



**magnitude
surveys**

**Geophysical Survey Report
of
Land off Loraine Way, Sproughton,
Ipswich, Suffolk**

**For
CgMs Ltd**

**On Behalf Of
Hopkins Homes Ltd**

Magnitude Surveys Ref: MSTM149

Suffolk County Council Site Code SPT 058

Suffolk County Council HER Event Number ESF25603

July 2017



magnitude surveys

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Report Issued:

24 July 2017

Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c. 3.3ha area of land off Loraine Way, Sproughton, Ipswich, Suffolk. A fluxgate gradiometer survey was successfully completed and anomalies of possible archaeological origin were detected. The geophysical results primarily reflect natural soil/geological variation and modern activity, however possible archaeological activity is reflected in the presence of a C-shaped anomaly of 23m diameter, which may reflect the presence of a ploughed out barrow or ring ditch.

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1. Introduction

- 1.1. Magnitude Surveys Ltd (MS) was commissioned by CgMs Ltd on behalf of Hopkins Homes Ltd to undertake a geophysical survey on a c. 3.3ha of land off Loraine Way, Sproughton, Ipswich, Suffolk (TM 12299 45169).
- 1.2. The geophysical survey comprised hand-pulled, cart-mounted fluxgate gradiometer survey.
- 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, 2014) and the European Archaeological Council (Schmidt *et al.*, 2015).
- 1.4. The survey commenced on 13 July 2017 and was completed on the same day.

2. Quality Assurance

- 2.1. Project management, survey work, data processing and report production have been carried out by qualified and professional geophysicists to standards exceeding the current best practice (CIfA, 2014; David *et al.*, 2008, Schmidt *et al.*, 2015).
- 2.2. Magnitude Surveys is a corporate member of ISAP (International Society of Archaeological Prospection).
- 2.3. Director Graeme Attwood is a Member of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, as well as the Secretary of GeoSIG, the CIfA Geophysics Special Interest Group. Director Finnegan Pope-Carter is a Fellow of the London Geological Society, the chartered UK body for geophysicists and geologists, as well as a member of GeoSIG, the CIfA Geophysics Special Interest Group. Director Chrys Harris has a PhD in archaeological geophysics from the University of Bradford.
- 2.4. All MS managers have postgraduate qualifications in archaeological geophysics. All MS field staff have relevant archaeology or geophysics degrees and supervisors have at least three years' field experience.

3. Objectives

- 3.1. The geophysical survey aimed to assess the subsurface archaeological potential of the survey area.

4. Geographic Background

4.1. The site is located to the northern end of the village of Sproughton, 3.6km west of Ipswich, Suffolk (Figure 1). The site is bounded by Loraine Way (B1113) to the west, residential properties of Lower Street to the south, and a wooded area to the east and north (Figure 2). Survey was undertaken across a number of adjacent fields, which are generally flat in the north, with a gentle slope to the west across the central and southern areas.

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	Pasture, flat	Surrounded by wire fences. Gas pipe markers were located parallel to the eastern edge. An overhead cable was identified running NW-SE across the northern end of the area.
2	Pasture, very slight slope down towards the western edge	Bounded by electric fencing to the south, hedge to the west, and wire fences to the north and east.
3	Pasture, flat	An overgrown area at the north-eastern corner was fenced off. A van was located to the east, and a building to the south.
4	Pasture, very slight slope down towards the western edge	Bounded by garden fences to the west and electric fences to the north. An area of burnt ground was identified to the centre.
5-6	Overgrown	Not surveyable

4.3. The underlying geology comprises Thanet sand formation and Lambeth Group (undifferentiated) - clay, silt and sand across the site. Superficial deposits consist of river terrace deposits (undifferentiated) - sand and gravel to the east, and Lowestoft Formation - sand and gravel to the west (British Geological Survey, 2017).

4.4. The soils consist of freely draining slightly acid loamy soils, with a small strip of loamy and clayey floodplain soils with naturally high groundwater on the eastern boundary (Soilscapes, 2017).

