



**magnitude
surveys**

**Geophysical Survey Report
Land at Pendle Road, Clitheroe**

**For
RPS Consulting Ltd**

Magnitude Surveys Ref: MSSD2187

September 2025



magnitude surveys

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Abstract

Magnitude Surveys Ltd was commissioned to assess the subsurface archaeological potential of c. 8.6ha area of land at Pendle Road, Clitheroe, Lancashire. A fluxgate gradiometer survey was carried out and responded well to the environment of the survey area. The survey has detected anomalies of agricultural and undetermined origins. Agricultural activity has been identified as a previous corner of a ditch/stream located on the boundary of the survey area, ploughing trends, and drainage features. Several anomalies of undetermined origin have been detected, for which archaeological origins cannot be discounted. Modern interference was detected within the survey area, attributed to telegraph poles, overhead cables and metal fencing.

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1. Introduction

- 1.1. Magnitude Surveys Ltd (MS) was commissioned by RPS Consulting Ltd to undertake a geophysical survey over a c. 8.6ha area of pastureland north of Pendle Road, Clitheroe, Lancashire (SD 75378 41083).
- 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 WSI produced by MS (Darlington, 2025).
- 1.5. The survey commenced on 26th August 2025 and took 2 days 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, is a member of CIfA 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. 300m southeast of Clitheroe (Figure 1). Gradiometer survey was undertaken across 3 fields under pasture, divided into 5 survey areas. The survey area is bordered by High Moor Road in the northwest, Pendle Road in the southwest and an unnamed road in the southeast. To the north the survey area was bordered by arable land (Figure 2).

Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	Pasture field that slopes down from north to south.	The survey area was bordered by trees on all sides except for a stream that ran along the southern border. There were gaps in the treeline at the northern and southern ends of the eastern boundary. High Moor Road ran adjacent to the northwestern border.
2	Pasture field that slopes down to the south.	The survey area was bordered by trees on all sides except for a stream that ran along the southern border. There were gaps in the treeline at the northern and southern ends of the western boundary.
3	Pasture field that slopes down to the north.	The survey area was bordered by trees on all sides except for a stream that ran along the northern border. High Moor Road ran adjacent to the northwestern border and Pendle Road ran adjacent to the southwestern border.
4	Pasture field that slopes down to the south.	The survey area was bordered by trees on all side except for a stream that ran along the southern border. A gate in the southern corner provided access to area 5. There were two depressions around the centre of the field that led up to the northern boundary. Pendle Road ran adjacent to the southwestern border.
5	Pasture field that slopes down to the east.	The area was bordered by a ditch and stream to the north and trees to the northwest. Access was to the field through a gate at the eastern corner. The southwest and southeast boundaries were lined with hedgerow, trees and a wire fence, and ran adjacent to Pendle Road and an unnamed road respectively. There was tree cover and a fallen tree in the northeast corner of the field. An overhead cable ran across the field in a northeast- southwest direction. There was a wood pile on the northwestern border.

- 4.2. The underlying geology comprises limestone of the Clitheroe Limestone Formation and mudstone of the Hodder Mudstone Formation. Superficial deposits comprise diamicton till across the survey area (British Geological Survey, 2025).

- 4.3. The soils consist of slowly permeable seasonally wet acid loamy and clayey soils (Soilscapes, 2025)

