WYAS Archaeological Services

Hay Green Lane

Birdwell

South Yorkshire

Geophysical Survey

Report no. 3414
April 2020

Client: Harworth Estates Investments Ltd.

Hay Green Lane, Birdwell, South Yorkshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey was undertaken on approximately 5.5 hectares of land located to the south of Hay Green Lane, Birdwell, South Yorkshire. Possible post-medieval ridge and furrow cultivation has been detected along with former field boundaries which correlate to old mapping and geological responses can be seen throughout. Magnetic disturbance has also been recorded around the periphery of the survey areas. Based on the results and interpretation of the geophysical survey the archaeological potential of the site is deemed low.

WYAS
Archaeological Services

Report Information

Client:	Harworth Estates Investments Ltd.
Address:	Advantage House, Poplar Way, Catcliffe
Report Type:	Geophysical Survey
Location:	Birdwell
County:	South Yorkshire
Grid Reference:	SE 3485 0126
Period(s) of activity:	?Post-medieval - modern
Report Number:	3414
Project Number:	X188
Site Code:	BDW20
OASIS ID:	archaeol1-392219
Date of fieldwork:	April 2020
Date of report:	April 2020
Project Management:	Emma Brunning BSc MCIfA
Fieldwork:	Chris Sykes BA MSc MCIfA
	Alastair Trace BSc MSc
Illustrations:	Chris Sykes
Photography:	Chris Sykes
Research:	Emma Brunning
Report:	Emma Brunning

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

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

Document Issue Record

Ver	Status	Author(s)	Reviewer	Approver	Date
1.0	Draft	EB	DW		April 20
2.0	Final	EB	DW	DW	April 20

Contents

List of Figures

List of Plates

1 Introduction

Archaeological Services ASWYAS has been commissioned by Prospect Archaeology on behalf of Harworth Estates Investments Limited to undertake a geophysical survey at land to the south of Hay Green Lane, Birdwell, South Yorkshire. This was undertaken in line with current best practice (CIfA 2014; Schmidt *et al.* 2015). The survey was carried out between 2nd and 3rd April 2020 to provide additional information on the archaeological resource of the site.

Site location, topography and land-use

The survey area is located at SE 3485 0126 (approximate centre), comprising approximately 5.5ha to the south of Birdwell (see Fig. 1).

The site is situated on land consisting of pasture and horse paddocks to the south of Hay Green Lane. It is bounded to the west by Birdwell Recreation Ground and to the east and south by agricultural and pasture fields. The site lies at 121m (above Ordnance Datum) aOD in the northeast, rising to approximately 129m aOD in the southwest.

Soils and geology

The recorded bedrock geology comprises Pennine Middle Coal Measures Formation – sandstone, a sedimentary bedrock that formed approximately 310 to 318 million years ago in the Carboniferous Period. No superficial deposits have been recorded (BGS 2020). Soils are described as slowly permeable seasonally wet acid loamy and clayey soils of the Soilscape 17 classification (CSAI 2020).

2 Archaeological Background

The archaeological background below is taken from a 1km search on Heritage Gateway (HG 2020) and information from ASWYAS site works in the vicinity.

Documentary evidence for settlement at Birdwell is sparse but it is recorded in Yorkshire Diaries of 1642 as ‘the Birdwell’ (Smith 1961). The place-name is traditionally believed to have originated from a large bird seen drinking at a well, thus the Bird Well (Hudson 1965).

Approximately 200m to the southwest of site trial trenching was undertaken on land off Sheffield Road, which is now housing. A number of features relating to modern field drainage were identified but no features or deposits of archaeological significance were observed (McNaught 2000).

550m to the southwest lies Tankersley Rescue Station which is believed to be the first purpose-built mines rescue station away from the colliery. It is Grade II listed (entry number 469990).

Roughly 800m to the south of the survey area a geophysical survey was carried out in 2014 by ASWYAS in advance of road improvements. No anomalies of an archaeological origin were recorded and the results were dominated by geological variances (Harrison 2014).

3 Aims, Methodology and Presentation

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 and to inform an assessment of the archaeological potential of the site. To achieve this aim, a magnetometer survey covering all amenable parts of the Site 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. Bespoke in-house 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. Processed and minimally processed data, together with interpretation of the survey results are

presented in Figures 3 to 5 inclusive at a scale of 1:1250. Figure 6 shows the processed data overlain the first edition Ordnance Survey map at a scale of 1:2500.

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 the European Archaeological Council (Schmidt *et al*. 2015) 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 and magnetic disturbance

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.

