magnitude surveys

Geophysical Survey Report

Land off Hunts Lane, Desford

For

Marrons

On Behalf Of

Peveril Homes

Magnitude Surveys Ref: MSSK2307

HER Event Number: TBC

January 2026

3 Captain Street

Bradford

BD1 4HA

01274 926020

info@magnitudesurveys.co.uk

Report By:

William Syson BA (Hons) MSc ACIfA

Report Approved By:

Leigh A. Garst BFA MSc MCIfA

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Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c. 5.1ha area of land off Hunts Lane, Desford. A fluxgate gradiometer survey was successfully completed across the survey area. The geophysical survey has detected anomalies of agricultural and undetermined origins. Agricultural activity has been identified in the form of mapped former field boundaries and an infilled pond, alongside drainage systems and ploughing regimes. Anomalies have been detected throughout the survey area which have been classified as undetermined due to a lack of contextual evidence to support a more definitive interpretation. Modern interference is not extensive and limited to the field edges.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by Marrons on behalf of Peveril Homes to undertake a geophysical survey over a c. 5.1ha area of land off Hunts Lane, Desford, Leicestershire (SK 47115 03702).

1.2. The geophysical survey comprised hand-carried GNSS-positioned fluxgate gradiometer survey. Magnetic survey is the standard primary geophysical method for archaeological applications in the UK due to its ability to detect a range of different features. The technique is particularly suited for detecting fired or magnetically enhanced features, such as ditches, pits, kilns, sunken featured buildings (SFBs) and industrial activity (David *et al*., 2008).

1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England (David *et al*., 2008), the Chartered Institute for Archaeologists (CIfA, 2020) and the European Archaeological Council (Schmidt *et al.,* 2015).

1.4. It was conducted in line with a Written Scheme of Investigation (WSI) produced by MS (Byrne, 2025).

1.5. The survey commenced on 26th November 2025and took one day to complete.

2. Quality Assurance

2.1. Magnitude Surveys is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, and a corporate member of ISAP (International Society for Archaeological Prospection).

2.2. The Directors of MS are involved in cutting edge research and the development of guidance/policy. Specifically, Dr Chrys Harris has a PhD in archaeological geophysics from the University of Bradford, is a Member of CIfA and was the Vice-Chair of the International Society for Archaeological Prospection (ISAP); Finnegan Pope-Carter has an MSc in archaeological geophysics and is a Fellow of the London Geological Society, as well as a member of GeoSIG (CIfA Geophysics Special Interest Group); Dr Paul Johnson has a PhD in archaeology from the University of Southampton, is a Fellow of the Society of Antiquaries of London and a Member of CIfA, has been a member of the ISAP Management Committee since 2015, and is currently the Chair of the Archaeological Prospection Community of the European Archaeological Association.

2.3. All MS managers, field and office staff have degree qualifications relevant to archaeology or geophysics and/or field experience.

3. Objectives

3.1. The objective of this geophysical survey was to assess the subsurface archaeological potential of the survey area.

4. Geographic Background

4.1. The survey area was located c. 500m northwest of the centre of Desford, Leicestershire (Figure 1). Gradiometer survey was undertaken across one field under arable cultivation. The survey area was located to the immediate north of the B582, northwest of Newbold Road and northeast of Desford Cemetery (Figure 2). Further agricultural fields bordered the survey area on all other sides.

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	Arable field with young crop, sloping down northwards	The survey area was bordered by a grass verge to the north, overgrown vegetation to the east and south, and metal garden fencing to the southeast. There was no physical boundary to the west.

4.3. The underlying geology comprises Edwalton Member mudstone throughout most the survey area, with a band of Edwalton Member dolomitic siltstone in the centre, as well as Cotgrave Sandstone Member sandstone and Gunthorpe Member mudstone in the north. Superficial deposits consist of Mid Pleistocene glaciofluvial sand and gravel in the southern extent, and alluvial clay, silt, sand and gravel in the north (British Geological Survey, 2026).

4.4. The soils consist of slightly acid loamy and clayey soils with impeded drainage in the north of the survey area, with slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils in the south (Soilscapes, 2026).

