Geophysical Survey Report

Land East of Thrapston,

Northamptonshire

For

Oxford Archaeology East

On Behalf Of

Equites Newlands (Thrapston East) Ltd

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Abstract

Magnitude Surveys was commissioned to assess the archaeological potential of a c. 70ha area of land east of Thrapston, Northamptonshire. A fluxgate gradiometer survey was successfully carried out across most of the survey area, though c. 10ha of land could not be surveyed due to adverse ground conditions. The survey identified a complex of anomalies suggesting the presence of archaeological features to the east of the survey area consisting of several enclosures connected by an intermediary ditch and anomalies consistent with settlement activity interspersed amongst it. A second focus of archaeological activity was identified to the west of this complex, with possible field systems and an enclosure in-between these foci. A possible medieval track or hollow-way feature was also identified, with historical extraction activity and ridge and furrow termini identified to the east and west of the feature respectively. Further evidence of ridge and furrow cultivation, former field boundaries, quarry infilling, and natural variations have also been identified. The height and density of mature wheat crop present within the survey area has created a dragging effect identifiable throughout the data as minor artefacts, however has not prevented confident interpretation of anomalies. Modern disturbance result from the infilling of a former quarry to the west and southeast of the survey area, as well as fencing at the edges of the survey area.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by Oxford Archaeology East, on behalf of Equites Newlands (Thrapston East) Ltd to undertake a geophysical survey over a c. 69.66ha area of agricultural land east of Thrapston, Northamptonshire (TL 0172 7821).

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 (Rigby, 2021).

1.5. The survey commenced on 15/06/2021 and took two weeks 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 is 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 Kayt Armstrong has a PhD in archaeological geophysics from Bournemouth University, is a Member of CIfA, the Editor of ISAP News, and is the UK Management Committee representative for the COST Action SAGA; Dr Paul Johnson has a PhD in archaeology from the University of Southampton, is a Fellow of the Society of Antiquaries of London, has been a member of the ISAP Management Committee since 2015, and is currently the nominated representative for the EAA Archaeological Prospection Community to the board 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. 1.5km east of Thrapston, Northamptonshire (Figure 1). Gradiometer survey was undertaken across five fields under arable cultivation, and one of undifferentiated grassland. The survey area was bound by further farmland to the north and east, by the A14 to the south, and by Thrapston Business Park to the west. (Figure 2). An area of c. 10.2ha could not be surveyed due to dense overgrown vegetation, which coincides with an area of a former quarry, the earthworks of which are identifiable in LiDAR data (Figure 5). For this reason, a sampling approach was undertaken within this area of the site.

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	The area consisted of an arable field, with tall wheat crop and sloped gently down from the west to east.	The survey area was surrounded by hedgerow and trees, with buildings and a track along the southern and south-eastern boundaries. A line of overhead cables (and associated poles) ran adjacent to the southern boundary in an east to west orientation.
2	The area consisted of overgrown grassland sloping down towards the northeast.	The survey area was surrounded by hedgerow and trees, with buildings located halfway along the western boundary and wooden canes and saplings in the south-eastern corner. Large areas of the field were unable to be surveyed due to tall and dense overgrown vegetation.
3	The area consisted of a flat arable field, with tall wheat crop.	The survey area was bordered by a farm track to the east and west and hedgerow and trees to the south. The field continued to the north.
4	The area consisted of an arable field, with tall wheat crop and sloped down gently from east to west.	The survey area was bordered by a ditch to the north, by trees and hedgerow to the east, south and west and a farm track along the southern and south-eastern boundaries.
5	The area consisted of an arable field, with tall wheat crop and sloped down from north to south.	The survey area was bordered by trees to the east and south, a farm track along the southern boundary and a road to the west. The field continued to the north.
6	The area consisted of a flat arable field, with tall wheat crop.	The survey area was bordered to the north and south by hedgerow, by a beck to the east and a farm track to the west. A line of overhead cables (and associated poles) ran adjacent to the southern boundary in an east to west orientation.

4.3. The underlying geology consists of (from east to west) limestone of the Blisworth Limestone Formation, mudstone of the Blisworth Clay Formation, limestone of the Cornbrash Formation, mudstone of the Kellaways Clay Member, interbedded sandstone and siltstone of the Kellaways Sand Member and mudstone of the Oxford Clay Formation. The superficial geology consists of

Diamicton of the Oadby Member along the western boundary of the site, and a band of Mid Pleistocene sands and gravel in the centre-western portion of the survey area.

4.4. The soils consist of lime-rich loamy and clayey soils with impeded drainage and freely draining lime-rich loamy soils (Soilscapes, 2021).

5. Archaeological Background

5.1. The following is a summary of a desk based assessment produced and provided by the client (Blackbourn, 2021).

5.2. A previous geophysical survey and archaeological investigations have found evidence of archaeological activity within the survey area. Fieldwalking in the north of Area 1 uncovered a possible prehistoric flint. Cropmarks of a possible enclosure, gully and Bronze Age barrow appear on aerial photographs that overlaps the northwest corner of Area 5 extending northwest as well as cropmarks of a possible prehistoric settlement within Area 3, comprising of four enclosures, two parallel ditches, field system, ring ditches and hut sites. Within Area 2 cropmarks of undated quarrying pits as well as possible medieval/post medieval buildings have been identified. A previous geophysical survey of the majority of site in 2001 identified a potential Iron Age or Romano-British settlement with trial trenching immediately northwest of Area 3 recording evidence of Iron Age activity.

5.3. Evidence of prehistoric activity has been identified in the surrounding areas. Approximately 315m to the north of the survey area, cropmarks of a possible prehistoric pit alignment or ditch were identified, along with further cropmarks of a possible prehistoric ringwork and settlement site c. 900m southwest of Area 2. These were excavated to reveal these features were a Late Bronze Age/Early Iron Age settlement, enclosed by the ringwork along with a later group of Late Iron Age pits and postholes. Cropmarks of a possible Iron Age settlement identified c. 600m to the southwest of site were excavated revealing Iron Age ditches, postholes, a limestone surface and a pit containing Iron Age pottery along with worked flint surface finds.

