WYAS Archaeological Services

Land at Westminster Drive

Dunsville

South Yorkshire

Geophysical Survey

Report no. 3205
November 2018

Client: Jones Homes (Yorkshire) Limited

West Yorkshire Joint Services

Land at Westminster Drive
Dunsville
South Yorkshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey, covering approximately 3.7 hectares, was undertaken on land to the west of Westminster Drive, Dunsville, South Yorkshire. This was part of a programme of archaeological works in advance of a proposed development. The magnetic survey has detected a number of equally spaced, linear anomalies trending in a north east to south west orientation. These responses are synonymous with that of a field drainage system. Two thin linear responses have also been identified, however these anomalies are believed to have a possible archaeological origin. Overall the archaeological potential of the site is low.

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Report Information

Client:	Jones Homes (Yorkshire) Limited
Address:	Green Bank House, Green Bank, Cleckheaton, West Yorkshire, BD19 5LQ
Report Type:	Geophysical Survey
Location:	Westminster Drive, Dunsville
County:	South Yorkshire
Grid Reference:	centred on SE 63927 07726
Period(s) of activity:	Post-medieval/ Early Modern
Report Number:	3205
Project Number:	8469
Site Code:	WDD18
OASIS ID:	archaeol11-332924
Date of fieldwork:	November 2018
Date of report:	Novemeber 2018
Project Management:	Christopher Sykes BSc MCIfA
Fieldwork:	Alastair Trace BSc MSc
	Clare Asplin BA
Report:	Alastair Trace
Illustrations:	Alastair Trace

Authorisation for distribution: --

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Nepshaw Lane South, Morley, Leeds LS27 7JQ
Telephone: 0113 383 7500.
Email: admin@aswyas.com

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1 Introduction

Archaeological Services WYAS (ASWYAS) were commissioned by Jones Homes (Yorkshire) Limited to undertake a geophysical (magnetometer) survey on overgrown pasture land to the west of Westminster Drive, Dunsville, South Yorkshire. This is in advance of a proposed development. Guidance contained within the National Planning Policy Framework (MHCLG 2018) was followed, in line with current best practice (CIfA 2014; David *et al*. 2008). The survey was carried out on 1st November 2018.

Site location, topography and land-use

The survey area is centred on National Grid Reference SE 63927 07726 and located immediately to the west of Dunsville. It lies at approximately 8m above Ordnance Datum (aOD) and is generally flat. The proposed area is approximately 3.7 hectares consisting of a single field. The survey area is bounded to the north and west by woodland, to the east by the village of Dunsville and to the south by agricultural fields, farmyard buildings and the A18.

Soils and geology

The underlying bedrock comprises of Chester Formation Sandstone formed approximately 250 million years ago in the Triassic Period in a setting dominated by rivers, channels and floodplains (BGS 2018). It is overlain by soils from the Newport association, which are described as typical brown sands (Soil Survey of England and Wales 1983).

2 Archaeological Background

The archaeological and historical background of the survey area, based upon an analysis of a 2km radius of the site, is summarised below.

The site is situated within an extensive archaeological landscape of rectilinear fields and enclosures as indicated by cropmarks mapped from aerial photographs (Riley 1980; Deegan 2001). The cropmark field systems, commonly known as ‘brickwork’ fields, extend over a substantial portion of the local landscape around Edenthorpe, Armthorpe, Kirk Sandall and Dunsville (Richardson 2013). The site sits immediately to the east of the peaty soils and fen peat of West Moor, which was not drained until the 17th century and is close to the eastern limit of agriculturally viable land in this area.

Many of the elements of the so-called ‘brickwork’ field system have their origins in the Iron Age but their reuse, subdivision and expansion continued in the Romano-British period (see Riley 1980; Richardson and Rose 2005; Rose and Roberts 2006; Howell 2001; Holbrey and Burgess 2001; Roberts 2008). The conditions required for their creation was a relatively flat landscape cleared of woodland. The need for a ditched field system in a well-drained landscape is suggestive of a need to corral or exclude animals. The expansion of the field systems also likely reflects population growth leading to competition for the best land necessitating division of the landscape in order to define, defend and contain.

