



GEOPHYSICAL SURVEY REPORT

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**THE UNIVERSITY OF LAW,
CHESTER:
REDEVELOPMENT OF
CHRISTLETON CAMPUS
CHRISTLETON
CHESHIRE**

prepared for

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GEOPHYSICAL SURVEY

Summary

Northern Archaeological Associates Ltd (NAA) was commissioned by The University of Law, to undertake a geophysical survey of land at Christleton Hall, University of Law Chester campus, Christleton, Cheshire (NGR 343800 365820). The survey was undertaken to evaluate the archaeological potential of three areas of green open space (Areas 1, 2 and 3) within the development boundary.

The magnetometer survey was successful in Areas 1 (open space and playing field) and 2 (walled garden) and created clear results demonstrating previous use of the site and geological features. The survey of Area 3 was not successful, as the area proved too small to produce meaningful results. Relatively few anomalies with an archaeological origin were identified in Area 1 and most related to modern services, the playing field or modern dumped material. Ridge and furrow was recorded across the area together with a ditch close to the northern boundary and a second ditch or trackway close to the southern boundary. Area 2 produced evidence of the previous use of the walled garden with most responses reflecting the position of former buildings alongside the walls. There was also evidence of ridge and furrow aligned north - south throughout which appeared to predate the walled garden.

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FIGURE LIST

Figure 1: Site location

Figure 2: Grid plan

Figure 3: Area 1 Processed Data, Raw Data, XY trace plot, Interpreted Data

Figure 4: Area 2; Processed Data, Raw Data, XY trace plot, Interpreted Data.

1.0 INTRODUCTION

1.1 Northern Archaeological Associates Ltd (NAA) was commissioned by The University of Law, to undertake a geophysical survey of land at Christleton Hall, University of Law Chester campus, Christleton, Cheshire (NGR 343800 365820) (**Figure 1**). This survey is in support of a planning application for redevelopment of The University of Law Chester campus for residential use (Use Class C3) including demolition of late 20th century buildings, conversion of Christleton Hall and erection of new residential dwellings.

1.2 This geophysical survey was undertaken on the 8th/9th February 2016 to evaluate the archaeological potential of areas of green open space within the development boundary.

2.0 LOCATION, TOPOGRAPHY AND GEOLOGY

2.1 The Site is situated at the western edge of the historic core of the village of Christleton, and lies approximately 2.9km south-east of Chester city centre. The proposed development boundary is situated within the Christleton Conservation Area, with the Grade II Listed Christleton Hall forming the focal point of the Site.

2.2 For ease of reference, the surveyed elements have been divided into three areas, (**Table 1**) Area 1 was the largest and consisted of open flat land used as open space and playing field in the north west of the Site, bounded by an access road to the east, and trees to the south, west and north. Area 2 consisted of the former walled garden in the south east corner of the Site, bounded by walls and buildings and Area 3 was a lawn immediately to the south of the hall.

2.3 The solid geology of the Site comprises pebbly (gravelly) sandstone of the Chester Pebble Beds Formation overlain by superficial deposits of Devensian till (BGS Sheet 109 - Chester). The proposed development is situated at approximately 33m AOD at the northern boundary, gently increasing in elevation to 36m AOD at the southern boundary.

3.0 BACKGROUND

3.1 The archaeological and historical background to the Site is covered in detail in the desk-based assessment, and is therefore summarised in brief below.

- 3.2 Christleton Hall was built in the mid 18th century on the west side of the village of Christleton on land that had formerly been part of the open fields surrounding the village. Associated with the hall was a walled garden which was laid out to the east and appears to have been constructed at the same time. The walled garden originally contained a series of greenhouses and other structures.
- 3.3 Christleton Hall was taken over by the Salvatorians, a Roman Catholic religious order, in 1934 and was used as a college. During the 20th century, the grounds were developed with a series of buildings and these were expanded further after the site became the Chester campus of the University of Law. The grounds also contained a burial ground for the Salvatorians, but this was subsequently cleared when the order gave up the site.
- 3.4 The site of a former post-medieval windmill, known as Christleton Mill, lies close to the north-eastern edge of the Site. The majority of the mound on which the mill stood appears to have been removed for the construction of an existing carpark, however, a small element may survive immediately inside the eastern boundary of the site.
- 3.5 No Roman finds have been made within the grounds of Christleton Hall, but a fragment of a Roman drinking cup was recovered in the 1970s during trenching along the Site boundary. Numerous findspots of Roman coins, pottery sherds and lead weights have been recorded from fields to the north and south-east of Christleton resulting from chance finds and metal detecting.
- 3.6 Examination of Environment Agency LIDAR mapping data suggests that the playing field contain ephemeral traces of ridge and furrow and a former field boundary although these are not visible at ground level.

4.0 AIMS AND OBJECTIVES

- 4.1 The aim of the survey was to evaluate all of the green spaces within the Site which were amenable to survey in order to evaluate the potential for below ground archaeological remains to exist in these areas.
- 4.2 The survey has been undertaken to conform with the appropriate professional standards and guidelines (English Heritage 2008 & ClfA 2014) with the aim of producing a report containing raw and processed greyscale plots of the surveyed areas, XY trace plots and interpretation plans of these results.

5.0 METHODOLOGY

5.1 The geophysical survey was undertaken as magnetometry using the Bartington 601-2 dual magnetic gradiometer system with data logger. The readings were recorded at a resolution of 0.1nT. All recorded survey data was collected with reference to a site survey grid, the survey grid comprised of individual 30m x 30m squares, and was established using Real Time Kinematic (RTK) differential GPS equipment and marked out using non metallic survey markers. All grid nodes were set out with a positional accuracy of at least 0.1m as per existing guidelines and could be re-locatable on the ground by a third party.

