Geophysical Survey Report

of

Land at Dibden Lane, Alderton

Tewkesbury

For

CgMs Heritage (Part of RPS Group PLC)

On Behalf Of

Green Volt Ltd.

Magnitude Surveys Ref: MSSP317

June 2018

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Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a c.5.94ha area of land at Dibden Lane, Alderton, Tewkesbury, Gloucestershire. A fluxgate magnetometer survey was successfully completed and no anomalies of a possible or probable archaeological origin have been identified. The geophysical results primarily reflect historic agricultural practice. At least three different groups of ridge and furrow cultivation have been identified across the site; the orientation of these regimes appear to conform to changes in direction of slope across the site. Intermittent weaker responses located in-between the furrows have also been identified and may indicate different phases of ploughing. There was no extant evidence for this ploughing at the time of survey. Other magnetic anomalies are likely to reflect more recent agricultural practice, natural background variation, and minor ferrous disturbances.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by CgMs Heritage (Part of RPS Group Plc) on behalf of Green Volt Ltd to undertake a geophysical survey on a c.5.94ha area of land at Dibden Lane, Alderton, Tewkesbury. (SP 4005 2331).

1.2. The geophysical survey comprised a hand-carried GNSS-positioned fluxgate magnetometer 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 7 June 2018 and was completed the following day.

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 of Archaeological Prospection).

2.2. Director Graeme Attwood is a Member of CIfA, 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.

2.3. All MS managers have relevant degree qualifications to archaeology 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 immediately to the east of Alderton (Figure 1), which is located approximately 11km east of Tewksbury town centre. Dibden Lane runs along the northern boundary of the site and the site lies within a larger field that extends further towards the south (Figure 2). To the northwest are residential properties, to the southwest is a pastoral field, and the east another arable field. A ditch flows along the eastern boundary of the site is into a small stream running along the southern boundary of the field the site lies within.

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	Field was under arable cultivation with a mature wheat crop at the time of survey. The ground surface sloped gently from north to south, curving round to northwest to southeast in the east of the survey area.	Site is bounded to the north and east by a hedge, partially by a fence along the northern half the western boundary, and a hedge along the southern half of the western boundary.

4.3. The underlying geology comprises mudstone from the Charmouth Mudstone Formation. No superficial deposits have been recorded across the majority of the survey area. Along the eastern boundary of the site runs a small area of superficial head deposits, comprising clay, silt sand and gravel (British Geological Survey, 2018).

4.4. The soils consist of lime-rich loamy and clayey soils with impeded drainage (Soilscapes, 2018).

5. Archaeological Background

5.1. This archaeological background has been produced using information provided in a desk-based assessment by CgMs Heritage (Connolly 2018). The information presented considers the site and a wider 1km search area.

5.2. Evidence of the early prehistoric period within the wider search area is limited to an assemblage of residual worked flint broadly dated to the Mesolithic/ Bronze age uncovered by trenching in land adjacent to the site. West of Alderton, two Neolithic pits have been excavated though nothing else was recorded from this excavation to suggest prehistoric activity.

5.3. Approximately 200m west of the site, several phases of later prehistoric settlement have been identified including a ring ditch, subsurface enclosure, field boundaries and a grain storage pit. East of Alderton, approximately 490m from site, evidence of late prehistoric settlement has been identified in the form of an enclosure, a number of post holes and grain pits. Cropmarks of two rectangular enclosures approximately 300m northwest of site have been identified as possibly being late Iron Age or Romano-British in origins. These enclosures contain a possible pit circle and potential field boundaries.

5.4. Evidence of Roman activity is limited to pottery sherds and the possible reoccupation of Iron Age settlements at the Willow Bank site, as suggested by the finds of Roman pottery.

5.5. Possible Anglo-Saxon activity in the extended search area is identifiable with a sunken featured building, disarticulated remains and a possible in-situ burial unearthed through an evaluation c.200m west from the site.

5.6. Medieval activity in the search area is limited to agricultural finds. Throughout the survey area satellite imagery shows ridge and furrow, typical of Medieval methods. In fields adjacent to the site, to the north, south and east, more ridge and furrow is visible. Several ditch like features have been identified running into a dry valley c.100m to the east of the site.

