

SFNY19



SALLY FARM, THORNTON BRIDGE, NORTH YORKSHIRE

GEOPHYSICAL SURVEY

commissioned by Sally Farms Ltd

May 2019

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PROJECT INFO:

HA Project Code **SFNY19** / NGR **SE 4204 7014** / Parish **Thornton Bridge** / Local Authority **North Yorkshire** / OASIS Ref. **headland5-350476**

PROJECT TEAM:

Project Manager **David Harrison** / Author **David Harrison, Olivier Vansassenbrouck** / Fieldwork **Mark Evans, Phoebe Utting** / Graphics **Beata Wieczorek-Oleksy, Nick Hannon**

Approved by **David Harrison**



Headland Archaeology North
Unit 16 | Hillside | Beeston Rd | Leeds LS11 8ND
t 0113 387 6430
e north@headlandarchaeology.com
w www.headlandarchaeology.com



PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey over 11 hectares at Thornton Bridge, North Yorkshire where a new poultry unit is proposed. The survey covered only the proposed development footprint within a larger application area. The survey has not identified any anomalies of definite archaeological potential, mainly identifying anomalies which are consistent with post-medieval and modern land division and drainage. A cluster of discrete anomalies in the centre of the survey area may be archaeological in origin, perhaps being due to a spread of magnetically enhanced material, possibly rubble or building material. However, no clear pattern is discernible in the dataset and a modern cause such as tipping/infilling is equally plausible. These anomalies are ascribed low to moderate archaeological potential. Three probable ditches, oblique to the surrounding agricultural anomalies, are also assessed as of possible archaeological potential although an agricultural origin is thought more likely. Therefore, on the basis of the geophysical survey, the archaeological potential over the majority of the development footprint is assessed as very low, and low to moderate in the vicinity of the cluster of discrete anomalies.