5. Archaeological Background

- 5.1. The following is a summary of a heritage statement produced and provided by RPS (Jacklin, 2025).
- 5.2. A series of archaeological work has been undertaken in the vicinity of the survey area, including geophysical survey and trial-trenching. Evaluation at Higher Standen Farm identified a partial Bronze Age ring ditch c.180m west of the survey area and was confirmed to be part of an Early Bronze Age barrow, containing nine cremations.
- 5.3. Other than the above Bronze Age barrow, recorded prehistoric activity comprises surface finds of artefacts including an awl and stone axe c.600m and 1km north of the survey area, and an arrowhead and axehead c. 1km to the south. A heavily corroded spear or arrowhead was identified c. 750m northwest of the survey area, possibly dating to the Late Bronze Age or Roman, with a copper alloy ring of similar dating discovered c. 400m northeast.
- 5.4. The suspected route of the Ribchester to Ilkley Roman Road is located c. 80m northwest of the survey area. Archaeological investigations to the southwest of the survey area did not find evidence of the survival of this feature. Surface finds dated to this period within 1km of the survey area include coins, a ring, and a brooch. A stone relief of possible Romano-British origin is also built into a wall at Standen Hall c. 1km southwest of the area.
- 5.5. Clitheroe is derived from Old English or Old Scandinavian. Despite this place name evidence, no early-medieval settlement has been discovered at Clitheroe. Surface finds include a pin and sword pommel recovered c. 750m to the southwest. Clitheroe Castle was likely established by the time of the 1086 Domesday Survey with related Medieval settlement located east of the fortification.
- 5.6. An early 19th century milestone is located outside of the survey area boundary to the south, on the junction of Pendle Road.

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-pulled 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 (Figure 3), as well as the total field data from the lower sensors (Figure 4). 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 (2025) 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. A fluxgate gradiometer survey was successfully completed over c. 8.6ha of land at Pendle Road, Clitheroe, Lancashire. The geophysical survey responded well to the environment of the survey area and has detected anomalies of agricultural and undetermined origins. Magnetic interference was detected at the edges of the survey area attributed to metal fencing and around pylons with overhead cables.

- 7.2.3. A former mapped field boundary present on historical OS maps has been identified in Area 5 as a rectilinear anomaly (Figure 7). This is likely a previous corner of the now straightened boundary ditch/stream located on site during the survey. Evidence of modern agricultural activity has been identified as agricultural trends in the north of the survey area. Linear anomalies consistent with field drains have also been identified in Areas 1 & 5.
- 7.2.4. Multiple linear and curvilinear anomalies have been identified across the survey area (Figure 5). These anomalies which do not correspond to any features identified on the historical OS mapping, lack any diagnostic characteristics or other supporting evidence to offer a confident interpretation and have been classed as undetermined.

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. **Ferrous/Debris (Spread)** – A ferrous/debris spread refers to a concentration of multiple discrete, dipolar anomalies usually resulting from highly magnetic material such as rubble containing ceramic building materials and ferrous rubbish.
- 7.3.1.4. **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.
- 7.3.1.5. **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 (Strong)** – In the north of Area 5 a strongly enhanced rectilinear anomaly was detected (Figures 4 & 5). This anomaly appears to correspond with a previous corner of the ditch/stream present on site during the survey (Figure 7) and is likely representative of enhanced backfill of this feature.
- 7.3.2.2. **Agricultural (Trend)** – Weakly enhanced trends have been identified in Area 1 (Figures 3 & 5). These appear as parallel linear anomalies in the data and correspond to modern ploughing regimes visible on recent satellite imagery.

7.3.2.3. **Drainage Features** – A series of weak negatively enhanced linear anomalies have been detected in Area 1, as well as a single dipolar anomaly in Area 5 (Figures 3 & 5). In Area 1 these anomalies are aligned in parallel, with c. 14-15m gaps and oriented in a northwest to southeast direction. These are indicative of field drainage.

7.3.2.4. **Undetermined (Weak)** – Across the survey area several weakly enhanced anomalies were detected, of undetermined origins (Figures 3, 4 & 5). There is no corroborative evidence to confirm an agricultural or archaeological origin for these features as they do not correspond with any mapped features on available historical maps.

8. Conclusions

- 8.1. A fluxgate gradiometer survey was successfully completed across a c. 8.6ha area of land at Pendle Road, Clitheroe, Lancashire. The survey responded well to the local environment and identified anomalies of agricultural and undetermined origins. Magnetic disturbance was generally limited to the edges of the survey area caused by metal fencing and telegraph poles with overhead cables.
- 8.2. Agricultural activity has been identified as the previous corner of a ditch/stream present during the survey and located on historical OS maps, as well as linear trends interpreted as plough regimes and track marks. Evidence of field drainage was located within the north of the survey and close to the southern boundary.
- 8.4. Curvilinear and linear anomalies of undetermined origin were detected throughout the survey area which do not correspond with any current or former features and may be agricultural, archaeological or natural in origin, but without further context a more confident interpretation cannot be determined.