5. Archaeological Background

5.1. Awaiting Background Information (DBA or other) from Client

6. Methodology

6.1. Data Collection

6.1.1. Magnetometer surveys are generally the most cost effective and suitable geophysical technique for the detection of archaeology in England. Therefore, a magnetometer survey should be the preferred geophysical technique unless its use is precluded by any specific survey objectives or the site environment. For this site, no factors precluded the recommendation of a standard magnetometer survey. Geophysical survey therefore comprised the magnetic method as described in the following section.

6.1.2. Geophysical prospection comprised the magnetic method as described in the following table.

6.1.3. Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Magnetic	Bartington Instruments Grad-13 Digital Three-Axis Gradiometer	1m	200Hz reprojected to 0.125m

6.1.4. The magnetic data were collected using MS' bespoke hand-carried GNSS-positioned system.

6.1.4.1. MS' hand-carried system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a multi-channel, multi-constellation GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The RTK GPS is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

6.1.4.2. Magnetic and GPS data were stored on an SD card within MS' bespoke datalogger. The datalogger was continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allowed for data collection, processing and visualisation to be monitored in real-time as fieldwork was ongoing.

6.1.4.3. A navigation system was integrated with the RTK GPS, which was used to guide the surveyor. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient collection and processing.

6.2.Data Processing

6.2.1. Magnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to the EAC and Historic England guidelines for 'minimally enhanced data' (see Section 3.8 in Schmidt *et al.*, 2015: 33 and Section IV.2 in David *et al.,* 2008: 11).

Sensor Calibration – The sensors were calibrated using a bespoke in-house algorithm, which conforms to Olsen *et al*. (2003).

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

6.3. Data Visualisation and Interpretation

6.3.1. This report presents the gradient of the sensors' total field data as greyscale images, as well as the total field data from the lower sensors (Figure 3). The gradient of the sensors minimises external interferences and reduces the blown-out responses from ferrous and other high contrast material. However, the contrast of weak or ephemeral anomalies can be reduced through the process of calculating the gradient. Consequently, some features can be clearer in the respective gradient or total field datasets. Multiple greyscale images of the gradient and total field at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plot (Figure 6). XY trace plots visualise the magnitude and form of the geophysical response, aiding anomaly interpretation.

6.3.2. Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street maps, satellite imagery, historical maps, LiDAR data, and soil and geology maps. Google Earth (2026) was also consulted, to compare the results with recent land use.

6.3.3. Geodetic position of results – All vector and raster data have been projected into OSGB36 (ESPG27700) and can be provided upon request in ESRI Shapefile (.SHP) and Geotiff (.TIF) respectively. Figures are provided with raster and vector data projected against OS Open Data.

7. Results

7.1. Qualification

7.1.1. Geophysical results are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible, an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports, as well as reports from further work, in order to constantly improve our knowledge and service.

7.2. Discussion

7.2.1. The geophysical results are presented in combination with satellite imagery and historical maps (Figure 7).

7.2.2. The fluxgate gradiometer survey responded well to the environment of the survey area. The geophysical survey has identified anomalies of agricultural and undetermined origin. Magnetic disturbance is generally limited to the field edges.

7.2.3. Anomalies highlighting the prolonged use of the landscape for agricultural activities have been detected throughout the survey area and identified as former mapped field boundaries (Figures 5 & 7). A former infilled pond visible on historic mapping has also been identified in the south (Figures 5 & 7). Anomalies indicative of modern agricultural practices have been detected and categorised as drainage systems and modern ploughing regimes which are visible on satellite imagery (Figures 5 & 7).

7.2.4. Several weakly enhanced linear anomalies have been detected throughout the survey area and categorised as undetermined (Figures 5 & 8). Due to a limited context and a lack of clear patterns or morphologies, a more confident interpretation cannot be provided.

7.3.Interpretation

7.3.1. General Statements

7.3.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually.

7.3.1.2. **Ferrous (Spike)** – Discrete dipolar anomalies are likely to be the result of isolated pieces of modern ferrous debris on or near the ground surface.

7.3.1.3. **Magnetic Disturbance** – The strong anomalies produced by extant metallic structures, typically including fencing, pylons, vehicles and service pipes, have been classified as 'Magnetic Disturbance'. These magnetic 'haloes' will obscure weaker anomalies relating to nearby features, should they be present, often over a greater footprint than the structure causing them.

