WYAS Archaeological Services

Lanes Farm

Hemsworth

West Yorkshire

Geophysical Survey

Report no. 2903
October 2016

Client: Aqua Consultants

Lanes Farm,
Hemsworth
West Yorkshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey, covering approximately 2.5 hectares, was carried out on agricultural land at Lanes Farm, Hemsworth, West Yorkshire. The survey was undertaken prior to the proposed development of the site. Across the scheme, anomalies characterised as geological and agricultural in origin have been identified along with a possible former stream to the east of the survey area. Clusters of pit-type responses have been detected which may be indicative of settlement, but no patterns within the responses can be made and therefore a possible archaeological origin has been given. Therefore the archaeological potential of this scheme of work is considered to be low to medium across the site.

WYAS
Archaeological
Services

Report Information

Client:	Aqua Consultants
Report Type:	Geophysical Survey
Location:	Hemsworth
County:	West Yorkshire
Grid Reference:	SE 4455 1504
Period(s) of activity:	Prehistoric/ Post-Medieval/ Modern
Report Number:	2903
Project Number:	6534
Site Code:	HEM16
OASIS ID:	archaeol11-266195
Date of fieldwork:	October 2016
Date of report:	October 2016
Project Management:	Christopher Sykes BA MSc
Fieldwork:	Paul Johnson BSc MSc
	Dan Shiel BA
Report:	Emma Brunning BSc MCIfA
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Photography:	Dan Shiel
Research:	Christopher Sykes

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

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1 Introduction

Archaeological Services WYAS (ASWYAS) were commissioned by Aqua Consultants (the Client) to undertake a geophysical (magnetometer) survey at Lanes Farm, Hemsworth, to inform a proposed planning application. Guidance contained within the National Planning Policy Framework (DCLG 2012) was followed, in line with current best practice (CIfA 2014; David *et al*. 2008). The survey was carried out on the 6th October 2016 to provide additional information on the archaeological resource of the Proposed Development Area (PDA).

Site location, topography and land-use

The PDA consists of two fields totaling approximately 2.9 ha approximately 2km to the northeast of Hemsworth. It is bound to the east by a stream and surrounded by agricultural land on all sides. The site is located approximately 7km to the south of Pontefract (see Fig. 1) and consists of agricultural land. One of the fields was unsuitable for survey as stacks of hay bales covered the area (see Plate 1). The survey area is centred at SE 4455 1504. The topography of the site consisted of a slight gradient from north to south with a height above Ordnance Datum (aOD) between 43m - 48m.

Soils and geology

The proposed development overlies bedrock deposits of the Pennine Upper Coal Measures formation – mudstone, siltstone and sandstone. No superficial deposits have been recorded (BGS 2016). Soils of the PDA belong to the Badsey (713a) association consisting of slowly permeable seasonally waterlogged loamy over clayey and fine silty soils over soft rock (SSEW 1983).

2 Archaeological and Historical Background

Evidence for archaeological activity lies to the immediate east of the PDA in the form of cropmarks (823) (ASWYAS 2010), suggesting small enclosures and field divisions. Evidence for medieval metalworking (3383) lies approximately 400m to the southwest and a medieval settlement (2593) lies to the immediate west (*Rosenberg pers. comm).*

Hemsworth Lanes farmhouse is a Grade II listed building (1226646) dating from the 17th century.

3 Aims and Methodology

The main aim of the geophysical survey was to provide sufficient information to enable an assessment to be made of the impact of the development on potential sub-surface archaeological remains and for further evaluation or mitigation proposals, if appropriate, to be recommended. 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 5800 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.

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. The processed and minimally processed data, together with an interpretation of the survey results are presented in Figures 3 to 5 inclusive at a scale of 1:1000.

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. A copy of the completed OASIS form is included in Appendix 4.

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). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

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 3 to 5)

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. There is no obvious pattern or clustering to their distribution in this survey to suggest anything other than a random background scatter of ferrous debris in the plough-soil.

Larger, ferrous responses around the periphery of the site are due to wire fencing within the field boundaries.

Geological anomalies

Numerous discrete anomalies within the dataset are typical of responses associated with geology and are thought to be caused by variations in the depth and composition of the soils and the superficial deposits from which they derive. It is likely that the majority are associated with the topography of the PDA.