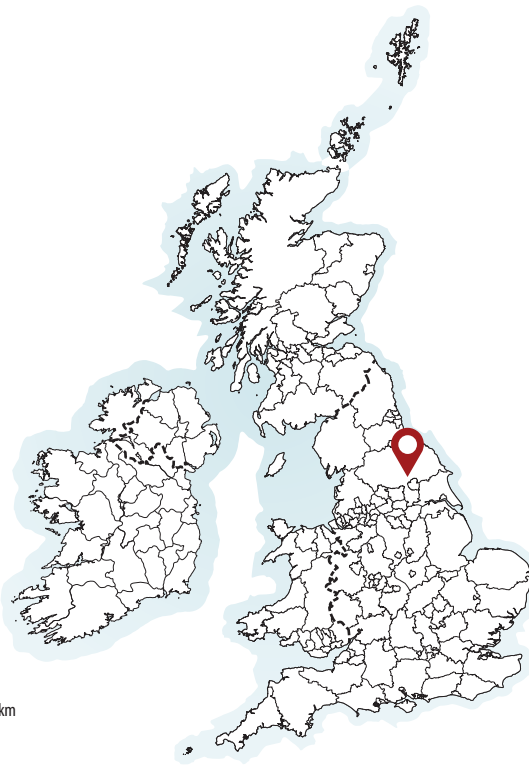
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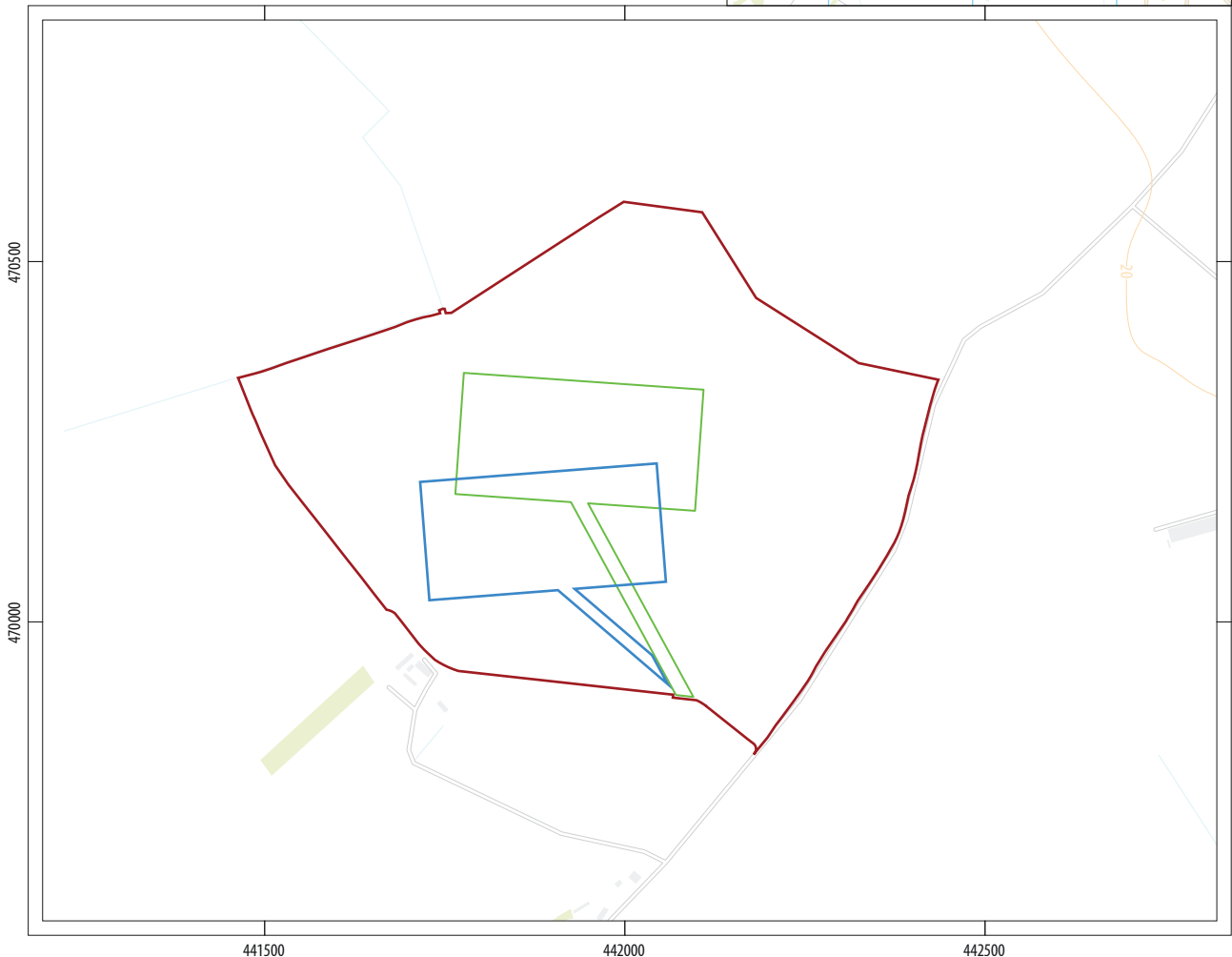
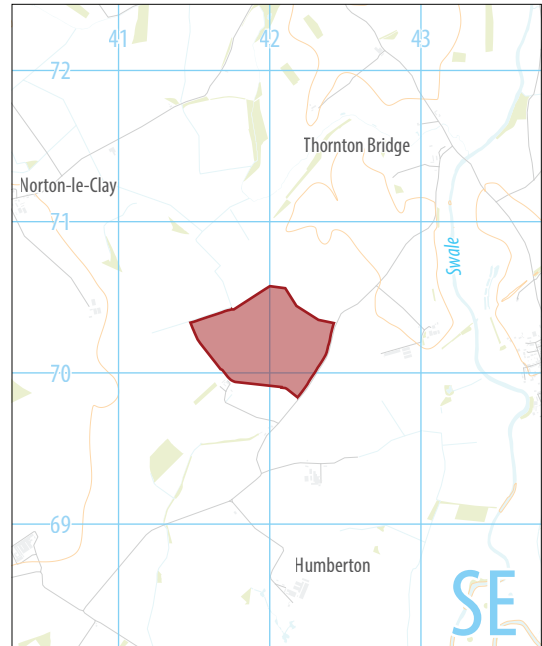
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Sally Farm
Thornton Bridge
North Yorkshire



0 200km
1:12,500,000 @ A4



0 200m
1:10,000 @ A4

- application area
- proposed development area
- previous geophysical survey area



Headland Archaeology North
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t 0113 387 6430
e north@headlandarchaeology.com
w www.headlandarchaeology.com

SALLY FARM, THORNTON BRIDGE, NORTH YORKSHIRE

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Ian Pick Associates Ltd (the Agent) on behalf of Sally Farms Ltd (the Client), to undertake a geophysical (magnetometer) survey of land at Thornton Bridge, North Yorkshire, where a new poultry unit is proposed. The results of the survey will inform future archaeological strategy at the site.

