WYAS Archaeological Services

Land at Minster Way

Beverley

East Yorkshire

Geophysical Survey

Report no. 3193
August 2018

Client: Peter Ward Homes Ltd.

West Yorkshire Joint Services

Land at Minster Way
Beverley,
East Yorkshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey, was undertaken on approximately 16 hectares of land located to the north of Minster Way, Beverley, East Yorkshire. Responses that have been interpreted as archaeology and possible archaeology have been detected in the survey area such as enclosures, linear and curvi-linear trends. Agricultural trends can be seen throughout the survey area in the form of modern ploughing and former field boundaries. Geological anomalies have also been recorded. Therefore, based on the results and interpretation of the data, the archaeological potential is considered to be high to medium.

WYAS
Archaeological
Services

Report Information

Client:	Peter Ward Homes Ltd
Address:	Annie Reed Road, Beverley, East Yorkshire, HU17 0LF
Report Type:	Geophysical Survey
Location:	Beverley
County:	North Yorkshire
Grid Reference:	TA 03515 37760
Period(s) of activity:	Prehistoric
Report Number:	3193
Project Number:	8408
Site Code:	MWB18
OASIS ID:	archaeol1-329555
Date of fieldwork:	August 2018
Date of report:	September 2018
Project Management:	Emma Brunning BSc MCIfA
Fieldwork:	Chris Sykes BSc MSc MCIfA
	Alastair Trace BSc MSc
	Claire Stephens BA
	Michael Offley BA
Report:	Emma Brunning & Alastair Trace
Illustrations:	Emma Brunning
Research:	Emma Brunning

Authorisation for distribution: ----------

Nepshaw Lane South, Morley, Leeds LS27 7JQ
Telephone: 0113 535 0163
Email: admin@aswyas.com

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1 Introduction

Archaeological Services WYAS (ASWYAS) were commissioned by the Ed Dennison Archaeological Services Ltd on behalf of Peter Ward Homes Ltd (the Client), to undertake a geophysical (magnetometer) survey on land north of Minster Way, Beverley, East Yorkshire. Guidance contained within the National Planning Policy Framework (MHCLG 2018) was followed, in line with current best practice (CIfA 2014; David *et al*. 2008). The survey was carried out between the 27th and the 31st August 2018 to provide additional information on the archaeological resource of the Proposed Development Area (PDA).

Site location, topography and land-use

The survey area is approximately centered on National Grid Reference TA 03515 37760 and located to the south of Beverley (Fig. 1). The proposed geophysical area is approximately 16 hectares comprising of one field used for arable cultivation.

The site area is bounded to the south by (Beverley Southern Relief Road), to the west by Shepherd Lane, to the north by residential housing and to the east by further arable fields. The site lies at approximately 12m above Ordnance Datum (aOD) across the whole survey area.

Soils and geology

The underlying bedrock comprises Flamborough Chalk Formation overlain by superficial deposits of Devensian Till (BGS 2018). The overlying soils are classified in the Holderness association, described as slow permeable seasonally waterlogged (SSEW 1983).

2 Archaeological Background

A desk-based assessment for the proposed Beverley Southern Relief Road was undertaken in 2011 (WYG 2011, which included a 1km study area. This document contains a detailed analysis of the archaeological and historical background of the area. No archaeological features were identified within the PDA, apart from some unclassified cropmarks. An Archaeological Assessment for the proposed development, being prepared at the same time as the geophysical survey took place, identified unclassified cropmarks in the centre and eastern part of the PDA, as well as a small 19th century field barn and enclosure identified from the first edition Ordnance Survey (OS) map in the approximate centre of the north-west boundary of the PDA (Dennison 2018).

The first edition (OS) map shows the development site as undeveloped land sub-divided into several fields. Later OS maps show little change to the development site although Beverley is shown as gradually expanding.