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

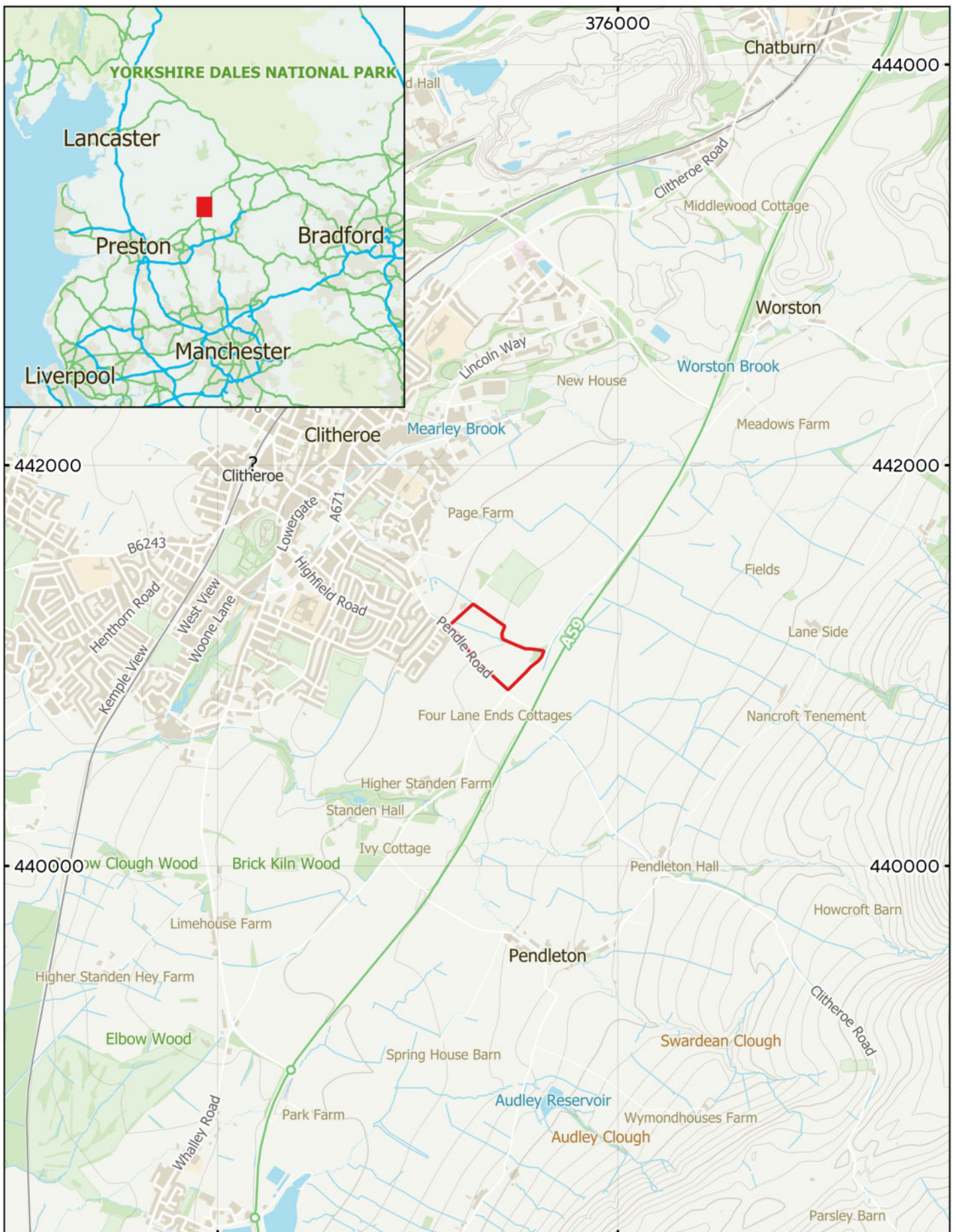
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12. Project Metadata