Magnetic disturbance along the limits of the survey areas are due to be linked to metal fencing within the field boundaries. Service pipes have been located to the east of Area 3 and in the southern section of Area 4. A band of ferrous responses in the south of Area 1 relates to a temporary fence within the horse paddock.

Geological anomalies

The survey has detected a number of anomalies that have been interpreted as geological in origin. It is thought that the responses have been detected because of the variation in the composition and depth of the deposits of superficial material in which they derive. It is possible that any archaeological remains, if present, may have been masked by the geological anomalies.

Agricultural anomalies

Former field boundaries have been detected throughout the survey areas and correspond with the first edition Ordnance Survey mapping dating from 1855 (OM 2020) and as shown in Figure 6, by the 1893 map most of the boundaries have been removed.

Parallel linear trends can be seen within Area 4 on differing alignments and are likely to relate to post-medieval ridge and furrow cultivation. There is quite a significant amount of ploughing within this area which has also enhanced the magnetic background levels.

Ploughing trends in the remaining areas are thought to be more of a modern date.

5 Conclusions

The geophysical survey has worked well having detected a number of magnetic anomalies associated with post-medieval ridge and furrow and former field boundaries. Geological anomalies have been recorded throughout due to variations within the soil whilst magnetic disturbance around the periphery of the fields are due to metal fencing within the boundaries. It is possible that if any archaeological anomalies were present then the geological and agricultural responses will have masked these. Based on the interpretation of the geophysical survey the archaeological potential of the site is deemed low.

