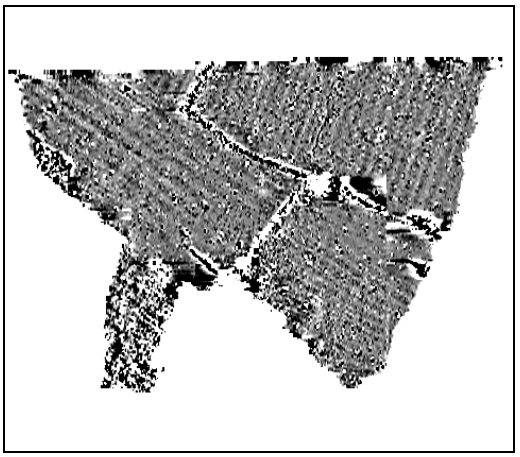
A Geophysical Survey of Gresty Green, Crewe



Field 1 Showing ridge and furrow

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Compiled By:
Archaeological Research Services Ltd
Baltic Business Centre
Saltmeadows Road
Gateshead
NE8 3DA

Checked By:
Ben Johnson and Jim
Tel: 0161 9762544
Fax: 01629 814657
admin@archaeologicalresearchservices.com
www.archaeologicalresearchservices.com

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Archaeological Research Services Ltd Report

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Executive Summary

Archaeological Research Services Ltd were commissioned by CgMs to undertake a geophysical survey of Gresty Green, Crewe.

This geophysical survey identified a number of features within the field system. The fields have clearly been utilised for agriculture in the medieval or post-medieval period, with ridge and furrow present in both fields. Former field boundaries were discovered, as well as a large area of magnetic disturbance. The area of disturbance may be associated with the nearby housing, or previous modern groundwork on the site, but this cannot be confirmed other than by invasive investigation. The amorphous cut features identified may be associated with former field boundaries or could be geological in origin.

A substantial number of 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 Archaeological Research Services Ltd (ARS 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 Kate Mapplethorpe and Brian Marshall of ARS Ltd over three days from the 14th December 2010. Weather conditions during the survey were a mixture of dry spells and snow.

1.2. Location and topography

1.2.1. The survey area is centred at NGR SJ 70769 53400 and is approximately 5ha in extent (see Figures 1 and 2).

1.2.2. The study site comprises two areas, which are currently used as grazing fields. The site is bounded to the north by railway track and sidings. The east is bounded by Crewe Road. The south and west are bounded by housing. Separating the two fields is a fence/ tree boundary. Field 2 has a large marshy area. Other obstacles in Field 2 include metal poles possibly associated with past fencing/boundaries.

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 Triassic rocks (undifferentiated) – mudstone with subordinate sandstone and siltstone. The superficial geology is diamicton till (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:	North
Pattern:	Zigzag
Lines/m:	1
Samples/m	4
Range	100nT
Audio:	On
Volume:	High
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 ±1000nT, 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.

2.5. Data Processing

2.5.1. 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.

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

- Despike:
  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

2.6. Data Presentation

2.6.1. 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).

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

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

3. RESULTS

3.1 Great deals of discrete bipolar anomalies are evident throughout the survey area. These anomalies are likely to represent buried ferrous objects.

Field 1

3.2. Field 1 shows high levels of magnetic disturbance to the south-west boundary, and particularly in the small 'dog leg' part of the field to the south. There are two possible causes for this disturbance. The high level of readings could be related to underground power cabling for the houses which bound this area of the site. Another possibility is, given the large quantities of bipolar anomalies already mentioned, this part of the field could have been disturbed previously and its levels raised with back fill, most probably when the majority of housing was constructed. This process would also account for the bipolar anomalies in the rest of Fields 1 and 2, having been deposited and then ploughed into the soil.

3.2.1. A former field boundary is present in the centre of the field, running north-west to south-east, with a further branch running south. Two amorphous cut features showing high positive readings, at the eastern extent of this boundary, are likely areas of disturbance associated with this boundary. Ridge and furrow is evident in this field, the majority of which runs north-west to south-east, although an area to the north, encapsulated by the former field boundary, runs from north to south. Also within this encapsulated area is a feint line of bipolar anomalies running north south, possibly the result of another, older field boundary.

Field 2

3.3. A large area of Field 2, covered by marshy ground, had to be excluded from this survey, due to ground and weather conditions. The area of high levels of magnetic disturbance seen in Field 1 continues in this field at its south-west extent. Two former field boundaries are evident running north to south, one just to the west of the marsh area, and one to the south running up through the marsh. There are also amorphous cut features in the areas of these boundaries which are likely to be associated with the potential field boundaries. Ridge and furrow is present in this field and runs north to south.

4. CONCLUSION

4.1. This geophysical survey identified a number of features within the field system. The fields have clearly been utilised for agriculture in the medieval or post-medieval period, with ridge and furrow present in both fields. Former field boundaries were discovered, as well as a large area of magnetic disturbance. The area of disturbance may be associated with the nearby housing, or previous modern groundwork on the site, but this cannot be confirmed other than by invasive investigation. The amorphous cut features identified may be associated with former field boundaries or could be geological in origin.

5. PUBLICITY, CONFIDENTIALITY AND COPYRIGHT

5.1. Any publicity will be handled by the client.

5.2. Archaeological Research Services Ltd will retain the copyright of all documentary and photographic material under the Copyright, Designs and Patent Act (1988).

