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ARCHAEOLOGICAL CONSULTANCY

Bedlington School, Northumberland Geophysics Report

Client: GALLIFORD TRY

AB Heritage Project No: 10452

Date: 17/11/2014

Bedlington School, Northumberland

Geophysics Report

Client	**Galliford Try**
Project Number	**10452**
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1.0	DRAFT	G. Rose	A. Buckley	17-11-14

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1. INTRODUCTION

1.1 Site Location & Description

1.1.1 The proposed development site (hereafter referred to as the site) is located approximately c.2km to the east of Bedlington, Northumberland, within an urban environment at centre point NZ 27997 82697; the eastern boundary of the site lies adjacent to the line of the A183.

1.1.2 The overall site is 12.5ha in size and consists of multiple school buildings and fields of varying sizes. The main sports field is regularly used, and covers an area of c. 7ha to the east and south of the school. The other fields are primarily landscaped areas.

1.2 Geology & Topography

1.2.1 The site is rises from the south-eastern side where it sits at c.15m Above Ordnance Datum (aOD), to the north-western side by c.10m.

1.2.2 The fields to the west have been resurfaced for playing surfaces giving a flat topography; the field to the east has an undulating topography.

1.2.3 The underlying bedrock geology throughout the site is sandstone, of the Pennine Middle Coal Measures Formation, which should not significantly affect the results of this survey. The superficial deposits are of Devensian till (BGS, 2014),

2 AIMS & METHODOLOGY

2.1 Aims of Works

2.1.1 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; and
- Provide recommendations for any further archaeological work(s) necessary to contribute to the mitigation of the impacts of proposed development on these potential features.

2.1.2 The results of the survey are provided in this report, along with an interpretation of findings.

2.2 Methodology of Works Summary

Site Specific Information

2.2.1 A magnetometry survey was undertaken across the site of proposed development between Wednesday the 13th of November and Friday the 15th of November 2014, covering a total area of c.7.5 hectares (ha).

2.2.2 The AB Heritage staff members utilised over the course of the works were Glenn Rose (Senior Project Archaeologist) and John Pykett (Archaeological Technician). The weather conditions for the work were mainly dry, though with periods of rain throughout the survey; this would have had no material impact on the survey.

2.2.3 The work was undertaken and concluded within 3 days, with all data capture downloaded periodically on site for a data quality check.

Equipment

2.2.4 The magnetic survey equipment used was one Bartington Grad-601 (fluxgate magnetometer). A detailed methodology for the works undertaken is contained in Appendix A, with Table 1 recording a brief summary of site specific information on how the magnetometer was set up.

Table 1: Setting Parameters of Magnetometer

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

1.1.1 A GPS was used to setup and reference the survey site using a Trimble GeoXR, which has a sub-centimetre accuracy.

2.3 Known Constraints

2.3.1 The site is currently a school site with a large proportion of the area containing multiple buildings. These are likely to create a high magnetic disturbance of between c. 5m - 10m from the location of such features (see Figure 1 for plan of such features).

Plate 1: View of Area D; Facing School

2.3.2 In addition to the above, Area E is a sports field and contains multiple sport facilities, including areas of concrete (which were unsurvayable) or metallic goal posts, which all likely to cause magnetic disturbance in a zone of c. 1m – 2m from the site of the feature.

Plate 2: South-West Corner of Area E Showing Goal Posts

3 RESULTS & INTERPRETATIONS

3.1 Results

3.1.1 The results of the Bedlington School survey are documented on Figures 2 – 5. Of these, Figures 2 and 3 show the raw and processed geophysical data respectively, while Figures 4 and 5 show the interpretations made from the results. The [**AB**] numbers provided in this section refer to numbers correlating to Figures 4 and 5.

Possible Archaeological features [**AB 1**]

3.1.2 Within areas A - C there were no features identifiable as archaeology recorded during the course of the geophysical survey.

3.1.3 However, Area D did contain anomalies that could potentially be archaeological in nature. The two adjacent linear features are c. 25m and c.35m in length, and both show right angles.

3.1.4 In Area E, there is a rectilinear feature covering an area of c. 950m^2.

Other Features [**AB 2 - 4**]

3.1.5 Multiple areas of largely equidistant / positive features [**AB 2**] were identified throughout the site, running in multiple directions.