5.4. Roman activity includes a Roman road running on a northwest to southeast alignment, c. 520m north of the survey area. Earthworks possibly relating to Gartree Road are referred to as 'gravel walk' and were identified c. 800m to the north of site. Cropmarks of a Romano-British settlement have been identified c. 900m west of the site, centred on a small area of limestone possibly representing the site of a building. Evaluation trenching of this uncovered a possible Romano-British roundhouse and pit.

5.5. Ridge and furrow earthworks have been recorded c. 780m to the northeast of survey area. A windmill, thought to be of medieval origin has been recorded c. 125m southwest of the survey area, with a second possible site of a windmill located c. 450m west. Cropmarks of possible medieval enclosures have been identified c. 850m south of the survey area.

5.6. Evidence of modern activity has been recorded in the form of Elm Tree Lodge and a possible 19th-century garden, identified immediately west of the survey area. Located south of the survey area and the A14, Thrapston Army Camp was built during WWII. Evidence for modern quarrying activity (NHER 1842/0/15) is located c. 950m west of the survey area.

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 upper and 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 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 (Figures 12, 16, 20, 24 & 28). 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 (2021) 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 (Figures 4 and 7) and LiDAR (Figures 5 and 8).

7.2.2. The fluxgate gradiometer survey has responded well to the environment of the survey area. Anomalies associable with archaeological and agricultural activity, quarry infilling and natural processes have been identified. Low-amplitude, but high-frequency, noise produced by a dragging effect through the mature wheat crop is identifiable throughout the gradient and lower sensor total field data. Total field data from the upper sensor does not exhibit this high frequency noise to the same extent, as the sensor was typically positioned above the crop. For this reason, the magnetic data for both gradient (Figures 10, 14, 18, 22 and 26), and upper sensor Total Field are presented (Figures 9, 13, 17, 21 and 25). Though this noise complicated the identification of some weaker anomalies, it was still possible to identify several ephemeral anomalies from the data and a confident interpretation to be reached. Magnetic interference is otherwise identified with the infilling of quarries to the west and southeast of the survey area, and limited magnetic disturbances identified along the boundaries of survey areas (see Figures 3, 5, 6 and 8).

7.2.3. Probable archaeological activity was identified in the east of Area 3 with a complex consisting of at least three enclosures connected by ditches. Probable settlement activity associated with the complex is suggested by the strength of the anomalies, presence of multiple circular and oval anomalies, and concentration of discrete anomalies. Amongst the complex are anomalies possibly consistent with multiple dispersed deposits of possible archaeological and high temperature material. Anomalies in several locations overlap with each other suggesting multiple phases of activity. The complex corresponds to the outline of settlement remains highlighted by cropmarks and previous geophysical survey within and adjacent to the survey area, which have been dated to the Iron Age by trial trenching immediately northeast of Area 3, outside the survey area (see Section 5.2).

7.2.4. Surrounding the complex in Area 3 are several ephemeral and intermittent linear and curvilinear anomalies that may represent the presence of a field system around the complex. A weak sub-oval anomaly, which may be associated with the field system, appears to be another enclosure. Running across the settlement complex is a curving band of enhanced magnetic measurements which aligns with a bank identifiable in the LiDAR (Figures 5, 21-23). Towards the south, the band is flanked by two linear anomalies consistent with cut features such as ditches, suggesting the band and the bank may be anthropogenic in origin (Figure 5).

7.2.5. Further archaeological activity is recorded in Area 1, in three foci, which may be contemporaneous with those detected in Area 3 though it is not possible to be certain of this. Further probable archaeological anomalies are located within Area 1, including several enclosures and overlapping linear anomalies (Figures 17-19). Some of these anomalies appear to extend into the part of Area 2 where there is less disturbance from modern quarrying activity. Between the foci are several linear and curvilinear anomalies suggestive of possible field systems. Anomalies representing these field systems are predominantly weak, however, where stronger anomalies are present, they may highlight an difference in deposition processes.

7.2.6. Anomalies of archaeological origin in Area 1 are typically much less-clearly defined than those identified in Area 3. This would appear to be consistent with geological differences between the areas. In the south of Area 1, probable archaeology coincides with the glaciofluvial superficial deposits, which may contribute towards irregular edges to some anomalies.

7.2.7. Located in the northwest of Area 5, a weak linear anomaly consistent with a cut feature such as a ditch and a discrete anomaly associable with a pit have been detected. These anomalies align with cropmarks of a possible round barrow and enclosure that are recorded overlapping the northwestern corner of Area 5 (see Section 5.2; Figures 9-11).

7.2.8. Running between Areas 1 and 3 is a band of enhanced magnetic measurements, which runs north along a shallow valley, at the bottom of which is the boundary between these areas, bifurcating to continue along the southern edge of Area 4 and following the boundary between Area 1 and Area 5 (Figure 5). While this feature corresponds with the natural topography, it seems likely that the underlying depression (probably related to the natural drainage catchment pattern) has been reused, perhaps as part of the medieval landscape. The anomaly itself appears more well-defined than those solely relating to glaciofluvial deposits in Area 1 (Figures 17-19), while several oval inlets along its western edge are consistent with possible small-scale quarrying activity or clay extraction. These small possible extraction pits manifest in a distinctly different manner to the modern quarry infill in Areas 2 and 6. On its eastern side, the band is defined by curvilinear anomalies which appear to act as a terminus for ridge and furrow cultivation. Indeed, the band may reflect the line of a routeway, running along the field edges towards the farm present in modern and historical maps.

7.2.9. Other historical agricultural activity is identifiable with curving anomalies consistent with ridge and furrow cultivation identifiable in all areas except Areas 2 and 6. Several

anomalies also align with field boundaries identifiable on historical OS maps in Areas 1 and 5. Running along a furrow in Area 5, a linear anomaly is consistent with a possible drainage feature using a ceramic pipe.

