish fort.

11.1.6 The test pitting failed to identify any deposits or finds associated with the period of the battle and adds nothing to this discussion. It did identify two palaeochannels within the southern half of the flood plain, likely to be of different dates, and demonstrated that there was no evidence for a medieval road within this area.

11.1.7 The metal detecting survey in fields east of Percy Cross produced mostly material dated to the post-medieval period and associated with domestic life or the agricultural economy of the area. Whilst items of militaria are present in the assemblage, they are of modern date and not relatable to the Battle of Otterburn. ONs 115, 166 and 173 are copper alloy items of fragmentation; pieces of shell casing of modern date (sometimes referred to as ‘shrapnel’). ON 161 is a copper alloy modern artillery shell case with a base diameter of 1.2 inches (31 mm).

11.1.8 The only items possibly relating to the period around the Battle of Otterburn are a belt buckle dating from the mid-14th to 17th century and a sword pommel recovered from a neighbouring field and recovered by a volunteer after the WA survey work had been completed. This sword pommel again has a broad date range of between the 14th and 17th century. The centuries long range of these two items is unhelpful in assigning them to battlefield activity and it seems likely that they belong to the period post-dating the Battle of Otterburn.

11.1.9 The overall conclusion of the fieldwork is that the various non-intrusive and intrusive evaluation techniques of the fields available to us at the time of survey have failed to identify any significant evidence that the Battle of Otterburn took place across these land parcels.

12 ARCHIVE STORAGE AND CURATION

12.1 Museum

12.1.1 The archive resulting from the evaluation is currently held at the offices of Wessex Archaeology in Sheffield. The Great North Museum has agreed in principle to accept the archive on completion of the project, under an accession code **TBC**. Deposition of any finds

with the museum will only be carried out with the full written agreement of the landowner to transfer title of all finds to the museum.

12.2 Preparation of the archive

Physical archive

12.2.1 The archive, which includes paper records, graphics, artefacts and ecofacts, will be prepared following the standard conditions for the acceptance of excavated archaeological material by the Great North Museum, and in general following nationally recommended guidelines (SMA 1995; CIfA 2014c; Brown 2011).

12.2.2 All archive elements are marked with the **site/accession code**, and a full index will be prepared. The physical archive currently comprises the following:

- 01 cardboard boxes or airtight plastic boxes of artefacts and ecofacts, ordered by material type
- 01 files/document cases of paper records

Digital archive

12.2.3 The digital archive generated by the project, which comprises born-digital data (eg site records, survey data, databases and spreadsheets, photographs and reports), will be deposited with a Trusted Digital Repository, in this instance the Archaeology Data Service (ADS), to ensure its long-term curation. Digital data will be prepared following ADS guidelines (ADS 2013 and online guidance) and accompanied by metadata.

12.3 Selection strategy

12.3.1 It is widely accepted that not all the records and materials (artefacts and ecofacts) collected or created during the course of an archaeological project require preservation in perpetuity. These records and materials will be subject to selection in order to establish what will be retained for long-term curation, with the aim of ensuring that all elements selected to be retained are appropriate to establish the significance of the project and support future research, outreach, engagement, display and learning activities, ie the retained archive should fulfil the requirements of both future researchers and the receiving Museum.

12.3.2 The selection strategy, which details the project-specific selection process, is underpinned by national guidelines on selection and retention (Brown 2011, section 4) and generic selection policies (SMA 1993; Wessex Archaeology's internal selection policy) and follows CIfA's *Toolkit for Selecting Archaeological Archives*. It should be agreed by all stakeholders (Wessex Archaeology's internal specialists, external specialists, local authority, museum) and fully documented in the project archive.

12.3.3 In this instance, given the relatively low level of finds recovery, the selection process has been deferred until after the fieldwork stage was completed. Project-specific proposals for selection are presented below. These proposals are based on recommendations by Wessex Archaeology's internal specialists and external specialists and will be updated in line with any further comment by other stakeholders (museum, local authority). The selection strategy will be fully documented in the project archive.

12.3.4 Any material not selected for retention may be used for teaching or reference collections by Wessex Archaeology.

Finds

12.3.5 Modern and undated finds are recommended for disposal, all other finds are recommended for retention within the site archive.

Environmental remains

12.3.6 The flots should be retained within the site archive since they both contain material suitable for radiocarbon dating. The residues were discarded after sorting.

Documentary records

12.3.7 Paper records comprise site registers (other pro-forma site records are digital), drawings and reports (Written Scheme of Investigation, client report). All will be retained and deposited with the project archive.

Digital data

12.3.8 The digital data comprise site records (tablet-recorded on site) in spreadsheet format; finds records in spreadsheet format; survey data; photographs; reports. All will be deposited, although site photographs will be subject to selection to eliminate poor quality and duplicated images, and any others not considered directly relevant to the archaeology of the site.

12.3.9 Given the very limited results of the fieldwork, it is recommended that only selected digital data are deposited with ADS, an approach commensurate with the scale and significance of the project. Deposition will involve the uploading of the site report via OASIS only [optional: with selected additional photographs].

12.3.10 The table below summarises the recommended selection and deposition strategy.

Table 3: Archive selection and deposition strategy

Class	Element	Quantification	Depository	Format
Physical archive	Paper records	1 A4 file	Great North Museum	N/A
	MD survey finds	22 items recommended for retention	Great North Museum	N/A
	Environmental flots	2 bags	Great North Museum	N/A
	Sword Pommel (recovered by external MD enthusiast)	1 item	Great North Museum	N/A
Digital archive	Report	1 (15 MB)	ADS	.pdf
	Digital recording sheets	29 (c. 6 MB)	ADS	.pdf
	Images	132 c. (820 MB)	ADS	.jpg
	Finds database	500 KB	ADS	.csv
	Survey	1 MB	ADS	.dxf (vector graphics)

12.4 Security copy

12.4.1 In line with current best practice (eg, Brown 2011), on completion of the project a security copy of the written records will be prepared, in the form of a digital PDF/A file. PDF/A is an ISO-standardised version of the Portable Document Format (PDF) designed for the digital

preservation of electronic documents through omission of features ill-suited to long-term archiving.

12.5 OASIS

12.5.1 An OASIS (online access to the index of archaeological investigations) record (http://oasis.ac.uk) has been initiated, with key fields completed (**Appendix 5**). A .pdf version of the final report will be submitted following approval by the NNPA Archaeologist on behalf of the LPA. Subject to any contractual requirements on confidentiality, copies of the OASIS record will be integrated into the relevant local and national records and published through the Archaeology Data Service (ADS) ArchSearch catalogue.

13 COPYRIGHT

13.1 Archive and report copyright

13.1.1 The full copyright of the written/illustrative/digital archive relating to the project will be retained by Wessex Archaeology under the *Copyright, Designs and Patents Act 1988* with all rights reserved. The client will be licenced to use each report for the purposes that it was produced in relation to the project as described in the specification. The museum, however, will be granted an exclusive licence for the use of the archive for educational purposes, including academic research, providing that such use conforms to the *Copyright and Related Rights Regulations 2003*.

13.1.2 Information relating to the project will be deposited with the Historic Environment Record (HER) where it can be freely copied without reference to Wessex Archaeology for the purposes of archaeological research or development control within the planning process.

13.2 Third party data copyright

13.2.1 This document and the project archive may contain material that is non-Wessex Archaeology copyright (eg, Ordnance Survey, British Geological Survey, Crown Copyright), or the intellectual property of third parties, which Wessex Archaeology are able to provide for limited reproduction under the terms of our own copyright licences, but for which copyright itself is non-transferable by Wessex Archaeology. Users remain bound by the conditions of the *Copyright, Designs and Patents Act 1988* with regard to multiple copying and electronic dissemination of such material.

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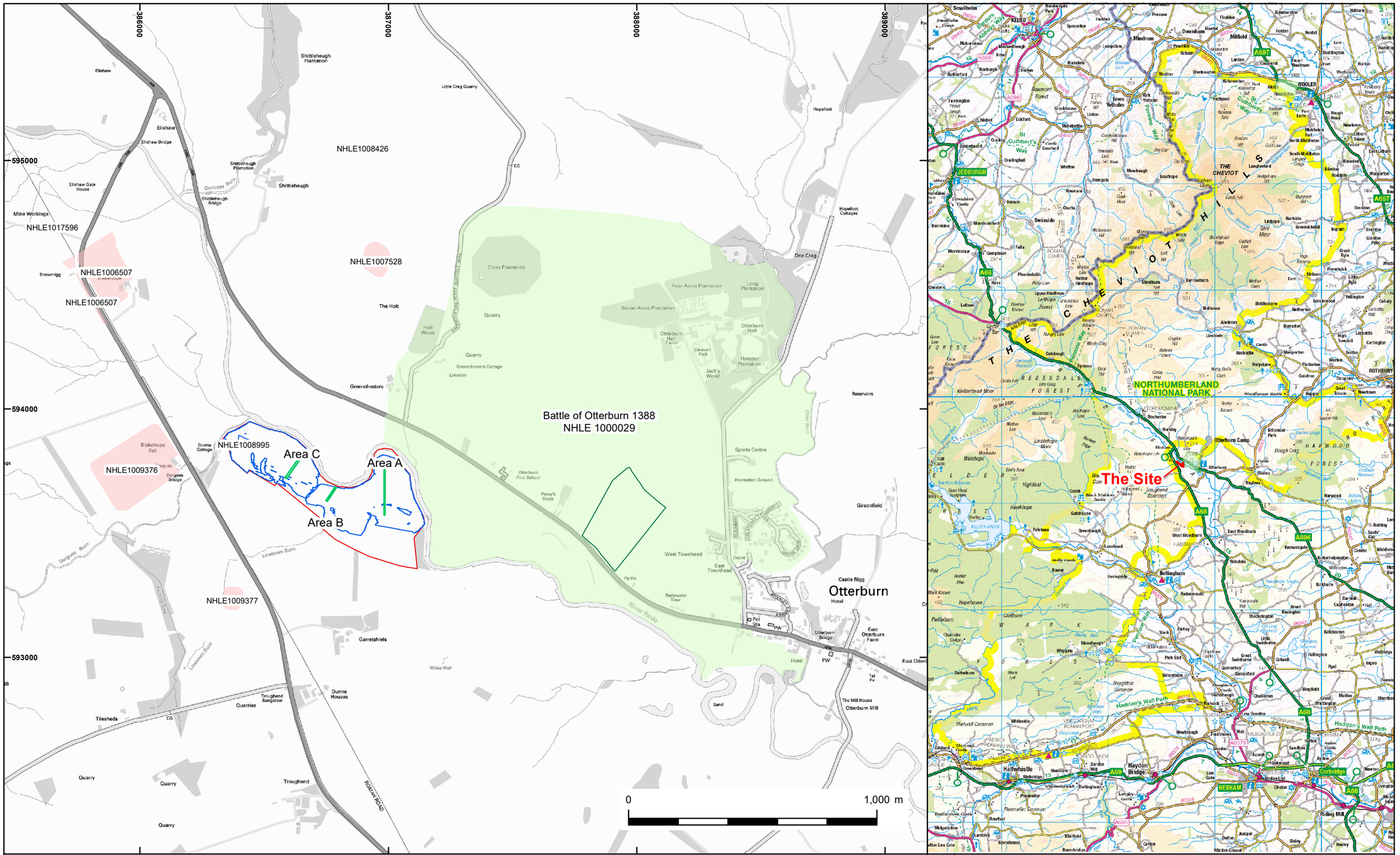

GPR Survey Extents
Metal detecting survey area
Detailed Survey Extents
Site boundary
Scheduled monuments
Battlefield

Date:	20/12/2021	Revision Number:	0
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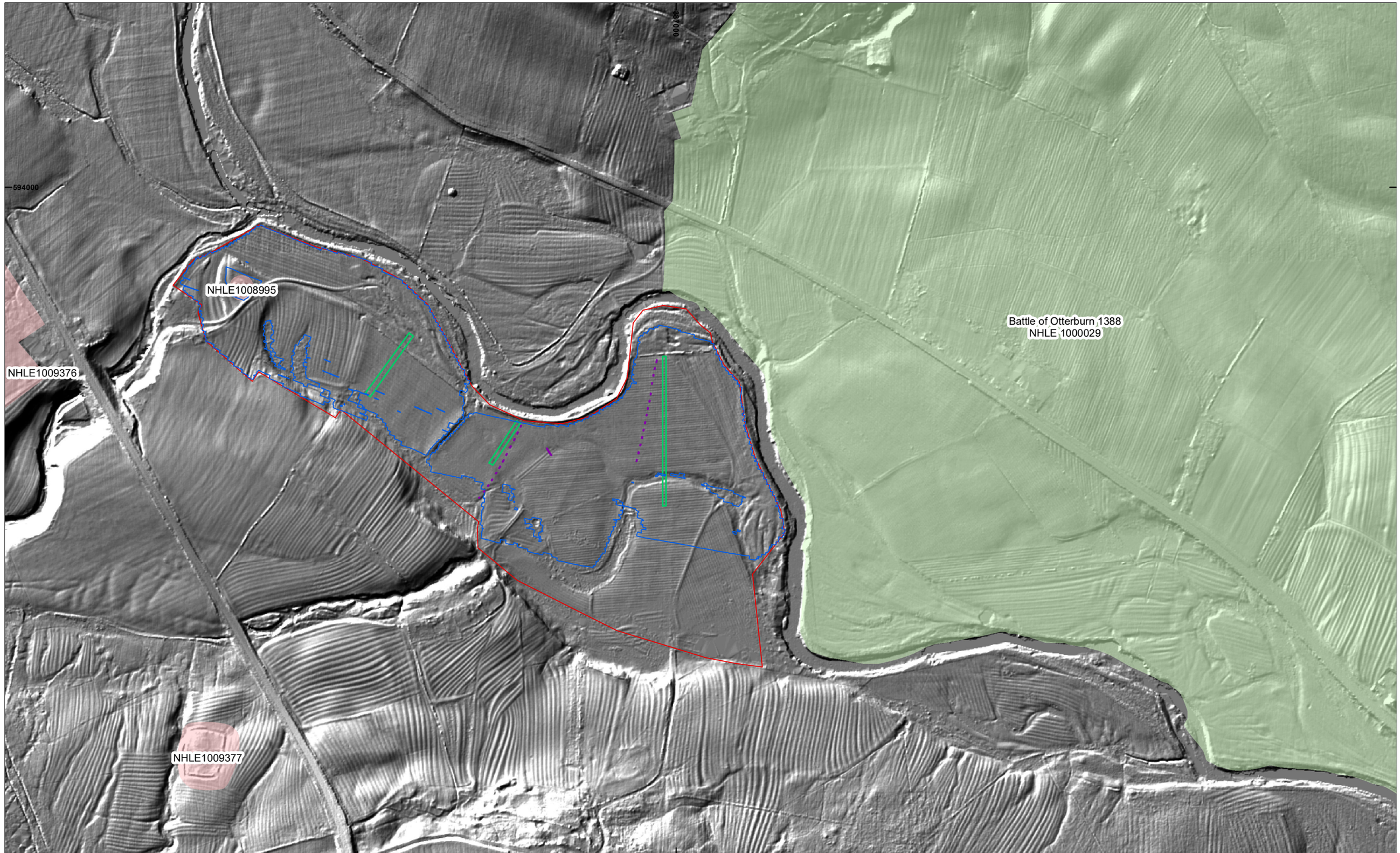
Site location and extent of geophysical surveys and battlefield