3.1.6 Magnetic disturbances [**AB 3**] were also identified throughout the site, with the majority of the disturbance associated with what are believed to be modern utilities. Such disturbance was also noted in the form of di-polar anomalies [**AB 4**], spread in an amorphous pattern across the site, which are associated with magnetic debris.

3.1.7 It is of note that there are known to have been coal mines within the site boundary (Mott MacDonald 2012), to the south-east of the school buildings. However, no clear evidence relating to such works were detected within the geophysical data, and therefore it is possible that modern disturbance on the site may have masked such evidence. If this is the case for more modern elements of the historic landscape, it is possible than any earlier below ground archaeological evidence may also have been masked and/or truncated.

3.2 Interpretation

3.2.1 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.

3.2.2 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 service.

Table 2: Interpretation of Geophysical Anomalies

AB No	Description	Potential Cause
AB 1	Archaeological features	Cut/Ditch Features

AB No	Description	Potential Cause
AB 2	Equidistant Positive linears	Drainage
AB 3	Negative/high positive area	Magnetic Disturbance
AB 4	DI-Polar (Positive with associated negative)	Magnetic Debris

3.2.3 Some possible archaeological features have identified within Area D. These linear features may have once formed some of the foundations of a previous rectangular structure located on site, based on the shape and extent of the anomalies.

3.2.4 The rectilinear feature in Area E may represent an archaeological feature of unknown date, with the form of the feature possibly suggestive of structural foundations. However, it should be taken into account that the size and shape of this geophysical anomaly does have similarities to a concreted area on site, c. 140m to the south of it, which is a modern feature (presumably relating to the purpose of the area as a sports field).

3.2.5 No other anomalies identified during the course of the geophysical survey were concluded to represent potential archaeology of any note.

3.2.6 Multiple areas apparent of field drainage [**AB 2**] were identified across the survey area, running in multiple directions. Area E contains the most concentrated array of these features, which is most likely related to the construction of the main sports field for the school. This suggests a wide spread of past impacts within the survey area, associated with past landscaping and the construction of drainage works for the existing school site.

3.2.7 Di-Polar anomalies [**AB 4**], associated with magnetic debris, along with magnetic disturbance [**AB 3**] from modern utilities, were also recorded across parts of the survey area.

4 CONCLUSION

4.1.1 A geophysical survey was undertaken by AB Heritage Limited at Bedlington School, Northumberland, between Wednesday the 13th of November and Friday the 15th of November 2014. The purpose of this was to understand the potential for any archaeological remains to survive undisturbed and, where possible, identify the form, function and extent of any potential remains.

4.1.2 The results of the survey identified possible archaeological features [**AB 1**] within Area D and E of the site, the form of which are suggestive if possible structural foundations.

4.1.3 Other features identified within the limits of the geophysical survey are believed to include an array of field drains and ground levelling [**AB 2**], associated with the development of the school and its playing fields, along with areas of magnetic disturbance [**AB 3 - 4**], associated with modern utilities and magnetic debris respectively.

4.1.4 The results of this geophysical survey will be presented to the Northumberland County Council Planning Archaeologist (Nick Best) to inform the decision making process on the proposed development site and the need for/scope of any future archaeological works.

5 ARCHIVE

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

Appendix Table 1: 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

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

6 REFERENCES

BGS (British Geological Society) 2014.*Geology of Britain viewer.*http://mapapps.bgs.ac.uk/geologyofbritain/home.html.

EH (English Heritage) 2014. The National Heritage List for England.http://www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england/

IFA, 2011.Standard and Guidance for archaeological geophysical survey.IFA

Jones D.M. 2008.Geophysical survey in Archaeological Field Evaluation. English Heritage.

R.J.C 2014. *Proposed Development Site at Bedlington Station, Northumberland: Archaeological Assessment*. Archaeological Practice Ltd

Schmidt, A 2002. Geophysical Data in Archaeology*: a Guide to Good* Practice. Oxford. Oxbow.

