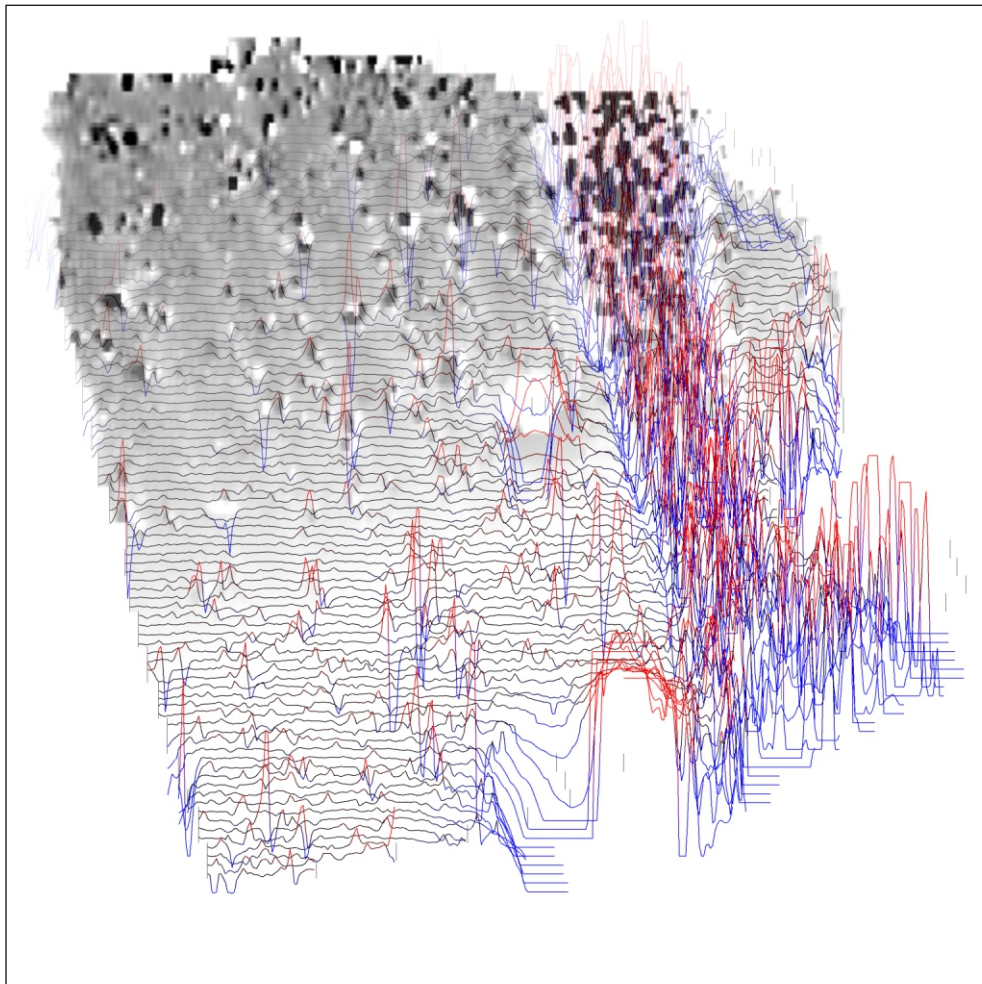




making sense of heritage

Land at Old Barn, Shottery Stratford-upon-Avon, Warwickshire

Detailed Gradiometer Survey Report



Ref: 103680.01
April 2014



**Land at Old Barn, Shottery
Stratford-upon-Avon, Warwickshire**

Detailed Gradiometer Survey Report

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Land at Old Barn, Shottery Stratford-upon-Avon, Warwickshire

Detailed Gradiometer Survey Report

Summary

Wessex Archaeology was commissioned by Gregory Gray Associates on behalf of Qualitas Consultants UK Ltd to undertake a detailed gradiometer survey of land close to Cottage Lane, near Stratford-upon-Avon (centred on NGR 418115, 254800). The aim of the work was to establish the presence, or otherwise, and nature of detectable archaeological features on the site as part of a programme of archaeological works ahead of a proposed development.