Responses along the eastern edge of the survey area are likely to be associated with the adjacent stream and may represent a former course.

Agricultural anomalies

Linear trends associated with modern ploughing can be seen throughout the survey areas and follow the orientation of the current field boundaries.

Possible anomalies

A collection of anomalies (**A**), in the form of linear trends and discrete features (which have been grouped in a circle on the interpretation diagram by ASWYAS) have been detected as being possibly archaeological in origin. However, they form no patterns and it may be that the underlying possible archaeology has been destroyed by modern ploughing.

To the south of (**A**), similar responses can be seen including a curving trend (**B**) which may form part of a larger feature, but, again due to the modern ploughing a definitive archaeological interpretation is difficult.

Trend (**C**) is likely to be a continuation of the east to west field boundary to the immediate west of the PDA. However, it does not appear on any available old mapping (OS 2016) and has therefore been interpreted as possible archaeology.

Due to cropmark evidence in the field to the immediate east the above anomalies may represent further settlement activity, however due to the segmented responses any interpretation must be taken with care.

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.

5 Conclusions

Throughout the site there are linear trends which reflect the current ploughing furrows. It is possible that this ploughing has damaged any archaeological remains below. The possible archaeological responses do not form any patterns but due to the cropmark evidence in the adjacent field to the east it is possible that they relate to a former settlement area. Geological responses in the easternmost section of the data are likely to reflect a former course of the stream.

Based on the evidence of this survey it is considered that the archaeological potential of the site is low to medium.