An archaeological investigation was undertaken along the southern boundary of the PDA, prior to the construction of the Beverley Southern Relief Road (Minster Way). This

investigation comprised of a 38.7 hectares geophysical survey, undertaken by Stratascan (Graham 2008), and targeted archaeological excavation by AOC archaeology.

The geophysics identified a number of positive and negative anomalies of archaeological origin. Most important of which were two curvilinear enclosures, and a notable rectilinear feature. Several additional linear anomalies were identified thought to represent cut features such as ditches and bank features.

The excavation undertaken by AOC archaeology (AOC 2015) identified a complex sequence of occupational activity at the site spanning the late Iron Age to the medieval period. A small late Iron Age settlement site, represented by three roundhouse ring gullies and a boundary ditch, were recorded. These were superseded by a large rectilinear enclosure and two additional ring gullies, the latter thought to represent ancillary enclosures rather than dwellings. It is suggested that the rectilinear enclosure would have contained a roundhouse but that this lay beyond the limit of excavation.

A phase of activity datable to the early Roman period was also identified (2nd and early 3rd centuries AD). During the late Roman period (late 3rd and 4th centuries AD) a rectilinear field system was established on the western part of the site and the central part of the site became of focus of activity. Numerous pits and small gullies were excavated in this area, and there is evidence for at least two posthole structures.

3 Aims and Methodology

The aims and objectives of the programme of geophysical survey were to gather sufficient information to establish the presence/absence, character and extent, of any archaeological remains within the specific area to inform an assessment of the archaeological potential of the site. To achieve this aim, a magnetometer survey covering all amenable parts of the PDA was undertaken (see Fig. 2).

The general objectives of the geophysical survey were:

- to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- to therefore determine the presence/absence and extent of any buried archaeological features; and
- to prepare a report summarising the results of the survey.

Magnetometer survey

The site grid was laid out using a Trimble VRS differential Global Positioning System (Trimble R6 model). The survey was undertaken using Bartington Grad601 magnetic gradiometers. These were employed taking readings at 0.25m intervals on zig-zag traverses 1.0m apart within 30m by 30m grids, so that 3600 readings were recorded in each grid. These readings were stored in the memory of the instrument and later downloaded to computer for processing and interpretation. Geoplot 3 (Geoscan Research) software was used to process and present the data. Further details are given in Appendix 1. The data was collected across the known and identified ridge and furrow, different for each field. As such grid north was adjusted for each field appropriately.

Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 displays processed magnetometer data at a scale of 1:2500 with Figure 3 displaying an overall interpretation at the same scale. The processed and minimally processed data, together with an interpretation of the survey results are presented in Figures 4 to 12 inclusive at a scale of 1:1250.

Technical information on the equipment used, data processing and survey methodologies are given in Appendix 1. Technical information on locating the survey area is provided in Appendix 2. Appendix 3 describes the composition and location of the archive. Appendix 4 will include an OASIS form.

The survey methodology, report and any recommendations comply with guidelines outlined by English Heritage (David *et al.* 2008) and by the Chartered Institute for Archaeologists (CIfA 2014).

The figures in this report have been produced following analysis of the data in processed formats and over a range of different display levels. All figures are presented to most suitably display and interpret the data from this site based on the experience and knowledge of Archaeological Services staff.

4 Results and Discussion (see Figures 4 to 12)

Ferrous anomalies

Ferrous anomalies, as individual 'spikes', or as large discrete areas are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris or material is common on rural sites, often being present as a consequence of manuring or tipping/infilling.

Geological anomalies

Anomalies associated with a likely geological or pedological origin have been recorded throughout and are seen to have caused a 'speckling' like effect within the data. It is thought that the responses have been detected because of the variation in the composition and depth of the soils and deposits of superficial material in which they derive.

These responses are concentrated to the eastern and southern sections of the survey area and are similar to the anomalies detected by the previous geophysical survey along the Beverley Southern Relief Road (Graham 2008). It is highly likely that some of these responses will have masked any archaeology.