The work was undertaken in accordance with a Written Scheme of Investigation (Harrison 2019a) which was submitted to and approved by Peter Rowe (Principal Archaeologist at North Yorkshire County Council), with guidance within the National Planning Policy Framework (MHCLG 2018) and in line with current best practice (Chartered Institute for Archaeologists 2016, Europae Archaeologia Consilium 2016).

The survey was initially carried out on 18 February 2019 (Illus 3; Harrison 2019b) and subsequently extended southwards on 18 April 2019 following the relocation of the proposed development footprint. This report presents the results of both phases of survey.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The application area (AA) is located 4km north-east of Boroughbridge and 1.5km west of Helperby, North Yorkshire, centred on SE 4204 7014 (Illus 1). The AA comprises an irregularly-shaped block of land over two fields of short silage (Illus 2). These are divided by a north/south field boundary and are bound to the south-east by Burton Lane, to the south by a farm access track and to the north and west by hedged field boundaries. The north-east of the AA is unbound and extends onto open arable farmland. The Proposed Development Area (PDA) covered the footprint of the proposed poultry units, concrete apron, planting areas and access track (Illus 3) the remainder of the AA being used for hen grazing and therefore remaining unaffected by the proposed development.

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Sherwood Sandstone overlain by Alne Glaciolacustrine Formation – clay and silt (NERC 2019).

The soils are classified in the Soilscape 18 Association, characterised as slowly permeable seasonally wet loams and clays (Cranfield University 2019).

2 ARCHAEOLOGICAL BACKGROUND

The AA is located 1.5km south-west of the medieval Thornton Bridge Hall (55427) and the purported site of the village of Thornton which is mentioned in the Domesday book.

Analysis of historical Ordnance Survey (OS) maps indicates that several field boundaries have been removed from within the AA since the publication of the first edition OS map in 1885.

3 AIMS, METHODOLOGY AND PRESENTATION

The general aim of the geophysical survey was to provide sufficient information to establish the presence/absence, character and extent of any archaeological remains within the development footprint. This will therefore enable an assessment to be made of the impact of the proposed development on any sub-surface archaeological remains, if present.

The specific archaeological objectives of the geophysical survey were:

- › to provide information about the nature and possible interpretation of any magnetic anomalies identified;



ILLUS 2 Proposed development area, looking north-east

- › to therefore model the presence/absence and extent of any buried archaeological features; and
- › to prepare a report summarising the results of the survey.

3.1 MAGNETOMETER SURVEY

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. A feature such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney & Gater 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.

The survey was undertaken using four Bartington Grad601 sensors mounted at 1m intervals (1m traverse interval) onto a rigid carrying frame. The system was programmed to take readings at a frequency of 10Hz (allowing for a 10–15cm sample interval) on roaming traverses (swaths) 4m apart (Illus 3). These readings were stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system was linked to a Trimble R8s Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point.

MLGrad601 and MultiGrad601 (Geomar Software Inc.) software was used to collect and export the data. Terrasurveyor V3.0.32.4 (DWConsulting) software was used to process and present the data.

3.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:10,000. Illus 2 is a site condition photo. Illus 3 is a 1:4,000 survey location plan showing the direction of survey as GPS swaths and the proposed poultry units. Large scale minimally processed (XY trace plot) data, fully processed (greyscale) data and an accompanying interpretative plot are presented at a scale of 1:2,000 in Illus 4–6 inclusive.

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 details the survey location information and Appendix 3 describes the composition and location of the site archive. Data processing details are presented in Appendix 4. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 5.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (Harrison 2019a), guidelines outlined by Europae Archaeologia Consilium (EAC 2016) and by the Chartered Institute for Archaeologists (Cifa 2016). All illustrations from Ordnance Survey mapping are reproduced with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

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

4 RESULTS AND DISCUSSION

Ground conditions were very good across the PDA (Illus 2) leading to a high standard of data throughout.

The survey has detected a relatively flat magnetic background against which numerous linear agricultural anomalies criss-cross the survey area. Against this background, numerous anomalies have been identified and these are discussed below and cross-referenced to specific examples on the interpretive figures, where appropriate.