5.2 The processing was undertaken using Geoplot 3.0 software and consisted of standard processing procedures (Appendix A). For this project the following steps were undertaken:

Area1

- Zero Mean Traverse +/-5 . +/-20 for grids 12 and 13
- Destagger
- Clipping to a factor of +/-30
- Despike
- High Pass filter

Area 2

- Zero Mean Traverse +/-5
- Destagger
- Despike
- Clipping to a factor of +/-50

5.3 Further details are available in Appendix A Technical Information.

Surface Conditions and other Mitigating Factors

5.4 The land was subject to a variety of uses, the largest plot (Area1) was used as open space and playing field, a smaller plot to the south east was an orchard within a walled garden (Area 2) and struck through by gravel pathways. A smaller plot to the south west was an area of lawn surrounded by trees (Area 3).

- 5.5 Area 1 was wet under foot particularly to the west, and was set out as open space and playing field. The metal goal posts of the rugby and football pitches have created large dipolar anomalies. A small but steep mound covered with trees was located to the north east of the playing field adjacent to the carpark and a lamp post was located on the edge of the area. Trees around the field perimeter reduced the surveyable area in places.
- 5.6 Area 2 was a former walled garden with areas of paving and some temporary structures. A number of trees associated with an orchard in this garden created further obstacles. Area 3 was hemmed in between buildings and trees and it was not possible to survey a full grid in this location.
- 5.7 The results of geophysical survey may not reveal all archaeology, geological, agricultural and modern responses may mask other features. Short lived features, such as graves, may not produce a strong or any response. Only clear features have been interpreted and discussed within this report.

6.0 RESULTS (FIGURES 3 – 7)

- 6.1 The magnetometer survey was successful in Areas 1 and 2 and created clear results demonstrating previous use of the site and geological features. The survey of Area 3 was not successful, as the area proved too small to produce meaningful results.
- 6.2 The word anomaly is used to refer to any outstanding high or low readings, positive readings are shown in the figures as darker areas and negative responses are shown as lighter results. A full terminology is listed in the Technical Information Appendix A
- 6.3 Figure 3 shows four views of the Area 1 data: minimally processed; processed as set out in the methodology; XY trace plot; and an interpretation of the data. The specific features and anomalies referred to in the text are numbered 1 – 5 on the interpretation plot. Figure 4 contains the equivalent data plots for Area 2.

Description

Area 1 (Figure 3)

- 6.4 Clear results showing strong bipolar and dipolar responses were revealed, as well as a weak positive linear anomaly parallel to the northern boundary. Adjacent to the southern boundary, a series of wide weak positive linear anomalies transected the

survey area with a stronger bipolar response on the eastern edge of the site. A number of parallel weak positive and negative anomalies aligned east – west spanned the Area. Towards the north-east corner, a positive linear anomaly aligned north-west to south-east was recorded just north of two areas of magnetic debris.

Area 2 (Figure 7)

- 6.5 This Area demonstrated strong responses associated with magnetic debris, mostly in the south east of the area and along the edges of the walls. Dipolar anomalies were also visible, one of which formed a circular feature towards the centre of the southern boundary. Another series of dipolar responses were recorded to the north-east of the latter feature, forming a roughly rectangular shape.
- 6.6 Mixed responses were identified forming a series of linear anomalies running east – west across the centre and along the northern boundary. A third linear anomaly ran parallel with the eastern boundary.
- 6.7 Weak associated positive and negative anomalies were seen running north – south across the whole of the area except where obscured by stronger responses.

Area 3

- 6.8 Area 3 was too small for a full grid to be surveyed. The survey did not produce any meaningful responses and is not discussed further here.

Interpretation

Area 1

- 6.9 Four large dipolar responses (1) were created by the goal posts. An east - west bipolar anomaly (2), which turns north at its western end, is likely to be a modern service as manholes were seen on the surface in this location.
- 6.10 At the southern end of the area, a series of parallel positive and negative linear anomalies (3) may reflect a former ditch or boundary feature.
- 6.11 A weak linear anomaly (4), aligned north-west to south-east, is likely to be geological in origin and lies just north of two small areas of magnetic debris which are unlikely to represent archaeology.

- 6.12 A weaker rectangular shape created by individual positive responses in the western half of the Area is likely to relate to the outline of the playing field.
- 6.13 A positive linear anomaly (5) is visible parallel to the northern boundary and could be a former field boundary or drainage ditch.
- 6.14 A series of parallel positive and negative linear anomalies running east – west across the field are likely to represent the remains of ridge and furrow.
- 6.15 A large negative response in the north-eastern corner of the area is related to the lamp post on top of the mound in this area. A large bipolar anomaly running along the south-western edge of the area represents a modern service. A further strong dipolar response on the edge of the access road probably related to a further lamp post.

Area 2

- 6.16 This Area is enclosed by walls and buildings, including temporary structures at the western end, which have affected the survey results. Gravel paths run through the middle and edges of the Area and are visible as mixed positive and negative linear responses.
- 6.17 Large areas of magnetic disturbance in the south-east quarter and adjacent to the eastern boundary wall are likely to relate to former buildings within the walled garden. A circular bipolar response to the west of the larger areas of disturbance may also relate to an earlier structure. Dipolar responses in the north-east quarter of the Area may relate to another structure or could be rubble or debris.
- 6.18 Sporadic small positive responses across the grassed areas may relate to the use of this area as an Orchard. A series of weak parallel anomalies on a north – south alignment appear to represent ridge and furrow.

7.0 CONCLUSIONS.

- 7.1 Area 1 demonstrated clear survey results, however, relatively few anomalies which may be of archaeological origin were identified. Most of the anomalies related to modern services, the playing field or modern dumped material.
- 7.2 Ridge and furrow was recorded across the area together with a ditch close to the northern boundary and a second ditch or trackway close to the southern boundary.

7.3 Area 2 showed evidence of the previous use of the walled garden with magnetic debris responses related to the position of former buildings alongside the walls. The evidence of ridge and furrow aligned north - south would appear to predate the walled garden.

8.0 STORAGE AND CURATION

8.1 The records are currently held by NAA. It is intended that the site archive will be transferred to the appropriate repositories. All material would be appropriately packaged for long-term storage in accordance with both national guidelines and to the requirements of the appropriate museum.

References

Abingdon Archaeological Geophysics. (2008) *Archaeological Geophysics : a Short Guide*.BAJR

ClfA. (2014) *Standard and guidance for archaeological geophysical survey*. Institute for Archaeology, Reading.

English Heritage. (2008) *Geophysical Survey in Archaeological Field Evaluation*. English Heritage, Portsmouth

NAA (2017). *Land at Christleton Hall, Christleton, Cheshire: Archaeological Desk-Based Assessment*. NAA Unpublished Report

APPENDIX A

TECHNICAL INFORMATION

Instrumentation

The Bartington 601-2 is a single axis, vertical component fluxgate gradiometer comprising a data logger battery cassette and two sensors. The sensors are Grad-01-1000L cylindrical gradiometer sensors mounted on a rigid carrying frame, each sensor contains two fluxgate magnetometers with 1m vertical separation.

The Magnetometer records two lines of data on each traverse, the grids are walked in a zig-zag pattern amounting to 15 traverses. The gradiometers are calibrated at the start of every day and recalibrated whenever necessary.

The difference in the magnetic field between the two fluxgates in each sensor is measured in nanoTesla (nT) and for this investigation the readings are measured at 0.1nT. The units' sensors can measure down to 1m from the ground level depending on the ground conditions.

Readings reach between +/-100nT and lower readings are created by upstanding or harder remains such as walls or areas of stone, higher readings are created by softer or cut features, such as ditches and pits (see below).

Magnetic anomalies and terminology

The different magnetic anomalies can represent different features created by soil and geology, human activity, modern services etc.

Positive linears are dark lines often caused by archaeological features, such as ditches and field boundaries but can also be natural.

Positive points represent cut features which can be archaeological or natural.

Positive linears with associated negative responses with strong readings are often modern services such as cables, however weaker responses can be archaeological features such as earthworks.

Negative linears represent earthworks, walls and other upstanding or compacted remains.

Negative points can represent archaeological or natural features.

Bipolar readings are composed of negative and positive readings often created by linear features such as pipelines.

Dipolar readings are single positive responses with a surrounding negative response. Strong responses tend to be caused by ferrous objects.

Areas of heating/burning or heated objects produce thermoremanent responses as this creates a magnetic field. These can appear as bipolar responses or as magnetic debris depending on whether it is in situ, or moved into place.

Magnetic debris is noticeable as areas of positive and negative responses, which can relate to general ground disturbance, spreads of ferrous debris or areas of rubble.

High amplitude magnetic disturbance is caused by standing metal structures such as fencing and buildings. This can cause interference extending out from the structure, across the area and is often found at the edges of the survey area.

Variable weak magnetic responses can demonstrate natural features or changes in geology or soil type.

Limitations

Poor results can be due to several factors including short lived archaeological occupation/use or sites with minimal cut or built features. Results can also be limited in areas with soils naturally deficient in iron compounds or in areas with soils overlying naturally magnetic geology, which will produce strong responses masking archaeological features.

Overlying layers such as demolition rubble or layers of made ground can hide any earlier archaeological features. The presence of above ground structures and underground services containing ferrous material can distort or mask nearby features.

Particularly uneven or steep ground can distort results beyond the capabilities of processing to even out. Over processing of data can also obscure features.