Figure 1



Test pit
Gradiometer Survey Extents
GPR Survey Extents
Site boundary
Scheduled monuments
Battlefield

0 250 m

Date:	20/12/2021	Revision Number:	0
Scale:	1:5,000 and 1:350,000 at A3	Illustrator:	NLC/RJH
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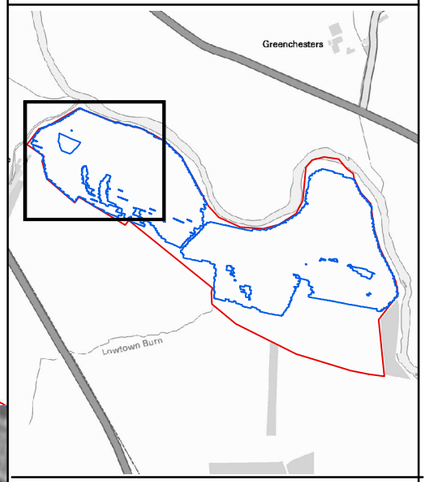
Site location and lidar hillshade model

Figure 2

386500



Detailed Survey Extents

Site boundary

+ 3nT

- 2nT

Coordinate system:
OSGB36 (OSTN15/OSGM15)

Date:	09/11/2021
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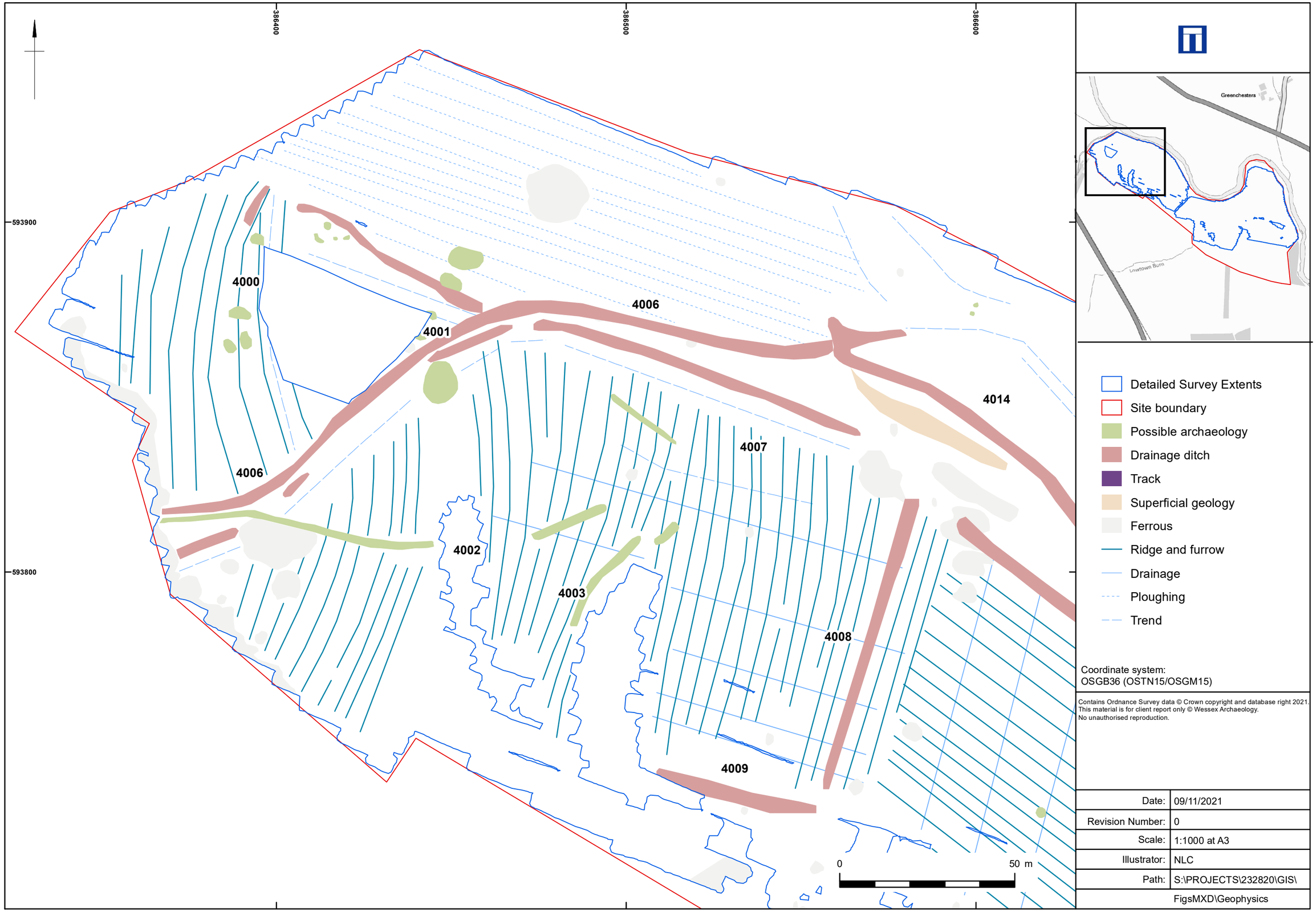
Detailed gradiometer survey results: Greyscale plot (west)

Figure 3



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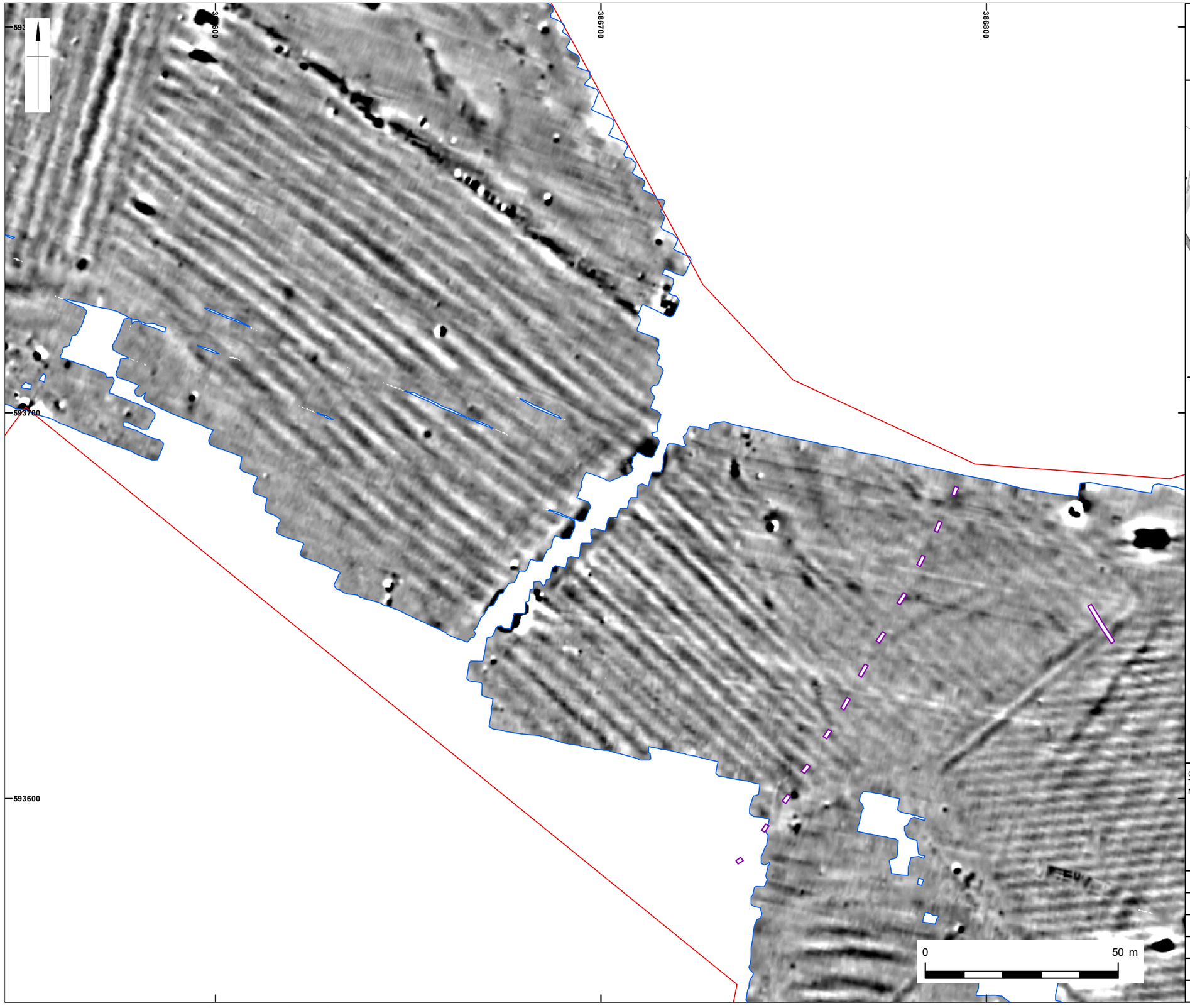
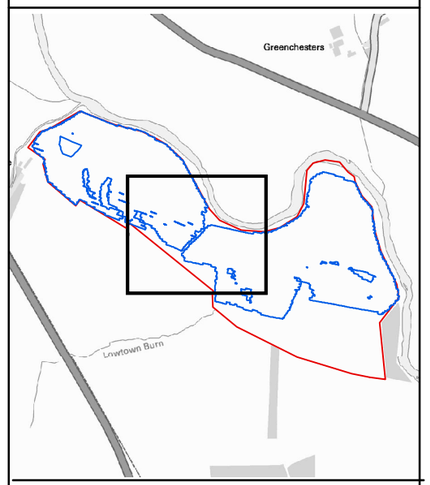
Detailed gradiometer survey results: Interpretation (west)

Figure 4





Test pit

Detailed Survey Extents

Site boundary

+ 3nT

- 2nT

Coordinate system:
OSGB36 (OSTN15/OSGM15)

Date:	20/12/2021
Revision Number:	0
Scale:	1:1000 at A3
Illustrator:	NLC
Path:	S:\PROJECTS\232820\GIS\
	FigsMXD\Geophysics

Detailed gradiometer survey results: Greyscale plot (central)

Figure 5

386600
386700
386800
593
593700
593600
4008
4011
0
50 m
Greenchesters
Lowtown Burn
Test pit
Detailed Survey Extents
Site boundary
Possible archaeology
Drainage ditch
Track
Superficial geology
Ferrous
Ridge and furrow
Drainage
Ploughing
Trend
Coordinate system:
OSGB36 (OSTN15/OSGM15)

Date:	20/12/2021
Revision Number:	0
Scale:	1:1000 at A3
Illustrator:	NLC
Path:	S:\PROJECTS\232820\GIS\
	FigsMXD\Geophysics

Detailed gradiometer survey results: Interpretation (central)

Figure 6

386900

387000

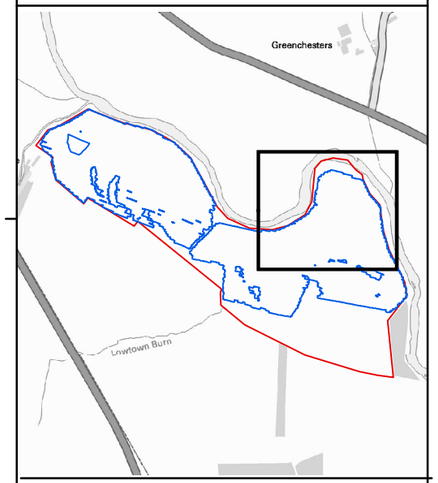
387100

593800

593700

593600

0 50 m



Test pit

Detailed Survey Extents

Site boundary

+ 3nT

- 2nT

Coordinate system:
OSGB36 (OSTN15/OSGM15)

Date:	20/12/2021
Revision Number:	0
Scale:	1:1000 at A3
Illustrator:	NLC
Path:	S:\PROJECTS\232820\GIS\
	FigsMXD\Geophysics

Detailed gradiometer survey results: Greyscale plot (north-east)

Figure 7

386900
387000
387100
593800
593700
593600
4013
4010
0
50 m
Greenchesters
Linwtown Burn
Test pit
Detailed Survey Extents
Site boundary
Possible archaeology
Drainage ditch
Track
Superficial geology
Ferrous
Ridge and furrow
Drainage
Ploughing
Trend
Coordinate system:
OSGB36 (OSTN15/OSGM15)

