Geophysical Survey Report
of
Land at Higham Lane,
Nuneaton, Warwickshire

For
CgMs Heritage (RPS Group)

On Behalf Of
Richborough Estates Ltd

Magnitude Surveys Ref: MSSP252
February 2018
Abstract
Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c. 11ha area of land off Higham Lane, Nuneaton. A fluxgate gradiometer survey was successfully completed and no anomalies of a probable or possible archaeological origin have been identified. The geophysical results reflect agricultural use, modern activity, and minor natural changes. A number of weak agricultural responses indicative of historic ploughing have been located within the site, along with traces of a field boundary which has since been removed.
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1. Introduction
1.1. Magnitude Surveys Ltd (MS) was commissioned by CgMs Heritage (RPS Group) on behalf of Richborough Estates to undertake a geophysical survey on a c.11ha area of land off Higham Lane, Nuneaton, Warwickshire (SP380941).
1.2. The geophysical survey comprised a GNSS-positioned, hand-carried 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 Monday 12th February and took two days to complete.

2. Quality Assurance
2.1. The survey will be 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).
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 and is the Vice-Chair of the International Society for Archaeological Prospection.
2.4. All MS managers have relevant degree qualifications to archaeological or geophysics. All MS field and office staff have relevant archaeology or geophysics degrees and/or 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 c. 2.8km to the north of Nuneaton (Figure 1). Survey was undertaken on an area of arable farmland approximately 11ha in size. To the north the site is bounded by the A5, with Higham Lane to the north-west. The southern and eastern boundaries are bounded by further agricultural fields (Figure 2). The topography of the survey area shows a slight slope from the western border downwards to the east.

4.2. Survey considerations:

<table>
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<tr>
<th>Survey Area</th>
<th>Ground Conditions</th>
<th>Further Notes</th>
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<tr>
<td>1</td>
<td>Arable land usage, covered by a young crop. The terrain sloped gently downward from west to east. At the time of survey, the ground was soft going.</td>
<td>Bounded by a wooden fence to the north and west, separating the site from the A5. The other boundaries were bordered by hedgerows. In the centre of the survey area was a small copse of trees surrounding a pond. This was the only area within the site that could not be surveyed.</td>
</tr>
</tbody>
</table>

4.3. The underlying geology comprises mainly of mudstone from the Mercia Mudstone Group along with interspersed siltstone deposits from the Gunthorpe Member. The only record of superficial deposits on the site is on the eastern boundary near to Change Brook, comprising of Alluvium. (British Geological Survey, 2018).  

4.4. The soils consist slightly acidic loamy and clayey soils with impeded drainage (Soilscapes, 2018).

5. Archaeological Background

5.1. The following archaeological background summaries a desk-based assessment produced by CgMs (Conolly, 2017).

5.2. Limited evidence for Palaeolithic activity has been found within the survey area or its immediate vicinity. Findings include a Palaeolithic hand axe and roughout, located west of Higham Lane, 190m and 90m respectively from the site. Evidence of any Bronze Age or Iron Age activity in this area is also sparse. To the south of the site an Iron age- Romano- British pit has been recorded. Excavated as part of a previous archaeological study next to the site, findings were limited, and the pit was found to be an isolated feature rather than part of a larger complex (Finn, C., and Burke, J., 2016). These findings were made as part of a follow up trial trenching scheme to a previous geophysical survey (Meadows A. and Walford J., 2015) which did not identify any anomalies that were thought to be of an archaeological origin; identifying only agricultural and modern anomalies.

5.3. The A5, running to the north of the site, follows the course of the Roman Watling Street. Although bounding the site, at no point does the Roman road or its agger extend into the survey area. Approximately 500m to the north of the site the possible location of a Roman settlement has been discovered on Higham Hill. Fieldwalking in this area has revealed several findings, the concentration of which is endemic to a settlement of some description.
5.4. The evidence to suggest any form of medieval activity within the site is negligible. Within the survey area, a 15th century coin has been located. The isolated nature of this find would suggest it was lost rather than buried. Another coin has been located approximately 465m away to the south west. According to Domesday Book the nearest recorded settlement is located approximately 1.5km south west.

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:

<table>
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<th>Method</th>
<th>Instrument</th>
<th>Traverse Interval</th>
<th>Sample Interval</th>
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<tr>
<td>Magnetic</td>
<td>Bartington Instruments Grad-13 Digital Three-Axis Gradiometer</td>
<td>1m</td>
<td>200Hz reprojected to 0.125m</td>
</tr>
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</table>

6.1.3. The magnetic data were collected using MS’ bespoke hand carried 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. A navigation system was integrated with the RTK GPS 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 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, as well as the total field data from the upper and/or lower sensors. 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 greyscales 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 maps, satellite imagery, historic maps, LiDAR data, and soil and geology maps. Google Earth (2018) 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 maps (Figure 6).

7.2.2. The fluxgate gradiometer survey has responded adequately to the survey area’s environment. The magnetic anomalies are generally weak in contrast from the background material (Figure 7), but slight agricultural and natural changes can still be discerned. No anomalies thought to be of an archaeological origin have been found. The survey has proved successful in identifying the location of a historic field boundary and other minor agricultural trends which are indicative of past ploughing regimes. However, ferrous features and waste around the boundary may hide subtler responses within these areas should any be present, however, this comprises a very limited extent of the greater survey area (Figure 7).

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. Agricultural – A number of weak, linear responses can be seen running near parallel to one another across the site. A weak agricultural trend can be seen running perpendicular to the northern and southern boundaries, marked as [1]. [1] correlates with the location of a former field boundary visible on historic mapping (Figure 6). There are numerous other, weaker responses located across the site, which occur both parallel and acute to the former field divisions. Endemic of ploughing or similar agricultural activity, these responses likely pertain to some form of historic land usage.

7.3.2.2. Ferrous (Spread) – To the west of the site, areas of Ferrous (Spread) responses have been identified [2]. Located in close proximity to the field entrance, recent satellite imagery (Figure 5) reveals areas of detritus and disturbance adjacent to [2], suggesting these responses are related to rubbish deposition.

8. Conclusions

8.1. A fluxgate magnetometer has been successfully completed at this site. The survey results reveal a relatively quiet magnetic background with geophysical anomalies exhibiting weak magnetic contrast. Still, this has not hindered the identification and interpretation of the more ephemeral features located within the survey area, including agricultural trends and natural changes. No anomalies of an archaeological origin have been identified. Evidence of agricultural use has been identified across the survey area, including a former field boundary and possible historic ploughing trends. A few ambiguous linear responses have been classified as ‘Undetermined’ but are considered more likely to be resultant from agricultural or natural processes, rather than from an archaeological origin. Other responses identified as ferrous in origin can mainly be attributed to adjacent modern features and recent modern activity.

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


Chartered Institute for Archaeologists, 2014. Standards and guidance for archaeological geophysical survey. CIfA.