Mott MacDonald 2012. *Bedlingtonshire High School: Phase 1, Geo-Environmental Assessment.*

Appendices

Appendix 1 Technical Information on Geophysical Survey

FLUXAGTE 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 and processing

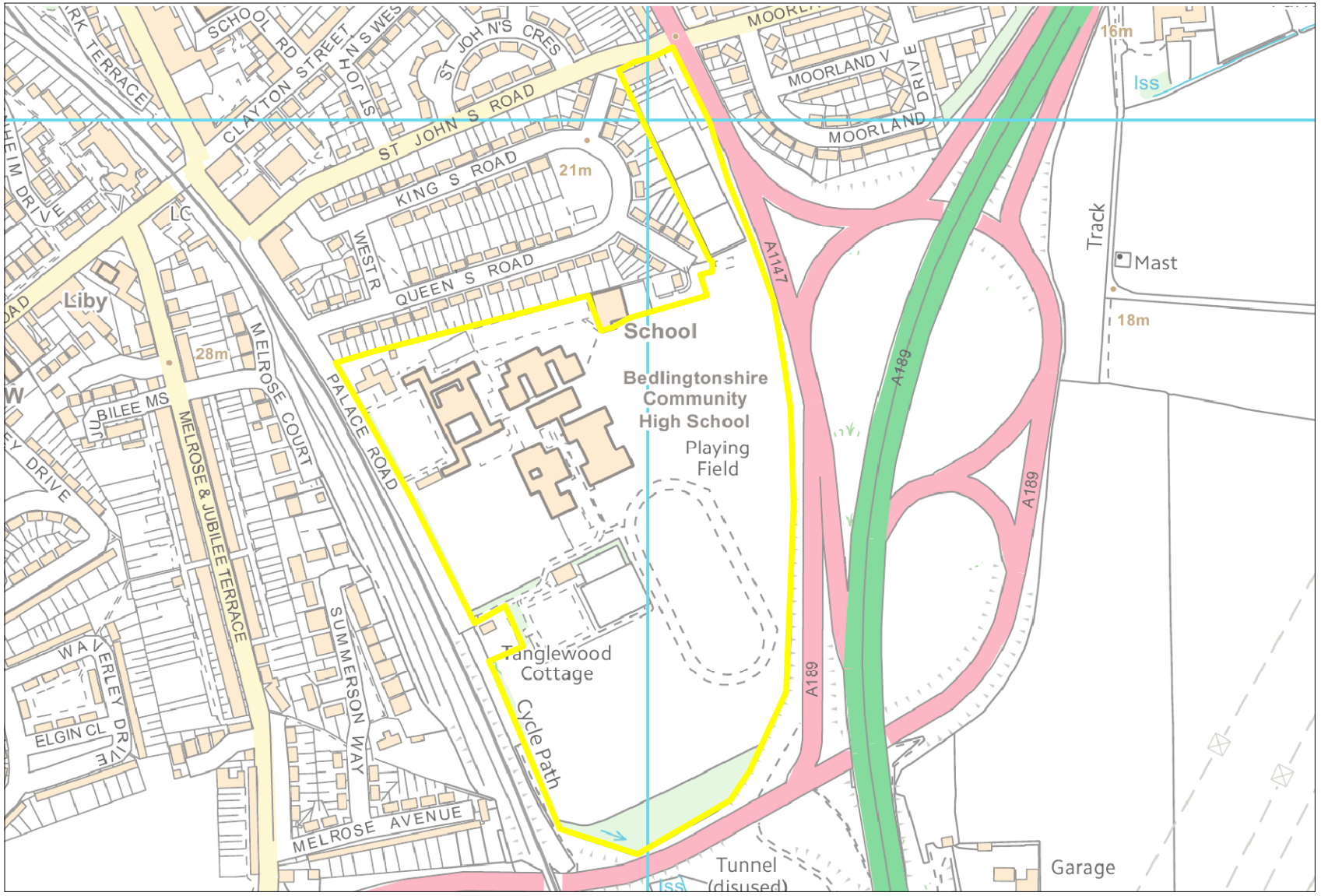
The readings are logged continually by the data logger during the survey, which is then downloaded on site to a site laptop. At the end of each job, data is transferred to the office PC's for processing and presentation.

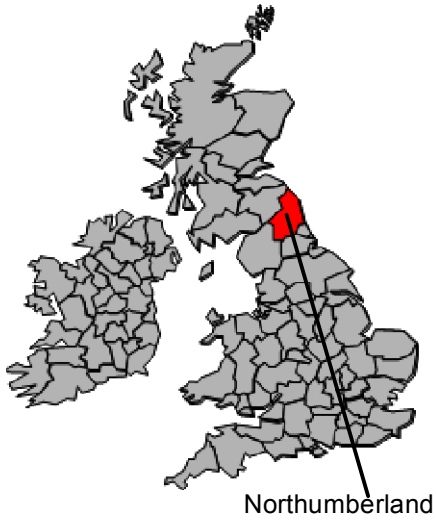
This 'regular xy' data is then downloaded into specialist data processing software, at user defined sample intervals (in this case 1 m by 0.25 m). This is processed as standard magnetometer data.

