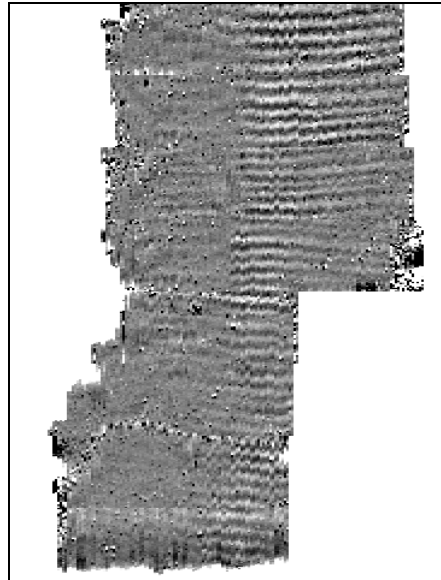


A Geophysical Survey of Land North of Bill Crane Way, Lutterworth, Leicestershire



Field 3 showing Ridge & Furrow

Archaeological Research Services Ltd

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Archaeological Research Services Ltd Report

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Executive Summary

Archaeological Research Services Ltd were commissioned by CgMs Consulting to undertake a geophysical survey on Land North of Bill Crane Way, Lutterworth, Leicestershire

This geophysical survey identified a number of features with the field system. A former field boundary was discovered, as well as a linear feature of magnetic disturbance. The linear feature may be associated with drainage or a service pipe, but these uses cannot be confirmed. Three amorphous possible cut features were also identified that may be associated with former field boundaries or could be geological in origin.

Discrete bipolar anomalies are evident throughout the survey area. These anomalies are likely to represent buried ferrous objects.

1. Introduction

1.1. Scope of work

- 1.1.1. This geophysical survey report has been prepared by Archaeological Research Services Ltd. The objective of the survey was to identify any anomalies of a possible archaeological origin within the survey area.
- 1.1.2. The geophysical survey has been carried out in accordance with government guidance on planning for the historic environment (PPS 5) and with the guidelines outlined in ‘Geophysical Survey in Archaeological Field Evaluation’ (English Heritage 2008).
- 1.1.3. The survey was undertaken by Ben Johnson and Kate Mapplethorpe of Archaeological Research Services Ltd over four days from the 7th December 2010. Weather conditions during the survey were extremely cold, with frozen ground and occasional cloud cover.

1.2. Location and topography

- 1.2.1. The survey area is centred at NGR SP 54273 86056 and is approximately 7.5ha in extent (see Figures 1 and 2).
- 1.2.2. The study site comprised of three fields, one of which is arable (Field 1) and two of which were under pasture (Fields 2 and 3). The site is bounded to the south by Bill Crane Way and to the east by Leicester Road. A stream, running north – south, bounded the site to the west.
- 1.2.3. The location of the survey grid together with referencing information has been plotted in Figure 2.
- 1.2.4. The solid geology of the site is Lias Group – Mudstone with Siltstone, Limestone and Sandstone. The superficial geology is Sand and Gravel (British Geological Survey 1:625000, V5 Bedrock and V4 Superficial).

2. METHODOLOGY

2.1. Survey Technique

- 2.1.1 Detailed gradiometry was deemed the most suitable technique for this survey. It is an efficient and effective method of locating anomalies of an archaeological origin. It is particularly useful for identifying cut features such as pits and ditches.

2.2. Basic Gradiometry Principle

- 2.2.1 This survey technique relies on measuring small differences in the magnetic properties of the soil that may be associated with archaeological deposits. Activities such as digging and backfilling of a pit or a ditch and the presence of thermoremanent features such as kilns or hearths produce distortions in the earth’s magnetic field. These anomalies can be identified and recorded using a gradiometer.

2.2.2 The fluxgate gradiometer measures the relative difference between the magnitude of the vertical component of the local field measured by two sensors positioned one above the other (English Heritage 2008).

