WYAS Archaeological Services

North Moor Farm

Market Rasen

Lincolnshire

Geophysical Survey

Report no. 3134
June 2018

Client: RJ & AE Godfrey

North Moor Farm, Market Rasen, Lincolnshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey, covering approximately 2.8 hectares, was undertaken on land to the north of North Moor Farm, Market Rasen, Lincolnshire. The magnetic survey has detected no anomalies of an archaeological origin. The majority of the responses are of a modern origin. Overall the archaeological potential of the site is low.

WYAS Archaeological Services

Report Information

Client:	RJ and AE Godfrey
Address:	Cadas House, Wootton Road, Elsham Top, Brigg, North Lincolnshire, DN20 0NU
Report Type:	Geophysical Survey
Location:	Market Rasen
County:	Lincolnshire
Grid Reference:	TF 095 914
Period(s) of activity:	Modern
Report Number:	3134
Project Number:	8340
Site Code:	NMF18
OASIS ID:	Archaeol11-318740
Date of fieldwork:	May 2018
Date of report:	June 2018
Project Management:	Emma Brunning BSc MCIfA
Fieldwork:	Chris Sykes BSc MSc MCIfA
	Jamie Ranaldi BSc MSc
	Alastair Trace BSc MSc
Report:	Emma Brunning
Illustrations:	Emma Brunning
Photography:	Chris Sykes

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 Ed Dennison Archaeological Services Ltd, on behalf of RJ & AE Godfrey, to undertake a geophysical (magnetometer) survey on agricultural land at North Moor Farm, Market Rasen, Lincolnshire. 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 24th May 2018.

Site location, topography and land-use

The survey area is located to the north of North Moor Farm, approximately 2.5km to the northwest of Market Rasen, centred on National Grid Reference TF 095 914 (Fig. 1.) and totals approximately 2.8ha which includes the route of an access road and a predefined area. It lies between 40m above Ordnance Datum (aOD) in the north to 28m aOD in the south. The Site is bounded to the south by North Moor Farm and to the north by Top Road (A1103). At the time of survey the field conditions consisted of pasture and arable.

Soils and geology

The bedrock geology of the survey area belongs to the Kimmeridge Clay Formation - Mudstone. The sedimentary bedrock formed approximately 152 – 157 million years ago during the Jurassic period. Superficial deposits of the area are described as Brown Sand – Sand. Deposits formed 3 million years ago in the Quaternary Period. (BGS, 2018). The soils of the area are described as Holme Moor, Aeolian sand (641c). Deep stoneless naturally very acidic, fine sandy soils, with a bleached subsurface horizon, affected by ground water. Where cultivated, groundwater is controlled by ditches. Some well drained very acidic sandy soils (SSEW 1983).

2 Archaeological Background

The following information has been taken from Historic England's Pastscape website (HE 2018).

A 1km search radius from the site has found an early Bronze Age flat axe (monument No. 892437) to the northeast of the survey area. A possible Prehistoric or Roman enclosure and boundary can be seen as cropmarks to the east (monument No. 1044307).

A Second World War army camp and Prisoner of War camp 407 (Usselby Camp) are located at Osgodby Moor, northwest of site.

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 R8s GNSS system. 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 8 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 Figs 3 to 8)

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.

Large areas of magnetic disturbance have been recorded in Areas 3 and 4. The disturbance in Area 3 is possibly due to consolidation of the field or buried ferrous debris whilst the Area 4 is likely to be associated with former farm buildings. Other areas of disturbance can be seen adjacent to the field boundaries and will be caused by metal fencing in the boundaries.

Agricultural anomalies

Linear trends, visible in Area 1 are associated with possible ploughing. A band of responses (**1**) in the north of Area 3 is likely to be a modern track leading from a gap within the field boundary. It is also plausible that is of some archaeological interest but as there is no corroborative evidence and that the responses are immediately north of the area of disturbance this interpretation is tentative.

5 Conclusions

The magnetic data have detected no anomalies associated with an archaeological origin. The majority of the responses are considered modern due to former farm buildings, debris and metal fencing within boundaries. A handful of linear responses are associated agriculture. Overall, based on the geophysical survey, the archaeological potential of the survey area is deemed to be low.

