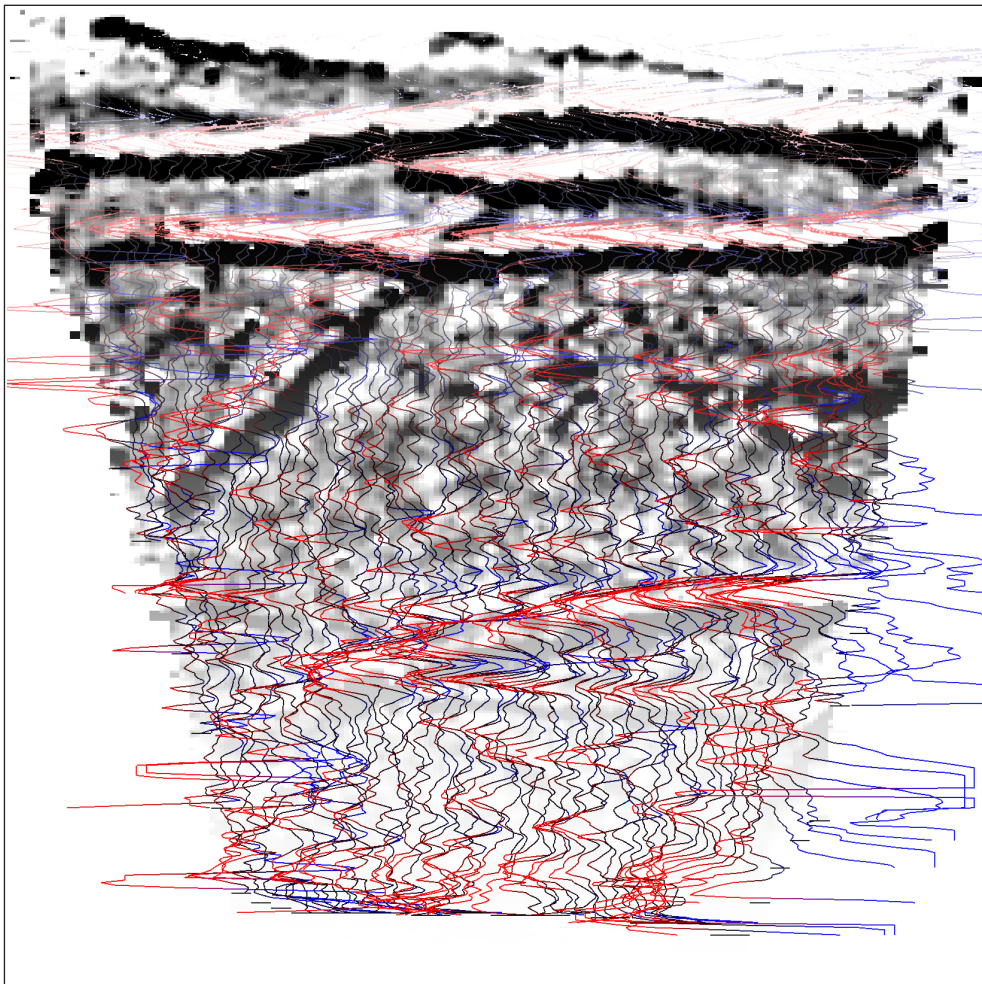




making sense of heritage

# Land at East Taphouse Liskeard, Cornwall

Detailed Gradiometer Survey Report



Ref: 106841.01  
May 2015



# Land at East Taphouse Liskeard, Cornwall

## Detailed Gradiometer Survey Report

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

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# Land at East Taphouse Liskeard, Cornwall

## Detailed Gradiometer Survey Report

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# **Land at East Taphouse Liskeard, Cornwall**

## **Detailed Gradiometer Survey Report**

### **Summary**

A detailed gradiometer survey was conducted over land at East Taphouse, Cornwall (centred on NGR 218000, 063280). The project was commissioned by Halsall Construction Limited with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features in support of a planning application for the residential development of the site.

The survey area comprises an arable field located immediately to the west of the village of East Taphouse, covering an area of 0.8ha. The geophysical survey was undertaken on 16<sup>th</sup> April 2015. The detailed gradiometer survey has demonstrated the presence of a number of anomalies of potential archaeological interest.

