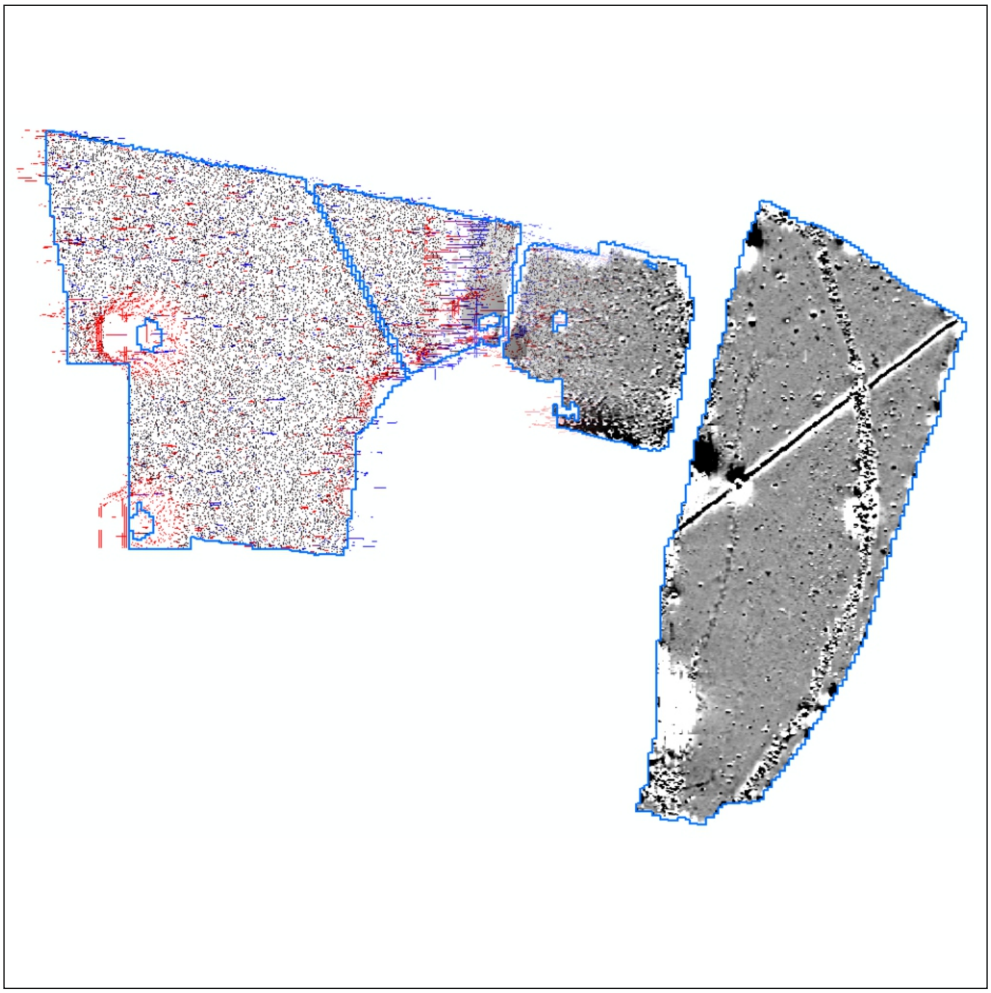
making sense of heritage

Parchfields Solar Park Rugeley Staffordshire

Detailed Gradiometer Survey Report



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geoservices

Parchfields Solar Park
Rugeley, Staffordshire

Detailed Gradiometer Survey Report

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* I= Internal Draft; E= External Draft; F= Final

Parchfields Solar Park
Rugeley, Staffordshire

Detailed Gradiometer Survey Report

Contents

Figures

Parchfields Solar Park
Rugeley, Staffordshire

Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land at Parchfields Farm, Rugeley, Staffordshire (centred on NGR 405167, 319297). The project was commissioned by Terence O'Rourke, working on behalf of Solstice Renewables, with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features in support of a planning application for the installation of a photovoltaic solar array within the site.