Fig. 1. Site location

PROJECT ID: 8340-NMF18

SURVEY AREA

LOCATION AND DIRECTION OF PLATES

N

Area 1

Area 2

Area 3

Area 4

Brookfields

Woodlands

Drain

Pond

Pond

North Moor Farm

Pond

Tank

Silos

Piggery

Drain

Pond

391800

391600

391400

391200

509600

509800

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Tel: 0113 535 0163

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

0 100m

PROJECT ID: 8340-NMF18

N

Drain

Pond

rookfields

Area 1

Area 2

2.0

-1.0

nT

391800

391600

509600

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0 50m

Fig. 3. Processed greyscale magnetometer data; Areas 1 and 2 (1:1000 @ A3)

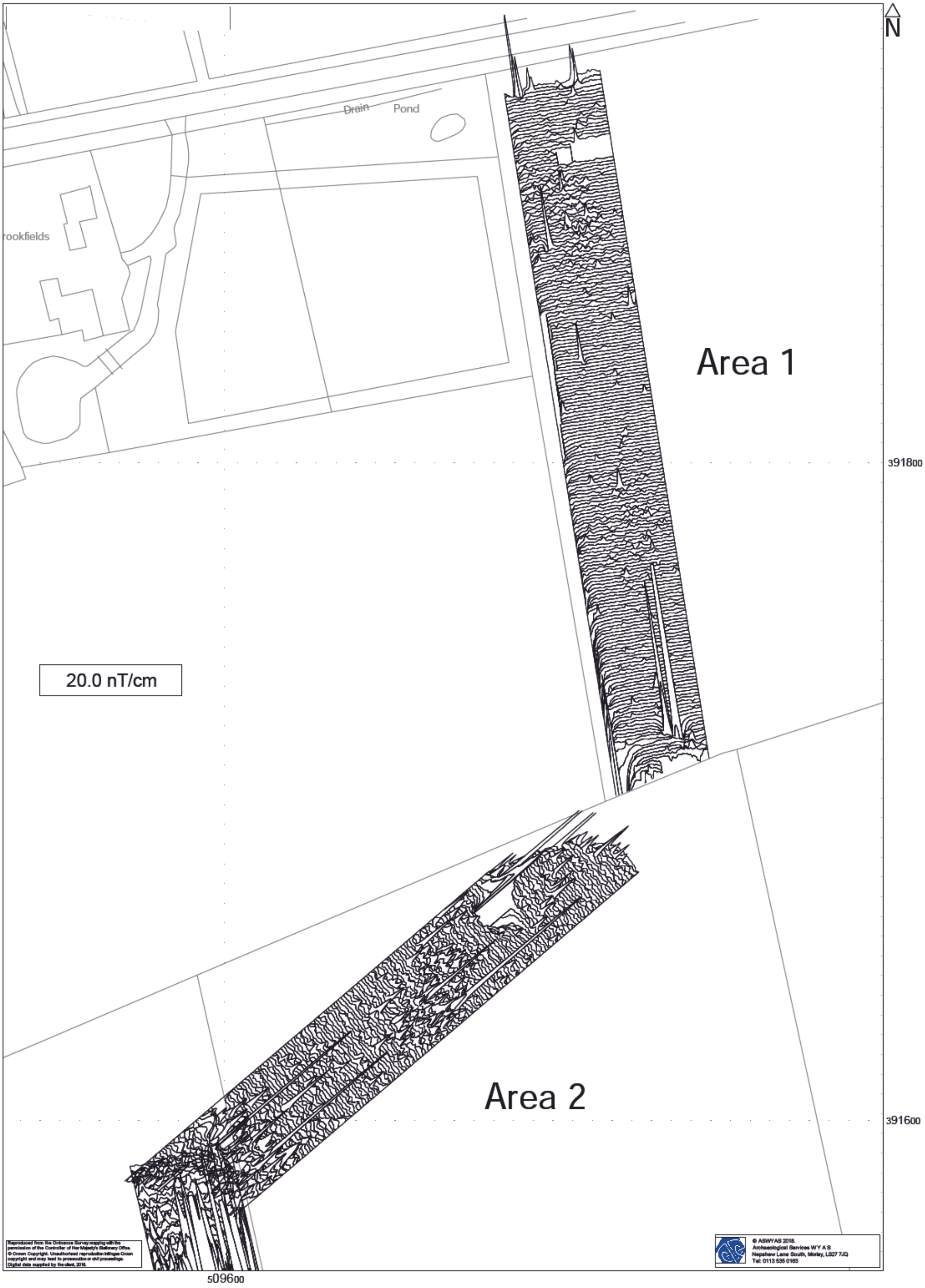

Fig. 4. XY trace plot of minimally processed magnetometer data; Areas 1 and 2 (1:1000 @ A3)

PROJECT ID: 8340-NMF18

N

Drain

Pond

rookfields

Area 1

TYPE OF ANOMALY		INTERPRETATION
	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	AGRICULTURAL

391800

Area 2

391600

1

509600

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Fig. 5. Interpretation of magnetometer data; Areas 1 and 2 (1:1000 @ A3)

0 50m

PROJECT ID: 8340-NMF18

N

Are

391600

2.0

-1.0

nT

Area 3

The Dale

Area 4

391400

North Moor Farm

Pond

Tank

Siols

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509600

Fig. 6. Processed greyscale magnetometer data; Areas 3 and 4 (1:1000 @ A3)

