

**ARCHAEOLOGICAL EVALUATION REPORT:**

**GEOPHYSICAL SURVEY BY MAGNETOMETRY ON LAND AT FREDERICK GOUGH SCHOOL,  
SCUNTHORPE, NORTH LINCOLNSHIRE**

Planning Reference: PA/2011/1544  
NGR: SE 90209 07755  
North Lincolnshire Museum Site Code: SCAH  
AAL Site Code: SCFG 12  
OASIS Reference: allenarc1-119785



Report prepared for Niven Architects

By

Allen Archaeology Ltd

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Element	Name	Date
Report prepared by:	Robert Evershed	22/02/2012
Report edited by:	Chris Clay	22/02/2012
Report produced by:	AAL20112017	22/02/2012

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*Cover image: View from south-east corner of site looking north-west*

## Executive Summary

- A geophysical survey by magnetometry was undertaken by Allen Archaeology on land at Frederick Gough School in Scunthorpe, North Lincolnshire, in order to fulfil the recommendations of the Historic Environment Officer at North Lincolnshire Council.
- The site is to the east and south of the existing school buildings and had coverage of short grass. The site lies at a height of approximately 25m above Ordnance Datum and the central NGR is SE 90209 07755.
- The survey has revealed one possible area of archaeological interest, a curvilinear positive magnetic anomaly towards the south-west corner of the survey area. This may be an archaeological feature or just variation in the natural geology.
- The survey has revealed the presence of modern service pipes running across the field. There are also some dipolar responses in the magnetic data which are likely to have been caused by modern ferrous detritus or other highly fired material, including in-situ goal posts, on or close to the surface.
- Overall, the construction of the school and the terracing of the field have most likely contributed to the removal of the majority of any former archaeological remains or the masking of such with magnetic noise. A single anomaly at the south-west end of the survey could be indicative of an area where archaeological remains may be encountered.

## 1.0 Introduction

- 1.1 A geophysical survey by magnetometry was undertaken by Allen Archaeology Limited (hereafter AAL) on land at Frederick Gough School in Scunthorpe, North Lincolnshire, on behalf of Niven Architects, in advance of the determination of a planning application for redevelopment of the school.
- 1.2 The site works and reporting conform to current national guidelines, as set out in 'Geophysical Survey in Archaeological Field Evaluation' (English Heritage 2008), 'The Use of Geophysical Techniques in Archaeological Evaluations' (IFA Paper 6), the Institute for Archaeologists 'Standard and guidance for archaeological geophysical survey' (IfA 2010), and a specification prepared by this company (AAL 2012).

## 2.0 Site Location and Description

- 2.1 Scunthorpe is situated approximately 13km south-west of the River Humber, in the unitary authority of North Lincolnshire. The school grounds comprise a sub-rectangular block of land of c.9.6 hectares in the southern suburb of Bottesford, with the block of school buildings in the northern portion of the site and playing fields to the south. The proposed survey area is towards the east side of the site, to the east and south of the existing school buildings and currently has coverage of short grass. The site lies at a height of approximately 25m above Ordnance Datum and the central NGR is SE 90209 07755.
- 2.2 The local geology comprises bedrock deposits of Frodingham Ironstone and Scunthorpe Mudstone, banded with limestone, with a superficial geology of blown sand (British Geological Survey 1982).

## 3.0 Planning Background

- 3.1 A planning application has been submitted to North Lincolnshire Council for '*partial demolition of part of the existing school, the construction of a new entrance, community sports facility, teaching block, 3G pitch, new car park and associated landscaping*' (Planning Application Reference PA/2011/1544). It was considered that insufficient information was submitted regarding the impact of the proposed development upon the potential archaeological resource, and the Historic Environment Officer advised a holding objection until such time as further information is submitted. The geophysical survey represents an initial stage of the proposed investigations and is intended to inform a subsequent stage of trial trenching and further mitigation if appropriate.
- 3.2 The relevant planning policy which applies to the effect of development with regard to cultural heritage is Planning Policy Statement 5 (PPS5).

