WYAS Archaeological Services

Swinston Hill Road

Dinnington

South Yorkshire

Geophysical Survey

Report no. 3717
February 2022

Clients: Hoober Urban Partnerships
Wakefield District Housing

REGISTERED CIfA ORGANISATION

West Yorkshire Joint Services

Land off Swinston Hill Road
Dinnington
South Yorkshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey was undertaken on approximately 1.5 hectares of land located to the south of Swinston Hill Road, Dinnington, South Yorkshire. Anomalies associated with possible medieval/post-medieval ridge and furrow cultivation have been detected along with responses associated with a recent boundary fence. Responses categorised as uncertain may be of some interest. Magnetic disturbance can be seen across the Site and a service pipe runs in the north. Based on the geophysical survey the archaeological potential of this Site is deemed to be low.

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Services

Report Information

Client:	Hoober Urban Partnerships and Wakefield District Housing
Address:	Unit 4, Fields End Business Park, Thurnscoe, Rotherham, S63 0JF
Report Type:	Geophysical Survey
Location:	Dinnington
County:	South Yorkshire
Grid Reference:	SK 53475 85240
Period(s) of activity:	post-medieval/modern
Report Number:	3717
Project Number:	XE87
Site Code:	SWH22
OASIS ID:	archaeol11- 504580
Date of fieldwork:	February 2022
Date of report:	February 2022
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Authorisation for distribution: ----------

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1 Introduction

Archaeological Services ASWYAS has been commissioned by Hoober Urban Partnerships and Wakefield District Housing to undertake a geophysical survey at land to the south of Swinston Hill Road, Dinnington, South Yorkshire. This was undertaken in line with current best practice (CIfA 2020; Schmidt *et al.* 2016). The survey was carried out on the 9th February 2022 to provide additional information on the archaeological resource of the Site.

Site location, topography and land-use

The Site is located to the south of Swinston Hill Road, to the east of the village of Dinnington located at SK 53475 85240 (see Fig 1). It comprises a single field of rough pasture and No. 166 Swinston Hill Road (see Plates 1-4). Of the available 1.45ha of land, only 1.15ha was suitable for survey. The Site lies at 115m (above Ordnance Datum) with a generally flat topography.

Soils and geology

The underlying bedrock deposits belong to the Cadeby Formation, which is described as Dolostone, a sedimentary bedrock formed approximately 252 to 272 million years ago in the Permian Period. No superficial deposits have been recorded (BGS 2022). Soils of the area are described as freely draining lime-rich loamy soils (Soilscape 5) (CSAI 2022).

2 Archaeological Background

A desk-based study of the adjacent plot of land to the west (Horn 2018) shows that although no archaeological investigations have occurred with the site, there is potential for late prehistoric and Roman sub-surface remains due to the proximity of known archaeological activity in the vicinity.

The Swinston Hill Wood Romano-British enclosure (MSY10757) lies 700m to the southeast of the site. In both size and shape, it compares closely with numerous small ditched enclosures in areas of woodland in South Yorkshire. Scratta Wood to the south and Edlington Wood to the north are similar examples. Their origins may lie in the later Iron Age, but fieldwork and excavation have produced predominantly Romano-British material.

Dinnington was originally a small, isolated farming community, based around the New Road area of the town, 800m to the northwest of the proposed development site. The earliest available map that covers the proposed development site is Jeffery's map of Yorkshire dated 1771 that shows Dinnington, as Dunnington with a cluster of buildings, a church and a possible mill to the immediate south. The neighbouring village of North Anston is shown with a windmill.

A geophysical survey was undertaken on land to the west of the site in March 2019 by ASWYAS (Chatterton and Williams 2019). Anomalies synonymous with previous agricultural use and modern land use caused wide spread magnetic disturbance. Anomalies that are potentially archaeological were identified within the data set as they did not conform to the modern field layout. Within the centre of the site, areas of magnetic disturbance related to former modern structures.