5.7. Historic map evidence of an Ordnance Survey (OS) drawing from 1811 shows the survey area as part of a larger field extending eastwards and southwards. In the 1st ed. OS map of 1884 the larger field the survey area lies within appears very close to its current form, except for a pond bisected by the eastern field boundary in the northeast corner, and trees located by a pond in the north-western portion of the survey area.

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-carried GNSS-positioned system.

6.1.3.1. MS' hand-carried 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, 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 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 greyscale images at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plot (Figure 8)). 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 6), historic maps (Figure 7), and a contour plot generated from the cart's GPS (Figure 9).

7.2.2. The fluxgate magnetometer survey has responded well to the environment of the survey area. The natural background is relatively quiet. Several discrete anomalies located towards the centre of the survey area and two broad anomalies towards the northwest corner are indicative of minor natural changes. Broad ferrous anomalies located along the northern and western boundaries are consistent with the presence of metallic features, while smaller discrete anomalies scattered across the site are indicative of minor near surface metallic debris. These ferrous responses do not significantly limit the interpretation of the survey results.

7.2.3. The geophysical results predominantly reflect historic agricultural use of the site with broad curvilinear anomalies characteristic of ridge and furrow cultivation identifiable in three distinct groups: Group 1, aligned approximately SSW to NNE, encompasses most of the survey area; Group 2, has a broader separation of anomalies but a similar alignment to Group 1 and occurs in the southeast corner of the survey area; and finally Group 3, which is orientated WNW to ESE in the eastern half of the site. These changes in direction appear to roughly respect changes in the slope of the terrain (see Figure 9). Another possible phase of ridge and furrow is highlighted by intermittent linear anomalies located in between the furrow anomalies of Group 3.

7.2.4. Transecting the ridge and furrow anomalies are faint linear trends that may reflect more recent ploughing. Further linear and curvilinear anomalies extending across the ridge and furrow may also reflect different phases of agricultural activity.

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. **Ridge and Furrow (Group 1)** – Curvilinear anomalies encompassing most of the survey area (extending from the western end) have been detected curving from a N-S alignment in the south to a SSW-NNE alignment in the north. The positive magnetic anomalies are likely to reflect the furrows of a ploughing regime. The widths of the furrow anomalies vary between c. 2.0-3.5m and separations between the furrows is typically c. 5.0-7.5m. Overlaying the interpretation with the topographic contours visualises how Group 1 correlates with areas where the topography slopes c. N-S (see Figure 9).

7.3.2.2. **Ridge and Furrow (Group 2)** – On a similar alignment to the ploughing of Group 1, is Group 2 towards the southeast corner of the site. However, the anomalies described as Group 2 curve slightly differently from those of Group 1, arching from N-S at the northern end to NNE-SSW along the southern boundary of the site. Furrow anomalies are typically c. 1.5-3.5m in width, whilst the separation between them is typically broader than Group 1 at c. 8.0-12.5m. Contours suggest the topography in the location of Group 2 slopes c. NNE-SSE (see Figure 9).

7.3.2.3. **Ridge and Furrow (Group 3)** – Encompassing much of the eastern half of the survey area is a parallel series of linear anomalies curving from E-W at the western end to WNW-ESE at the eastern end. Furrow anomalies do not extend all the way to the edge of the field, instead receding in strength c. 20m from the edge of the surveyed area. Contours highlight that Group 3 correlates with an area where the topography slopes c. NW-SE (see Figure 9).

7.3.2.4. **Ridge and Furrow (Fragmentary)** – Located in between the furrow anomalies of Group 3 are intermittent short and weak linear and curvilinear anomalies. The anomalies possibly reflect fragmentary evidence of furrows representing a different phase of historic agricultural practice at the site.

7.3.2.5. **Agricultural** – Weak, parallel linear trends which transect the ridge and furrow on a NE-SW alignment may reflect later ploughing (Figure 6). Weak parallel anomalies and trends which transect Group 1 at 90° may also reflect former agricultural processes; although a natural origin may also be possible.

