Land west of Ratby (Burrough Field) Leicestershire

Archaeological geophysical survey

Project No. ARC/3643/1376

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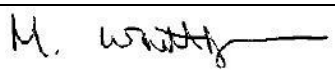
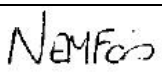
Signature		Signature	
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1. SUMMARY

Phase Site Investigations Ltd was commissioned to carry out a magnetic gradient survey at land to the west of Ratby (Burrough Field), Leicestershire. The aim of the survey was to help establish the presence / absence, extent, character, relationships and date (as far as circumstances and the inherent limitations of the technique permits) of archaeological features within the survey area.

The survey was undertaken using a Phase Site Investigations Ltd multi-sensor array cart system (MACS). The MACS comprised 4 Foerster 4.032 Ferex CON 650 gradiometers with a control unit and data logger. The MACS data was collected on profiles spaced 1 m apart with readings taken at between 0.1 and 0.15 m intervals.

The majority of the anomalies identified by this survey relate to modern material / objects, agricultural activity (including ridge and furrow) and possible natural variations. There are a number of anomalies of uncertain origin. Some of these could be related to anthropogenic features / activity. In the majority of cases these are probably associated with drainage features, agricultural or other modern activity or natural features / variations but as their exact cause cannot be determined with certainty an archaeological origin for some of the anomalies cannot be ruled out.

Some parts of the site have a very large number of isolated responses, which have contributed to a variable / 'disturbed' magnetic background. These are indicative of a spread of modern material. Some of the responses could be related to 'green waste', which is added to manure but which contains significant amounts of ferrous material, or they could be from a spread of rubble or other modern debris. There are several areas where very strong responses or magnetic disturbance from modern features / material dominate the surrounding data. It should be recognised that the strength of these responses from modern material / activity could mask anomalies from other sub-surface features in the area, should any such features be present.

2. INTRODUCTION

2.1 Overview

Phase Site Investigations Ltd was commissioned by Cotswold Archaeology to carry out an archaeological geophysical survey at land to the west of Ratby (Burrough Field), Leicestershire utilising magnetic gradiometers.

The aim of the survey was to help establish the presence / absence, extent, character, relationships and date (as far as circumstances and the inherent limitations of the technique permits) of archaeological features within the survey area.

The location of the site is shown in drawing ARC_3643_1376_01.

2.2 Site description

The site is situated at land to the west of Ratby, Leicestershire (approximate centre at NGR SK 507 060), approximately 8.3 km to the west of Leicester and covered an area of approximately 26.4 ha.

The site encompassed ten fields which were a mix of arable, pasture and a play field. The fields were divided by a mix of metal fences and hedges / dense vegetation. Burroughs Road ran through the survey. Spoil and manure heaps, an abandoned farm vehicle, play equipment, trees, a pond, waterlogged ground and construction activity were present in some of the survey areas. The majority of the site was undulating with a downwards slope to the west, south and east in the western part of the survey area.

The geology of the site consists of mudstones of the Edwalton Member and the Gunthorpe Member. There are no recorded superficial deposits over the majority of the site with Diamicton of the Thrussington Member recorded over Area 2 and parts of Areas 1, 3, 6 and 7. Sand and gravel River Terrace Deposits are recorded along the western boundary of Area 1 and over the majority of Area 10 (British Geological Survey, 2024).

2.3 Archaeological background

An archaeological / heritage desk-based assessment, or other archaeological background information, was not available at the time of writing this report.

Historic maps (maps.nls.uk, 2024) indicate that the site has been in use for agriculture since before 1885. Several field boundaries, footpaths and two ponds are shown on historic maps that are no longer visible on site.

A previous geophysical survey has been undertaken on fields to the north of the current site (Phase Site Investigations Ltd, 2023) and this concluded that,

'*The majority of the anomalies identified by this survey relate to modern material / objects, agricultural activity (including possible ridge and furrow) and possible natural variations. There are several trends of uncertain origin. Some of these could be related to anthropogenic features / activity but these do not form any obvious patterns or relationships that would indicate an archaeological origin. It is likely that the majority of them are associated with agricultural activity, drainage features or natural features / variations but their exact cause cannot be determined with certainty.*'

2.4 Scope of work

The survey area was specified by the client.

The presence of dense vegetation, field boundaries, spoil and manure heaps, play equipment, waterlogged ground and construction activity reduced the area that could be covered within the survey areas. In total an area of approximately 24.4 ha was covered by the magnetic survey.

No other problems were encountered during the survey which was carried out between 8 April and 12 April 2024.

3. SURVEY METHODOLOGY

3.1 Magnetic survey

The survey was undertaken using a Phase Site Investigations Ltd multi-sensor array cart system (MACS).

The MACS comprised 4 Foerster 4.032 Ferex CON 650 gradiometers with a control unit and data logger. The Foerster gradiometers do not require balancing as each sensor is automatically 'zeroed' using the control unit software.

The MACS utilises an RTK GNSS system which means that survey grids do not have to be established. Instead an area is surveyed over a series of continuous profiles and the position of each data point is recorded using an RTK GNSS system. The sensors have a separation of 1 m which means that data was collected on profiles spaced at 1 m apart. Readings were taken at between 0.1 m and 0.15 m intervals.

Data is collected on zig-zag profiles along the full length or width of a field, although fields can be sub-divided if they are particularly large. Marker canes are set-out along field boundaries at set intervals and these are used to align the profiles. The survey profiles are usually offset from field boundaries, buildings and other metallic features by several metres to reduce the detrimental effect that these surface magnetic features have on the data. The location of the MACS data is converted direct to Ordnance Survey co-ordinates using the UK OSTN15 projection. As the survey is referenced direct to Ordnance Survey National Grid co-ordinates temporary survey stations are not established.

3.2 Data processing and presentation

The MACS data was stored direct to a laptop using in-house software which automatically corrects for instrument drift and calculates a mean value for each profile. A positional value is assigned to each data point based on the sensor number and recorded GNSS co-ordinates. The data is gridded using in-house software and parameters are set based on the sensor spacing and mean values. No additional processing is required. The gridded data is then displayed in Surfer 9 (Golden Software) and image files of the data are created.

The data was exported as greyscale raster images (PNG files). Data for the entire site is presented at a scale of 1:4000 and plots for individual fields / areas (or parts of fields / areas) with accompanying interpretations are shown at a scale of 1:1500. All greyscale plots were clipped at -2 nT to 3 nT. Greyscale plots have been 'smoothed' using a visual interpolation but the data itself has not been interpolated.

The data has been displayed relative to a digital base plan provided by the client as drawing *'Ratby additional areas revised 2.dwg'*. The base plan was in the Ordnance Survey National Grid co-ordinate system and as the survey grids / data were referenced directly to National Grid co-ordinates the data could be simply superimposed onto the base plan in the correct position.

X-Y trace plots were examined for all of the data and overlain onto the greyscale plot to assist in the interpretation, primarily to help identify dipolar and bipolar responses that will probably be associated with surface / near-surface iron objects. However, X-Y trace plots have not been presented here as they do not show any additional anomalies that are not visible in the greyscale data. A digital drawing showing the X-Y trace plot overlain on the greyscale plot is provided in the digital archive.

All isolated responses have been assessed using a combination of greyscale and X-Y trace plots. There are a large number of small / relatively weak isolated dipolar and bipolar anomalies present in the data. There is no evidence to suggest that they are associated with archaeological features and so these have not been shown in the interpretation. Several larger / stronger isolated bipolar anomalies have been shown but these are also not thought to be archaeologically significant.

Anomalies associated with agricultural and / or drainage regimes are present in the data but each individual anomaly has not been shown on the interpretation. Instead the general orientation of the regime is indicated.

The data was examined over several different ranges during the interpretation to ensure that the maximum information possible was obtained from the data.

The anomalies have been categorised based on the type of response that they exhibit and an interpretation as to the cause(s) or possible cause(s) of each anomaly type is also provided.

A general discussion of the anomalies is provided for the entire site and then the results are discussed on an area by area basis. A discussion of the general categories of anomaly which have been identified by the survey is provided in Appendix 1.5.

The geophysical interpretation drawing must be used in conjunction with the relevant results section and appendices of this report.

4. RESULTS

4.1 General

The data quality across the majority of the survey area is very good allowing the data to be viewed at a narrow range of readings to better identify weak anomalies. There are several areas that have a more disturbed magnetic background but this is due to the presence of magnetic material in the topsoil or sub-surface, rather than low data quality.

Some parts of the site have a very large number of isolated responses, which have contributed to a variable / 'disturbed' magnetic background. These are indicative of a spread of modern material. Some of the responses could be related to 'green waste', which is added to manure but which contains significant amounts of ferrous material, or they could be from a spread of rubble or other modern debris. In some parts of the site the number of isolated responses / extent of the magnetic disturbance means that it is not possible to differentiate between the responses associated with modern material or any isolated responses that could have potential to be related to archaeological features / activity. Only selected larger / stronger responses have been shown in these areas.

Historic maps indicate the presence of former field boundaries within the survey area but not all of these have been identified by the survey. When former boundaries are not detected by a magnetic survey it can suggest that the soils have a low magnetic susceptibility. This can in turn indicate that other infilled features (such as infilled ditches) may also not be identified. However, it is also possible that former boundaries have not been identified because they were relatively ephemeral features and they do not have significant sub-surface remains.

There are several strong linear responses that are artificial data products. These are related to a sensor movement or jolt caused by rough ground. These responses are not related to a sub-surface feature and their presence has not affected the reliability of the survey or interpretation.

4.2 Area 1

Basic topography: Undulating ground with general downwards slopes from the north-west and north-east.

Field / area description: Arable with immature crop. The majority of the area was relatively firm underfoot. The field was bounded by hedges and metal fencing. A shallow 'stream' / running water crossed the site running north to south through the centre of the area. There was construction activity in the north of the site and several traffic cones, some of which were situated over manhole covers were present in the field.