An archaeological evaluation comprising twenty trenches was subsequently undertaken on the same site in December 2019 (Bracken 2020). A number of ditches were excavated and while a single OSL date indicated Roman-period activity, no obvious field system was noted as many of the geophysical anomalies were not observed. A shallow pit containing evidence of in-situ burning was recorded, and oak charcoal was noted, but no datable finds were recovered. The results of the trial trenching suggest that significant archaeological remains were unlikely to be present.

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 1:2000. Processed and minimally processed data, together with interpretation of the survey results are presented in Figures 3 to 5 inclusive at a scale of 1:1000.

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 the European Archaeological Council (Schmidt *et al*. 2015) and by the Chartered Institute for Archaeologists (CIfA 2020). 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 within the north and east of the survey area are due to be linked with dumped ferrous materials such as fencing, rubbish and rubble.

Within the north of the data, on a northwest to southeast alignment a linear dipolar trend has been recorded which reflects a service pipe.

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 some of these anomalies are from deeply buried ferrous material.

Agricultural anomalies

A boundary fence which appears on aerial images dated 1999 but no longer within the field has been recorded within the data as a magnetically strong linear response due to its ferrous composition.

Parallel linear trends which are aligned on a northwest to southeast alignment may be associated with medieval/post-medieval ridge and furrow cultivation. Post-medieval ridge and furrow is visible as earthworks in the adjacent field to the southwest (HE 2022) which adds weight to this interpretation.

Uncertain anomalies

A number of anomalies recorded as having an uncertain interpretation have been recorded throughout the Site. The possibility that any of these might be of some archaeological interest cannot be dismissed, but the magnetic disturbance and ferrous responses in the area preclude any firm interpretation.

Given the nature of the Site and recent land-use, a combination of modern debris, agriculture and natural variations seems more likely.

5 Conclusions

The geophysical survey has detected magnetic anomalies associated with possible ridge and furrow cultivation, a former boundary fence, responses of an uncertain origin and geological anomalies. Magnetic disturbance within the Site are caused by dumped modern materials and a service pipe has also been recorded. Based on the geophysical survey, the archaeological potential of this Site is deemed to be low.

