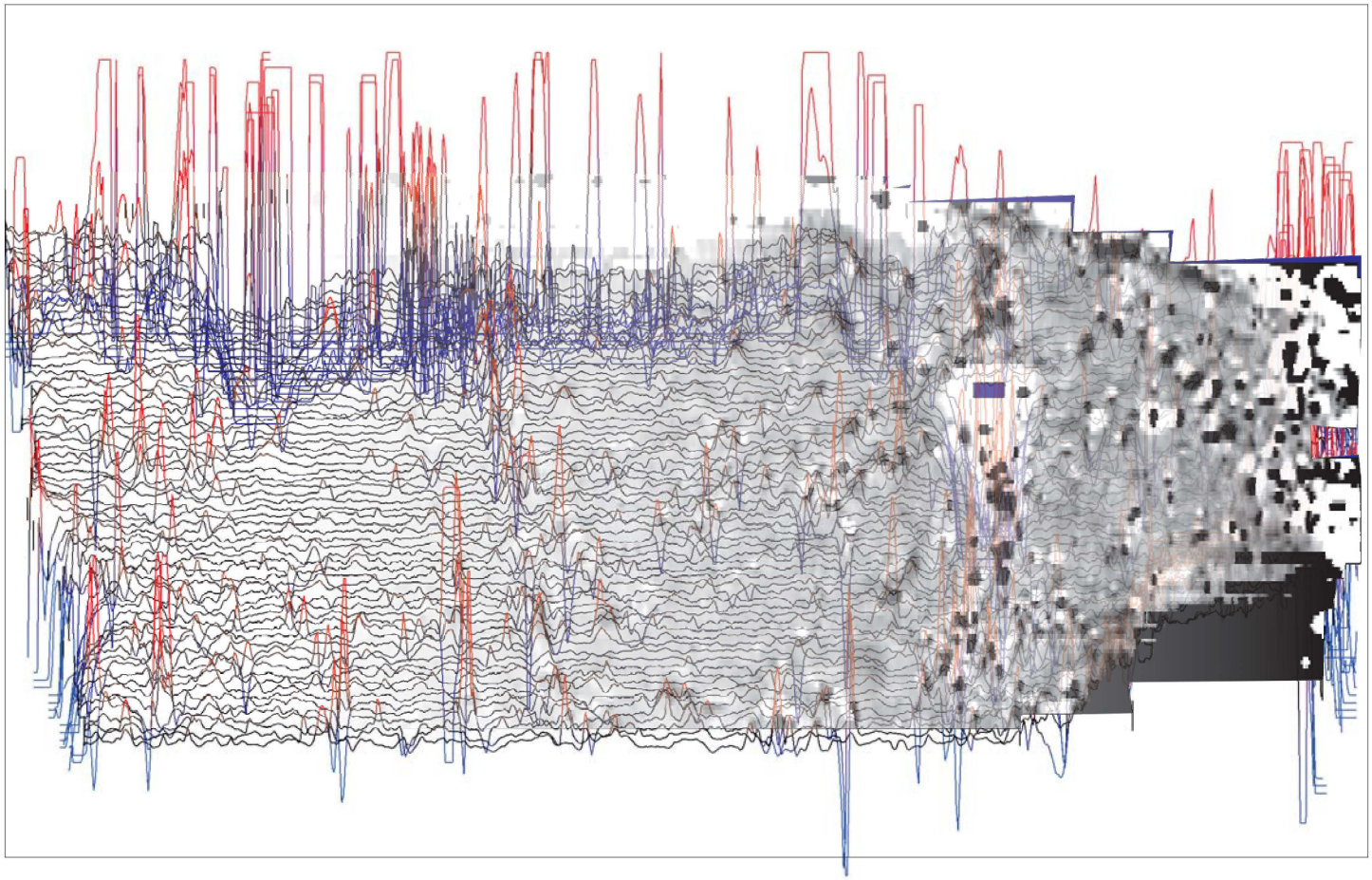
Wessex Archaeology

Dove Dairy, Stonewell Lane, Hartington, Derbyshire

Detailed Gradiometer Survey



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August 2011

DOVE DAIRY, STONEWELL LANE, HARTINGTON

DERBYSHIRE

Detailed Gradiometer Survey Report

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QUALITY ASSURANCE

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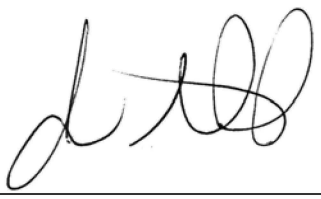
01	E	RDL	APN		02/08/11	
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I= Internal Draft E= External Draft F= Final

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Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land at Dove Dairy, Stonewell Lane, Hartington, Derbyshire, approximately centred on NGR 412561 360457. The project was commissioned by the Cathelco Group to assess the archaeological potential of this area, in support of a planning application for the proposed development of the former Dove Dairy site.

The site lies within an area of medieval/post-medieval ridge and furrow on the outskirts of the medieval settlement of Hartington, and is also the site of the original 19th century Hartington Dairy. The geophysical survey covered 1.69ha and has demonstrated the presence of archaeological features across the site, along with anomalies of probable and possible archaeological interest.

A former field boundary, which is present on 19th century OS mapping, shows up clearly in the dataset, along with numerous other discrete anomalies of probable archaeological origin. A number of smaller discrete anomalies appear throughout the dataset. Most of these appear to be geological in form but some may prove to be archaeological.

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Acknowledgements

The detailed gradiometer survey was commissioned by the Cathelco Group. The assistance of Sarah Whiteley of the Peak District National Park Authority, Teifion Salisbury of Cathelco and Andrea Caplan of Brooke-Smith Planning is gratefully acknowledged.

The fieldwork was directed by Chris Sykes and assisted by Mike Hartwell. Ben Urmston processed the geophysical data, Ben Urmston and Ross Lefort interpreted the data and Ross Lefort wrote this report. Illustrations were prepared by Linda Coleman. The project was managed on behalf of Wessex Archaeology by Andrew Norton.