8. Conclusions

8.1. The fluxgate magnetometer survey has responded well to the environment of the survey area. The results reveal a generally quiet natural magnetic background, though a few anomalies of varying strength and size appear to reflect some minor natural variation. Broad ferrous anomalies have been detected around the field's northern and western edges and are produced by adjacent metallic features. Scattered metallic debris in the near surface have also been detected, but these ferrous responses do not significantly limit the interpretation of the survey data. Overall the results primarily reflect agricultural activity. No anomalies have been classified as archaeological in origin; the detection of a range of different types of responses, of strong and weak magnetic strength, indicate that any underlying archaeological features with sufficient magnetic contrast should have been detected, if present. One anomaly has been classified as 'Undetermined', but this is confined between two furrows at the end of a ferrous disturbance, which suggests it may reflect a combination of agricultural and modern processes. An archaeological origin is considered less likely.

8.2. Agricultural activity has been classified mainly as ridge and furrow ploughing. No evidence for extant ridge and furrow as noted at the time of survey, suggesting the features have been subsequently ploughed out. Three distinct groups have been identified, although fragmentary linear responses between the furrows suggests additional ploughing phases. The different ploughing groups appear to correspond with changes in the direction of the slope across the site.

8.3. Later, or modern, ploughing trends have been detected transecting the ridge and furrow regime, along with several other linear responses and trends.

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 the any dictated time embargoes.

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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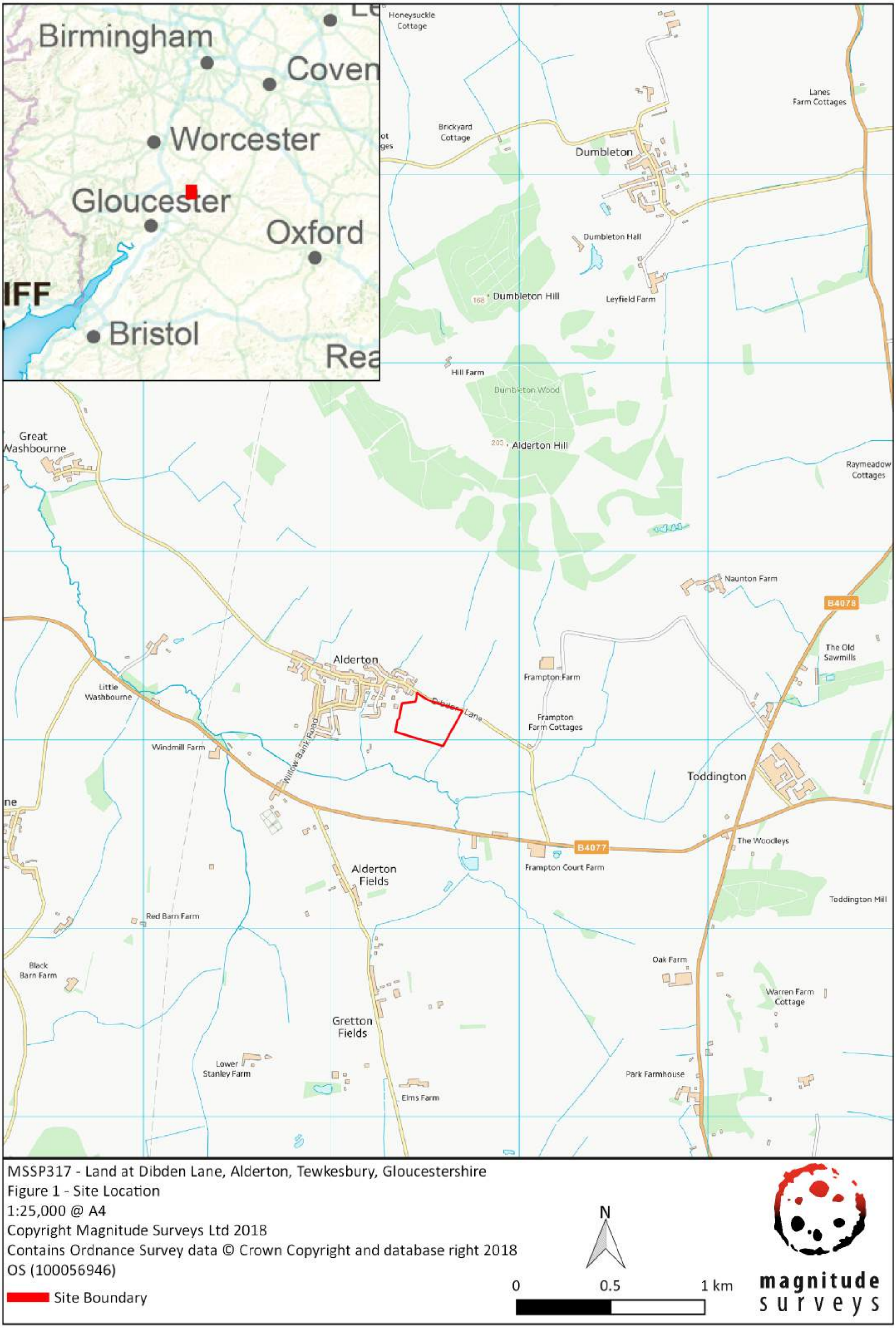