Interpretation drawing(s): ARC_3643_1376_04.

Summary of anomalies: Numerous isolated dipolar and small bipolar responses, that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown

to highlight areas where there may be significant relatively modern material / objects.

Areas of magnetic disturbance associated with relatively modern features / material.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

Relatively weak positive linear responses are present associated with modern ploughing regime(s).

A series of relatively weak positive linear responses could be related to the remnants of ridge and furrow but they could also be associated with a drainage regime.

A weak, diffuse, linear / curvi-linear trend broadly corresponds with the position of a former field boundary and is probably related to this feature.

Trends of uncertain origin.

Numerous isolated positive responses. There are a large number of these responses and they are all probably related to a spread of modern material. Only selected large / strong responses have been shown on the interpretation.

Further discussion / additional information:

An elongated area of magnetic disturbance (**Anomaly 1A**) in the south-west of the field will be related to modern material and could indicate the presence of a former, relatively modern track.

There is a general alignment of isolated bipolar responses and trends (**Anomalies 1B**) in the east of the field. There were manhole covers in this part of the field and it is possible that the responses are related to a combination of covers and drain (or the trench used to install a drain). **Anomalies 1C** are similar responses and are suggestive of a drain but it is not certain of there were manhole covers in this part of the field and so this interpretation is not certain. **Anomalies 1D** have a similar orientation and these are also aligned with a possible drainage regime to the east. It seems likely that anomalies 1C and 1D are related to drains, either drainage pipes or field drains but as this interpretation is not certain the possibility that either of them could be related to other infilled features cannot be discounted.

There is a suggestion that several trends in the south-east of the area (**Anomalies 1E**) form a regular shape. It is likely that this is a product of intersecting agricultural / drainage regimes but the possibility that some of the trends are related to other sub-surface features cannot be completely discounted.

The remaining trends within the survey area are all too weak, short and / or diffuse to reliably interpret. They do not form any obvious patterns or relationships that would suggest they are associated with sub-surface features and it is likely that they are a product of agricultural, drainage or other modern, activity or natural variations.

There are a large number isolated positive responses across the survey area, some of which are relatively large or strong. These responses are all probably related to modern material.

4.3 Area 2

Basic topography: Undulating with a gradual slope downwards from north to south.

Field / area description: Arable with immature crop. Bounded by combination of hedgerows and metal fencing. Relatively firm underfoot.

Interpretation drawing(s): ARC_3643_1376_06.

Summary of anomalies: Numerous isolated dipolar and small bipolar responses, that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects.

Areas of magnetic disturbance associated with relatively modern features / material.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

A series of weak positive linear responses that are probably associated with modern ploughing regime(s).

A relatively weak, diffuse, linear / curvi-linear trend broadly corresponds with the position of a former field boundary and is probably related to this feature.

Trends of uncertain origin.

Numerous isolated positive responses. There are a large number of these responses and they are all probably related to a spread of modern material. Only selected large / strong responses have been shown on the interpretation.

Further discussion / additional information:

Parts of this area are dominated by a very large number of isolated responses that have contributed towards areas of magnetic disturbance. These indicate the presence of concentrations of modern material.

There is a grouping of isolated bipolar responses in the south-west of the area (**Anomalies 2A**). This grouping could be coincidental but it is possible that they are related to the remains of a (modern) structure.

The trends within this survey area are all too weak, short and / or diffuse to reliably interpret. They do not form any obvious patterns or relationships that would suggest they are associated

with sub-surface features and it is likely that they are a product of agricultural, drainage or other modern, activity or natural variations.

There are a large number isolated positive responses across the survey area, some of which are relatively large or strong. These responses are all probably related to modern material.

4.4 Area 3

Basic topography: Downwards slope down to east and south.

Field / area description: Playing field under short grass. Play equipment was present in the north-west of the field. The field was bounded by hedges and fences. Firm underfoot.

Interpretation drawing(s): ARC_3643_1376_06.

Summary of anomalies: Numerous isolated dipolar and small bipolar responses, that are all thought to be associated with modern material. These have not been shown on the interpretation.

An area of magnetic disturbance associated with relatively modern features / material.

Linear bipolar anomalies associated with modern linear magnetic features. These are probably buried pipes or drains but could be other modern features.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

Trends of uncertain origin

Numerous isolated positive responses. There are a large number of these responses and they are all probably related to a spread of modern material. Only selected large / strong responses have been shown on the interpretation.

Further discussion / additional information:

Significant parts of this area are dominated by magnetic disturbance associated with modern material. It should be recognised that the magnetic disturbance could potentially mask anomalies from underlying features, should any such features be present

The trends within this survey area are all too weak, short and / or diffuse to reliably interpret. They do not form any obvious patterns or relationships that would suggest they are associated with sub-surface features and it is likely that they are a product of agricultural, drainage or other modern, activity or natural variations.

There are a large number isolated positive responses across the survey area, some of which are relatively large or strong. These responses are all probably related to modern material.

4.5 Area 4

Basic topography: Gradual slope downwards (to the south, east and west) from high ground near the northern boundary. The faint remains of

ridge and furrow, aligned broadly east to west, was visible across the field.

Field / area description: Pasture. Bounded by hedgerows and overhanging trees. Firm underfoot. Farm equipment and spoil heaps were present in the north of the field.

Interpretation drawing(s): ARC_3643_1376_08.

Summary of anomalies: Numerous isolated dipolar and small bipolar responses, that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects.

Areas of magnetic disturbance associated with relatively modern features / material.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

A series of relatively weak, broadly parallel positive linear responses associated with ridge and furrow.

Two relatively weak, diffuse, linear / curvi-linear trends broadly correspond with the position of former field boundaries and are probably related to this feature.

Trends of uncertain origin. Some are suggestive of agricultural features.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural features / variations. There are a large number of these responses, particularly in the northern half of the field, and they are all probably related to a spread of modern material. Only selected large / strong responses have been shown on the interpretation.

Further discussion / additional information:

Two curvi-linear trends (**Anomalies 4A**) are on the same alignment as ridge and furrow but stand out as they are stronger. They could simply be related to the agricultural activity where, for some reason, more magnetic soils have been aligned along the agricultural activity or they could be related to boundary features or headlands.

The trends within this survey area are all too weak, short and / or diffuse to reliably interpret. They do not form any obvious patterns or relationships that would suggest they are associated with sub-surface features and it is likely that they are a product of agricultural, or other

modern, activity or natural variations. **Anomalies 4B** stand out slightly, as they are stronger or more coherent, and could have greater potential to be related to sub-surface features but on balance it is more likely that they are a product of agricultural activity.

There are a large number isolated positive responses across the survey area, some of which are relatively large or strong. These responses are all probably related to modern material.

4.6 Area 5

Basic topography: Gradual slope downwards to the south / south-west.

Field / area description: Pasture. Bounded by hedgerows and overhanging trees. Firm underfoot. Manure heaps were present in the field.

Interpretation drawing(s): ARC_3643_1376_06.

Summary of anomalies: Numerous isolated dipolar and small bipolar responses, that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects.

An area of magnetic disturbance associated with relatively modern features / material.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

A series of relatively weak, broadly parallel positive linear responses associated with ridge and furrow.

Trends of uncertain origin. Some are suggestive of agricultural features.

A number of isolated positive responses, which are probably related to relatively modern buried ferrous / fired material or natural features / variations. Only selected large / strong responses have been shown on the interpretation.

Further discussion / additional information:

The trends within this survey area are all too weak, short and / or diffuse to reliably interpret. They do not form any obvious patterns or relationships that would suggest they are associated with sub-surface features and it is likely that they are a product of agricultural, or other modern, activity or natural variations. However, their exact cause cannot be determined.

There are a large number isolated positive responses across the survey area, some of which are relatively large or strong. These responses are all probably related to modern material.

4.7 Area 6

Basic topography: Undulating with a general slope downwards to the south / south-west. Extant ridge and furrow, aligned broadly east to west, was visible across the field.

Field / area description: Pasture. Bounded by hedgerows. Firm underfoot.

Interpretation drawing(s): ARC_3643_1376_06.

Summary of anomalies: Numerous isolated dipolar and small bipolar responses, that are all thought to be associated with modern material. These have not been shown on the interpretation.

An area of magnetic disturbance associated with relatively modern features / material.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

A series of relatively weak, broadly parallel positive linear responses associated with ridge and furrow.

A number of isolated positive responses, which are probably related to relatively modern buried ferrous / fired material or natural features / variations. Only selected large / strong responses have been shown on the interpretation.

Further discussion / additional information:

Other than responses associated with ridge and furrow and modern features / material there are no anomalies that stand out in this field.

4.8 Area 7

Basic topography: Gradual slope downwards to the south.

Field / area description: Pasture. Bounded by hedgerows and overhanging trees. Firm underfoot.

Interpretation drawing(s): ARC_3643_1376_06.

Summary of anomalies: Numerous isolated dipolar and small bipolar responses, that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects..

Areas of magnetic disturbance associated with relatively modern features / material.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

A number of isolated positive responses, which are probably related to relatively modern buried ferrous / fired material or natural features / variations. Only selected large / strong responses have been shown on the interpretation.

Further discussion / additional information:

Other than responses associated with modern features / material there are no anomalies that stand out in this field.

4.9 Area 8

Basic topography: Gradual slope downwards (to the south, south-east and south-west) from high ground near the northern boundary.

Field / area description: Pasture. Bounded by hedgerows and overhanging trees. Firm underfoot. A small pond was present in the east of the field and a line of trees was present in the west of the field.

Interpretation drawing(s): ARC_3643_1376_08.

Summary of anomalies: Numerous isolated dipolar and small bipolar responses, that are all thought to be associated with modern material. These have not been shown on the interpretation.