## **4.0 Archaeological and Historical Background**

- 4.1 An archaeological desk-based assessment was prepared and submitted in support of the application by AAL; a summary of which is presented below (AAL 2010).
- 4.2 Scatters of Mesolithic, Neolithic and Bronze Age material were recorded within 500m of the survey area, mainly to the east of the site.
- 4.3 Extensive fieldwork in advance of residential development to the east of the site has identified a mid to late Iron Age banjo enclosure, overlain by a series of late Iron Age settlement enclosures, which were in turn superseded by a Roman ditched trackway running east – west with associated enclosures. Subsequent fieldwork in the area between these features and the site failed to identify any evidence to suggest that the activity may extend into the site however. Further cropmarks indicative of later prehistoric to Roman settlement and agriculture have been recorded to the south of the site, close to Bottesford Beck.
- 4.4 There is only limited evidence of Anglo-Saxon and later activity in the vicinity of the site. It is situated in the parish of Bottesford, but is likely to have been in agricultural land throughout this period, at some distance to the north of the historic core of the village.

## **5.0 Methodology**

- 5.0.1 The geophysical survey consisted of a survey area totalling approximately 1.8 hectares, located over the proposed new sports pitch, PE Block and car park extension. The survey was undertaken in a series of 30m grids across the proposed survey area. The proposed new 'South Block' was not surveyed as it is located in an existing concrete surfaced tennis court, which is not suitable for magnetometry.
- 5.0.2 The fieldwork was carried out by a team of two experienced geophysicists from AAL over a period of one working day. The site was divided into a 30m by 30m grid, established on site with reference to local fixed boundaries and accurately tied into the National Grid using Ordnance Survey base mapping.
- 5.0.3 The survey was carried out using a Bartington Grad601-2 Dual Fluxgate Gradiometer with an onboard automatic DL601 data logger. This instrument is a highly stable magnetometer which utilises two vertically aligned fluxgates, one positioned 1m above the other. This arrangement is then duplicated and separated by a 1m cross bar. The 1m vertical spacing of the fluxgates provides for deeper anomaly detection capabilities than 0.5m spaced fluxgates. The dual arrangement allows for rapid assessment of the archaeological potential of the site. Data storage from the two fluxgate pairs is automatically combined into one file and stored using the onboard data logger.
- 5.0.4 Data collection was undertaken in a zigzag traverse pattern, using a sample interval of 0.25m and a traverse interval of 1m.

## 5.1 Summary of Survey Parameters

### 5.1.1 Fluxgate Magnetometer

Instrument:	Bartington Grad601-2 Dual Fluxgate Gradiometer
Sample interval:	0.25m
Traverse interval:	1.00m
Traverse separation:	1.00m
Traverse method:	Zigzag
Resolution:	0.1 nT
Processing software:	ArchaeoSurveyor 2.5
Surface conditions:	Pasture
Area surveyed:	1.8 ha
Date surveyed:	16 <sup>th</sup> February 2012
Surveyor	Robert Evershed
Survey assistant:	Iain Pringle
Data interpretation:	Robert Evershed, Dave Hibbitt and Mark Allen

## 5.2 Data Collection and Processing

- 5.2.1 The site was marked out in accordance to standard AAL procedures. For practical reasons a baseline was set up across the centre of the site running west-south-west to east-north-east along the line of one of the metal fences dividing up areas of the school grounds. The collection of magnetic data using a north to south traverse pattern is preferable for a magnetic survey if no other constraints dictate the direction of the principle traverses, for in any latitude there will be a greater peak-to-peak magnetic anomaly in this direction (Breiner 1999, 41). On this occasion it was practical to collect data on a specific north-north-west to south-south-east alignment. Data was collected by making successive parallel traverses across each grid in a zigzag pattern. Several key points of the survey grids were tied in to fixed features and these are recorded in the surveyor's site notes.
- 5.2.2 The survey was carried out using a Bartington Grad601-2 Dual Fluxgate Gradiometer with an onboard automatic DL601 data logger. This instrument is a highly stable magnetometer which utilises two vertically aligned fluxgates, one positioned 1m above the other. This arrangement is then duplicated and separated by a 1m cross bar. The 1m vertical spacing of the fluxgates provides for deeper anomaly detection capabilities than 0.5m spaced fluxgates. The dual arrangement allows for rapid assessment of the archaeological potential of the site. Data storage from the two fluxgate pairs is automatically combined into one file and stored using the onboard data logger.
- 5.2.3 The data collected from the survey has been analysed using the current version of ArchaeoSurveyor 2. The resulting data set plots are presented with positive nT/m as black and negative nT/m values as white.

The data has been subjected to processing using the following filters:

- De-stripe (also known as Zero Mean Traverse or ZMT)
- Clipping
- Interpolation

- 5.2.4 The de-stripe process is used to equalise underlying differences between grids or traverses. Differences are most often caused by directional effects inherent to magnetic surveying instruments, instrument drift, instrument orientation (for example off-axis surveying or heading errors) and delays between surveying adjacent grids. The destripe process is used with care however as it can sometimes have an adverse effect on linear features that run parallel to the orientation of the process.
- 5.2.5 The clipping process is a data truncation process and is used to remove extreme data point values which can mask fine detail in the data set. Excluding these values allows the details to show through.
- 5.2.6 Interpolation is a process which is used to remove the sometimes 'blocky' appearance of data when presented in greyscale form and produces a smoother greyscale image. The process mathematically calculates and inserts additional values between existing data points.
- 5.2.7 Plots of the data are presented in raw linear greyscale, processed linear greyscale and trace plot form with any corrections to the measured values or filtering processes noted, and as a supplemental (English Heritage 2008, 10) graphical interpretation of the main anomalies detected.

## 6.0 Magnetometer Survey Results (Figures 3 – 6)

- 6.1 The raw data was initially processed to values of -10nT/m to 10nT/m to evaluate the anomalies present. For the purposes of interpreting the anomalies, the survey data has been processed to values of -3 nT/m to 3 nT/m (Figure 4). This enhances faint anomalies that may otherwise not be noted in the data; however it also includes all ferrous and other magnetically enhanced material within the study area, making the resulting greyscale image particularly 'noisy'. The survey results revealed a number of anomalies across the data set, and these are discussed in turn and noted as numbers in square brackets.
- 6.2 The surface conditions were suitably conducive to surveying, although several large metal fences running across the site caused some interference to the survey.
- 6.3 Immediately noticeable in the data set are the large positive magnetic anomalies [1], running parallel across the site west-south-west to east-north-east. These anomalies are the result of large metal fences running across the site dividing up areas of the school grounds.
- 6.4 Linear positive magnetic anomalies [2] are most likely service pipes associated with the construction of the school. The survey also revealed a system of positive magnetic anomalies, [3] and [4], which is identified as drainage running across the site.
- 6.5 Towards the south-west corner of the survey area, a curvilinear anomaly, [5], may be of archaeological origin such as an enclosure ditch. It may also represent a variation in the natural geology however.
- 6.6 Anomalies [6] and [7] very likely represent extraneous disturbance related to the construction of the school. These may mask potential archaeological remains, although it is more likely that the construction of the school in these areas has removed any archaeological remains that may have been present. The area of extraneous disturbance [8] is the modern surface of a cricket pitch.

- 6.7 Scattered randomly throughout the site are a number of strong and weak dipolar responses (the strongest of these being identified by a yellow circle). The characteristic dipole response of pairs of positive and negative 'spikes' suggests near-surface ferrous metal or other highly fired material. Specifically [9] and [10], represent football goalposts still in-situ, and some of the others may well be former goalposts for football or rugby that have been cut off at ground level and the bases still remain.

## **7.0 Discussion and Conclusions**

- 7.1 The site ground conditions proved relatively receptive to geophysical surveying. However it was a fairly magnetically 'noisy' site, particularly as a result of the large metal fences running across the survey area.
- 7.2 The survey identified one possible anomaly of archaeological interest, [5], which could be the remains of an enclosure ditch. Such a feature is morphologically suggestive of the type of later prehistoric to Roman agricultural and settlement enclosures well represented in the wider landscape (AAL 2010 and Winton 1998, Figure 2 and 51). However, a natural geological origin for this anomaly is equally possible.
- 7.3 Linear anomalies, [2] – [4] are very likely to be modern services and drainage features associated with the school and its playing fields.
- 7.4 The survey also detected a number of dipolar responses spread randomly across the site indicating near-surface ferrous metal or other highly fired material, including former metal goal posts in several areas. Significant areas of extraneous interference towards the north end of the survey area represented by [6] and [7] are likely to be the result of the construction of the adjacent school buildings and spreads of building rubble directly below the existing ground surface.
- 7.5 The construction of the school and the associated terracing of the site are likely to have had a significant impact on any archaeological features or deposits that may have existed on the site. There is a slight possibility that the widespread disturbance evident in the survey masks any archaeological features, although it seems more likely that these areas of disturbance represent significant truncation of earlier deposits. Anomaly [5] which may be of archaeological interest may indicate an area at the south end of the survey where archaeological deposits survive.