Agricultural anomalies

Former field boundaries have been identified throughout the survey area, those marked on the interpretation diagram as **A1** correspond to the 1855-1913 Ordnance Survey 6 inch mapping. The former boundaries show on the old mapping until 1961 (NLS 2018).

Other linear trends have also been recorded as former field boundaries but do not show on the old mapping, it is possible that these either predate any available mapping or are associated with other agricultural origins.

The thin and tightly packed agricultural anomalies across the site are indicative of modern agricultural practice, rather than ridge and furrow, which generally are wider spaced and broader in magnetic signature.

Possible archaeological anomalies

A number of linear and curvi-linear trends have been detected which are likely to be of archaeological interest. However, the magnetic signature from these anomalies is relatively weak and therefore any interpretation is cautious.

Anomalies (**P1**) along the southern limits of the dataset consist of linear and curvi-linear trends and small pit-like responses. In view of the archaeological features excavated to the immediate south, these anomalies may be an extension of the prehistoric settlement.

A negative response (**P2**) appears to form a large rectilinear anomaly, measuring approximately 70m along its east to west axis. One possible interpretation is that foundation remains are *in situ* although this is pure speculation and due to the amount of geological responses within this area the same interpretation for this anomaly cannot be dismissed.

Anomalies (**P3**) along the northern limits have also been interpreted as of a possible archaeological interest although they do not form any patterns and again, a geological origin is also likely.

Archaeological anomalies

Strong magnetic responses have been located in the northwest of the dataset comprising ditch-like features and linear trends suggesting a rectilinear enclosure measuring approximately 32m by 20m. Further trends and short ditch length can be seen immediately to the south which are likely to be associated. A ditch can also be seen running from the southeastern corner of the enclosure running on a northwest to southeast alignment before the response lessens in magnetic strength and is shown as a possible archaeological trend. Mapping from 1855 records a field boundary in the approximate position of this mapping, and the archaeological potential may reflect late nineteenth century agriculture.

5 Conclusions

The magnetic survey has detected anomalies of an archaeological origin in the form of an enclosure, further ditches and linear trends. A number of possible archaeological anomalies have also been recorded which may form ring ditches, enclosures, pits and linear trends.

Old field boundaries which correspond to former mapping can be seen along with modern ploughing trends. Geological responses have been recorded throughout which has made the interpretation on a whole difficult.

Based on the geophysical survey the archaeological potential is deemed to be high to medium.