5. Archaeological Background

- 5.1. The following section summarises the archaeological background of the site and the surrounding area (1km radius, based on a SCC HER search obtained by CgMs [search dated 9/6/17]).
- 5.2. Palaeolithic evidence is limited to a single flint flake (HER SPT026), found 850m south of the site. A Mesolithic occupation site (HER SPT002), situated on a knoll above the floodplain 850m southeast of the survey area, has been excavated on five occasions since 1924. These excavations have identified a multitude of flint cores, flakes, scrapers, several picks and axes, and two microliths. Excavation in 1958 uncovered pits and further finds mixed with Bronze Age and Neolithic material, including some Beaker pottery. Other Mesolithic finds include a lithic working site (HER SPT017), which included four postholes, as well as numerous cores, flakes, axes, a single scraper and five microliths, located 730m southeast of the survey area. A flint findspot, with three flakes and a scraper (MonUID MSF14535), has also been recorded 220m south of the site).
- 5.3. Neolithic and Bronze Age activity has also been recorded in the area. Four ring ditches have been found, in close proximity to each other, 430m north of the site (HER BRF064, BRF065, BRF066, BRF067). One of these (HER BRF065) has an associated linear feature, while another (HER BRF066) is located adjacent to an enclosure with an opening on the west side. A further ring ditch (HER SPT049) is located 475m south of the site, with three further examples (HER SPT019) located 930m southwest of the site, one of which is oval shape; 680m west of site a cropmark of a partial ring ditch with a pit on the western side has been recorded (HER SPT041). All of these are thought to be ploughed out Bronze Age barrows. Other finds from the locality which relate to the Neolithic and Bronze Age include a Neolithic axe (HER SPT006), Bronze Age dirk with blade (HER SPT018), and, from 615m southeast of the site, at least two Bronze Age cinerary urns containing the cremated remains of two individuals (HER SPT005).
- 5.4. Evidence of Roman activity in the area is limited to two findspots of Roman coins, one 160m southwest of site (HER SPT015), and one 435m north (HER BRF119). The Roman road, Pye Road (Margary 3c (S1)) (BRF023), follows the line of the modern A1100, Loraine Way.
- 5.5. The village has Medieval heritage with the main body of the Church of All Saints (HER SPT 016) dating back to the 14th or 15th century. It is thought to be one of the two churches documented in the Domesday survey in the Bramford parish. A red ware bottle (HER SPT016) was discovered in the tower wall of the church. A number of other buildings in the village have later Medieval origins.
- 5.6. The external boundaries of the site appear, from regression of historic mapping, to have remained constant through the 19th and 20th centuries. No internal boundaries are noted. Similarly, no additional buildings are noted.

6. Methodology

6.1. Data Collection

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

6.1.2. 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

6.1.3. The magnetic data were collected using MS' bespoke hand-pulled cart system.

- 6.1.3.1. MS' cart system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a Hemisphere S321 GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The Hemisphere S321 GNSS Smart Antenna is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.
- 6.1.3.2. 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.
- 6.1.3.3. Rows of temporary sight markers were established in each survey area to guide the surveyor and ensure full coverage with the cart. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient data 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 Historic England's standards for "raw or minimally processed data" (see sect 4.2 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. Multiple greyscale images at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plot (Figure 7). XY trace plots visualise the magnitude and form of the geophysical response, aiding in anomaly interpretation.
- 6.3.2. Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street mapping, satellite imagery, historic mapping, and soil and geology mapping. Google Earth (2017) was consulted as well, to compare the results with recent land usages.

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 of further work in order to constantly improve our knowledge and service.

7.2. Discussion

- 7.2.1. The geophysical results are presented in consideration with satellite imagery (Figure 5) and historic mapping (Figure 6).
- 7.2.2. The fluxgate gradiometer survey has responded well to the environment of the survey area. A distinct C-shaped anomaly, around 23m in diameter, has been detected in Area 4 and is classified as 'Possible Archaeology'. However, ferrous responses from the fence mask an area that may otherwise have revealed a complete annular anomaly. The morphology and responses could be consistent with those of a ring ditch or ploughed out barrow. It is worth noting that other ring ditches known from the area (see Section 5.3) have diameters ranging from 20 – 25m. Natural variations in the soil and superficial geology, which consists of clay, silt and sand, are apparent across the site; these amorphous responses are particularly visible in Areas 1 and 2. Ferrous interference, resulting from modern features, dominates the perimeters of the survey areas; two linear services are also evident. In addition, a small number of anomalies of unknown origin have been detected.

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. **Undetermined** – Anomalies are classified as Undetermined when the anomaly origin is ambiguous through the geophysical results and there is no supporting or correlative evidence to warrant 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 not ferrous in nature.
- 7.3.1.3. **Ferrous (Discrete/Spread)** – Discrete ferrous-like, dipolar anomalies are likely to be the result of modern metallic disturbance on or near the ground surface. A ferrous spread refers to a concentrated deposition of these discrete, dipolar anomalies. Broad dipolar ferrous responses from modern metallic features, such as fences, gates, neighbouring buildings and services, may mask any weaker underlying archaeological anomalies should they be present.

7.3.2. Magnetic Results - Specific Anomalies

- 7.3.2.1. **Archaeology (Possible)** – A slightly irregular C-shaped anomaly is present in Area 4, showing up as a weak positive contrast against the background. This anomaly may actually form a complete annular response, although the potential remainder of the full ring (that is, the northern-most quarter) is masked by strong dipolar anomalies caused by the adjacent electric fence and gate. The anomaly has a diameter of approximately 23m, while the positive responses delineating the circumference have a width of c. 1.5-2.5m. A possible internal anomaly is located within the eastern side, although this is partially obscured by a dipolar ferrous response and cannot be confidently identified.
- 7.3.2.2. **Archaeology (Possible)** – A further, much weaker, C-shaped anomaly has been identified towards the eastern corner of Area 1. This anomaly has a diameter of c. 10m and, like that described in Section 7.3.2.1, potentially represents a ring-shaped feature but is obscured by discrete ferrous responses. However, this anomaly is considerably more ephemeral than the previously described example.
- 7.3.2.3. **Natural** – The underlying geology and soils are such that natural variations of the mineral content within them have been detected by the fluxgate gradiometer. These variations are most visible across Areas 1 and 2, where a number of amorphous, indistinct anomalies have been detected. In the interests of clarity, only indicative trends have been illustrated. Areas 2 and 4 also demonstrate concentrations of small scale variations, which have been categorised as 'Natural (Spread)'.