MS Job Code	MSSD2187
Project Name	Land North of Pendle Road, Clitheroe
Client	RPS Consulting Ltd
Grid Reference	(SD 75378 41083)
Survey Techniques	Magnetometry
Survey Size (ha)	8.6ha (Magnetometry)
Survey Dates	2025-8-26 to 2025-8-27
Project Lead	Henry Russell BA MA ACIfA
Project Officer	Henry Russell BA MA ACIfA
HER Event No	TBC
OASIS No	N/A
S42 Licence No	N/A
Report Version	1.0

13. Document History

Version	Comments	Author	Checked By	Date
0.1	Initial draft for Project Officer to Review	HA	DB	04 September 2025
0.2	Second draft	HA	HR	05 September 2025
0.3	Sign Off	HR	KD	12 September 2025
0.4	Sign Off Corrections	DB	KD	16 September 2025
1.0	Final	HR	KD	25 September 2025



MSSD2187 - Land North of Pendle Road, Clitheroe

Figure 1 - Geophysical Survey Location

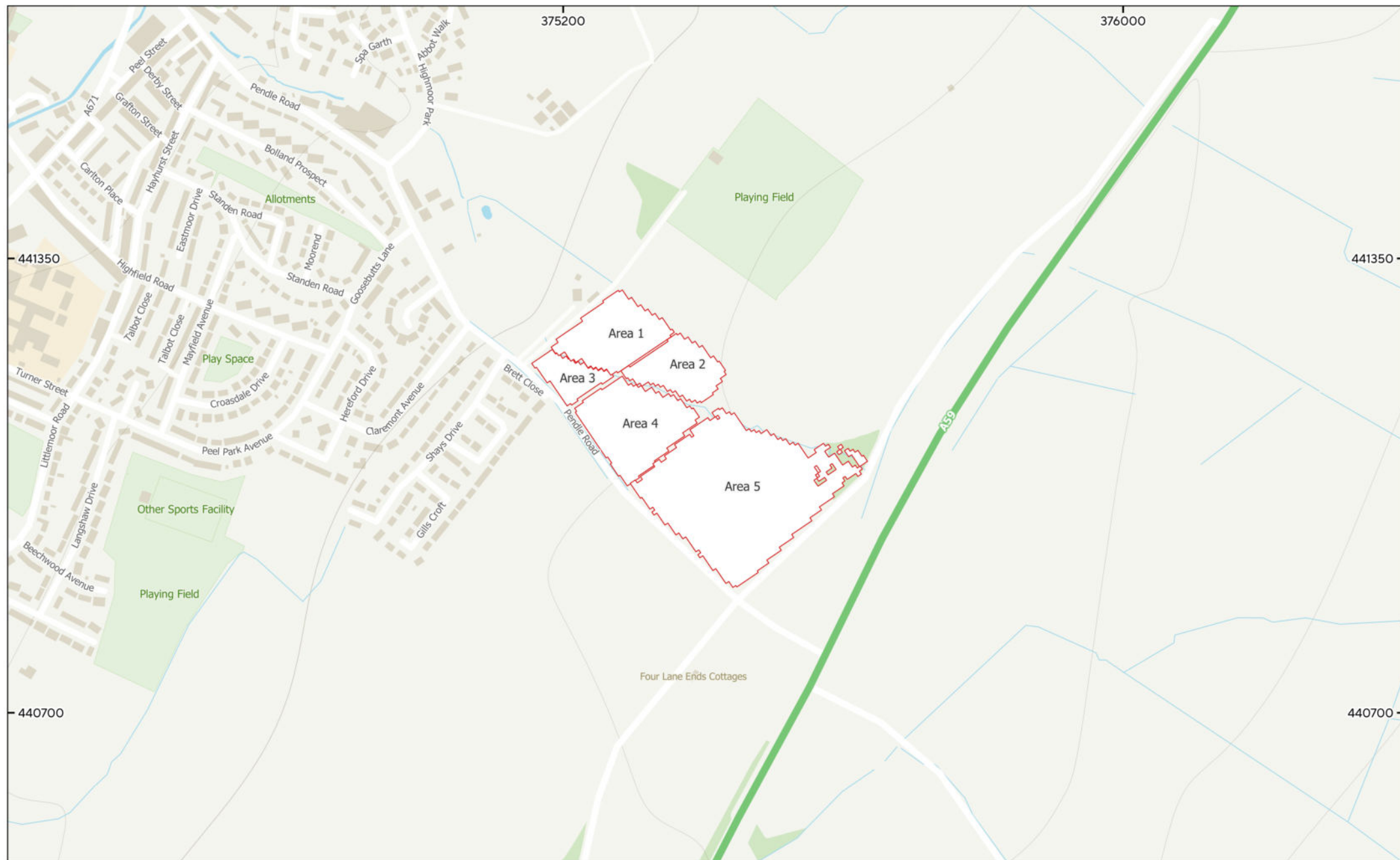
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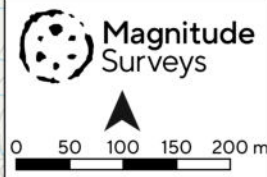
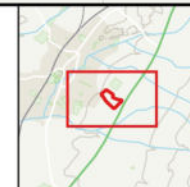
Geophysical Survey Areas