The anomalies identified as being of archaeological interest are primarily linear responses interpreted as ditch features. These are likely to represent former field boundaries or trackways however the small scale of the survey area means that it is difficult to place these features in their wider context.

The most complex area of potential archaeology is located in the south of the field. Within this area, numerous linear and discreet features have been identified with archaeological potential and consist of features interpreted as pits and ditches of unknown origin and date. These may relate to enclosures and/or former field systems. Areas of increased magnetic response may relate to the strong magnetic values associated with identified linear ditch features.

Two bands of very strong magnetic response have been identified across the northern extents of the survey area. It is possible that these are geological in origin although this is unlikely due to the regular appearance of these anomalies. It is more likely that these relate to a former road system within the area, not present on consulted historic mapping.



# **Land at East Taphouse Liskeard, Cornwall**

## **Detailed Gradiometer Survey Report**

### **Acknowledgements**

Wessex Archaeology would like to thank Nicola Thorogood and Halsall Construction Limited for commissioning the geophysical survey.

The fieldwork was directed by Alistair Salisbury with assistance from Diana Chard. Alistair Salisbury processed the geophysical data. The geophysical data was interpreted by Laura Andrews in addition to writing this report. The geophysical work was quality controlled by Elizabeth Richley and Lucy Learmonth. Illustrations were prepared by Garreth Davey. The project was managed on behalf of Wessex Archaeology by Caroline Budd.



# Land at East Taphouse Liskeard, Cornwall

## Detailed Gradiometer Survey Report

### 1 INTRODUCTION

#### 1.1 Project background

1.1.1 Wessex Archaeology was commissioned by Halsall Construction Limited to carry out a geophysical survey over land at East Taphouse, Cornwall (hereafter “the Site”, centred on NGR 218000, 063280) (**Figure 1**). The survey forms part of an ongoing programme of archaeological works being undertaken in support of a planning application for the residential development of 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 immediately west of the village of East Taphouse and approximately 7km southwest of the town Liskeard.

1.2.2 The Site occupies an area of 0.8ha of agricultural land, currently utilised for grazing. The Site is bounded by A390 to the north, the B3359 to the west, Farmer’s Lane to the south and the residential area of Lower Hillside to the east.

1.2.3 The Site is on a steep incline sloping from approximately 185m above Ordnance Datum (aOD) at the southwest corner to approximately 172m aOD at the northeast corner.

#### 1.3 Soils and geology

1.3.1 The solid geology comprises Slate and Siltstone of the Saltash Formation. There are no superficial deposits recorded on the Site but overlying superficial geological deposits of Clay, Silt, Sand and Gravel are recorded immediately to the northeast of the site and so some overlap may occur (BGS 2015).

1.3.2 The soils underlying the Site are likely to consist of typical brown earths of the 541k (Denbigh 2) association with some possible overlap to the north and south of the typical brown podzolic soils of the 611c (Manod) association (SSEW SE Sheet 5 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 A Desk-Based Assessment (DBA) has been prepared by Wessex Archaeology to determine, as far as is possible from existing information, the nature, extent and significance of the historic environment (Wessex Archaeology 2015). The results of this assessment are summarised below and will be referred to, where relevant, in the discussion of the geophysical results.
- 1.4.2 There are three listed buildings identified within the 1km study area and aside from these, there are no other designated assets (World Heritage Sites, Conservation Areas, Registered Parks and Gardens) identified within the Study Area.
- 1.4.3 Evidence for prehistoric burial monuments can be found in the western part of the Study area where six bowl barrows thought to be of Late Neolithic to Late Bronze Age are recorded.
- 1.4.4 The western extents of the Site incorporate the mapped extents of the Bradock Down Historic Battlefield (WA07) This is speculative and other sources document the battlefield as being further southwest. The area is thought to be the site of a battle during the English Civil war fought by the Royalist army under Sir Ralph Hopton defeated parliamentary forces.
- 1.4.5 Historic mapping shows the Site to be under woodland until the Ordnance Survey County series map of 1907. Until 1963 the maps show the presence of an enclosure in the northwest corner of the field which is subsequently removed. No other features are visible within the Site.