7.3.1.4. **Undetermined** – Anomalies are classified as Undetermined when the origin of the geophysical anomaly is ambiguous and there is no supporting contextual evidence to justify a more certain classification. These anomalies are likely to be the result of geological, pedological or agricultural processes, although an archaeological origin cannot be entirely ruled out. Undetermined anomalies are generally distinct from those caused by ferrous sources.

7.3.2. Magnetic Results - Specific Anomalies

7.3.2.1. **Agricultural (Weak/Spread)** – Multiple linear anomalies and amorphous zones of strongly enhanced dipolar anomalies have been detected throughout the survey area and identified as former mapped field boundaries (Figure 5). The anomalies are indicative of cut features containing magnetically enhanced infill and correspond to the location of mapped former field boundaries visible on historical mapping (Figures 4, 5 & 7).

7.3.2.2. **Agricultural (Spread)** – A discrete zone of weakly enhanced dipolar anomalies has been detected in the southern extent of the survey area (Figure 4). This area corresponds to a former pond depicted on historical mapping and is likely the result of magnetically enhanced infill (Figures 4 & 7).

7.3.2.3. **Drainage (Trend) –** Three parallel linear anomalies have been identified running roughly east-west across the north of the survey area (Figure 5). The trends exhibit a weakly dipolar signal which is indicative of probable land-drains.

7.3.2.4. **Agricultural (Trend) –** Weak positive linear trends have been detected. These align with the direction of modern ploughing and result from arable cultivation (Figures 4 & 5). Only a representative sample of the anomalies has been drawn.

7.3.2.5. **Undetermined (Weak) –** Multiple weakly enhanced linear anomalies have been detected in the southern extent of the survey area (Figure 5). These anomalies lack a clear diagnostic morphology or signal, and do not correspond with any mapped features (Figures 4, 5 & 7).

8. Conclusions

8.1. A fluxgate gradiometer survey was successfully completed across the survey area. The survey has detected anomalies of an agricultural and undetermined origin. Modern Interference was limited to the field edges.

8.2. Historical agricultural activity has been detected in the form of mapped former field boundaries and an infilled pond. Modern agricultural activity was identified within the data as drainage systems and modern ploughing regimes.

8.3. Multiple linear anomalies have been classified as ‘undetermined’ due to a lack of context, or any clear pattern which would enable a confident interpretation.

9. Archiving

9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.

9.2. MS contributes reports to the ADS Grey Literature Library upon permission from the client, subject to any dictated time embargoes.

10. Copyright

10.1. Copyright and intellectual property pertaining to all reports, figures and datasets produced by Magnitude Services Ltd is retained by MS. The client is given full licence to use such material for their own purposes. Permission must be sought by any third party wishing to use or reproduce any IP owned by MS.