Processing and figures

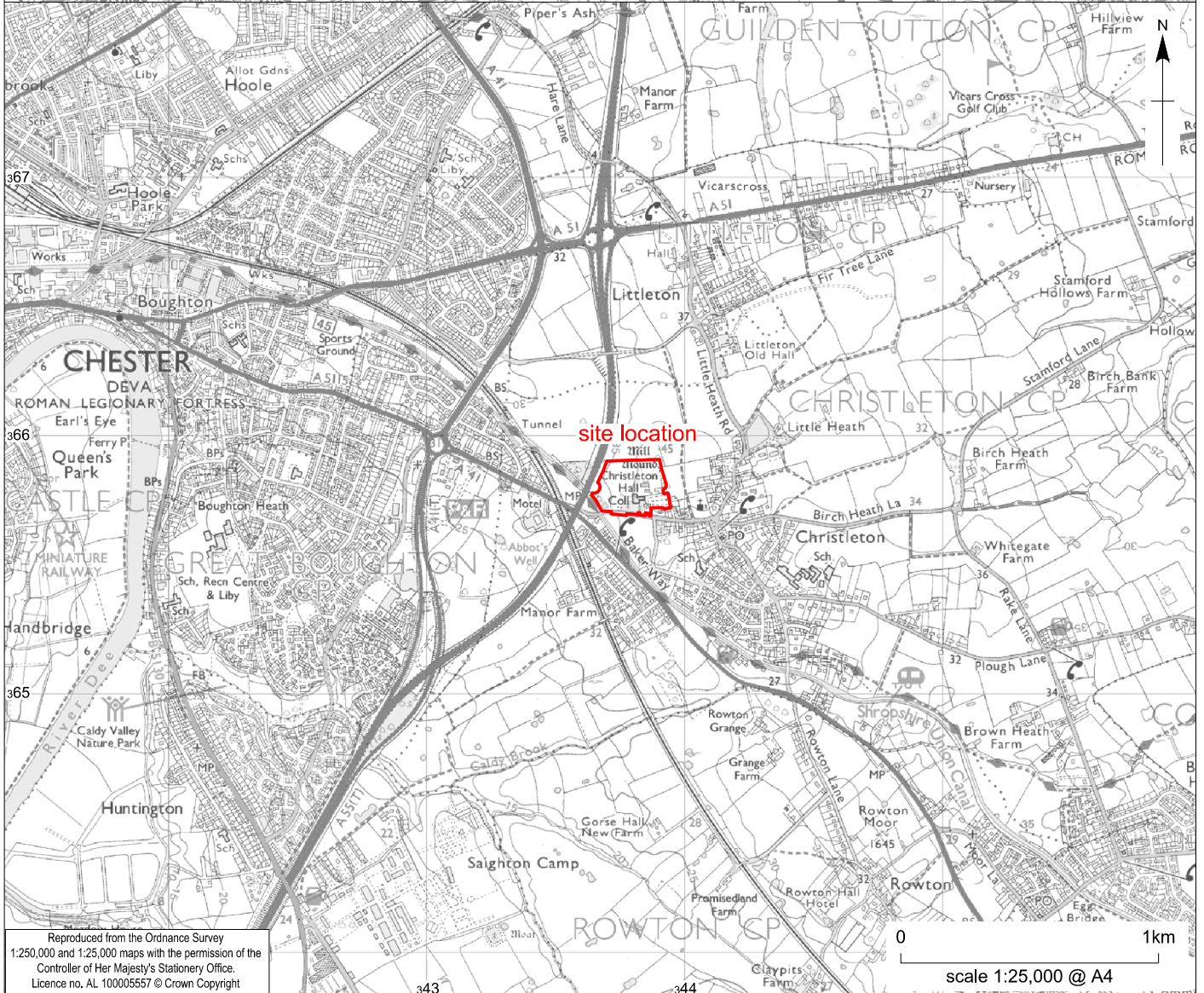
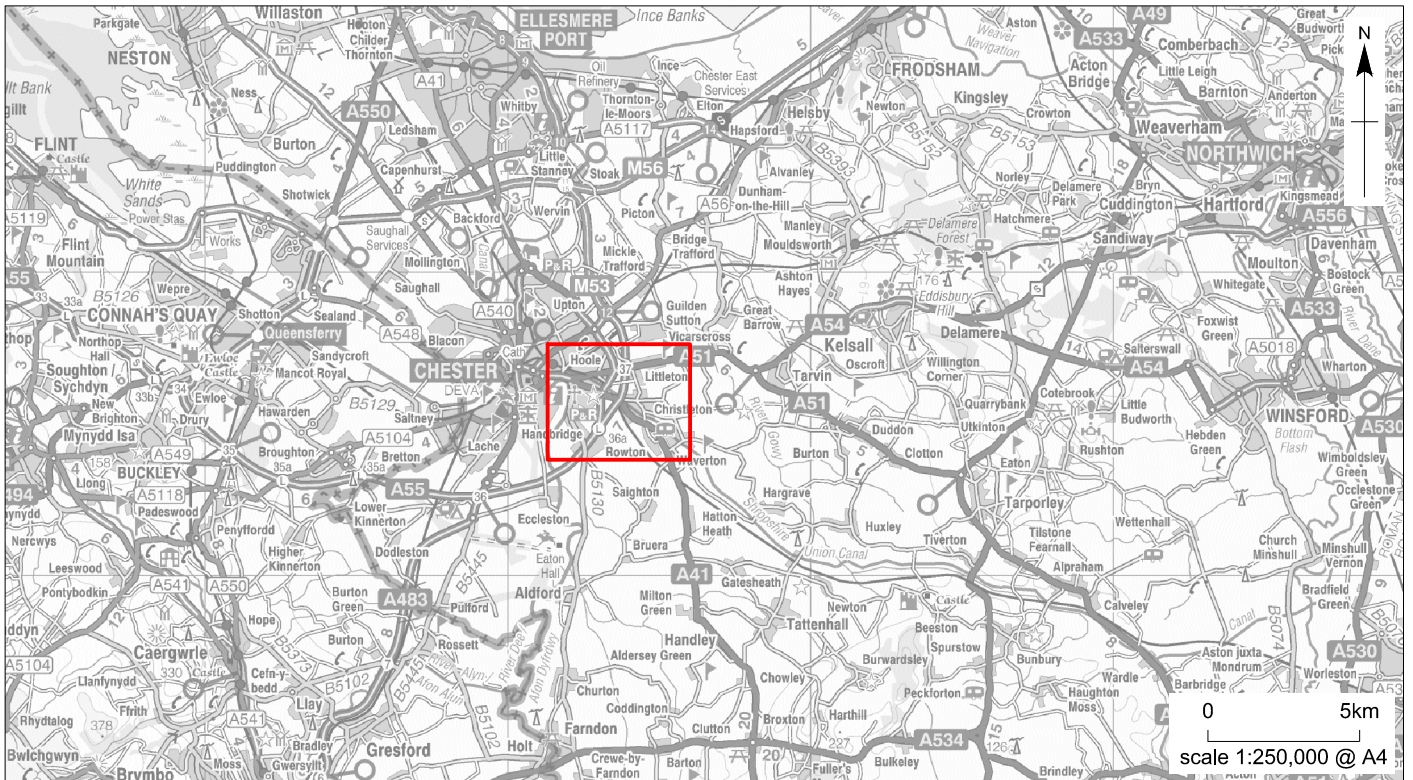
The processing is undertaken using Geoplot 3.0 software, and the following processing techniques:

- Zero Mean Traverse - to remove directional effects inherent in the survey,

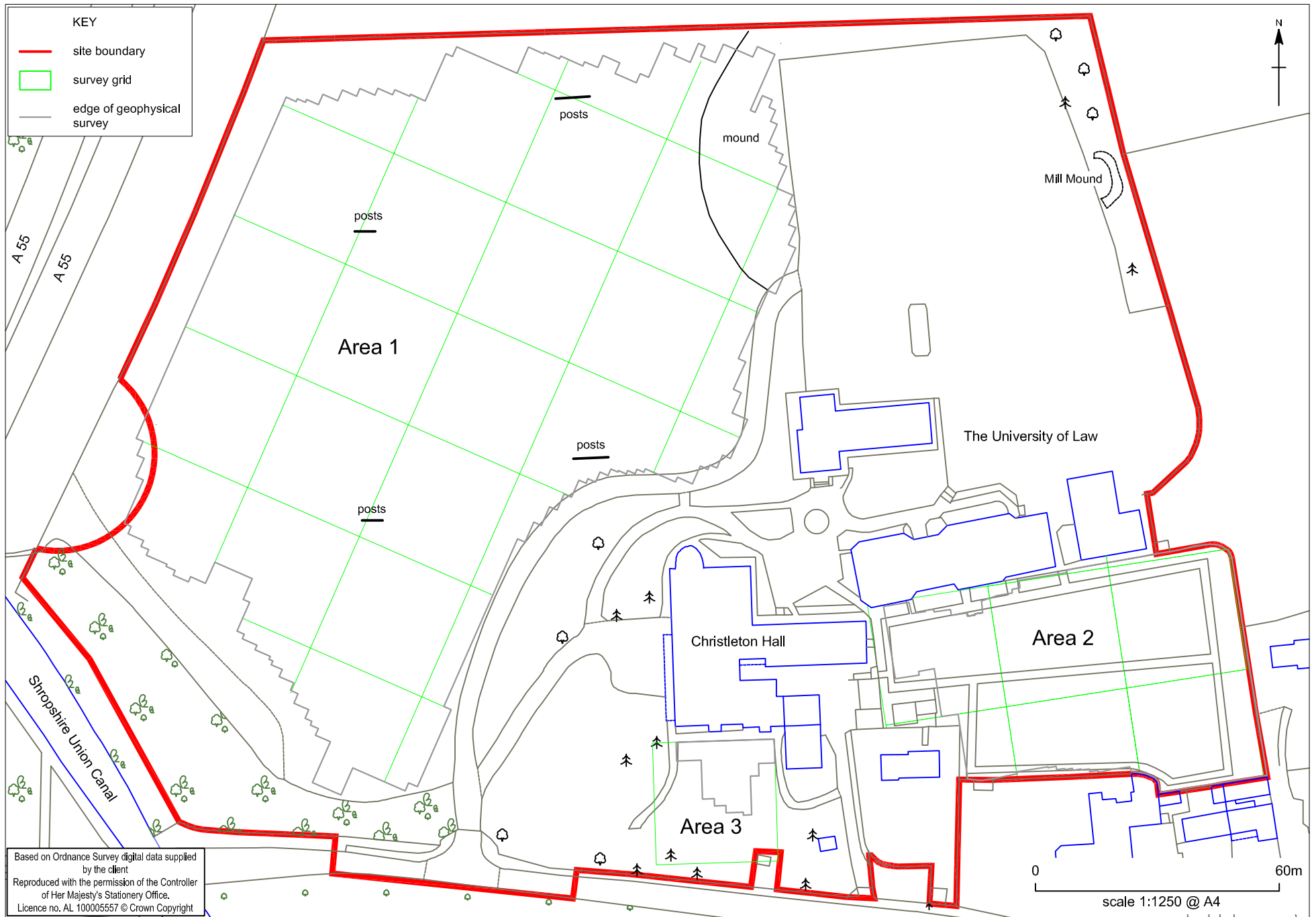
- Destagger - to shift the traverses back or forward to correct for user error,
- Clipping - to enhance the weaker features,
- Despiking - removing data points that are above an appropriate mean to reduce the appearance of dominant readings, created by modern ferrous objects distorting the results.

The data can produce a series of images to demonstrate the results of surveys these are detailed below:

- XY Trace Plot – This creates a line drawing showing the peaks and troughs of the readings as vertical offset from a centreline.
- Greyscale/Colourscale Plot – This demonstrates the results as a shaded drawing with highest readings showing as black, running through different shades to lowest showing as white. This can also be created using a colour pallet to demonstrate the different values.
- Interpreted data – This is created to show features and particular high or low readings to reinforce and clarify the written interpretation of the data. This is based on the Greyscale plot but with different colours used to represent particular readings