- 7.3.2.4. **Ferrous (Discrete and Spread)** – Responses caused by two linear sub-surface services are visible in the data. The first runs northwest-southeast across Area 1; the second runs along the eastern boundary of Area 1 and 3, in accordance with the gas pipe markers noted in Section 4.2. Such features produce very strong dipolar responses, and have effectively masked any weaker anomalies up to 10m away from the line of the service itself. The perimeters of the survey areas also demonstrate the proximity of modern features, such as buildings, vehicles and fencing, which are evidenced in the data by further broad-scale dipolar anomalies. Smaller, discrete anomalies are distributed across all the survey areas, probably representing ferrous debris on or near the soil surface.
- 7.3.2.5. **Undetermined** – A small number of anomalies have been detected, the origins of which cannot be confidently identified from the geophysical data alone. These are primarily located in the area of the annular anomaly and, while they may reflect agricultural, modern or natural variation, an archaeological origin cannot be ruled out.

8. Conclusions

- 8.1. The fluxgate magnetometer has responded well to the conditions of the survey area. A range of weak and strong anomalies, with a variety of origins, have been detected, indicating the effectiveness of the technique on this site. Possible archaeological activity was detected in the form of a distinct C-shaped anomaly, which may be consistent with responses from a ploughed out barrow or ring ditch. It is possible that the corresponding sub-surface feature forms a complete ring, although strong dipolar responses caused by the adjacent fence prevent the detection of any weaker anomalies. A further, smaller and more ephemeral, C-shaped anomaly has also been identified that may represent a similar archaeological feature.
- 8.2. Natural variations in the soils and/or superficial geology have been detected as a series of amorphous responses across the survey area.
- 8.3. Strong dipolar responses dominate a significant proportion of the survey areas, caused by both sub-surface services and modern activity such as fences, buildings and vehicles.
- 8.4. A small number of anomalies have also been detected that have been classified as 'Undetermined' on the grounds that their origins cannot be confidently identified from the geophysical data alone.

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 all reports to the ADS Grey Literature Library subject to any time embargo dictated by the client.
- 9.3. Whenever possible, MS has a policy of making data available to view in easy to use forms on its website. This can benefit the client by making all of their reports available in a single repository, while also being a useful resource for research. Should a client wish to impose a time embargo on the availability of data, this can be achieved in discussion with MS.