11. References

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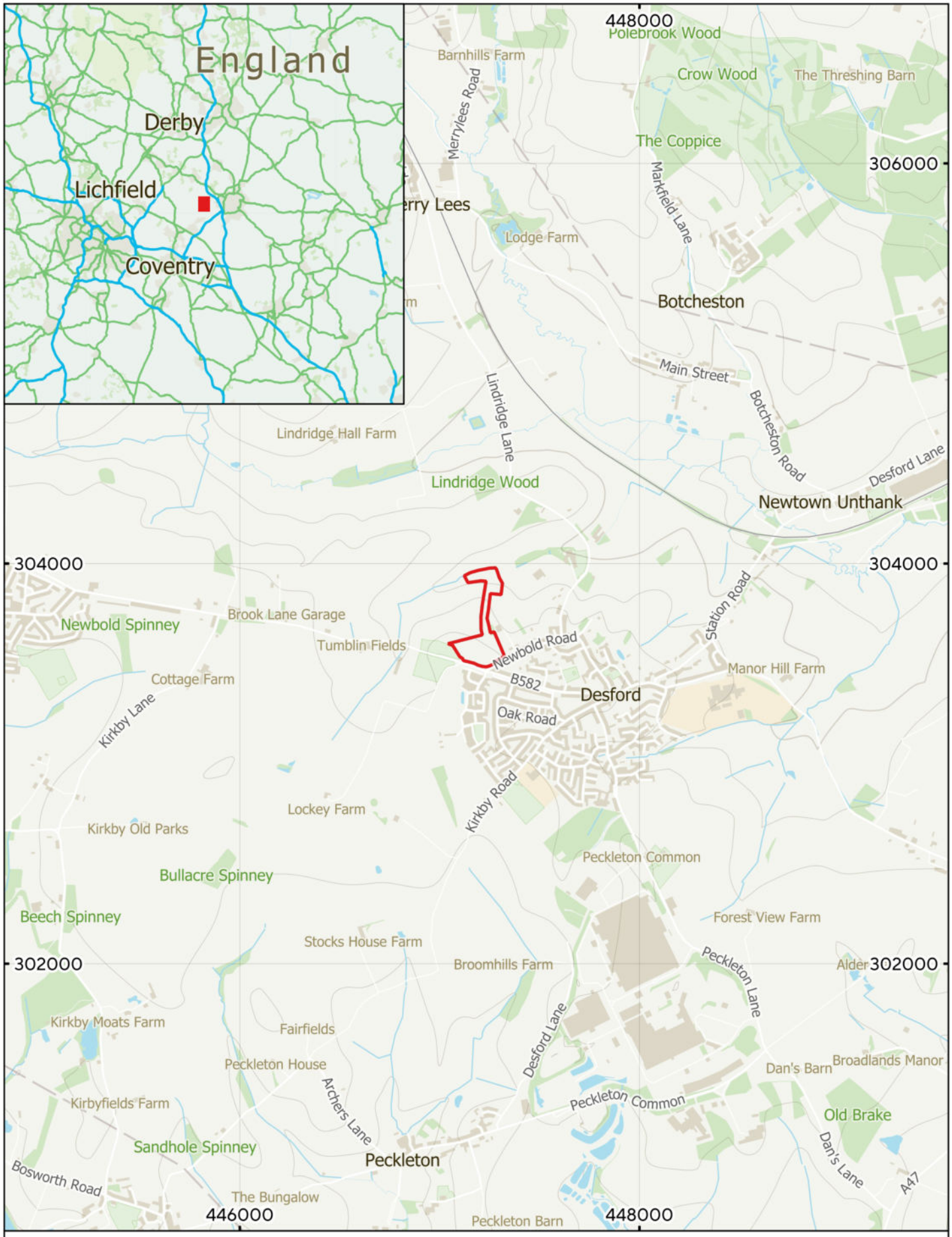
12. Project Metadata

MS Job Code	MSSK2307
Project Name	Land off Hunts Lane, Desford
Client	Marrons
Grid Reference	SK 47115 03702
Survey Techniques	Magnetometry
Survey Size (ha)	5.1ha (Magnetometry)
Survey Dates	2025-11-26
Project Lead	Lucy Johnson BA
Project Officer	Lucy Johnson BA
HER Event No	TBC
OASIS No	N/A
S42 Licence No	N/A
Report Version	0.3

13. Document History

Version	Comments	Author	Checked By	Date
0.1	Initial draft for Project Lead to Review	WS	MS	07 January 2026
0.2	Corrections	WS	LAG	08 January 2026
0.3	Sign Off	DT	LAG	12 January 2026



MSSK2307 - Hunts Lane, Desford, Leicestershire
Figure 1 - Geophysical Survey Location
1:25,000 @ A4