## **8.0 Effectiveness of Methodology**

- 8.1 The non-intrusive evaluation methodology employed was appropriate to the scale of the site to be surveyed. Magnetometry surveying was the prospection technique best suited to the identification of archaeological remains on the site. Other techniques would have required justification and may have proved too time consuming or cost-prohibitive.



## 9.0 Acknowledgements

9.1 Allen Archaeology would like to thank Niven Architects for this commission and Frederick Gough School for their cooperation during the fieldwork.

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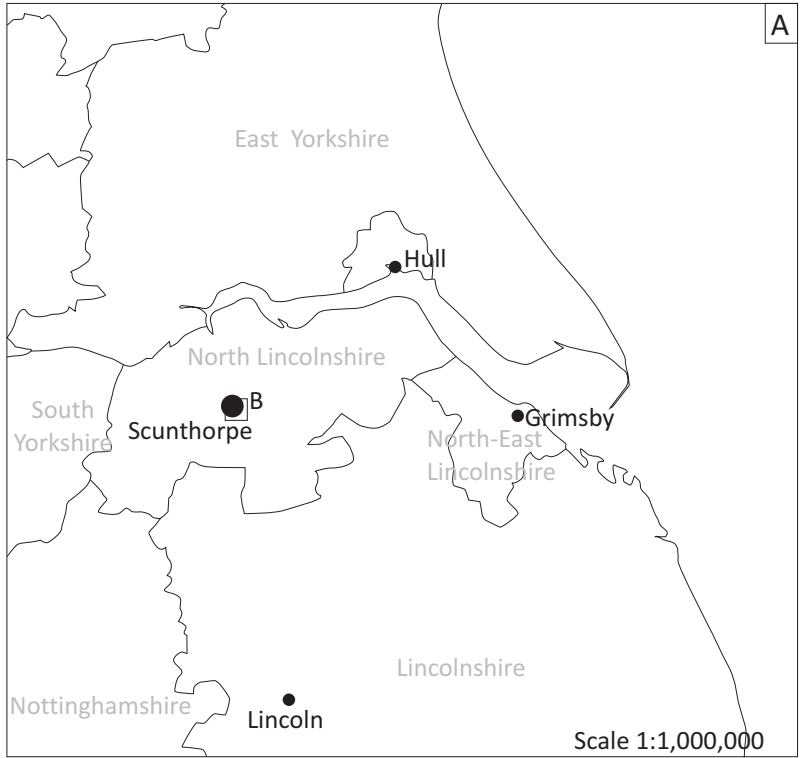
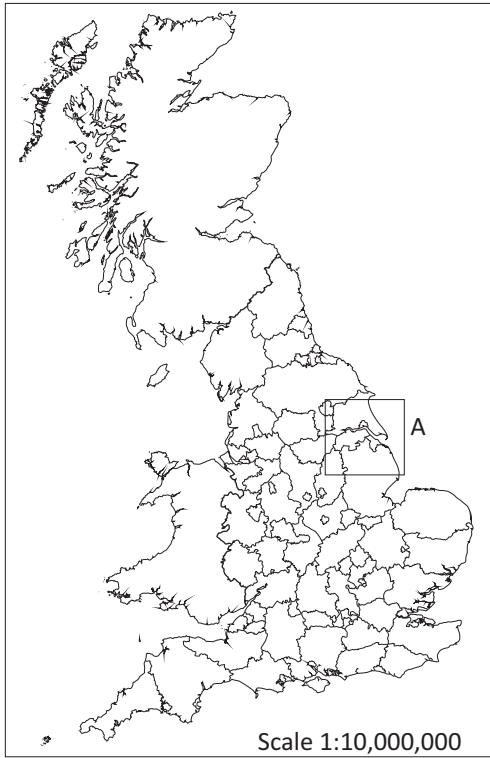
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**Figure 1:** Site location at scale 1:25,000, with site outlined in red and survey area in blue  
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**Figure 2:** Site location at scale 1:2,000, with the site outlined in red and survey area in blue