10. Copyright

- 10.1. Copyright and the 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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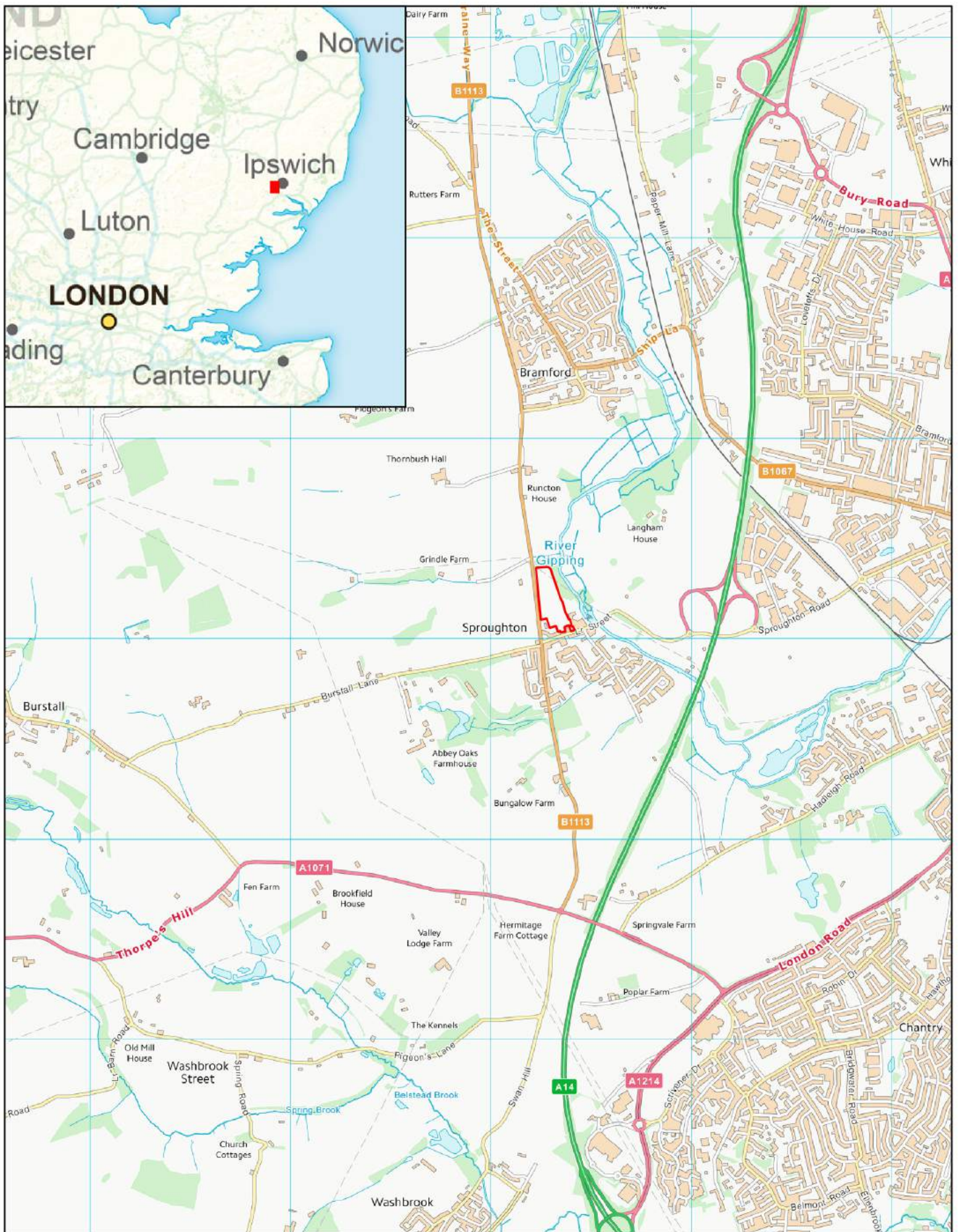
Google Earth, 2017. Google Earth Pro V 7.1.7.2606. 52° 03' 50" N, 1° 05' 45" W. Eye alt 531m. ©2016 Google © 2017 Google.

Olsen, N., Toffner-Clausen, L., Sabaka, T.J., Brauer, P., Merayo, J.M.G., Jorgensen, J.L., Leger, J.M., Nielsen, O.V., Primdahl, F., and Risbo, T., 2003. Calibration of the Orsted vector magnetometer. *Earth Planets Space* 55: 11-18.

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MSTM149 - Land off Loraine Way, Sproughton, Ipswich

Figure 1 - Site Location

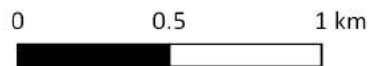
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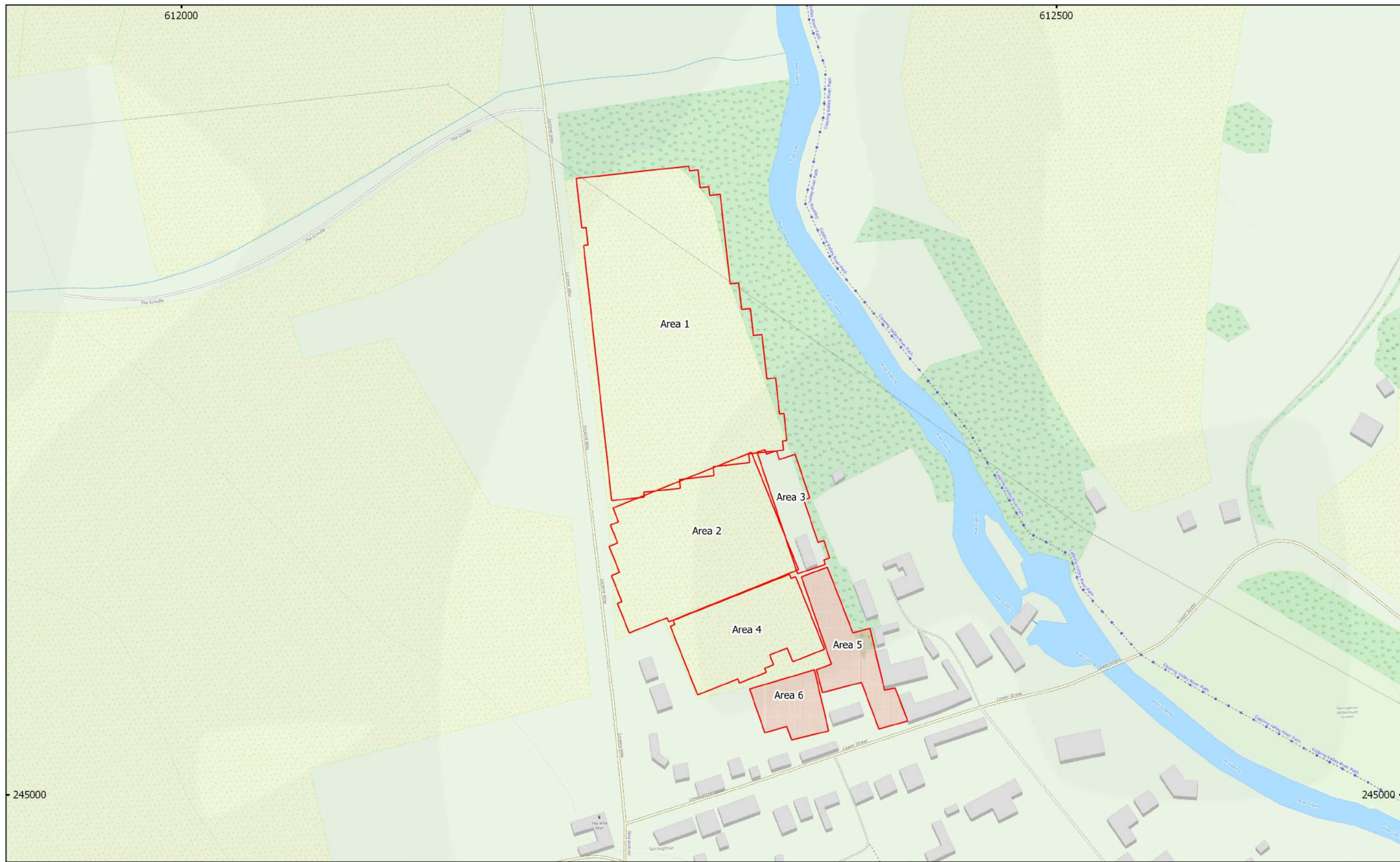
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OS (100056946)