Geophysical Survey Area

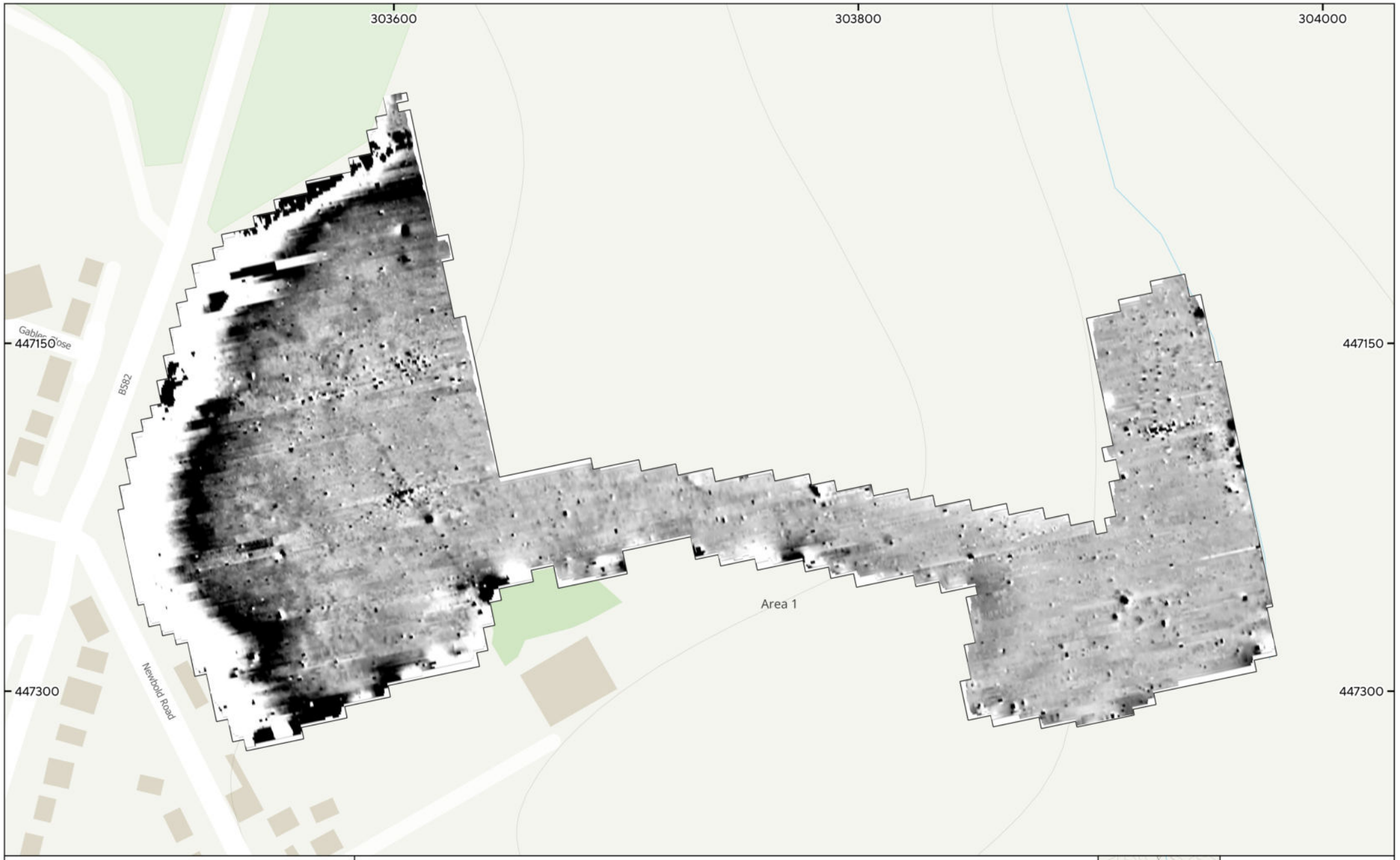
0 0.5 1 km

MSSK2307 - Hunts Lane, Desford, Leicestershire
Figure 2 - Geophysical Survey Area
1:5,000 @ A3