Date:	20/12/2021
Revision Number:	0
Scale:	1:1000 at A3
Illustrator:	NLC
Path:	S:\PROJECTS\232820\GIS\
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Detailed gradiometer survey results: Interpretation (north-eastl)

Figure 8

386900

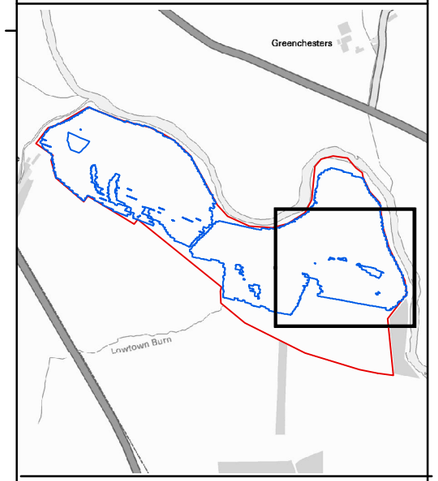
387000

387100

593

593600

593500



Test pit

Detailed Survey Extents

Site boundary

+ 3nT

- 2nT

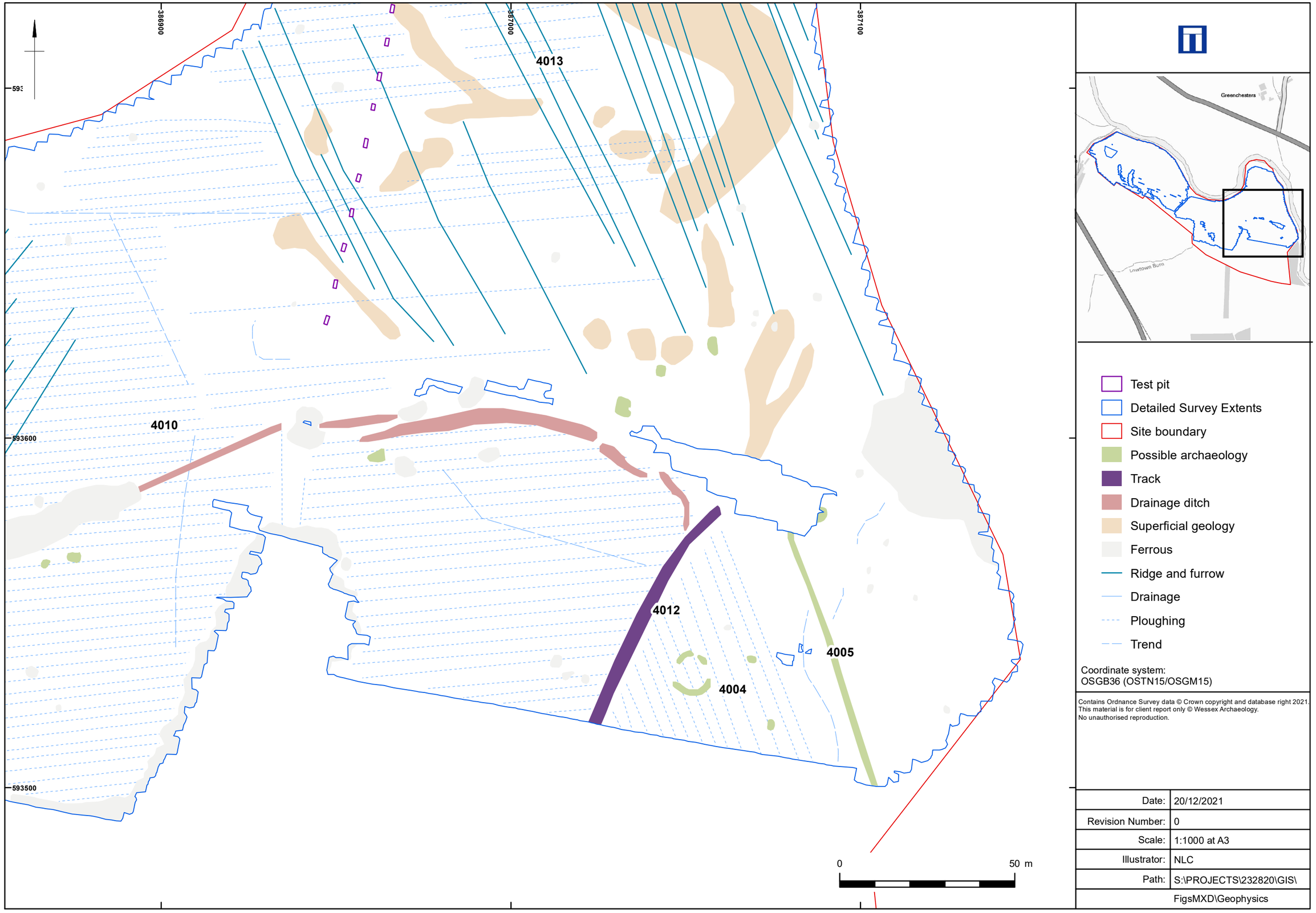
Coordinate system:
OSGB36 (OSTN15/OSGM15)

0 50 m

Date:	20/12/2021
Revision Number:	0
Scale:	1:1000 at A3
Illustrator:	NLC
Path:	S:\PROJECTS\232820\GIS\
	FigsMXD\Geophysics

Detailed gradiometer survey results: Greyscale plot (south-east)

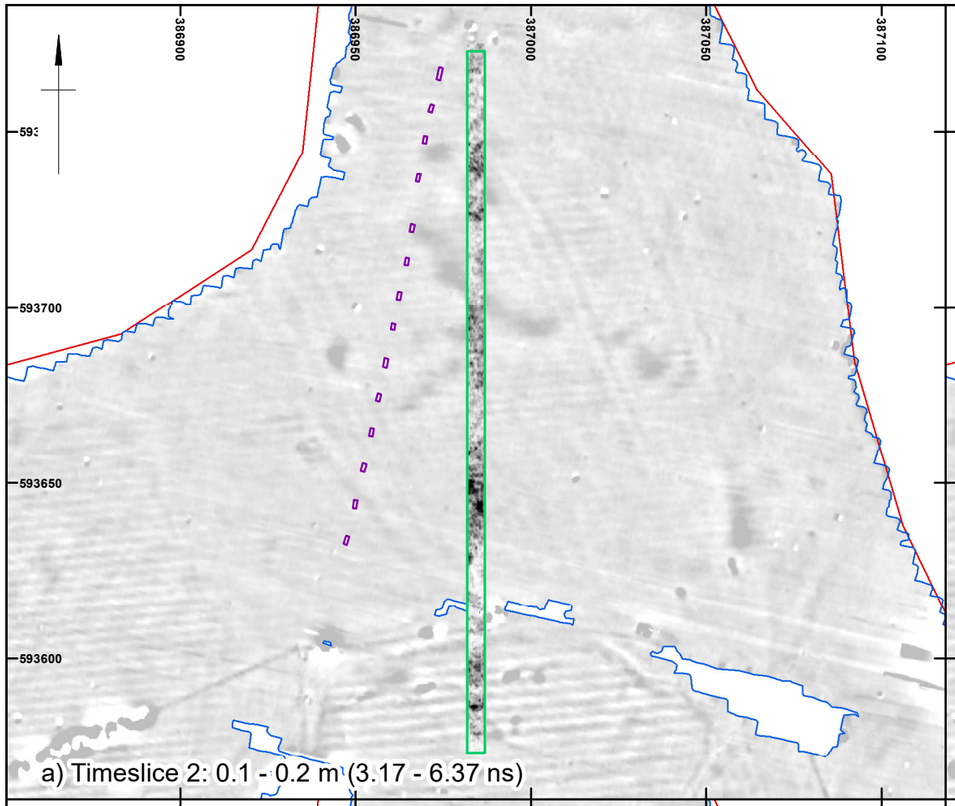
Figure 9

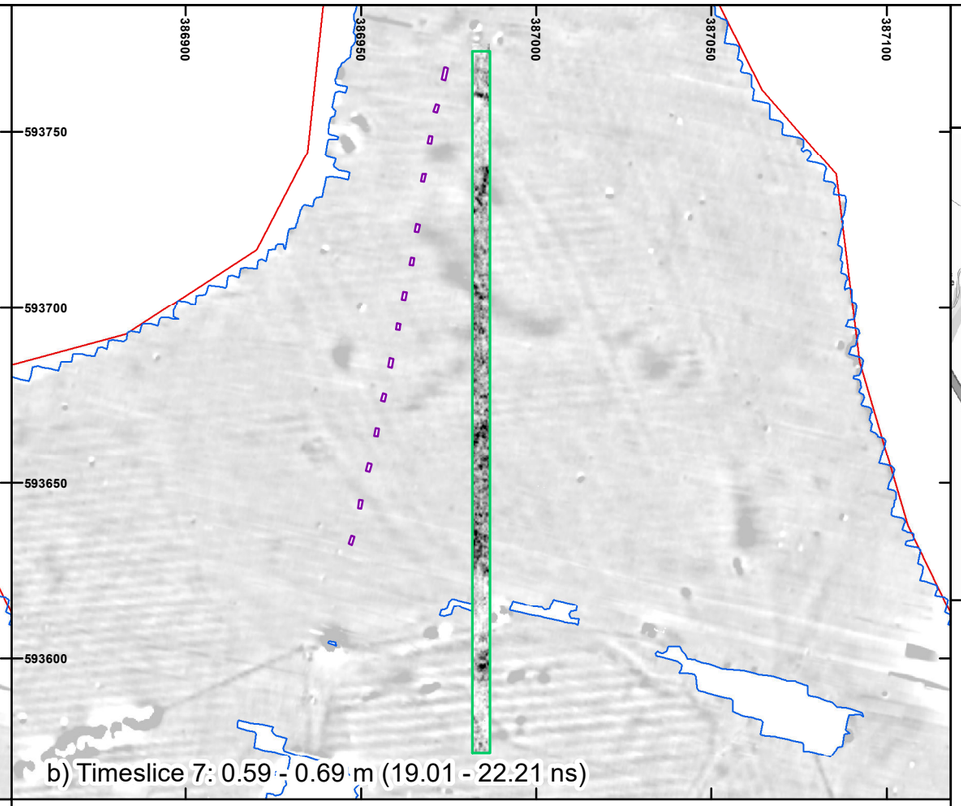


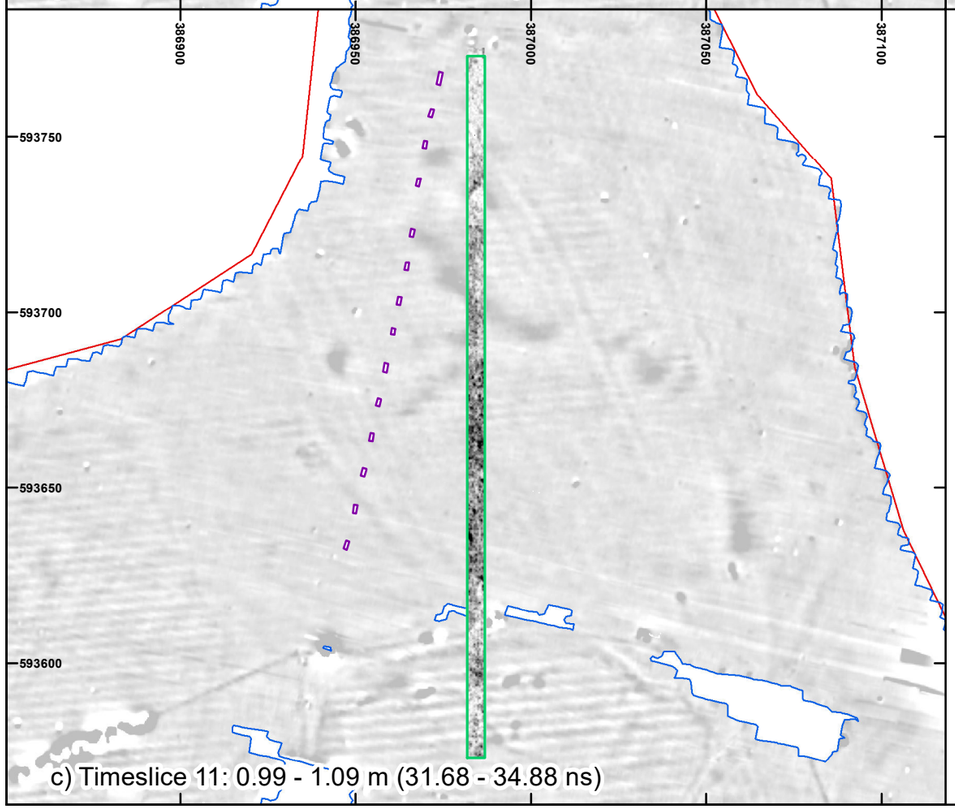
Date:	20/12/2021
Revision Number:	0
Scale:	1:1000 at A3
Illustrator:	NLC
Path:	S:\PROJECTS\232820\GIS\
	FigsMXD\Geophysics

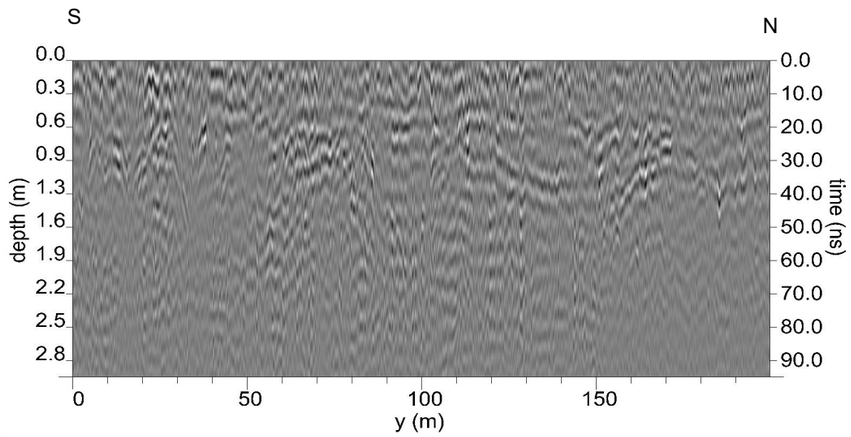
Detailed gradiometer survey results: Interpretation (south-east)