## **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 guidelines (English Heritage 2008).
- 2.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team on 16<sup>th</sup> April 2015. Field conditions at the time of the survey were good, with dry conditions throughout the period of survey. An overall coverage of 0.8ha 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 (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 ( $\pm 5nT$  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 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 a few anomalies of probable and possible archaeological interest across the Site, along with several areas of increased magnetic response and a large amount of ferrous. Results are presented as a series of greyscale plots, XY plots and archaeological interpretations at a scale of 1:1000 (**Figures 2 to 4**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and  $\pm 25$ 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 dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.
- 3.1.4 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 present than have been identified through geophysical survey.

#### **3.2 Gradiometer survey results and interpretation**

- 3.2.1 A number of positive linear responses have been identified at **4000** and **4001** extending across the southern extents of the Site. These have been interpreted as two separate ditches as they appear to be on a different alignment, although they may be related. These features have been classified as probable archaeology due to the lack of corresponding features in the historical mapping consulted for the DBA (WA 2014). The ditch at **4000** also appears to have an intersecting perpendicular anomaly in the very eastern extents of the Site.
- 3.2.2 Several irregularly shaped positive anomalies at **4002** have been interpreted as irregular features, possibly pits, of probable archaeology due to their size, magnetic value (between 1 and 8 nT) and topology. It is possible that these anomalies are related to the linear features identified at **4000** and **4001**.
- 3.2.3 To the north of the field at **4003** a positive linear anomaly crosses the extent of the Site, parallel with the northern field boundary, with an intersection towards the southwest of the Site. It is possible that this feature intersects with **4001** outside of the survey area but this cannot be confirmed from this dataset.
- 3.2.4 Two approximately parallel linear bands of very strong polar magnetic values (+15 to -10nT) extend across the northern extents of the Site at **4004** and **4005**. These have been interpreted as ditches of possible archaeological potential. These bands appear to extend out either side of the survey area therefore their overall extents cannot be



ascertained. It is possible that these may represent ditches along an old road or trackway that has been identified as existing in the DBA (Wessex Archaeology 2014). It is also possible that these features may be geological in origin due to the strength of their magnetic response, but this is thought unlikely as the features are very regular and parallel. Due to the small size of this Site it is not possible to place these features in a wider context to aid interpretation.

- 3.2.5 A similar though more irregular feature at **4006** appears to extend from the eastern extents of the survey area towards the western extents. This has been identified as a ditch of possible archaeological potential.
- 3.2.6 Large irregular areas of positive magnetic response have been identified at the eastern extents of the site at **4007** and along the southern boundary at **4008**. These have been interpreted as features of possible archaeological potential due to their form, size and magnetic value (1-4nT), however it is not possible to ascertain their origin from such a small dataset.
- 3.2.7 A further linear positive anomaly has been identified along the north boundary of the Site at **4009**. This has been interpreted as a ditch of possible archaeological potential, due to its proximity to the ferrous responses of the field boundaries, which may be obscuring its extents.
- 3.2.8 The remaining anomalies detected throughout the dataset include isolated positive anomalies interpreted as pits of possible archaeological interest and weak linear trends of uncertain origin. It is unclear whether these features indicate the presence of archaeological features or are modern or geological in origin.
- 3.2.9 There are several areas of increased magnetic response such as at **4010**, increasing in density around the strongest of the identified anomalies. This is likely to be related to the spreading of debris related to the formation of the features.

### **3.3 Modern Services**

- 3.3.1 There were no modern services detected within the survey area.
- 3.3.2 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 CONCLUSION**

- 4.1.1 The detailed gradiometer survey has been successful in detecting anomalies of probable and possible archaeological interest across the Site. In addition to these, anomalies interpreted as areas of increased magnetic response have also been identified.
- 4.1.2 The anomalies of probable and possible archaeological interest are primarily linear ditch features and irregular pit anomalies. Due to the small size of the Site it is not possible to ascertain the nature of these features, although it is likely that most relate to former field boundaries.
- 4.1.3 The most complex area of potential archaeology is located in the south of the field (**4000**, **4001** and **4002**). Within these areas, numerous linear and discreet features have been identified with archaeological potential and consist of likely pit and ditch features of



unknown origin and date. These may relate to enclosures and former field systems but due to the small area of the Site, the period and usage can only be speculated. They may also relate to the linear ditch identified at **4003**.

- 4.1.4 Two parallel linear features have been identified at **4004** and **4005** of unknown provenance. The very strong response separates these features from the surrounding anomalies. Due to the alignment of the field boundaries evident these may represent a former boundary, road or trackway, not apparent in historical mapping. A similar feature has also been identified to the south. It is difficult to interpret the origin of these features outside of their wider context as they likely extend far beyond the boundaries of area surveyed.
- 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. Features across the Site have been identified as having a strong magnetic response which may obscure features of a weaker magnetic response within the vicinity.



## 5 REFERENCES

### 5.1 Bibliography

Wessex Archaeology, 2014. *Archaeological Desk-Based Assessment, Land at East Taphouse, Cornwall*. Unpublished Client Report.

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 5, Soils of South West England*. Ordnance Survey: Southampton.

1882-1987 OS County Series: Cornwall and the Isle of Scilly, 1:2,500

### 5.3 Online resources

British Geological Survey, <http://bgs.ac.uk> [accessed April 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  $\pm 100$ 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 two main categories: archaeological and unidentified responses.

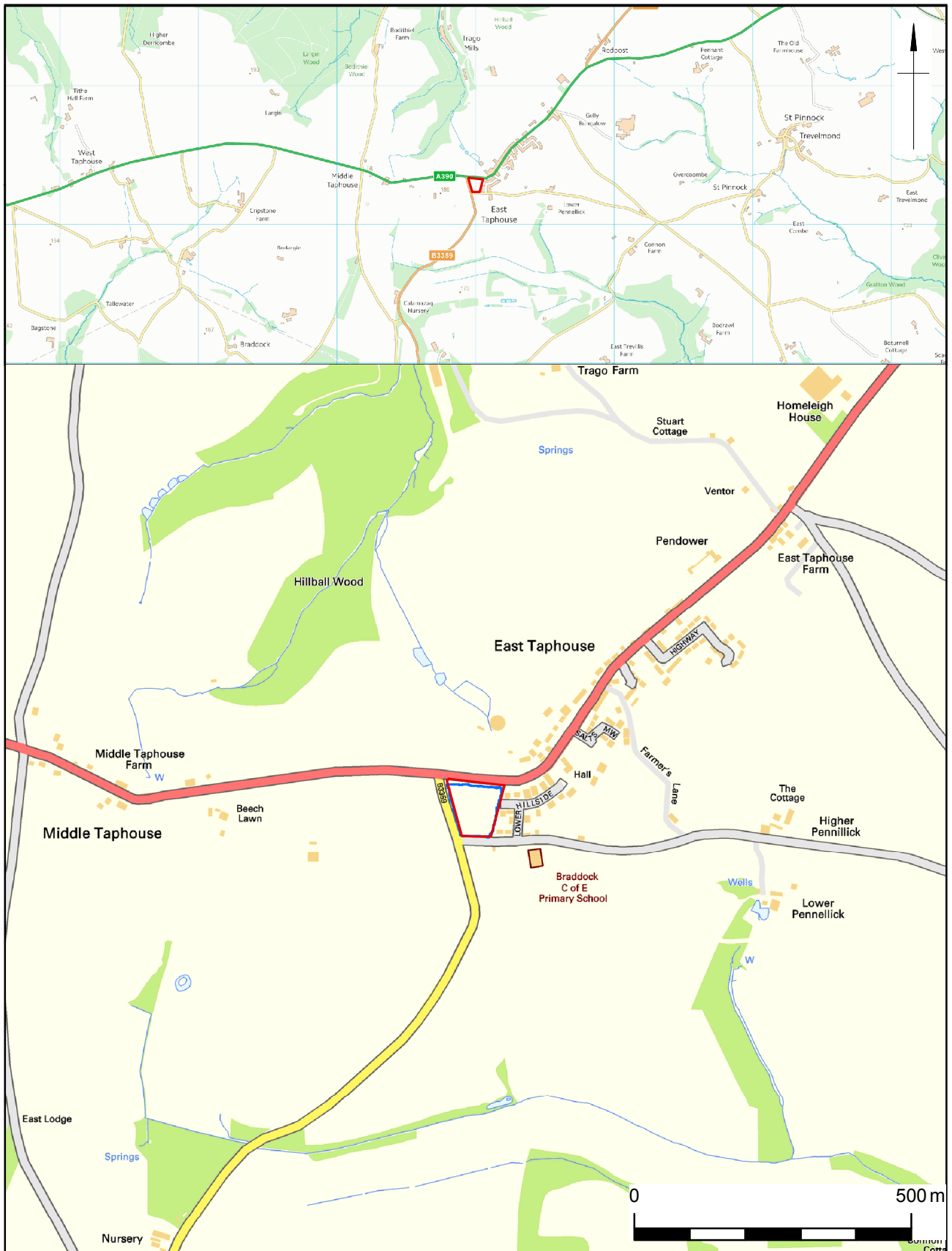
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided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