The survey was undertaken on 14th March 2014 and the site is located approximately 1.9km west of the centre of Stratford-upon-Avon. The site comprises two pasture fields located on the west side of the village of Shottery.

Detailed gradiometer survey was undertaken over all accessible parts of the site, a total of 0.92ha, and has demonstrated the presence of a few anomalies of probable and possible archaeological significance along with regions of increased magnetic response and at least one modern service.

Most of the anomalies detected relate to agricultural and modern features. The two most significant archaeological features are two pit-like anomalies and some possible ridge and furrow.

A band of magnetic disturbance across the centre of the site is consistent with a former track, although it is possible that it is modern in origin and relates to agricultural activity.



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Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by Gregory Gray Associates on behalf of Qualitas Consultants UK Ltd. The assistance of Gregory Gray and Annabel Leung is gratefully acknowledged in this regard.

The fieldwork was carried out by Jennifer Smith and Laura Andrews. The geophysical data was processed and interpreted by Ross Lefort who also wrote this report. The geophysical work was quality controlled by Dr. Paul Baggaley and Ben Urmston. Illustrations were prepared by Ross Lefort and Karen Nichols. The project was managed on behalf of Wessex Archaeology by Ben Urmston.



Land at Old Barn, Shottery Stratford-upon-Avon, Warwickshire

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project Background

1.1.1 Wessex Archaeology was commissioned by Gregory Gray Associates on behalf of Qualitas Consultants UK Ltd to carry out a programme of geophysical survey over land at Old Barn, near Cottage Lane on the west side of Stratford-upon-Avon, Warwickshire (centred on NGR 418115, 254800; **Figure 1**), hereafter “the Site”. The survey forms part of an ongoing programme of archaeological works being undertaken ahead of proposed development at 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 approximately 1.9km west of the centre of Stratford-upon-Avon on the edge of Shottery. The Site comprises two pasture fields at a place called Old Barn close to Cottage Lane. (**Figure 1**). The entire available area was surveyed and comes to 0.92ha.

1.2.2 The land is on a gentle east facing slope of Bordon Hill; the land slopes from 50m above Ordnance Datum (aOD) at the west to less than 45m aOD at the east. The relief in the wider area gently undulates and falls and flattens close to the River Avon that is located to the east of the Site. A small stream named Shottery Brook flows close to the Site to the east and this watercourse flows into the River Avon further south. The Site is defined by field boundaries.

1.3 Soils and Geology

1.3.1 The bedrock geology under most of the Site is recorded as Mercia mudstone group mudstone (Triassic) with the western edge of the Site recorded as Blue Lias formation and Charmouth mudstone formation mudstone (Jurassic and Triassic) (BGS). No superficial deposits are recorded under the Site although gravel and alluvial deposits are recorded either side of the River Avon (BGS).

1.3.2 The soils recorded across the Site are typical calcareous pelosols of the 411b (Evesham 2) association (SSEW 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 following information is summarized from the Heritage Gateway website (www.heritagegateway.org.uk). A search was performed for all heritage assets within 500m of the Site. For a full account of recorded heritage assets a Desk-Based Assessment (DBA) should be consulted.
- 1.4.2 No prehistoric or Roman records exist within 500m of the centre of the site and the few records in this area date to the medieval and later. Shotton is recorded as a shrunken medieval village with earthworks visible on aerial photographs and map evidence also suggesting the settlement was larger in the past (MWA892). The most notable medieval and post-medieval monument is Anne Hathaway's Cottage that is located a short distance to the east of the Site; the house dates back to the medieval and is reputed to be the birthplace of William Shakespeare's wife (MWA5896). A post-medieval rifle range is recorded to the south of the Site and is marked on 1886 Ordnance Survey maps.