An area of magnetic disturbance associated with relatively modern features / material.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

Two series of broadly parallel positive linear responses associated with ridge and furrow.

Trends of uncertain origin.

Numerous isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural features / variations. Only selected large / strong responses have been shown on the interpretation.

Positive linear anomalies of uncertain origin.

Further discussion / additional information:

There are two regimes of ridge and furrow visible in the data.

A general alignment of trends (**Anomalies 8A**) and an area of magnetic disturbance correspond with a line of trees and could reflect a former field boundary.

There are several anomalies that appear to run slightly oblique to the ridge and furrow and which could be related to infilled features. **Anomalies 8B** and **8C** could possibly be caused by infilled archaeological ditches but they could also be related to agricultural features / activity. It is not certain if **Anomalies 8D** may relate to Anomalies 8C or if they are caused by ridge and furrow. It is possible that Anomalies 8D may be a continuation of Anomalies 10A to the south.

Anomalies 8E are an alignment of negative trends. These responses are suggestive of a relatively modern feature, such as a drain or non-magnetic pipe.

The remaining trends within this survey area are all too weak, short and / or diffuse to reliably interpret. They do not form any obvious patterns or relationships that would suggest they are associated with sub-surface features and it is likely that they are a product of agricultural, or other modern, activity or natural variations. **Anomalies 8F** stand out slightly, as they are stronger or more coherent, and could have greater potential to be related to sub-surface features but their exact cause is not certain.

There are a large number isolated positive responses across the survey area, some of which are relatively large or strong. These responses are all probably related to modern material.

4.10 Area 9

Basic topography: Gradual slope downwards to the south / south-west. Extant ridge and furrow, aligned broadly north to south, was visible across the field.

Field / area description: Pasture. Bounded by hedgerows and overhanging trees. Firm underfoot.

Interpretation drawing(s): ARC_3643_1376_10.

Summary of anomalies: A number of isolated dipolar and small bipolar responses, that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects.

An area of magnetic disturbance associated with relatively modern features / material.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

A series of broadly parallel positive linear responses associated with ridge and furrow. There is a suggestion of second series of responses that could be related to ridge and furrow or other agricultural activity.

Trends of uncertain origin.

A number isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural features / variations. Only selected large / strong responses have been shown on the interpretation.

Further discussion / additional information:

There is a slight stagger in some of the responses related to ridge and furrow. This is a product of the height and steepness of the extant ridge and furrow causing there to sometimes be an offset in the GNSS position of the data (where the GNSS is on a steep angle relative to the sensors).

Anomaly 9A is a negative trend. This could be a continuation of a possible feature identified in Area 8 and is suggestive of a relatively modern feature, such as a drain or non-magnetic pipe.

Anomalies 9B are relatively weak but stand out slightly. The cause of these responses is not certain but it is likely that they are related to agricultural activity.

There are a large number of isolated positive responses across the survey area, some of which are relatively large or strong. These responses are all probably related to modern material.

4.11 Area 10

Basic topography: Gradual slope downwards to the south / south-west. Extant ridge and furrow, aligned broadly north to south, was visible across the field.

Field / area description: Pasture. Bounded by hedgerows and overhanging trees. Firm underfoot.

Interpretation drawing(s): ARC_3643_1376_10.

Summary of anomalies: Numerous isolated dipolar and small bipolar responses, that are all thought to be associated with modern material. These have not been shown on the interpretation. Several larger / stronger isolated bipolar responses have been shown. These will be related to concentrations, or larger objects or features, of relatively modern ferrous or fired material. They are not thought to be archaeologically significant but have been shown to highlight areas where there may be significant relatively modern material / objects.

Very strong responses associated with strongly magnetic relatively modern features / material. These responses can extend for some distance beyond the feature and in some cases the feature causing the strong response may be located beyond the survey area.

There are several relatively strong linear responses that are artificial data products. These will be related to a sensor movement or jolt caused by rough / uneven ground. These responses are not related to a sub-surface feature and their presence has not affected the reliability of the survey or interpretation.

A series of broadly parallel positive linear responses associated with ridge and furrow.

Trends of uncertain origin.

A number isolated positive responses, the majority of which are probably related to relatively modern buried ferrous / fired material or natural features / variations. Only selected large / strong responses have been shown on the interpretation.

Positive linear anomalies of uncertain origin.

Further discussion / additional information:

There are several anomalies that appear to run slightly oblique to the ridge and furrow and which could be related to infilled features. **Anomaly 10A** could possibly be caused by an infilled archaeological ditch but it could also be related to agricultural features / activity. This may be a continuation of Anomalies 8D to the north. **Anomaly 10B** is relatively strong but is closer aligned to the ridge and furrow and it is not certain of this is caused by a sub-surface feature or the ridge and furrow.

The remaining trends within this survey area are all too weak, short and / or diffuse to reliably interpret. They do not form any obvious patterns or relationships that would suggest they are associated with sub-surface features and it is likely that they are a product of agricultural, or other modern, activity or natural variations. **Anomalies 10C** stand out slightly, as they are stronger or more coherent, and could have greater potential to be related to sub-surface features but their exact cause is not certain.

There are a large number of isolated positive responses across the survey area, some of which are relatively large or strong. These responses are all probably related to modern material.

5. DISCUSSION AND CONCLUSIONS

The majority of the anomalies identified by this survey relate to modern material / objects, agricultural activity (including ridge and furrow) and possible natural variations. There are a number of anomalies of uncertain origin. Some of these could be related to anthropogenic features / activity. In the majority of cases these are probably associated with drainage features, agricultural or other modern activity or natural features / variations but as their exact cause cannot be determined with certainty an archaeological origin for some of the anomalies cannot be ruled out.

Some parts of the site have a very large number of isolated responses, which have contributed to a variable / 'disturbed' magnetic background. These are indicative of a spread of modern material. Some of the responses could be related to 'green waste', which is added to manure but which contains significant amounts of ferrous material, or they could be from a spread of rubble or other modern debris. There are several areas where very strong responses or magnetic disturbance from modern features / material dominate the surrounding data. It should be recognised that the strength of these responses from modern material / activity could mask anomalies from other sub-surface features in the area, should any such features be present.

It should be noted that a geophysical survey does not directly locate sub-surface features - it identifies variations or anomalies in the background response caused by features. The interpretation of geophysical anomalies is often subjective and it is rarely possible to identify the cause of all such anomalies. Not all features will produce a measurable anomaly and the effectiveness of a geophysical survey is also dependant on the site-specific conditions. The main factors that may limit whether a feature can be detected are the composition of a feature, its depth and size and the surrounding material. It is not possible to guarantee that a geophysical survey will identify all sub-surface features. Confirmation on the identification of anomalies and the presence or absence of sub-surface features can only be achieved by intrusive investigation.

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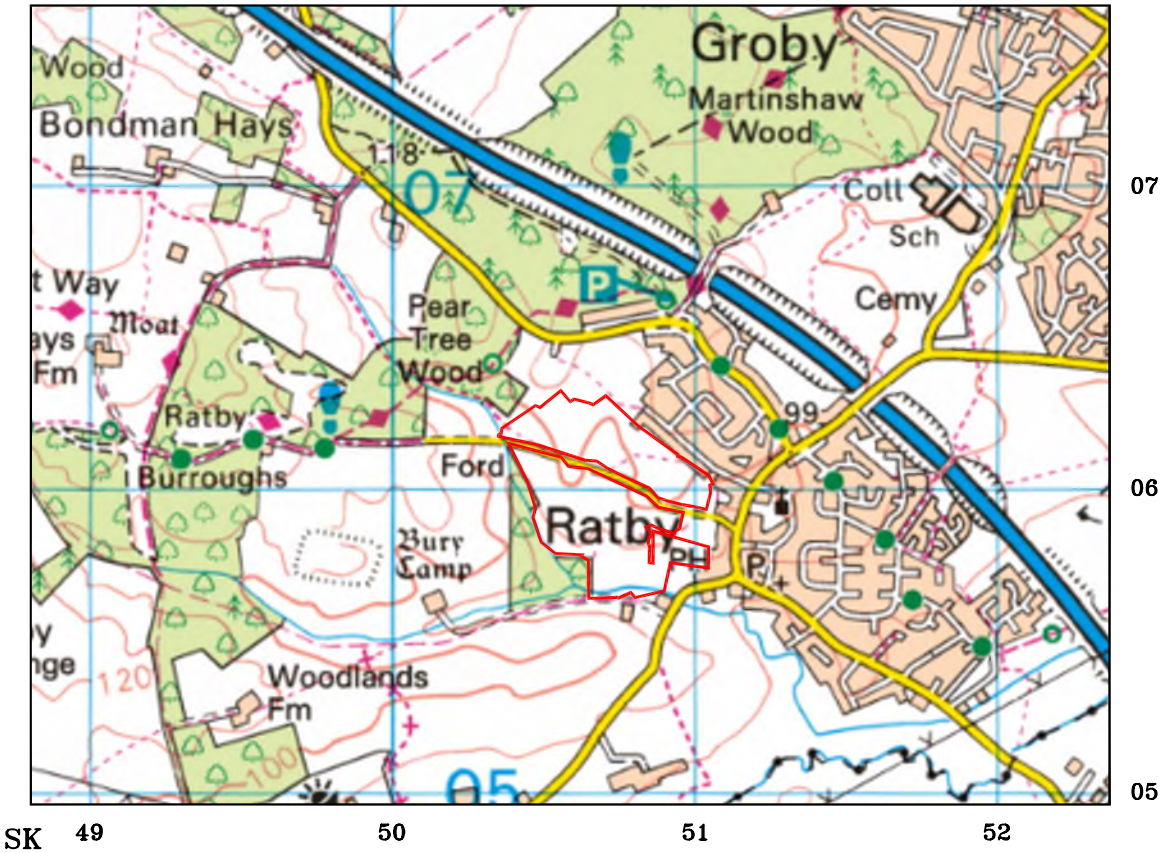