4.1 FERROUS ANOMALIES

Ferrous anomalies, characterised as individual 'spikes', 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 is common on most sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious clustering to these ferrous anomalies which might indicate an archaeological origin. Far more probable is that the 'spike' responses are likely caused by the random distribution of ferrous debris in the upper soil horizons.

Three high magnitude spikes (TP1–TP3; Illus 6) are due to the proximity of telegraph poles. A single high magnitude 'spike' anomaly (MH1) in the north-west of the PDA is due to a manhole cover.

A dipolar linear anomaly (F1) in the west of the PDA is caused by a wire fence.

Magnetic disturbance along the north/south field boundary within the east of the survey area is caused by ferrous material within, or adjacent to, the field boundaries and is of no archaeological interest.

4.2 AGRICULTURAL ANOMALIES

Analysis of historical Ordnance Survey (OS) maps indicates that six field boundaries have been removed from within the survey area since the publication of the first edition OS map in 1885. These former boundaries have been detected by the survey, on varying alignments, as high magnitude linear anomalies (FB1–FB6; Illus 6).

Broadly-spaced parallel linear anomalies are characteristic of modern field drains, whereas the more closely-spaced parallel linear anomalies are indicative of modern ploughing.

4.3 GEOLOGICAL ANOMALIES

Numerous discrete low-magnitude anomalies have been identified throughout the PDA. The frequency and distribution of these anomalies precludes an archaeological interpretation and the anomalies are thought to be caused by localised variation in the depth and composition of the topsoil.

4.4 QUARRYING ANOMALIES

Broad and amorphous areas of magnetic enhancement (Q1–Q3) are thought to be possibly due to localised post-medieval mineral extraction. Although not recorded in these locations on historic OS maps, several ponds are recorded in the surrounding landscape.

4.5 POSSIBLE ARCHAEOLOGICAL ANOMALIES

A cluster of high magnitude discrete anomalies (AAP1) is identified in the centre of the PDA. No clear archaeological pattern is discernible in the data and the anomalies may have a modern origin, perhaps being due to tipping or infilling. However, an archaeological origin cannot be completely dismissed.

Three high magnitude linear anomalies (D1–D3; Illus 6) have been identified oblique to the surrounding agricultural anomalies. The anomalies may locate soil-filled ditches and may be archaeological in origin. However, in the absence of any clear patterns an agricultural interpretation is preferred, and the anomalies are thought more likely to be agricultural in origin, probably due to drains.

5 CONCLUSION

The survey has successfully evaluated the proposed development footprint and has not identified any anomalies of definite archaeological potential, mainly identifying anomalies which are consistent with post-medieval and modern land division and drainage. A cluster of discrete anomalies in the centre of the survey area may be archaeological in origin, perhaps being due to a spread of magnetically enhanced material, possibly rubble or building material. However, no clear pattern is discernible in the dataset and a modern cause such as tipping/infilling is equally plausible. These anomalies are ascribed low to moderate archaeological potential. Three probable ditches, oblique to the surrounding agricultural anomalies, are also assessed as of possible archaeological potential although an agricultural origin is thought more likely. Therefore, on the basis of the geophysical survey, the archaeological potential over the majority of the development footprint is assessed as very low, and low to moderate in the vicinity of the cluster of discrete anomalies.

6 REFERENCES

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- ▭ Application Area
- ▭ Proposed Development Area
- ▭ Previous Geophysical Survey Area
- GPS Swaths
- Proposed poultry units and associated infrastructure
- 2 Location and direction of ILLUS 2