7.2.10. Natural variations across the survey area include broad curvilinear anomalies following glaciofluvial sand and gravel deposits in Areas 1 and 5 (see Section 4.4, Figures 17-19). Bands and patches of weak diffuse anomalies are identifiable in Areas 1, 5 and 4 appear to reflect variations within the limestone geology (See Section 4.2; Figures 3, 4, 6 and 7).

7.2.11. As mentioned above, data across the majority of Area 2, all of Area 6 and the eastern edge of Area 1 is consistent with debris infilling. In Area 2 this is consistent with an area of disturbed ground recorded on LiDAR; however, in the geophysical data the debris continues east into Area 1 (Figures 5 and 6). A comparatively quiet area in the northeast corner of Area 2 corresponds with relatively undisturbed ground in the LiDAR data, however it still possibly contains linear anomalies that extend from archaeological activity in Area 1 and several strong dipolar anomalies. In the north of Area 1 several anomalies also coincide with earthworks and depressions in the LiDAR that appear to be associated with the quarry (Figure 5). In Area 6 and the east of Area 1 similar area of debris coincide with earthworks for a quarry on historical OS maps (Figure 7).

7.2.12. Several weak linear anomalies and smalls discrete anomalies have been identified across the survey area, which are typically too isolated to classify more confidently than as undetermined (Figures 3 and 5). A few small discrete dipolar anomalies, suggestive of high temperature effected materials are distributed across the survey area, though these anomalies are too isolated to designate a more specific interpretation and are likely to be modern in origin. (Figures 3, 5, 6 and 8).

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. **Archaeology Probable** – Along the eastern boundary of Area 3, a complex consisting of three or four enclosures connected by a linear anomaly consistent with a cut feature, such as a ditch, have been recorded (Figures 21-23). They correspond to cropmarks and anomalies recorded in a previous geophysical survey within the survey area that were later dated to the Iron Age after trial trenching immediately outside the survey area to the northeast (see Section 5.2). A strong L-shaped anomaly [**3a**], encloses sub-circular and sub-oval anomalies to the west and south. The concentration, strength and morphology of these anomalies are consistent with settlement activity, that appears to extend northwards and eastwards beyond the bounds of Area 3.

7.3.2.2. **Archaeology Probable** – Located to the south of [**3a**] are two conjoining enclosures [**3b**] (Figures 21-23). The eastern enclosure has a rectangular sub-enclosure in its north-western corner, while a sub-circular annular anomaly with a diameter of c.15m forms part of the western edge of the western enclosure. These enclosures are connected to [**3a**] by a strong linear anomaly consistent with a cut feature [**3c]** suggesting a relationship between them. Interspersed amongst the two enclosures are several curvilinear anomalies and discrete anomalies consistent with cut features such as pits. Also, amongst the complex of [**3a**], [**3b]** and [**3c**] are areas of enhanced magnetic signal visible in the gradient and total field dataset, which may relate to the presence of archaeological deposits within the complex.

7.3.2.3. **Archaeology Possible** – Several ephemeral and intermittent linear and curvilinear anomalies are located just to west of the settlement complex in Area 3 (Figures 21-23). These anomalies are indicative of cut features such as ditches, and may reflect a field system around the complex. A weak sub-oval anomaly has been recorded, which may represent another enclosure [**3d**]. In the southwest corner of [**3d**] is a small area of enhanced magnetic signal, which may relate to the presence of archaeological deposits similar to those detected in [**3b**].

7.3.2.4. **Archaeology Possible** – A slightly curving band of enhanced magnetic measurements runs approximately south to north across the settlement complex of Area 3 [**3e**] (Figures 21-23). Towards its southern end it is flanked by two linear anomalies consistent with cut features such as ditches. The band appears to align with a raised feature identifiable in the LiDAR data (Figure 5). The exact

relationship between the band and the settlement complex is uncertain, however, it and the LiDAR feature appear to reflect a bank that has possibly been enhanced by anthropogenic activity.

7.3.2.5. **Archaeology Probable** – Across Area 1 there are three foci of archaeological activity with anomalies that are typically more diffuse than those in Area 3 (Figures 3-8). The first focus towards the east of the survey area consists of a strong L-shaped anomaly consistent with a cut feature such as ditch, that appears to possibly enclose internal discrete anomalies and smaller curving anomalies similar to those in Area 3 [**1a**] (Figures 21-23). The second, to the west of Area 1, constitutes linear anomalies of weak and strong magnetic signal running perpendicular to each other to create an orthogonal pattern, possibly reflecting a further enclosure system and field system [**1b**] (Figures 17-20). Some of the anomalies of [**1b**] follow the direction of glaciofluvial deposits in the vicinity, which possibly contributes towards the irregular shape of some of the anomalies. While weak linear anomalies appear to continue west into Area 2 not disturbed by modern extraction activity (Figure 19). The third, towards the centre and south of Area 1 consist of two possible conjoining enclosures [**1c**], with a further enclosure, to the south, connected via linear anomalies on a similar orientation (Figures 17-20). Circular and discrete anomalies are located within and around these possible enclosures as well as an area of enhanced magnetic signal possibly relating to lenses of archaeological deposits.

7.3.2.6. **Archaeology Possible** – Surrounding the foci of Area 1 are several predominantly weak linear and curvilinear anomalies consistent with cut features such as ditches [**1d**] (Figures 19, 23 and 27). These anomalies often align with segments of the three foci, suggesting they form part of a possible field system associated with the foci of archaeological activity. In some locations the anomalies have a stronger magnetic signal, possibly highlighting different deposition processes.

7.3.2.7. **Archaeology Possible**– Located towards the northwest corner of Area 5 is a weak linear anomaly [**5a**] aligned southwest to northeast and a weak discrete anomaly (Figures 9-11). The anomalies appear consistent with cut features such as a ditch and pit respectively. Possible prehistoric activity including a round barrow and enclosure were previously noted to overlap the northwest corner of Area 5 (see Section 5.2).