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.





Legend

Site Boundary

0 125 250 500 m

Figure 1: Site Location and Field Identification

Project: Bedlington School

Date: 17/11/14	Job number: 10452
Drawn by: ZE	Approved by: GR

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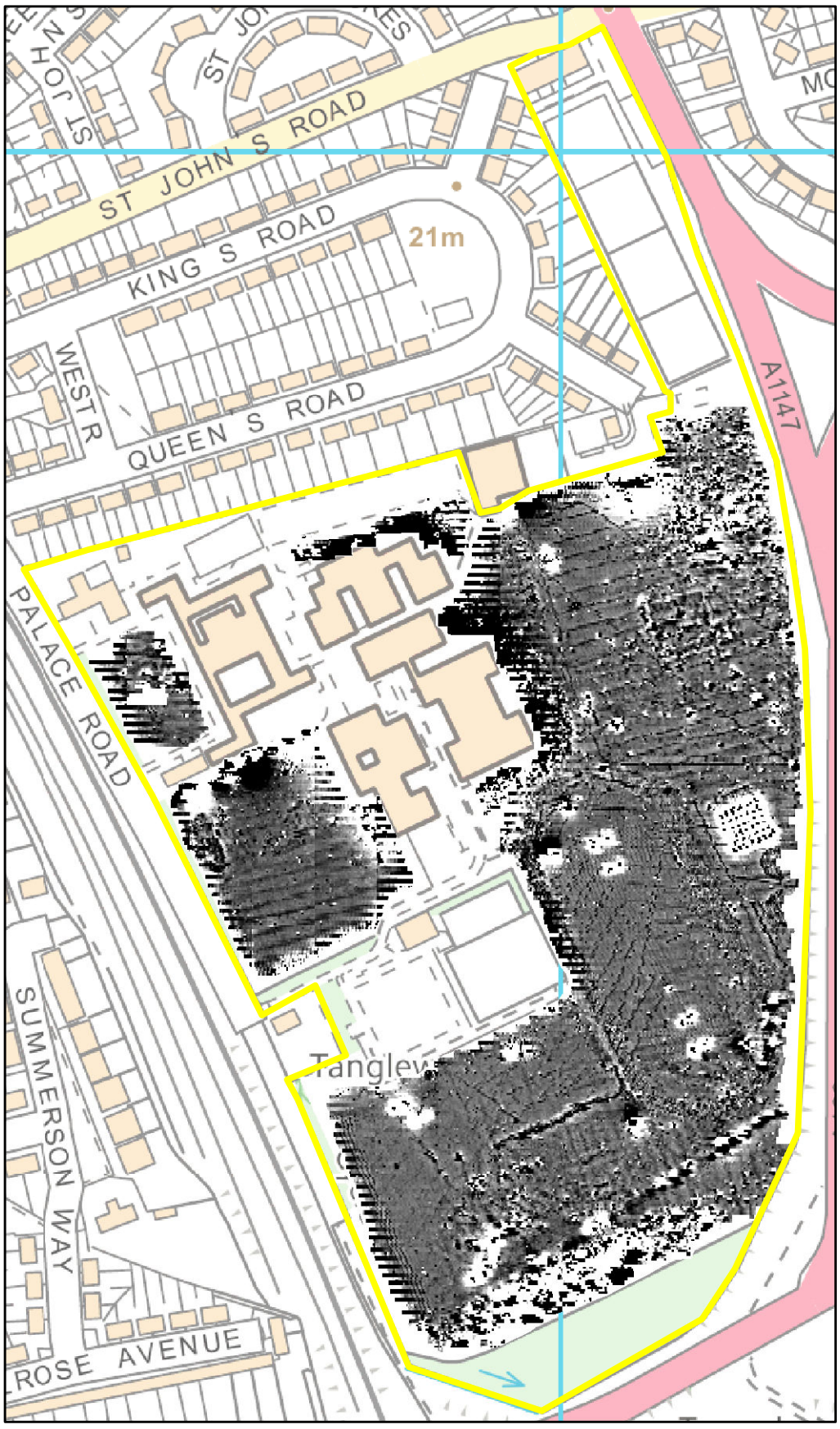

