



WYAS
**Archaeological
Services**

Land at Rheda

Frizington

Cumbria

Geophysical Survey

Report no. 3094

March 2018

Client: WYG Planning & Environment



Land at Rheda Frizington Cumbria

Geophysical Survey

Summary

A geophysical (magnetometer) survey, covering approximately 7.8 hectares, was undertaken on land at Rheda, Frizington, Cumbria. This was part of a programme of archaeological works in advance of a proposed development. The magnetic survey has detected anomalies of archaeological origin in the form of a rectilinear enclosure. Former field boundaries and paths have also been located along with ploughing trends and areas of magnetic disturbance. Overall the archaeological potential of the site is high.

Report Information

Client: WYG Planning & Environment
 Address: Arndale House, Otley Road, Headingley, Leeds, LS6 2UJ
 Report Type: Geophysical Survey
 Location: Rheda, Frizington
 County: Cumbria
 Grid Reference: NY 0268 1685
 Period(s) of activity: Prehistoric/ Modern
 Report Number: 3094
 Project Number: 8211
 Site Code: RHF18
 OASIS ID: archaeo111-311321
 Date of fieldwork: February 2018
 Date of report: March 2018
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 Fieldwork: Christopher Sykes BA MSc MCIfA
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 Report: Emma Brunning
 Illustrations: Emma Brunning

Authorisation for
 distribution: -----



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Contents

Report information	ii
Contents	iii
List of Figures	iv
List of Plates	iv
1 Introduction	1
Site location, topography and land-use	1
Soils and geology	1
2 Archaeological Background	1
3 Aims, Methodology and Presentation	2
Magnetometer survey	2
Reporting	2
4 Results and Discussion	3
Ferrous anomalies	3
Agricultural anomalies	3
Archaeological anomalies.....	3
5 Conclusions	4

Figures

Appendices

Appendix 1: Magnetic survey - technical information

Appendix 2: Survey location information

Appendix 3: Geophysical archive

Appendix 4: Oasis form

Bibliography

List of Figures

- 1 Site location (1:50000)
- 2 Survey location showing greyscale magnetometer data (1:2000 @ A3)
- 3 Processed greyscale magnetometer data (1:1250 @ A3)
- 4 XY trace plot of minimally processed magnetometer data (1:1250 @ A3)
- 5 Interpretation of magnetometer data (1:1250 @ A3)

List of Plates

- 1 General view of site, looking south
- 2 General view of site, looking north

1 Introduction

Archaeological Services WYAS (ASWYAS) were commissioned by WYG Planning & Environment to undertake a geophysical (magnetometer) survey on land at Rheda, Frizington, Cumbria. This is in advance of a proposed development. 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 between the 19th and 21st February 2018.

Site location, topography and land-use

The survey area is centred on National Grid Reference NY 0268 1685 and located to the southwest of Frizington, Cumbria. It is bounded to the south by Meadowcroft Road, the west by Rheda Park, the east by residential housing and to the north by agricultural land. It lies at approximately 145m above Ordnance Datum (aOD) and is generally flat. The proposed area is approximately 7.8 hectares, consisting of one field.

Soils and geology

The underlying bedrock comprises Bees Sandstone which is a sedimentary bedrock that formed approximately 247 to 252 million years ago in the Triassic period (BGS 2018). Soils of the area are described as slowly permeable seasonally wet slightly acid, but base-rich loamy and clayey (CSAI 2018).

2 Archaeological Background

A detailed Archaeological Desk-Based Assessment has been produced by WYG to which this report will form part of the assessment of the site (WYG 2018). Below is a brief synopsis of the findings of that report.

Although Whitehaven and its environs have played an important part in the history and development of this area of Cumbria, very little is recorded for Rheda and Frizington. There are no recorded heritage assets within the vicinity of the survey area prior to the Roman period despite prehistoric sites and finds locations being abundant within Cumbria as a whole. It has been reported that a Roman road may have passed to the southeast of the site and may have led from the Roman fort at Papcastle towards the fort at Ravenglass.

Part of a medieval wheel-headed cross is located to the southwest of the survey area. The cross, which probably dates to the 13th century, is mounted on a plinth which reads *Cross Lacon* on one side and *Removed from roadside 1911* on another.