2 METHODOLOGY

2.1 Introduction

- 2.1.1 The detailed magnetometer survey was conducted using Bartington Grad601-2 dual fluxgate gradiometer systems. The survey was conducted in accordance with English Heritage guidelines (2008).
- 2.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team on 14th March 2014. Field conditions at the time of the survey were good, with firm conditions under foot.

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 (2008).
- 2.2.2 The magnetometer 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 EH 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 ($\pm 5nT$ 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 to all survey areas, 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 gradiometer survey has been successful in identifying anomalies of likely, probable and possible archaeological interest, along with a modern service. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1000 (**Figures 2 to 4**). The data are displayed at -2nT (white) to $+3\text{nT}$ (black) for the greyscale image and $\pm 25\text{nT}$ 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 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 Gradiometer Survey Results and Interpretation

- 3.2.1 The clearest features visible in the data are two sub-oval pit-like anomalies with a large example located at **4000** and a smaller one at **4001**. These features have magnetic values over $+3\text{nT}$ and measure 5.8m and 2.6m in length respectively. They have been classed as probable archaeology due to their size and magnetic values.
- 3.2.2 Some weak parallel linear trends are visible across the site such as those around **4002**; these anomalies may prove to be of archaeological significance but are considered to be of uncertain origin. The remaining trends are considered to be agricultural with ceramic field drains, ridge and furrow and ploughing trends observed; all three can be seen around **4003**. The ridge and furrow are potentially the most archaeologically significant of all these agricultural trends and are visible as weak, broad and diffuse positive and linear trends.
- 3.2.3 There are spreads of increased magnetic response in the southern field such as around **4004**. These areas are characterised by concentrations of small dipolar and bipolar (black and white) anomalies. Several explanations are possible for these spreads including that they are geological, are concentrations of archaeological debris or that they represent modern debris. As it is not possible to determine which is the case from the geophysical data alone these spreads are considered to be of uncertain origin.
- 3.2.4 A modern service is visible at **4005** and a regular spread of ferrous debris around **4006**; this will be discussed in more detail below.
- 3.2.5 The remaining anomalies include ploughing trends, weak linear trends of uncertain origin and small positive anomalies of possible archaeological significance. These small positive anomalies may prove to be archaeological features such as small pits or postholes but as their spatial distribution forms no significant patterns are classed as possible archaeology as a geological explanation is also possible for them.

3.3 Gradiometer Survey Results and Interpretation: Modern Services

- 3.3.1 One service has been observed running through the data at **4005** and this appears to possibly represent a pipe. There is a line of ferrous responses at **4006** that seems to run along a disturbed area of ground observed during the fieldwork. The nature of this spread of ferrous is unclear but no clear service can be discerned from it, although it is possible



that the localised magnetic disturbance is sufficient to mask the response over a pipe or cable.

- 3.3.2 It is not clear from the geophysical data whether any of the services identified are in active use. It should also be noted that 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 DISCUSSION

4.1 Summary

- 4.1.1 The detailed gradiometer survey has been successful in detecting a few anomalies of probable and possible archaeological interest within the Site, in addition to regions of increased magnetic response and at least one modern service.
- 4.1.2 Aside from two probable pits and some ridge and furrow very few archaeological anomalies have been detected. Most of the anomalies observed relate to modern use and agricultural activity.
- 4.1.3 It is possible that the broad band of ferrous anomalies across the northern portion of the southern field relates to an archaeological feature such as a former track, although the magnitude of the responses suggests it is likely to be modern in origin and may be associated with agricultural activity.
- 4.1.4 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; however, it is assumed that the centreline of services is coincident with the centreline of their anomalies. Similarly, it is difficult to estimate the depth of burial of the services through gradiometer survey.
- 4.1.5 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 encountered than have been identified through geophysical survey.