Approximately 2km to the north east of site, along the A18, lies the conjectured location of the battle of Hatfield Chase (HER 04931). The battle of Hatfield Chase or Heathfield in AD633, between Edwin, King of Cumbria and Cadwallon and Penda, King of Mercia, is thought to have taken place on the site, possibly near the Lings. An archaeological desk-based assessment (CgMs 2017) has been undertaken on this site, enhanced by a geophysical survey (Stratscan 2014) and trial trenching (Headland 2017).

Directly to the south of the site an unclassified linear earthwork is recorded (HER 01826/01). The date and function of the earthwork is unknown. It lies within wood running parallel to Thorne Road (Magilton 1977, 37).

Within the surrounding area, there have been several recorded find spots indicative of early prehistoric activity. These recordings include a Neolithic flint flake found in a gravel pit on the south side of Woodhouse Lane (HER 01828) and Bronze Age flints and a Middle Bronze Age spearhead found to the south east (HER 016066/1 and 02737/01). Additionally a Roman coin has been recovered in the garden of 181 High Street, Dunsville, probably 4th century of Constantine I (Magiliton 1977).

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. 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 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. There are additional concentrations of magnetic disturbance along the edges of the surveyed fields, likely to represent the build-up of plough-soil.

Furthermore, there are two areas of magnetic disturbance in the north of the survey area. These responses directly correspond to the locations of two telegraph poles, carrying power lines above the site. An additional area of increased magnetic disturbance to the east is most likely representative of heavily consolidated soils.

Agricultural anomalies

Well defined, parallel linear trends can be seen throughout the site. The orientation (north east to south west) and regular spacing of these anomalies suggest a field drainage system. Field drains can be distinguished by their unique magnetic signature, giving a faintly dipolar response. In this case, the drains have generated a very strong magnetic response possibly indicating that they are made of a ceramic or fired material.

Examination of 1st Edition Ordnance Survey mapping (1854) has highlighted the presence of a former field boundary running east to west across the northern half of the site. The boundary is no longer visible on post-1982 mapping. There is also no geophysical response present in the data that could be linked to this former boundary. It is likely that the implementation of a modern field drainage system has distorted any remaining signature.

Geological anomalies

The survey has detected a number anomalies that have been interpreted as geological in origin. It is thought that these responses have been detected because of the variation in the composition and depth of the deposits of superficial material in which they derive.

Possible archaeology

Two thin linear trends have been identified within the survey area. Both responses are very faint, most likely due to the disturbance generated by the modern field drains. One linear anomaly is on a north west to south east orientation, perpendicular to the modern field drains. The second runs almost east-west across the survey. This orientation is very similar to that of the former field boundary previously identified in 1st Edition mapping, but the anomaly is approximately 50m south of where the boundary is outlined on mapping.

Although it is possible that the 1st Edition mapping is inaccurate and that this response represents the former field boundary, these features may indicate cropmark field systems, commonly known as ‘brickwork’ fields identified throughout the local area. The best example of this is outlined directly north of the site (Fig2).

5 Conclusions

The magnetic survey has been able to identify a number of field drains across the site on a north east to south west orientation. Additionally it has outlined two very faint linear trends, believed to be of possible archaeological origin, most likely linked to the ‘brickwork’ field systems seen across the local landscape. The majority of the responses are modern associated with recent agricultural practises. On this basis, the site overall can be said to have low archaeological potential.

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 South Yorkshire Historic Environment Record).