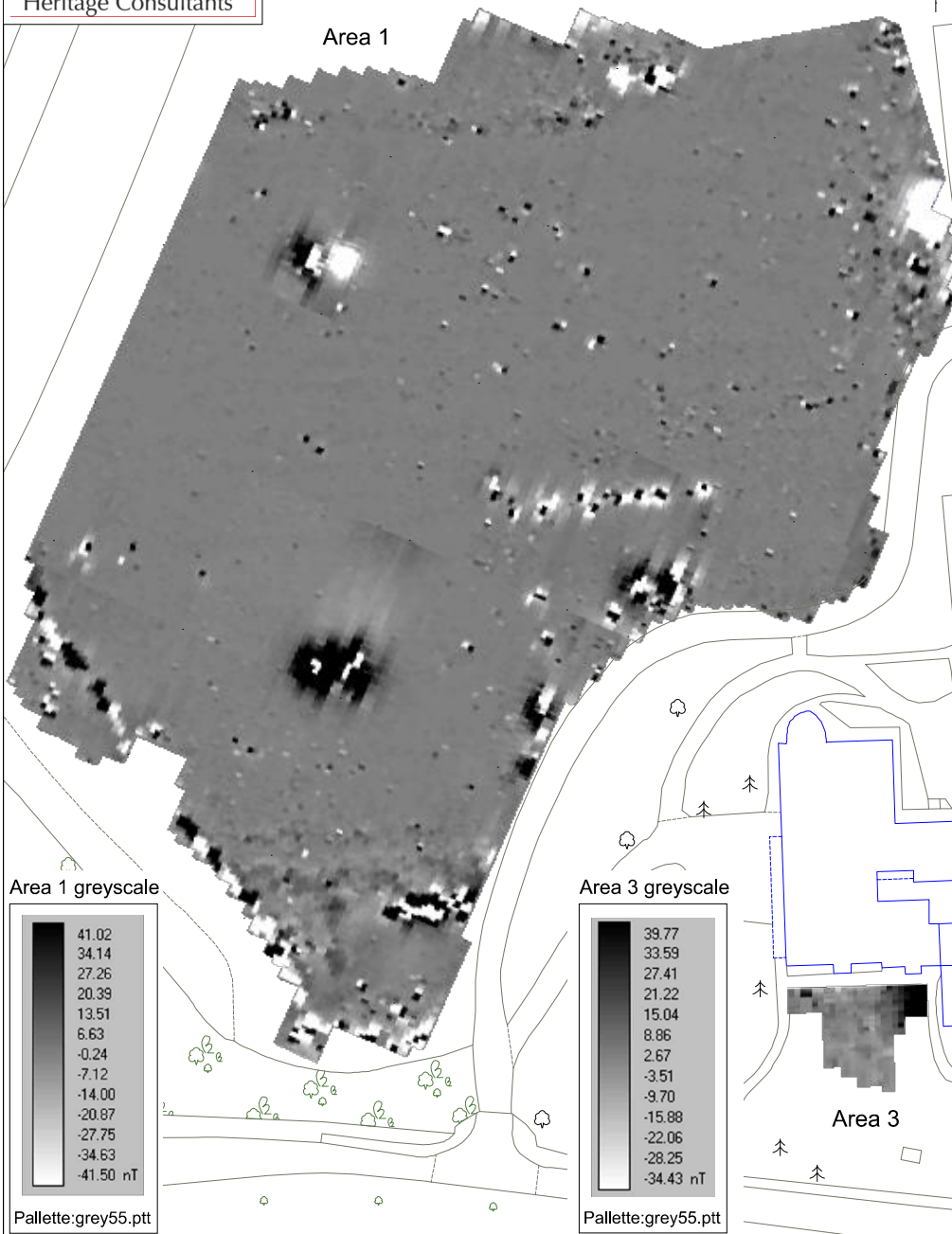
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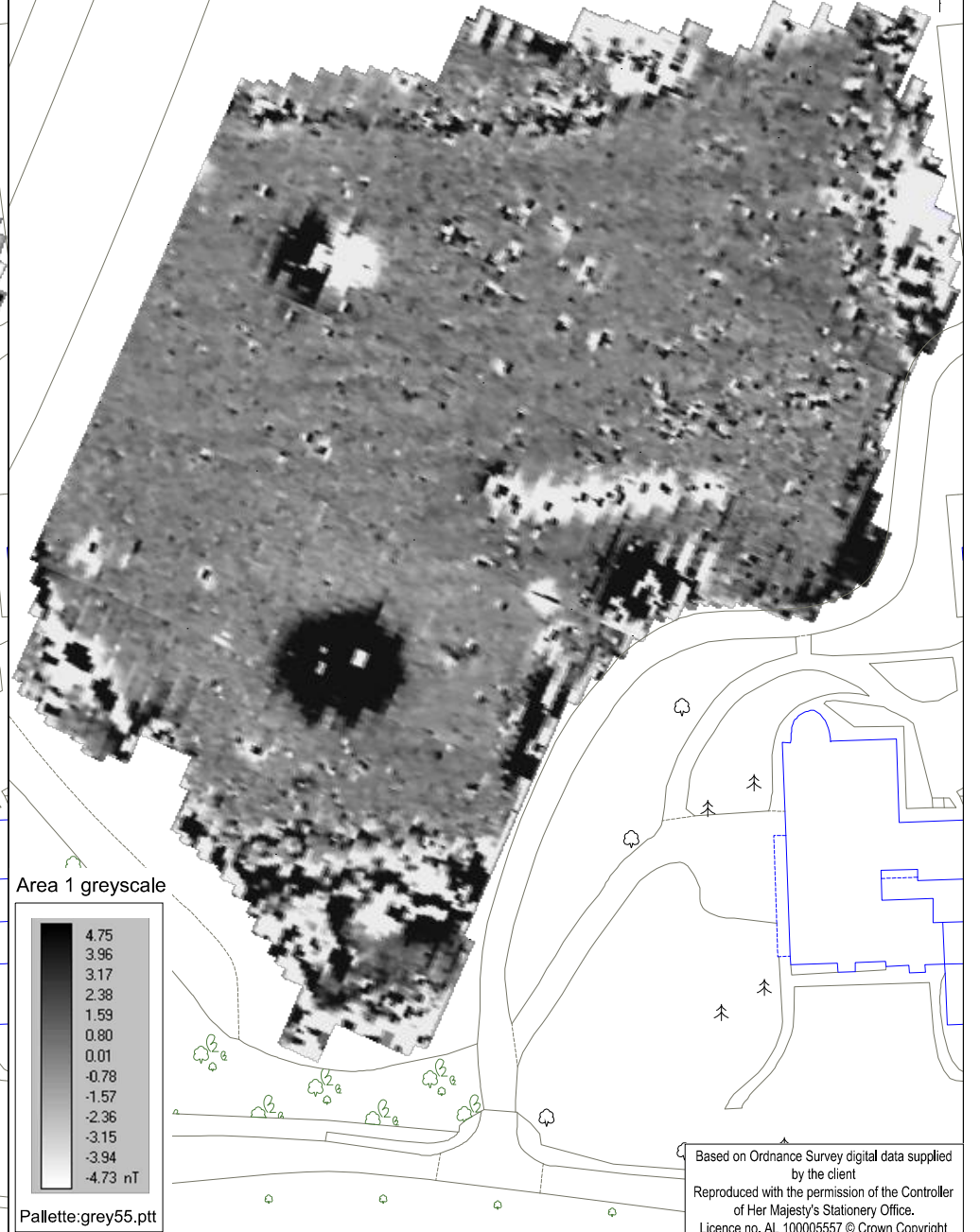
Christleton: site grids