 Site Boundary

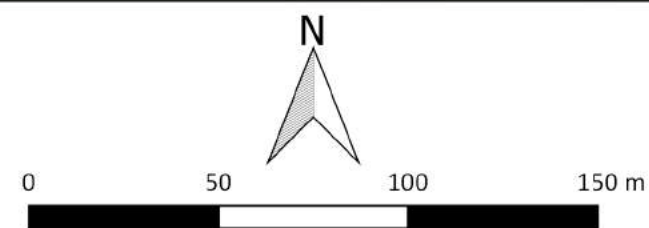


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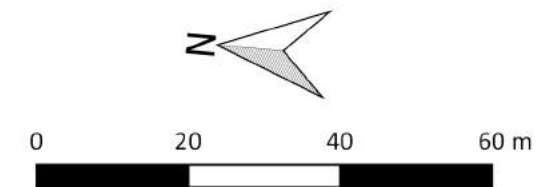
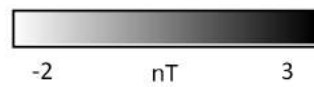
MSTM149 - Land off Loraine Way, Sproghston, Ipswich
 Figure 2 - Location of Survey Areas
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 Copyright Magnitude Surveys Ltd 2017
 Contains OSM TF Landscape Maps © Thunderforest 2017
 Contains Data © OpenStreetMap contributors 2017