Survey Extent

Magnitude Surveys

0 50 100 150 200 m

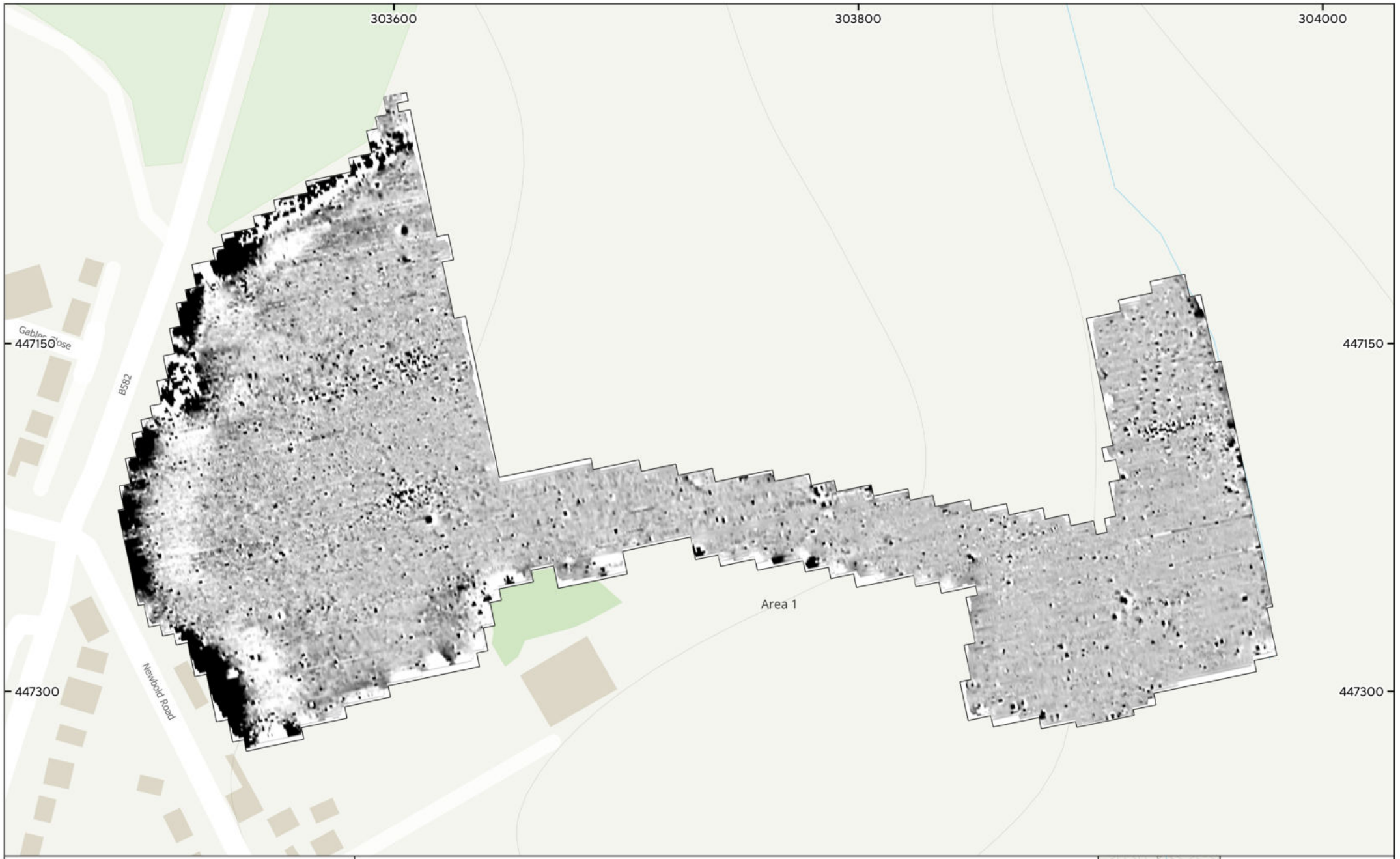


MSSK2307 - Hunts Lane, Desford, Leicestershire
Figure 3 - Magnetic Total Field (Lower Sensor)
1:1,500 @ A3