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Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project Background

1.1.1 Wessex Archaeology was commissioned by the Cathelco Group to carry out a geophysical survey of land at Dove Dairy, Hartington, Derbyshire, hereafter 'the Site'. The project was commissioned to assess the archaeological potential of this area in support of a planning application for the proposed development of the former Dove Dairy site. The Site is approximately centred on National Grid Reference (NGR) 412561 360457, and comprises three separate survey areas surrounding the dairy.

1.1.2 The site lies within an area of medieval/post-medieval ridge and furrow on the outskirts of the medieval settlement of Hartington, and is also the site of the original 19th century Hartington Dairy (ARS 2010). Sarah Whiteley, archaeologist for the Peak District National Park Authority (PDNPA) requested that a programme of geophysical survey be carried out prior to the planning application. Wessex Archaeology produced a Writtne Scheme of Investigation (WSI; Wessex Archaeology 2011), detailing how the survey would be carried out.

1.1.3 The aim of the project was to establish the presence/absence, extent and character of detectable archaeological remains within the survey areas.

1.1.4 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

1.2 Survey Areas

1.2.1 The Site consisted of three survey areas approximately 20km south-east of Buxton, Derbyshire (**Figure 1**). The current land use is largely for pasture. The total survey area covered was 1.69ha.

1.2.2 The Site occupies a gentle southwest-facing slope on the west side of Hartington. The land slopes gently downwards from 230m above Ordnance Datum (aOD) at the eastern side of the survey area to 220m aOD beyond the western end of the survey area.

1.2.3 The soils underlying the Site are most likely stagnohumic gley soils that are waterlogged seasonally (SSEW 1975). Soils in such geological settings have been shown to produce magnetic contrasts suitable for the detection of archaeological remains through survey with the Bartington Grad 601-2 gradiometer.

2 METHODOLOGY

2.1 Introduction

2.1.1 The work consisted of detailed gradiometer survey conducted using Bartington Grad 601-2 dual gradiometer systems. The survey was conducted in accordance with English Heritage guidelines *Geophysical Survey in Archaeological Field Evaluation* (2008).

2.1.2 The geophysical survey was conducted by Wessex Archaeology's in-house geophysics team on 18th July 2011. Ground conditions for survey were moderate, with much of the survey area under pasture with occasional rain showers during the day.

2.2 Method

2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS system, which is precise to within 0.05m and therefore exceeds English Heritage recommendations.

2.2.2 The detailed gradiometer survey was conducted using Bartington Grad 601-2 gradiometer systems over 30m x 30m grids with a sample interval of 0.25m along transects spaced 1m apart. This results in 3600 logged values per grid. Data were collected in the zigzag manner.

2.2.3 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse function (±10nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey areas, with no further data filtering or interpolation. The data were clipped at -2 to 3 nT for the greyscale image and -25 to 25 nT for the XY trace plots.

2.2.4 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

3 RESULTS AND INTERPRETATION

3.1 Introduction

3.1.1 The geophysical survey identified a number of anomalies of definite and possible archaeological origin. Results are presented as a series of greyscale, XY trace plots and interpretation diagrams over the Site at a scale of 1:1250 (**Figures 2** to **4**).

3.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, relict field boundaries, ploughing trends, ferrous/burnt or fired objects, and areas of general increased magnetic response. Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.

3.1.3 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

3.2 Detailed Survey Results and Interpretation

3.2.1 The northern survey area measures 0.29ha in area and is dominated on the western side by ferrous responses from the modern dairy. Next to this disturbance are a number of positive and negative linear features aligned roughly north-south (**4000**). They are aligned with the field boundaries and are parallel to one another so have been interpreted as ploughing trends. There are a number of small oval and circular shaped positive anomalies spread in varying concentrations throughout this area. Most are concentrated to the north around **4000**, there are no obvious patterns in the distribution of these anomalies and they have been termed possible archaeology. These anomalies may represent archaeological features such as pits and post holes, but could potentially be natural features with a magnetically enhanced fill. The area around **4001** features a number of small ferrous anomalies. These anomalies can easily mask archaeological remains so the lower concentration of possible archaeological remains may be in part related to this.

3.2.2 The second survey area lies to the west of the proposed development, and measures 0.18ha and is again dominated by a large ferrous shadow in the north-eastern corner. This shadow is created by the present dairy complex and the nearby road. There are a number of smaller ferrous anomalies present in this area. These are likely to be modern originating from agricultural activity. There are a number of faint positive trends running through this area (**4002**). Most are linear with the exception of one curved example and are at different alignments from one another. Some are aligned NNW-SSE, parallel to the field boundaries. There isn't a clear enough pattern to say that these are ploughing trends and the others at different alignments are even less likely to be related to ploughing. These anomalies may be of archaeological interest.

3.2.3 There are a number of small circular and oval shaped positive anomalies like those discussed ion the first survey area, and these are interpreted as possible archaeological features. To the west of the ferrous shadow in the north-eastern corner are some larger elongated anomalies, tagged as possible archaeology. These anomalies may indicate larger features of possible archaeological interest in this area but could be a closely spaced cluster of small features.

3.2.4 The central area is the largest of the three areas measuring 1.22ha in area. There are three linear features of probable archaeological interest in this area. One is aligned NNW-SSE (**4004**), another N-S (west of **4005**) and the last is aligned ENE-SWS (north of **4005**). These anomalies are positive with ferrous responses defining the anomalies at certain points. The N-S anomaly has been identified using old edition OS maps as a field boundary that was removed after 1899 (OS 1899). The ENE-SWS anomaly is likely part of this earlier phase of field boundary too. The linear anomaly aligned NNW-SSE could again be an old field boundary but it could not be located on the OS maps consulted. The earliest map consulted dated to 1880 (1:2500 Staffordshire). It should be noted that this anomaly may not relate to a field boundary and could be an archaeological feature.

3.2.5 A number of anomalies of possible archaeological interest have come to light. The most noteworthy example is T-shaped in appearance with positive magnetic values (**4003**). There is a fairly even distribution of small oval to circular shaped anomalies (**4008**). These all possess positive values and may be either small archaeological cut features, such as pits and post holes, or are natural in origin. Given the relatively even spread of these anomalies across the site there is a chance that most of these anomalies are natural. There are no obvious patterns of distribution aside from a linear arrangement marked with a trend close to **4006**. The linear alignment of this group may be coincidental as it is only made up of four anomalies.

3.2.6 A number of linear trends have been tagged. Some mark the relict field boundaries discussed above but others are located over isolated anomalies. A linear trend just south of **4007**, aligned ENE-WSW, runs through a short curving trend and joins up with the N-S relict field boundary at **4005**. Both the linear and curved trends have slightly positive values and are not thought to be related to each other. The linear may have some agricultural function given its relationship with a relict field boundary. Another linear trend is aligned NW-SE, east of **4006**, that also possesses positive magnetic values.

3.2.7 There are some irregular shaped rounded anomalies with diffuse edges and slightly positive magnetic readings (**4007**). These are not thought to be archaeological and are classed as geology.

3.2.8 There are a lot of ferrous anomalies running along the northern edge of this survey area (**4009**). This is likely to come from the road and possibly the field boundary. The east of this survey area has a heavy concentration of ferrous responses including a large one from a livestock feeder (south of **4005**). All of these responses are likely to be from modern installations and debris.

4 CONCLUSION

4.1.1 The detailed gradiometer survey has been successful in detecting anomalies of probable and possible archaeological potential within the study area, and can therefore be considered to have successfully fulfilled the aims as set out in the geophysical specification.

4.1.2 This geophysical survey has clearly demonstrated the presence of possible archaeological features throughout the survey area. Some of these could extend beyond the limits of the survey area, which was delimited by the size of the proposed development.

4.1.3 Of interest are the anomalies interpreted as former field boundaries which correspond in orientation and position to those on 19th century OS maps. They were systematically removed to create larger sized fields during the early and mid twentieth century.

4.1.4 A number of smaller features have been identified with interesting anomalies discovered such as the T-shaped anomaly at **4003** and the linear anomaly at **4004**.

4.1.5 Where dense concentrations of pit-like responses have been identified, it is possible that clusters of features may result in a single extended anomaly. It is also possible that the fill of archaeological features may not exhibit sufficient magnetic contrast from the surrounding natural layers to be resolved as an anomaly.

5 REFERENCES

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APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING

Survey Methods and Equipment

The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have a resolution of 0.1nT over a ±3000nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20m or 30m site grid, which is achieved using a Leica 1200 RTK GPS system and then extended using tapes. The Leica 1200 RTK GPS system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined to an accuracy of 1-2cm in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.

Scanning surveys consist of recording data at 0.25m intervals along transects spaced 10m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detail surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (English Heritage, 2008).

Post-Processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:

- Destripe – Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger – Shifting each traverse forward or backward by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data)

Typical displays of the data used during processing and analysis:

- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This image can include a hidden line algorithm to remove certain lines and enhance the image. This type of image is useful as it shows the full range and shape of individual anomalies.
- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

APPENDIX 2: GEOPHYSICAL INTERPRETATION

The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.

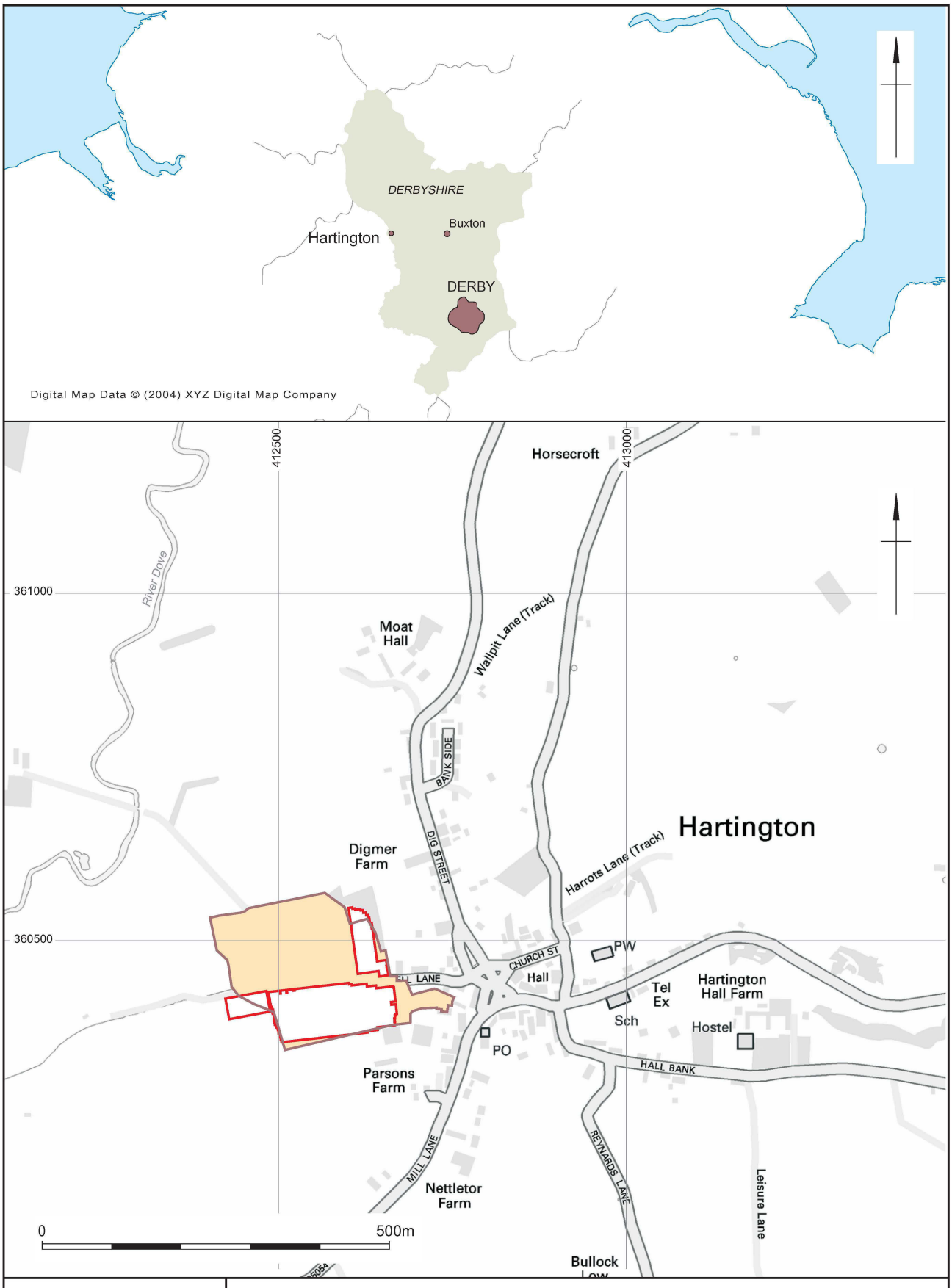
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Probable archaeology – used for features which give a clear response but which form incomplete patterns.
- Possible archaeology – used for features which give a response but which form no discernable pattern or trend.

The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Increased magnetic response – used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend – used for low amplitude or indistinct linear anomalies.
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.

Finally, services such as water pipes are marked where they have been identified.



Site boundary

Survey area

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Site location

Figure 1

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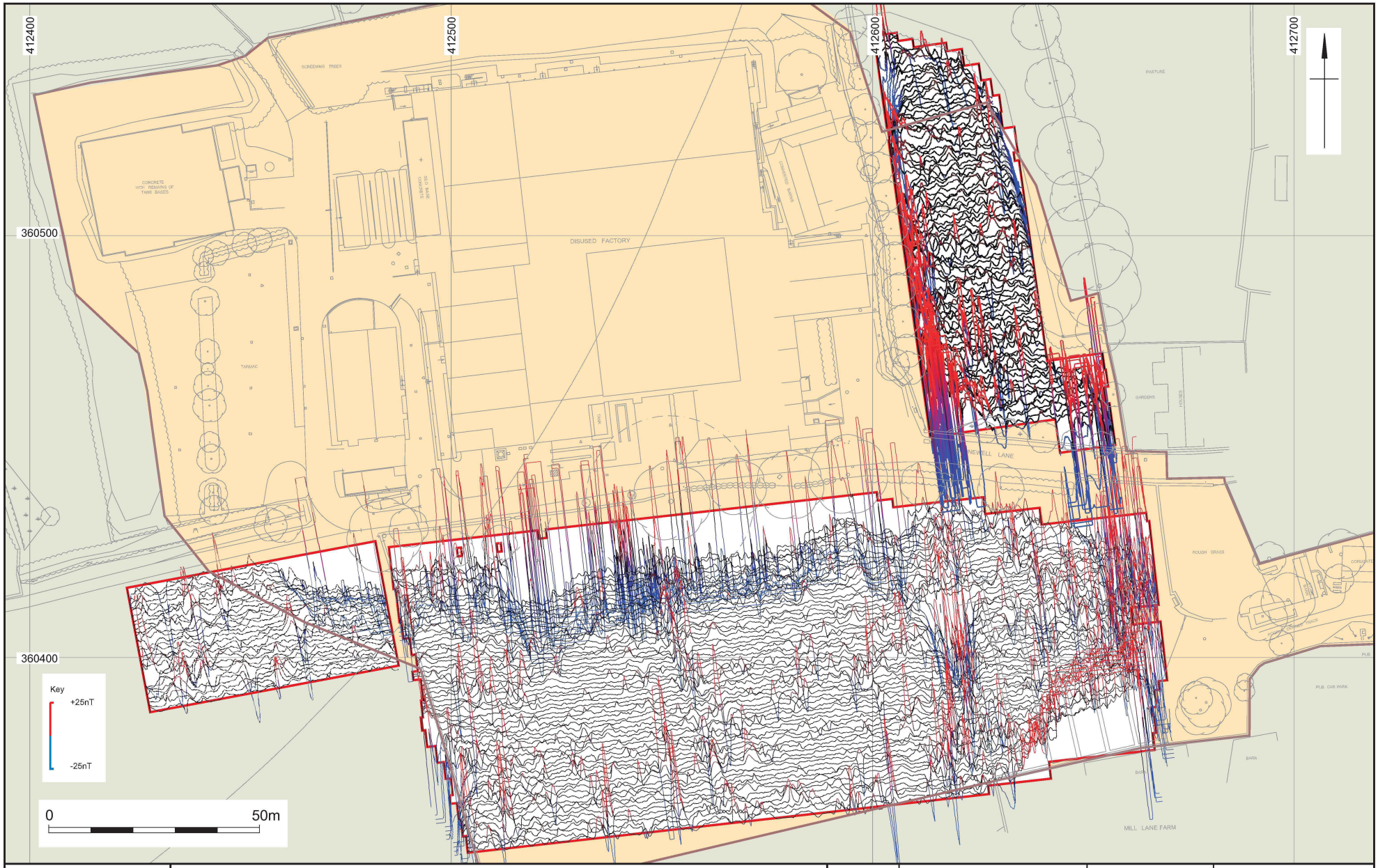
Detailed survey area showing greyscale plot image.