The survey area lies within an area known as North Park, formerly the grounds of Rheda Mansion which was demolished in the 1970s, the site of which now occupied by modern

houses and grounds. The grand stable block, known as the Dower House, still exists to the west of the survey area and has been converted to modern dwellings.

There are a number of features to the north of the site of unknown date mostly cropmarks in nature forming enclosures and trackways with associated ridge and furrow. Evidence of mining is also present.

3 Aims, Methodology and Presentation

The main aim of the geophysical survey was to provide additional information on the known archaeology within the area. To achieve this, a magnetometer survey covering all available 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.

Reporting

A general site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 shows a more detailed site location plan at a scale of 1:2000. 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 1:1250.

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. 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 Figs 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.

Magnetic disturbance along the limits of the survey area are due to metal fencing within the boundaries. Service pipes have also been recorded within the dataset.

Agricultural anomalies

Former field boundaries have been recorded which correspond to old mapping dating from 1867 (OM 2018). By the 1899 map they have been removed. The 1899 map depicts the site as North Park and shows two footpaths crossing the site which have been detected by the magnetic survey. These are shown on the mapping until 1957.

Linear trends throughout the dataset represent former ploughing some of which may be medieval ridge and furrow.

Archaeological anomalies

A rectilinear enclosure has been detected in the centre of the survey area measuring approximately 55m by 46m. There is no known archaeology within the area but it can be clearly stated that this response is definitely archaeological. It is unclear as to the date and purpose of the enclosure. The western and southern sides of the enclosure have an increased magnetic strength which perhaps relates to the greater preservation of the feature to the west.

Although a late Prehistoric date for this enclosure is preferred, its apparent superimposition over a field boundary may suggest that it is more recent.

5 Conclusions

The magnetic survey has identified a rectilinear enclosure of an archaeological origin. Former field boundaries and paths have also been recorded. Ploughing trends can be seen throughout the survey area, along with three service pipes and magnetic disturbance along the site boundary. On this basis the site overall can be said to have high archaeological potential.

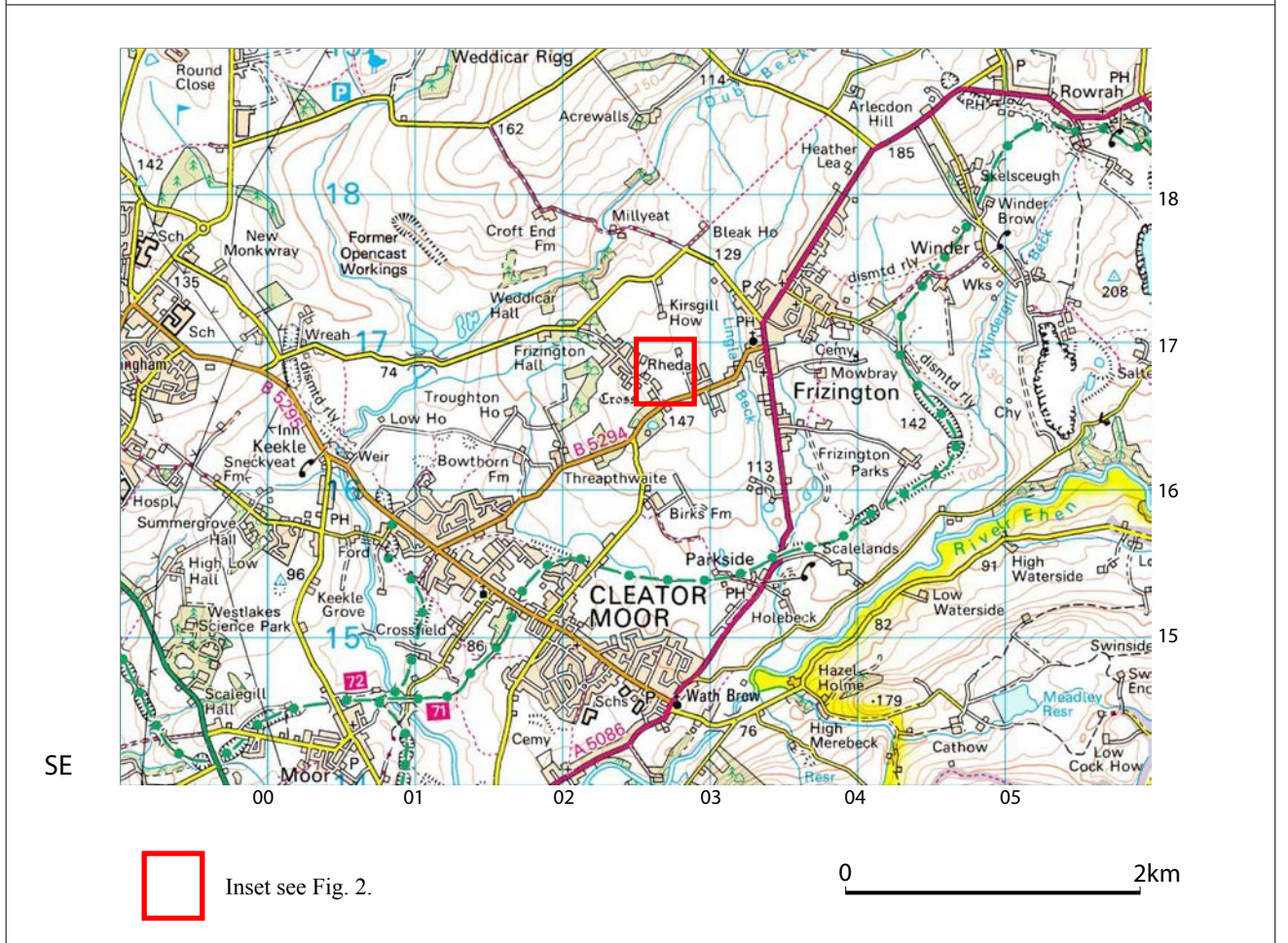
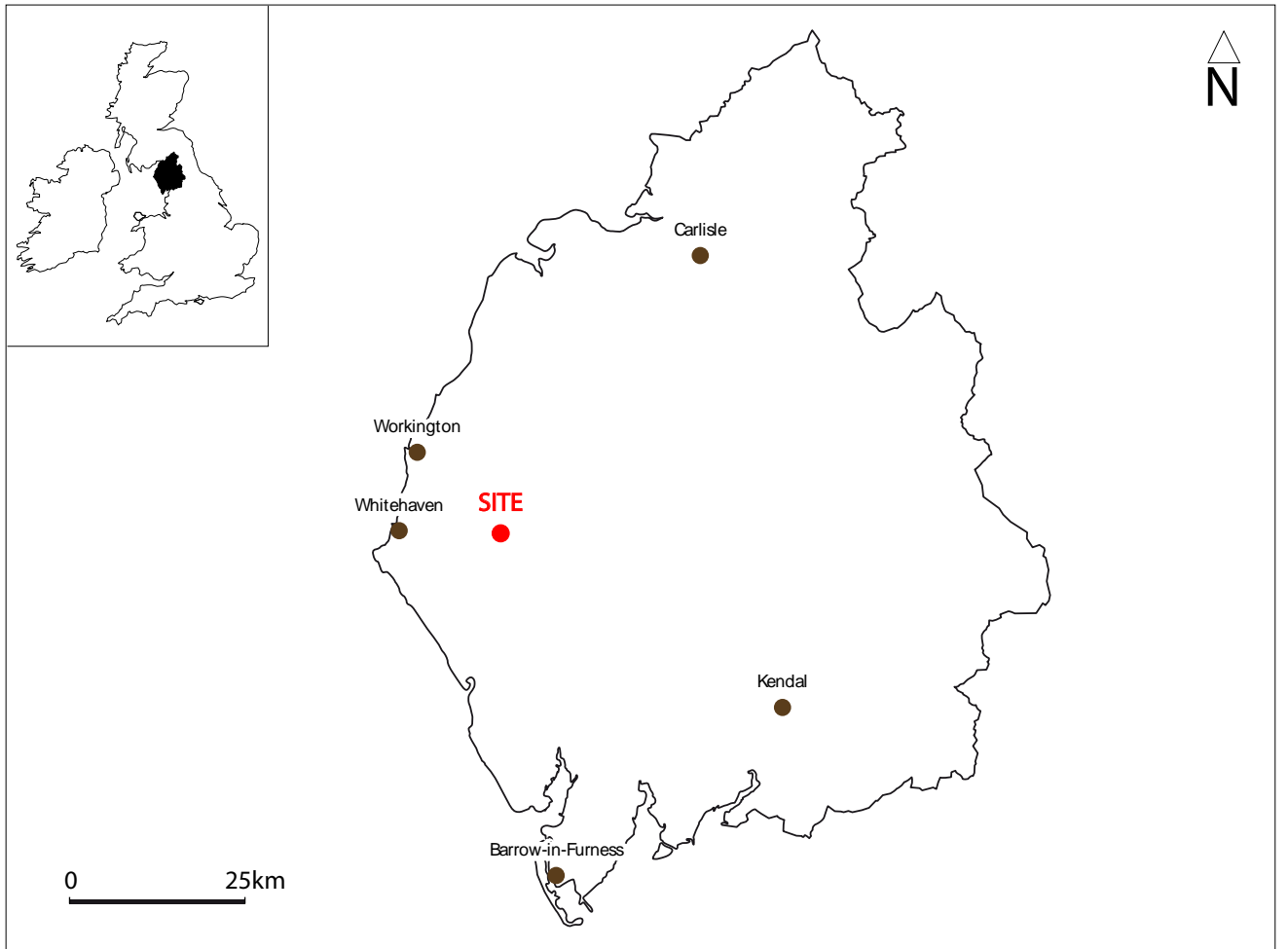