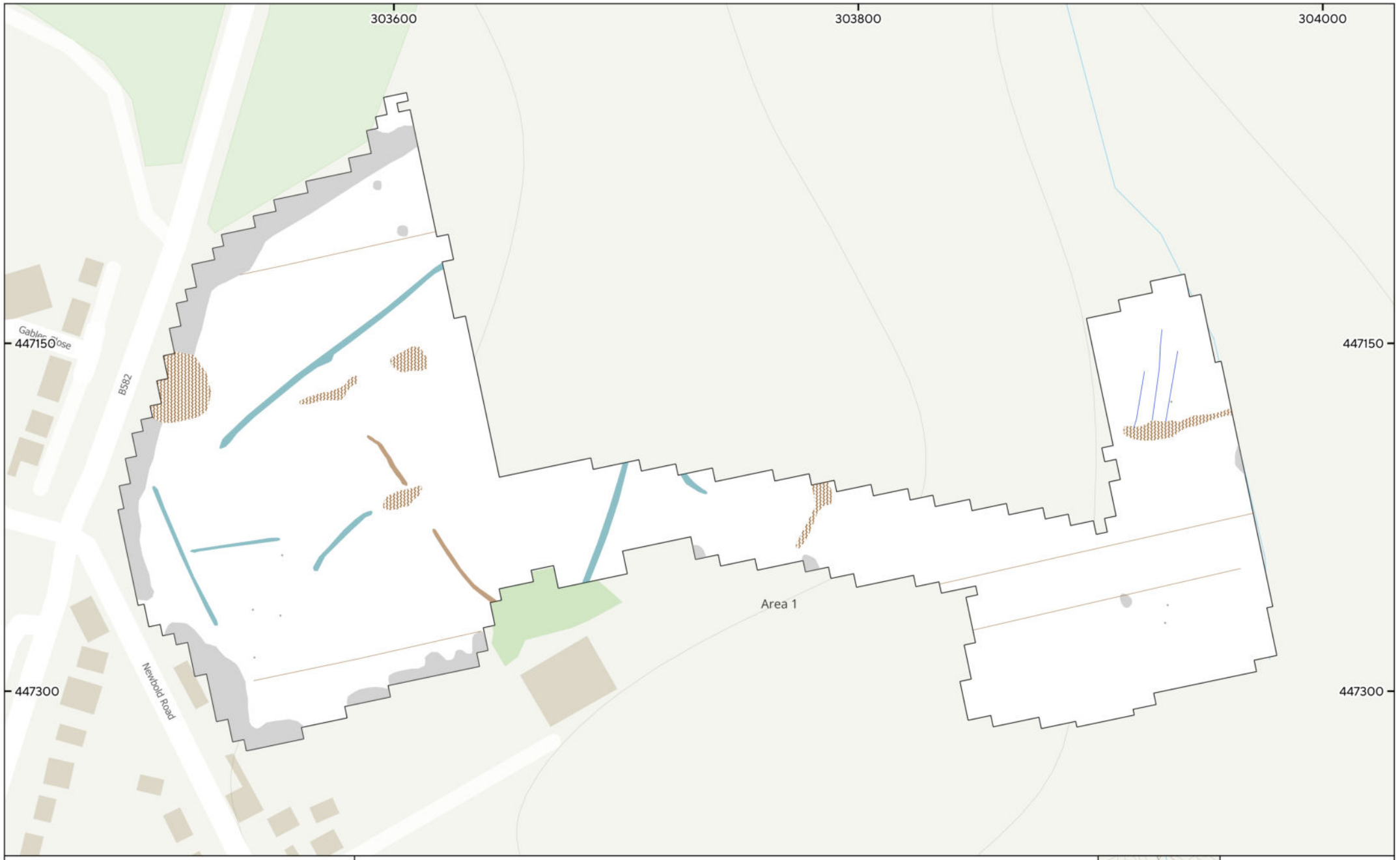
48997 nT 49005

Magnitude Surveys

0 15 30 45 60 m



MSSK2307 - Hunts Lane, Desford, Leicestershire
Figure 4 - Magnetic Gradient
1:1,500 @ A3