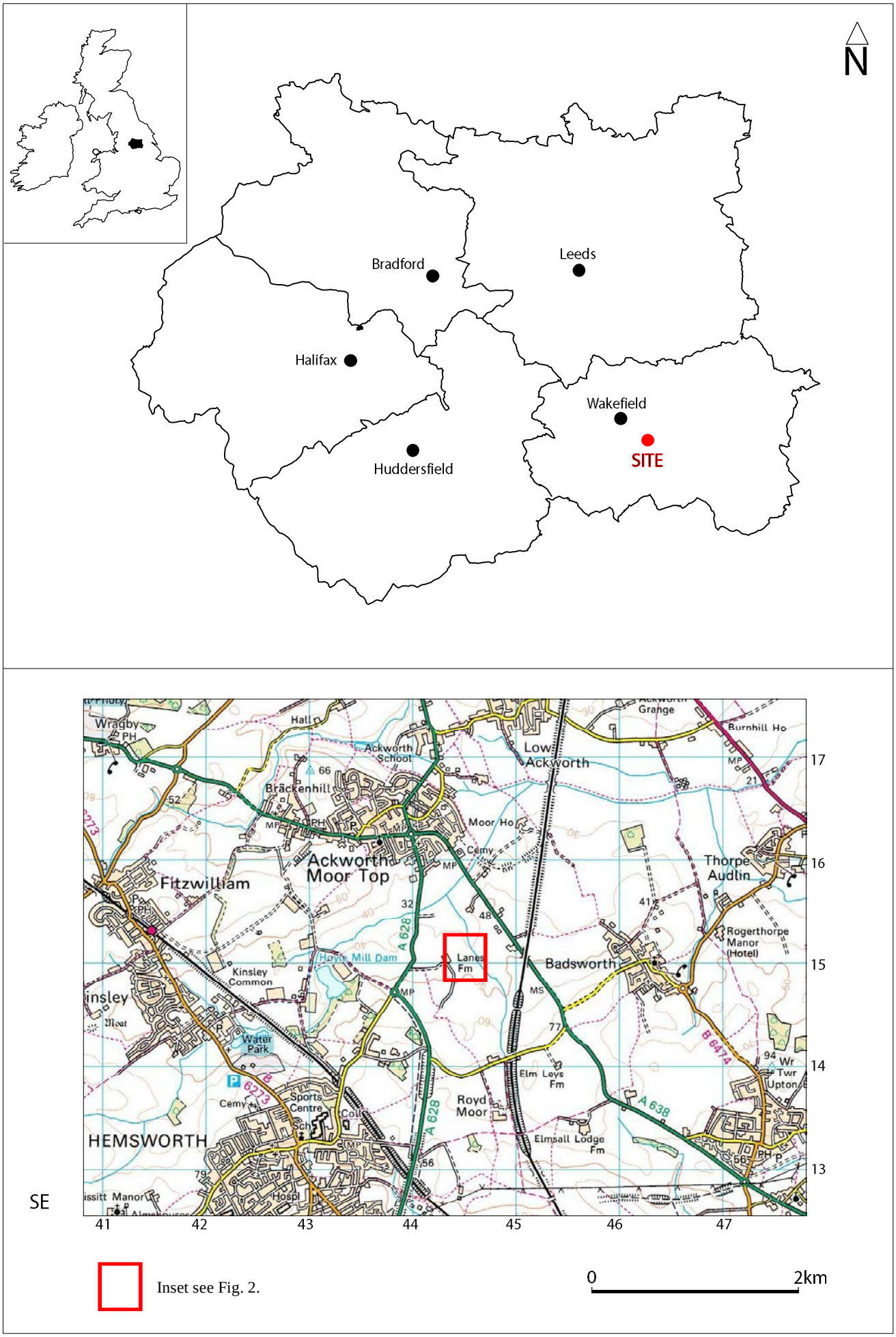

Fig. 1. Site location

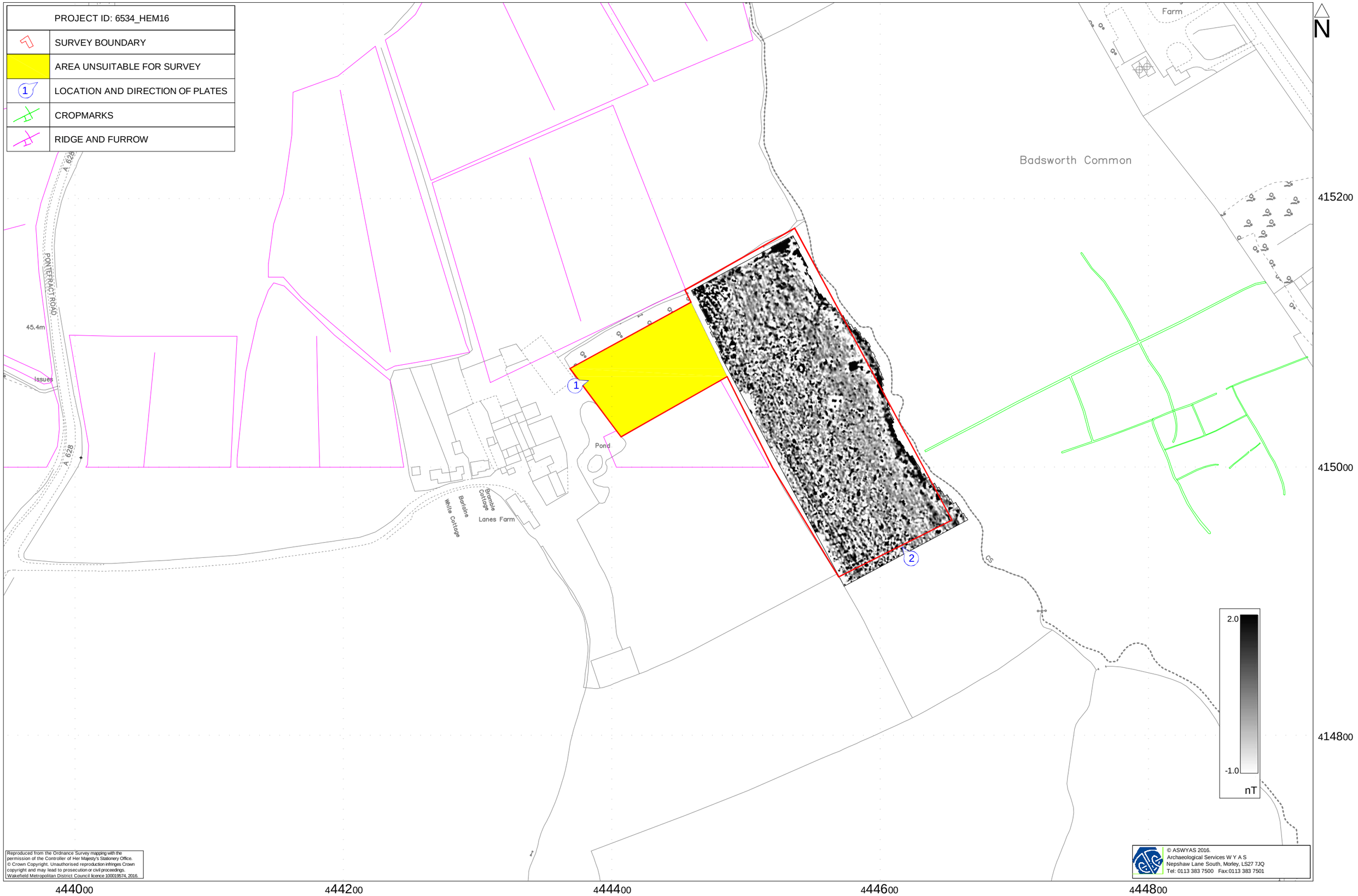

Fig. 2. Survey location showing greyscale magnetometer data (1:2500 @ A3)

PROJECT ID: 6534_HEM16

N

Issues

Pond

4150 00

2.0

-1.0

nT

CS

4444 00

4446 00

Archaeological Services W Y A S
Nepshaw Lane South, Morley, LS27 7JQ
Tel: 0113 383 7500 Fax:0113 383 7501

0 50m

Fig. 3. Processed greyscale magnetometer data (1:1000 @ A3)

PROJECT ID: 6534_HEM16

N

20.0 nT/cm

Issues

Pond

4150 00

4444 00

4446 00

0 50m

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Fig. 4. XY trace plot of minimally processed magnetometer data (1:1000 @ A3)

PROJECT ID: 6534_HEM16

N

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

A

B

C

Issues

Pond

CS

4150 00

4444 00

4446 00

Archaeological Services W Y A S
Nepshaw Lane South, Morley, LS27 7JQ
Tel: 0113 383 7500 Fax:0113 383 7501

0 50m

Fig. 5. Interpretation of magnetometer data (1:1000 @ A3)

Plate 1. Area unsuitable for survey, looking west

Plate 2. General view of site, looking north

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.

The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.

Appendix 2: Survey location information

An initial survey station was established using a Trimble VRS differential Global Positioning System (Trimble R6 model). The cart 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 West Yorkshire Historic Environment Record).

Appendix 4: Oasis form

OASIS DATA COLLECTION FORM: England

OASIS ID: archaeol11-266195

Project details

Project name	Lanes Farm, Hemsworth
Short description of the project	A geophysical (magnetometer) survey, covering approximately 2.5 hectares, was carried out on agricultural land at Lanes Farm, Hemsworth, West Yorkshire. The survey was undertaken prior to the proposed development of the site. Across the scheme, anomalies characterised as geological and agricultural in origin have been identified along with a