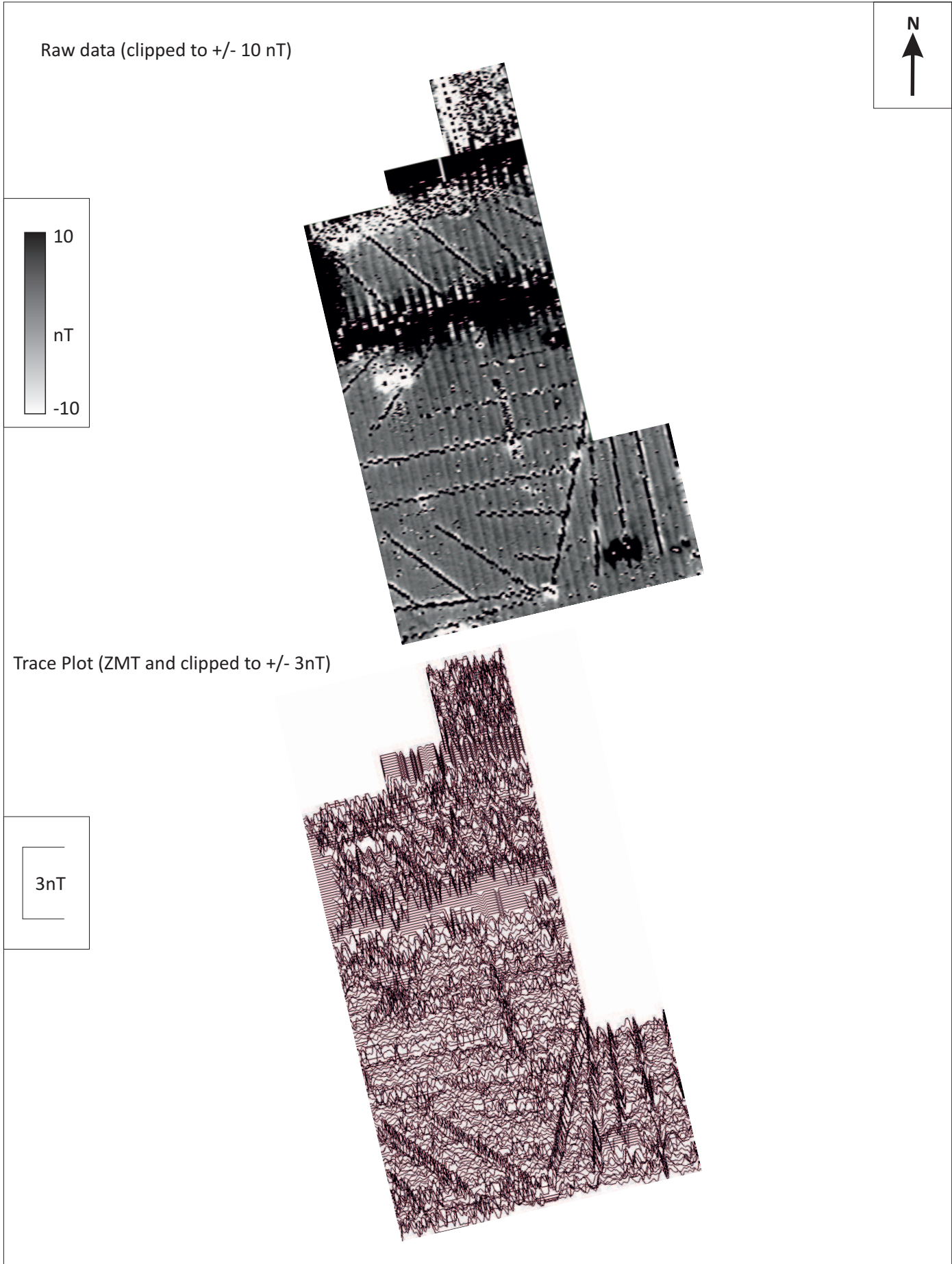
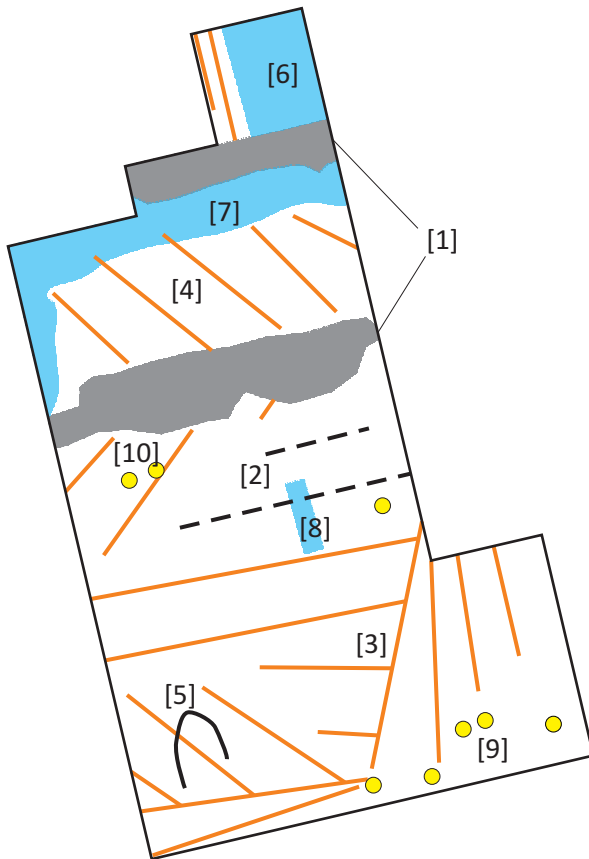