SITE LOCATION

SCALE

0m 500m 1000m

NOTE

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Scale [A4 Sheet]	Drawing	Status
AS SHOWN	ARC_3643_1376_01	FINAL

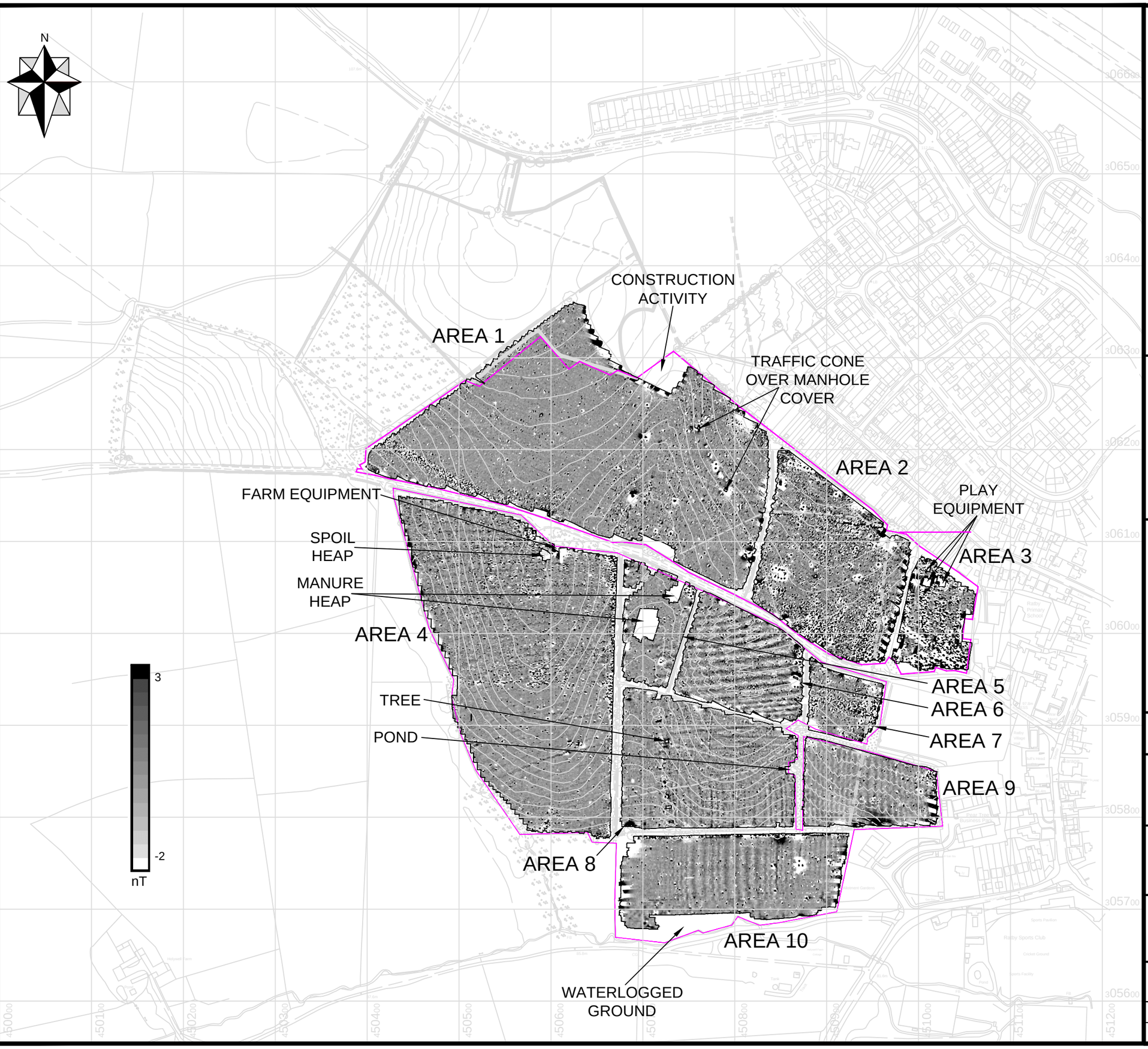
Client: COTSWOLD ARCHAEOLOGY MILTON KEYNES

Site: LAND WEST OF RATBY (BURROUGH FIELD) LEICESTERSHIRE

Title: SITE LOCATION MAP

Job No: ARC_3643_1376

		Drawn	CW
Chk.	NF	Date	25/04/2024



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APPROXIMATE SITE BOUNDARY

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Scale [A3 Sheet]	Drawing	Status
1:4000	ARC_3643_1376_02	FINAL

Client
COTSWOLD ARCHAEOLOGY
MILTON KEYNES

Site
LAND WEST OF RATBY
(BURROUGH FIELD)
LEICESTERSHIRE

Title
LOCATION OF SITE SHOWING
MAGNETIC GRADIENT DATA

ARC_3643_1376

Surveyed	JW, RS, MP	Drawn	MW
Chk.	NF	Date	12/04/2024

AREA 1

AREA 2

AREA 4

AREA 5

AREA 6

3

-2

nT

NOTES

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Scale [A3 Sheet]	Drawing	Status
1:1500	ARC_3643_1376_03	FINAL

Client: COTSWOLD ARCHAEOLOGY MILTON KEYNES

Site: LAND WEST OF RATBY (BURROUGH FIELD) LEICESTERSHIRE

Title: GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA: AREAS 1, 5 AND PARTS OF AREAS 2, 4 AND 6

Job No: ARC_3643_1376

Surveyed	JW, RS, MP	Drawn	MW
Chk.	NF	Date	12/04/2024

AREA 1

AREA 2

AREA 4

AREA 5

AREA 6

1A

1B

1C

1D

1E

2A

RF

RF/FD?

ANOMALY TYPE	INTERPRETATION
LARGE / STRONG ISOLATED BIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE CAUSED BY MODERN MAGNETIC FEATURE (FEATURE MAY BE LOCATED BEYOND THE SURVEY AREA)
APPROXIMATE ORIENTATION OF WEAK, BROADLY PARALLEL POSITIVE LINEARS	AGRICULTURAL ACTIVITY. PROBABLE MODERN PLOUGHING REGIME
RF / RF? APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEAR / CURVI-LINEAR RESPONSES	AGRICULTURAL ACTIVITY. PROBABLE / POSSIBLE RIDGE AND FURROW (THE LATTER COULD BE RELATED TO LATER AGRICULTURAL OR DRAINAGE REGIME)
FD? APPROXIMATE ORIENTATION OF BROADLY PARALLEL POSITIVE LINEARS	AGRICULTURAL FEATURES. POSSIBLE DRAINAGE REGIME BUT COULD BE RELATED TO OTHER AGRICULTURAL ACTIVITY
LINEAR / CURVI-LINEAR TREND	BROADLY CORRESPONDS WITH FORMER FIELD BOUNDARY AND IS PROBABLY RELATED TO THIS FEATURE
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL. BUT SOME COULD BE OR NATURAL VARIATION OR TO SUB-SURFACE FEATURES

NOTES

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Scale [A3 Sheet]	Drawing	Status
1:1500	ARC_3643_1376_04	FINAL

Client
COTSWOLD ARCHAEOLOGY
MILTON KEYNES

Site
LAND WEST OF RATBY
(BURROUGH FIELD)
LEICESTERSHIRE

Title
INTERPRETATION OF MAGNETIC GRADIENT DATA: AREAS 1, 5 AND PARTS OF AREAS 2, 4 AND 6

Job No
ARC_3643_1376

Surveyed	JW, RS, MP	Drawn	MW
Chk.	NF	Date	12/04/2024

NOTES

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Scale [A3 Sheet]	Drawing	Status
1:1500	ARC_3643_1376_05	FINAL