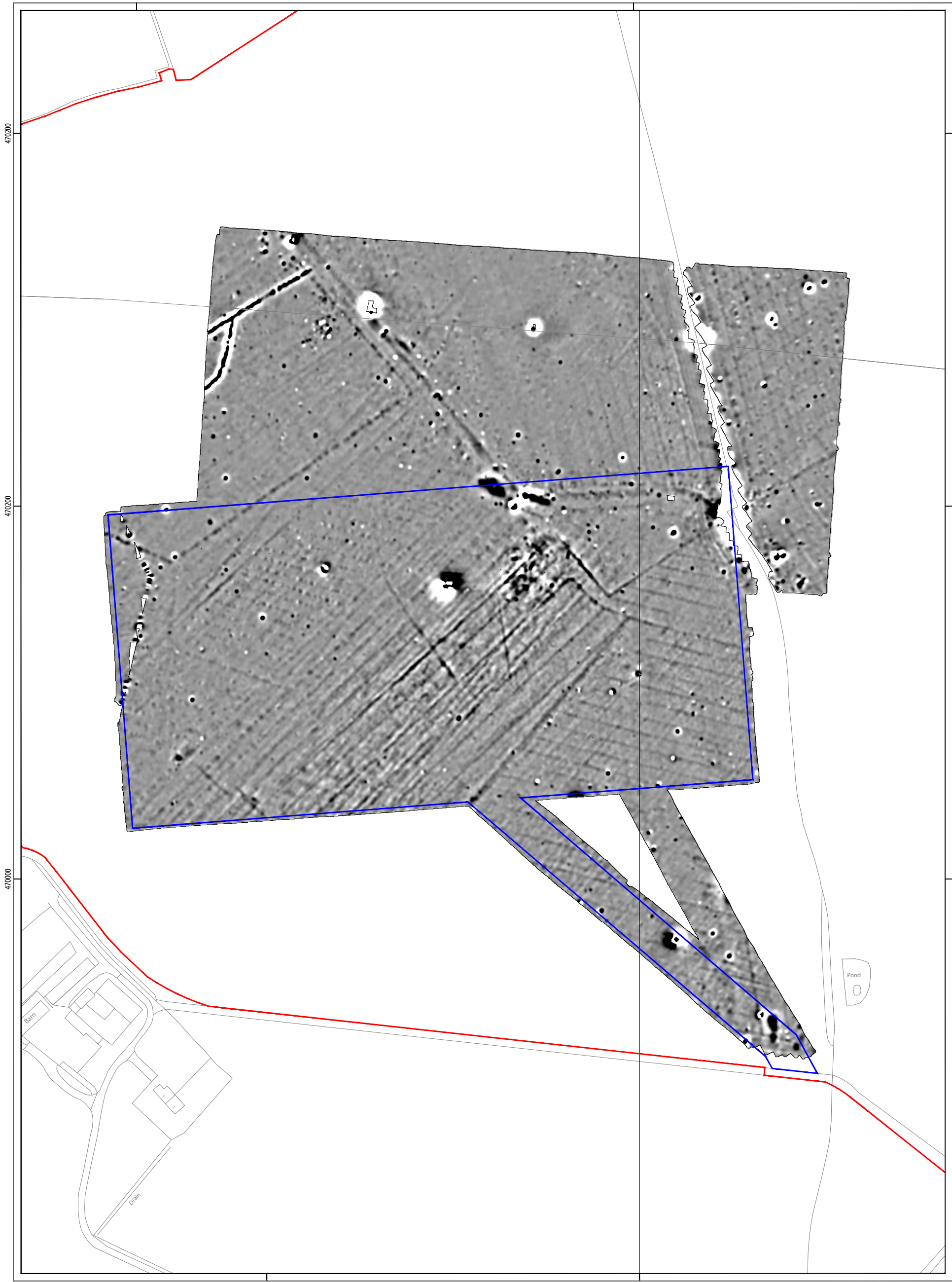
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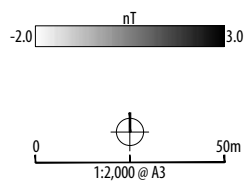
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ILLUS 3 Survey location showing GPS swaths and proposed poultry unit