Figure 10

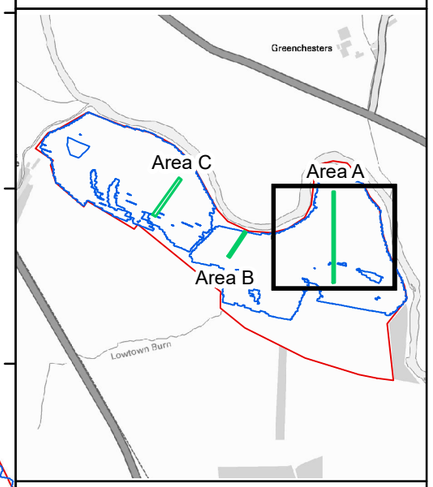








d) Representative radargram



Test pit
GPR survey extents
Gradiometer Survey Extents
Site boundary

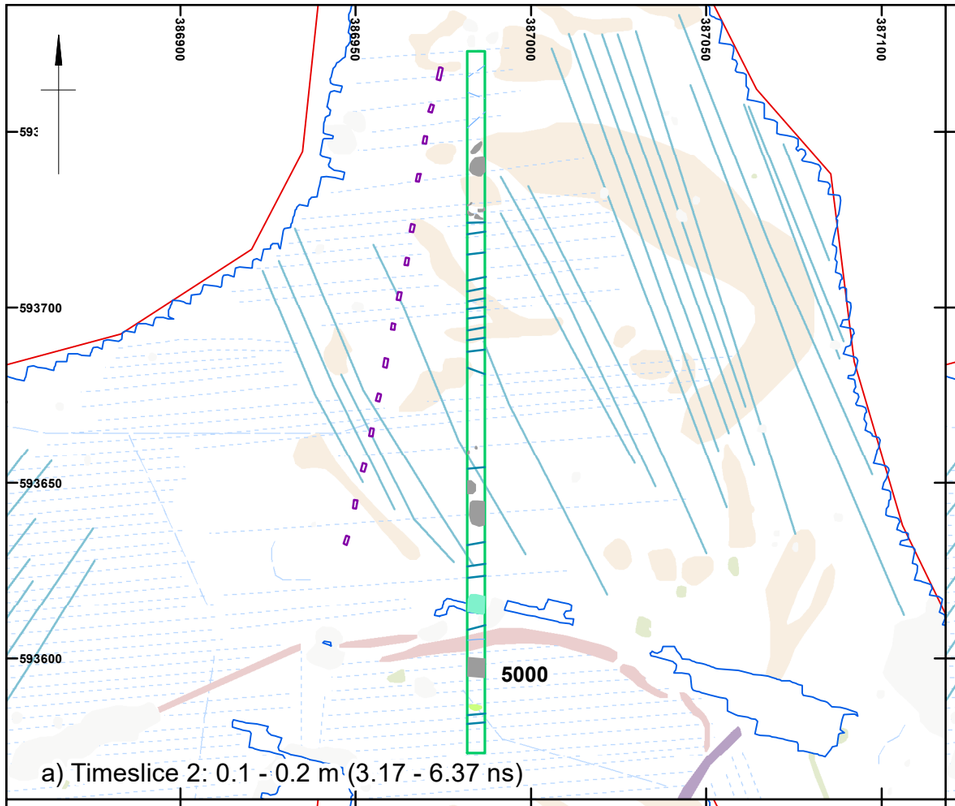
Coordinate system:
OSGB36 (OSTN15/OSGM15)

0 50 m

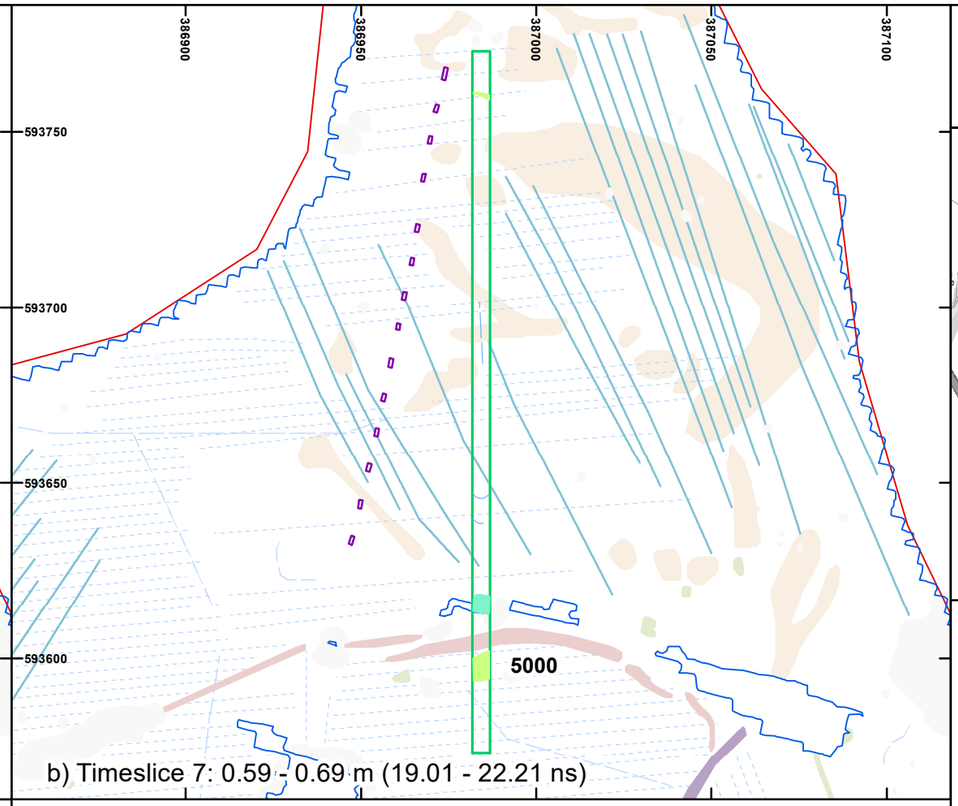
Date:	20/12/2021
Revision Number:	0
Scale:	1:1,750 at A3
Illustrator:	NLC
Path:	S:\PROJECTS\232820\GIS\
	FigsMXD\Geophysics

GPR survey results (Area A): Greyscale timeslices and represetative radargram

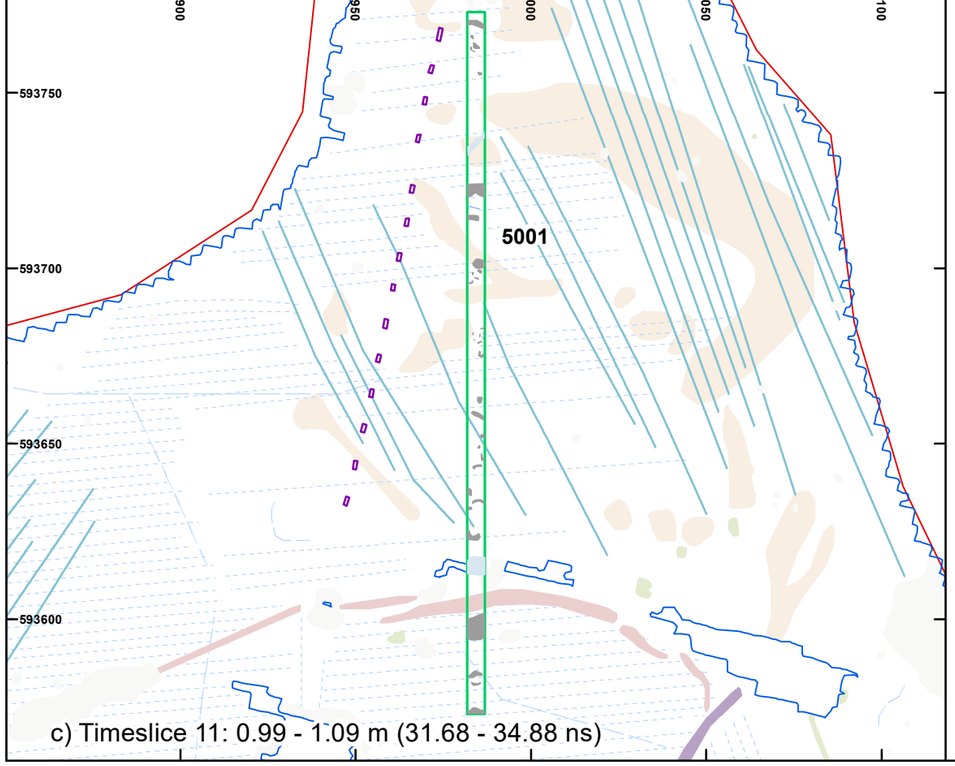
Figure 11



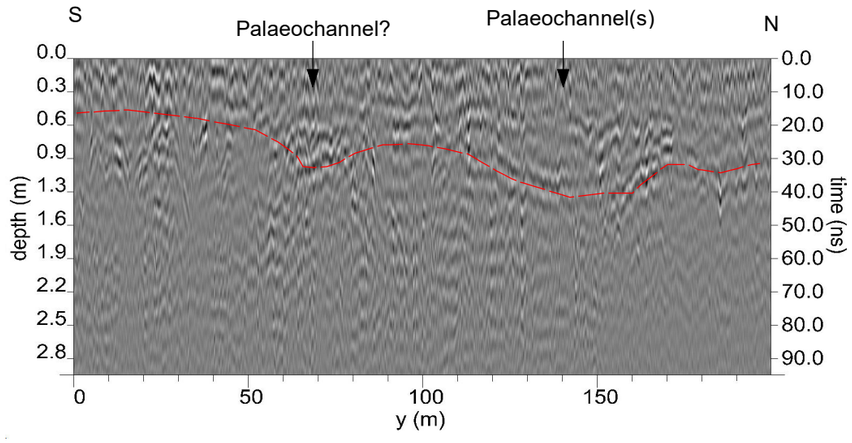
a) Timeslice 2: 0.1 - 0.2 m (3.17 - 6.37 ns)



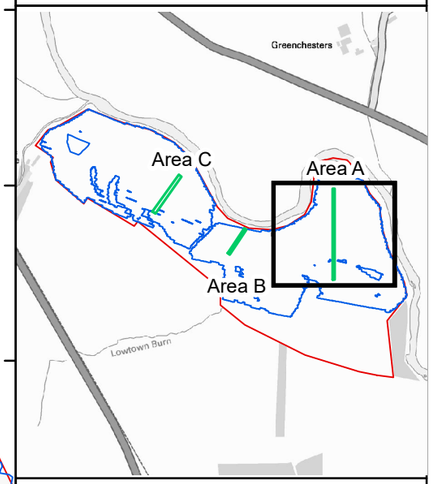
b) Timeslice 7: 0.59 - 0.69 m (19.01 - 22.21 ns)



c) Timeslice 11: 0.99 - 1.09 m (31.68 - 34.88 ns)



d) Representative radargram



- Test pit
- Gradiometer Survey Extents
- Site boundary
- GPR survey extents
- Drainage ditch
- Possible archaeology
- High amplitude
- Superficial geology
- Ridge and furrow
- Trend

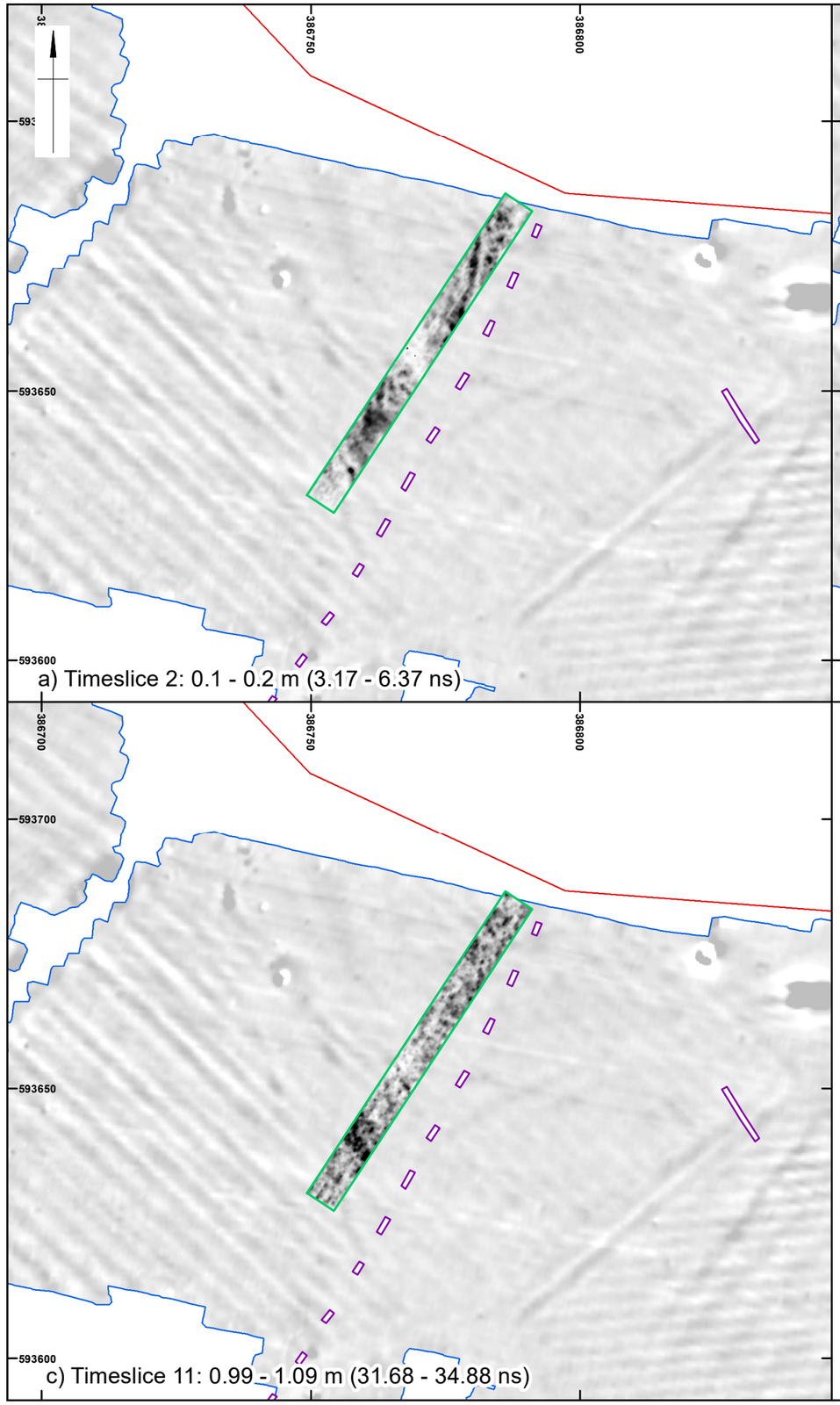
Coordinate system:
OSGB36 (OSTN15/OSGM15)