2.2.3 By mapping these anomalies detailed plans of sites can be obtained. Where anomalies have characteristic shapes or values interpretations may be attributed to them. Further investigation is often required in order to ascertain detailed information on the origin of these anomalies.

2.3 Grid Locations and Referencing

2.3.1 A series of 30m x 30m grids was set up across the survey area using a Leica TCR 307 (TPS 300 Series) Total Station Theodolite. The location of these grids was referenced using topographical features around the site such as fences and field boundaries. The location and referencing of the survey grids can be seen in Figure 2.

2.4 Survey Equipment Specifications

2.4.1 This survey was undertaken using a Bartington Grad 601-2 Gradiometer, manufactured by Bartington Instruments Ltd. The parameters set for this instrument were as follows:

Grid Size:	30m x 30m
Start:	East
Pattern:	Zigzag
Lines/m:	1
Samples/m	4
Range	100nT
Audio:	On
Volume:	Low
Threshold:	1nT
Sensors:	2
Reject:	50Hz

2.4.2 The Bartington Grad 601-2 has a maximum depth of scan of around 0.5m-1.0m. However strongly magnetic features may be recorded at a greater depth.

2.4.3 With a range setting of ± 100 nanoTeslas (nT), values are recorded with a resolution of 0.01nT. However, due to the internal noise of the instrument, the actual resolution achieved is approximately 0.03nT. When used with a range setting of ± 1000 nT, values are recorded with a resolution of 0.1nT. For this survey the instrument had a range setting of 100nT.

2.4.4 Data was collected along traverses 1m apart and readings were taken at 0.25m intervals. Therefore each complete 30m x 30m survey grid contains 3600 readings.

2.4.5 Data is collected consecutively at a fixed rate and is automatically saved to the data logger at the end of each traverse and grid. The data is downloaded daily and a copy is made to a memory stick. On the completion of a survey the data is copied to a server at ARS Ltd.

2.4. Data Processing

2.4.1 Processing is undertaken using specialist software called *Geoplot 3.00v* manufactured by *Geoscan Research Ltd.* Through this software it is possible to mitigate for ‘artefacts’ introduced into the data during data collection and employ image processing methods to enhance features of interest. It is also possible to apply processes that use mathematical descriptions of the measurements to infer information about causative features.

2.4.2 The following processes have been carried out on the gradiometer data in this report:

- **Despiking:**
This function can be used to automatically locate and remove “iron spikes” often evident in gradiometer data. It operates over the whole of the data set.
 - *Geoplot Settings*
X Radius: 1
Y Radius: 1
Threshold: 3 Std Dev.
Spike Replacement: Mean
- **Zero Mean Traverse:**
This function sets the mean background of each traverse within a grid to zero. It is particularly useful for removing the striping effects that can sometimes occur in gradiometer data.
 - *Geoplot Settings*
Least Mean Square Fit: Off
- **Interpolate:**
This function gives a smoother appearance to the data and can improve the visibility of larger, weak archaeological features.
 - *Geoplot Settings*
Direction: X then Y
Mode: Expand
Expand Method: Linear

2.5. Data Presentation

2.5.1 Raw (or minimally processed) data collected during the survey is presented in greyscale format and a colour scale plot is provided to highlight extreme values within the data set (see Figures 3 and 4).

2.5.2 Processed data is also presented in greyscale format and can be seen in Figure 5.

2.5.3 An interpretation of anomalies can be seen on the ‘Abstraction and Interpretation of Anomalies’ plot (see Figure 6).

3. RESULTS

- 3.1. The gradiometer survey undertaken on Land North of Bill Crane Way, Lutterworth, Leicestershire has identified some features of a possible archaeological origin.