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 Sources

British Geological Survey

<http://www.bgs.ac.uk/discoveringgeology/geologyofbritain/viewer.html>

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

5.3 HER Records Consulted

MWA892 – Site of possible shrunken settlement at Shottery

MWA5896 – Anne Hathaway's Cottage, Shottery

MWA7257 – Rifle range and butts



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 ± 100 nT 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 four main categories: archaeological, modern, agricultural and uncertain origin/geological.

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 modern category is used for anomalies that are presumed to be relatively modern in date:

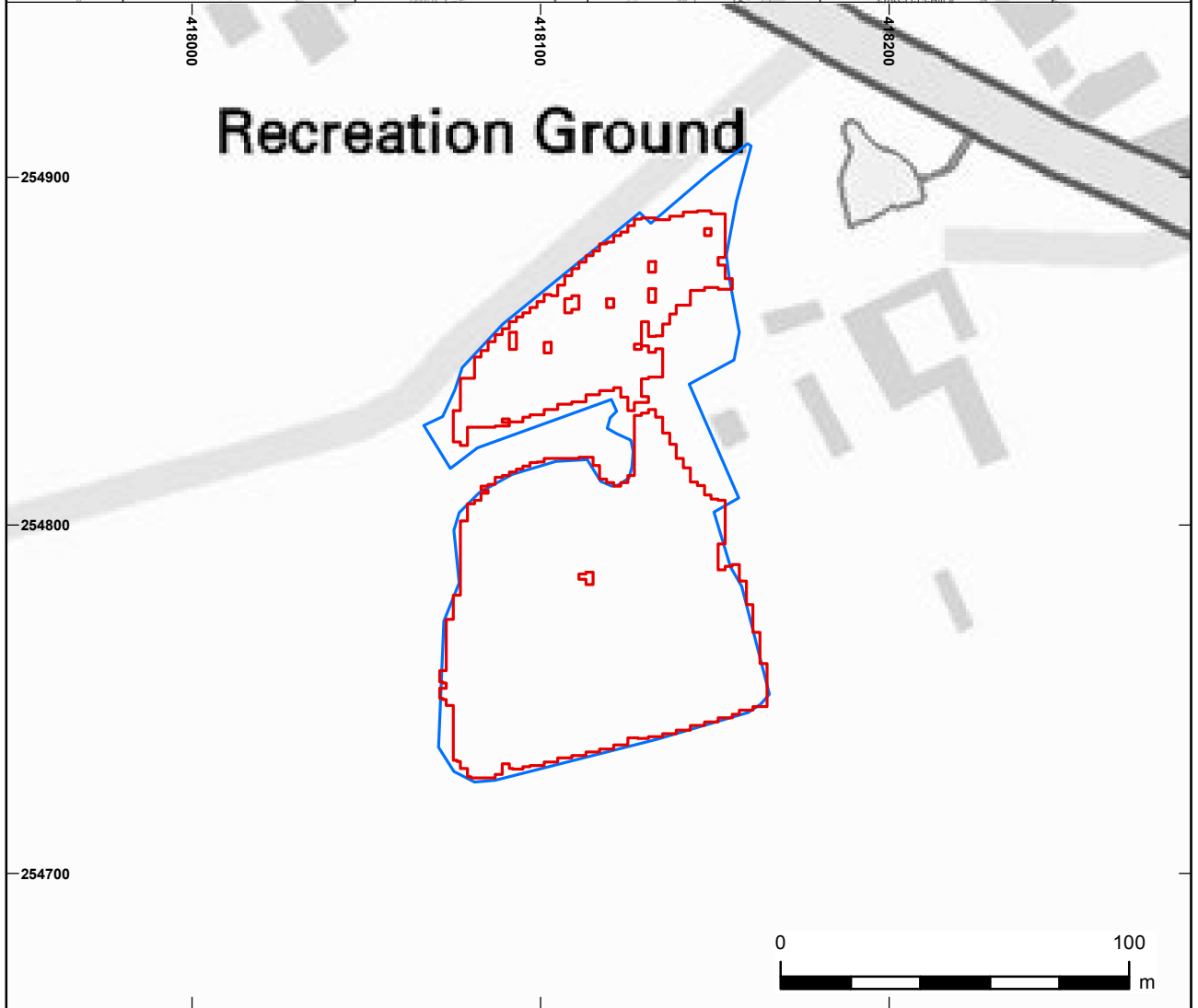
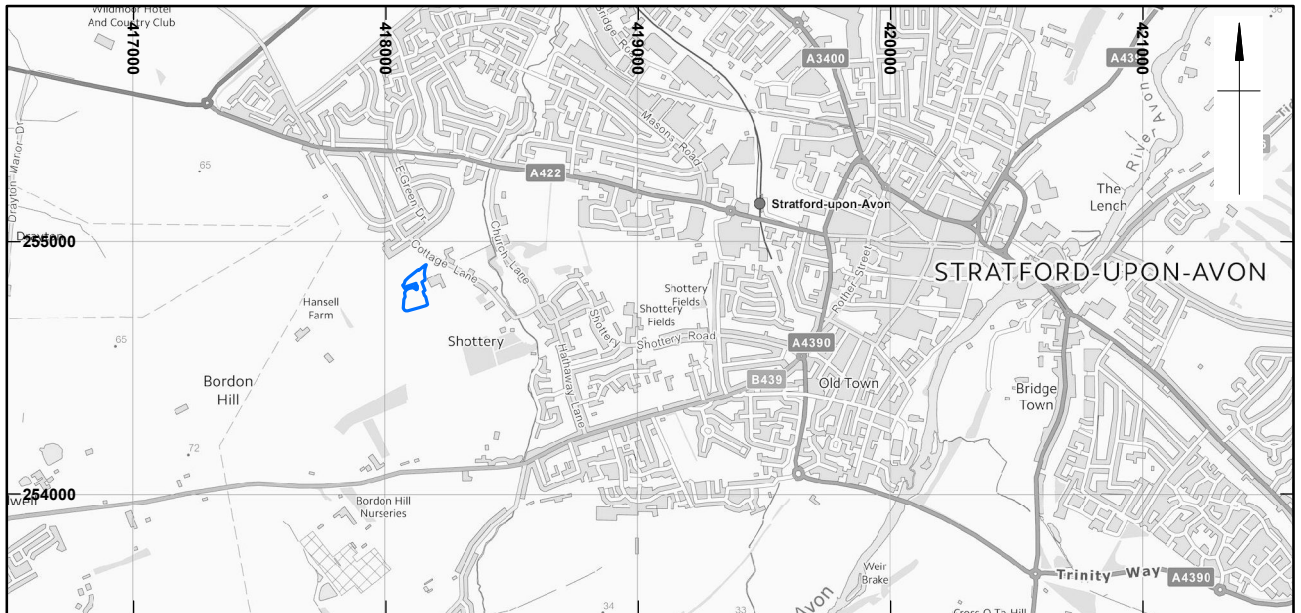
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be observed.