The site comprises arable fields located to the northeast of Colton Road, covering an area of 14.9ha. The geophysical survey was undertaken between 5th and 8th May 2015. The detailed gradiometer survey has demonstrated the presence of a number of anomalies of potential archaeological interest almost entirely within the eastern field.

The anomalies identified as being of archaeological interest consist of ditch and pit-type features. In the eastern field linear ditch features are likely to represent archaeology as well as former field boundaries and watercourses identified from historic mapping. The central and western fields contain possible pit-like features of archaeological interest alongside unclassified trends.

Additionally, this archaeological investigation has detected modern services, areas of increased magnetic response and evidence for historic cultivation.

Parchfields Solar Park
Rugeley, Staffordshire

Detailed Gradiometer Survey Report

Acknowledgements

Wessex Archaeology would like to thank Terence O'Rourke for commissioning the geophysical survey. The assistance of John Trehy is gratefully acknowledged in this regard.

The fieldwork was undertaken by Chris Hirst, Eleanor Claxton-Mayer and Matthew Tooke. Garreth Davey processed and interpreted the geophysical data and wrote the report. The geophysical work was quality controlled by Genevieve Shaw and Paul Baggaley. Illustrations were prepared by Garreth Davey. The project was managed on behalf of Wessex Archaeology by Lucy Learmonth.

Parchfields Solar Park
Rugeley, Staffordshire

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Terence O'Rourke, working on behalf of Solstice Renewables, to carry out a geophysical survey at Parchfields Farm, Rugeley, Staffordshire (hereafter "the Site", centred on NGR 405167, 319297) (**Figure 1**). The survey forms part of an ongoing programme of archaeological works being undertaken in support of a planning application for the installation of a photovoltaic solar array within the Site.

1.1.2 The aim of the geophysical survey was to establish the presence/absence, extent and character of detectable archaeological remains within the survey area.

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

1.2 Site location and topography

1.2.1 The Site is located 1.3km northeast of Rugeley and 13km southeast of Stafford, Staffordshire.

1.2.2 The Site occupies an area of 14.9ha of agricultural land, currently utilised for pasture. The Site is bounded to the north and east by agricultural land, to the south by Colton Road (B5013) and to the west by a farm track and further agricultural fields.

1.2.3 The Site is predominantly flat at approximately 70-72m above Ordnance Datum (aOD) and sloping gently down towards the River Trent to the south-west.

1.3 Soils and geology

1.3.1 The solid geology comprises Bromsgrove formation sandstone to the south and Mercia formation mudstone to the north with overlying River Deposits recorded across the majority of the site (BGS 2015).

1.3.2 The soils underlying the Site are likely to consist of the typical brown earths of the 541r (Wick 1) association (SSEW SE Sheet 3-1 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

1.4 Archaeological background

1.4.1 The potential for the survival of buried archaeological has been assessed and details of relevant sites within 1km of the Site are summarised below and have been included to provide context and inform the geophysical interpretation. This information has been

compiled from data provided by the Staffordshire Historic Environment Record (SHER) and the National Heritage List for England (NHLE).

1.4.2 There are no World Heritage Sites, Registered Parks and Gardens, Conservation Areas or Historic Battlefields identified within 1km of the Site, however there are two Scheduled Monuments and 13 listed buildings.

1.4.3 There is no recorded evidence of Prehistoric or Romano-British occupation within 1km of the Site. The only documented evidence of Anglo-Saxon period is the discovery of three small pottery sherds found in a furrow discovered approximately 1km northeast of the Site.

1.4.4 Features recorded in the area are predominantly of medieval, post medieval and 20th century date. The Site itself falls within area of land classified as historical water meadows and the eastern extents are recorded as being part of a potential medieval deer park, possibly associated with Colton Hall Farm.

1.4.5 Colton Hall Farm is recorded as the location of a reputed 14th century medieval manor house, originating as a hunting lodge. The manor is recorded as being destroyed by fire, however the current farm buildings stand on the ruins of a former building and earthworks have been identified south of the farm with masonry reported below the surface.