Field 1

- 3.1.1. Field 1 shows what may be the ploughed out continuation of the ridge and furrow seen in Field 3 although they may be associated with modern arable cultivation. There are three possible cut features, one centrally in the field, one to the east, and another to the south east. Given the amorphous and diffuse shapes of these features a definitive purpose for them cannot be determined. They may be associated with former field boundaries or could be geological in origin.

Field 2

- 3.1.2. Field 2 showed only modern plough markings.

Field 3

- 3.1.3. Field 3 showed firm evidence of ridge and furrow activity, running east – west on the site. A former field boundary, in the centre of the field, can be seen, as well as a probably related, small cut feature immediately to its south. In the south of the site a linear area of magnetic disturbance runs in an arc from east to west from the fence boundary to the stream. The linear feature may be associated with drainage or a service pipe, but these uses cannot be confirmed.
- 3.1.4. Discrete bipolar anomalies are evident throughout the survey area. These anomalies are likely to represent buried ferrous objects.

3. CONCLUSION

- 4.1. This geophysical survey identified a number of features within the field system. A former field boundary was discovered, as well as a linear feature of magnetic disturbance. The linear feature may be associated with drainage or a service pipe, but these uses cannot be confirmed. Three amorphous cut features were also identified that may be associated with former field boundaries or could be geological in origin.

4. PUBLICITY, CONFIDENTIALITY AND COPYRIGHT

- 4.1. Any publicity will be handled by the client.
- 4.2. Archaeological Research Services Ltd will retain the copyright of all documentary and photographic material under the Copyright, Designs and Patent Act (1988).

5. STATEMENT OF INDEMNITY

- 5.1. All statements and opinions contained within this report arising from the works undertaken are offered in good faith and compiled according to professional standards. No responsibility can be accepted by the author/s of the report for

any errors of fact or opinion resulting from data supplied by any third party, or for loss or other consequence arising from decisions or actions made upon the basis of facts or opinions expressed in any such report(s), howsoever such facts and opinions may have been derived.

6. ACKNOWLEDGEMENTS

- 6.1. Archaeological Research Services Ltd would like to thank Simon Mortimer of CgMs Consulting. Thanks are also expressed to Mr & Mrs Tivey for facilitating our work.

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Bartington Instruments. *OM1800 Operation Manual for Grad 601 Magnetic Gradiometer.*