6. STATEMENT OF INDEMNITY

6.1. 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.

7. ACKNOWLEDGEMENTS

7.1. Archaeological Research Services Ltd would like to thank Paul Gajos of CgMs Consulting.

3. REFERENCES

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

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

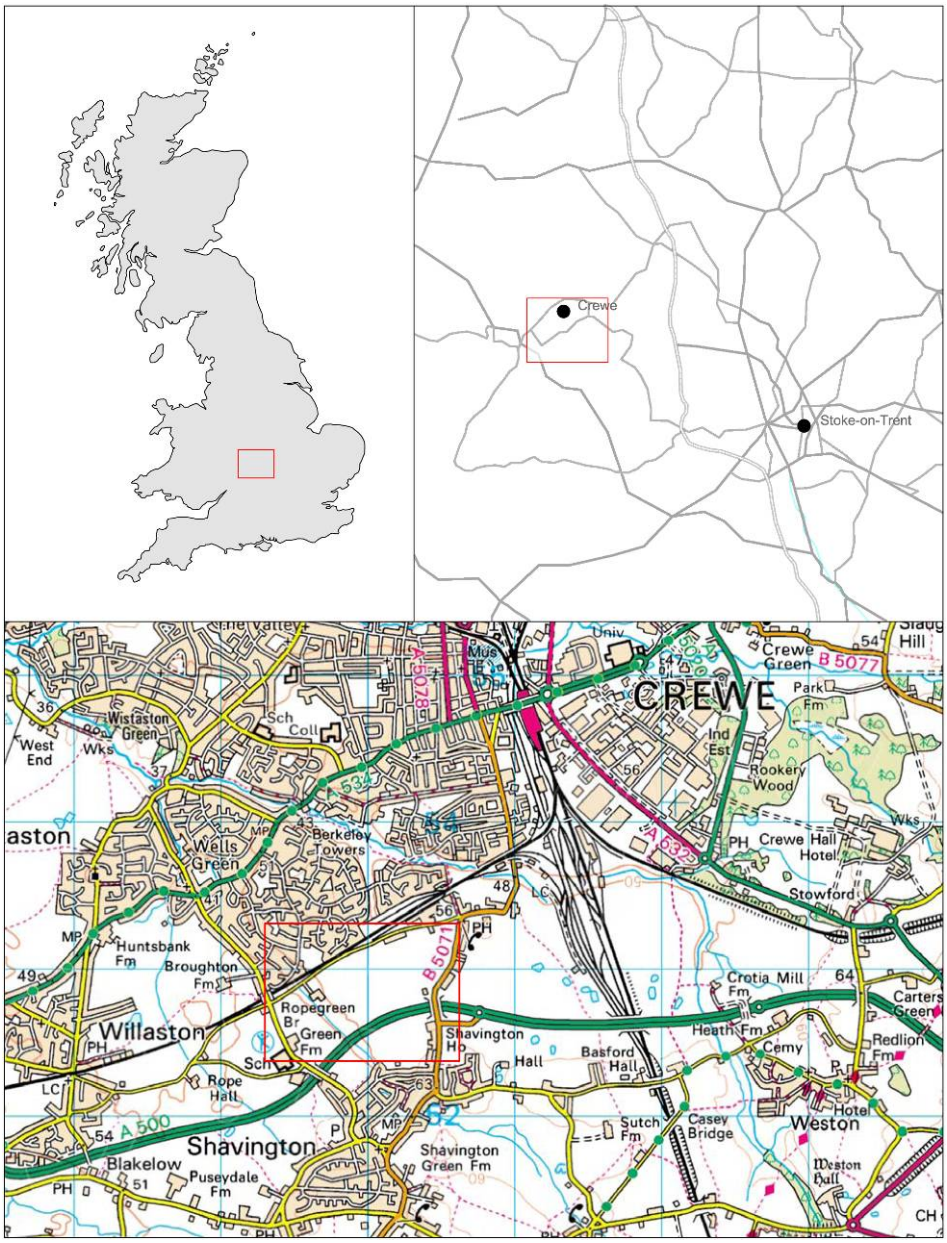

Figure 1. Location of Site
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Figure 2. Reference Grid Area

Scale = 1:1500 @ A3

Key:

Grid 1

Grid 2

1 Field Number

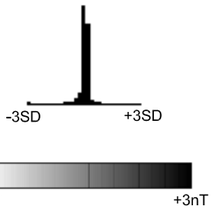
Metres 0 20 40

Notes:

Figure 3. Raw Gradiometer Data

Scale = 1:1500 @ A3

Key:



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

Metres 0 20 40

Notes:

Figure 4. Processed Gradiometer Data Extremes

Scale = 1:1500 @ A3

Key:

-3SD +3SD

-3nT +3nT

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

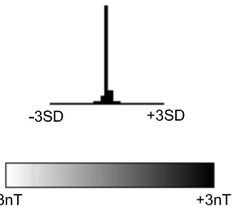
Metres 0 20 40

Notes:

Figure 5. Processed Gradiometer Data

Scale = 1:1500 @ A3

Key:



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

Metres 0 20 40

Notes:

Figure 6. Interpretation

Scale = 1:1500 @ A3

Key:

- Area of magnetic disturbance
- Former field boundary
- Area of ridge and furrow
- Bi-polar anomaly
- Amorphous cut feature
- Possible older boundary

Metres 0 20 40

Notes: