

**Land at Ashton House
Nursery, Cheshire
Geophysical Survey
Report**

Client: ASHTON HOUSE NURSERY

AB Heritage Project No:10801

Date: 06/04/2016

Land at Ashton House Nursery, Ashton Hayes, Chester, Cheshire Geophysical Survey Report

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Project Number 10801
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1. NON TECHNICAL SUMMARY

- 1.1.1 AB Heritage Limited (herein AB Heritage) were commissioned by Ashton House Nursery to undertake a programme of geophysical survey covering c. 0.8 ha of land at Ashton House Nursery, Cheshire, ahead of a proposed development.
- 1.1.2 Based on the results of the geophysical survey there is limited potential for the recovery of archaeological remains.

2. INTRODUCTION

2.1 Project Background

- 2.1.1 AB Heritage Limited (hereinafter AB Heritage) have been commissioned by Ashton House Nursery to conduct a Geophysical Survey (Magnetometer Survey) covering the proposed development on land at Ashton House Nursery, Church Road, Ashton Hayes, Cheshire, (see Figure 1) prior to development of the site.
- 2.1.2 The purpose of the survey is to identify any potential surviving archaeological remains along the proposed route.

2.2 Site Location & Description

- 2.2.1 The proposed development at Ashton House Nursery, in Cheshire (hereafter referred to as the site), covers approximately 0.8 hectares (ha) and is centred at the National Grid Reference (NGR) SJ 50659 69338. It is situated on the north-eastern side of Ashton Hayes, and is approximately c. 2.4km north-west of Kelsall, directly c. 1.1km north of the A54, and c. 10.6km north-east of Chester.
- 2.2.2 The site is currently pasture and is directly south-east of Ashton House Nursery (see Figure 1). The site boundary is made up of hedgerows on all sides, the southern edge of the site bounds Pentre Lane, to the east of the site are fields, and to the north and west is Ashton House Nursery.

2.3 Geology & Topography

- 2.3.1 The underlying bedrock geology comprises of Wilmslow Sandstone Formation overlain by superficial Glaciofluvial deposits of Devensian sand and gravels, in the north-east corner the superficial deposits are Till made up of Devensian Diamicton (BGS 2016). The soils on site are freely draining and slightly acidic sandy soils (Soilscape 2016).
- 2.3.2 This form of geology is likely to create a variable response within the geophysical data (English Heritage, 2008).
- 2.3.3 Topographically the application site is relatively flat with an average height of about 41m Above Ordnance Datum, the site rises slightly from c. 40m in the west to c. 42m in the east.

3. AIMS & METHODOLOGY

3.1 Aims of Survey Works

3.1.1 Geophysical survey is a programme of non-intrusive archaeological work. The aims of this geophysical survey were to:

- Identify any geophysical anomalies of possible archaeological origin within the specified survey area;
- Accurately locate these anomalies and present the findings in map form

3.2 Methodology of Survey Works Summary

Site Specific Information

3.2.1 A geophysical survey was undertaken covering c. 0.8 ha of land at Ashton House Nursery on the 24th of March 2016.

3.2.2 The AB Heritage staff members who undertook the works were Glenn Rose (Project Officer), and Peter Bonvoisin (Archaeological Technician).

3.2.3 The weather conditions were dry throughout the survey; these conditions had no material impact upon the survey.

Equipment

3.2.4 The magnetic survey equipment used was two Bartington Grad-601 (fluxgate magnetometers). Please see Appendix A, which contains a detailed methodology for the works undertaken; however, briefly, Table 1, below, shows site specific information on how the magnetometer was set up:

Table 1: Setting Parameters of Magnetometer

Grid Size	30x30 metres
Data Capture Distances	1m x 0.25m
Sensors	2
Sensitivity	0.1nT

3.2.5 A Trimble Geo XR GPS was used to setup the geophysical survey. This has sub-centimetre accuracy suitable for this survey.

3.3 Known Constraints

- 3.3.1 In the east corner of the site a small group of willows and scrub was present (Plate 1) this obstructed a small area of survey. The area immediately to the west of the willows appears to have been levelled; this modern restructuring is likely to cause some disturbance in the results.
- 3.3.2 To the north of the site animal pens were also present (Plate 2); these had a small local area of magnetic disturbance c.2-5m from the metallic fences. In the north-west corner of the site there was also some debris at the time of survey, this can also be seen in Plate 2. Though the vehicle was moved prior to surveying that area.

Plate 1: View of western corner of site, taken looking west.



Plate 2: View of northern side of site, taken looking north.



4. RESULTS

4.1.1 For the purposes of this detailed magnetic survey, results for the geophysics data have been shown within Figures 2-3, with interpretations shown in Figure 4.

4.2 Geophysical Survey Results

4.2.1 Di-polar anomalies [**GP 1**] are present on site; these are located in an amorphous pattern across the site, with a small grouping in the north-east corner.

4.2.2 There is magnetic disturbance [**GP 2**] that extends along western edge of the site and ranges from c. -24 to c. 60 nT covering an area of c. 1,625m². Also an area of magnetic disturbance [**GP 2**] extends from the centre of the southern side of the site; this area ranges from c. -80 to c. 90nT, and covers an area of c. 1,250m².

5. INTERPRETATIONS AND DISCUSSION

- 5.1.1 Interpretation of the results of geophysical survey is based on professional judgement as to the likely/probable cause of an anomaly or reading. For example, strong dipolar discrete anomalies of small size are often associated with ferrous debris or similarly magnetic debris. In addition, where a positive linear anomaly is recorded, which has a negative anomaly associated alongside either side of it, is often likely to relate to the line of a modern utility.
- 5.1.2 GP numbers have been used to place interpretations into categories. Below is a discussion of the results, there has also been applied a confidence rating to the features identified (See Appendix 1). As with English Heritage 2008 guidelines for geophysical survey for archaeological field evaluation, this is an acceptable additional option only on the clear understanding that such ratings are subjective and potentially fallible assessments which can only really be tested through excavation.

Table 2: Interpretation of Geophysical Anomalies

AB No	Appearance	Potential Cause
GP 1	Negative and positive readings	Modern ground disturbance
GP 2	Di-polar Anomalies	Amorphous Magnetic debris

- 5.1.3 The Di-Polar anomalies [GP 1] present across the site are likely caused by magnetic debris, and the collection of Di-Polar anomalies within the north east of the site are most likely due to shrubs and newly planted trees in this area.
- 5.1.4 Within the site, magnetic disturbance [GP 1] borders the western edge of the site, and is found partway along the southern edge of the site. There is a high confidence that this disturbance is caused by re-landscaped ground based on the above ground features.

6. CONCLUSION

- 6.1.1 A geophysical survey was undertaken by AB Heritage at the proposed development site at Ashton House Nursery.
- 6.1.2 The purpose of this work was to understand the potential for any archaeological remains to survive within the site, and, where possible, identify the form, function and extent of any potential remains.
- 6.1.3 Overall the geophysical survey has identified no archaeological features and limited potential for archaeological remains.

7. ARCHIVE

7.1.1 The Site Archive will contain the following, as a minimum:

Table 3: Site Archive Data

Archive	Format
Raw Geophysical Data files	XYZ and Text
Processed geophysical data files	JPEG, BMAP
Archaeological Interpretation	Shape Files ARC GIS
Final Report	PDF
Final Images	PDF

7.1.2 A physical and digital archive will be stored in a suitable format at AB Heritage Limited offices in Taunton, Somerset.

8. REFERENCES

BGS (British Geological Society) 2015. *Geology of Britain viewer*.
<http://mapapps.bgs.ac.uk/geologyofbritain/home.html>.

CIFA, 2014. *Standard and Guidance for archaeological geophysical survey*.

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<http://www.landis.org.uk/soilscapes/>

Jones, D.M. (ED) 2008. *Geophysical Survey in Archaeological Field Evaluation. English Heritage*.

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Appendix 1 Technical Information on Geophysical Survey

FLUXGATE MAGNETOMETRY SURVEY

The magnetic survey is carried out using a fluxgate gradiometer, which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field, whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity, disturbance from modern services etc.

Survey equipment

The Bartington Grad 601-2 dual magnetic gradiometer is capable of surveying to an accuracy of 0.1 nanotesla (nT).

Sample interval and depth of scan

The magnetometer data is collected in 30mx30m grids at a resolution of 1m x 0.25m. This sample density is recommended for site evaluation (English Heritage, 2008). This equates to 3600 points per 30mx30m grid. The magnetometer has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects are buried within the site.

Data capture

The readings are logged continually by the data logger during the survey, which is then downloaded on site to a site laptop. At the end of each job, data is transferred to the office PC's for processing and presentation.

This 'regular xy' data is then downloaded into specialist data processing software, at user defined sample intervals (in this case 1 m by 0.25 m). This is processed as standard magnetometer data.

Processing

Standard Raw Magnetometer data processing consists of:

Zero mean Traverse- This process sets the background mean of each traverse within each grid to zero, the operation allows for the removal of striping effects.

Destagger- The collection of geophysical data can lead to errors with time due to a slight variation in speed of traverses or time lag within the collection of data. The process corrects the errors of stagger within the data.

Non-Standard Magnetometer processing:

Interpolation- The results of greyscale geophysical data can sometimes appear blocky in nature. Interpolation is a process which calculates and inserts values between existing data to give a smoother grey scale image.

Clipping – The clipping process will clip extreme values from the data set and increase the contrast in the data values closer to the mean. As most data within a data set is concentrated around the mean clipping can produce a better visualisation of standard data sets, particularly very weak signals that tend to be lost in a myriad of grey shades.

Some degree of heading error is inevitable when using a fluxgate gradiometer with such an acute sensitivity to the direction of travel in bi directional manner i.e. zigzag traverses. The error displays as a series of alternating lighter and darker stripes in the traverse direction and the function assesses and corrects the mean for each line of data to bring them in to the same mean range and remove any visible artefacts.

Display of data

Greyscale-This is display takes a range of reading and divides into a set number of classes. Each class is represented by a specific shade of grey and the higher the positive reading the darker the grey.

Colour- Colour can be applied to Greyscale plots to show high and low data collection points in a more direct way.

XY Trace Plot- Data is represented by a line, which is incremented along the Y axis. This produces a stepped effect, thus the data can be viewed to show a possible shaping of a feature. Typically features are clipped to limit odd readings.

Assigned ranges can be adjusted to give the best display of the data.

Some degree of heading error is inevitable when using a fluxgate gradiometer with such an acute sensitivity to the direction of travel in bi directional manner i.e. zigzag traverses. The error displays as a series of alternating lighter and darker stripes in the traverse direction and the function assesses and corrects the mean for each line of data to bring them in to the same mean range and remove any visible artefacts.

GPS METHODOLOGY

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to sub-cm accuracy, a far greater accuracy than a standard GPS unit. An RTK system uses a base station receiver and a number of mobile units (rovers). The base station takes measurements from satellites in view and then broadcasts them along with its known position to the rover receivers. The rover receiver also collects measurements from the satellites in view and processes them with the base station data. The rover then computes its location relative to the base.

During such a survey a Trimble GeoXR Differential Global Positioning System (dGPS), capable of Real Time Kinematic (RTK) is used to set out a nominal grid prior to the survey. This increases the accuracy and efficiency of the survey. The data is then downloaded from the unit on the day, using a USB stick.

CONFIDENCE RATING OF INTERPRETATION

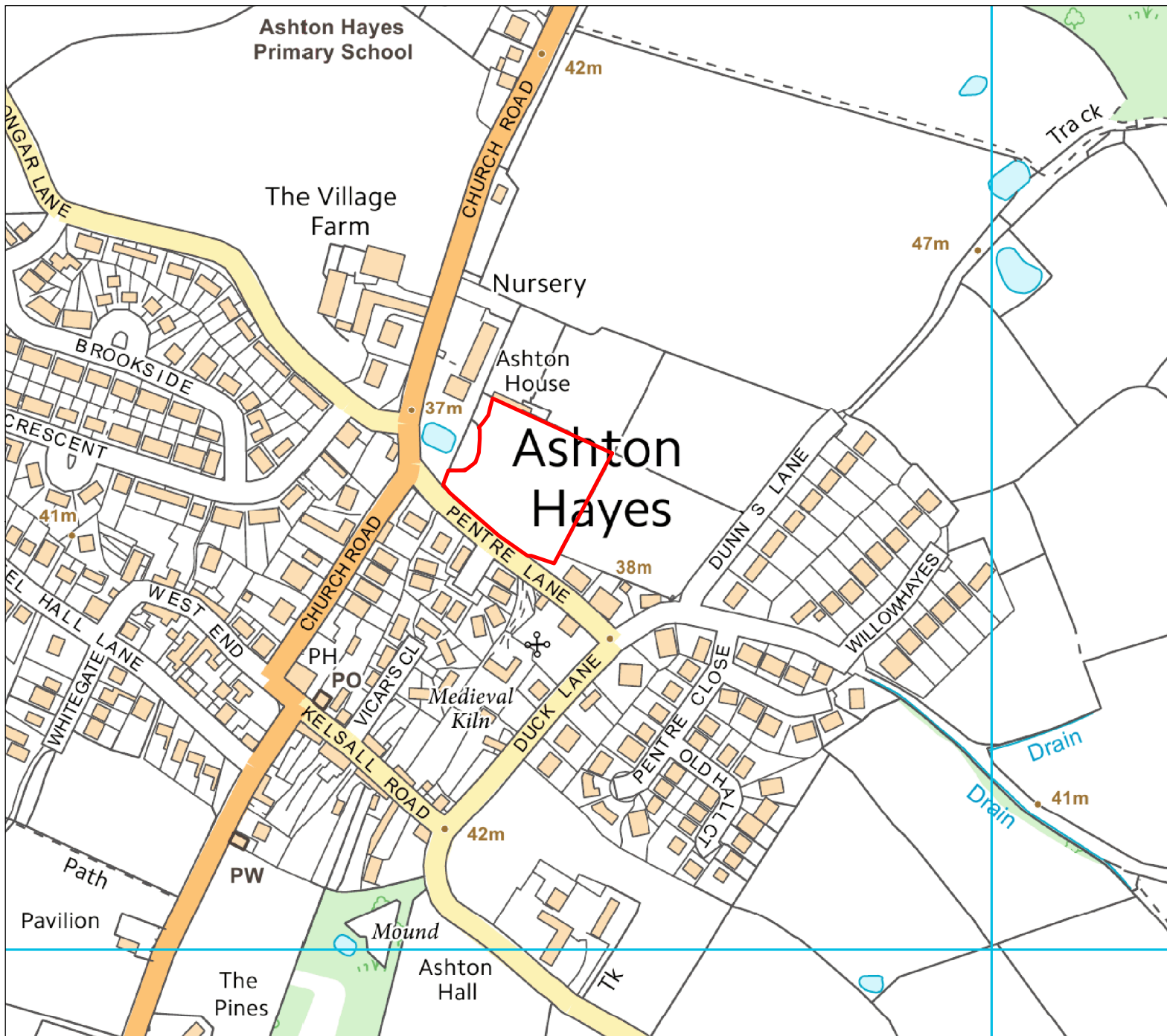
Categories for interpretations when there is corroborative evidence from mapping/desk based or excavation data can be assigned to magnetic anomalies (for example, Utility, Road, Wall, etc.) and where appropriate, such interpretations will be applied.

Table 2: Table of Confidence with interpretation

Interpretation Confidence	Evidence
High	Backed by mapping/desk based work/ excavation. A clear feature with a clear form.
Medium	A feature which has an unclear structure though has grouped potential or associated potential.
Low	Unknown provenance entirely based on form.