Figure 2

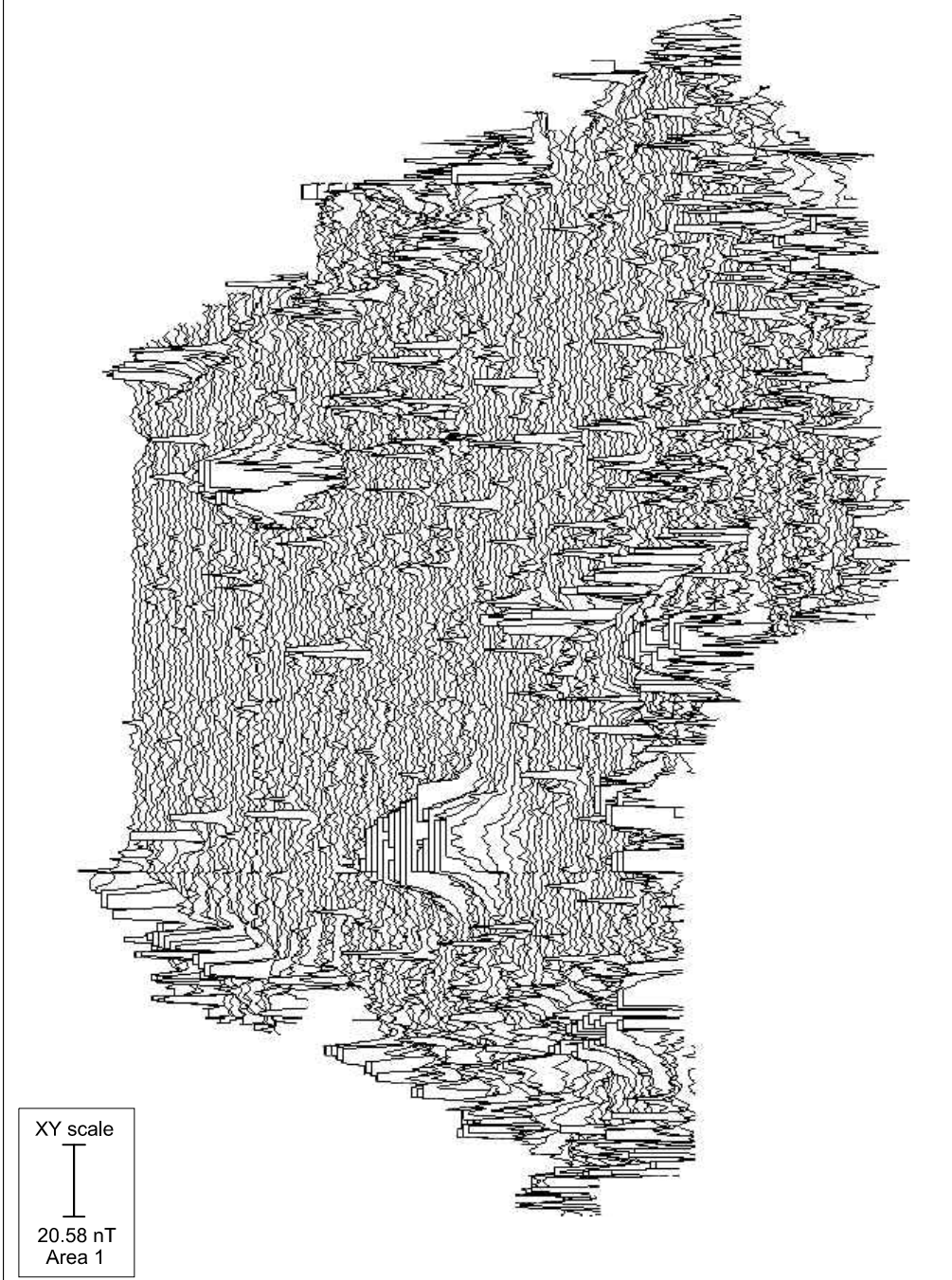
Areas 1 and 3 minimally processed gradiometer data