0 50 m

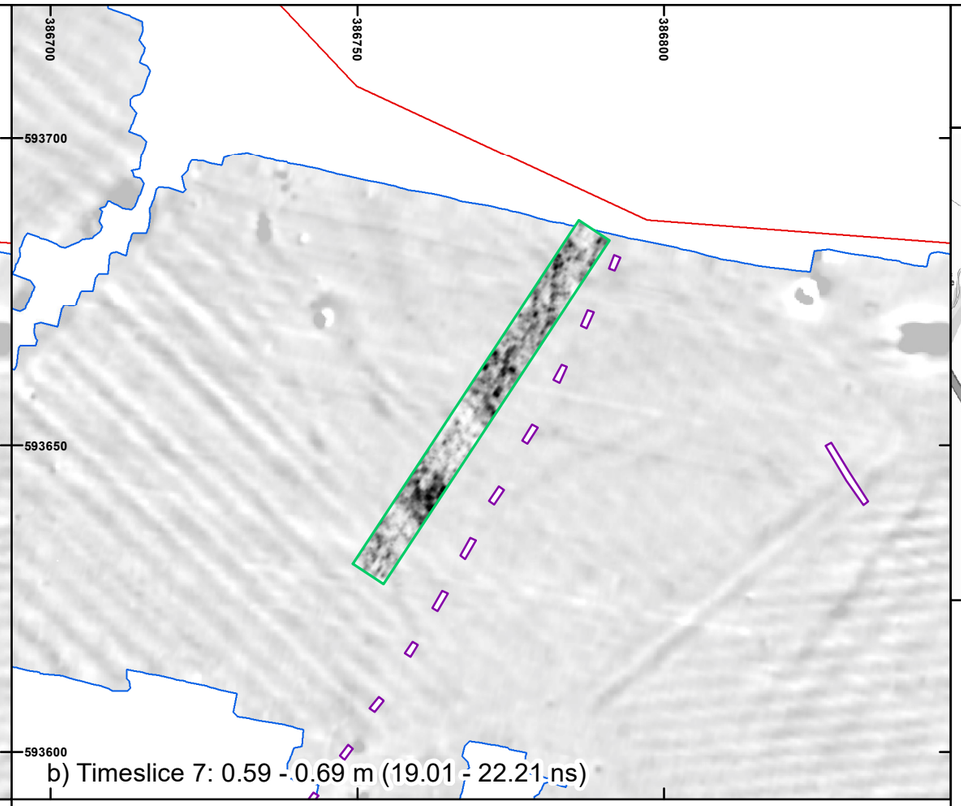
Date:	21/12/2021
Revision Number:	0
Scale:	1:1,750 at A3
Illustrator:	NLC
Path:	S:\PROJECTS\232820\GIS\
	FigsMXD\Geophysics

GPR survey results (Area B): Archaeological interpretation and annotated radargram

Figure 12

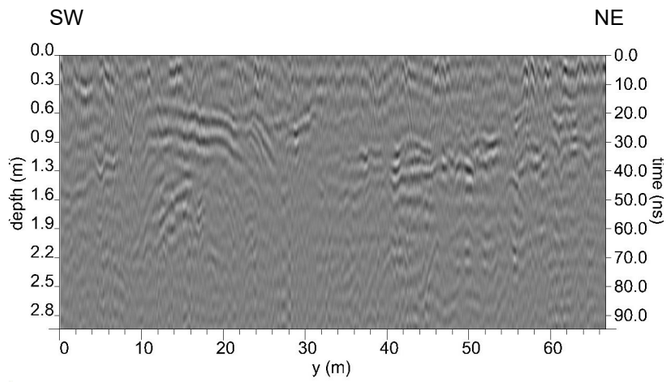


a) Timeslice 2: 0.1 - 0.2 m (3.17 - 6.37 ns)

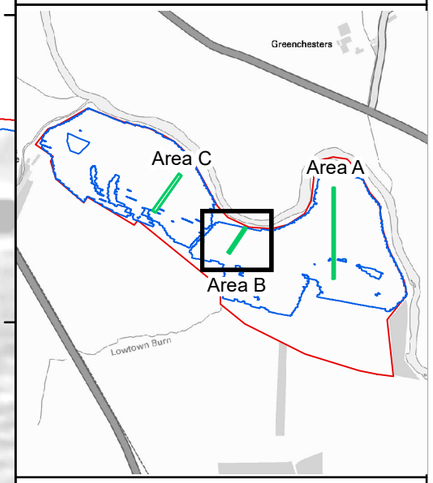


b) Timeslice 7: 0.59 - 0.69 m (19.01 - 22.21 ns)

c) Timeslice 11: 0.99 - 1.09 m (31.68 - 34.88 ns)



d) Representative radargram



Test pit

GPR survey extents

Gradiometer Survey Extents

Site boundary

High Amplitude

Low Amplitude

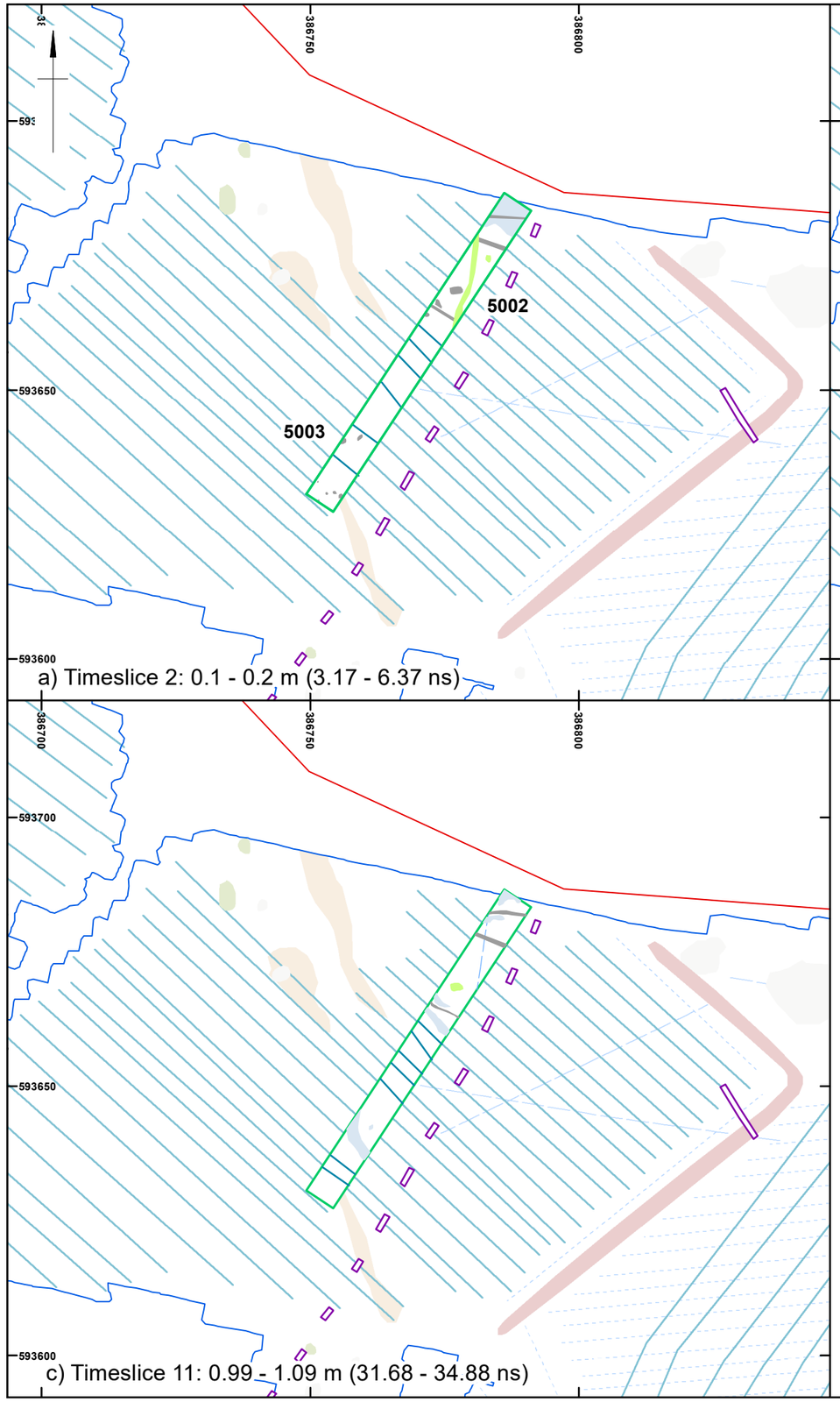
Coordinate system:
OSGB36 (OSTN15/OSGM15)

0 25 m

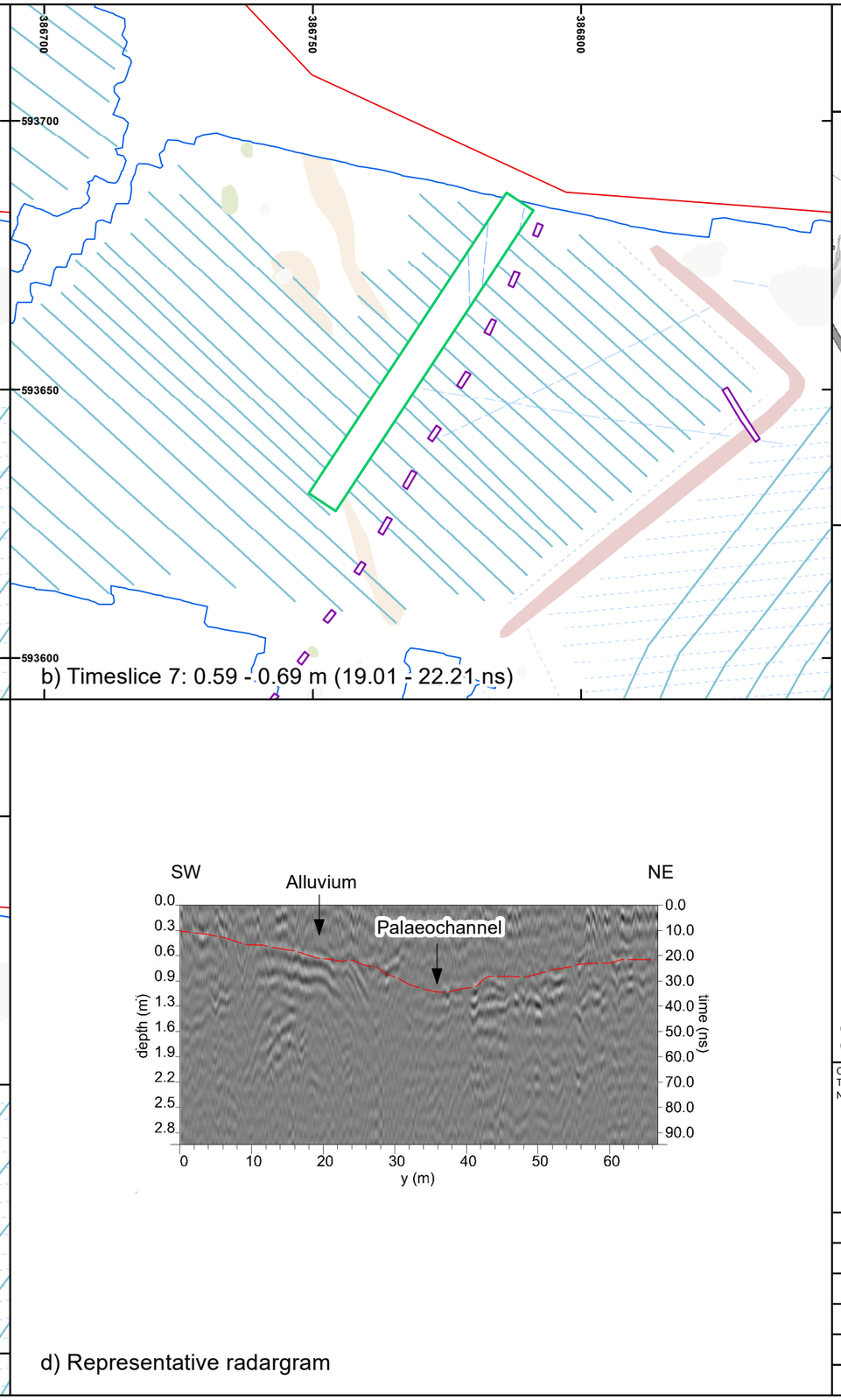
Date:	20/12/2021
Revision Number:	0
Scale:	1:1,750 at A3
Illustrator:	NLC
Path:	S:\PROJECTS\232820\GIS\
	FigsMXD\Geophysics