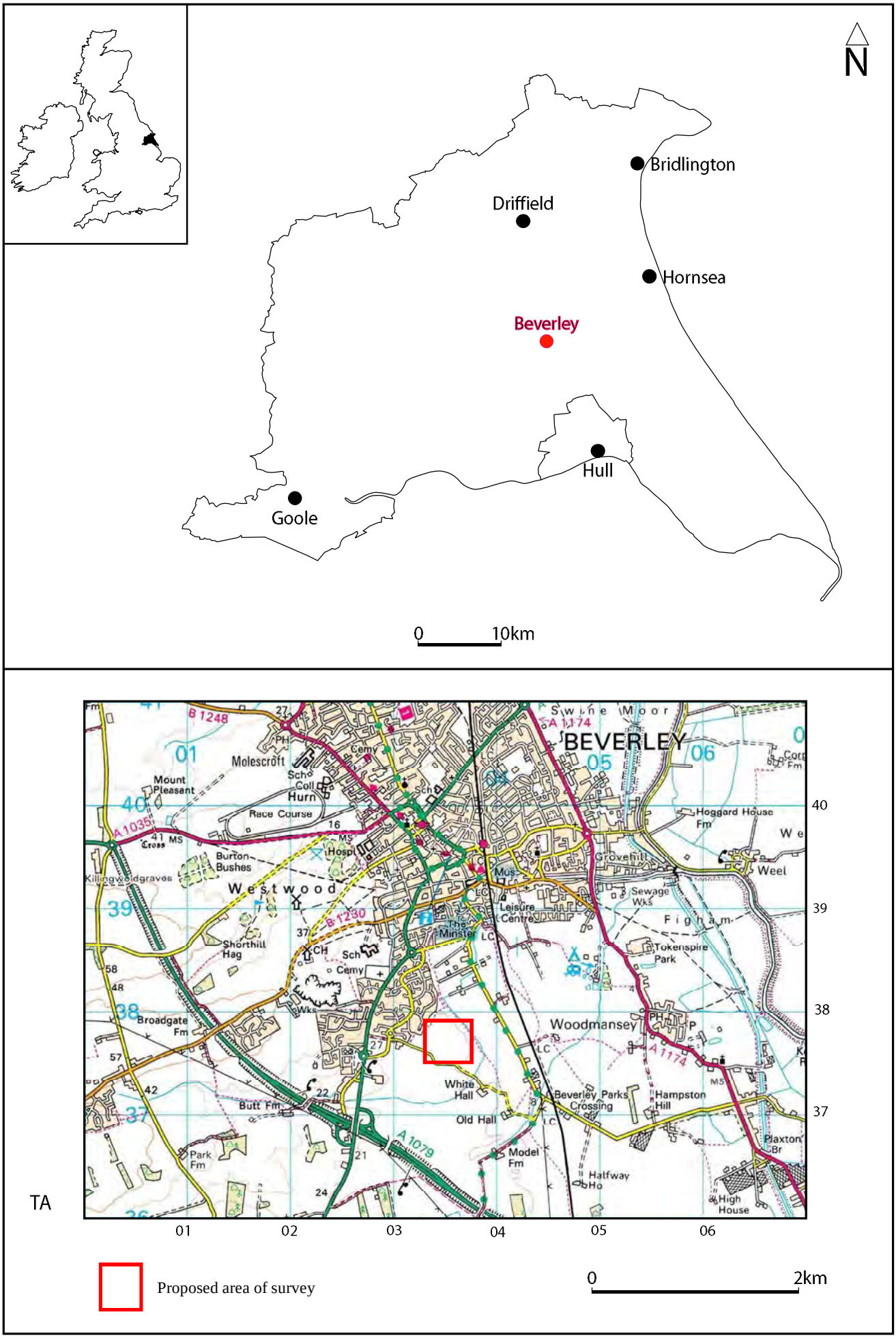

Fig. 1. Site location

PROJECT ID: 8408_MWB18	
	SURVEY BOUNDARY
	SECTOR BOUNDARY

N

SECTOR 1
SEE FIGS 4-6

SECTOR 3
SEE FIGS 10-12

SECTOR 2
SEE FIGS 7-9

438000

437800

437600

2.0

-1.0

nT

5032 00

5034 00

5036 00

5038 00

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0 100m

Fig. 2. Location of survey area showing greyscale magnetometer data (1:2500 @ A3)

PROJECT ID: 8408_MWB18	
	SECTOR BOUNDARY

TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	OLD FIELD BOUNDARY
	LINEAR TREND	AGRICULTURAL
	MAGNETIC ENHANCEMENT	GEOLOGY
	LINEAR TREND	GEOLOGY
	MAGNETIC ENHANCEMENT	ARCHAEOLOGY?
	LINEAR TREND	ARCHAEOLOGY?
	MAGNETIC ENHANCEMENT	ARCHAEOLOGY
	LINEAR TREND	ARCHAEOLOGY

N

SECTOR 1
SEE FIGS 4-6

SECTOR 2
SEE FIGS 7-9

SECTOR 3
SEE FIGS 10-12

P3
A1
P2
P1

438000
437800
437600

503200
503400
503600
503800

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0 100m

Fig. 3. Overall interpretation of magnetometer data (1:2500 @ A3)

PROJECT ID: 8408_MWB18

SECTOR BOUNDARY

N

2.0

-1.0

nT

438000

437800

503400

503600

0 50m

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Fig. 4. Processed greyscale magnetometer data: Sector 1 (1:1250 @ A3)