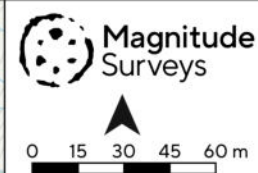
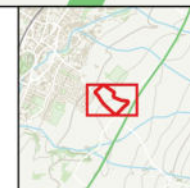
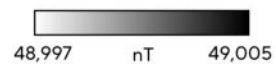
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 Figure 2 - Geophysical Survey Areas
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Survey Extent



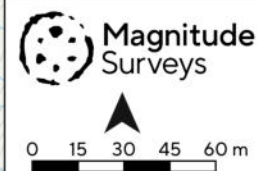
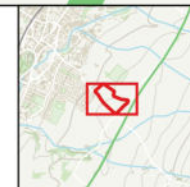
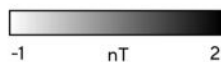


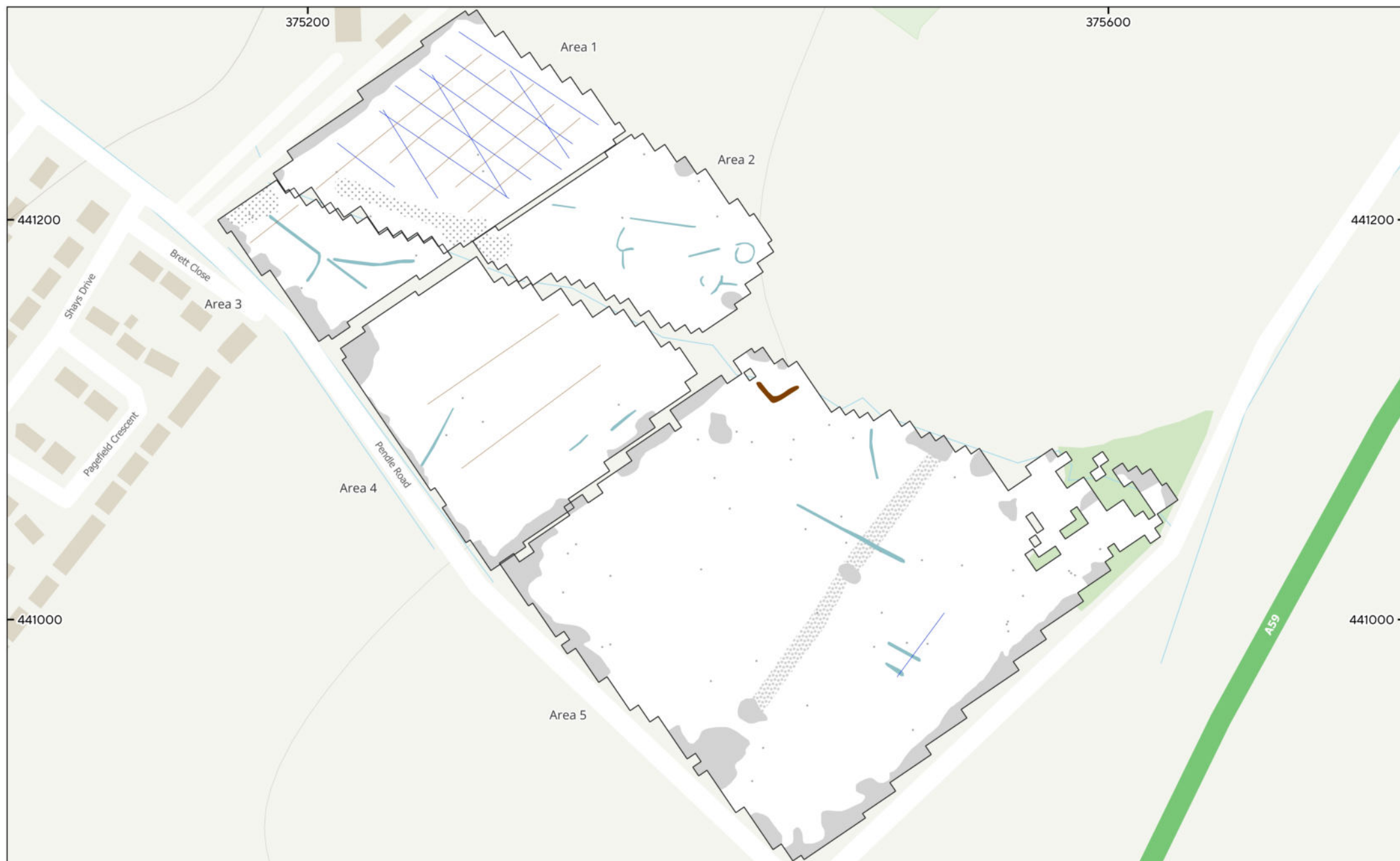