GPR survey results (Area A): Greyscale timeslices and represetative radargram

Figure 13



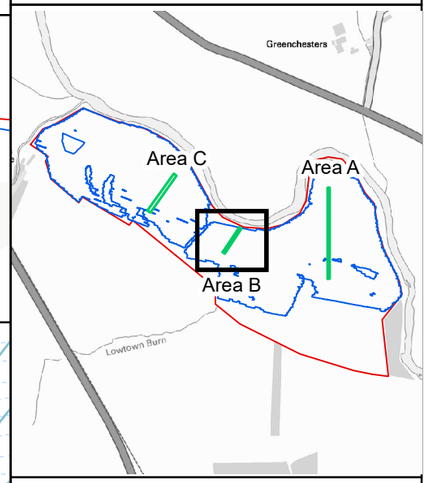
a) Timeslice 2: 0.1 - 0.2 m (3.17 - 6.37 ns)



b) Timeslice 7: 0.59 - 0.69 m (19.01 - 22.21 ns)

c) Timeslice 11: 0.99 - 1.09 m (31.68 - 34.88 ns)

d) Representative radargram



- Test pit
- Gradiometer Survey Extents
- Site boundary
- GPR survey extents
- Drainage ditch
- Possible archaeology
- High amplitude
- Superficial geology
- Ridge and furrow
- Trend

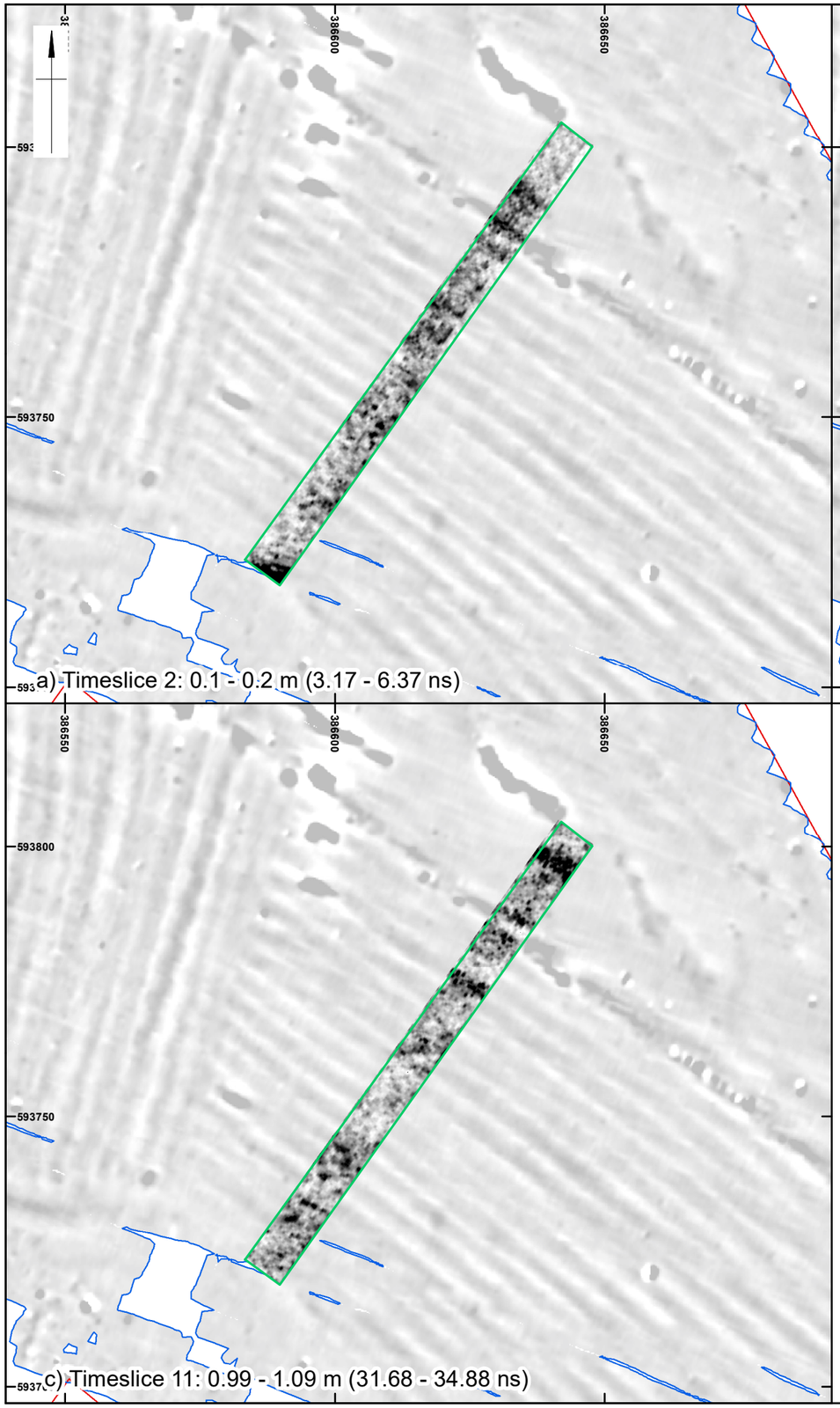
Coordinate system:
OSGB36 (OSTN15/OSGM15)

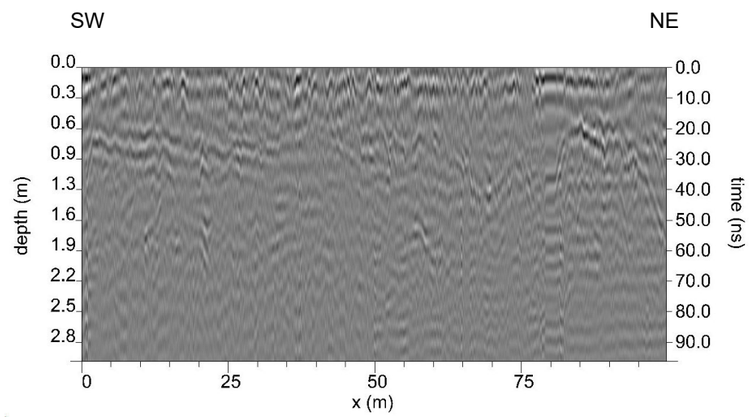
0 25 m

Date:	21/12/2021
Revision Number:	0
Scale:	1:1,000 at A3
Illustrator:	NLC
Path:	S:\PROJECTS\232820\GIS\
	FigsMXD\Geophysics

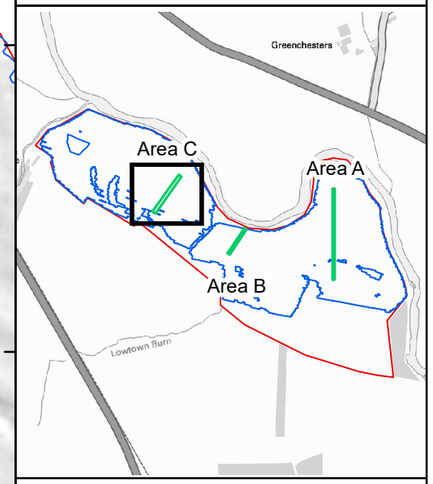
GPR survey results (Area B): Archaeological interpretation and annotated radargram

Figure 14





d) Representative radargram



GPR survey extents
Gradiometer Survey Extents
Site boundary

High Amplitude

Low Amplitude

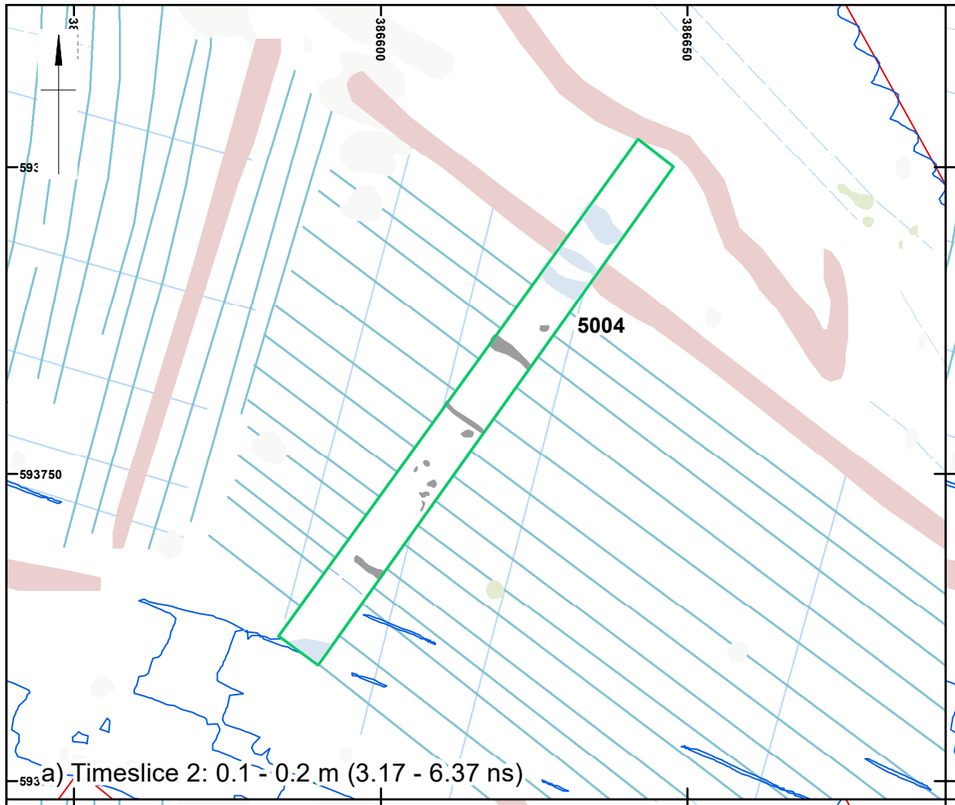
Coordinate system:
OSGB36 (OSTN15/OSGM15)

0 25 m

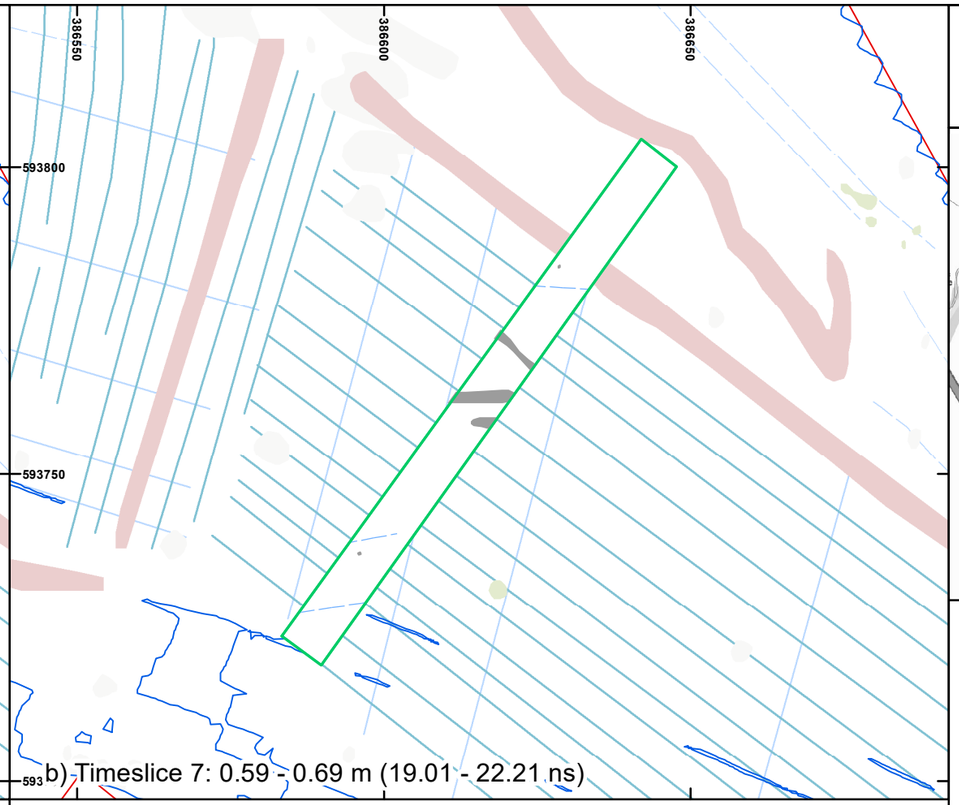
Date:	17/11/2021
Revision Number:	0
Scale:	1:1,750 at A3
Illustrator:	NLC
Path:	S:\PROJECTS\232820\GIS\
	FigsMXD\Geophysics