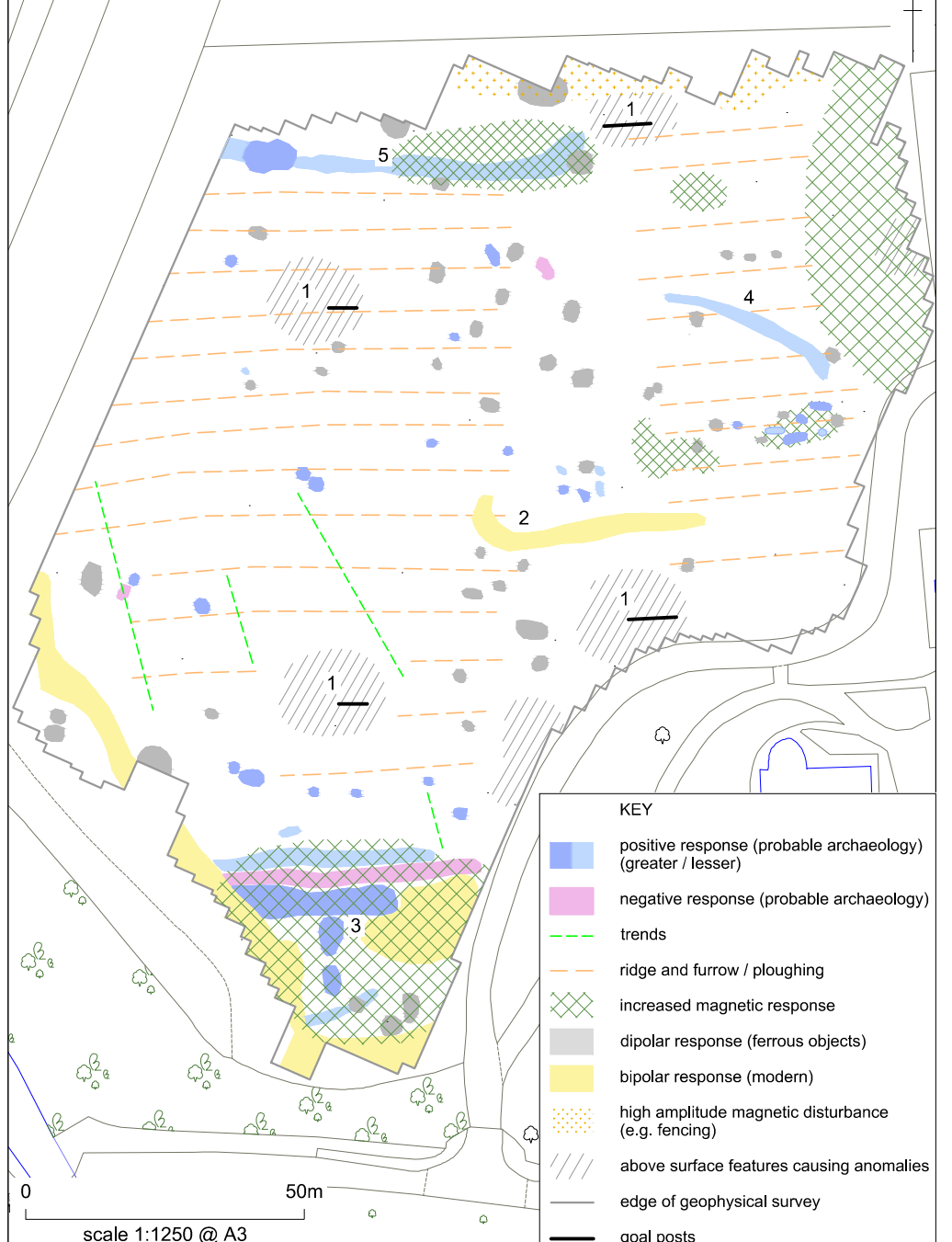
Area 1 processed gradiometer data



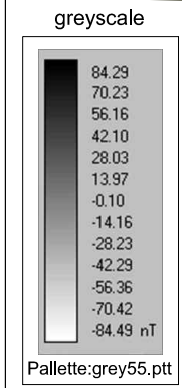
Area 1 XY plot



Area 1 interpretation

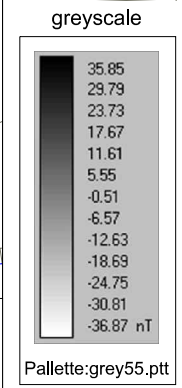


Area 2 minimally processed gradiometer data

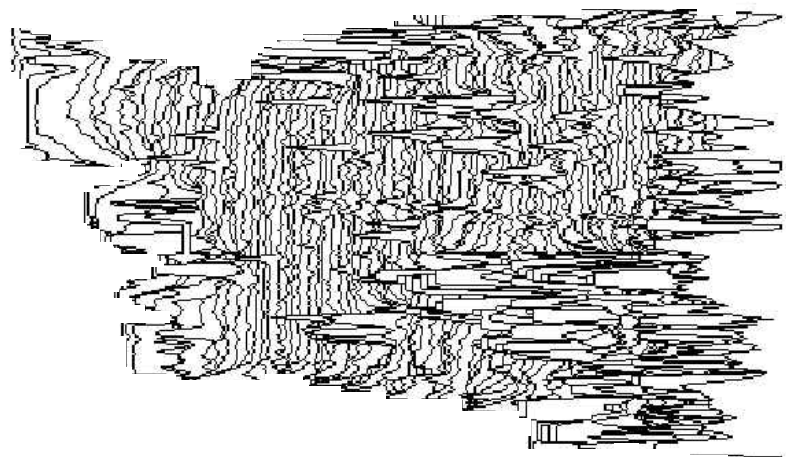


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Area 2 processed gradiometer data



Area 2 XY plot



XY scale
119.25 nT
Area 2

Area 2 interpretation