PROJECT ID: 8408_MWB18

SECTOR BOUNDARY

N

438000

20.0 nT/cm

437800

5034 00

5036 00

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Fig. 5. XY trace plot of minimally processed magnetometer data: Sector 1 (1:1250 @ A3)

0 50m

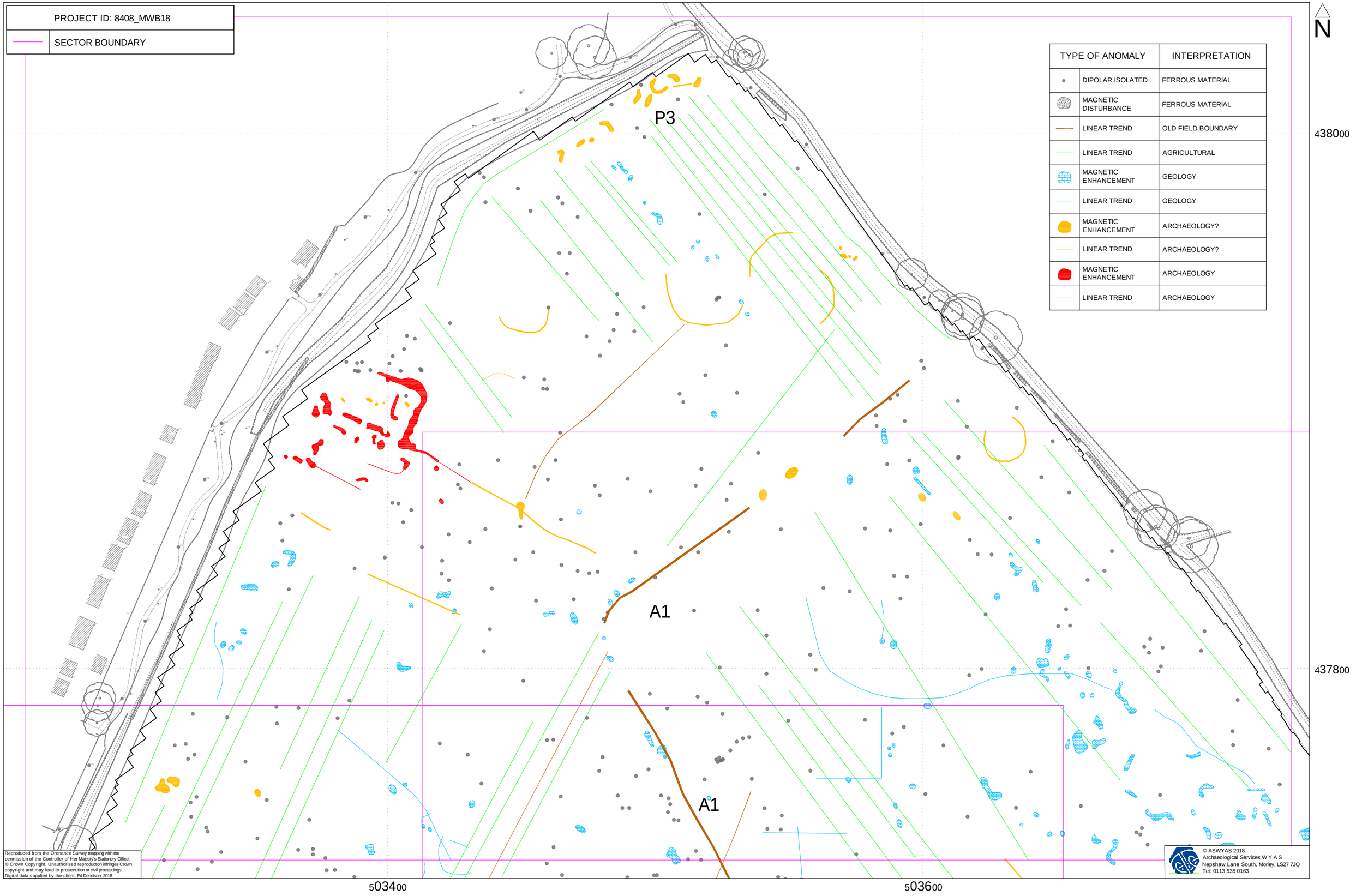

Fig. 6. Interpretation of magnetometer data: Sector 1 (1:1250 @ A3)