MSSD2187 - Land North of Pendle Road, Clitheroe
 Figure 3 - Magnetic Total Field (Lower Sensor) (Areas 1 - 5)
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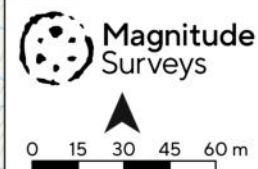
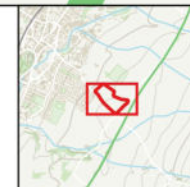
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Figure 4 - Magnetic Gradient (Areas 1 - 5)
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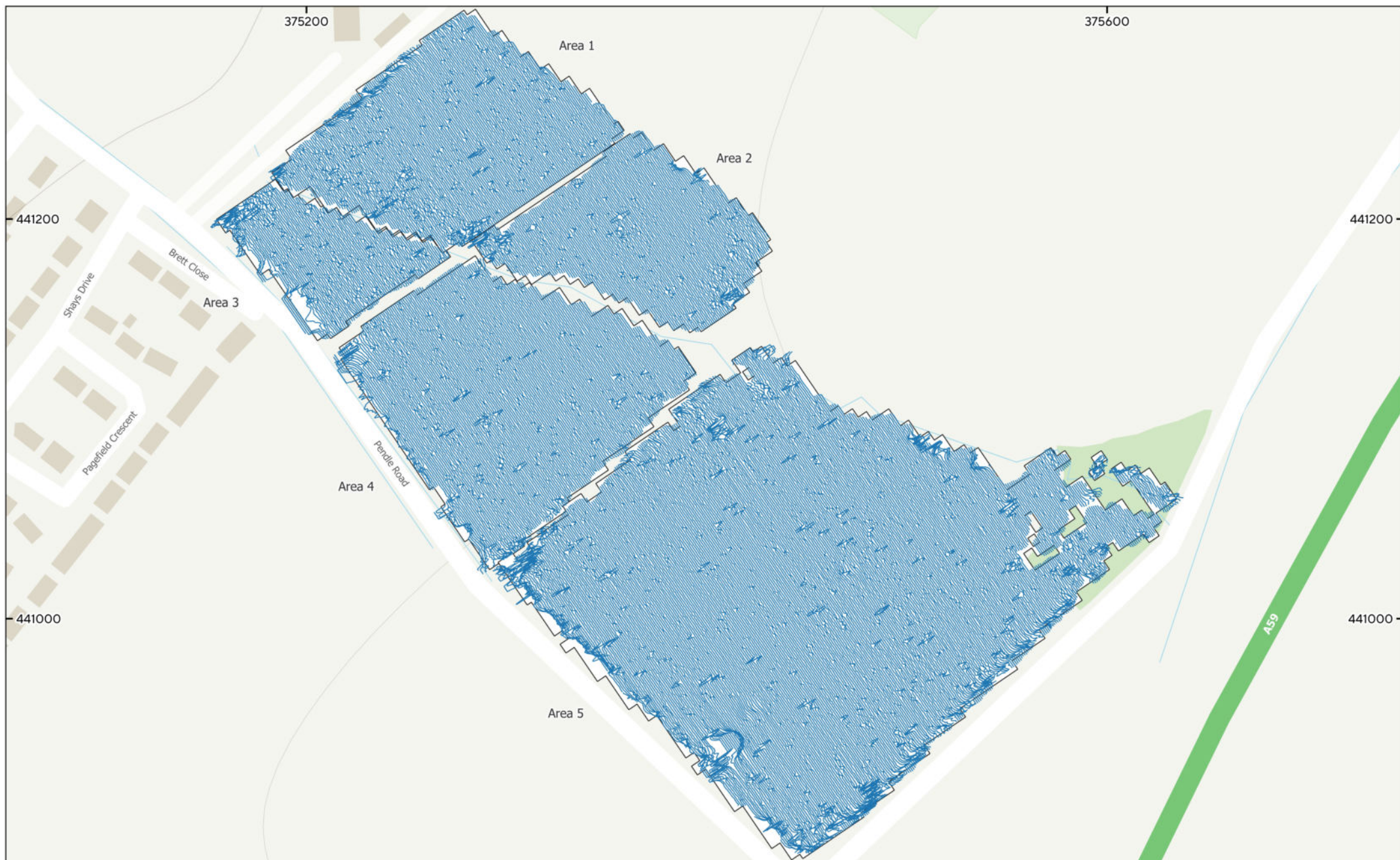