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Site Boundary

N

+ 10

Plotting Perameters

- 10

Field Identification

Approximate Area Boundaries are shown in green

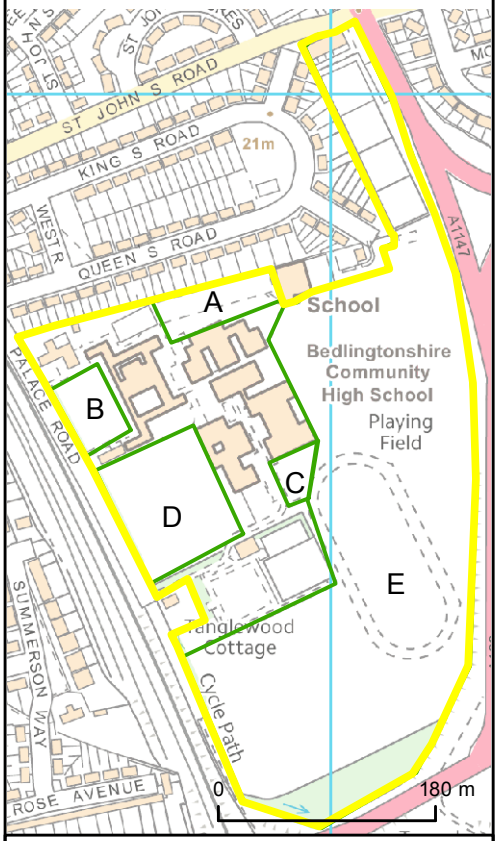

Figure 2: Raw Geophysical Data

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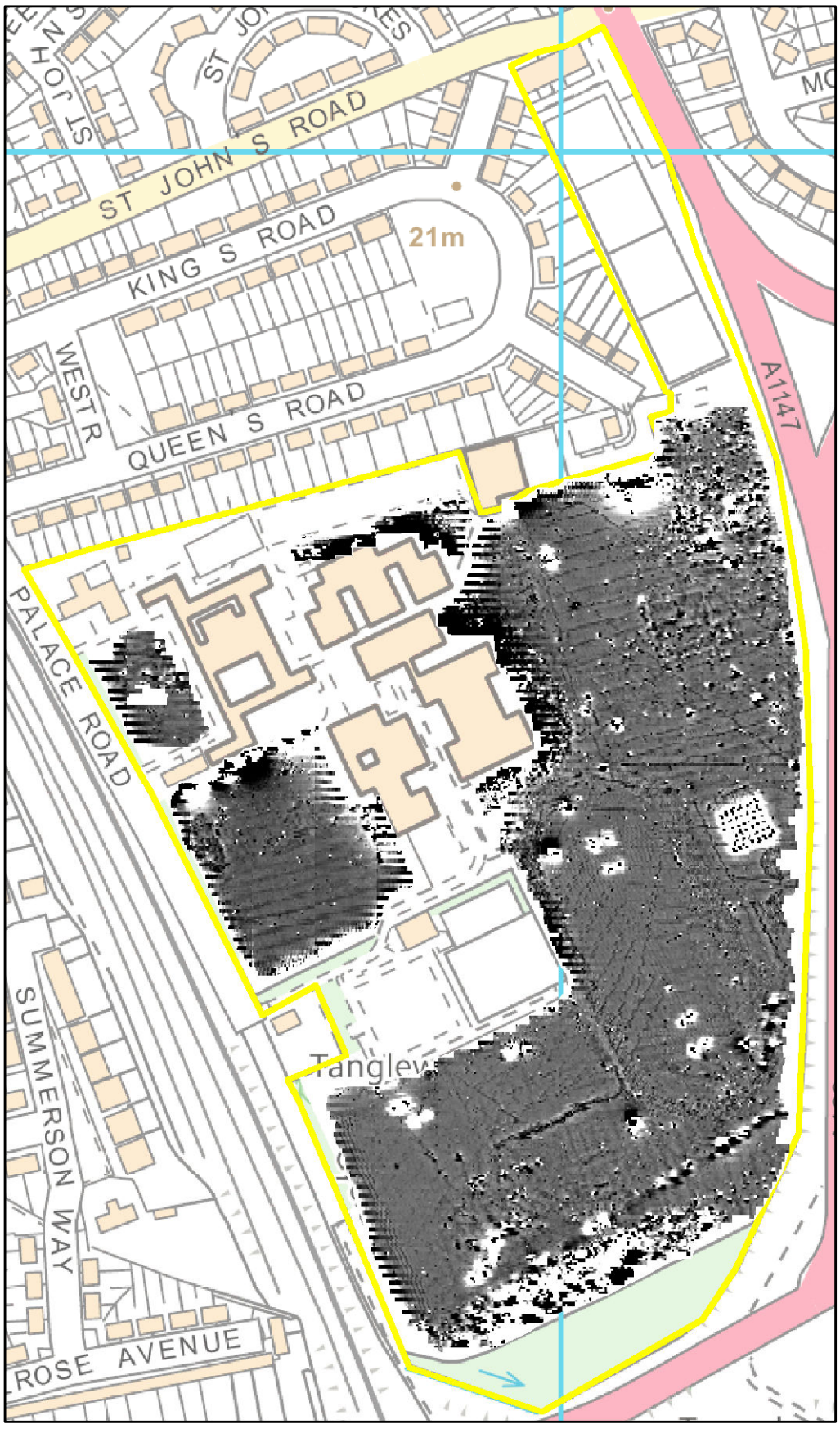