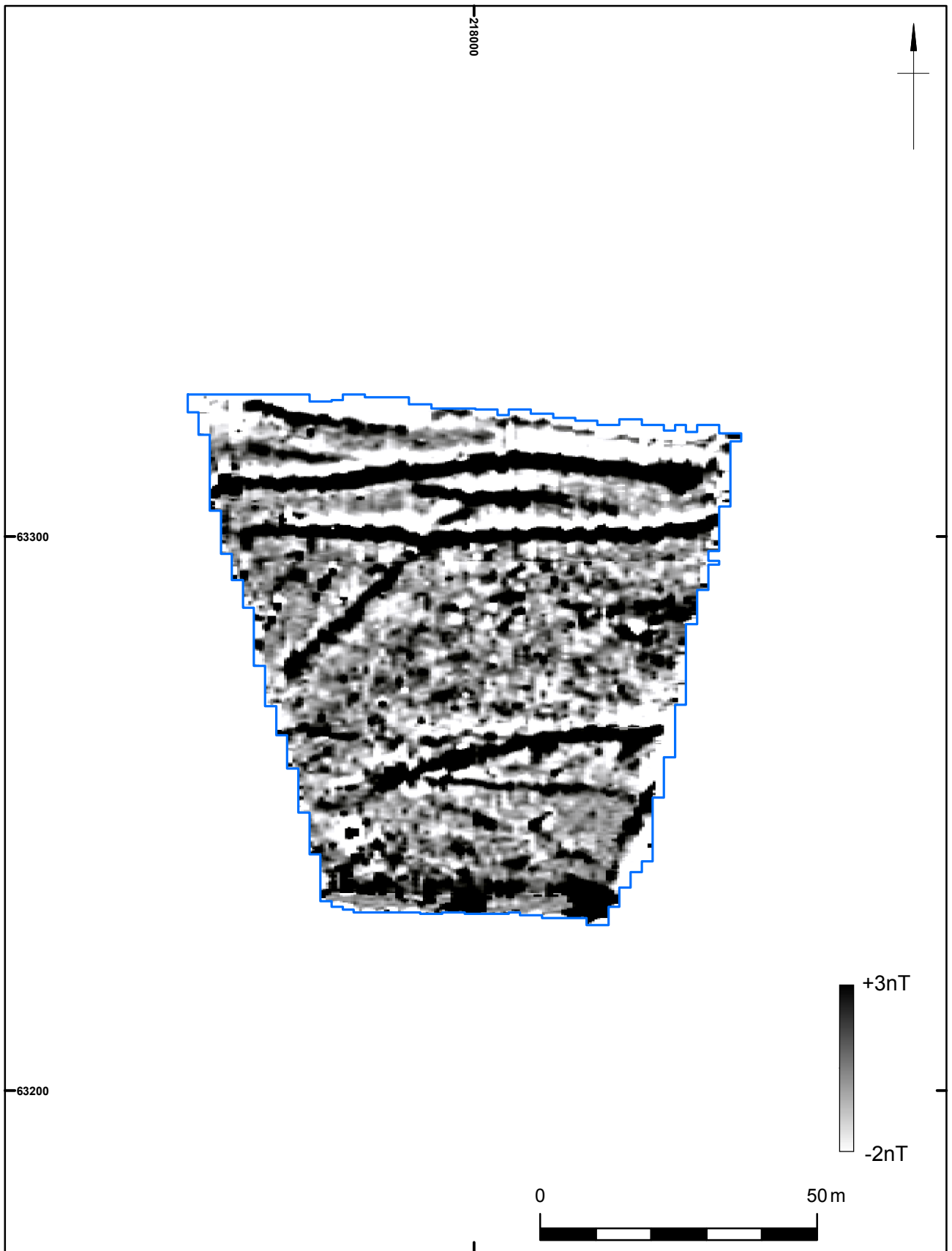




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Site location and survey extents