MSSP317 - Land at Dibden Lane, Alderton, Tewkesbury, Gloucestershire

Figure 1 - Site Location

1:25,000 @ A4

Site Boundary

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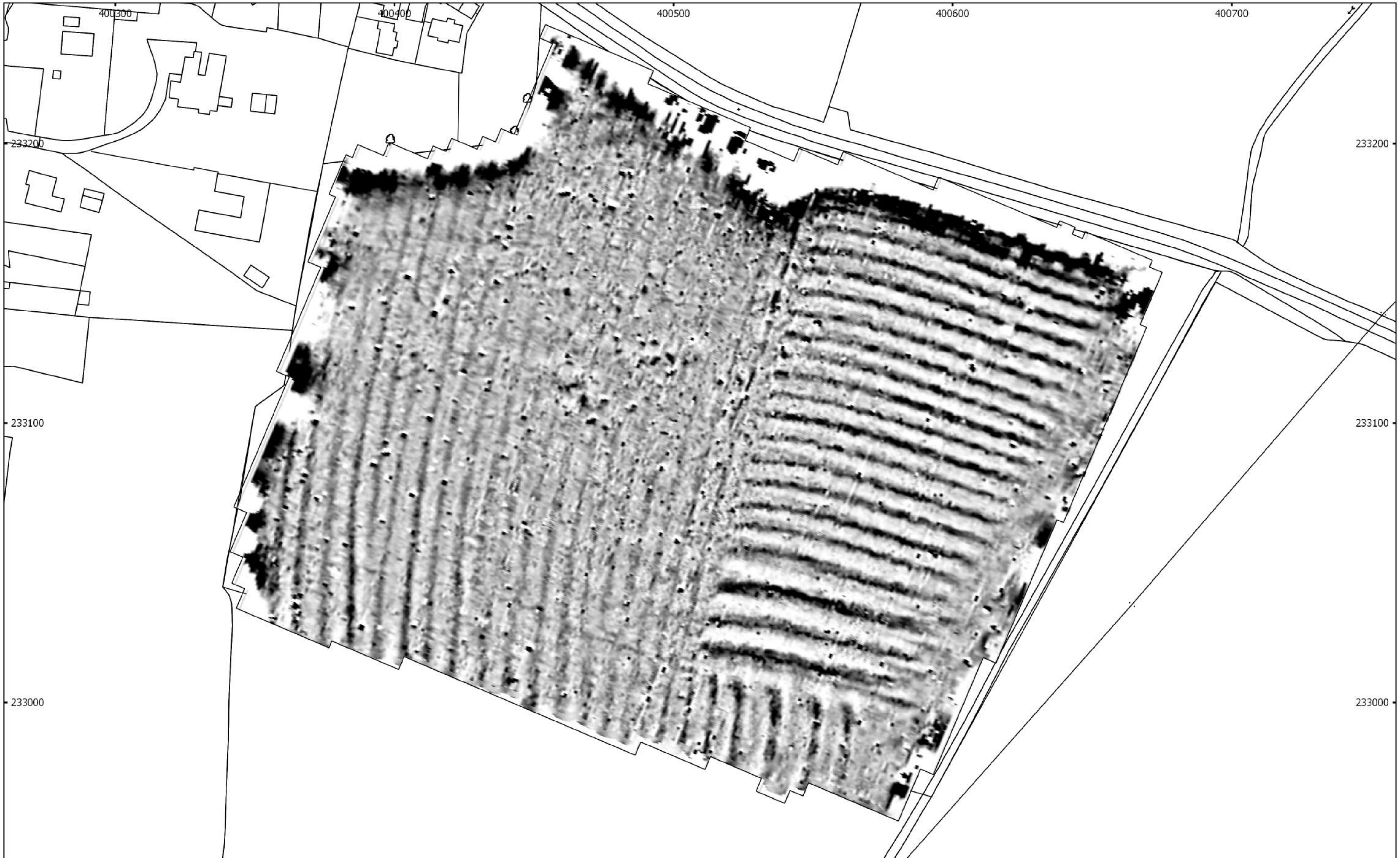
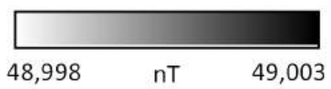
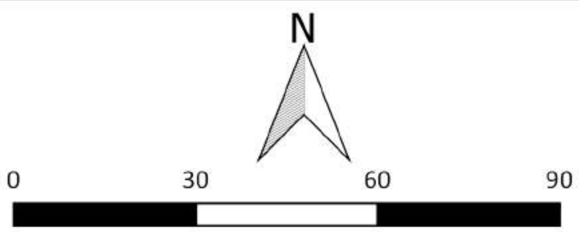
MSSP317 - Land at Dibden Lane, Alderton, Tewkesbury, Gloucestershire
Figure 2 - Location of Survey Area
1:10000 @ A3