possible former stream to the east of the survey area. Clusters of pit-type responses have been detected which may be indicative of settlement, but no patterns within the responses can be made and therefore a possible archaeological origin has been given. Therefore the archaeological potential of this scheme of work is considered to be low to medium across the site.
Project dates	Start: 06-10-2016 End: 06-10-2016
Previous/future work	Not known / Not known
Any associated project reference codes	6534 - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 1 - Minimal cultivation
Monument type	SETTLEMENT Medieval
Monument type	METALWORKING Medieval
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Not recorded
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Not known / Not recorded
Solid geology (other)	Pennine Upper Coal Measues
Drift geology	LACUSTRINE CLAYS, SILTS AND SANDS
Techniques	Magnetometry

Project location

Country	England
Site location	WEST YORKSHIRE WAKEFIELD HEMSWORTH Lanes Farm, Hemsworth
Study area	2.9 Hectares
Site coordinates	SE 445 150 53.62940052405 -1.327017234285 53 37 45 N 001 19 37 W Point
Height OD / Depth	Min: 43m Max: 48m

Project creators

Name of Organisation	Archaeological Services WYAS
Project brief originator	Prospect Archaeology Ltd
Project design originator	Prospect Archaeology Ltd
Project director/manager	C. Sykes
Project supervisor	D. Shiel

Project archives

Physical Archive Exists?	No
Digital Archive recipient	Prospect Archaeology
Digital Contents	"Survey"
Digital Media available	"Geophysics","Images raster / digital photography","Text"
Paper Archive Exists?	No

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Lanes Farm, Hemsworth
Author(s)/Editor(s)	Brunning, E
Date	2016
Issuer or publisher	ASWYAS
Place of issue or publication	Morley, Leeds
Description	A4 report

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Entered on	20 October 2016

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