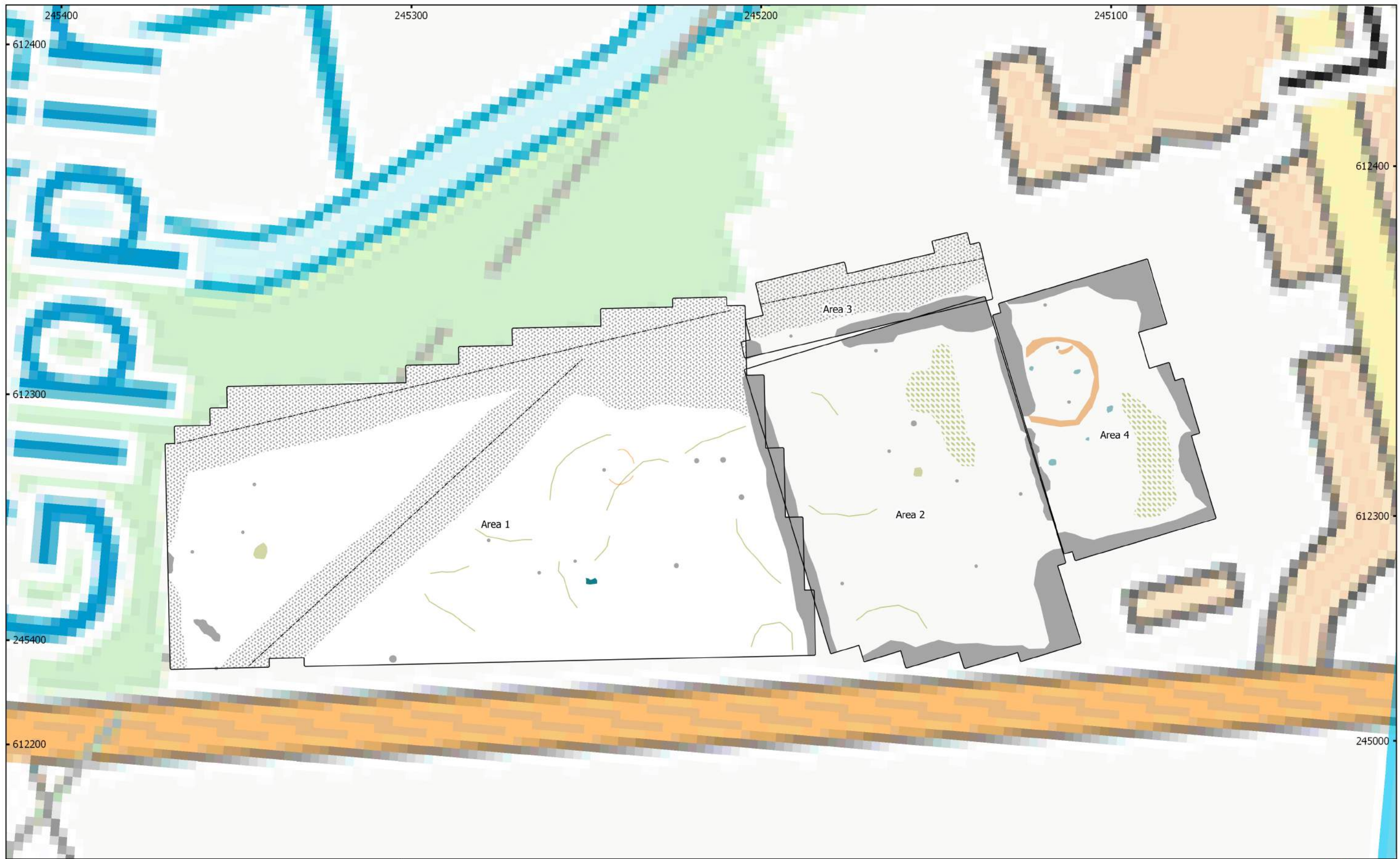
- Surveyable
- Not surveyable





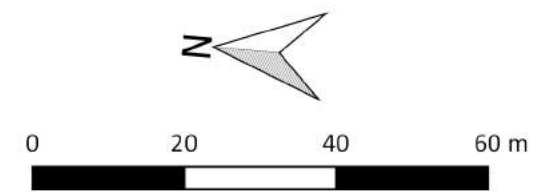
MSTM149 - Land off Loraine Way, Sproughton, Ipswich, Suffolk
 Figure 3 - Magnetic Greyscale
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MSTM149 - Land off Loraine Way, Sproughton, Ipswich, Suffolk
 Figure 4 - Magnetic Interpretation
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- | | |
|---------------------------------------|------------------------------|
| Archaeology Possible (Weak) | Undetermined (Strong) |
| Ferrous (Dipolar) | Undetermined (Weak) |
| Ferrous (Spread)/Magnetic Disturbance | Archaeology Possible (Trend) |
| Natural (Spread) | Natural (Trend) |
| Natural (Weak) | Service |