magnitude surveys



MSSP317 - Land at Dibden Lane, Alderton, Tewkesbury, Gloucestershire
Figure 3 - Magnetic Total Field (Lower Sensor)
1:1,250 @ A3





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MSSP317 - Land at Dibden Lane, Alderton, Tewkesbury, Gloucestershire
Figure 4 - Magnetic Gradient
1:1,250 @ A3

MSSP317 - Land at Dibden Lane, Alderton, Tewkesbury, Gloucestershire
Figure 5 - Magnetic Interpretation
1:1,250 @ A3

- Ridge and Furrow
- Ridge and Furrow Possible (Fragmentary)
- Agricultural
- Agricultural (Trend)
- Natural (Strong)
- Natural (Weak)
- Natural (Trend)
- Undetermined (Weak)
- Ferrous (Dipolar)

magnitude surveys

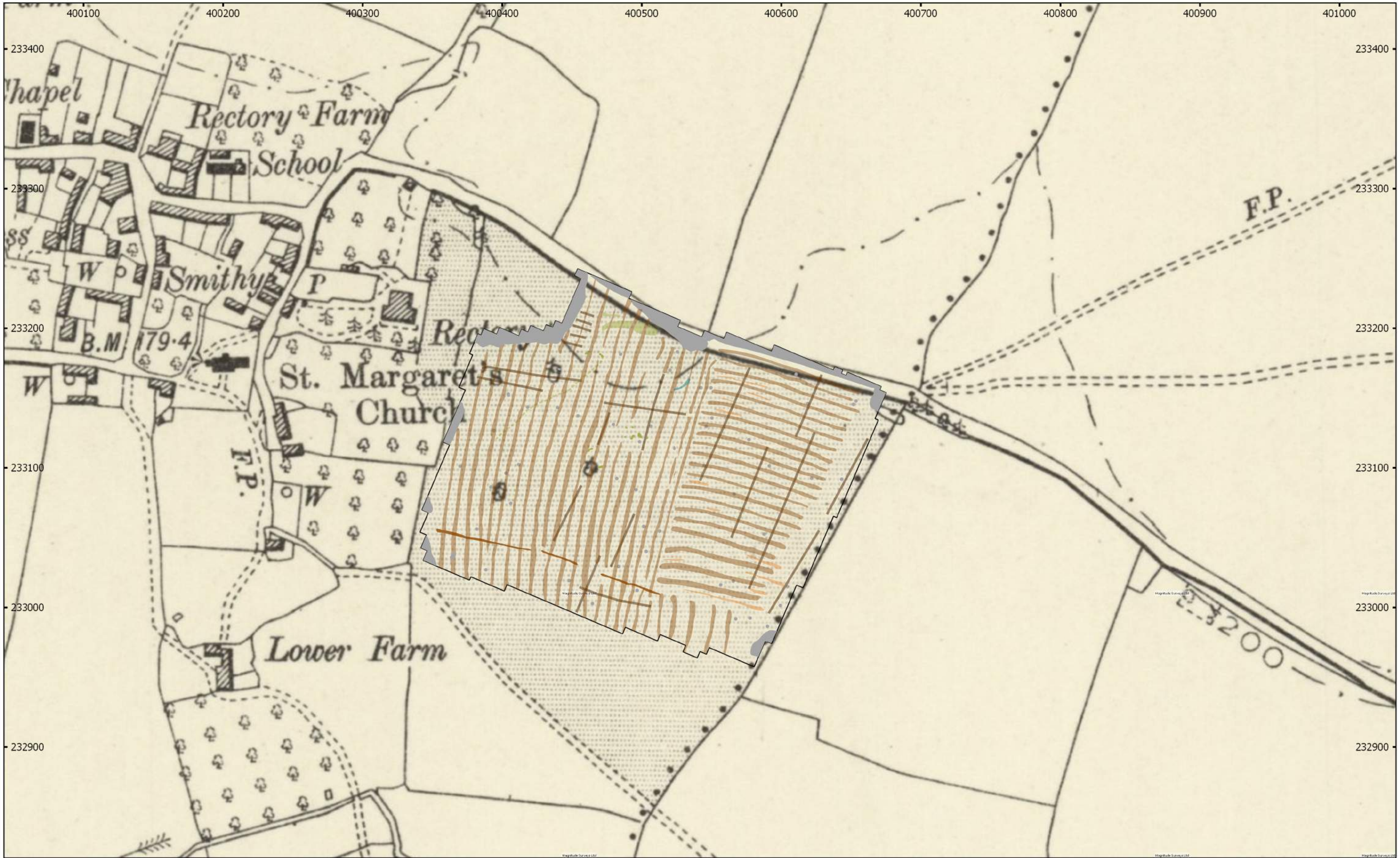
MSSP317 - Land at Dibden Lane, Alderton, Tewkesbury, Gloucestershire
Figure 6 - Magnetic Interpretation Over Satellite Imagery
1:1,250 @ A3

Ridge and Furrow
Ridge and Furrow Possible (Fragmentary)
Agricultural
Agricultural (Trend)
Natural (Strong)
Natural (Weak)
Natural (Trend)
Undetermined (Weak)
Ferrous (Dipolar)