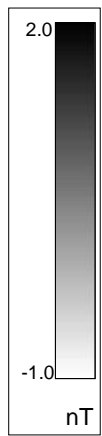


Fig. 1. Site location

PROJECT ID: 8211_RHF18	
	SITE BOUNDARY
	LOCATION AND DIRECTION OF PLATES



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Fig. 2. Survey location showing processed greyscale data (1:2000 @ A3)



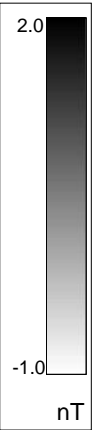


517000



516800

516600



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302600

302800

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

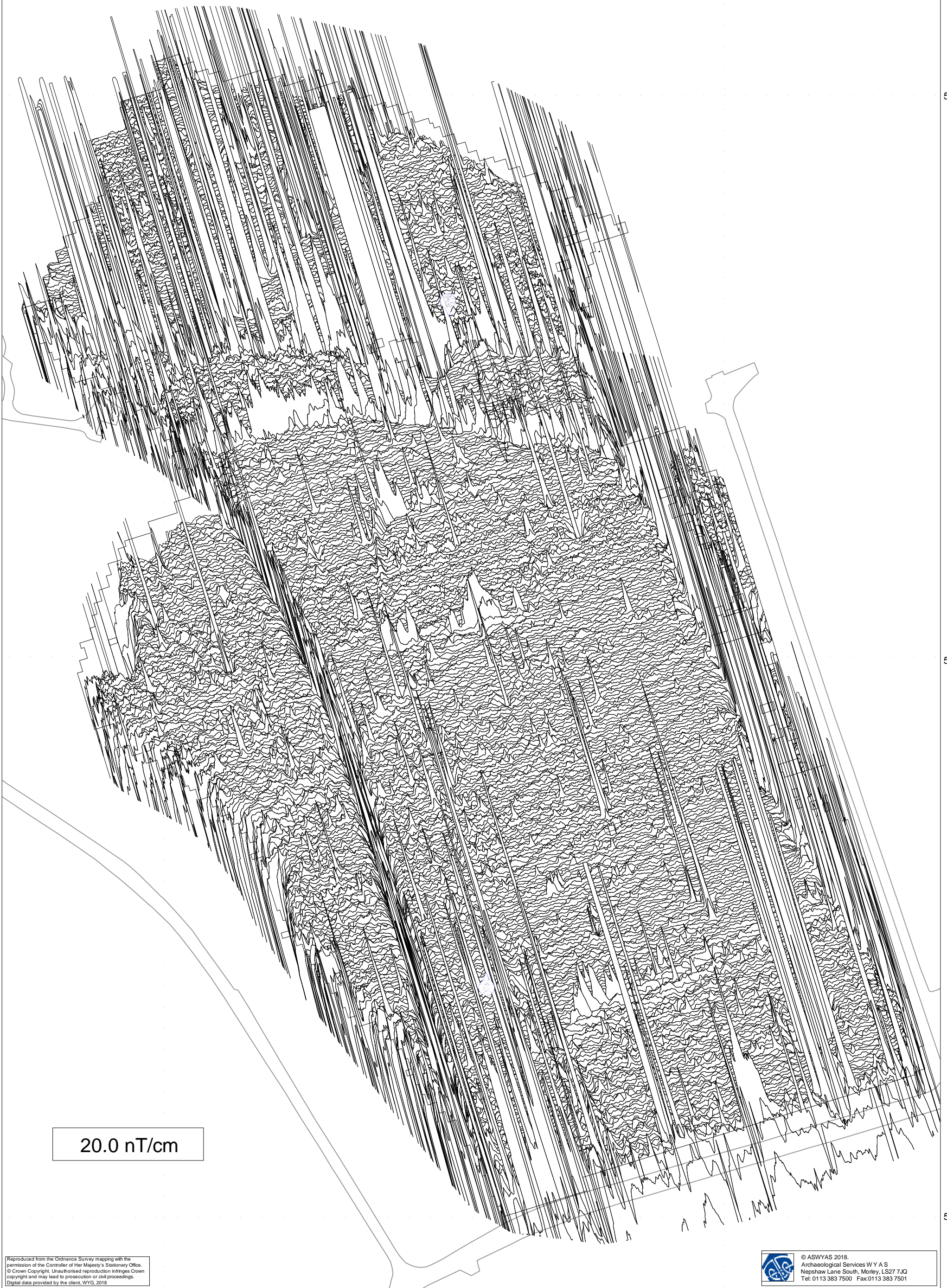




51700

516800

516600



20.0 nT/cm

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

0 50m



TYPE OF ANOMALY		INTERPRETATION
•	DIPOLAR ISOLATED	FERROUS MATERIAL
—	DIPOLAR LINEAR	SERVICE PIPE
••••	MAGNETIC DISTURBANCE	FERROUS MATERIAL
■	MAGNETIC ENHANCEMENT	FORMER FIELD BOUNDARY
■	MAGNETIC ENHANCEMENT	FORMER FOOTPATH
—	LINEAR TREND	AGRICULTURAL
■	MAGNETIC ENHANCEMENT	ARCHAEOLOGY - DITCH



517000

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302600

302800

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





Plate 1. General view of site looking south



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 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 CS6 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 Cumbria Historic Environment Record).

Appendix 4: Oasis form

OASIS DATA COLLECTION FORM: England

[List of Projects](#) | [Manage Projects](#) | [Search Projects](#) | [New project](#) | [Change your details](#) | [HER coverage](#) | [Change country](#) | [Log out](#)

Printable version

OASIS ID: archaeol11-311321

Project details

Project name	Land at Rheda, Frizington
Short description of the project	A geophysical (magnetometer) survey, covering approximately 7.8 hectares, was undertaken on land at Rheda, Frizington, Cumbria. This was part of a programme of archaeological works in advance of a proposed development. The magnetic survey has detected anomalies of archaeological origin in the form of a rectilinear enclosure. Former field boundaries and paths have also been located along with ploughing trends and areas of magnetic disturbance Overall the archaeological potential of the site is high.
Project dates	Start: 19-02-2018 End: 21-02-2018
Previous/future work	No / Not known
Any associated project reference codes	8211 - Sitecode
Type of project	Field evaluation
Monument type	NONE None
Significant Finds	ENCLOSURE Uncertain
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)	BEES SANDSTONE
Drift geology (other)	LOAMS, CLAY
Techniques	Magnetometry

Project location

Country	England
Site location	CUMBRIA COPELAND ARLECDON AND FRIZINGTON Land at Rheda, Frizington

Study area	7.8 Hectares
Site coordinates	NY 026 168 54.536954381122 -3.50554009622 54 32 13 N 003 30 19 W Point
Height OD / Depth	Min: 145m Max: 145m

Project creators

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

Project archives

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

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Land at Rheda, Frizington, Cumbria
Author(s)/Editor(s)	Brunning, E
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	9 March 2018

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