English Heritage (2008) *Geophysical Survey in Archaeological Field Evaluation.*

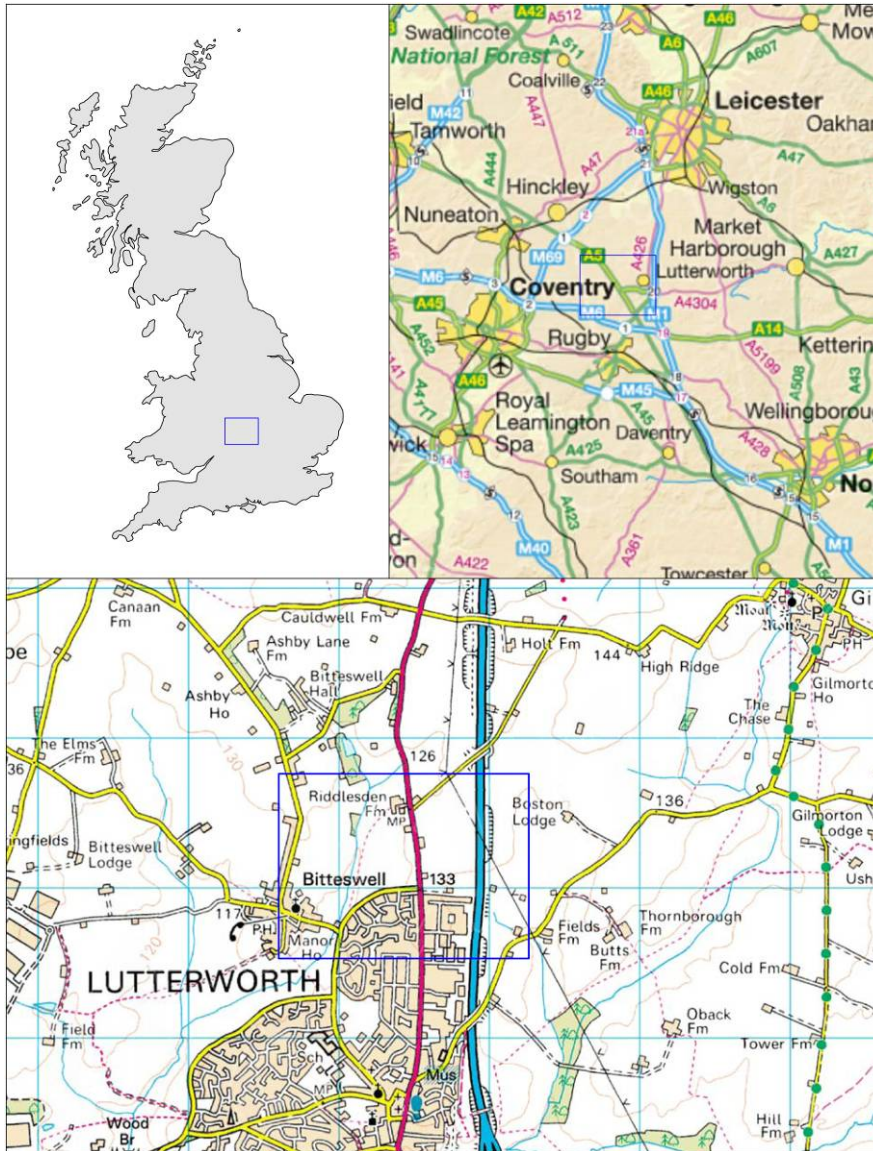


Figure 1. Location of Site
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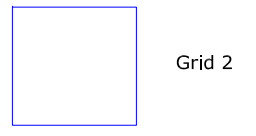
Figure 2. Reference Grid Area

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Key:



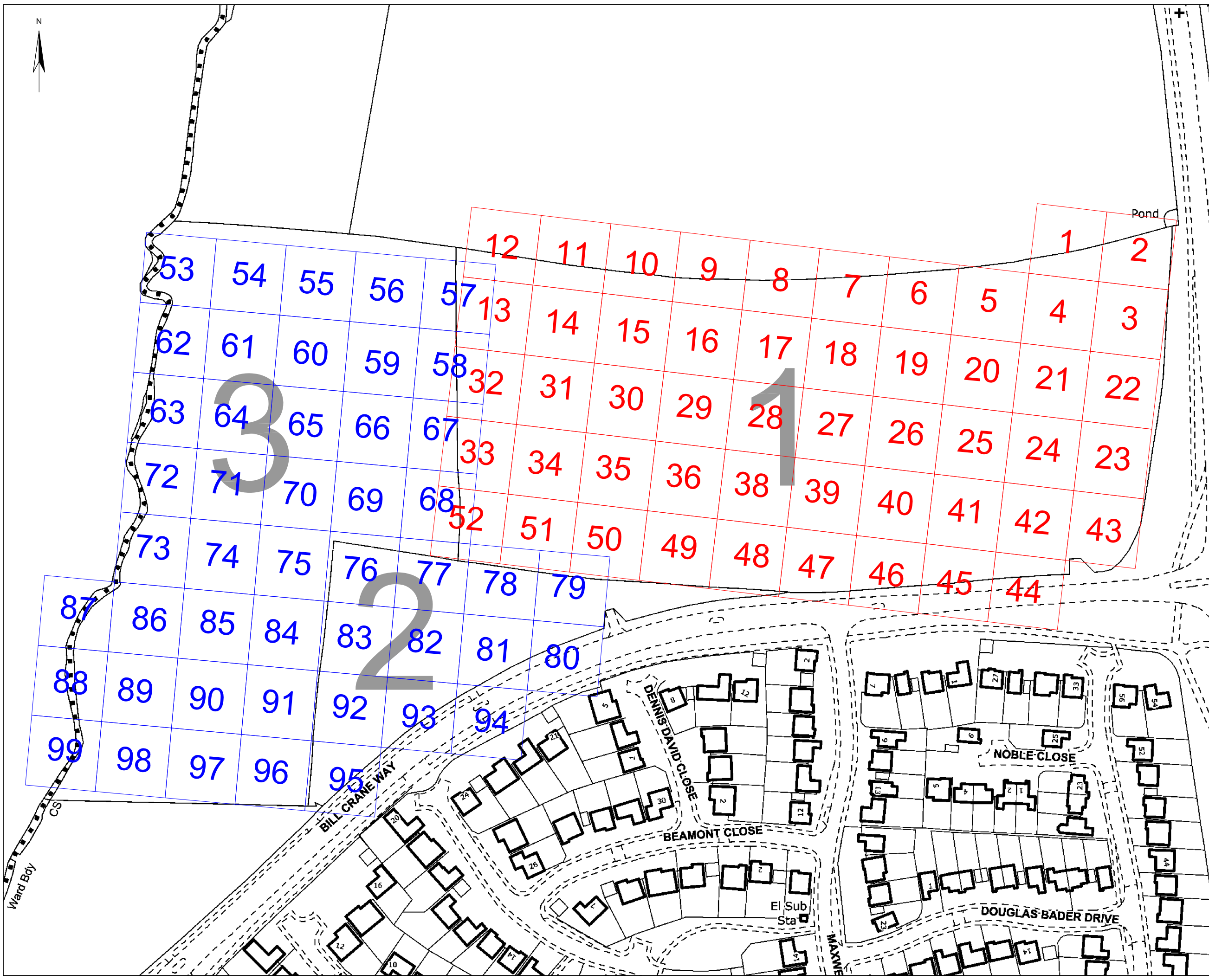
Grid 1



Grid 2

1

Field Number



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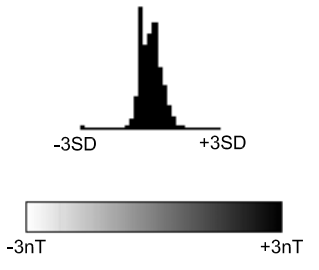
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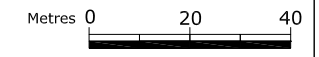
Figure 3. Raw Gradiometer Data

Scale = 1:1500 @ A3

Key:



Plotting Parameters:
 Maximum: +3nT Black
 Minimum: -3 nT White



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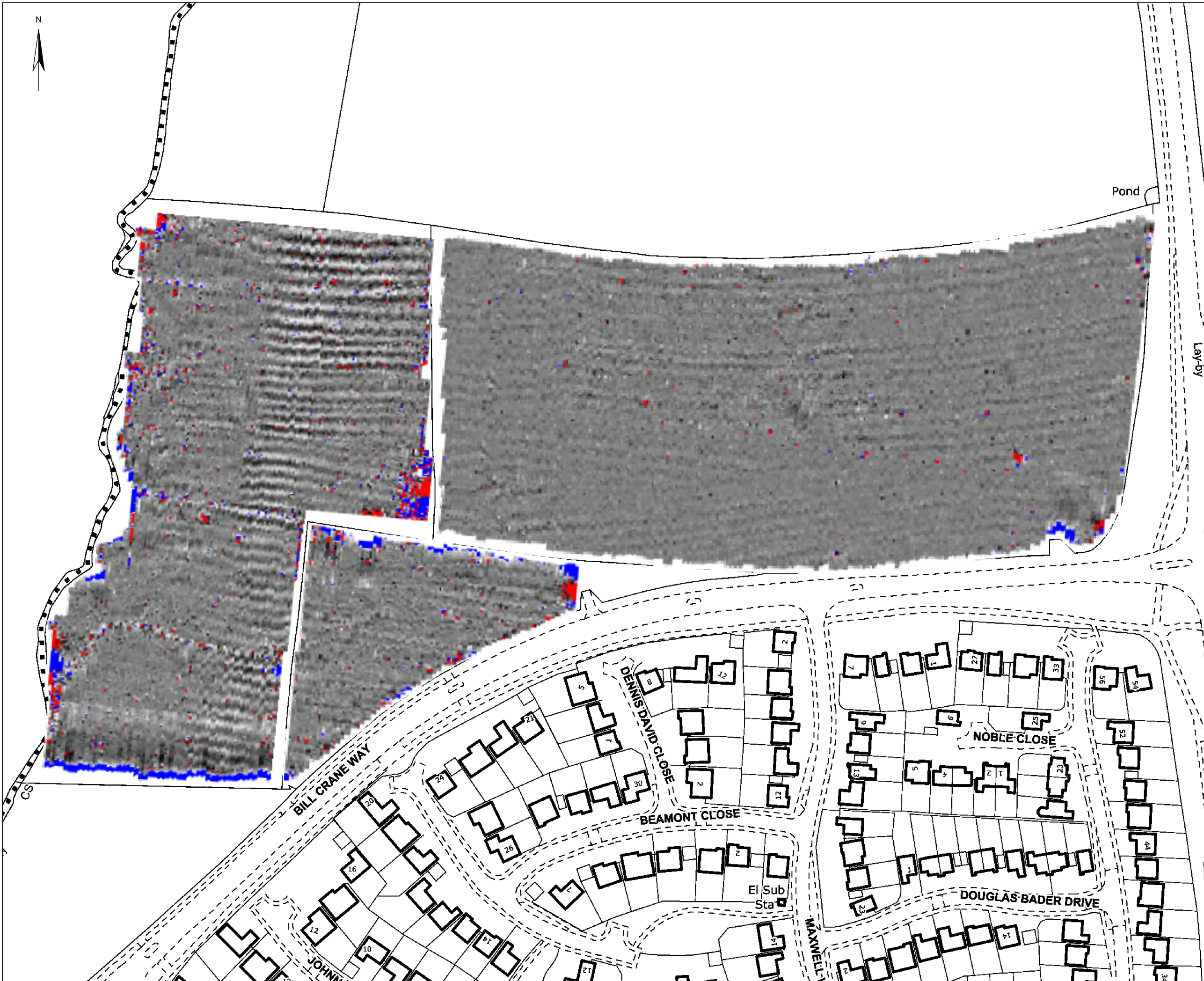
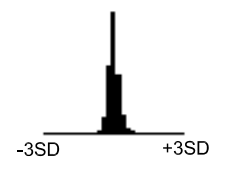


Figure 4. Processed Gradiometer Data

Scale = 1:1500 @ A3

Key:



Plotting Parameters:
 Maximum: +3nT Red
 Minimum: -3 nT Blue

Notes:

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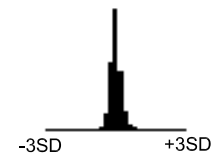
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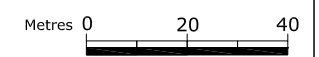
Figure 5. Processed Gradiometer Data

Scale = 1:1500 @ A3

Key:



Plotting Parameters:
Maximum: +3nT Black
Minimum: -3 nT White



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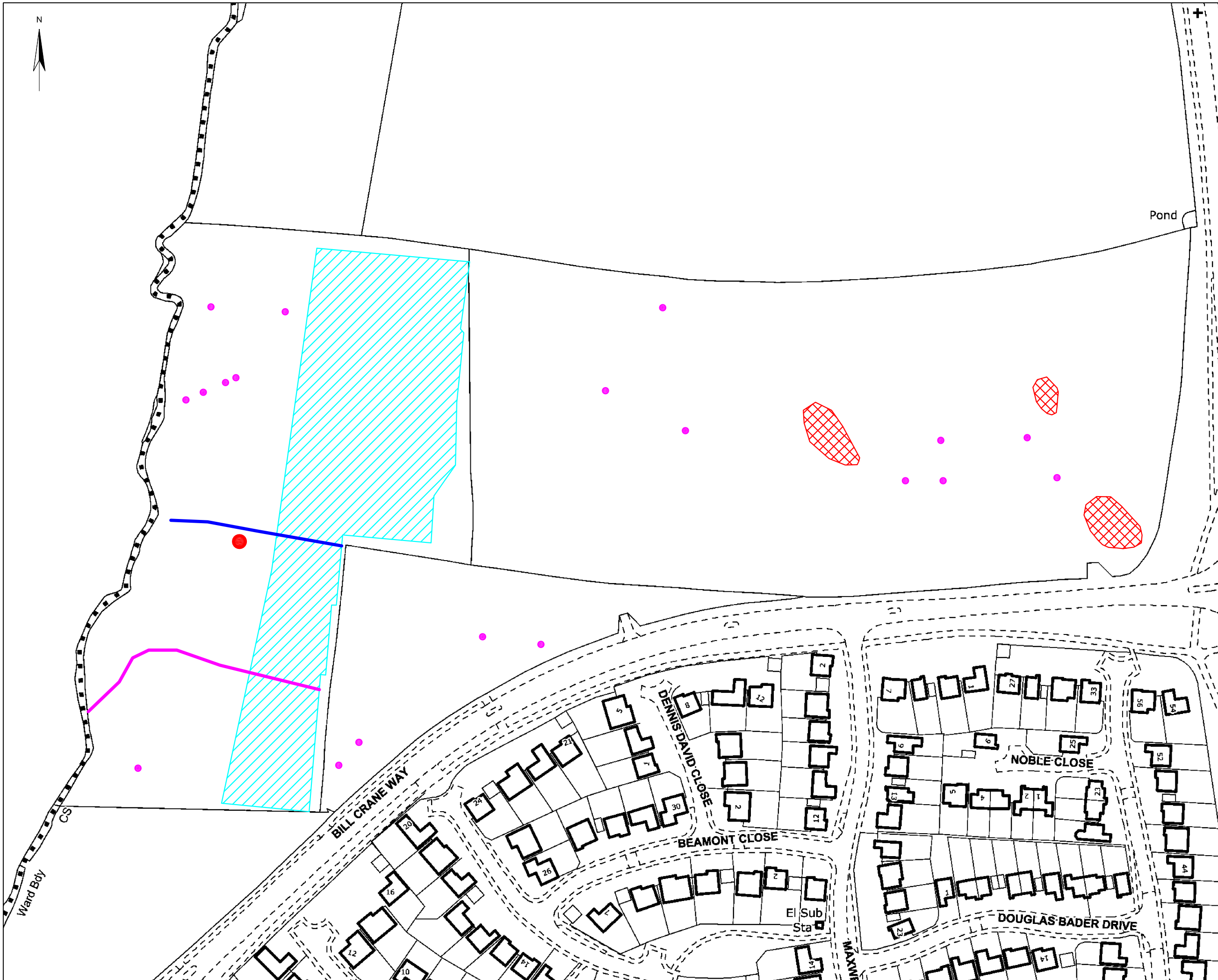


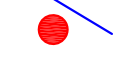


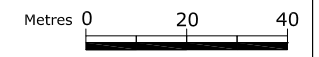


Figure 6. Interpretation
 Scale = 1:1500 @ A3

Key:

-  Amorphous cut feature
-  Linear area of magnetic disturbance
-  Former field boundary and possible associated feature
-  Area of ridge and furrow
-  Bi-polar anomaly



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