GPR survey results (Area C): Greyscale timeslices and represetative radargram

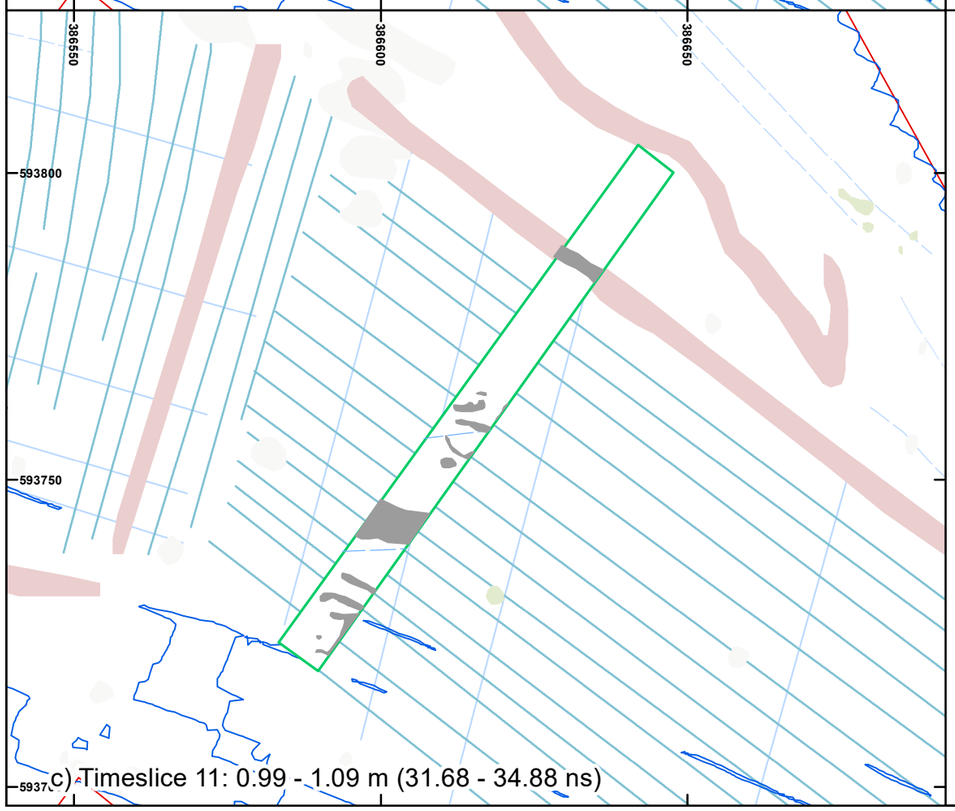
Figure 15



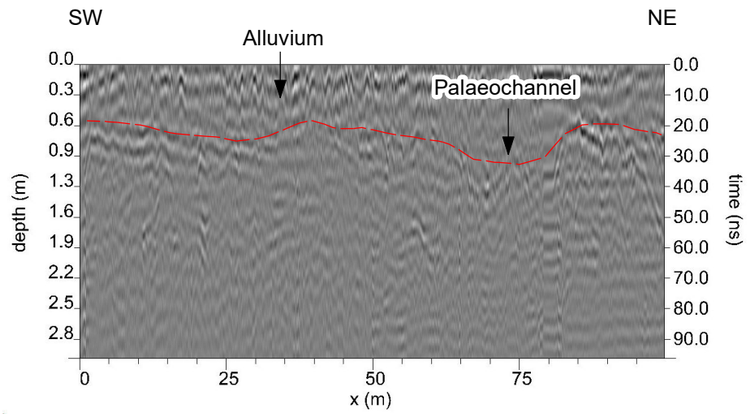
a) Timeslice 2: 0.1 - 0.2 m (3.17 - 6.37 ns)



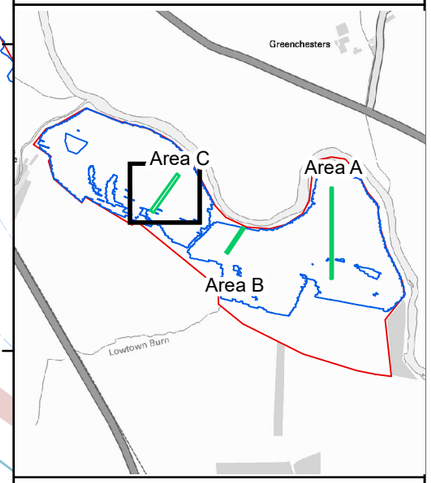
b) Timeslice 7: 0.59 - 0.69 m (19.01 - 22.21 ns)



c) Timeslice 11: 0.99 - 1.09 m (31.68 - 34.88 ns)



d) Representative radargram



- Gradiometer Survey Extents
- Site boundary
- GPR survey extents
- Drainage ditch
- Possible archaeology
- High amplitude
- Superficial geology
- Ridge and furrow
- Trend

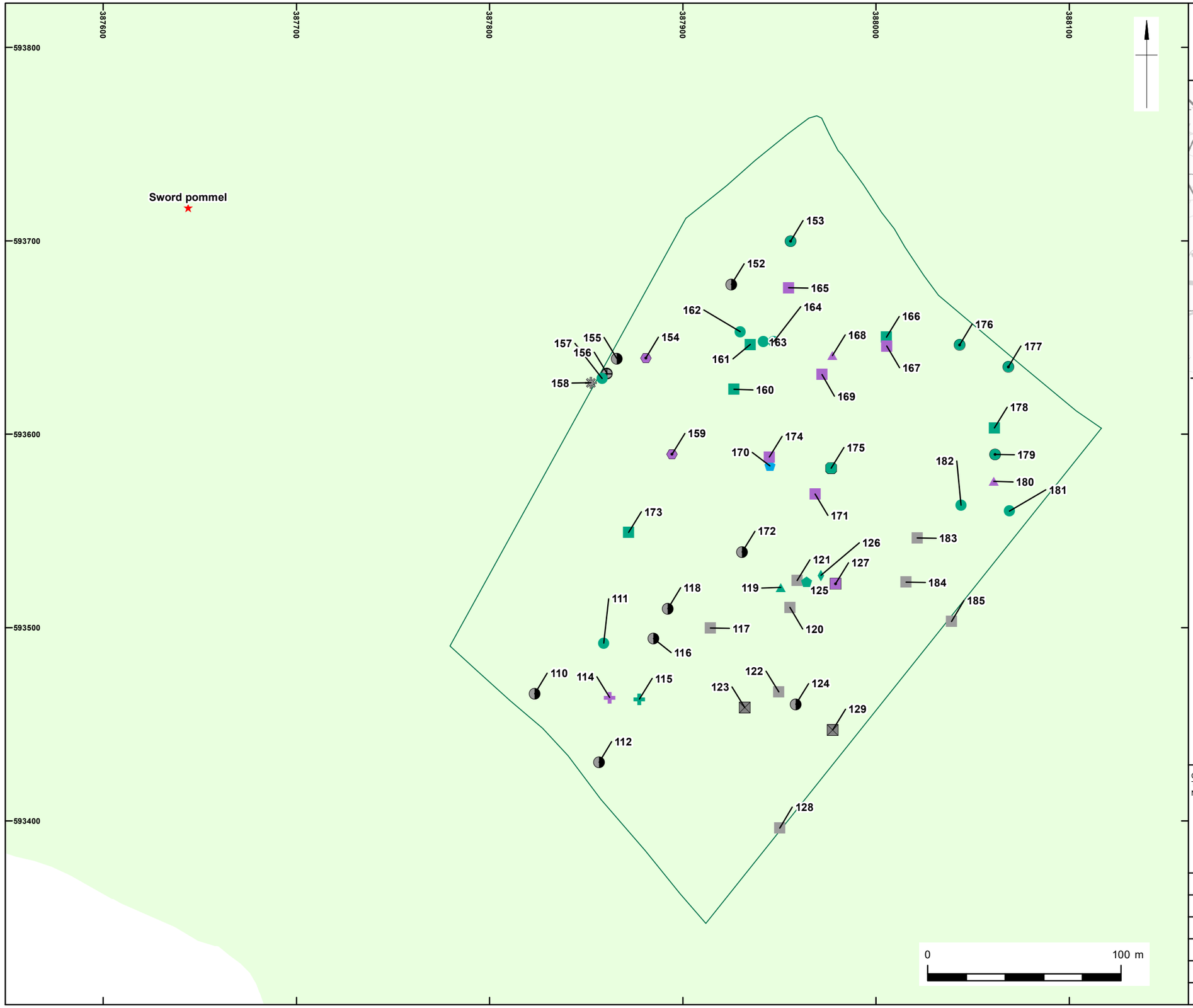
Coordinate system:
OSGB36 (OSTN15/OSGM15)

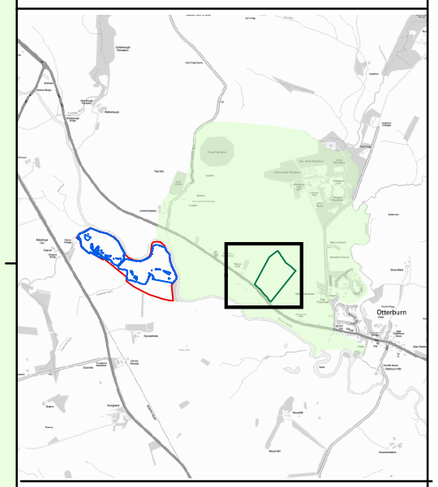
0 25 m

Date:	21/12/2021
Revision Number:	0
Scale:	1:1,000 at A3
Illustrator:	NLC
Path:	S:\PROJECTS\232820\GIS\
	FigsMXD\Geophysics

GPR survey results (Area C): Archaeological interpretation and annotated radargram

Figure 16





Metal detecting survey area

Battlefield

Metal Detecting Finds by Material and Type

- Unknown, Sword pommel
- Ag, Buckle
- Cu, Brooch
- Cu, Buckle
- Cu, Button
- Cu, Coin
- Cu, Cooking Pot fragment
- Cu, Weight/measure
- Cu, Strap end
- Cu, Object
- Fe, Curved object
- Fe, Farrier's file
- Fe, Horseshoe
- Fe, Nail
- Fe, Object
- Pb, Spindle Whorl
- Pb, Strap
- Pb, Weight/measure
- Pb, Fragment
- Pb, Object

Coordinate system:
OSGB36 (OSTN15/OSGM15)

Date:	09/12/2021
Revision Number:	0
Scale:	1:1000 at A3
Illustrator:	RJH
Path:	S:\PROJECTS\232820\GIS\
	FigsMXD\Geophysics

Finds distribution plot of Metal Detecting Survey

Figure 17

APPENDICES

Appendix 1: Gradiometer Survey Equipment and Data Processing

Survey methods and equipment

The magnetic data for this project were acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1 m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1 m separation and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of 0.03 nT over a ±100 nT range, and measurements from each sensor are logged at intervals of 0.25 m. All data are stored on an integrated data logger for subsequent post-processing and analysis.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20 m or 30 m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02 m in real-time and therefore exceed the level of accuracy recommended by European Archaeologiae Consilium (Schmidt *et al.* 2015) for geophysical surveys.

Scanning surveys consist of recording data at 0.25 m intervals along transects spaced 10 m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detailed surveys consist of 20 m x 20 m or 30 m x 30 m grids, and data are collected at 0.25 m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20 m or 30 m grid respectively and are the recommended methodologies for archaeological surveys of this type (Schmidt *et al.* 2015).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125 m intervals along traverses spaced up to 0.25 m apart, resulting in a maximum of 28800 readings per 30 m grid, exceeding that recommended by European Archaeologiae Consilium recommendations (Schmidt *et al.* 2015) for characterisation surveys.

Post-processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:

- Destripe – Applying a zero-mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;

- Destagger – Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;

- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data)

Typical displays of the data used during processing and analysis:

- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies. XY plots can be made available upon request.

Appendix 2: GPR Survey Equipment and Data Processing

Survey Methods and Equipment

The ground penetrating radar (GPR) data were collected using a cart mounted shielded antennae with central frequencies suitable for the types of target being investigated. Lower frequency antennae are able to acquire data from deeper below the surface, whereas higher frequencies allow high resolution imaging of near-surface targets at the expense of deep penetration. The exact make and model of equipment varies.

The depth of penetration of GPR systems is determined by the central frequency of the antenna and the relative dielectric permittivity (RDP) of the material through which the GPR signal passes. In general, soils in floodplain settings may have a wide range of RDPs, although around 8 may be considered average, resulting in a maximum depth of penetration c. 2.5m with the GPR signal having a velocity of approximately 0.1m/ns.

The GPR beam is conical in shape, however, and whilst most of the energy is concentrated in the centre of the cone, the GPR signal illuminates a horizontal footprint, which becomes wider with increasing depth. At the maximum depth of the antenna, it becomes impossible to resolve any feature smaller than the horizontal footprint for the corresponding depth. The size of the footprint is dependent upon central frequency, and its size increases as the central frequency decreases.

The vertical resolution is similarly dependent upon the central frequency; for the 300MHz antenna, features of the order of 0.05m may be resolved vertically. Antennae with lower frequencies can therefore penetrate more deeply but are less resolute in both horizontal and vertical directions. Choice of antenna frequency is guided largely by the anticipated depth to the target and the required resolution.

GPR data for detailed surveys are collected along traverses of varying length separated by 0.5m with cross lines collected running perpendicular to these traverses at wider separations. The data sampling resolution is governed by the data logger and a minimum separation of 0.05m between traces is collected for all surveys.

Post-Processing

The radar data collected during the detail survey are downloaded from the GPR system for processing and analysis using commercial software (GPR Slice). This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

Typical data and image processing steps may include:

- Gain – Amplifies GPR data based upon its position in the profile, which boosts the contrast between anomalies and background. A wobble correction is also applied during this step;
- Background Filter - is used to remove banding noises that are seen across the radargrams
- Bandpass – Removes GPR data lying outside a specified range, which removes high- and low-frequency noise.

Typical displays of the data used during processing and analysis:

- Timeslice – Presents the data as a series of successive plan views of the variation of reflector energy from the surface to the deepest recorded response. The variation in amplitude is represented using a greyscale with black indicating high amplitude and white indicating low amplitude responses.

- Radargram – Presents each radar profile in a vertical view with distance along the profile expressed along the x axis and depth along the y axis. The amplitude variation is expressed using a greyscale.

Appendix 3: Geophysical Interpretation

The interpretation methodology used by Wessex Archaeology separates the anomalies into four main categories: archaeological, modern, agricultural, and uncertain origin/geological.

The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.

- Possible archaeology – used for features which give a response, but which form no discernible pattern or trend.

The modern category is used for anomalies that are presumed to be relatively modern in date:

- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.

- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be observed in gradiometer data. GPR is also known to be very effective at locating buried utilities and they are often identifiable within the radargrams as strong hyperbolic reflectors.

The agricultural category is used for the following:

- Former field boundaries – used for ditch sections that correspond to the position of boundaries marked on earlier mapping.

- Ridge and furrow – used for broad and diffuse linear anomalies that are considered to indicate areas of former ridge and furrow.

- Ploughing – used for well-defined narrow linear responses, usually aligned parallel to existing field boundaries.