7.3.2.8. **Agricultural (Strong, Weak & Spread)** – Following the field boundary between Areas 1 and 3 is a band of magnetic enhancement (Figures 21-23). The band follows the natural topography of the valley between these areas northwards and splits along the southern field boundaries of Area 5 and Area 4 (Figures 5 & 13-15). The topographic features are probably related to the natural drainage catchment of the survey area. However, the magnetic signal of the band, and associated anomalies arguably reflect anthropogenic reuse of the feature, perhaps in the medieval landscape. The band is clearly defined with edges that are not comparable with most anomalies of natural origins such as those associated with glaciofluvial deposits in Area 1 (Figures 18 and 19). Along its

western edge in Area 1 are three oval inlets suggestive of extraction features such as clay pits. These are in contrast to the strong anomalies for modern quarrying in Areas 2 and 6 supporting the notion that they reflect an earlier form of small scale localised extraction. The eastern edge of this feature is defined by two curvilinear anomalies which also appear to be a terminus for the ridge and furrow in Area 3, to the east. The band may reflect the line of a routeway or hollow-way, running along the field edges towards or from the farm on modern and historical maps of the survey area.

7.3.2.9. **Ridge and Furrow** – Anomalies consistent with ridge and furrow cultivation have been identified, within all survey areas except for Areas 2 and 6 (Figures 3, 4, 6 and 7). These anomalies typically consist of striations of linear positive magnetic anomalies for the furrows, with a negative anomaly in-between for the cultivation ridges. In Area 3 the ridge and furrow cultivation appears to terminate with eastern edge of the possible routeway and curves over the bank associated with [**3e**] (Figures 21-23).

7.3.2.10. **Agricultural (Weak)** – Several weak linear anomalies interpreted in Areas 1 and 5 align with former field boundaries identified on historical OS maps (Figures 4 and 7).

7.3.2.11. **Drainage Feature** – Running northwest to southeast across Area 5 is a linear anomaly with magnetic dipoles along its length, consistent with the presence of a ceramic drain (Figures 9 and 11). The anomaly aligns with ridge and furrow in the area suggesting that the drain is lain along one of the furrows of the system.

7.3.2.12. **Undetermined –** Discrete dipolar anomalies in Areas 1 and 5 do not have the sharp contrast in the XY traces of ferrous objects (Figures 9, 11, 21 and 23). This suggests the anomalies may result from small areas of high temperature material likely of modern origin.

7.3.2.13. **Industrial/Modern –** Across Areas 6, 2 and extending into 1, large areas of strong magnetic anomalies relating to disturbance associated with the infilling of extraction activity have been recorded (Figures 11, 19 and 27). These areas coincide with extraction activity identified on LiDAR (Figures 5 and 8) and on historical mapping (Figure 7).

8. Conclusions

8.1. Fluxgate gradiometer has been successfully undertaken over of most of the survey area, however, c. 10ha could not be surveyed due to adverse ground conditions. The survey has responded well to the environment of the area surveyed. Anomalies associated with archaeological, agricultural, quarrying and natural activity have been identified. Interference associated with mature wheat crop was identified throughout most of the survey data, though ephemeral anomalies were still identified against this background. Other strong magnetic disturbance is associable with the infilling of the quarries to the east and west of the survey area.

8.2. Towards the east of the survey area, a probable Iron Age settlement complex consisting of at least three enclosures connected by a ditch, surrounded by a possible field system and further enclosure have been recorded. A possible anthropogenic bank, whose direct relationship to complex is unknown, crosses the complex north to south. To the southwest of the complex, several foci of enclosures and field systems have been detected, which may be contemporaneous with the larger complex to the east of the site. In between the three foci of activity, ephemeral anomalies suggest the presence of possible field systems.

8.3. A possible trackway or hollow-way following a natural depression along field edges, runs northwards from the farm near the centre of the survey area. This possible routeway or hollow-way is potentially a feature of the medieval landscape, flanked by the terminus of ridge and furrow to the east and possible extraction/clay pits to the west. Anomalies consistent with ridge and furrow have been identified throughout all survey area except for areas affected by the quarry infilling. Other anomalies of agricultural origins relate to former field boundaries and drainage feature with a ceramic drain.

8.4. Natural variations identified across the survey area include glaciofluvial sands and gravels across the west of the survey area and variations in the limestone geology.

8.5. Linear, curvilinear and discrete anomalies interpreted as being of undetermined origins have also been identified. Discrete anomalies characteristic of material subjected to high temperatures were identified in several locations and while likely to be modern in origin, an archaeological provenance cannot be ruled out.

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	MSTL977
Project Name	Land East of Thrapston, Northamptonshire
Client	Oxford Archaeology East
Grid Reference	TL 0172978213
Survey Techniques	Magnetometry
Survey Size (ha)	69.66ha (Magnetometry)
Survey Dates	2021-06-16 to 2021-06-25
Project Lead	William Rigby BA MA PCIfA
Project Officer	William Rigby BA MA PCIfA
HER Event No	ENN110302
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 Lead to Review	RL & SP	WR	06 July 2021
0.2	Draft for Director Approval	SP	PJ	08 July 2021
1.0	Issued as Final	WR	WR	13 July 2021