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Legend
 Site Boundary



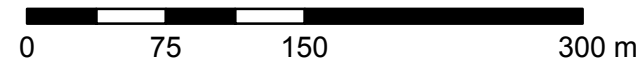
Cheshire

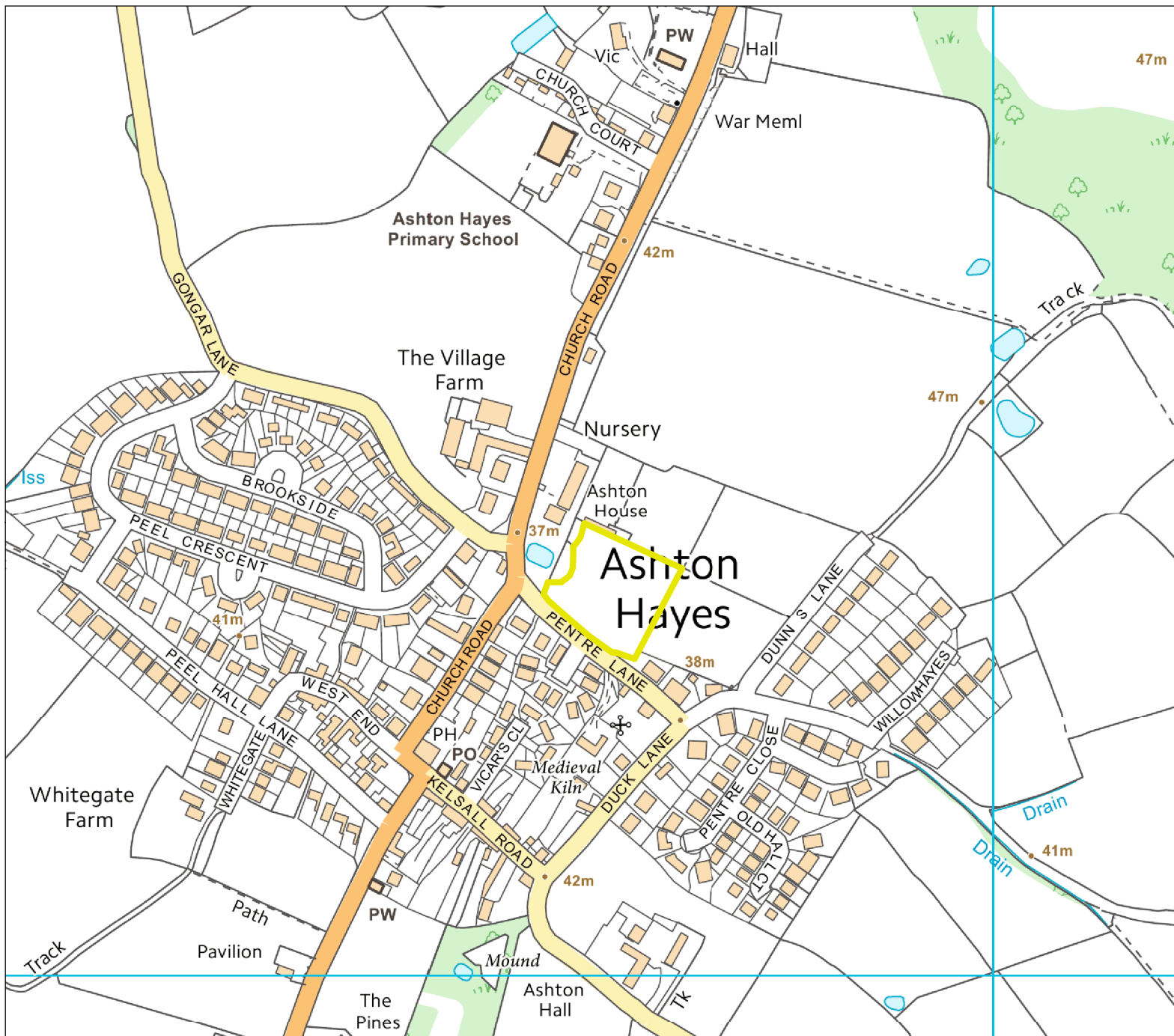
Figure 1: Site Location and Field Identification