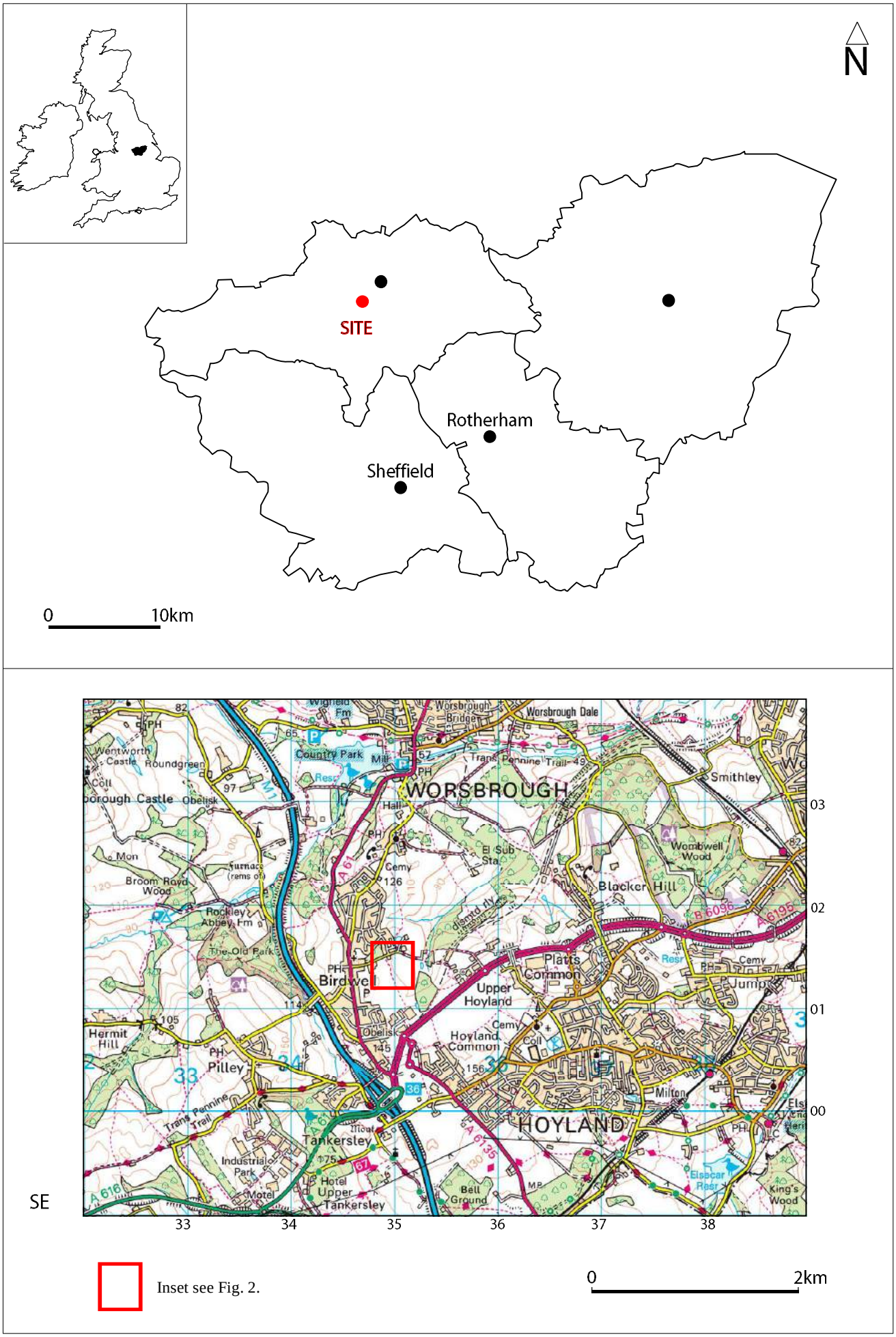

Fig. 1. Site location

PROJECT ID: X188_BDW20	
	SURVEY AREA
	UNSURVEYABLE
1	PHOTO LOCATIONS

FIELD 1

FIELD 2

FIELD 3

FIELD 4

2.0

-1.0

nT

N

4014000

4012000

4010000

4344000

4346000

4348000

4350000

4352000

0 100m

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

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

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

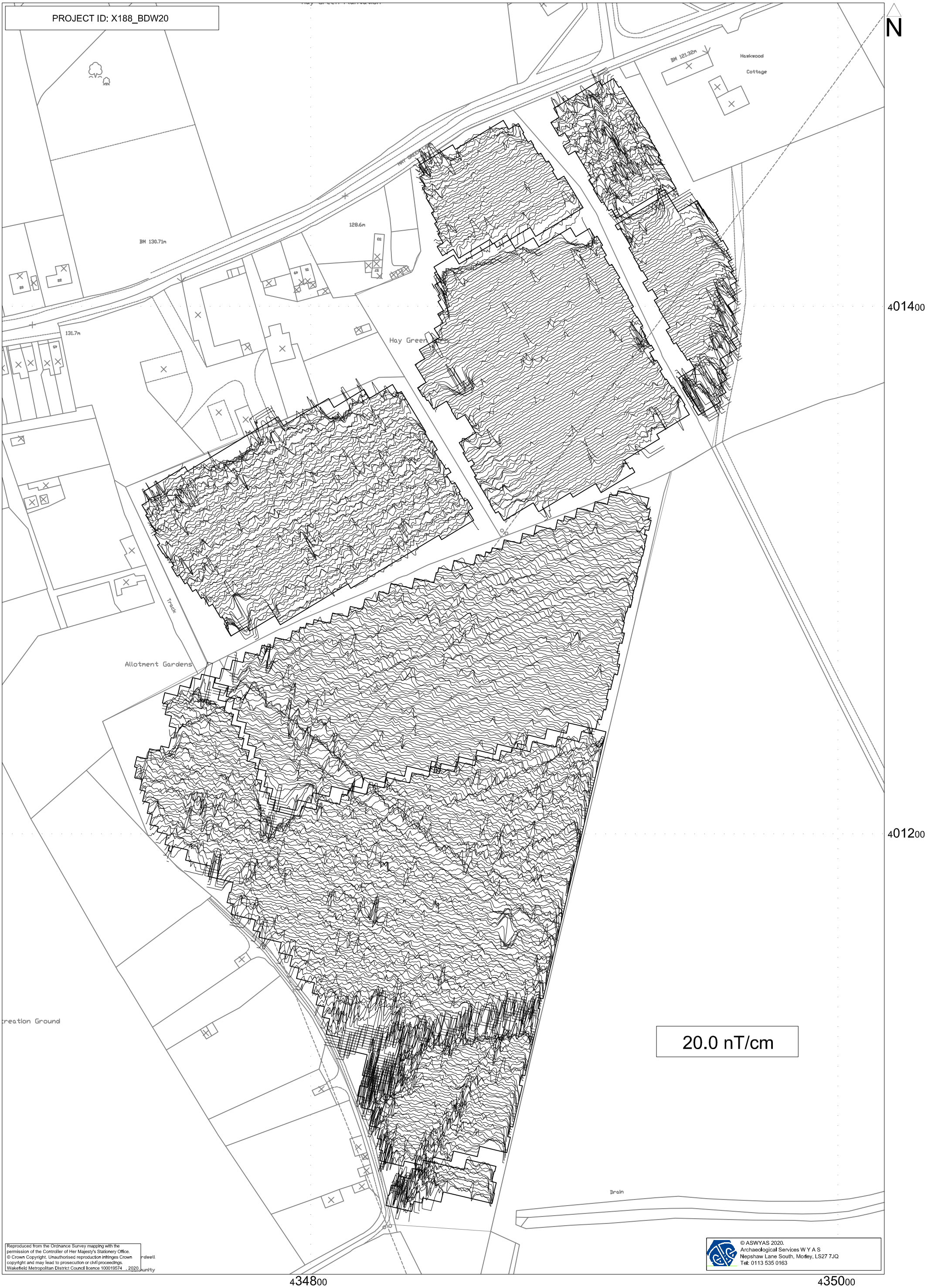

Fig. 4. XY trace plot of minimally processed magnetometer data (1:1250 @ A3)