1.4.6 A buried ditch feature 0.5km north of the site contained fragments of medieval pottery and a further curvilinear feature has been identified 0.7km east, this has been documented as a former road relating to the Colton Hall Farm.

1.4.7 The map regression exercise indicated that the Site area has been in use as arable fields from at least the 19th century to present, however internal boundaries have changed over time.

2 METHODOLOGY

2.1 Introduction

2.1.1 The detailed gradiometer survey was conducted using a Bartington Grad 601-2 dual fluxgate gradiometer system. The survey was conducted in accordance with English Heritage (EH) guidelines (English Heritage 2008).

2.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between the 5th and 8th May 2015. Field conditions at the time of the survey were good, with dry conditions throughout the period of survey. An overall coverage of 6.3 ha was achieved.

2.2 Method

2.2.1 Individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (EH 2008).

2.2.2 The detailed gradiometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with English Heritage guidelines (2008). Data were collected in the zigzag method.

2.2.3 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse function (±5nT 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 throughout the survey area, with no interpolation applied.

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

3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

3.1 Introduction

3.1.1 The detailed gradiometer survey has identified magnetic anomalies of potential archaeological interest across the Site, along with areas of increased magnetic response and ferrous responses. Results are presented as a series of greyscale plots, XY plots and archaeological interpretations at a scale of 1:1500 (**Figures 2** to **4**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots.

3.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (**Figure 4**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.

3.1.3 Magnetic anomalies have been identified in all fields. Anomalies in the eastern field present primarily linear features likely to be former field boundaries and water courses seen in historic mapping whilst the central and western fields present possible pit-like features of archaeological interest alongside unclassified trends.

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

3.1.5 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be present than have been identified through geophysical survey.

3.2 Gradiometer survey results and interpretation

3.2.1 Two short linear positive anomalies at **4000** (**Figure 4**) are identified as potential ditch features and form an L-shaped layout on a different alignment to the current field boundaries. They are characterised as possible archaeology.

3.2.2 A number of oval shaped positive anomalies have been identified throughout the Site, such as those at **4001** to **4002** and at **4006**. They are approximately oval or elongated in shape, have a magnetic strength of between +1 and +3nT and have been characterised as possible archaeology. They may represent small pit-type features of possible archaeological potential and are mostly single instances except for a small cluster present at **4006**. However due to their sparseness and the fact that they generally do not form a recognisable spatial distribution, apart from the cluster at **4006**, where the anomalies aligned. These types of anomailes may also represent small geological or natural features such as tree throws or a change in the superficial deposits.

3.2.3 At eastern extent of the eastern field **4003**, a curvilinear ditch-like feature consisting of numerous dipolar responses has been identified running approximately southwest to northeast before turning northwest along the existing field boundary and is assumed to then be connected to the brook which runs through the Site. The magnetic responses are typical of a backfilled feature probably containing ferrous and ceramic debris and this feature correlates with a mapped watercourse in the area. In the centre of the feature **4003**, a large cluster of stronger dipolar anomalies are identified as ferrous responses correlating to the location of a sluice and are likely to be related. Both the watercourse and sluice can be seen in historic mapping (Ordnance Survey 1882).

3.2.4 Weak bipolar anomalies at **4004** present a curvilinear feature aligned almost north-south with a turn to the east at the north end seeming to terminate in the middle of the field. This feature is incredibly weak but appears to cut the trackway **4005** suggesting that it postdates it. The bipolar responses indicate that it is likely to be a ceramic drain and the linear extends from an area of ferrous response surrounding Parchfields Farm and is possibly associated

3.2.5 A strong positive linear anomaly at **4005** aligned northeast to southwest across the field is identified as a former field boundary and is likely to be related to a former trackway that crossed the area and is shown in historic mapping (Ordnance Survey 1882).

3.2.6 A weak curvilinear feature is identified at **4007**, however, given the weakness of the magnetic response, it is not possible to define if this is an archaeological feature or otherwise and has therefore been characterised as a trend of uncertain origin.