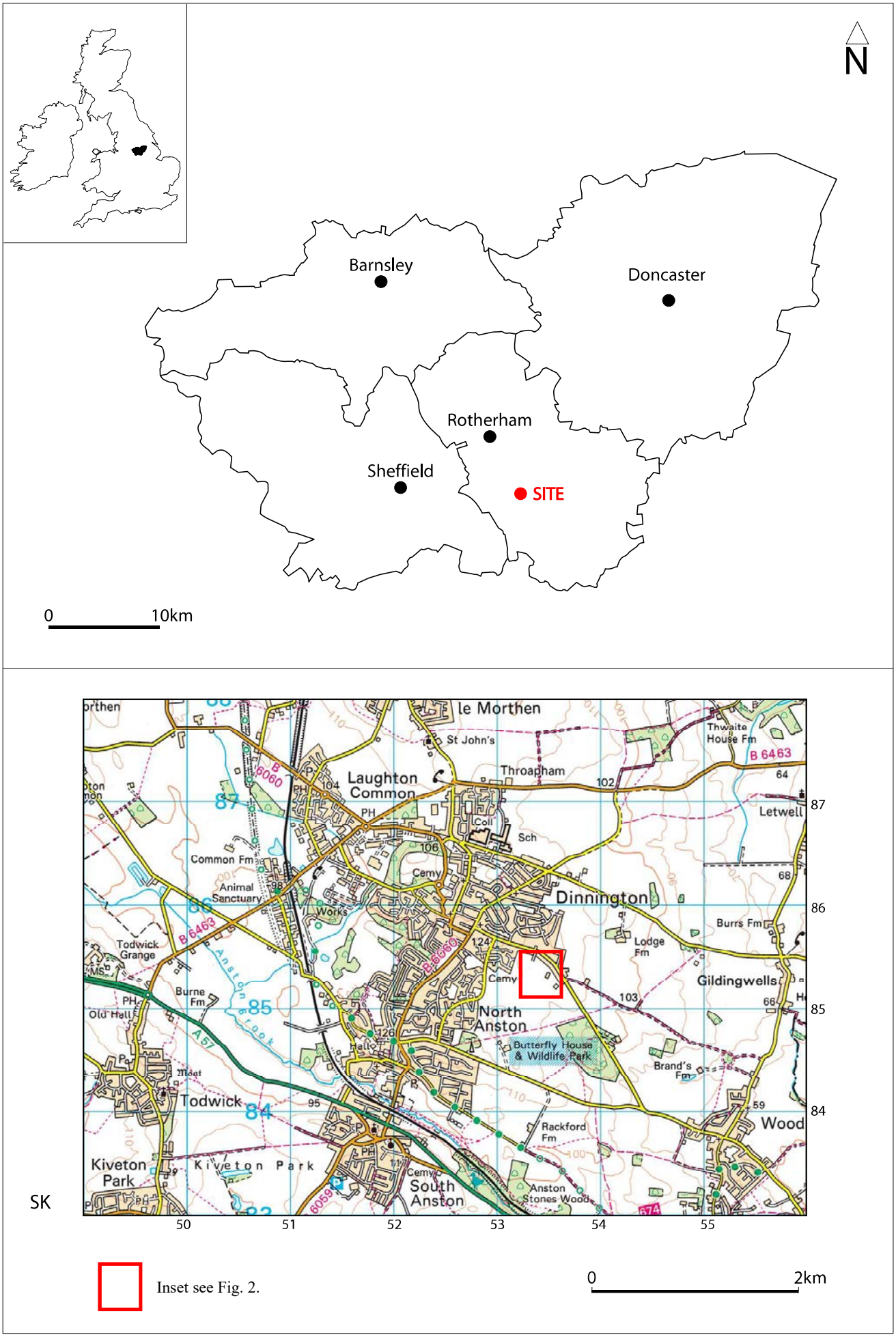

Fig. 1. Site location

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Project ID: XE87_SWH22

Survey location showing processed magnetometer data

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Fig. 2

Title

SURVEY AREA