□ Application Area
□ Proposed Development Area

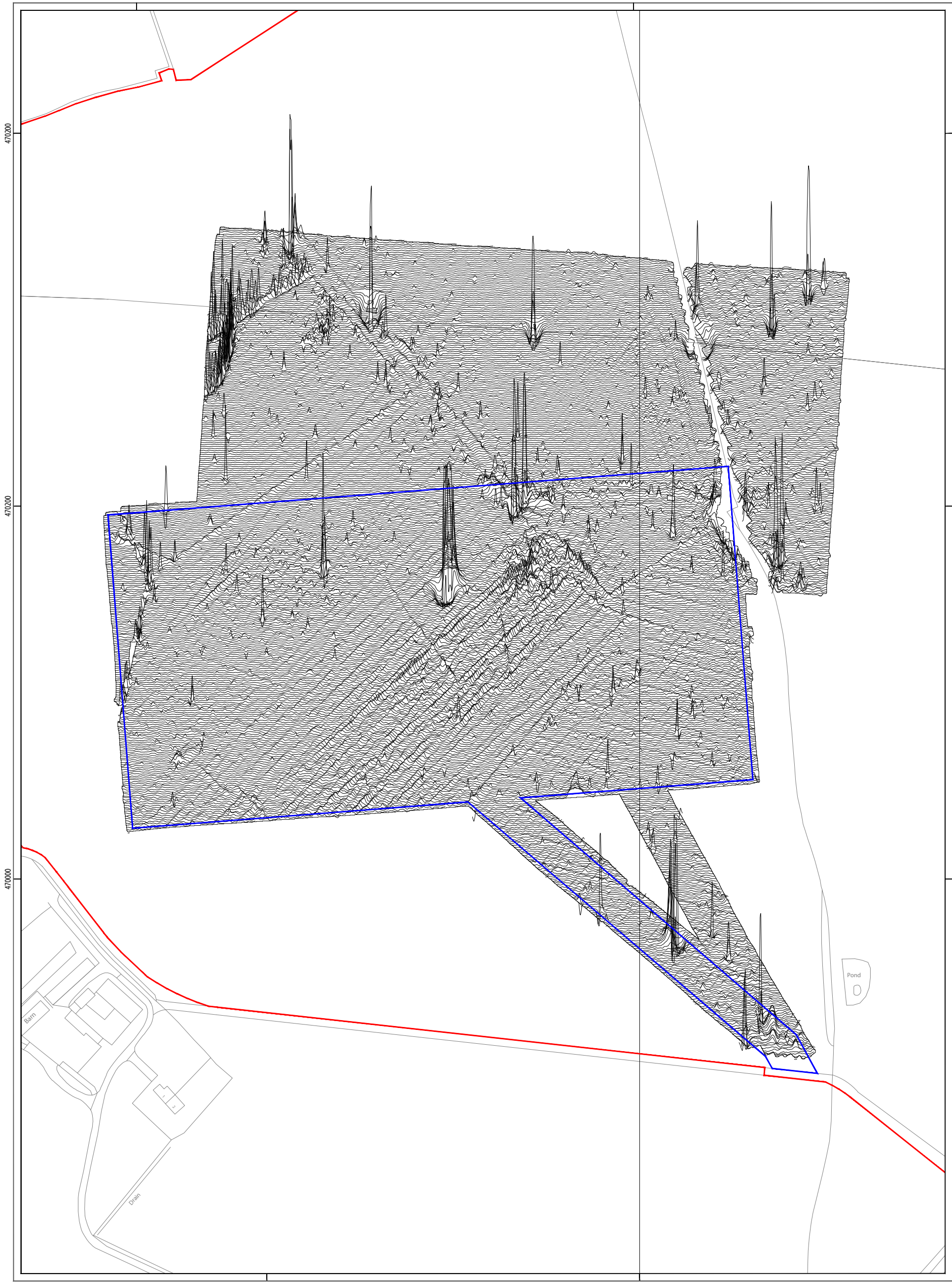


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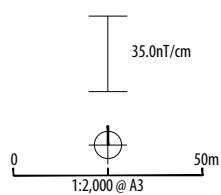
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ILLUS 4 Processed greyscale magnetometer data