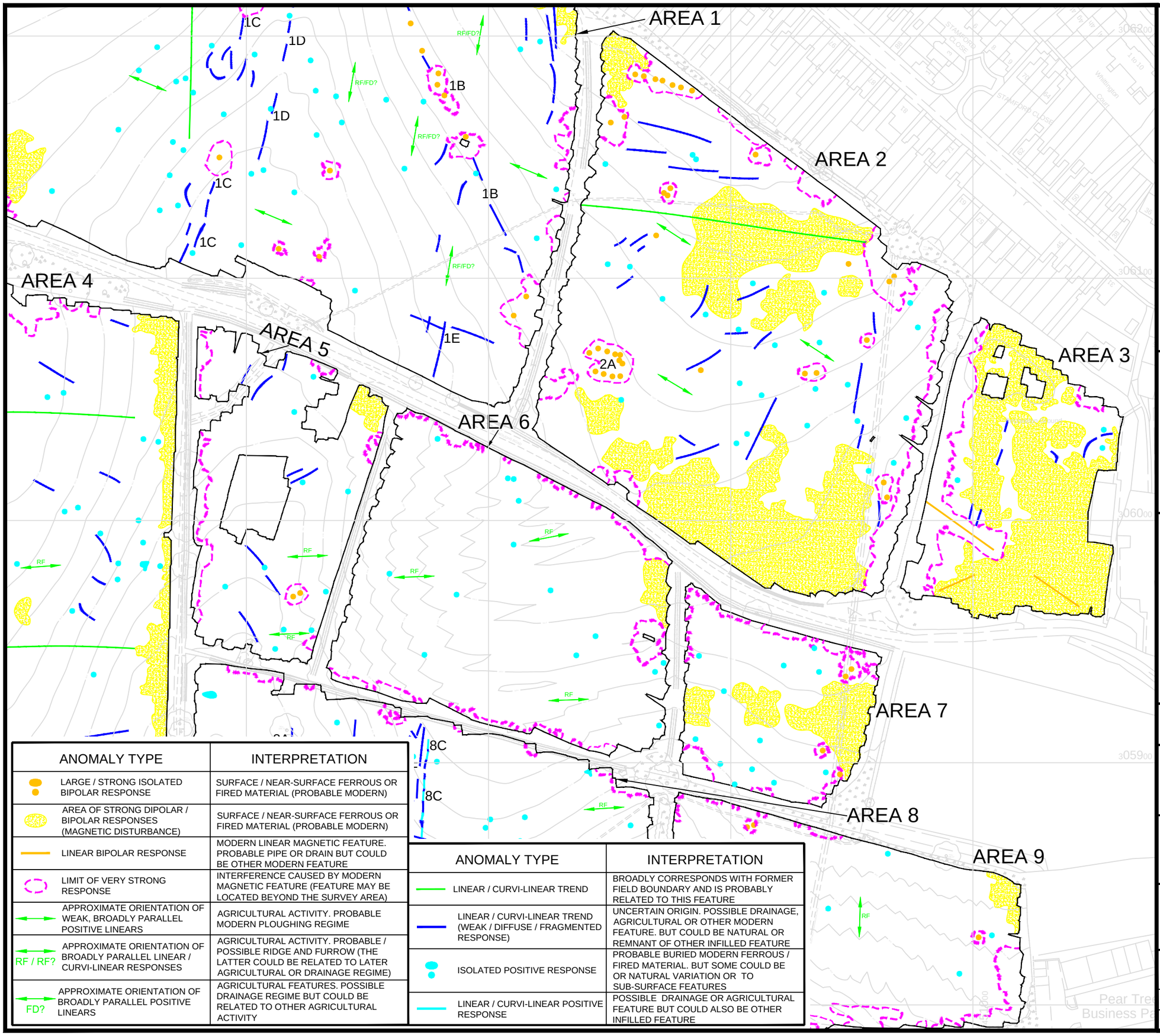
Client: COTSWOLD ARCHAEOLOGY MILTON KEYNES

Site: LAND WEST OF RATBY (BURROUGH FIELD) LEICESTERSHIRE

Title: GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA: AREAS 2, 3, 5, 6, 7 AND PARTS OF AREAS 1, 4, 8 AND 9

Job No: ARC_3643_1376

Surveyed	JW, RS, MP	Drawn	MW
Chk.	NF	Date	12/04/2024



ANOMALY TYPE	INTERPRETATION
LARGE / STRONG ISOLATED BIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
LINEAR BIPOLAR RESPONSE	MODERN LINEAR MAGNETIC FEATURE. PROBABLE PIPE OR DRAIN BUT COULD BE OTHER MODERN FEATURE
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE CAUSED BY MODERN MAGNETIC FEATURE (FEATURE MAY BE LOCATED BEYOND THE SURVEY AREA)
APPROXIMATE ORIENTATION OF WEAK, BROADLY PARALLEL POSITIVE LINEARS	AGRICULTURAL ACTIVITY. PROBABLE MODERN PLOUGHING REGIME
RF / RF? APPROXIMATE ORIENTATION OF BROADLY PARALLEL LINEAR / CURVI-LINEAR RESPONSES	AGRICULTURAL ACTIVITY. PROBABLE / POSSIBLE RIDGE AND FURROW (THE LATTER COULD BE RELATED TO LATER AGRICULTURAL OR DRAINAGE REGIME)
FD? APPROXIMATE ORIENTATION OF BROADLY PARALLEL POSITIVE LINEARS	AGRICULTURAL FEATURES. POSSIBLE DRAINAGE REGIME BUT COULD BE RELATED TO OTHER AGRICULTURAL ACTIVITY

ANOMALY TYPE	INTERPRETATION
LINEAR / CURVI-LINEAR TREND	BROADLY CORRESPONDS WITH FORMER FIELD BOUNDARY AND IS PROBABLY RELATED TO THIS FEATURE
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL. BUT SOME COULD BE OR NATURAL VARIATION OR TO SUB-SURFACE FEATURES
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	POSSIBLE DRAINAGE OR AGRICULTURAL FEATURE BUT COULD ALSO BE OTHER INFILLED FEATURE

NOTES

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Scale [A3 Sheet]	Drawing	Status
1:1500	ARC_3643_1376_06	FINAL

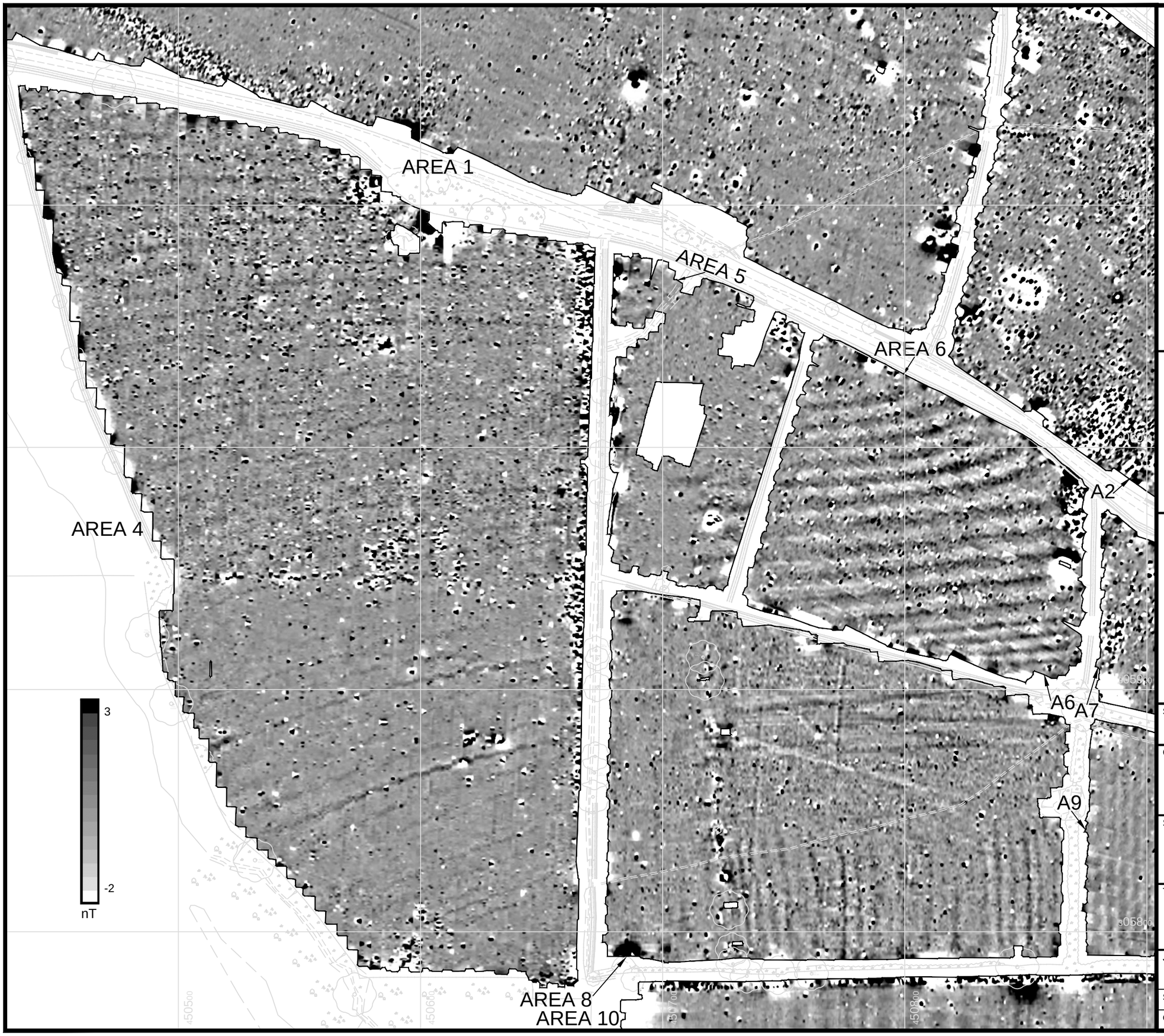
Client
COTSWOLD ARCHAEOLOGY
MILTON KEYNES

Site
LAND WEST OF RATBY
(BURROUGH FIELD)
LEICESTERSHIRE

Title
INTERPRETATION OF MAGNETIC GRADIENT DATA: AREAS 2, 3, 5, 6, 7 AND PARTS OF AREAS 1, 4, 8 AND 9

Job No
ARC_3643_1376

Surveyed	JW, RS, MP	Drawn	MW
Chk.	NF	Date	12/04/2024



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:1500	ARC_3643_1376_07	FINAL