The agricultural category is used for the following:

- Former field boundaries – used for ditch sections that correspond to the position of boundaries marked on earlier mapping.
- Agricultural ditches – used for ditch sections that are aligned parallel to existing boundaries and former field boundaries that are not considered to be of archaeological significance.
- Ridge and furrow – used for broad and diffuse linear anomalies that are considered to indicate areas of former ridge and furrow.
- Ploughing – used for well-defined narrow linear responses, usually aligned parallel to existing field boundaries.
- Drainage – used to define the course of ceramic field drains that are visible in the data as a series of repeating bipolar (black and white) responses.

The uncertain origin/geological 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:

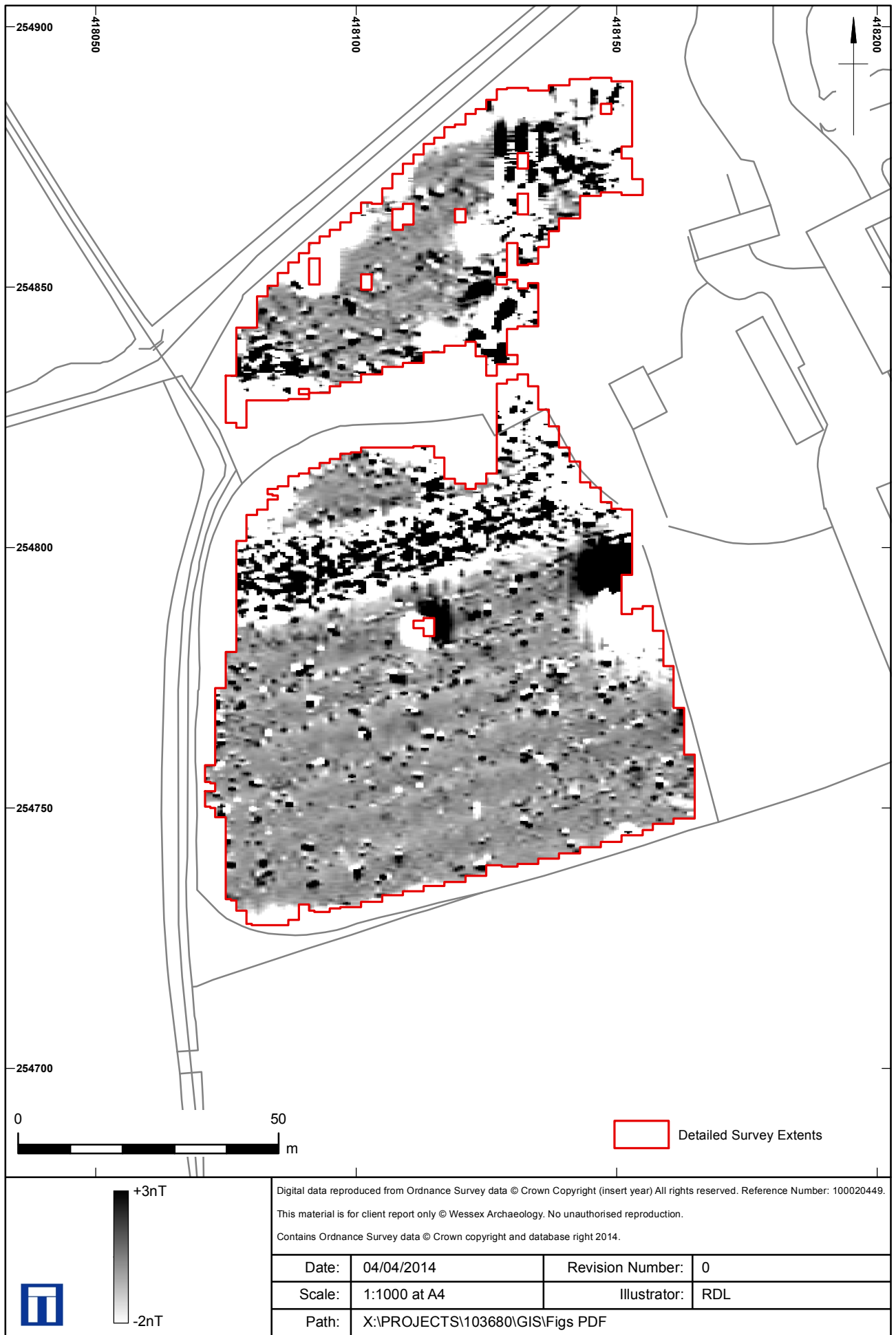
- Increased magnetic response – used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend – used for low amplitude or indistinct linear anomalies.
- Superficial geology – used for diffuse edged spreads considered to relate to shallow geological deposits. They can be distinguished as areas of positive, negative or broad bipolar (positive and negative) anomalies.