- Drainage – used to define the course of ceramic field drains that are visible in the data as a series of repeating bipolar (black and white) responses. These can sometimes repeat or ‘ring’ through GPR datasets, particularly if there are ploughing furrows on the surface

The uncertain origin/geological category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Increased magnetic response – used for areas dominated by indistinct anomalies in gradiometer data, which may have some archaeological potential.

- Trend – used for low amplitude or indistinct linear anomalies.

- Superficial geology – used for diffuse edged spreads considered to relate to shallow geological deposits. They can be distinguished as areas of positive, negative, or broad bipolar (positive and negative) anomalies. These can be distinguished as areas of high and/or low amplitude response in GPR data, but are commonly amorphous in form.

In addition, for the interpretation of GPR datasets two additional categories are also employed:

- High Amplitude – used for features which give a notably high amplitude response but display no discernible pattern.
- Low Amplitude – used for features which give a notably low amplitude response but display no discernible pattern.

Appendix 4: Trench and test pit summaries

NGR coordinates and OD heights taken at centre of each trench; depth bgl = below ground level

Trench No 30	Length 11.50 m	Width 1.10 m	Depth 0.30 m

Context Number	Fill Of/Filled With	Interpretative Category	Description	Depth BGL
3001		Topsoil	Turf and topsoil. Mid greyish brown sandy silt with rooting and turf.	0.0
3002		Alluvium	Mid yellowish brown sandy silt with very occasional charcoal.	0.2
3003	3004	Cut of linear ditch running NE - SW	Ditch is cut into alluvium 3002 and filled with similar alluvial material. Parallel to 3005 to SE	0.45
3004	3003	Secondary fill	Secondary ditch fill. Gradual buildup of material within ditch cut. Mid yellowish brown slightly sandy silt, occasional charcoal.	0.2
3005	3006	Cut of linear ditch running NE - SW	Ditch is cut into alluvium 3002 and filled with similar alluvial material. Parallel to 3003 to NW	0.4
3006	3005	Secondary fill	Secondary ditch fill. Gradual buildup of material within ditch cut. Mid yellowish brown slightly sandy silt, occasional charcoal.	0.2

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 1
Length: 2.50 m	Width: 1.10 m	Depth: 1.20 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
101	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0-0.15		
102	Mid yellowish brown sandy silt with very occasional charcoal flecks and degraded sandstone fragments	Alluvium	0.15-1.2		
103	Mottled mid yellow and pale yellow sand with occasional iron panning	Natural substrate	1.2+		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 2
Length: 2.50 m	Width: 1.10 m	Depth: 1.20 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
201	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0-0.15		

202	Mid yellowish brown sandy silt with very occasional charcoal flecks and degraded sandstone fragments	Alluvium	0.15-1.10		
203	Mottled mid yellow and pale yellow sand with occasional iron panning	Natural substrate	1.10+		

Site Code: 232820	**Site Name: Battle of Otterburn**		**Test Pit ID: 3**		
Length: 2.50 m	**Width: 1.10 m**		**Depth: 1.20 m**		
Context Number	**Description**	**Interpretation**	**Depth m BGL**	**Depth m aOD**	**Samples**
301	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0-0.15		
302	Mid yellowish brown sandy silt with very occasional charcoal flecks and degraded sandstone fragments	Alluvium	0.15-1.00		
303	Mottled mid yellow and pale yellow sand with occasional iron panning	Natural substrate	1.00 +		

Site Code: 232820	**Site Name: Battle of Otterburn**		**Test Pit ID: 4**		
Length: 2.50 m	**Width: 1.10 m**		**Depth: 1.20 m**		
Context Number	**Description**	**Interpretation**	**Depth m BGL**	**Depth m aOD**	**Samples**
401	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0-0.15		
402	Mid yellowish brown sandy silt with very occasional charcoal flecks and degraded sandstone fragments	Alluvium	0.15-1.10		
403	Soft mid brownish grey fine clay with occasional mottling. Appears waterlain	Soft grey clay palaeochannel fill	1.10 +		

Site Code: 232820	**Site Name: Battle of Otterburn**		**Test Pit ID: 5**		
Length: 3 m	**Width: 1.10 m**		**Depth: 1.20 m**		
Context Number	**Description**	**Interpretation**	**Depth m BGL**	**Depth m aOD**	**Samples**
501	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.2		

502	Mid yellowish brown sandy silt with very occasional charcoal flecks and degraded sandstone fragments	Alluvium	0.2 - 1		
503	Soft mid brownish grey fine clay with occasional mottling. Appears waterlain	Fill of possible palaeochannel	1 +		

Site Code: 232820	**Site Name: Battle of Otterburn**	**Test Pit ID: 6**
Length: 3 m	**Width: 1.10 m**	**Depth: 1.20 m**

Context Number	**Description**	**Interpretation**	**Depth m BGL**	**Depth m aOD**	**Samples**
601	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0.0 - 0.2		
602	Mid yellowish brown sandy silt with very occasional charcoal flecks and degraded sandstone fragments	Alluvium	0.2 - 01.0		
603	Soft mid brownish grey fine clay with occasional mottling. Appears waterlain	Fill of palaeochannel	1.0 - 1.1		
604	Band of gravel within palaeochannel fill, sub rounded with course sand and pea grit matrix. Appears natural	Gravel band	1.1 - 1.2		

Site Code: 232820	**Site Name: Battle of Otterburn**	**Test Pit ID: 7**
Length: 3 m	**Width: 1.10 m**	**Depth: 1.20 m**

Context Number	**Description**	**Interpretation**	**Depth m BGL**	**Depth m aOD**	**Samples**
701	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0.0 - 0.25		
702	Mid yellowish brown sandy silt with very occasional charcoal flecks and degraded sandstone fragments. More mottled with pale yellow sand towards base	Alluvium	0.25 - 1		
703	Soft mid brownish grey fine clay with occasional mottling. Appears waterlain	Palaeochannel fill	1.0 - 1.2		<102> 1 small bag

Site Code: 232820	**Site Name: Battle of Otterburn**	**Test Pit ID: 8**
Length: 2.50 m	**Width: 1.10 m**	**Depth: 1.20 m**

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
801	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0.0 - 0.25		
802	Mid yellowish brown sandy silt with very occasional charcoal flecks and degraded sandstone fragments	Alluvium	0.25 - 1.1		
803	Soft mid brownish grey fine clay with occasional mottling. Appears waterlain	Palaeochannel fill	1.1 - 1.2+		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 9
Length: 2.50 m	Width: 1.10 m	Depth: 0.90 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
901	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.25		
902	Mid yellowish brown sandy silt with very occasional charcoal flecks and degraded sandstone fragments. More compact than pits to north	Older alluvium and natural mix	0.25 - 0.7		
903	Mottled mid yellow and pale yellow sand with occasional iron panning	Natural substrate	0.7 +		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 10
Length: 2 m	Width: 1.10 m	Depth: 0.80 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
1001	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.25		
1002	Mid yellowish brown sandy silt with very occasional charcoal flecks and degraded sandstone fragments. More compact than pits to north	Harder alluvium and natural	0.25 - 0.6		
1003	Mottled mid yellow and pale yellow sand and gravel with occasional iron panning	Natural substrate	0.6 +		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 11
Length: 1.50 m	Width: 1.10 m	Depth: 0.40 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
1101	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.25		
1102	Mid yellowish brown sandy silt with very occasional charcoal flecks and degraded sandstone fragments. More compact than in pits 1-8 to north	Alluvium	0.25 - 0.4		
1103	Mottled mid yellow and pale yellow sand and gravel with occasional iron panning	Natural substrate	0.4+		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 12
Length: 1.50 m	Width: 1.10 m	Depth: 0.30 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
1201	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.25		
1202	Mottled mid yellow and pale yellow sand and gravel with occasional iron panning	Natural substrate	0.25 +		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 13
Length: 3 m	Width: 1.10 m	Depth: 0.55 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
1301	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.2		
1302	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium	0.2 - 0.55		
1303	Mottled mid yellow/greyish brown and pale yellow sands and gravels	Natural gravel and sand	0.55 +		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 14
Length: 2.50 m	Width: 1.10 m	Depth: 0.55 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples

1401	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.25		
1402	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium	0.25 - 0.55		
1403	Mottled mid yellow/greyish brown and pale yellow sands and gravels	Natural sand and gravel	0.55 +		

Site Code: 232820	**Site Name: Battle of Otterburn**	**Test Pit ID: 15**
Length: 2 m	**Width: 1.10 m**	**Depth: 0.60 m**

Context Number	**Description**	**Interpretation**	**Depth m BGL**	**Depth m aOD**	**Samples**
1501	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.25		
1502	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium	0.25 - 0.6		
1503	Mottled mid yellow/greyish brown and pale yellow sands and gravels	Natural sand and gravel	0.6 +		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 16
Length: 2.50 m	Width: 1.10 m	Depth: 0.90 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
1601	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.25		
1602	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium	0.25 - 0.6		
1603	Mottled mid yellow/greyish brown and pale yellow sands and gravels	Mixed sands and gravels	0.6 +		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 17
Length: 2.50 m	Width: 1.10 m	Depth: 0.85 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
1701	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.25		
1702	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium	0.25 - 0.85		
1703	Mottled mid yellow/greyish brown and pale yellow sands and gravels	Natural sands and gravels	0.85 +		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 18
Length: 2 m	Width: 1.10 m	Depth: 0.75 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
1801	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.3		
1802	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium and sand mix	0.3 - 0.75		
1803	Mottled mid yellow/greyish brown and pale yellow sands and gravels	Natural sands and gravels	0.75 +		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 19
Length: 2.50 m	Width: 1.10 m	Depth: 0.55 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
1901	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.25		
1902	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium	0.25 - 0.55		
1903	Mottled mid yellow/greyish brown and pale yellow sands and gravels	Natural sands and gravels	0.55 +		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 20
Length: 2.50 m	Width: 1.10 m	Depth: 0.70 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
2001	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.25		
2002	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium	0.25 - 0.7		
2003	Mottled mid yellow/greyish brown and pale yellow sands and gravels	Natural sands and gravels	0.7 +		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 21
Length: 2.50 m	Width: 1.10 m	Depth:

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
2101	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.25		
2102	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium	0.25 - 0.5		
2103	Banded mid yellowish brown sandy silt and mid brownish yellow sand	Mixed alluvial and sand deposit- multiple flooding deposits?	0.5 - 1		
2104	Mid greyish brown silty clay with occasional charcoal flecks	Palaeochannel fill	1+		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 22
Length: 2.50 m	Width: 1.10 m	Depth: 1.20 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
2201	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.25		
2202	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium	0.25 - 0.5		
2203	Banded mid yellowish brown sandy silt and mid brownish yellow sand	Mixed alluvial and sand deposit- multiple flooding deposits?	0.5 - 0.9		
2204	Mid greyish brown silty clay with occasional charcoal flecks	Palaeochannel fill	0.9 +		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 23
Length: 2.50 m	Width: 1.10 m	Depth: 0.80 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
2301	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.15		
2302	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium	0.15 - 0.4		
2303	Banded mid yellowish brown sandy silt and mid brownish yellow sand	Alluvium and sand mix- flood deposit?	0.4 - 0.65		
2304	Mid greyish brown silty clay with occasional charcoal flecks	Palaeochannel fill	0.65 +		<101> 20 litres

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 24
Length: 2.50 m	Width: 1.10 m	Depth: 1.20 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
2401		Turf and topsoil	0 - 0.25		
2402	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium	0.25 - 0.4		
2403	Banded mid yellowish brown sandy silt and mid brownish yellow sand	Alluvium and sand mix- flood deposit?	0.4 - 1		
2404	Mid grey and mid brown mottled silty clay	Palaeochannel fill	1.00 +		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 25
Length: 2.50 m	Width: 1.10 m	Depth: 1.20 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
2501	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.15		
2502	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium	0.15 - 0.4		
2503	Banded mid yellowish brown sandy silt and mid brownish yellow sand	Sand and alluvium mixture	0.4 - 0.8		
2504	Mid greyish brown silty clay with occasional charcoal flecks	Palaeochannel fill	0.8 +		

Site Code: 232820	Site Name: Battle of Otterburn	Test Pit ID: 26
Length: 2.50 m	Width: 1.10 m	Depth: 0.60 m

Context Number	Description	Interpretation	Depth m BGL	Depth m aOD	Samples
2601	Dark greyish yellowish brown sandy silt with rooting and turf	Turf and topsoil	0 - 0.15		
2602	Mid yellowish brown sandy silt with very occasional charcoal flecks	Alluvium	0.15 - 0.4		
2603	Mottled mid yellow/greyish brown and pale yellow sands and gravels	Natural sands and gravels	0.4 +		

Appendix 5: Assessment of the environmental evidence

Table 4: Assessment of the environmental evidence

Test Pit	Feature Type	Context	Sample Code	Sample vol. (l)	Flot vol. (ml)	Bioturbation proxies	Charcoal >2mm (ml)	Charcoal	Waterlogged vegetative parts	Waterlogged plant remains	Invertebrates	Preservation	Other
7	Palaeochannel	703	232820_102	0.1	100	n/a	-	-	A** (woody frags.), *Alnus glutinosa* twigs and stemwood/ branchwood + bark	*Carex* sp. seed C	*Daphnia ephippia* A, caddis fly (Trichoptera) larval cases A, beetles C	Good	-
23	Palaeochannel	2304	232820_101	15	20	5%, B	Trace	*Calluna vulgaris* tp. stems A*, *Fraxinus excelsior*	-	-	-	Mixed	Coal A*, clinker/cinder A*, fragmented

Scale of abundance: C = <5, B = 5–10, A = 10–30, A* = 30–100, A** = 100–500, A*** = >500; Bioturbation proxies: Roots (%), Uncharred seeds (scale of abundance)

Appendix 6: Oasis record