3.2.7 Ploughing trends in the form of weak positive, regularly spaced linear anomalies are evident in all the fields such as those highlighted at **4008** and **4009.** They are predominantly oriented east to west and northwest to southeast and they are presumed to be modern in origin.

3.3 Modern Services

3.3.1 A modern service has been identified in the survey dataset at **4010** (**Figure 4**), alongside this in the western extents of the Site the bases of two electricity pylons have caused a small area of positive magnetic disruption to the data which will mask weaker features of archaeological potential.

3.3.2 It should be noted that the gradiometer survey may not detect all services present on Site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on Site.

4 CONCLUSION

4.1.1 The detailed gradiometer survey has been successful in detecting anomalies of archaeological interest with the majority of them located in the eastern field.

4.1.2 The anomalies of archaeological interest are primarily a possible section of L-shaped ditch and several pit type responses with a potential cluster of them at **4006**. In addition to this a former field boundary and an infilled watercourse have also been identified in the easternmost field and interpreted with historic mapping (Ordnance Survey 1882). The infilled watercourse appears to truncate the former field boundary and trackway at **4005** suggesting that it postdates it, and again the former field boundary and trackway is truncated by a ceramic drain at **4004**.

4.1.3 The remaining anomalies appear to be agricultural in origin with frequent ploughing trends visible across the Site on differing alignments. This is likely due to variable boundaries and different farming processes but these are likely to be post-medieval and modern in provenance as they follow similar orientations to the current field boundaries. Other agricultural features include a ceramic drain which originated from the area of Parchfields Farm and a large amount of ferrous response bordering the farm buildings and boundaries.

4.1.4 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. This is especially true of the areas surrounding the pylons, around Parchfields Farm and in the vicinity of the modern service where no or very few anomalies of archaeological potential have been identified.

5 REFERENCES

5.1 Bibliography

English Heritage, 2008.*Geophysical Survey in Archaeological Field Evaluation*. Research and Professional Service Guideline No 1, 2nd edition.

5.2 Cartographic and documentary sources

Soil Survey of England and Wales, 1983.*Sheet 3, Soils of Midland and Western England*. Ordnance Survey: Southampton.

Ordnance Survey. (1885). *Staffordshire XLV.NE*. OS County Series map. Southampton: Ordnance Survey.

5.3 Online resources

British Geological Survey, http://www.bgs.ac.uk [accessed May 2015]

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 an effective resolution of 0.03nT over a ±100nT 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 Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m 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 detailed 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 (EH, 2008).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.

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 longitudinally 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 type of image is useful as it shows the full range 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.