0 62.5 125 250 m

Legend

Site Boundary

N

+20

Plotting Perameters

-20

Area Identification

Approximate Area Boundaries are shown in green

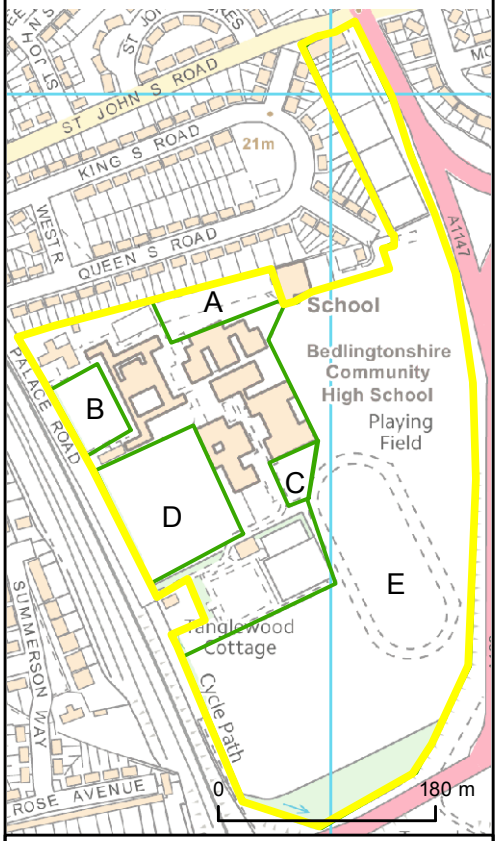

Figure 3: Processed Geophysical Data

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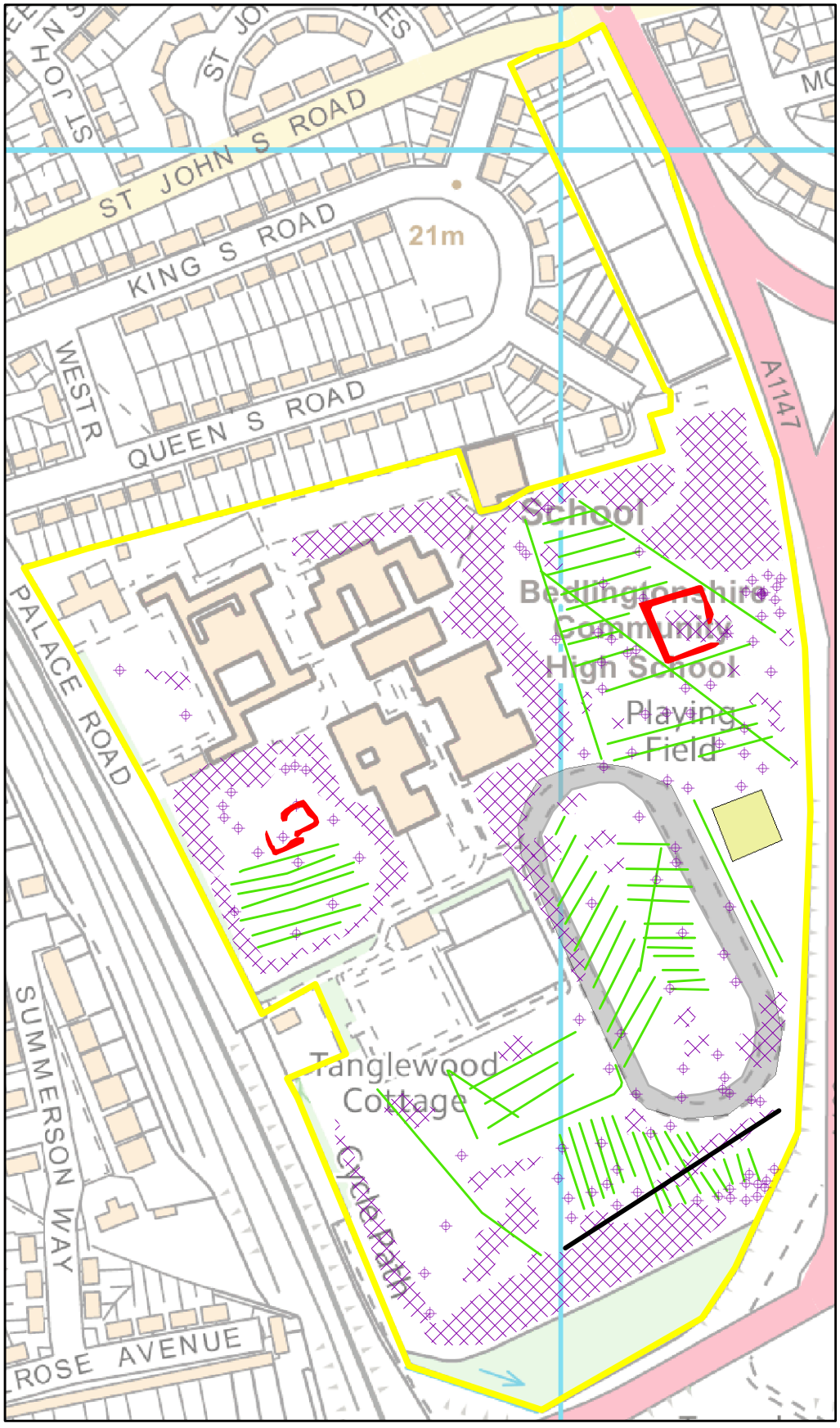

N

Legend

- Possible Archaeology [AB1]