Appendix 4: Oasis form

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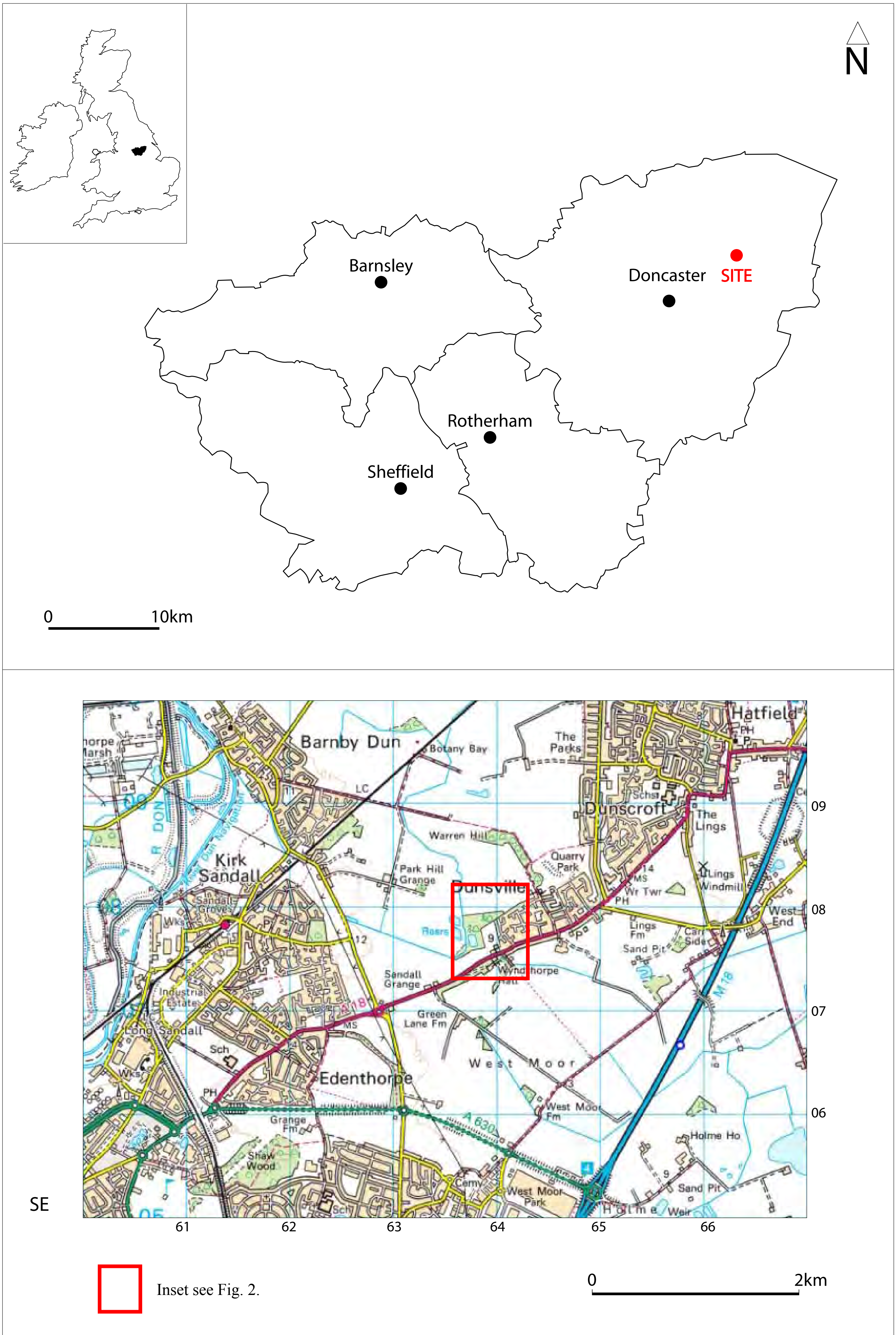