Figure 1

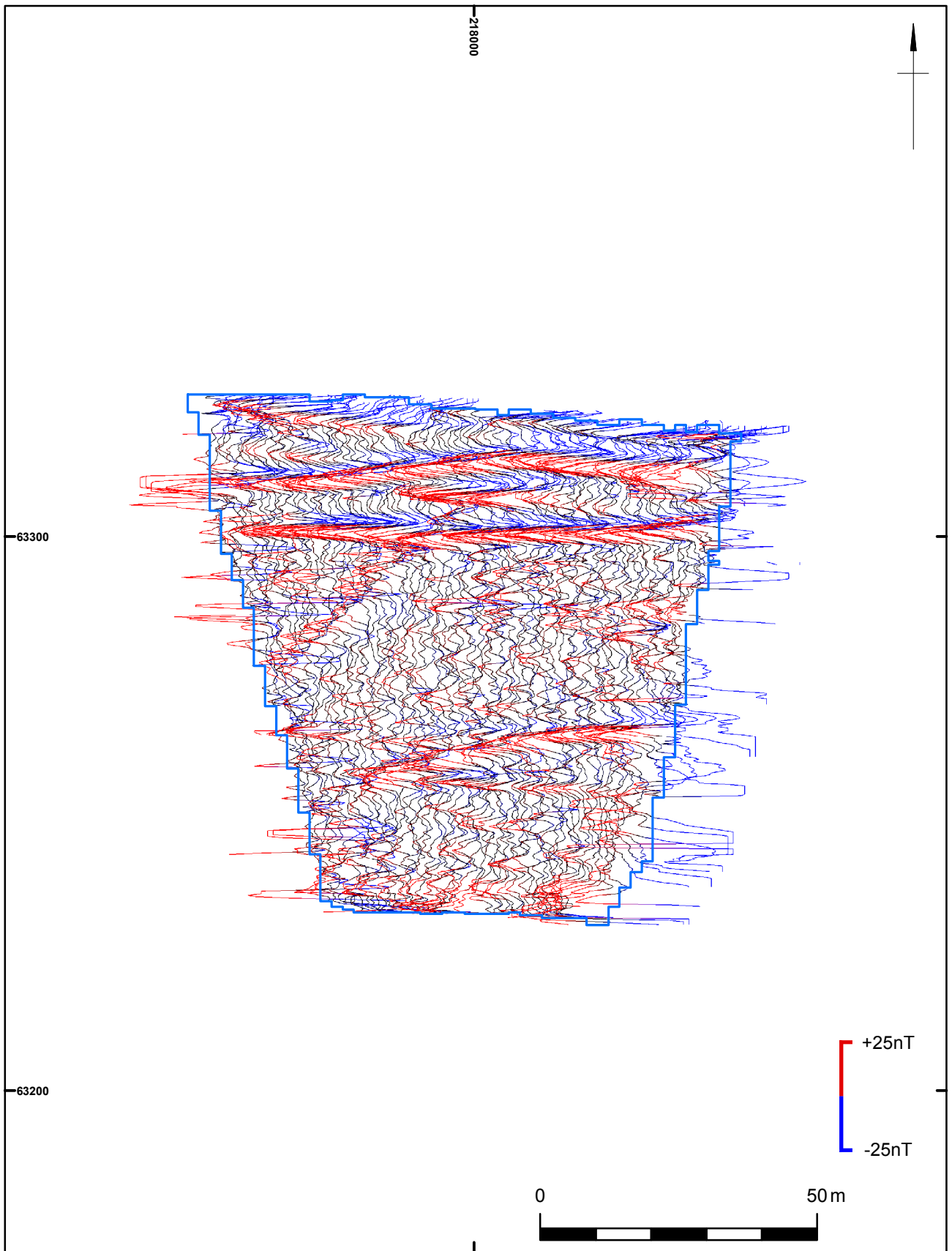






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Greyscale plot

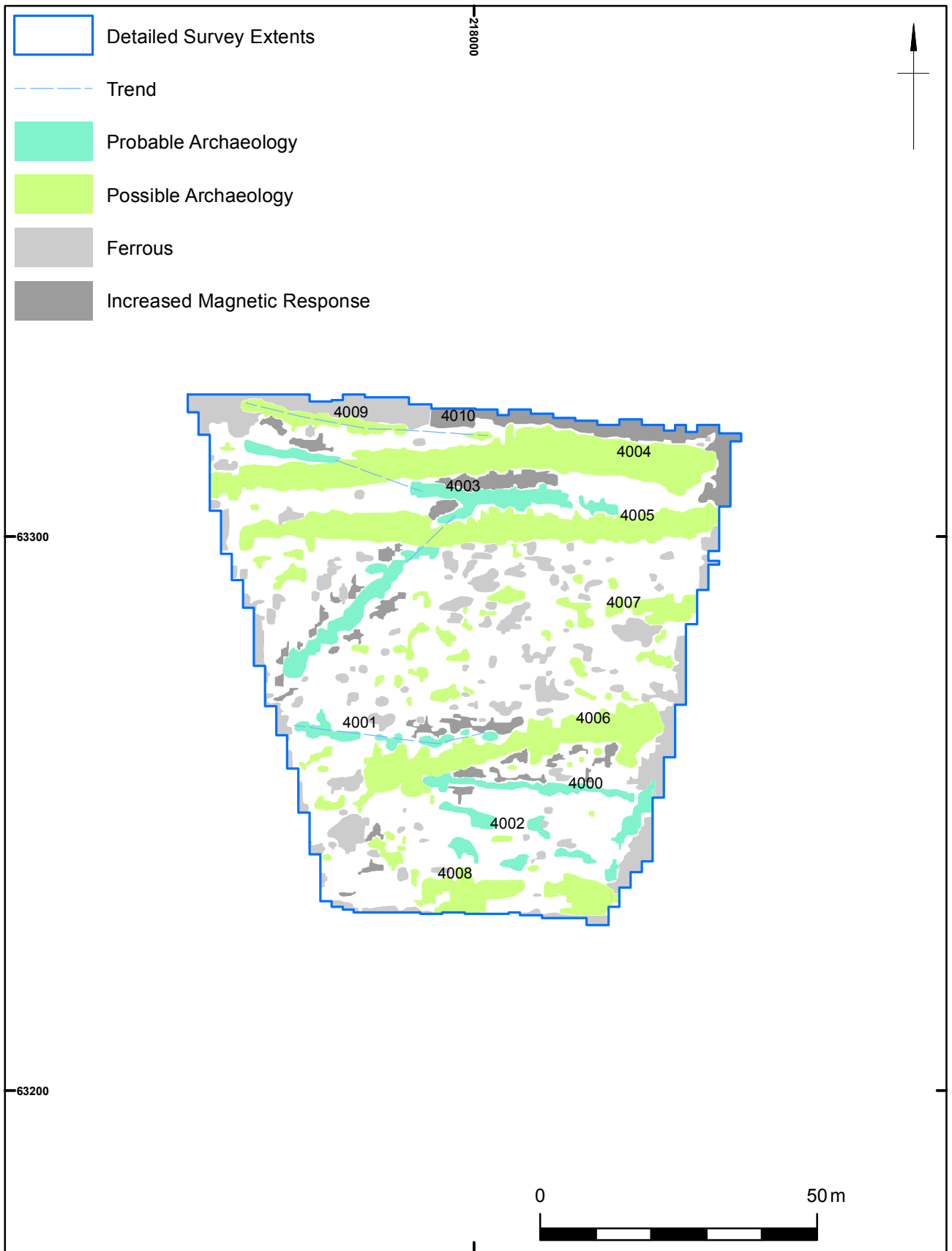
Figure 2



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XY Trace plot

Figure 3



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