PROJECT ID: 8408_MWB18

SECTOR BOUNDARY

N

2.0

-1.0

nT

438000

5034 00

5036 00

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0 50m

Fig. 7. Processed greyscale magnetometer data: Sector 2 (1:1250 @ A3)

PROJECT ID: 8408_MWB18

SECTOR BOUNDARY

N

4380 00

20.0 nT/cm

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Tel: 0113 535 0163

5034 00

5036 00

0 50m

Fig. 8. XY trace plot of minimally processed magnetometer data: Sector 2 (1:1250 @ A3)

PROJECT ID: 8408_MWB18

SECTOR BOUNDARY

N

A1

A1

A1

A1

P2

P2

P1

P1

P1

TYPE OF ANOMALY		INTERPRETATION
	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	OLD FIELD BOUNDARY
	LINEAR TREND	AGRICULTURAL
	MAGNETIC ENHANCEMENT	GEOLOGY
	LINEAR TREND	GEOLOGY
	MAGNETIC ENHANCEMENT	ARCHAEOLOGY?
	LINEAR TREND	ARCHAEOLOGY?

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438000

503400

503600

0 50m

Fig. 9. Interpretation of magnetometer data: Sector 2 (1:1250 @ A3)

PROJECT ID: 8408_MWB18

SECTOR BOUNDARY

N

437800

437600

2.0

-1.0

nT

5036 00

5038 00

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Tel: 0113 535 0163

0 50m

Fig. 10. Processed greyscale magnetometer data: Sector 3 (1:1250 @ A3)

PROJECT ID: 8408_MWB18

SECTOR BOUNDARY

N

437800

437600

5036 00

5038 00

20.0 nT/cm

0 50m

Archaeological Services W Y A S
Nepshaw Lane South, Morley, LS27 7JQ
Tel: 0113 535 0163

Fig. 11. XY trace plot of minimally processed magnetometer data: Sector 3 (1:1250 @ A3)

PROJECT ID: 8408_MWB18

SECTOR BOUNDARY

N

TYPE OF ANOMALY		INTERPRETATION
	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	OLD FIELD BOUNDARY
	LINEAR TREND	AGRICULTURAL
	MAGNETIC ENHANCEMENT	GEOLOGY
	LINEAR TREND	GEOLOGY
	MAGNETIC ENHANCEMENT	ARCHAEOLOGY?
	LINEAR TREND	ARCHAEOLOGY?

A1

A1

A1

A1

A1

A1

P2

P2

P1

P1

437800

437600

503600

503800

Archaeological Services W Y A S
Nepshaw Lane South, Morley, LS27 7JQ
Tel: 0113 535 0163

0 50m

Fig. 12. Interpretation of magnetometer data: Sector 3 (1:1250 @ A3)

Appendix 1: Magnetic survey - technical information

Magnetic Susceptibility and Soil Magnetism

Iron makes up about 6% of the Earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haemetite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms. Areas of human occupation or settlement can then be identified by measuring the magnetic susceptibility of the topsoil because of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. The magnetic susceptibility of a soil can also be enhanced by the application of heat and the fermentation and bacterial effects associated with rubbish decomposition. The area of enhancement is usually quite large, mainly due to the tendency of discard areas to extend beyond the limit of the occupation site itself, and spreading by the plough.