Fig. 1. Site location

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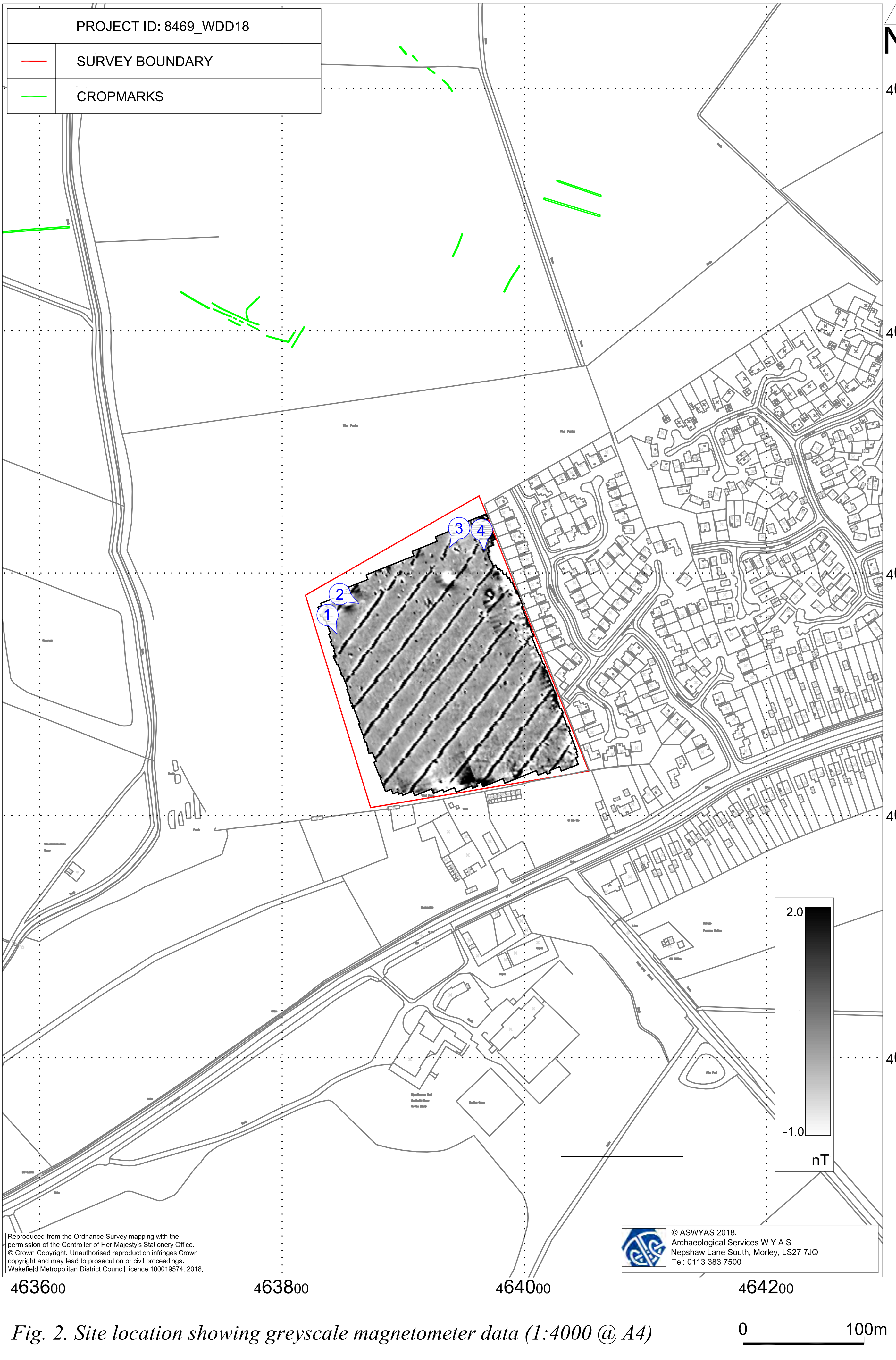

Fig. 2. Site location showing greyscale magnetometer data (1:4000 @ A4)