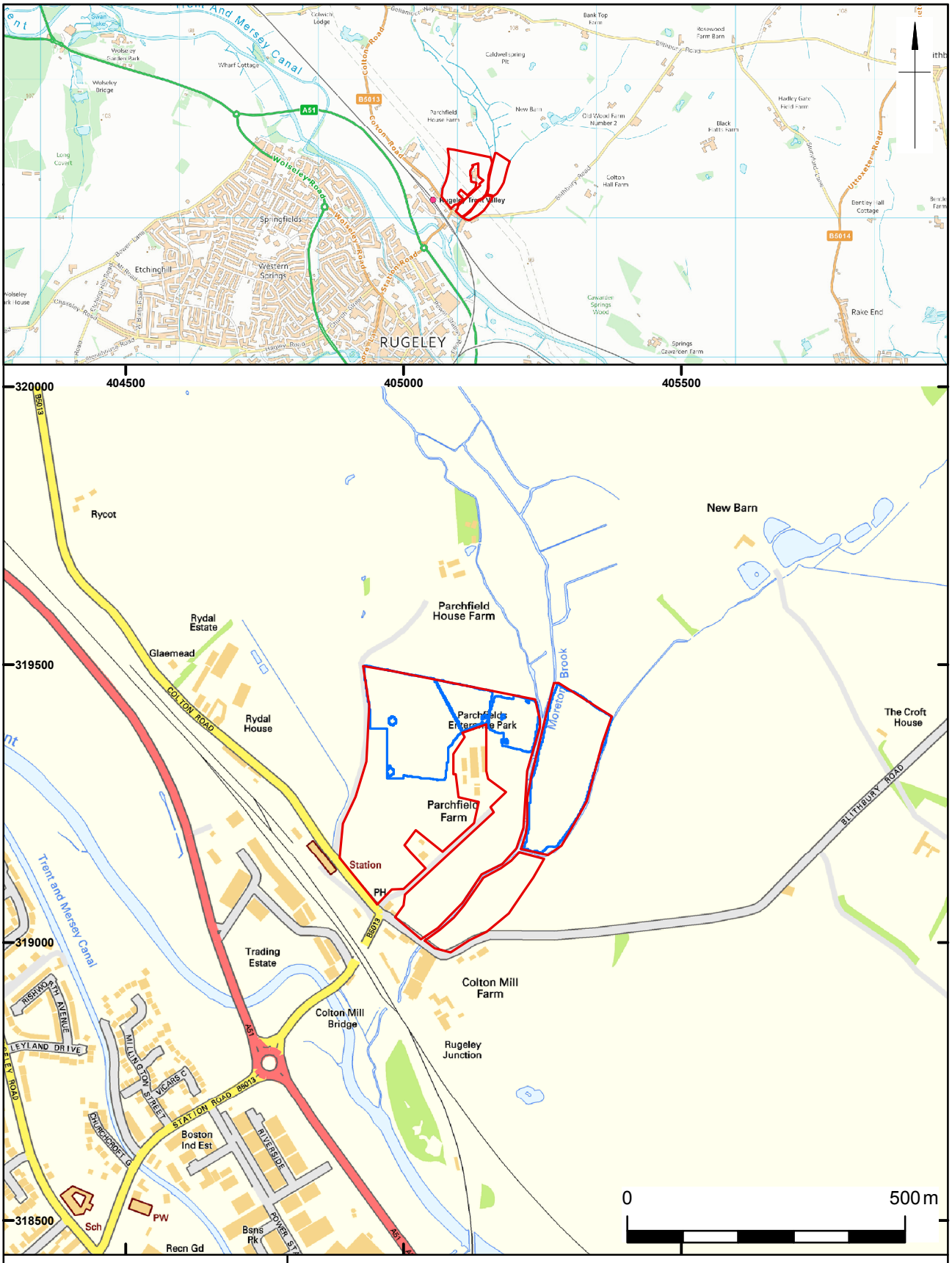
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided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

Detailed Survey Extents

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Scale:	1:40000 and 1:10000 at A4	Illustrator:	GJD
Path:	X:\PROJECTS\109160\GIS\FigsMXD\2015_05_12\Fig01.mxd		

Site location and survey extents

Figure 1

405000
405100
405200
405300
319500
319400
319300
319200
Detailed Survey Extents
+3nT
-2nT
0
100 m

Date:	15/05/2015
Revision Number:	0
Scale:	1:1500 at A3
Illustrator:	GJD
Path:	X:\PROJECTS\109160\GIS\
	FigsMXD\2015_05_15\

Greyscale Plot

Figure 2

405000
405100
405200
405300
319500
319400
319300
319200
+25nT
-25nT
0
100 m
Detailed Survey Extents

Date:	15/05/2015
Revision Number:	0
Scale:	1:1500 at A3
Illustrator:	GJD
Path:	X:\PROJECTS\109160\GIS\
	FigsMXD\2015_05_15\

XY Trace Plot

Figure 3

405000
405100
405200
405300
319500
319400
319300
319200
4000
4001
4002
4003
4004
4005
4006
4007
4008
4009
4010
0
100 m
Detailed Survey Extents
Ploughing
Trend
Possible Archaeology
Agricultural
Former Field Boundary
Modern Services
Ferrous
Increased Magentic Response

Date:	15/05/2015
Revision Number:	0
Scale:	1:1500 at A3
Illustrator:	GJD
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	FigsMXD\2015_05_15\

Archaeological Interpretation

Figure 4

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