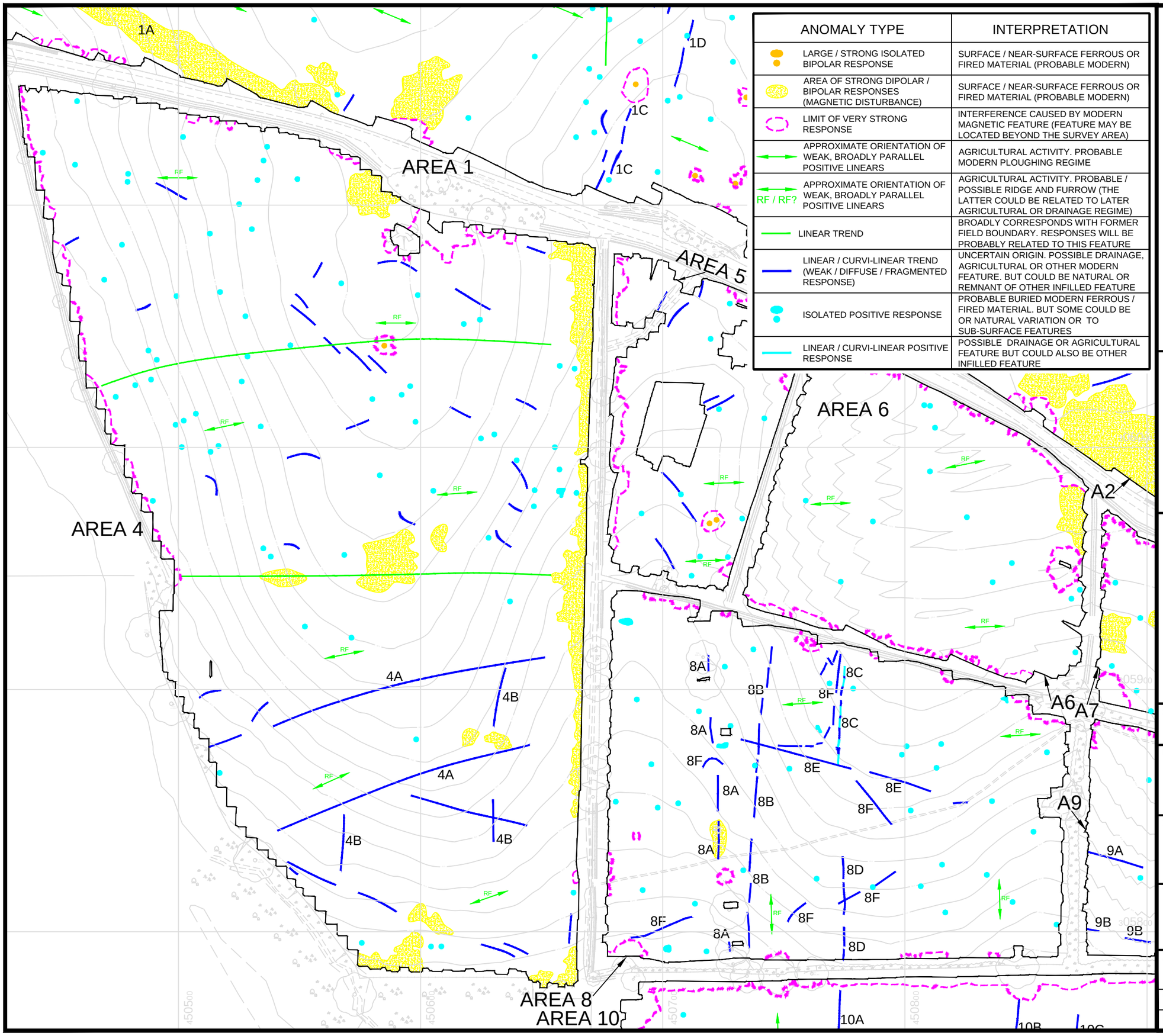
Client
COTSWOLD ARCHAEOLOGY
MILTON KEYNES

Site
LAND WEST OF RATBY
(BURROUGH FIELD)
LEICESTERSHIRE

Title
INTERPRETATION OF MAGNETIC GRADIENT DATA: AREAS 4, 5, 6, 8 AND PARTS OF AREAS 1, 2, 7, 9 AND 10

Job No
ARC_3643_1376

Surveyed	JW, RS, MP	Drawn	MW
Chk.	NF	Date	12/04/2024



ANOMALY TYPE	INTERPRETATION
LARGE / STRONG ISOLATED BIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE CAUSED BY MODERN MAGNETIC FEATURE (FEATURE MAY BE LOCATED BEYOND THE SURVEY AREA)
APPROXIMATE ORIENTATION OF WEAK, BROADLY PARALLEL POSITIVE LINEARS	AGRICULTURAL ACTIVITY. PROBABLE MODERN PLOUGHING REGIME
RF / RF? APPROXIMATE ORIENTATION OF WEAK, BROADLY PARALLEL POSITIVE LINEARS	AGRICULTURAL ACTIVITY. PROBABLE / POSSIBLE RIDGE AND FURROW (THE LATTER COULD BE RELATED TO LATER AGRICULTURAL OR DRAINAGE REGIME)
LINEAR TREND	BROADLY CORRESPONDS WITH FORMER FIELD BOUNDARY. RESPONSES WILL BE PROBABLY RELATED TO THIS FEATURE
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL. BUT SOME COULD BE OR NATURAL VARIATION OR TO SUB-SURFACE FEATURES
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	POSSIBLE DRAINAGE OR AGRICULTURAL FEATURE BUT COULD ALSO BE OTHER INFILLED FEATURE

NOTES

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Scale [A3 Sheet]	Drawing	Status
1:1500	ARC_3643_1376_08	FINAL

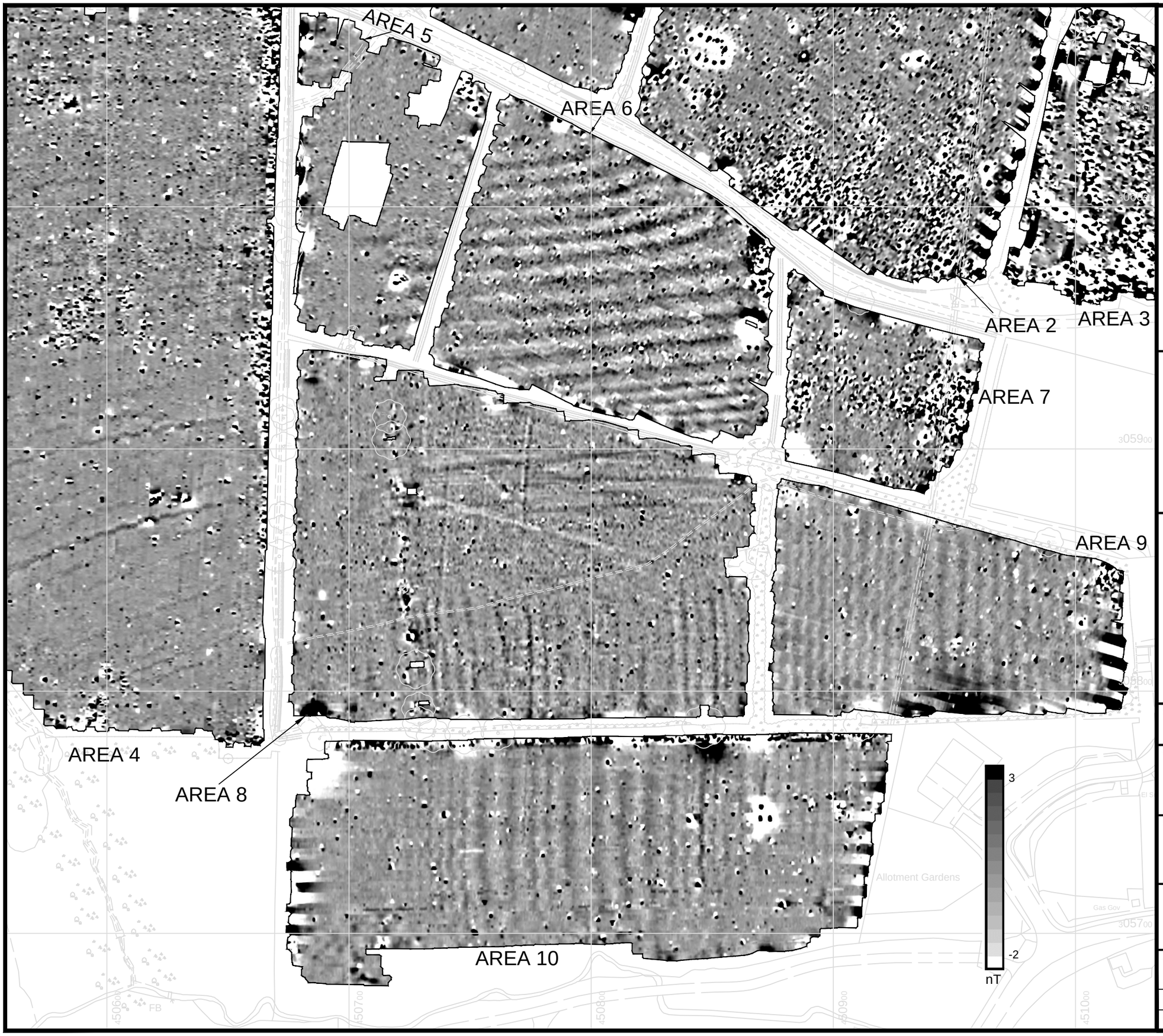
Client: COTSWOLD ARCHAEOLOGY MILTON KEYNES

Site: LAND WEST OF RATBY (BURROUGH FIELD) LEICESTERSHIRE

Title: INTERPRETATION OF MAGNETIC GRADIENT DATA: AREAS 4, 8 AND PARTS OF AREAS 1, 2, 5, 6, 7, 9 AND 10

Job No: ARC_3643_1376

Surveyed	JW, RS, MP	Drawn	MW
Chk.	NF	Date	12/04/2024



NOTES

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Scale [A3 Sheet]	Drawing	Status
1:1500	ARC_3643_1376_09	FINAL

Client
COTSWOLD ARCHAEOLOGY
MILTON KEYNES

Site
LAND WEST OF RATBY
(BURROUGH FIELD)
LEICESTERSHIRE

Title
GREYSCALE PLOTS OF MAGNETIC GRADIENT DATA: AREAS 5, 6, 7, 8, 9, 10 AND PARTS OF AREAS 2, 3 AND 4

Job No
ARC_3643_1376

Surveyed	JW, RS, MP	Drawn	MW
Chk.	NF	Date	12/04/2024

ANOMALY TYPE	INTERPRETATION
LARGE / STRONG ISOLATED BIPOLAR RESPONSE	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
AREA OF STRONG DIPOLAR / BIPOLAR RESPONSES (MAGNETIC DISTURBANCE)	SURFACE / NEAR-SURFACE FERROUS OR FIRED MATERIAL (PROBABLE MODERN)
LINEAR BIPOLAR RESPONSE	MODERN LINEAR MAGNETIC FEATURE. PROBABLE PIPE OR DRAIN BUT COULD BE OTHER MODERN FEATURE
LIMIT OF VERY STRONG RESPONSE	INTERFERENCE CAUSED BY MODERN MAGNETIC FEATURE (FEATURE MAY BE LOCATED BEYOND THE SURVEY AREA)
LINEAR RESPONSE	ARTIFICIAL ANOMALY CAUSED BY ISOLATED SENSOR MOVEMENT. THIS HAS NOT AFFECTED THE RELIABILITY OF THE SURVEY OR THE INTERPRETATION
APPROXIMATE ORIENTATION OF WEAK, BROADLY PARALLEL POSITIVE LINEARS	AGRICULTURAL ACTIVITY. PROBABLE MODERN PLOUGHING REGIME
RF / RF? APPROXIMATE ORIENTATION OF WEAK, BROADLY PARALLEL POSITIVE LINEARS	AGRICULTURAL ACTIVITY. PROBABLE / POSSIBLE RIDGE AND FURROW (THE LATTER COULD BE RELATED TO LATER AGRICULTURAL OR DRAINAGE REGIME)
LINEAR / CURVI-LINEAR TREND (WEAK / DIFFUSE / FRAGMENTED RESPONSE)	UNCERTAIN ORIGIN. POSSIBLE DRAINAGE, AGRICULTURAL OR OTHER MODERN FEATURE. BUT COULD BE NATURAL OR REMNANT OF OTHER INFILLED FEATURE
ISOLATED POSITIVE RESPONSE	PROBABLE BURIED MODERN FERROUS / FIRED MATERIAL. BUT SOME COULD BE OR NATURAL VARIATION OR TO SUB-SURFACE FEATURES
LINEAR / CURVI-LINEAR POSITIVE RESPONSE	POSSIBLE DRAINAGE OR AGRICULTURAL FEATURE BUT COULD ALSO BE OTHER INFILLED FEATURE

AREA 6
AREA 2
AREA 3
AREA 7
AREA 9
AREA 4
AREA 8
AREA 10
Allotment Gardens

NOTES

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Scale [A3 Sheet]	Drawing	Status
1:1500	ARC_3643_1376_10	FINAL

Client: COTSWOLD ARCHAEOLOGY MILTON KEYNES

Site: LAND WEST OF RATBY (BURROUGH FIELD) LEICESTERSHIRE

Title: INTERPRETATION OF MAGNETIC GRADIENT DATA: AREAS 6, 7, 9, 10 AND PARTS OF AREAS 2, 3, 4, 5 AND 8

Job No: ARC_3643_1376

Surveyed	JW, RS, MP	Drawn	MW
Chk.	NF	Date	12/04/2024

BIBLIOGRAPHY AND REFERENCES

British Geological Survey, 2024, online resource - www.bgs.ac.uk

Phase Site Investigations Ltd, 2023, Land west of Ratby, Leicestershire, arcaheological geophysical survey

National Library of Scotland, 2024, online resource - maps.nls.uk

APPENDIX 1

Magnetic survey: technical information

1.1 Theoretical background

1.1.1 Magnetic instruments measure the value of the Earth's magnetic field; the units of which are nanoTeslas (nT). The presence of surface and sub-surface features can cause variations or anomalies in this magnetic field. The strength of the anomaly is dependent on the magnetic properties of a feature and the material that surrounds it. The two magnetic properties that are of most interest are magnetic susceptibility and thermoremnant magnetism.

1.1.2 Magnetic susceptibility indicates the amount of ferrous (iron) minerals that are present. These can be redistributed or changed (enhanced) by human activity. If enhanced material subsequently fills in features such as pits or ditches then these can produce localised increases in magnetic responses (anomalies) which can be detected by a magnetic gradiometer even when the features are buried under additional soil cover.

1.1.3 In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected. Less magnetic material such as masonry or plastic service pipes which intrude into the topsoil may give a negative magnetic response relative to the background level. The strength of magnetic responses that a feature will produce will depend on the background magnetic susceptibility, how rapidly the feature has been infilled, the level and type of human activity in the area and the size and depth of a feature. Not all infilled features can be detected and natural variations can also produce localised positive and negative anomalies.

1.1.4 Thermoremnant magnetism indicates the amount of magnetism inherent in an object as a result of heating. Material that has been heated to a high temperature (fired), such as brick, can acquire strong magnetic properties and so although they may not appear to have a high iron content they can produce strong magnetic anomalies

1.1.5 The magnetic survey method is highly sensitive to interference from surface and near-surface magnetic 'contaminants'. Surface features such as metallic fencing, reinforced concrete, buildings or walls all have very strong magnetic signatures that can dominate readings collected adjacent to them. Identification of anomalies caused by sub-surface features is therefore more difficult, or even impossible, in the vicinity of surface magnetic features. The presence of made ground also has a detrimental effect on the magnetic data quality as this usually contains magnetic material in the form of metallic scrap and brick. Identification of features beneath made ground is still possible if the target feature is reasonably large and has a strong magnetic response but smaller features or magnetically weak features are unlikely to be identified.

1.1.6 The interpretation of magnetic anomalies is often subjective and it is rarely possible to identify the cause of all magnetic anomalies. Not all features will produce a measurable magnetic response and the effectiveness of a magnetic survey is also dependant on the site-specific conditions. The main factors that may limit whether a feature can be detected are the

composition of a feature, its depth and size and the surrounding material. It is not possible to guarantee that a magnetic survey will identify all sub-surface features.

1.1.7 Most high resolution, near surface magnetic surveys utilise a magnetic gradiometer. A gradiometer is a hand-held instrument that consists of two magnetic sensors, one positioned directly above the other, which allows measurement of the magnetic gradient component of the magnetic field. A gradiometer configuration eliminates the need for applying corrections due to natural variations in the overall field strength that occur during the course of a day but it only measures relative variations in the local magnetic field and so comparison of absolute values between sites is not possible.

1.1.8 Features that are commonly located using magnetic surveys include archaeological ditches and pits, buried structures or foundations, mineshafts, unexploded ordnance, metallic pipes and cables, buried piles and pile caps. The technique can also be used for geological mapping; particularly the location of igneous intrusions.

1.2 Instrumentation

1.2.1 A multi-sensor array cart system (MACS) utilising 4 Foerster 4.032 Ferex CON 650 gradiometers, spaced at 1 m intervals, with a control unit and data logger was used for the magnetic survey.

1.3 Survey methodology

1.3.1 The MACS utilises an RTK GNSS system which means that survey grids do not have to be established. Instead an area is surveyed over a series of continuous profiles and the position of each data point is recorded using an RTK GNSS system. The sensors have a separation of 1 m which means that data was collected on profiles spaced at 1 m apart. Readings were taken at between 0.1 m and 0.15 m intervals.

1.3.2 Data is collected on zig-zag profiles along the full length or width of a field, although fields can be sub-divided if they are particularly large. Marker canes are set-out along field boundaries at set intervals and these are used to align the profiles. The survey profiles are usually offset from field boundaries, buildings and other metallic features by several metres to reduce the detrimental effect that these surface magnetic features have on the data. The location of the MACS data is converted direct to Ordnance Survey co-ordinates using the UK OSTN15 projection. As the data is related direct to Ordnance Survey National Grid co-ordinates temporary survey stations are not established.

1.3.3 The Foerster gradiometers have a resolution of 0.2 nT but the stability of the cart system significantly reduces noise caused by instrument tilt and movement when compared with a traditional hand-held gradiometer system and the increased data intervals provide a higher resolution data set. The sensors have a range of ± 10,000nT and readings are taken at 0.1 nT resolution.

1.4 Data processing and presentation

1.4.1 The MACS data is stored direct to a laptop using in-house software which automatically corrects for instrument drift and calculates a mean value for each profile. A positional value is assigned to each data point based on the sensor number and recorded GNSS co-ordinates. The data is gridded using in-house software and parameters are set based on the sensor spacing and mean values. No additional processing is required. The gridded data is then displayed in Surfer 9 (Golden Software) and image files of the data are created.

1.4.2 The data was exported as greyscale raster images (PNG files). Data for the entire site is presented at a scale of 1:4000 and plots for individual fields / areas (or parts of fields / areas) with accompanying interpretations are shown at a scale of 1:1500. All greyscale plots were clipped at -2 nT to 3 nT. Greyscale plots have been 'smoothed' using a visual interpolation but the data itself has not been interpolated.

1.4.3 The data has been displayed relative to a digital base plan provided by the client as drawing *'Ratby additional areas revised 2.dwg'*. The base plan was in the Ordnance Survey National Grid co-ordinate system and as the survey grids / data were referenced directly to National Grid co-ordinates the data could be simply superimposed onto the base plan in the correct position.

1.5 Interpretation

1.5.1 The anomalies have been categorised based on the type of response that they have and an interpretation as to the cause(s) or possible cause(s) of each anomaly type is also provided. The following anomaly types may be present within the data:

Dipolar, bipolar and strong responses

Dipolar and bipolar responses are those that have a sharp variation between strongly positive and negative components.

In the majority of cases these responses are usually caused by modern ferrous features / objects, although fired material (such as brick), some ferrous or industrial archaeological features and strongly magnetic gravel could also produce dipolar and bipolar responses.

Isolated dipolar responses are those that have a single positive and negative element. They are usually caused by isolated, ferrous or fired material on or near to the surface. The objects that cause dipolar responses are usually relatively small, such as spent shotgun cartridges, iron nails and horseshoes (hence they are often referred to as 'iron spikes') or pieces of modern brick or pot. Some types of archaeological artefacts can also produce this type of response but unless there is strong supporting evidence to the contrary they are assumed not to be of archaeological significance.

Bipolar anomalies have strong positive and negative components but are not technically magnetic dipoles. The majority of **isolated bipolar responses** are caused by ferrous or fired material on or near to the surface. These responses tend to be produced from larger objects, compared to dipolar anomalies, or a concentration of smaller objects. Some archaeological features/ activity, including areas of burning or industrial activity can also produce this type of response but unless there is strong supporting evidence to the contrary they are assumed not to be of archaeological significance.

Smaller isolated dipolar and bipolar responses have not been shown on the interpretation as there is no evidence to suggest that they are related to archaeological activity. Several larger isolated bipolar responses have been shown as these could be associated with more significant sub-surface features or material (although in this instance they are not thought to be of archaeological interest).

Bipolar linear anomalies are usually produced by metallic buried pipes / cables, although some ceramic pipes or features containing fired material, such as brick structures or foundations, can also produce bipolar anomalies. In some instances the anomaly can extend for a significant distance beyond the feature that produces the anomaly. Bipolar anomalies are often very strong and can potentially mask responses from other sub-surface features in the vicinity of the underlying feature.

Areas containing numerous **strong dipolar / bipolar responses (magnetic disturbance)** are usually caused by greater concentrations of ferrous or fired material and are often found adjacent to field boundaries where such material tends to accumulate. Above ground metallic or strongly magnetic features, such as fences, gates, pylons and buildings can also produce very strong bipolar responses. If an area of magnetic disturbance is located away from existing field boundaries then it could indicate a former field boundary, several large isolated objects in close proximity, an area where modern material has been tipped or an infilled cut feature, such as a quarry pit. Areas of dipolar / bipolar response can occasionally be caused by features / material associated with archaeological industrial activity or natural deposits that have varying magnetic properties but they are usually caused by modern activity. Responses in areas of magnetic disturbance can sometimes be so strong that archaeological features located beneath them may not be detected.

Very strong responses, notably bipolar anomalies, from modern features can dominate the data for a significant distance beyond the feature. The extent of these areas is usually shown either as part of the bipolar anomaly or as a **limit of very strong response.** It should be noted that this effect extends beyond the feature and so the limit of the response does not correspond to the actual size or location of the feature within it. In many cases where these strong responses are present at the edge of survey area the feature causing the anomaly be actually be located beyond the survey area. It should be recognised that other sub-surface features located within these areas may not be detected.

There are several **strong linear responses** that are artificial data products. These are related to a sensor movement or jolt caused by rough ground. These responses are not related to a sub-surface feature and their presence has not affected the reliability of the

Negative linear / curvi-linear anomalies

Negative linear / curvi-linear anomalies occur when a feature has lower magnetic readings than the surrounding material and can often be associated with ploughing regimes or plastic / concrete pipes or natural features.

They can also indicate the presence of a feature that cuts into magnetic soils or bedrock and which is infilled with less magnetic material and in certain geologies can be associated with archaeological features.

Any negative linear anomalies in this data set are thought to relate to agricultural or other relatively modern activity.

Linear / curvi-linear anomalies (probable agricultural)

In many geological / pedological conditions agricultural features / regimes can produce magnetic anomalies due to the accumulation / alignment of magnetic topsoil. In most cases these are exhibited as a series of **broadly parallel positive linear** anomalies. The majority of these responses are associated with modern ploughing regimes but in some instances, where the responses are broader and more widely spaced, they can indicate the presence of the remnants of ridge and furrow.

Field drain systems can also produce linear anomalies, usually where the drains are made from fired ceramic or infilled with magnetic gravels.

Where a series of parallel anomalies are present then the approximate orientation of the anomalies are shown on the interpretation drawing to indicate the direction of the agricultural regime but for the sake of clarity individual anomalies have not been shown.

Individual anomalies may be shown if the response is not part of a regime.

Broad area of positive / negative responses

Broad areas of positive / negative responses can have a variety of causes. If the areas are generally quite large and irregular in shape then they are usually suggestive of natural features, such as lenses of sand and gravel deposits, palaeochannels or other natural features / variations where the natural material differs from the surrounding sub-surface. In some instances anomalies of this type can be associated with anthropogenic (usually modern) activity.

There are no anomalies of this type in this data set.

Linear / curvi-linear trends

An anomaly is categorised as a **trend** if it is not certain that the response is associated with an extant sub-surface feature. Trends are usually weak, irregular, diffuse or discontinuous and it is usually not certain what their cause is, if they represent significant sub-surface features or even if they are associated with definite features.

It is possible that some of the trends are associated with geological / pedological variations. Others may be produced by artificial constructs within the data, either caused by processing or in some instances by intersecting anomalies (usually different agricultural regimes) that give the appearance of curving or regular shapes. Many trends are a product of weak, naturally occurring responses that happen to form a regular pattern but which are not associated with a sub-surface feature.

In some instances former features that have been severely truncated can still produce broad, diffuse or weak responses even if the underlying feature has been removed. This is due to the presence of magnetic soils associated with the former feature still being present along its route. In other instances the magnetic properties of the soils filling a feature may vary and so the magnetic signature of the feature can change, even if the sub-surface feature itself remains uniform. If a response from a feature becomes significantly weak or diffuse then part of the anomaly may be shown as a trend as it is uncertain if the feature is still present or has been severely truncated or removed.

Isolated positive responses

Isolated positive responses can occur if the magnetism of a feature, area or material has been enhanced or if a feature is naturally more magnetic than the surrounding material. It is often difficult to determine which of these factors causes any given responses and so the origin of this type of anomaly can be difficult to determine. They can have a variety of causes including geological variations, infilled archaeological features, areas of burning (including hearths), industrial archaeological features, such as kilns, or deeper buried ferrous material and modern fired material.

The large number of isolated responses and lack of an obvious pattern to their distribution suggests that these anomalies are probably associated with geological / pedological variations or deeper buried ferrous or fired material. Only the larger or stronger areas of positive response have been shown on the interpretation. The majority, if not all of these responses, will be related to natural variations or relatively modern material but have been shown as their exact cause cannot be determined with certainty.

Positive linear / curvi-linear anomalies

Positive magnetic anomalies indicate an increase in magnetism and if the resulting anomaly is linear or curvi-linear then this can indicate the presence of a man-made feature. **Positive linear / curvi-linear** anomalies can be associated with agricultural / drainage activity, or sometimes infilled natural features, but they can also be caused by ditches that are infilled with magnetically enhanced material and as such can indicate the presence of archaeological features.

1.5.2 Several different ranges of data were used in the interpretation to ensure that the maximum information possible is obtained from the data.

1.5.3 X-Y trace plots were examined for all of the data and overlain onto the greyscale plot to assist in the interpretation, primarily to help identify dipolar / bipolar responses that will probably be associated with surface / near-surface iron objects. X-Y trace plots have not been used in the report as they do not show any additional anomalies that are not visible in the greyscale data. A digital drawing showing the X-Y trace plot overlain on the greyscale plot has been provided in the digital archive.

1.5.4 All isolated responses have been assessed using a combination of greyscale and X-Y trace plots.

1.5.5 Anomalies associated with agricultural and drainage regimes are present in the data. The general orientation of these regimes has been shown on the interpretation but, for the sake of clarity, each individual anomaly has not been shown.

1.5.6 The greyscale plots and the accompanying interpretations of the anomalies identified in the magnetic data are presented as 2D AutoCAD drawings. The interpretation is made based on the type, size, strength and morphology of the anomalies, coupled with the available information on the site conditions. Each type of anomaly is displayed in separate, easily identifiable layers annotated as appropriate.

1.6 Limitations of magnetic surveys

1.6.1 The magnetic survey method requires the operator to walk over the site at a constant walking pace whilst holding the instrument. The presence of an uneven ground surface, dense, high or mature vegetation or surface obstructions may mean that some areas cannot be surveyed.

1.6.2 The depth at which features can be detected will vary depending on their composition, size, the surrounding material and the type of magnetometer used for the survey. In good conditions large, magnetic targets, such as buried drums or tanks can be located at depths of more than 4 m. Smaller targets, such as buried foundations or archaeological features can be located at depths of between 1 m and 2 m.

1.6.3 A magnetic survey is highly sensitive to interference from surface and near-surface magnetic ‘contaminants’. Surface features such as metallic fencing, reinforced concrete, buildings or walls all have very strong magnetic signatures that can dominate readings collected adjacent to them. Identification of anomalies caused by sub-surface features is therefore more difficult or even not possible in the vicinity of surface and near-surface magnetic features.

1.6.4 The presence of made ground also has a detrimental effect on the magnetic data quality as this usually contains magnetic material in the form of metallic scrap and brick. Identification of features beneath made ground is still possible if the target feature is reasonably large and has a strong magnetic response but smaller features or magnetically weak features are unlikely to be identified.

1.6.5 It should be noted that anomalies that are interpreted as modern in origin may be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

1.6.6 A magnetic survey does not directly locate sub-surface features - it identifies variations or anomalies in the local magnetic field caused by features. It can be possible to interpret the cause of anomalies based on the size, shape and strength of response but it should be recognised that a magnetic survey produces a plan of magnetic variations and not a plan of all sub-surface features. Interpretation of the anomalies is often subjective and it is rarely possible to identify the cause of all magnetic anomalies. Geological or pedological (soil) variations or features can produce responses similar to those caused by man-made (anthropogenic) features.

1.6.7 Anomalies identified by a magnetic survey are located in plan. It is not usually possible to obtain reliable depth information on the features that cause the anomalies.

1.6.8 Not all features will produce a measurable magnetic response and the effectiveness of a magnetic survey is also dependant on the site-specific conditions. It is not possible to guarantee that a magnetic survey will identify all sub-surface features. A magnetic survey is often most-effective at identifying sub-surface features when used in conjunction with other complementary geophysical techniques.