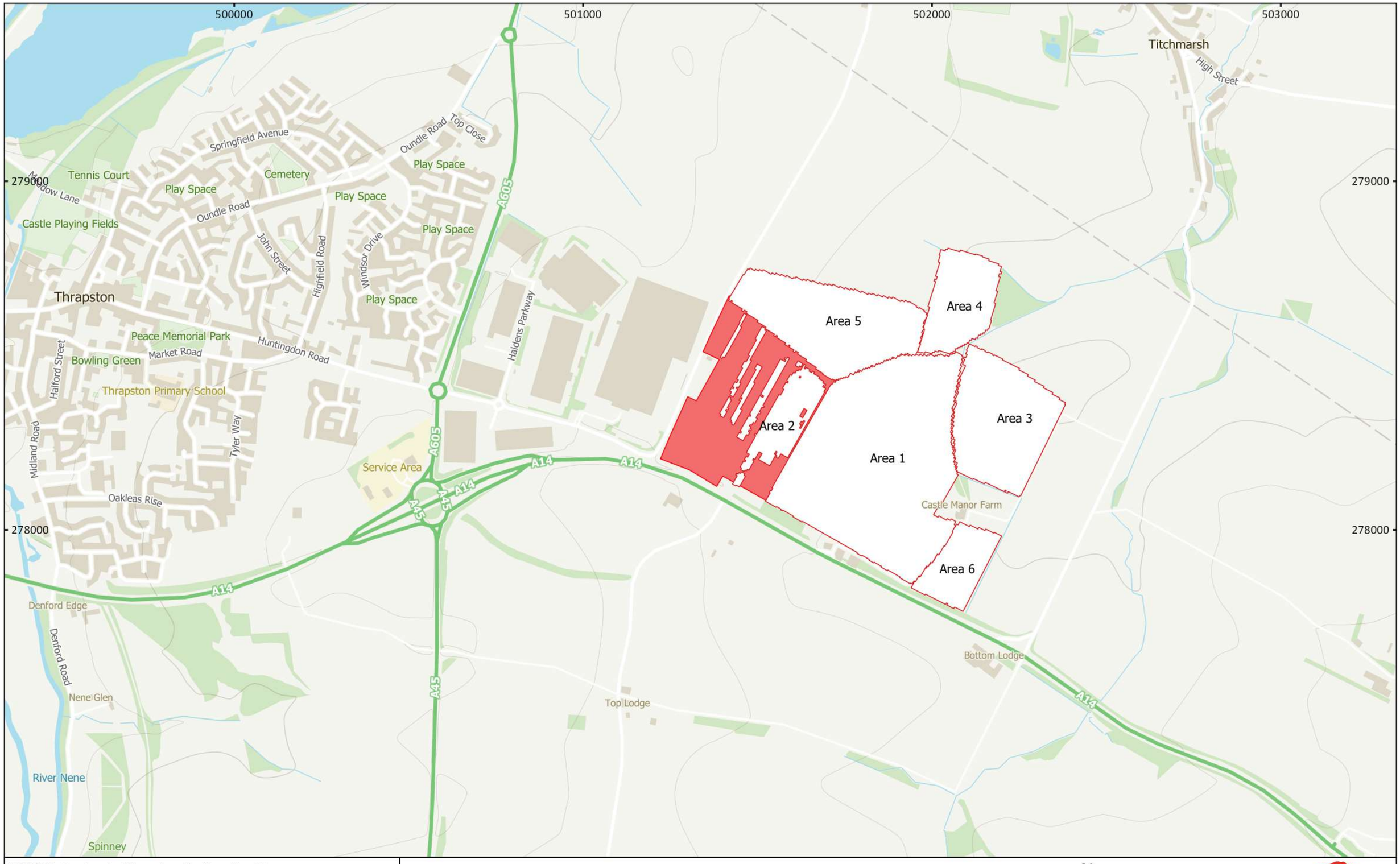
MSTL977 - Land east of Thrapston, Northamptonshire
Figure 1 - Site Location
1:25,000 @ A4

Site Boundary

N

0 0.5 1 km

magnitude surveys



MSTL977 - Land east of Thrapston, Northamptonshire
Figure 2 - Location of Survey Area
1:10,000 @ A3

Survey Extent
Unsurveyable Areas

N

0 250 500 750 m

magnitude surveys

501600

502000

502400

278800

278800

Area 4

Area 5

Area 3

Area 2

278400

278400

Area 1

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 3 - Magnetic Total Field (Lower Sensor) Overview (North)
1:3,000 @ A3

48,998 nT 49,003

A14

A14

N

0 50 100 150 m

magnitude surveys

501600
502000
502400
278800
278400
Area 1
Area 2
Area 3
Area 4
Area 5
MSTL977 - Land east of Thrapston, Northamptonshire
Figure 4 - Magnetic Interpretation Over Historical Maps and Satellite Imagery Overview (North)
1:3,000 @ A3

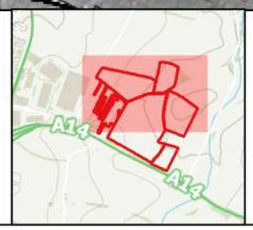
Contains historical maps: Ordnance Survey, 6" 2nd edition c. 1882-1913.

Archaeology Probable (Strong)
Archaeology Probable (Weak)
Archaeology Probable (Zone)
Archaeology Possible (Strong)
Archaeology Possible (Weak)
Archaeology Possible (Spread)
Agricultural (Strong)
Agricultural (Weak)
Agricultural (Spread)
Industrial/Modern
Industrial/Modern (Spread)
Natural (Strong)
Natural (Weak)
Natural (Zone)
Undetermined (Strong)
Undetermined (Weak)
Magnetic Disturbance
Ferrous/Debris (Spread)
Ridge and Furrow (Trend)
Agricultural (Trend)
Drainage Feature
Service
A14
A14
N
0
50
100
150 m
magnitude surveys

501600
502000
502400
278800
278400
Area 1
Area 2
Area 3
Area 4
Area 5

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 5 - Magnetic Interpretation Over LiDAR (Composite 1m DTM) Overview (North)
1:3,000 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Probable (Zone)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Archaeology Possible (Spread)
- Agricultural (Strong)
- Agricultural (Weak)
- Agricultural (Spread)
- Industrial/Modern
- Industrial/Modern (Spread)
- Natural (Strong)
- Natural (Weak)
- Natural (Zone)
- Undetermined (Strong)
- Undetermined (Weak)
- Magnetic Disturbance
- Ferrous/Debris (Spread)
- Ridge and Furrow (Trend)
- Agricultural (Trend)
- Drainage Feature
- Service



N
0 50 100 150 m
magnitude surveys

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 6 - Magnetic Total Field (Lower Sensor) Overview (South)
1:3,000 @ A3

48,998 nT 49,003

N

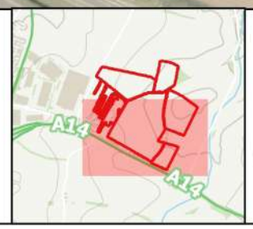
0 50 100 150 m

magnitude surveys

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 7 - Magnetic Interpretation Over Historical Maps and Satellite Imagery Overview (South)
1:3,000 @ A3

Contains historical maps: Ordnance Survey, 6" 2nd edition c. 1882-1913.