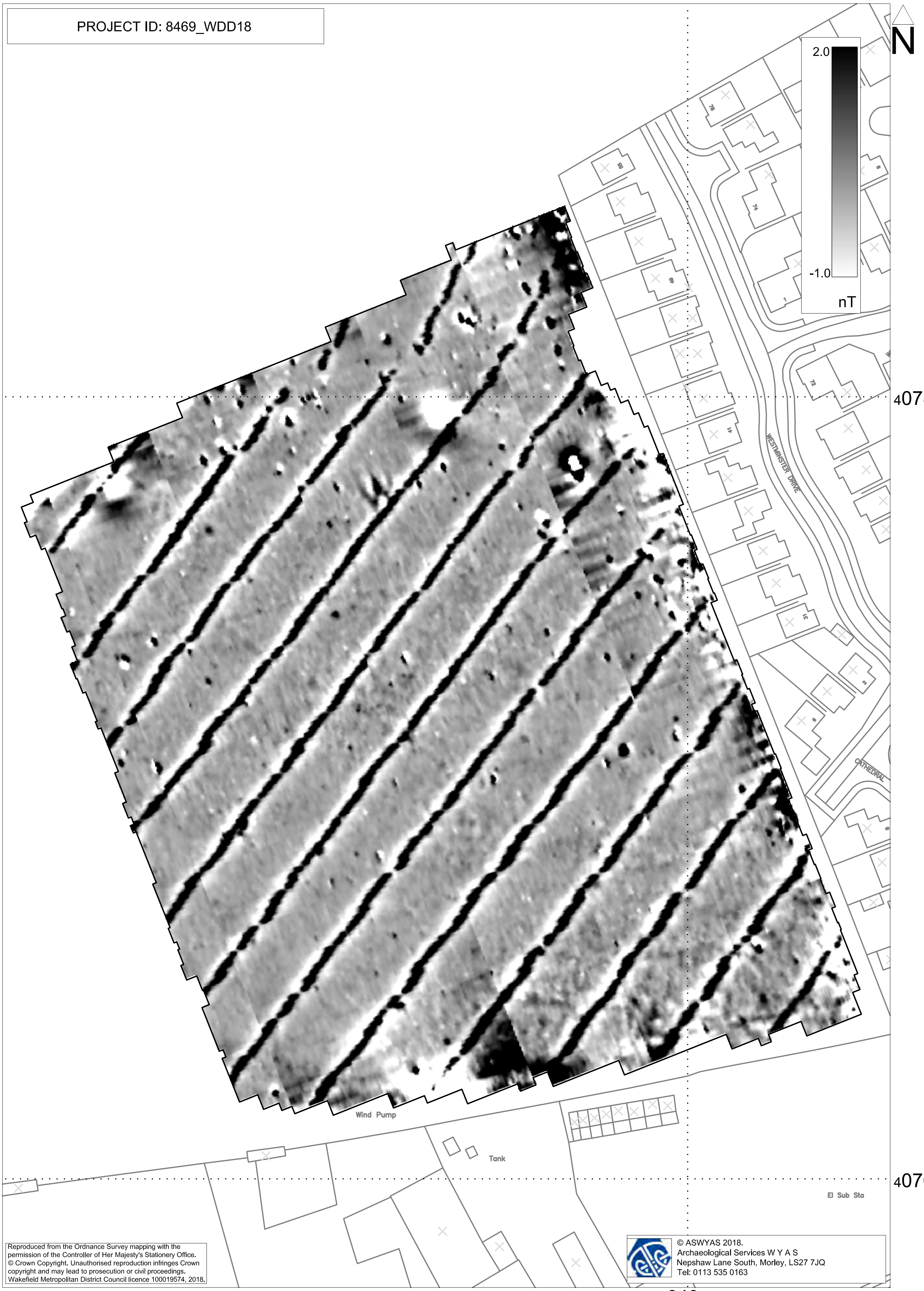

Fig. 3. Processed greyscale magnetometer data (1:1250 @ A4)

0 30m

Fig. 4. XY trace plot of minimally processed magnetometer data (1:1250 @ A4)