Project: Ashton House Nursery

Date: 21/03/16 Job Number: 10801

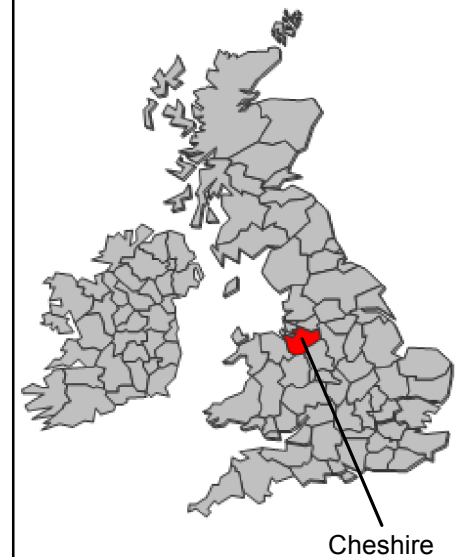
Drawn by: PB Approved by: GR





Legend

 Site Boundary



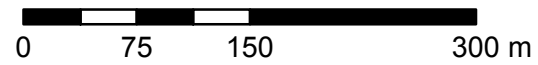
Cheshire

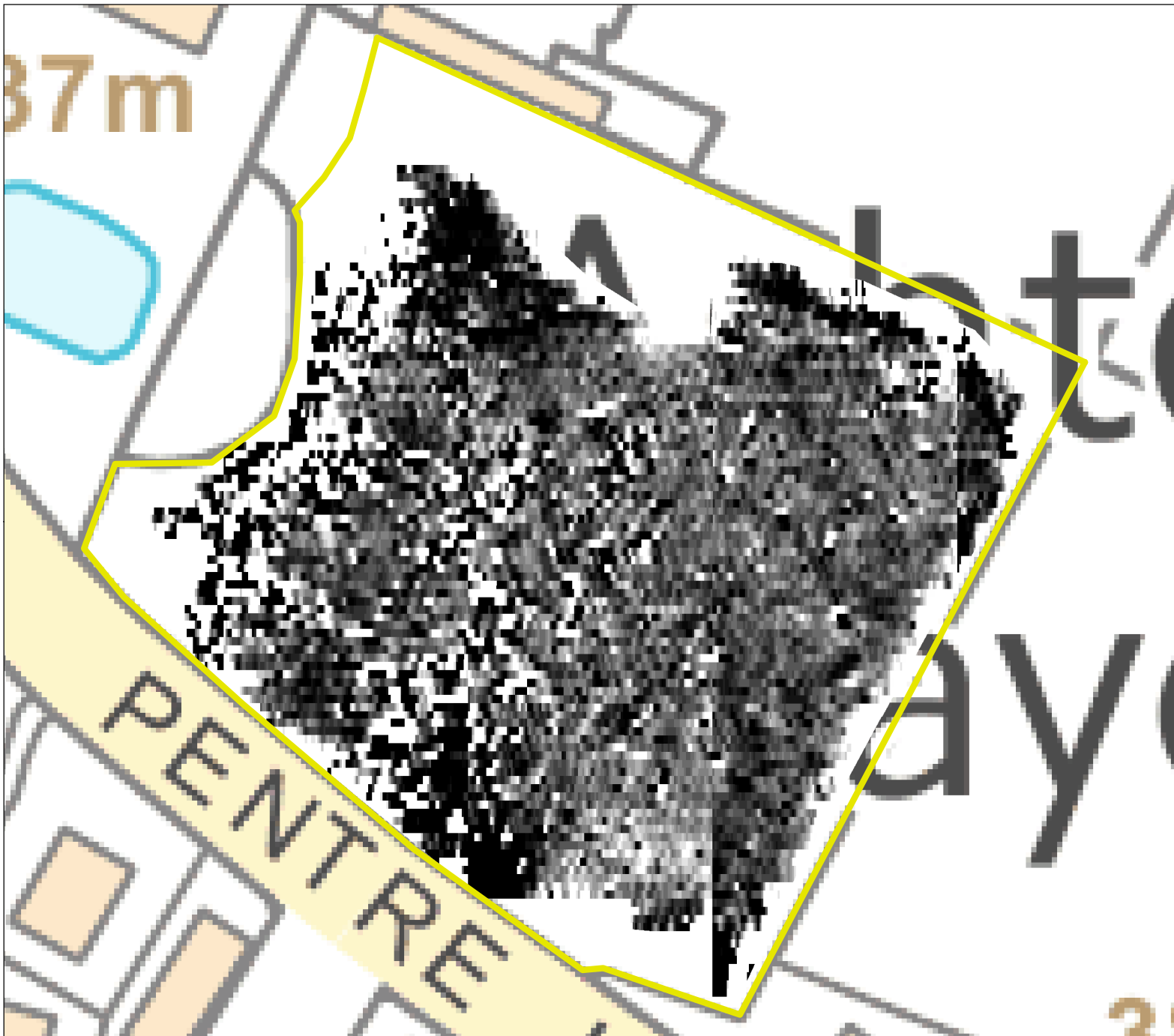
Figure 1: Site Location

Project: Ashton House

Date: 31/03/16 Job Number: 10801

Drawn by: ZE Approved by: GR





Legend

 Site Boundary

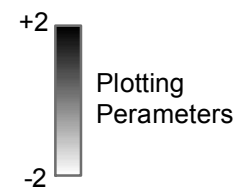
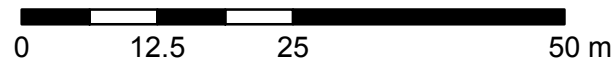