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Probable (Zone)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Archaeology Possible (Spread)
- Agricultural (Strong)
- Agricultural (Weak)
- Agricultural (Spread)
- Industrial/Modern
- Industrial/Modern (Spread)
- Natural (Strong)
- Natural (Weak)
- Natural (Zone)
- Undetermined (Strong)
- Magnetic Disturbance
- Ferrous/Debris (Spread)
- Ridge and Furrow (Trend)
- Agricultural (Trend)
- Service



N

0 50 100 150 m

magnitude surveys

501600
502000
502400
278400
278000
Area 1
Area 1
Area 3
Area 6
A14
A14

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 8 - Magnetic Interpretation Over LiDAR (Composite 1m DTM) Overview (South)
1:3,000 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Probable (Zone)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Archaeology Possible (Spread)
- Agricultural (Strong)
- Agricultural (Weak)
- Agricultural (Spread)
- Industrial/Modern
- Industrial/Modern (Spread)
- Natural (Strong)
- Natural (Weak)
- Natural (Zone)
- Undetermined (Strong)
- Magnetic Disturbance
- Ferrous/Debris (Spread)
- Ridge and Furrow (Trend)
- Agricultural (Trend)
- Service

N
0 50 100 150 m
magnitude surveys

501400
501600
501800
278700
278600
278500
278400
Area 5
Area 2

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 9 - Magnetic Gradient (Northwest)
1:1,500 @ A3

-1 nT 2

A14
A14

N

0 25 50 75 m

magnitude surveys

501400
501600
501800
278700
278600
278500
278400
Area 5
Area 2

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 10 - Magnetic Total Field (Upper Sensor)(Northwest)
1:1,500 @ A3

48,998 nT 49,003

N

0 25 50 75 m

magnitude surveys

501400
501600
501800
278700
278600
278500
278400
Area 5
5a
Area 2

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 11 - Magnetic Interpretation (Northwest)
1:1,500 @ A3

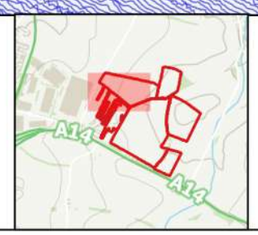
Archaeology Probable (Weak)
Archaeology Possible (Weak)
Agricultural (Strong)
Agricultural (Spread)
Industrial/Modern
Industrial/Modern (Spread)
Natural (Strong)
Natural (Weak)
Natural (Zone)
Undetermined (Strong)
Magnetic Disturbance
Ferrous/Debris (Spread)
Ridge and Furrow (Trend)
Drainage Feature
Ferrous (Spike)

A14
A14

N
0
25
50
75 m
magnitude surveys

501400
501600
501800
278700
278600
278500
278400
Area 5
Area 2

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 12 - XY Trace Plot (Northwest)
30nT/cm at 1:1,500 @ A3



N
0
25
50
75 m
magnitude surveys

502000
502200
502400
278800
278700
278600
278500
Area 5
Area 4
-1 nT 2
0 25 50 75 m
N
magnitude surveys
A14
A14
MSTL977 - Land east of Thrapston, Northamptonshire
Figure 13 - Magnetic Gradient (Northeast)
1:1,500 @ A3

502000
502200
502400
278800
278700
278600
278500
Area 5
Area 4
MSTL977 - Land east of Thrapston, Northamptonshire
Figure 14 - Magnetic Total Field (Upper Sensor)(Northeast)
1:1,500 @ A3

48,998 nT 49,003
A14
A14
N
0 25 50 75 m
magnitude surveys

502000
502200
502400
278800
278700
278600
278500
Area 5
Area 4

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 15 - Magnetic Interpretation (Northeast)
1:1,500 @ A3

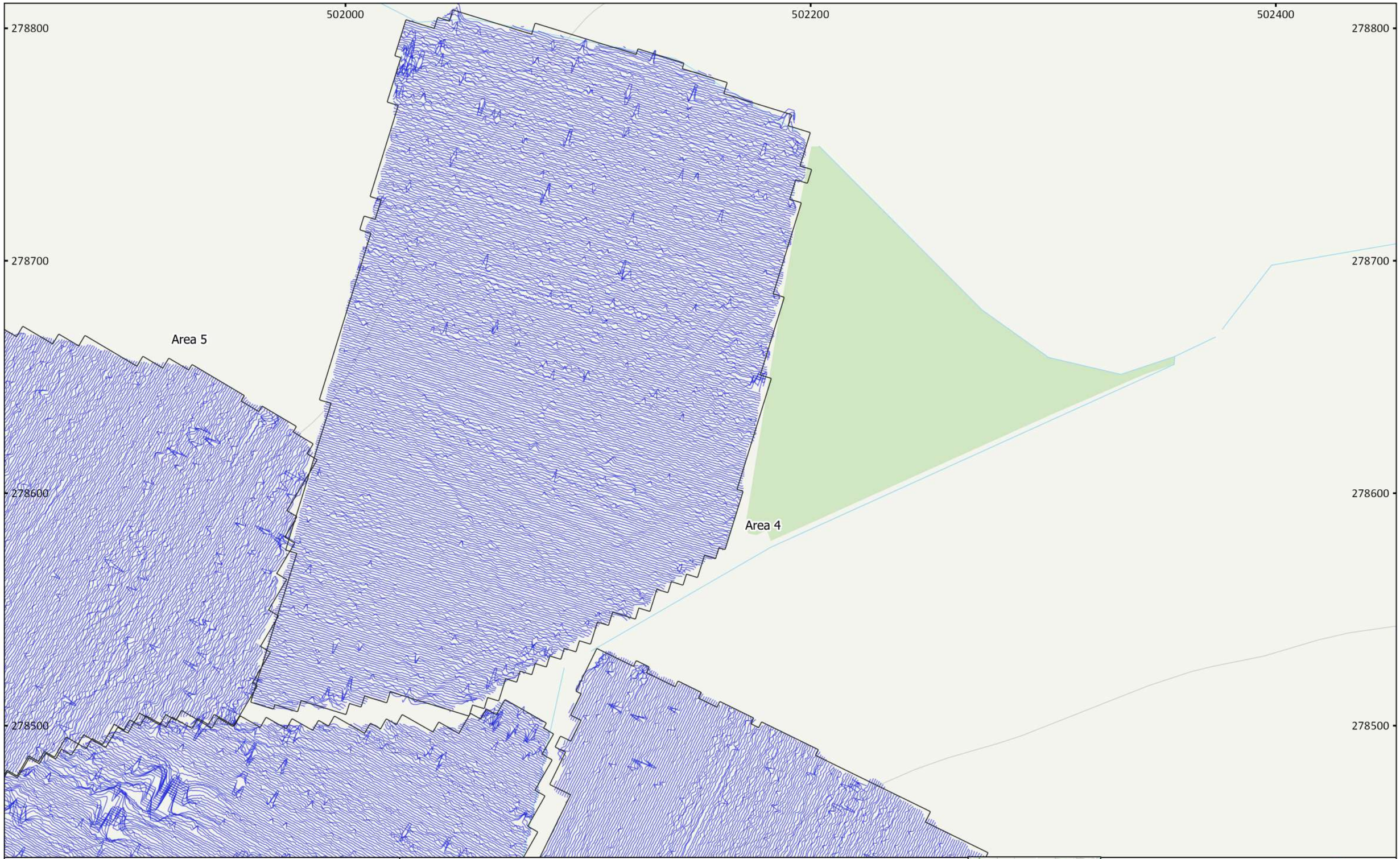
Agricultural (Strong)
Agricultural (Weak)
Agricultural (Spread)
Industrial/Modern
Natural (Zone)
Undetermined (Strong)
Magnetic Disturbance
Ferrous/Debris (Spread)
Undetermined (Weak)
Ridge and Furrow (Trend)
Ferrous (Spike)