PROJECT ID: X188_BDW20

N

4014 00

4012 00

TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
	DIPOLAR LINEAR	SERVICE PIPE
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	TEMPORARY FENCING
	LINEAR TREND	RIDGE AND FURROW
	LINEAR TREND	AGRICULTURAL
	LINEAR TREND	FORMER FIELD BOUNDARY
	LINEAR TREND	GEOLOGY
	MAGNETIC ENHANCEMENT	GEOLOGY

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

4348 00

4350 00

0 50m

Fig. 5. Interpretation of magnetometer data (1:1250 @ A3)

PROJECT ID: X188_BDW20

FIELD 1

FIELD 2

FIELD 3

FIELD 4

N

4014000

4012000

4010000

2.0

-1.0

nT

4344000

4346000

4348000

4350000

4352000

0

100m

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

Fig. 6. Processed greyscale magnetometer data with the first edition OS mapping (1:2500 @ A3)

Plate 1. General view of survey area, facing south

Plate 2. General view of survey area, facing northwest

Plate 3. General view of survey area, facing northeast

Plate 4. General view of survey area, facing southwest

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 South Yorkshire Historic Environment Record).

Appendix 4: Oasis form

OASIS DATA COLLECTION FORM: England

OASIS ID: archaeol11-392219

Project details

Project name	Hay Green Lane, Birdwell
Short description of the project	A geophysical (magnetometer) survey was undertaken on approximately 5.5 hectares of land located to the south of Hay Green Lane, Birdwell, South Yorkshire. Possible post-medieval ridge and furrow cultivation has been detected along with former field boundaries which correlate to old mapping and geological responses can be seen throughout. Magnetic disturbance has also been recorded around the periphery of the survey areas. Based on the results and interpretation of the geophysical survey the archaeological potential of the site is deemed low.
Project dates	Start: 02-04-2020 End: 03-04-2020
Previous/future work	No / Not known
Any associated project reference codes	BDW20 - Sitecode
Type of project	Field evaluation
Monument type	NONE None
Significant Finds	NONE None
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 (other)	Pennine Middle Coal Measures
Drift geology (other)	loam and clay
Techniques	Magnetometry

Project location

Country	England
Site location	SOUTH YORKSHIRE BARNSLEY BARNSLEY Birdwell
Study area	5.5 Hectares
Site coordinates	SE 3485 0126 53.506623569936 -1.474481873912 53 30 23 N 001 28 28 W Point
Height OD / Depth	Min: 121m Max: 129m

Project creators

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

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	Hay Green Lane, Birdwell, South Yorkshire
Author(s)/Editor(s)	Brunning, E
Date	2020
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	17 April 2020

OASIS:

Bibliography

BGS, 2020. www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html. British Geological Survey (viewed April 2020)

CIfA, 2014. *Standard and Guidance for Archaeological Geophysical Survey*. Chartered Institute for Archaeologists

CSAI, 2020. www.landis.org.uk/soilscapes. Cranfield Soil and AgriFood Institute (viewed April 2020)

HG, 2020. www.heritagegateway.org.uk (viewed April 2020)

Harrison, D, 2014. *A61 Birdwell Junction, Barnsley, South Yorkshire. Geophysical Survey.* Archaeological Services WYAS Report No. 2648

Hudson, D. 1965, 'The Development of the Village of Birdwell', Dissertation of Kesteven Training College (unpublished)

MHCLG, 2019. *National Planning Policy Framework*. Ministry of Housing, Communities and Local Government.

McNaught, R. B., 2000, *Land off Sheffield Road, Birdwell, Barnsley, South Yorkshire. Archaeological Evaluation*, Archaeological Services WYAS Report No. 776

OM, 2020. https://www.old-maps.co.uk/ Old-maps (viewed April 2020)

Schmidt, A. Linford, P., Linford, N., David, A., Gaffney, C., Sarris, A, and Fassbinder, J. 2015. *EAC Guidelines for the Use of Geophysics in Archaeology*. English Heritage

Smith, A.H., 1961, *The Place-names of the West Riding, Vol. 30, Part 1*