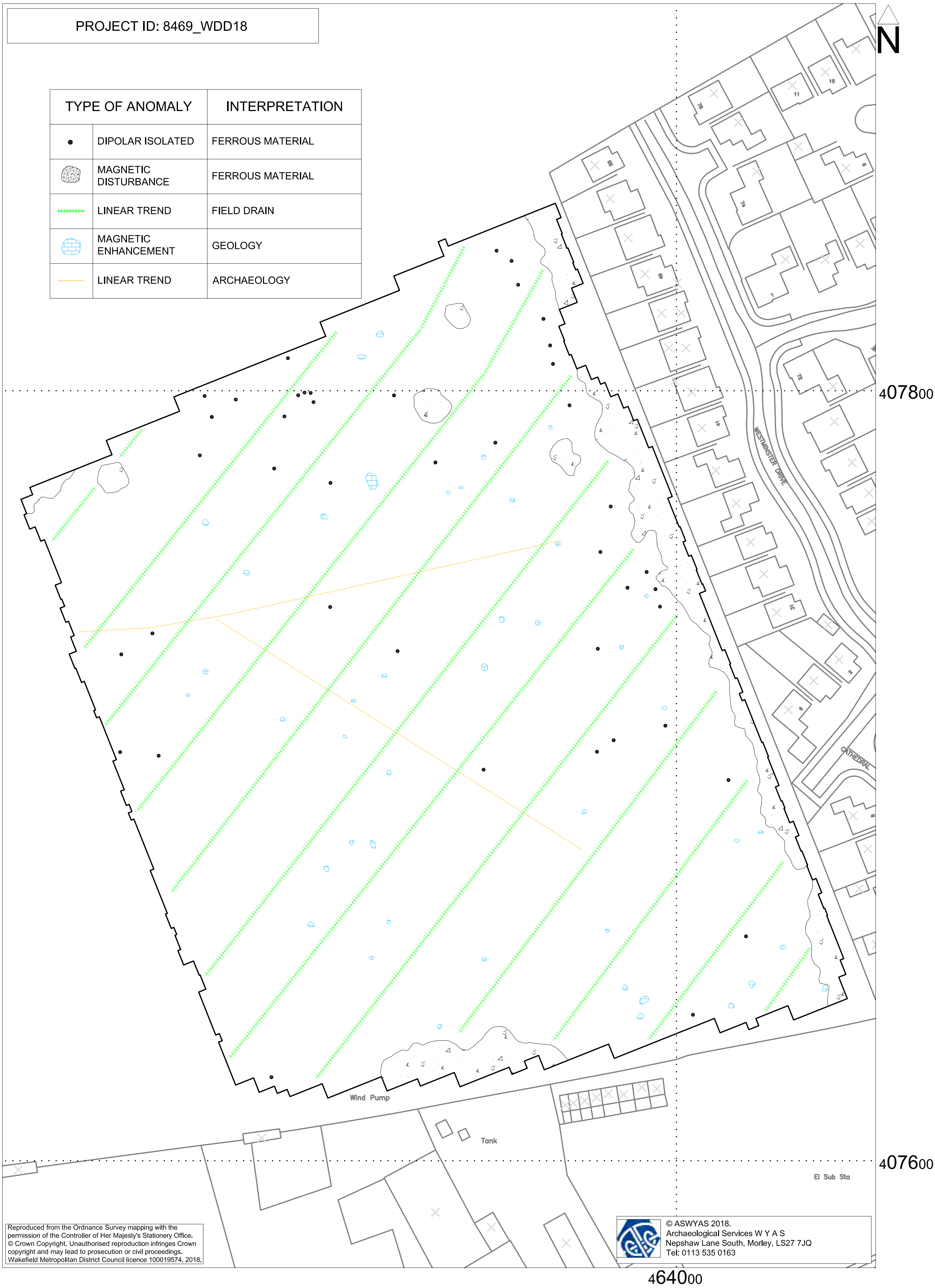

Fig. 5. Interpretation of magnetometer data (1:1250 @ A4)

0 30m

Plate 1. General view of site, facing south east

Plate 2. General view of site, facing east

Plate 3. General view of site, facing south west

Plate 4. General view of site, facing south