A14
A14

N

0 25 50 75 m

magnitude surveys



MSTL977 - Land east of Thrapston, Northamptonshire
Figure 16 - XY Trace Plot (Northeast)
30nT/cm at 1:1,500 @ A3

magnitude surveys

501400
501600
501800
278300
278200
278100
Area 2
Area 1
A14

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 17 - Magnetic Gradient (West)
1:1,500 @ A3

-1 nT 2

N

0 25 50 75 m

magnitude surveys

501400

501800

278300

278300

278200

278200

Area 2

278100

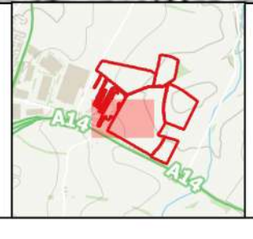
278100

A14

Area 1

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 18 - Magnetic Total Field (Upper Sensor)(West)
1:1,500 @ A3

48,998 nT 49,003



N

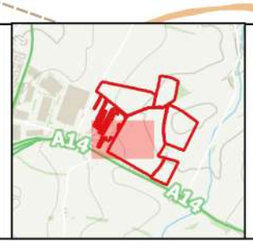
0 25 50 75 m

magnitude surveys

501400
501600
501800
278300
278200
278100
Area 2
Area 1
A14
1b
1d
1c

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 19 - Magnetic Interpretation (West)
1:1,500 @ A3

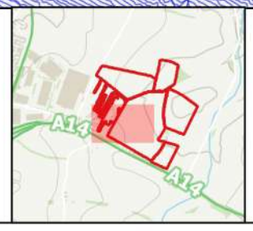
- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Probable (Zone)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Agricultural (Strong)
- Agricultural (Weak)
- Industrial/Modern
- Industrial/Modern (Spread)
- Natural (Weak)
- Natural (Zone)
- Undetermined (Strong)
- Magnetic Disturbance
- Ferrous/Debris (Spread)
- Ridge and Furrow (Trend)
- Service
- Ferrous (Spike)