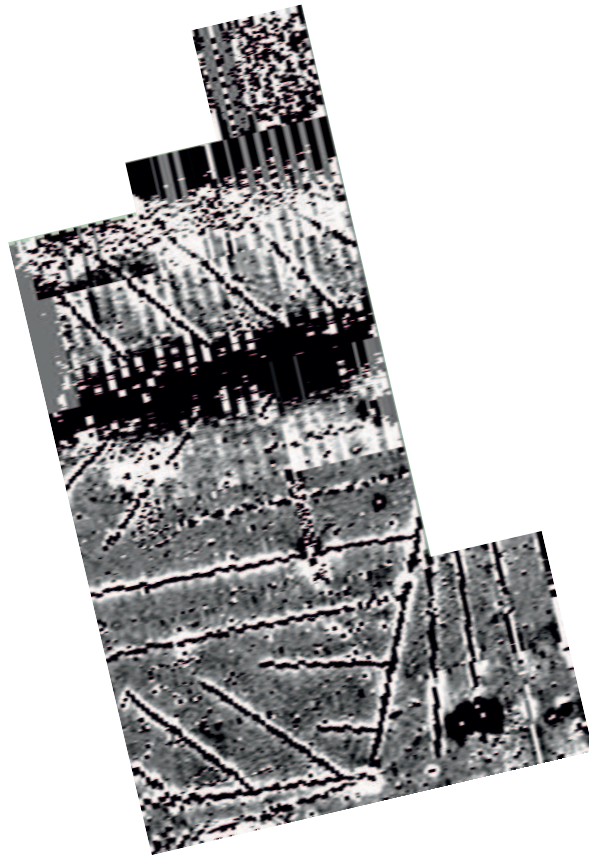
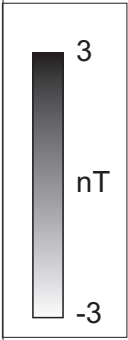