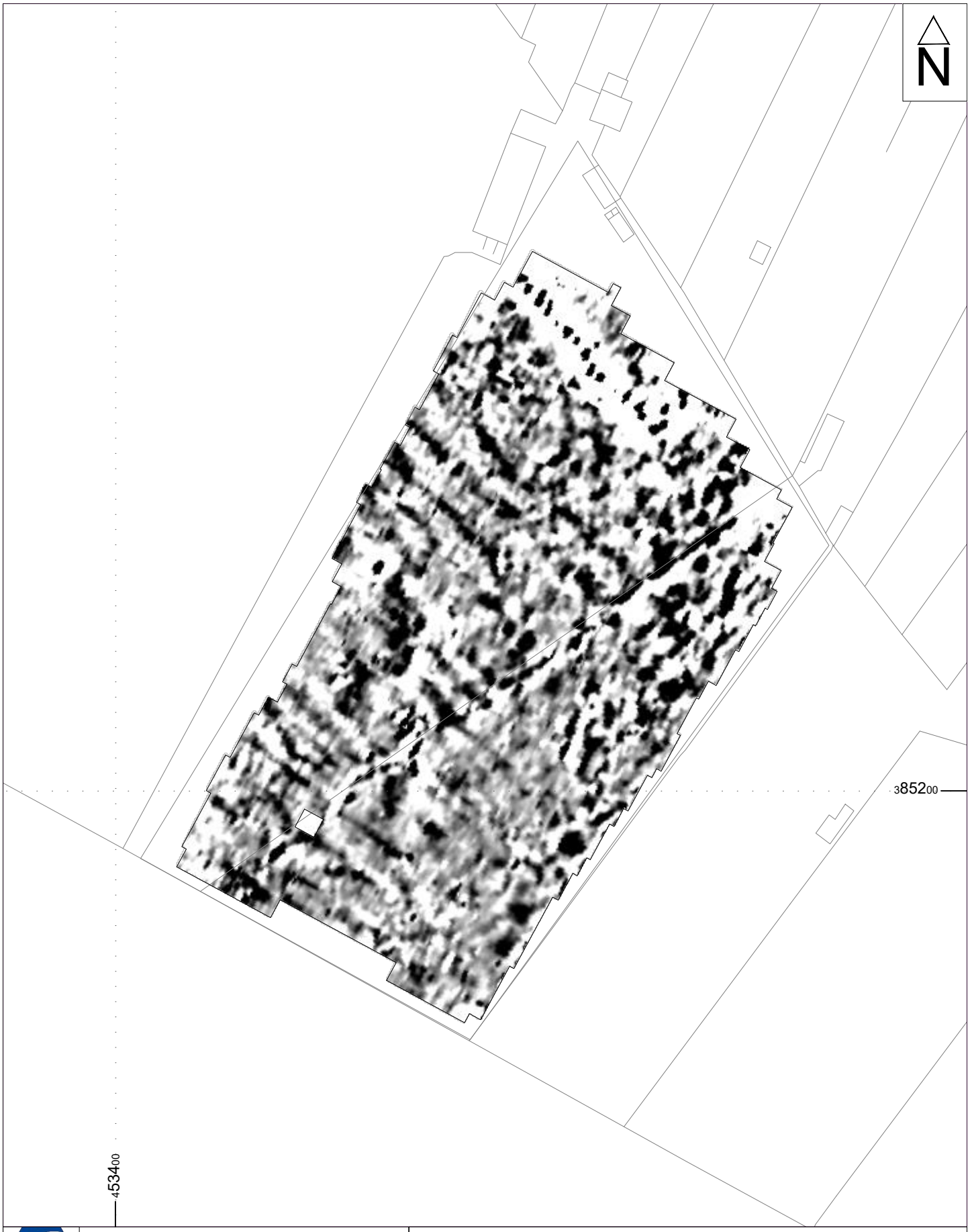
UNSUITABLE FOR SURVEY

1 PHOTO LOCATIONS

nT -1.0 2.0

0 50m

1:2000 @ A4



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Processed greyscale magnetometer data

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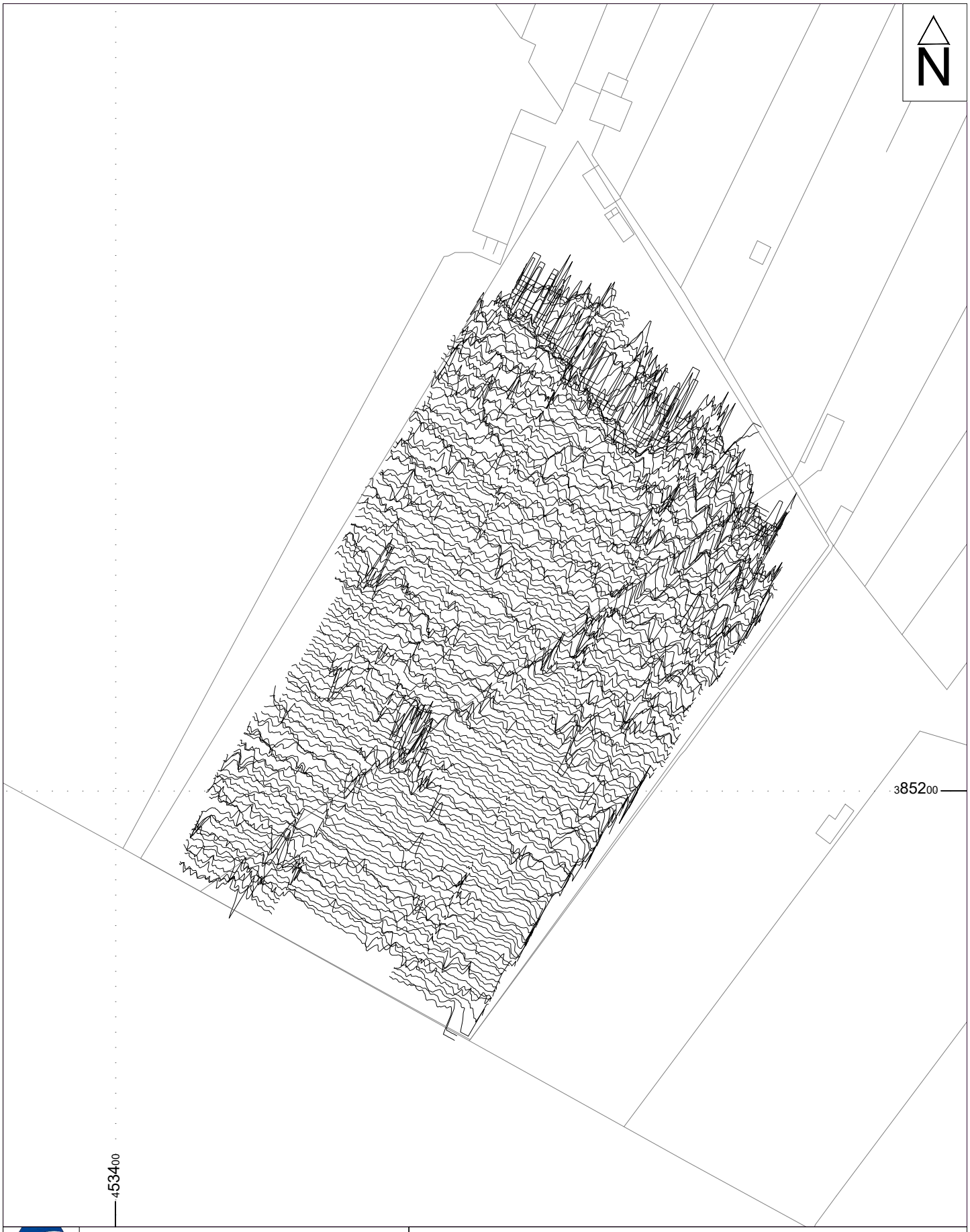
Fig. 3