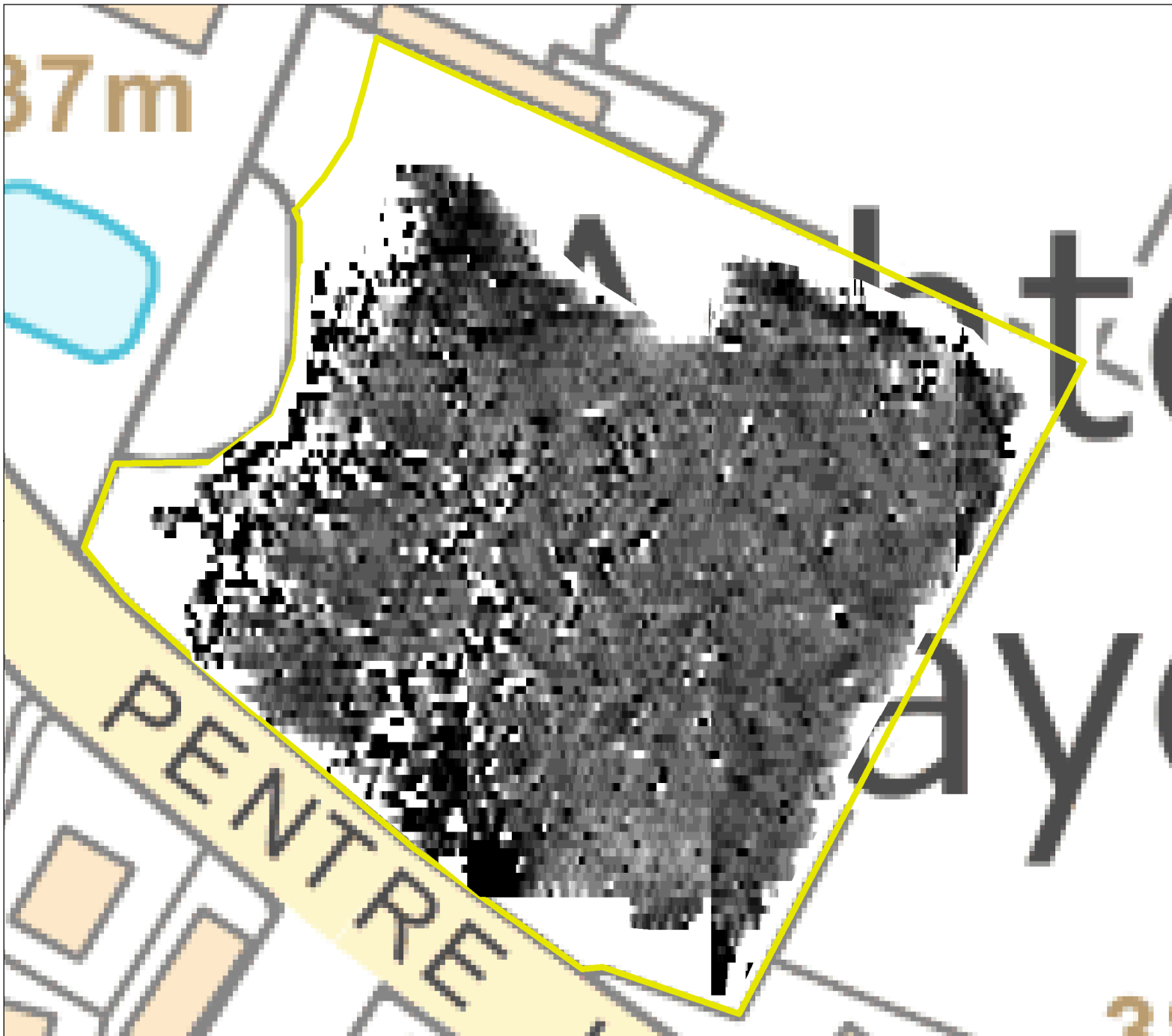
Figure 2: Raw Geophysical Data

Project: Ashton House


Date: 31/03/16 Job Number: 10801

Drawn by: ZE Approved by: GR





Legend

 Site Boundary

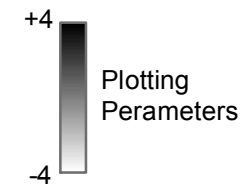
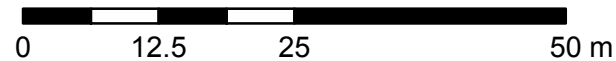