Figure 3: Greyscale raw data and processed trace plot, both at scale 1:2,000

Processed (ZMT and clipped to +/- 3 nT)







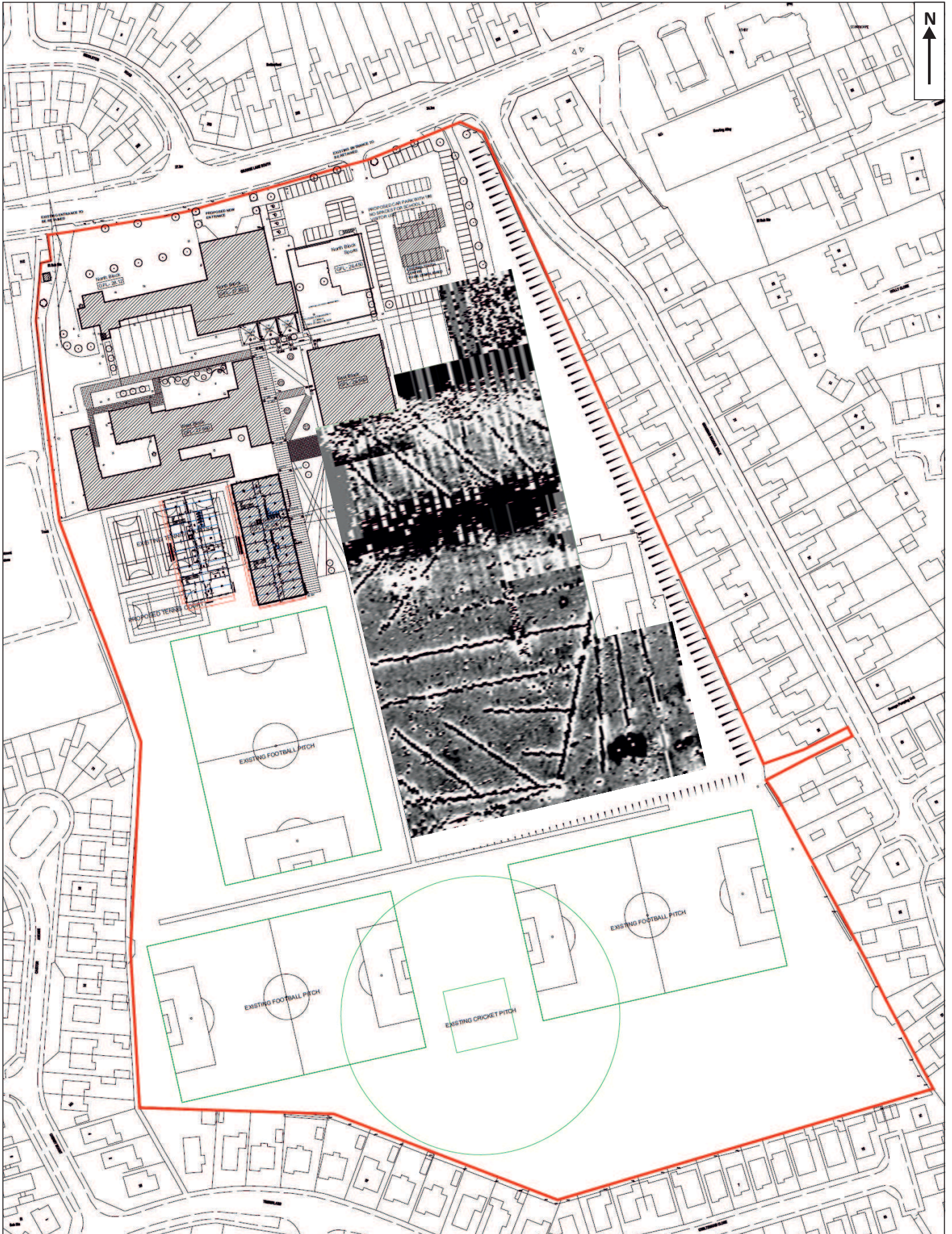
- |   |  |
|---|--|
|  Positive magnetic anomaly |  Area of extraneous disturbance  |
|  Service                   |  Examples* of large dipolar responses<br><i>Indicative of ferrous or highly fired material</i> |
- \*Smaller/weaker responses omitted for clarity



Figure 4: Processed greyscale plot of survey area with interpretation, both at scale 1:2,000