Figure 2



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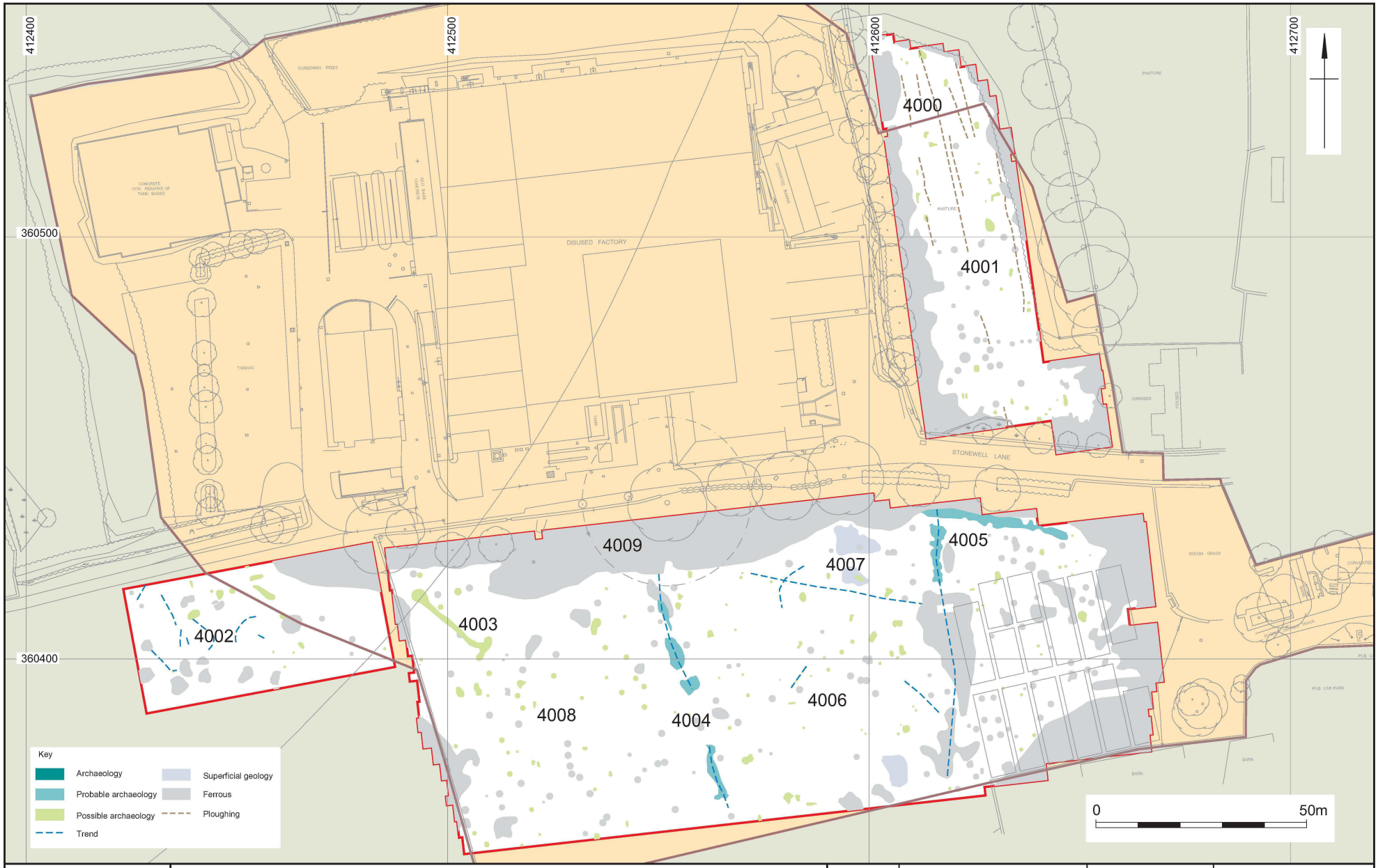
Detailed survey area showing XY trace image.

Figure 3



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Detailed survey area showing interpretation

Figure 4

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