0 50m

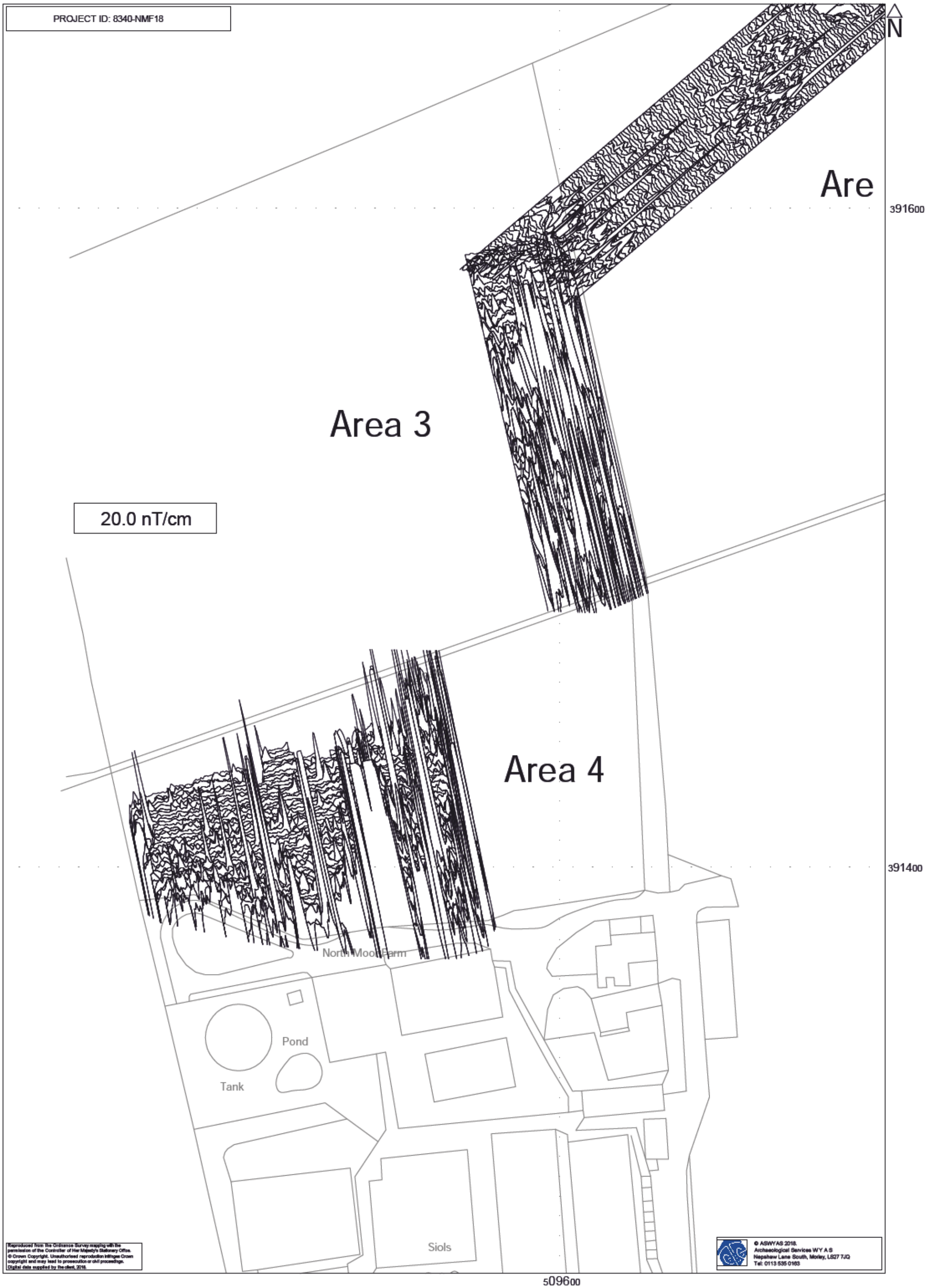

Fig. 7. XY trace plot of minimally processed magnetometer data; Areas 3 and 4 (1:1000 @ A3)

PROJECT ID: 8340-NMF18

N

Are

391600

1

Area 3

TYPE OF ANOMALY		INTERPRETATION
	DIPOLAR ISOLATED	FERROUS MATERIAL
	MAGNETIC DISTURBANCE	FERROUS MATERIAL
	LINEAR TREND	AGRICULTURAL

The Dale

Area 4

391400

North Moor Farm

Pond

Tank

Siols

Archaeological Services W Y A S
Nepshaw Lane South, Morley, LS27 7JQ
Tel: 0113 535 0183

509600

Fig. 8. Interpretation of magnetometer data; Areas 3 and 4 (1:1000 @ A3)

0 50m

Plate 1. General view of Area 1, looking north

Plate 2. General view of Area 2, looking southwest

Plate 3. General view of Area 3, looking north

Plate 4. General view of Area 4, looking northwest

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

The survey grid was set out using a Trimble R8s GNSS system with its integrated Trimble 360 tracking technology which supports signals from all existing and planned constellations and augmentation systems tracking the full range of satellite systems including GPS, GLONASS, Galileo, BeiDou and QZSS. 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 Lincolnshire Historic Environment Record).

Appendix 4: Oasis form

OASIS DATA COLLECTION FORM: England

OASIS ID: archaeol11-318740

Project details

Project name	North Moor Farm, Market Rasen
Short description of the project	A geophysical (magnetometer) survey, covering approximately 2.8 hectares, was undertaken on land to the north of North Moor Farm, Market Rasen, Lincolnshire. The magnetic survey has detected no anomalies of an archaeological origin. The majority of the responses are of a modern origin. Overall the archaeological potential of the site is low.
Project dates	Start: 24-05-2018 End: 24-05-2018
Previous/future work	No / Not known
Any associated project reference codes	8340 - Sitecode
Type of project	Field evaluation
Monument type	NONE None
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Farm infrastructure (e.g. barns, grain stores, equipment stores, etc.)
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology	KIMMERIDGE CLAY
Drift geology (other)	acidic sandy soils
Techniques	Magnetometry

Project location

Country	England
Site location	LINCOLNSHIRE WEST LINDSEY MIDDLE RASEN North Moor Farm, Market Rasen
Study area	2.8 Hectares
Site coordinates	

	TF 095 914 53.407769289721 -0.352573452985 53 24 27 N 000 21 09 W Point
Height OD / Depth	Min: 28m Max: 40m

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","Images raster / digital photography","Survey","Text"
Paper Archive Exists?	No

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	North Moor Farm, Market Rasen
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	4 June 2018

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