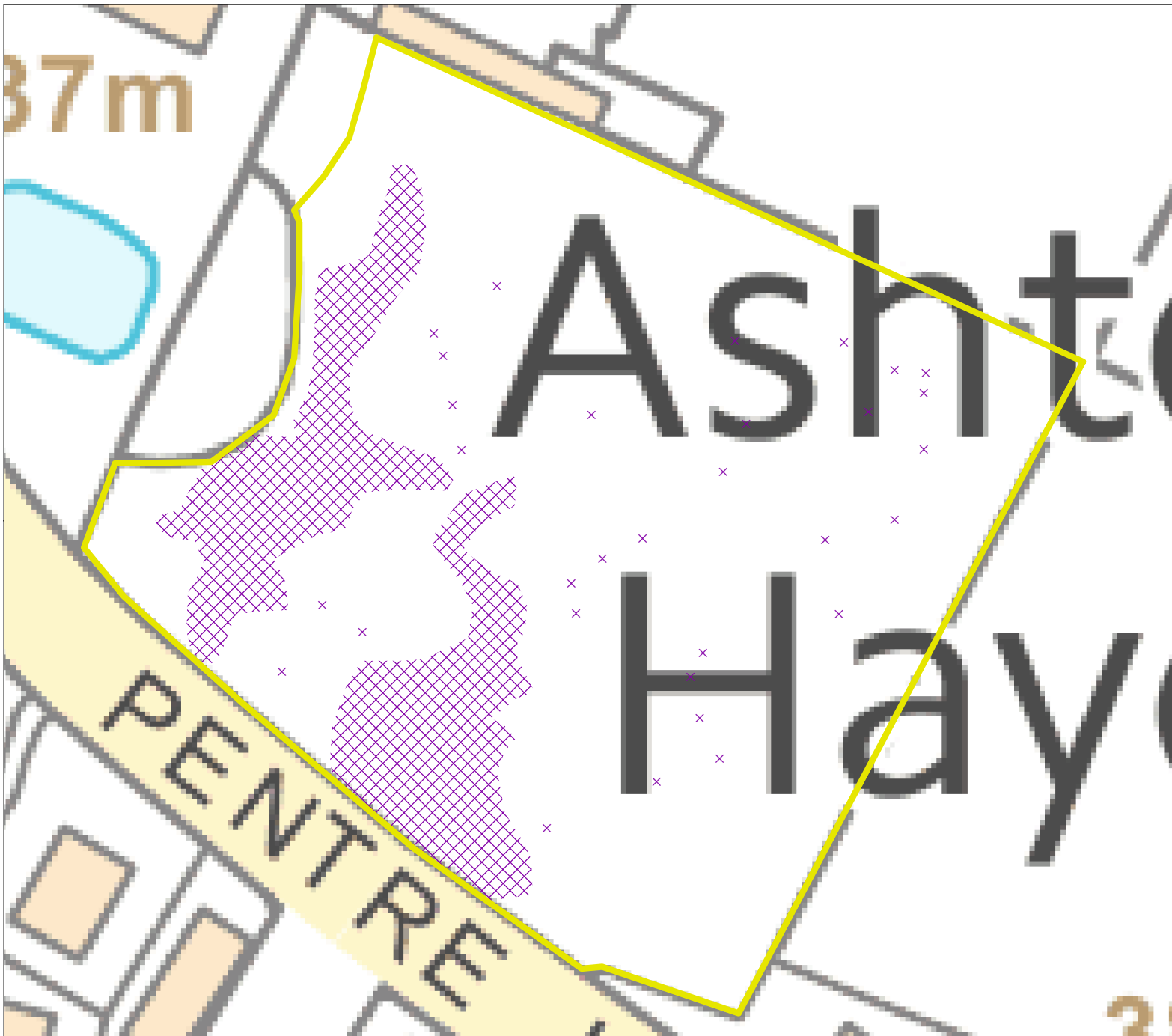
Figure 3: Processed Geophysical Data

Project: Ashton House

Date: 08/04/16 Job Number: 10801

Drawn by: ZE Approved by: GR








- Legend**
-  Magnetic Disturbance [GP1]
 -  Di-Polar Anomalies [GP2]
 -  Site Boundary

Figure 4: Interpretation of Geophysical Data	
Project: Ashton House	
Date: 31/03/16	Job Number: 10801
Drawn by: ZE	Approved by: GR