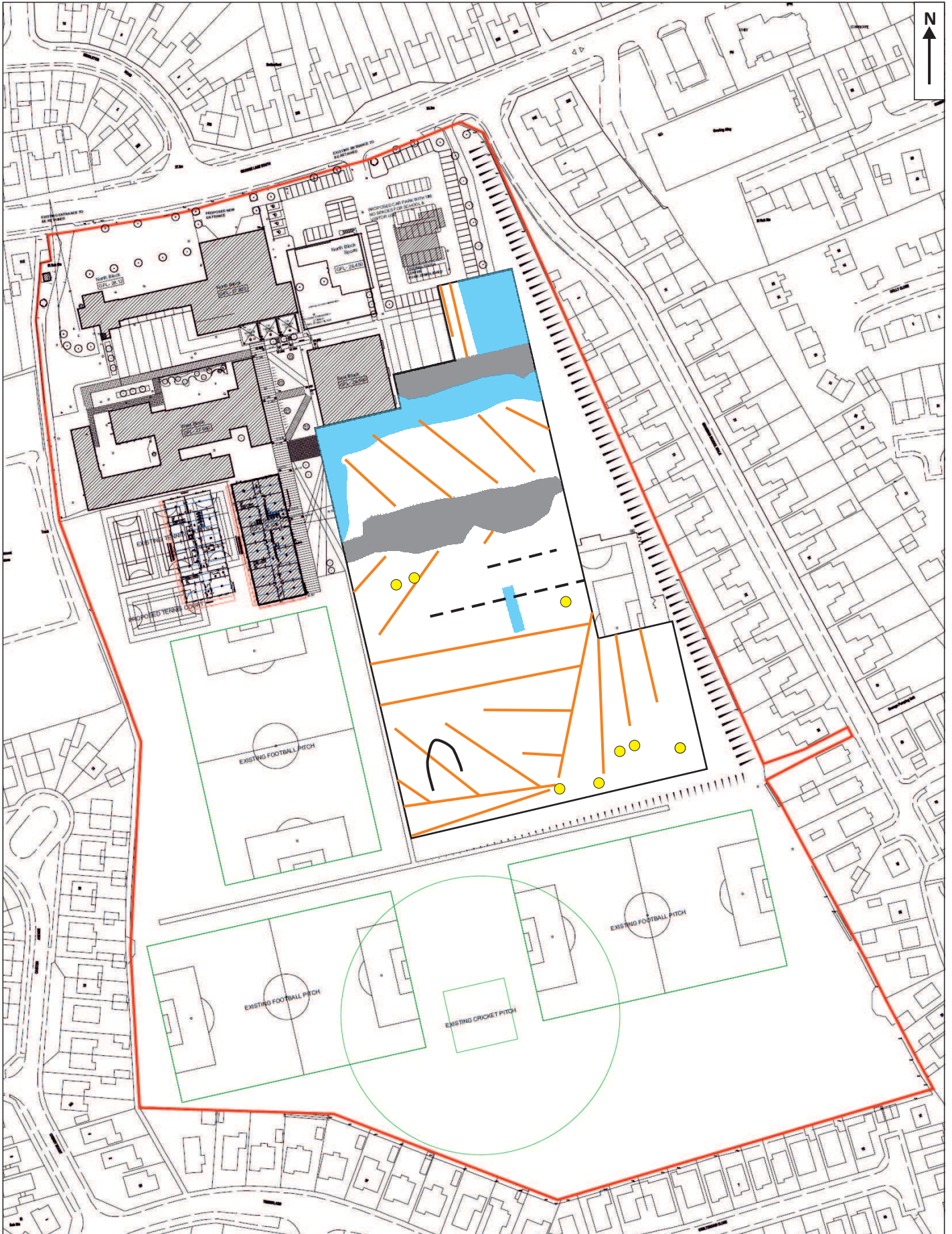




0  200m  
Scale 1:2,000

**Figure 5:** Processed greyscale plot located in real space at scale 1:2,000





0 200m  
Scale 1:2,000

**Figure 6:** Interpretative plot in real space at scale 1:2,000



Allen Archaeology Limited  
Website: [www.allenarchaeology.co.uk](http://www.allenarchaeology.co.uk)

Company Registered in England and Wales No: 6935529

**Lincoln**  
Unit 1C  
Branston Business Park  
Lincoln Road  
Branston  
Lincolnshire LN4 1NT

**Birmingham**  
Arion Business Centre  
Harriet House  
118 High Street  
Birmingham  
B23 6BG

**Cambridge**  
Wellington House  
East Road  
Cambridge  
CB1 1BH

**Southampton**  
International House  
Southampton International Business Park  
George Curl Way  
Southampton  
SO18 2RZ

Tel/Fax: +44 (0) 1522 794400  
Email: [info@allenarchaeology.co.uk](mailto:info@allenarchaeology.co.uk)

Tel/Fax: +44 (0) 800 610 2545  
Email: [birmingham@allenarchaeology.co.uk](mailto:birmingham@allenarchaeology.co.uk)

Tel/Fax: +44 (0) 800 610 2550  
Email: [cambridge@allenarchaeology.co.uk](mailto:cambridge@allenarchaeology.co.uk)

Tel: +44 (0) 800 610 2555  
Email: [southampton@allenarchaeology.co.uk](mailto:southampton@allenarchaeology.co.uk)