N

0 30 60 90 m

magnitude surveys



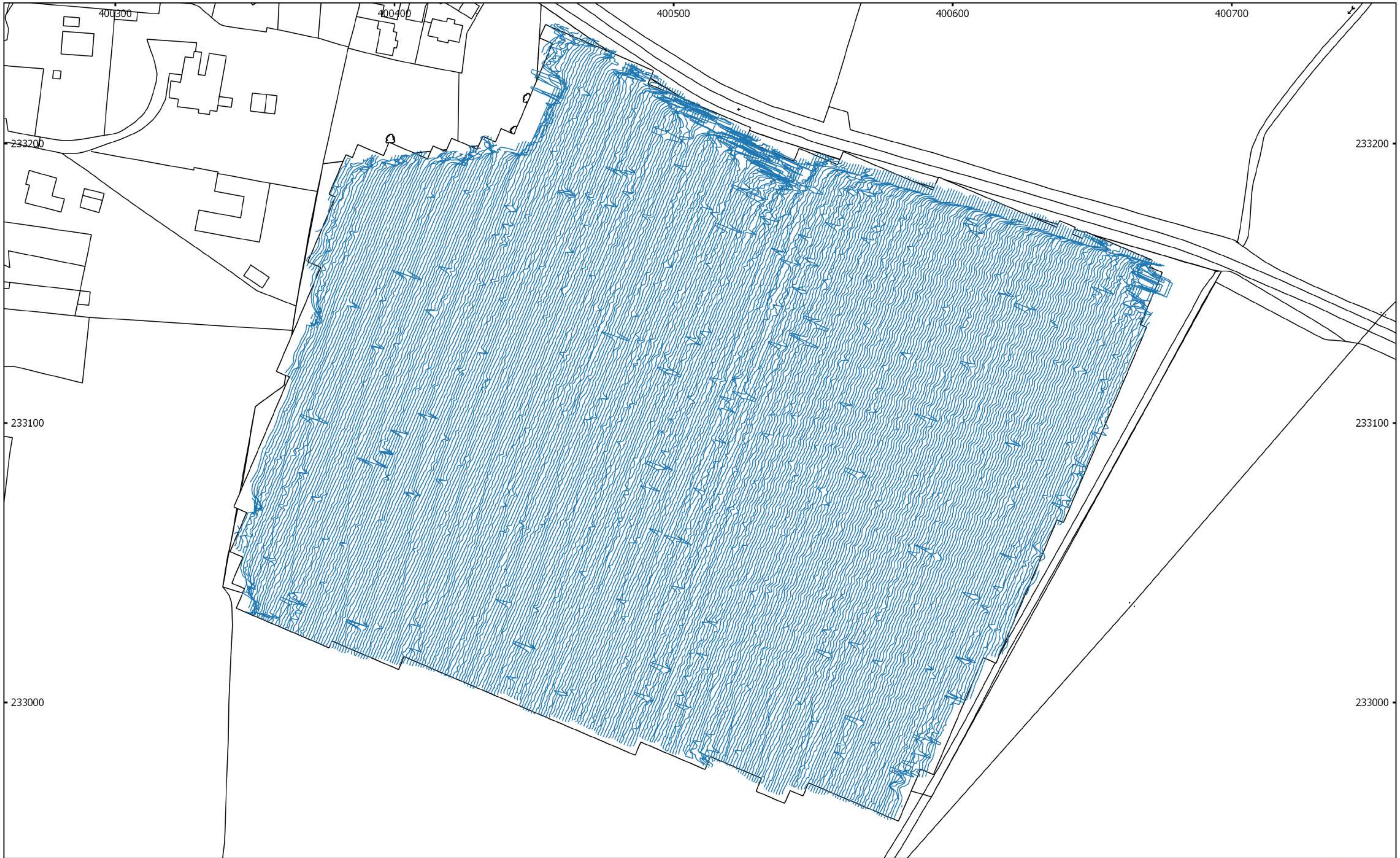
MSSP317 - Land at Dibden Lane, Alderton, Tewkesbury, Gloucestershire
Figure 7 - Magnetic Interpretation Over Historic Maps
1:2,500 @ A3

- Ridge and Furrow
- Ridge and Furrow Possible (Fragmentary)
- Agricultural
- Agricultural (Trend)
- Natural (Strong)
- Natural (Weak)
- Natural (Trend)
- Undetermined (Weak)
- Ferrous (Dipolar)

N

0 70 140 210 m

magnitude surveys



MSSP317 - Land at Dibden Lane, Alderton, Tewkesbury, Gloucestershire
Figure 8 - XY Trace Plot
25nT/cm at 1:1,250 @ A3

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MSSP317 - Land at Dibden Lane, Alderton, Tewkesbury, Gloucestershire
Figure 9 - Simplified Interpretation with Contours
1:1,250 @ A3

Contours
Ridge and Furrow
Ridge and Furrow Possible (Fragmentary)

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