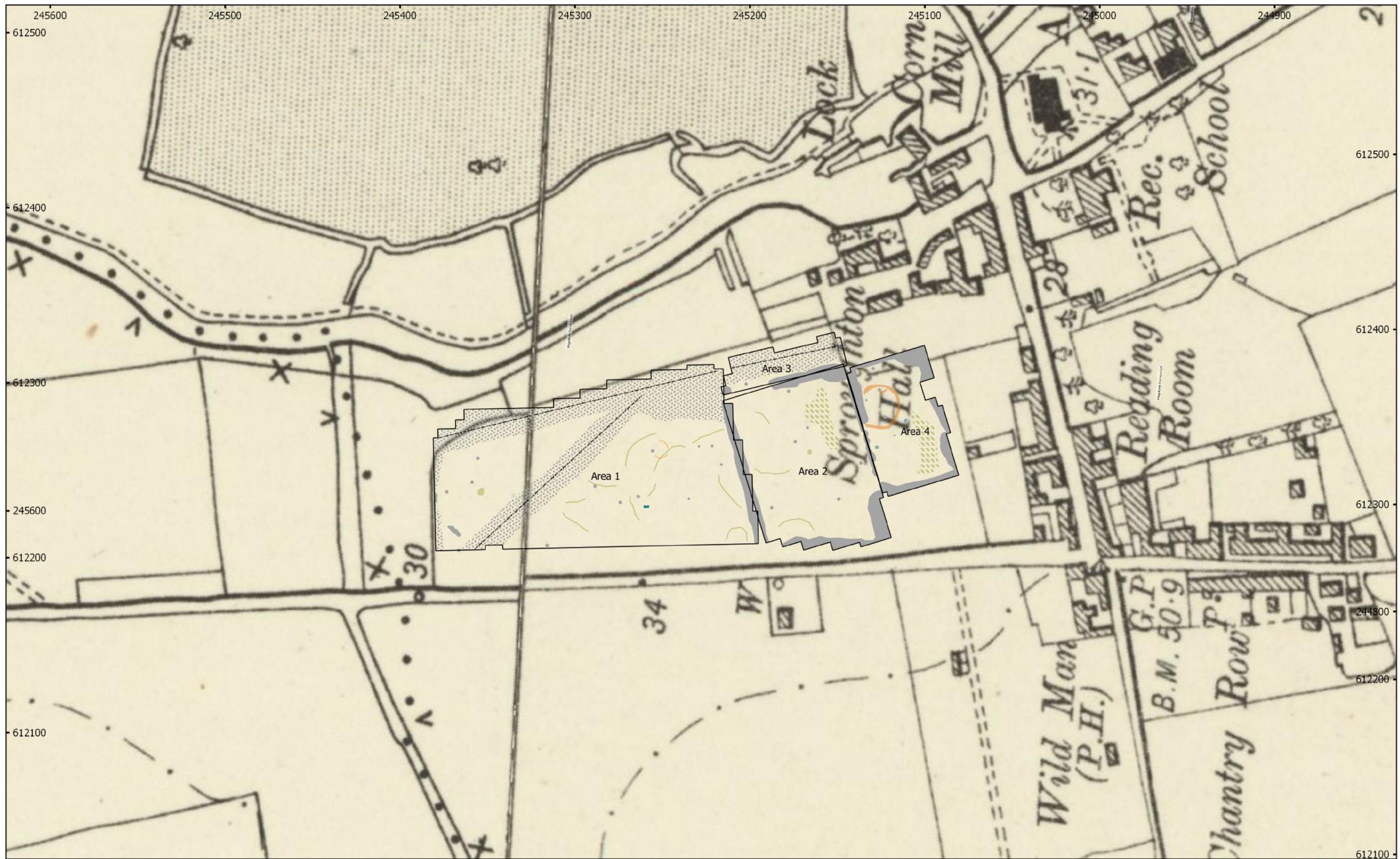




MSTM149 - Land off Loraine Way, Sproughton, Ipswich, Suffolk
 Figure 5 - Magnetic Interpretation over Satellite Imagery
 1:1000 @ A3
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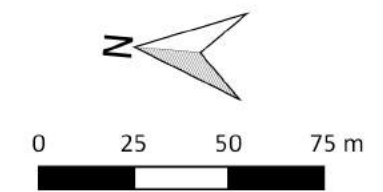
- | | |
|---------------------------------------|------------------------------|
| Archaeology Possible (Weak) | Undetermined (Strong) |
| Ferrous (Dipolar) | Undetermined (Weak) |
| Ferrous (Spread)/Magnetic Disturbance | Archaeology Possible (Trend) |
| Natural (Spread) | Natural (Trend) |
| Natural (Weak) | Service |