Types of Magnetic Anomaly

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes)

These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance

These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend

This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

Methodology: Gradiometer Survey

The main method of using the fluxgate gradiometer for commercial evaluations is referred to as ***detailed survey*** and requires the surveyor to walk at an even pace carrying the instrument within a grid system. A sample trigger automatically takes readings at predetermined points, typically at 0.25m intervals, on traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation.

During this survey a Bartington Grad601 magnetic gradiometer was used taking readings on the 0.1nT range, at 0.25m intervals on zig-zag traverses 0.5m apart within 30m by 30m square grids. The instrument was checked for electronic and mechanical drift at a common point and calibrated as necessary. The drift from zero was not logged.

The gradiometer data have been presented in this report in processed greyscale format. The data in the greyscale images have been interpolated and selectively filtered to remove the effects of drift in instrument calibration and other artificial data constructs and to maximise the clarity and interpretability of the archaeological anomalies.

Appendix 2: Survey location information

An initial survey station was established using a Trimble VRS differential Global Positioning System (Trimble R6 model). The data was geo-referenced using the geo-referenced survey station with a Trimble RTK differential Global Positioning System (Trimble R6 model). The accuracy of this equipment is better than 0.01m. The survey grids were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if co-ordinates are measured off hard copies of the mapping rather than using the digital co-ordinates.

Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

Appendix 3: Geophysical archive

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2000), and graphics files (Adobe Illustrator CS2 and AutoCAD 2008) files; and
- a full copy of the report.

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the East Yorkshire Historic Environment Record).

Appendix 4: Oasis form

OASIS DATA COLLECTION FORM: England

OASIS ID: archaeol11-329555

Project details

Project name	Minster Way, Beverley
Short description of the project	A geophysical (magnetometer) survey, was undertaken on approximately 16 hectares of land located to the north of Minster Way, Beverley, East Yorkshire. Responses that have been interpreted as archaeology and possible archaeology have been detected in the survey area such as enclosures, linear and curvi-linear trends. Agricultural trends can be seen throughout the survey area in the form of modern ploughing and former field boundaries. Geological anomalies have also been recorded. Therefore, based on the results and interpretation of the data, the archaeological potential is considered to be high to medium.
Project dates	Start: 27-08-2018 End: 31-08-2018
Previous/future work	Yes / Not known
Any associated project reference codes	8408 - Sitecode
Type of project	Field evaluation
Monument type	NONE None
Significant Finds	ENCLOSURE Late Prehistoric
Methods & techniques	"Geophysical Survey"
Development type	Housing estate
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Not known / Not recorded
Solid geology	CHALK (INCLUDING RED CHALK)
Drift geology (other)	seasonally waterlogged soils
Techniques	Magnetometry

Project location

Country	England
Site location	

	EAST RIDING OF YORKSHIRE EAST RIDING OF YORKSHIRE BEVERLEY Minster Way, Beverley
Study area	16 Hectares
Site coordinates	TA 0351 3776 53.825567428899 -0.427243768525 53 49 32 N 000 25 38 W Point
Height OD / Depth	Min: 12m Max: 12m

Project creators

Name of Organisation	Archaeological Services WYAS
Project brief originator	Ed Dennison Archaeological Services Ltd
Project design originator	Ed Dennison Archaelogical Services Ltd
Project director/manager	E. Brunning
Project supervisor	C. Sykes

Project archives

Physical Archive Exists?	No
Digital Archive recipient	Ed Dennison Archaeological Services Ltd.
Digital Contents	"Survey"
Digital Media available	"Geophysics","Survey","Text"
Paper Archive Exists?	No

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Land at Minster Way, Beverley, East Yorkshire
Author(s)/Editor(s)	Brunning, E
Author(s)/Editor(s)	Trace, A
Date	2018
Issuer or publisher	ASWYAS
Place of issue or publication	Leeds
Description	A4 report with A3 figures

Entered by	Emma Brunning (emma.brunning@aswyas.com)
Entered on	27 September 2018

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