nT -1.0 2.0

0 30m

1:1000 @ A4



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XY trace plot of minimally processed magnetometer data

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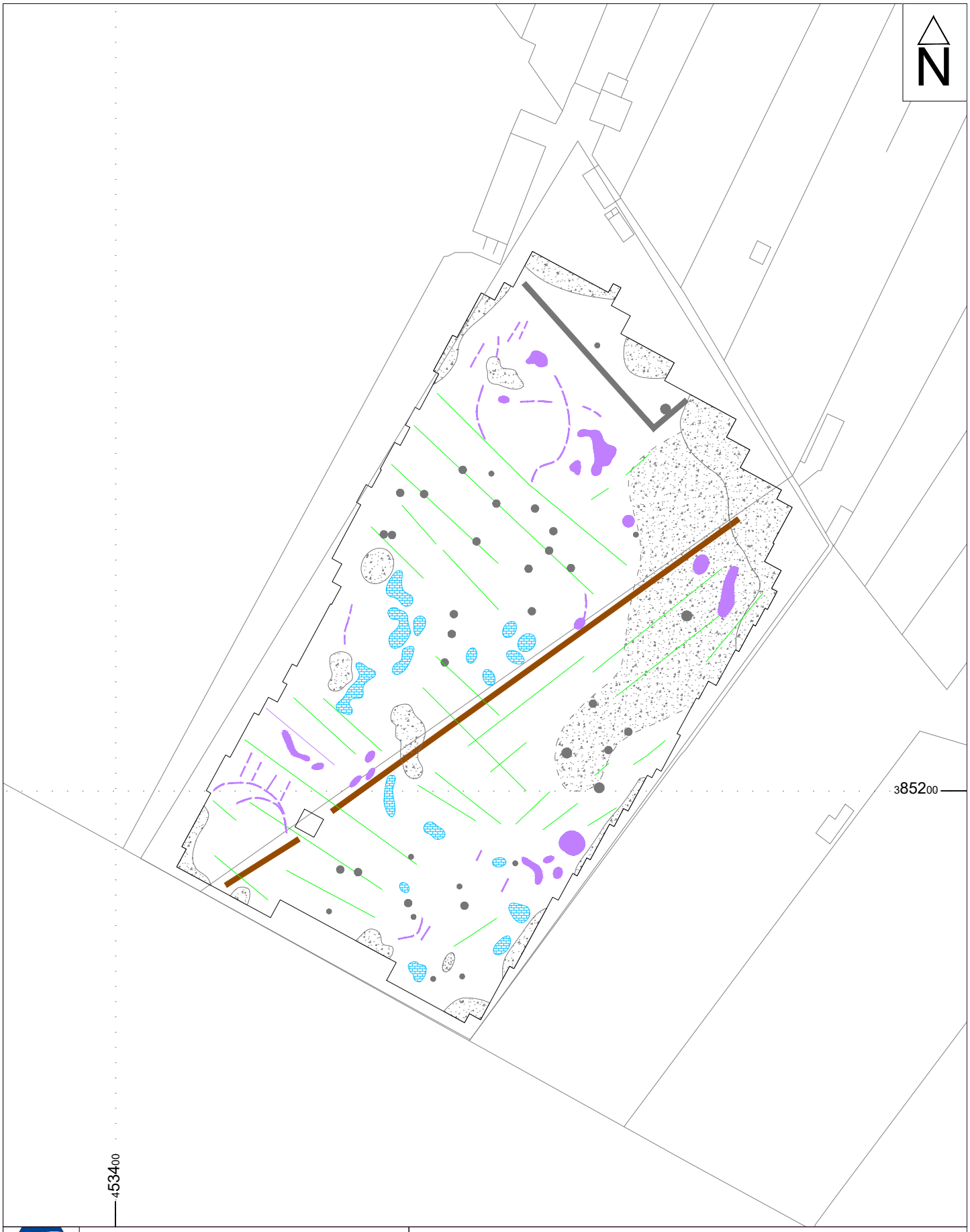
Fig. 4