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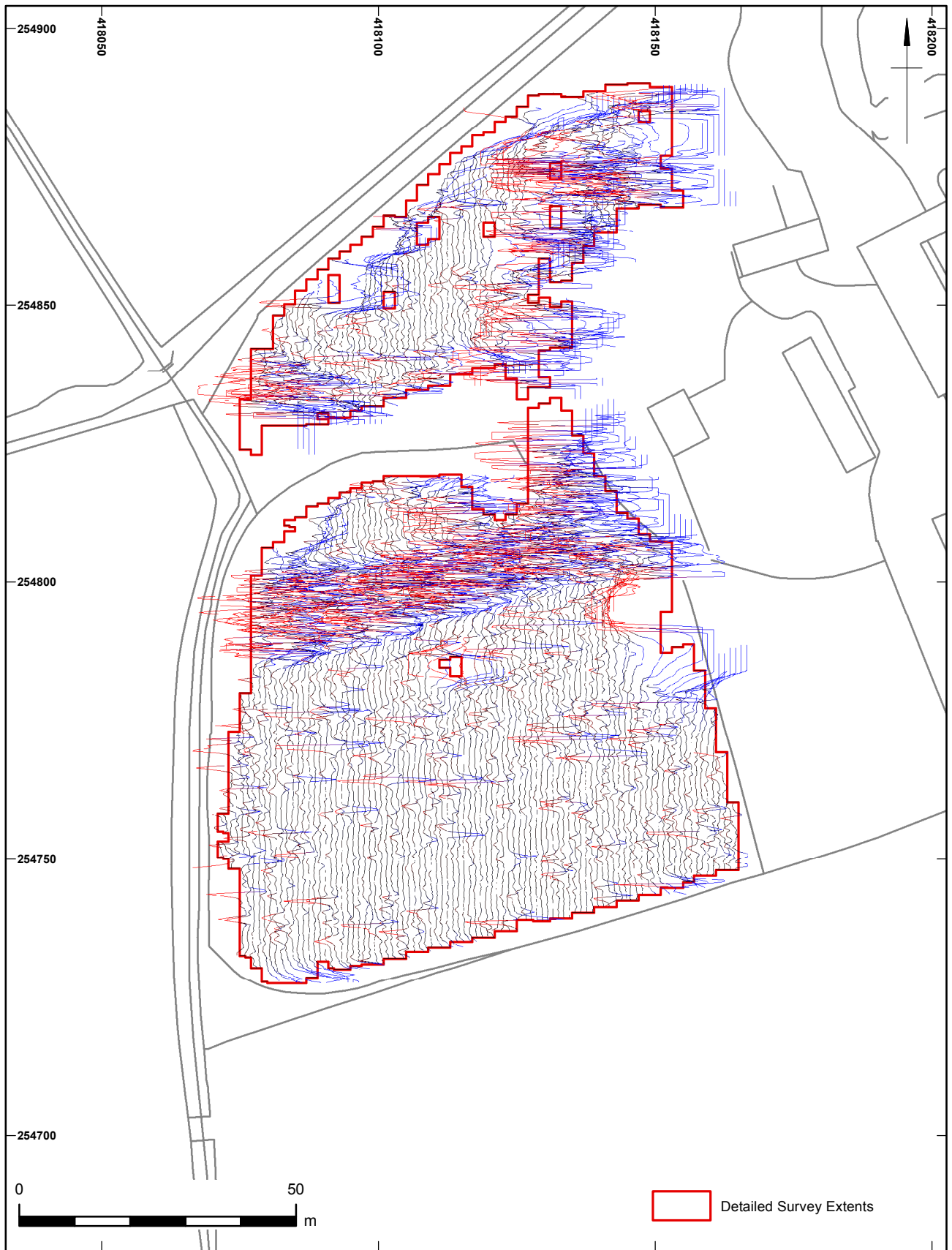
Site location and detailed survey extents