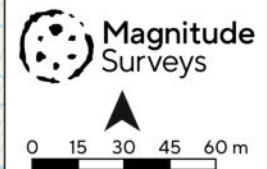
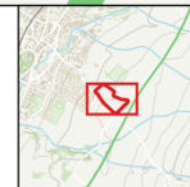
MSSD2187 - Land North of Pendle Road, Clitheroe
 Figure 5 - Magnetic Interpretation (Areas 1 - 5)
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- | | | |
|-------------------------|----------------------|------------------|
| Agricultural (Strong) | Overhead Cables | Drainage Feature |
| Magnetic Disturbance | Undetermined (Weak) | Ferrous (Spike) |
| Ferrous/Debris (Spread) | Agricultural (Trend) | |





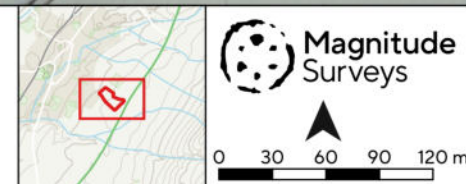
MSSD2187 - Land North of Pendle Road, Clitheroe
Figure 6 - XY Trace Plot (Areas 1 - 5)
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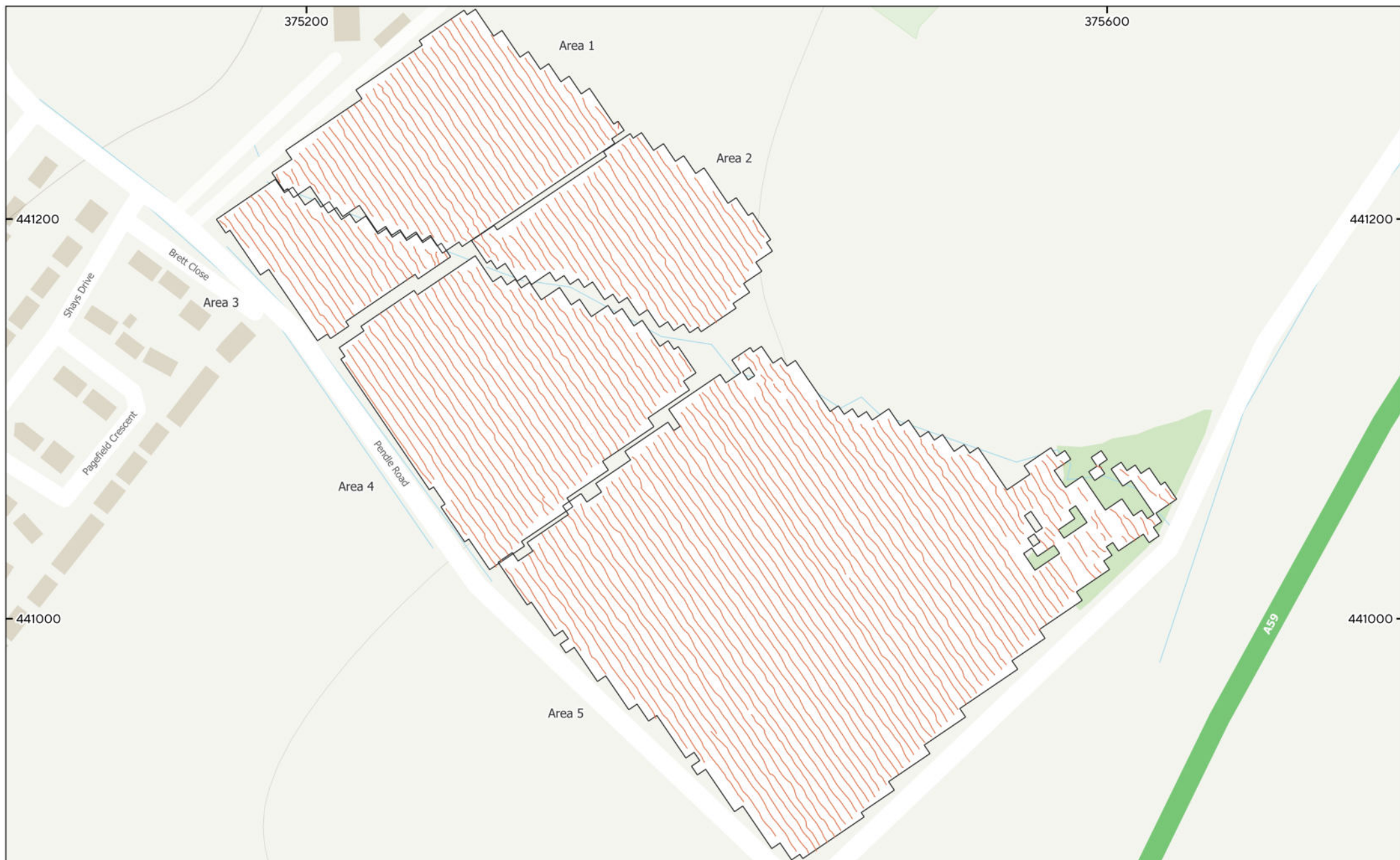


MSSD2187 - Land North of Pendle Road, Clitheroe
 Figure 7 - Magnetic Interpretation over Historical Mapping &
 Satellite Imagery (Areas 1 - 5)
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 Contains historical mapping © CLS Data 2025: Ordnance Survey, 6"
 2nd edition c. 1882-1913
 Contains satellite imagery © Google Satellite 2025

■ Agricultural (Strong) - - - Overhead Cables — Drainage Feature
 ■ Magnetic Disturbance ■ Undetermined (Weak) · Ferrous (Spike)
 ··· Ferrous/Debris (Spread) — Agricultural (Trend)




**Magnitude
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MSSD2187 - Land North of Pendle Road, Clitheroe
Figure 8 - GNSS Plot (Areas 1 - 5)
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— GNSS Lines