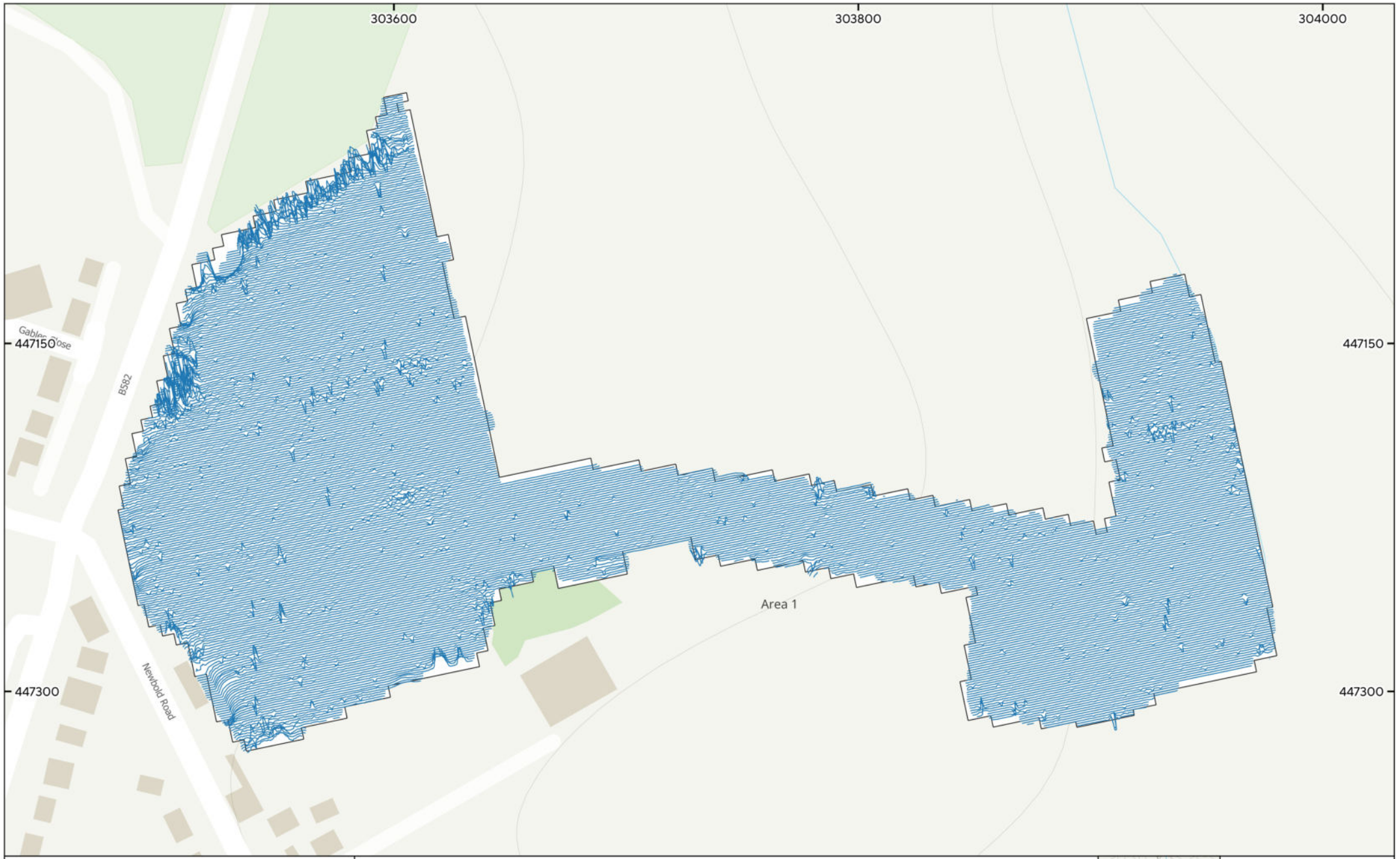


MSSK2307 - Hunts Lane, Desford, Leicestershire
Figure 5 - Magnetic Interpretation
1:1,500 @ A3

Agricultural (Weak)
Agricultural (Spread)
Undetermined (Weak)
Magnetic Disturbance
Drainage Feature
Agricultural (Trend)
Ferrous (Spike)

Magnitude Surveys

0 15 30 45 60 m



MSSK2307 - Hunts Lane, Desford, Leicestershire
Figure 6 - XY Trace Plot
90nT/cm at 1:1,500 @ A3

Magnitude Surveys

0 15 30 45 60 m

MSSK2307 - Hunts Lane, Desford, Leicestershire
Figure 7 -Magnetic Interpretation over Historical Mapping and Satellite Imagery
1:3,000 @ A3

- Agricultural (Weak)
- Agricultural (Spread)
- Undetermined (Weak)
- Magnetic Disturbance
- Drainage Feature
- Agricultural (Trend)
- Ferrous (Spike)

Magnitude Surveys

0 30 60 90 120 m