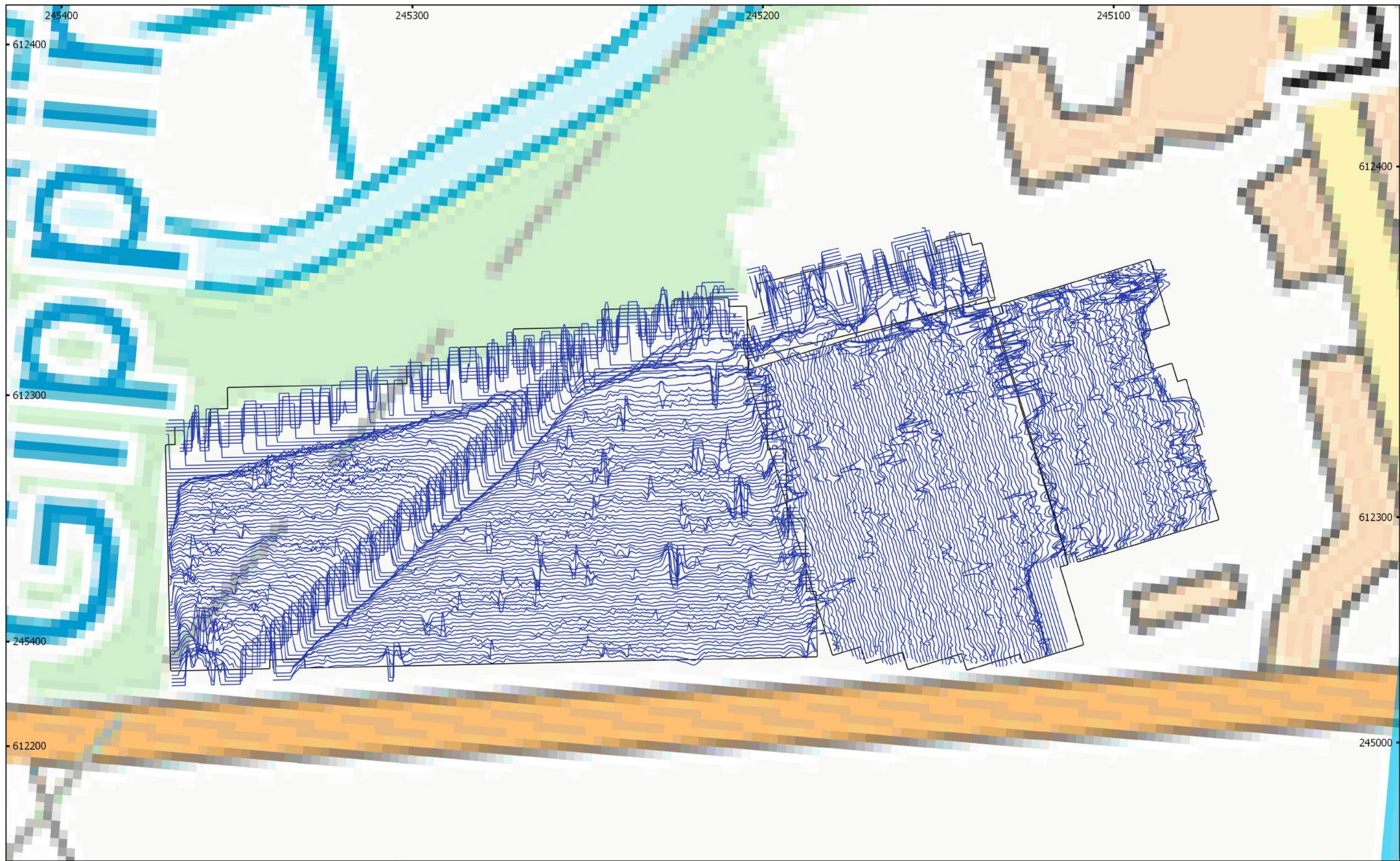
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MSTM149 - Land off Loraine Way, Sproynton, Ipswich, Suffolk
 Figure 6 - Magnetic Interpretation over Historic Mapping
 1:2000 @ A3
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 Contains historic mapping Ordnance Survey, 6" 2nd edition c. 1882 - 1913 ©
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- | | |
|---------------------------------------|------------------------------|
| Archaeology Possible (Weak) | Undetermined (Strong) |
| Ferrous (Dipolar) | Undetermined (Weak) |
| Ferrous (Spread)/Magnetic Disturbance | Archaeology Possible (Trend) |
| Natural (Spread) | Natural (Trend) |
| Natural (Weak) | Service |





MSTM149 - Land off Loraine Way, Sproughton, Ipswich, Suffolk
Figure 7 - XY Trace Plot
20nT/cm at 1:1000 @ A3
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0 20 40 60 m

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OASIS ID: magnitud1-287777

Project details

Project name	MSTM149 - Land of Loraine Way, Sproughton, Ipswich
Short description of the project	Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c. 3.3ha area of land off Loraine Way, Sproughton, Ipswich, Suffolk. A fluxgate gradiometer survey was successfully completed and anomalies of possible archaeological origin were detected. The geophysical results primarily reflect natural soil/geological variation and modern activity, however possible archaeological activity is reflected in the presence of a C-shaped anomaly of 23m diameter, which may reflect the presence of a ploughed out barrow or ring ditch.
Project dates	Start: 13-07-2017 End: 09-08-2017
Previous/future work	Not known / Not known
Any associated project reference codes	ESF25603 - HER event no.
Type of project	Field evaluation
Site status	None
Current Land use	Grassland Heathland 5 - Character undetermined
Monument type	POSSIBLE RING DITCH Uncertain
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Not recorded
Prompt	Planning condition
Position in the planning process	Not known / Not recorded
Solid geology	TERTIARY - UNDIFFERENTIATED
Solid geology (other)	Thanet Sand Formation and Lambeth Group - Clay, Silt and Sand
Drift geology	RIVER TERRACE DEPOSITS
Techniques	Magnetometry

Project location

Country	England
Site location	SUFFOLK BABERGH SPROUGHTON Land of Loraine Way, Sproughton, Ipswich
Postcode	IP8 3PN
Study area	3 Hectares

Site coordinates TM 1229 4519 52.063807417682 1.097407969047 52 03 49 N 001 05 50 E Point

Project creators

Name of Organisation Magnitude Surveys Ltd
Project brief originator Suffolk County Council Archaeological Service
Project design originator Magnitude Surveys Ltd
Project director/manager Graeme Attwood
Project supervisor Leanne Swinbank

Project archives

Physical Archive Exists? No
Digital Archive recipient Magnitude Surveys
Digital Contents "Survey"
Digital Media available "Geophysics"
Paper Archive Exists? No

Project bibliography 1

Publication type Grey literature (unpublished document/manuscript)
Title Geophysical Survey Report of Land off Loraine Way, Sproughton, Ipswich, Suffolk
Author(s)/Editor(s) Brown, H. and Fortuny, M.
Other bibliographic details MSTM149
Date 2017
Issuer or publisher Magnitude Surveys
Place of issue or publication Bradford
Entered by Graeme Attwood (g.attwood@magnitudesurveys.co.uk)
Entered on 9 August 2017

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