15.0 nT/cm

0 30m

1:1000 @ A4



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Interpretation of magnetometer data

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Fig. 5

Interpretation

- FERROUS
- AGRICULTURAL
- UNCERTAIN
- SERVICE PIPE
- FORMER BOUNDARY
- MAGNETIC DISTURBANCE
- GEOLOGY

0 30m

1:1000 @ A4

Plate 1. General view of Site, looking west

Plate 2. General view of Site, looking southwest

Plate 3. Vie of area unsuitable for survey

Plate 4. General view of Site, looking northeast

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 and metadata

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2003), and graphics files (Adobe Illustrator CS6 and AutoCAD 2017) 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 SouthYorkshire Historic Environment Record).

Appendix 4: Oasis form

Summary for archaeol11-504580

OASIS ID (UID)	archaeol11-504580
Project Name	Geophysical Survey at Swinston Hill Road, Dinnington
Activity type	Geophysical Survey, MAGNETOMETRY SURVEY
Project Identifier(s)	
Planning Id	
Reason For Investigation	Planning: Pre application
Organisation Responsible for work	Archaeological Services WYAS
Project Dates	09-Feb-2022 - 09-Feb-2022
Location	Swinston Hill Road, Dinnington NGR : SK 53475 85240 LL : 53.3613383399737, -1.19793326381682 12 Fig : 453475,385240
Administrative Areas	Country : England County : South Yorkshire District : Rotherham Parish : Dinnington St. John's
Project Methodology	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.
Project Results	A geophysical (magnetometer) survey was undertaken on approximately 1.5 hectares of land located to the south of Swinston Hill Road, Dinnington, South Yorkshire. Anomalies associated with possible medieval/post-medieval ridge and furrow cultivation have been detected along with responses associated with a recent boundary fence. Responses categorised as uncertain may be of some interest. Magnetic disturbance can be seen across the Site and a service pipe runs in the north. Based on the geophysical survey the archaeological potential of this Site is deemed to be low.
Keywords	
HER	South Yorkshire Archaeology Service - noRev - LITE
HER Identifiers	
Archives	

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