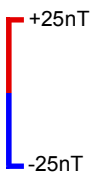
Figure 1



Greyscale plot

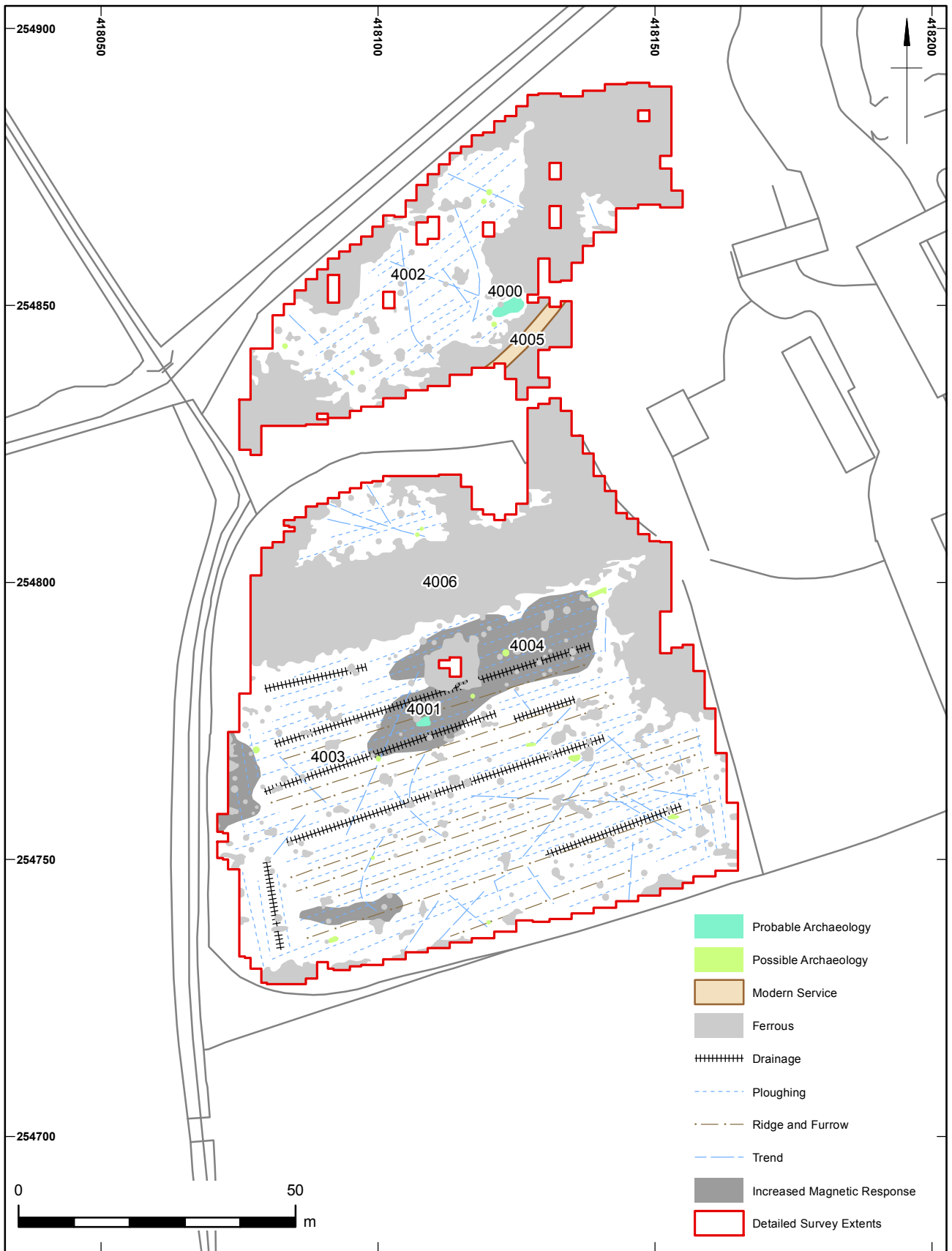
Figure 2




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XY trace plot

Figure 3



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