- ▭ Application Area
- ▭ Proposed Development Area



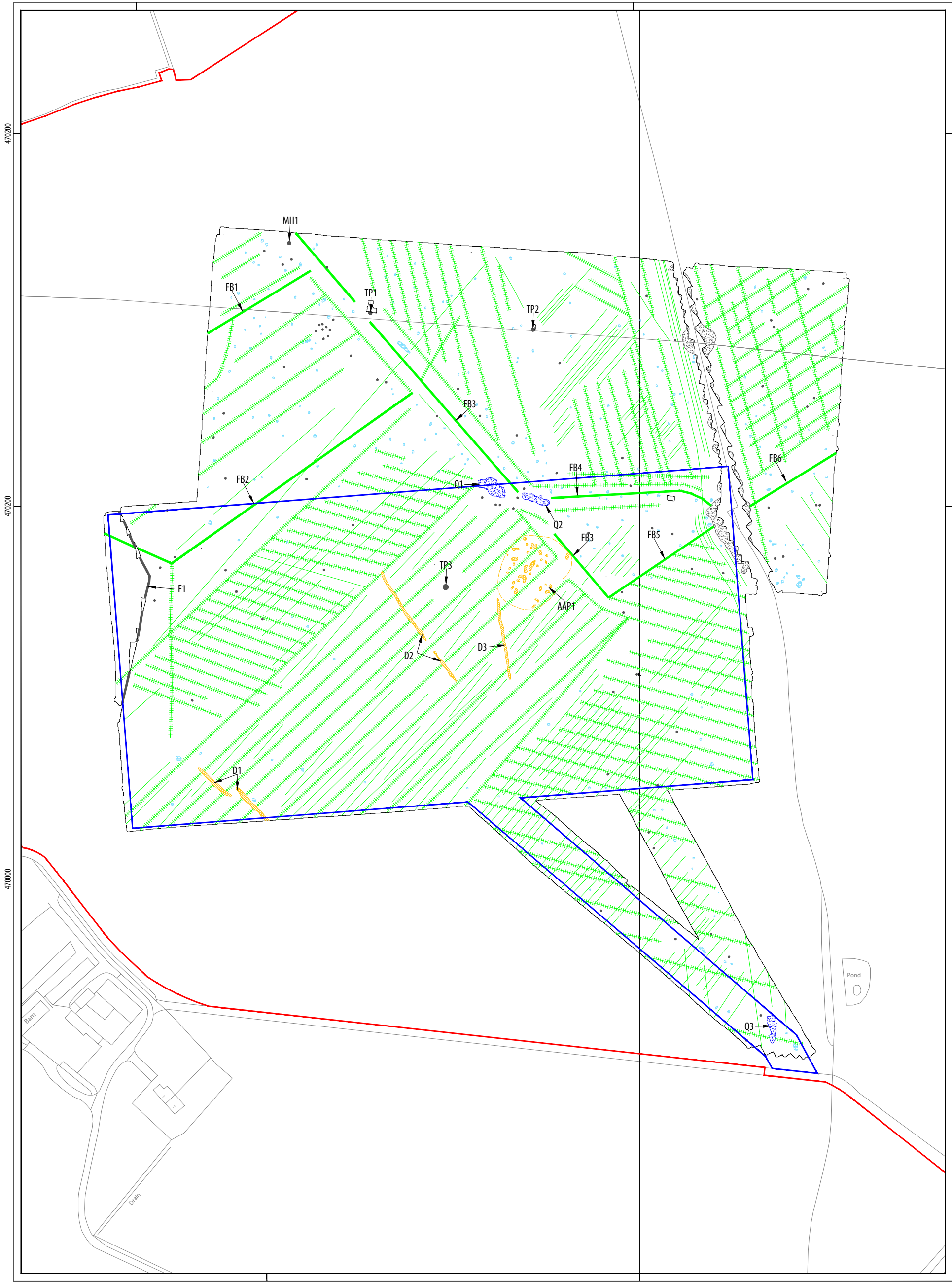
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ILLUS 5 XY trace plot of minimally processed magnetometer data



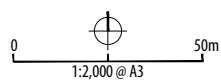
- ▭ Application Area
- ▭ Proposed Development Area

TYPE OF ANOMALY	INTERPRETATION
● dipolar isolated	ferrous material
● magnetic disturbance	ferrous material
— linear	fence

TYPE OF ANOMALY	INTERPRETATION
— linear	former field boundary
— linear trend	agricultural
— linear trend	field drain
● magnetic enhancement	quarrying?
● magnetic enhancement	geology
● magnetic enhancement	archaeology?

INTERPRETATION	ABBREVIATIONS
former field boundary	AAP area of archaeological potential
agricultural	D ditch
field drain	F fence
quarrying?	FB field boundary
geology	MH manhole cover
archaeology?	Q quarrying?

ABBREVIATIONS	INTERPRETATION
AAP	area of archaeological potential
D	ditch
F	fence
FB	field boundary
MH	manhole cover
Q	quarrying?
TP	telegraph pole



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NORTH Unit 16, Hillside, Beeston Road
Leeds LS11 8ND
0113 387 6430
www.headlandarchaeology.com

ILLUS 6 Interpretation of magnetometer data

7 APPENDICES

APPENDIX 1 MAGNETOMETER SURVEY

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 haematite. 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 so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue 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. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

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.

Lineartrend 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 (sometimes only visible on an XY trace plot) 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.

APPENDIX 2 SURVEY LOCATION INFORMATION

An initial survey base station was established using a Trimble VRS differential Global Positioning System (dGPS). The magnetometer data was georeferenced using a Trimble RTK differential Global Positioning System (Trimble R8s model).

Temporary sight markers were laid out using a Trimble VRS differential Global Positioning System (Trimble R8s model) to guide the operator and ensure full coverage. The accuracy of this dGPS equipment is better than 0.01m.