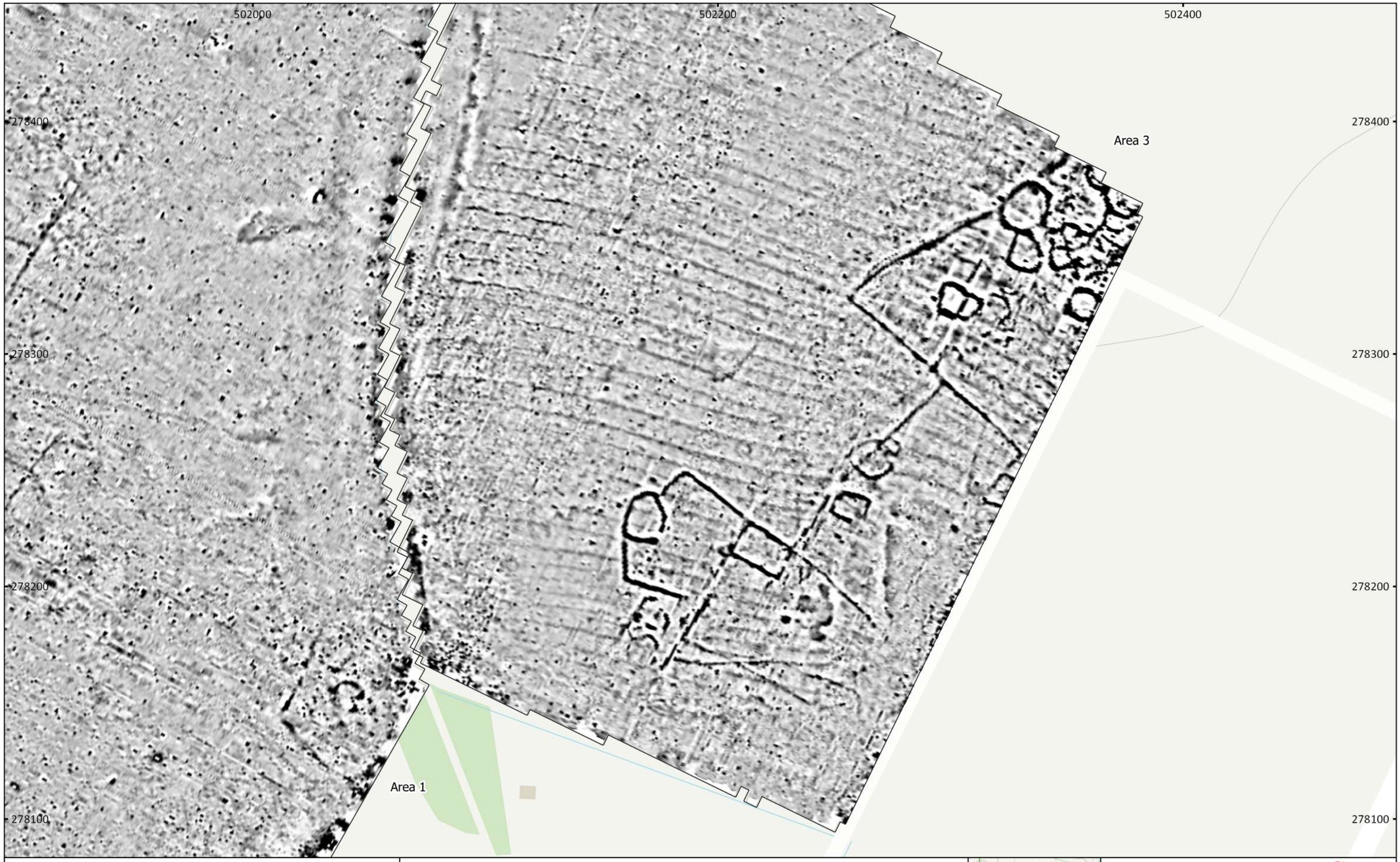
N
0 25 50 75 m
magnitude surveys

501400
501600
501800
278300
278200
278100
Area 2
Area 1
A14

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 20 - XY Trace Plot (West)
30nT/cm at 1:1,500 @ A3



N
0 25 50 75 m
magnitude surveys



MSTL977 - Land east of Thrapston, Northamptonshire
Figure 21 - Magnetic Gradient (East)
1:1,500 @ A3

-1 nT 2

N

0 25 50 75 m

magnitude surveys

502000
502200
502400
278400
278300
278200
278100
Area 3
Area 1

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 22 - Magnetic Total Field (Upper Sensor)(East)
1:1,500 @ A3

48,998 nT 49,003

A14 A14

N

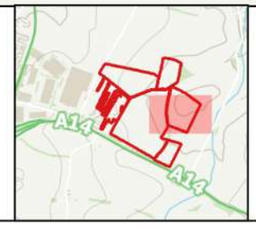
0 25 50 75 m

magnitude surveys

502000
502200
502400
278400
278300
278200
278100
Area 3
Area 1
1d
1a
3e
3d
3a
3c
3b
3e

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 23 - Magnetic Interpretation (East)
1:1,500 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Probable (Zone)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Archaeology Possible (Zone)
- Agricultural (Strong)
- Agricultural (Weak)
- Agricultural (Spread)
- Industrial/Modern
- Natural (Strong)
- Natural (Weak)
- Natural (Zone)
- Undetermined (Strong)
- Magnetic Disturbance
- Ferrous/Debris (Spread)
- Agricultural (Trend)
- Ridge and Furrow (Trend)
- Ferrous (Spike)



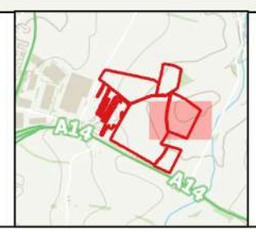
N

0 25 50 75 m

magnitude surveys

502000
502200
502400
278400
278300
278200
278100
Area 3
Area 1

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 24 - XY Trace Plot (East)
30nT/cm at 1:1,500 @ A3



N
0 25 50 75 m
magnitude surveys

501800
502000
502200
278000
277900
277800
Castle Manor Farm
Area 1
Area 6
A14
MSTL977 - Land east of Thrapston, Northamptonshire
Figure 25 - Magnetic Gradient (South)
1:1,500 @ A3

-1 nT 2
N
0 25 50 75 m
magnitude surveys

501800

502200

278000

278000

277900

277900

Area 1

A14

277800

Area 6

277800

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 26 - Magnetic Total Field (Upper Sensor)(South)
1:1,500 @ A3

48,998 nT 49,003

N

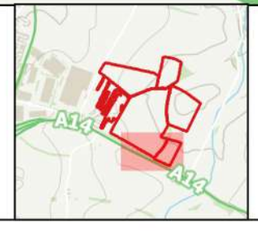
0 25 50 75 m

magnitude surveys

501800
502000
502200
278000
277900
277800
Castle Manor Farm
Area 1
Area 6
A14

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 27 - Magnetic Interpretation (South)
1:1,500 @ A3

- Archaeology Probable (Strong)
- Archaeology Probable (Weak)
- Archaeology Possible (Strong)
- Archaeology Possible (Weak)
- Agricultural (Strong)
- Agricultural (Weak)
- Industrial/Modern (Spread)
- Natural (Weak)
- Natural (Zone)
- Magnetic Disturbance
- Ferrous/Debris (Spread)
- Ridge and Furrow (Trend)
- Service
- Ferrous (Spike)



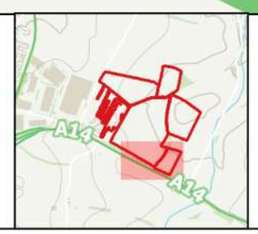
N

0 25 50 75 m

magnitude surveys

501800
502000
502200
Castle Manor Farm
278000
278000
277900
277900
Area 1
A14
277800
277800
Area 6

MSTL977 - Land east of Thrapston, Northamptonshire
Figure 28 - XY Trace Plot (South)
30nT/cm at 1:1,500 @ A3



N
0 25 50 75 m
magnitude surveys