The survey data 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 coordinates are measured off hard copies of the mapping rather than using the digital coordinates.

Headland Archaeology cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE

The geophysical archive comprises an archive disk containing the raw data in XYZ format, a raster image of each greyscale plot with associate world file, and a PDF of the report.

The project will be archived in-house in accordance with recent good practice guidelines (http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_3). The data will be stored in an indexed archive and migrated to new formats when necessary.

APPENDIX 4 DATA PROCESSING

The gradiometer data has been presented in this report in processed greyscale and minimally processed XY trace plot format.

Data collected using RTK GPS-based methods cannot be produced without minimal processing of the data. The minimally processed data has been interpolated to project the data onto a regular grid and de-striped to correct for slight variations in instrument calibration drift and any other artificial data.

A high pass filter has been applied to the greyscale plots to remove low frequency anomalies (relating to survey tracks and modern agricultural features) in order to maximise the clarity and interpretability of the archaeological anomalies.

The data has also been clipped to remove extreme values and to improve data contrast.

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: *headland5-350476*

PROJECT DETAILS	
Project name	Sally Farm, Thornton Bridge, North Yorkshire
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey over 11 hectares at Thornton Bridge, North Yorkshire where a new poultry unit is proposed. The survey covered only the proposed development footprint within a larger application area. The survey has not identified any anomalies of definite archaeological potential, mainly identifying anomalies which are consistent with post-medieval and modern land division and drainage. A cluster of discrete anomalies in the centre of the survey area may be archaeological in origin, perhaps being due to a spread of magnetically enhanced material, possibly rubble or building material. However, no clear pattern is discernible in the dataset and a modern cause such as tipping/infilling is equally plausible. These anomalies are ascribed low to moderate archaeological potential. Three probable ditches, oblique to the surrounding agricultural anomalies, are also assessed as of possible archaeological potential although an agricultural origin is thought more likely. Therefore, on the basis of the geophysical survey, the archaeological potential over the majority of the development footprint is assessed as very low, and low to moderate in the vicinity of the cluster of discrete anomalies.
Project dates	Start: 18-02-2019 End: 18-04-2019
Previous/future work	No / Not known
Any associated project reference codes	SFNY19 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	N/A None
Monument type	N/A None
Significant Finds	N/A None
Significant Finds	N/A 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	Between deposition of an application and determination
Solid geology (other)	Sherwood Sandstone
Drift geology	Lacustrine Clays, Silts And Sands
Techniques	Magnetometry
PROJECT LOCATION	
Country	England
Site location	North Yorkshire Harrogate Thornton Bridge Sally Farm, Thornton Bridge, North Yorkshire
Study area	11 Hectares
Site coordinates	SE 4204 7014 54.125220630756 -1.356654599811 54 07 30 N 001 21 23 W Point
PROJECT CREATORS	
Name of Organisation	Headland Archaeology
Project brief originator	Ian Pick and Associates
Project design originator	Headland Archaeology
Project director/manager	Harrison, D

Project supervisor	Evans, M
Project supervisor	Dyulgerski, K
Type of sponsor/funding body	Developer
PROJECT ARCHIVES	
Physical Archive Exists?	No
Digital Archive recipient	In house
Digital Contents	"Survey"
Digital Media available	"Geophysics"
Paper Archive Exists?	No
PROJECT BIBLIOGRAPHY 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Sally Farm, Thornton Bridge, North Yorkshire; Geophysical Survey
Author(s)/Editor(s)	Harrison, D
Author(s)/Editor(s)	Vansassenbrouck, O
Date	2019
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Entered on	3 May 2019



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Headland Archaeology South & East
Building 68C | Wrest Park | Silsoe | Bedfordshire MK45 4HS
t 01525 861 578
e southandeast@headlandarchaeology.com

Headland Archaeology Midlands & West
Unit 1 | Clearview Court | Ivyford Rd | Hereford HR2 6JR
t 01432 364 901
e midlandsandwest@headlandarchaeology.com

Headland Archaeology North
Unit 16 | Hillside | Beeston Rd | Leeds LS11 8ND
t 0113 387 6430
e north@headlandarchaeology.com

Headland Archaeology Scotland
13 Jane Street | Edinburgh EH6 5HE
t 0131 467 7705
e scotland@headlandarchaeology.com

www.headlandarchaeology.com