- Field Drains [AB2]
- Magnetic Disturbance [AB3]
- Di-Polar Anomalies [AB4]
- Possible Services
- Race Track
- Concrete Slab
- Site Boundary

Area Identification

Approximate Area Boundaries are shown in green

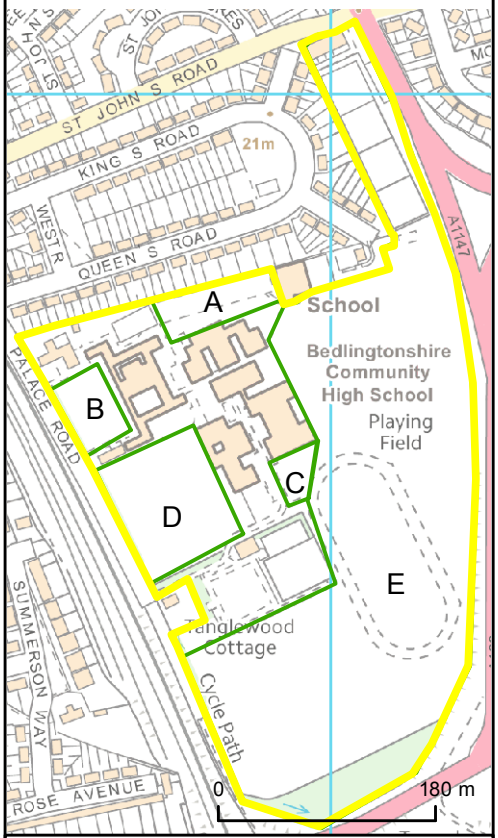

Figure 4: Geophysical Data Results Interpretation

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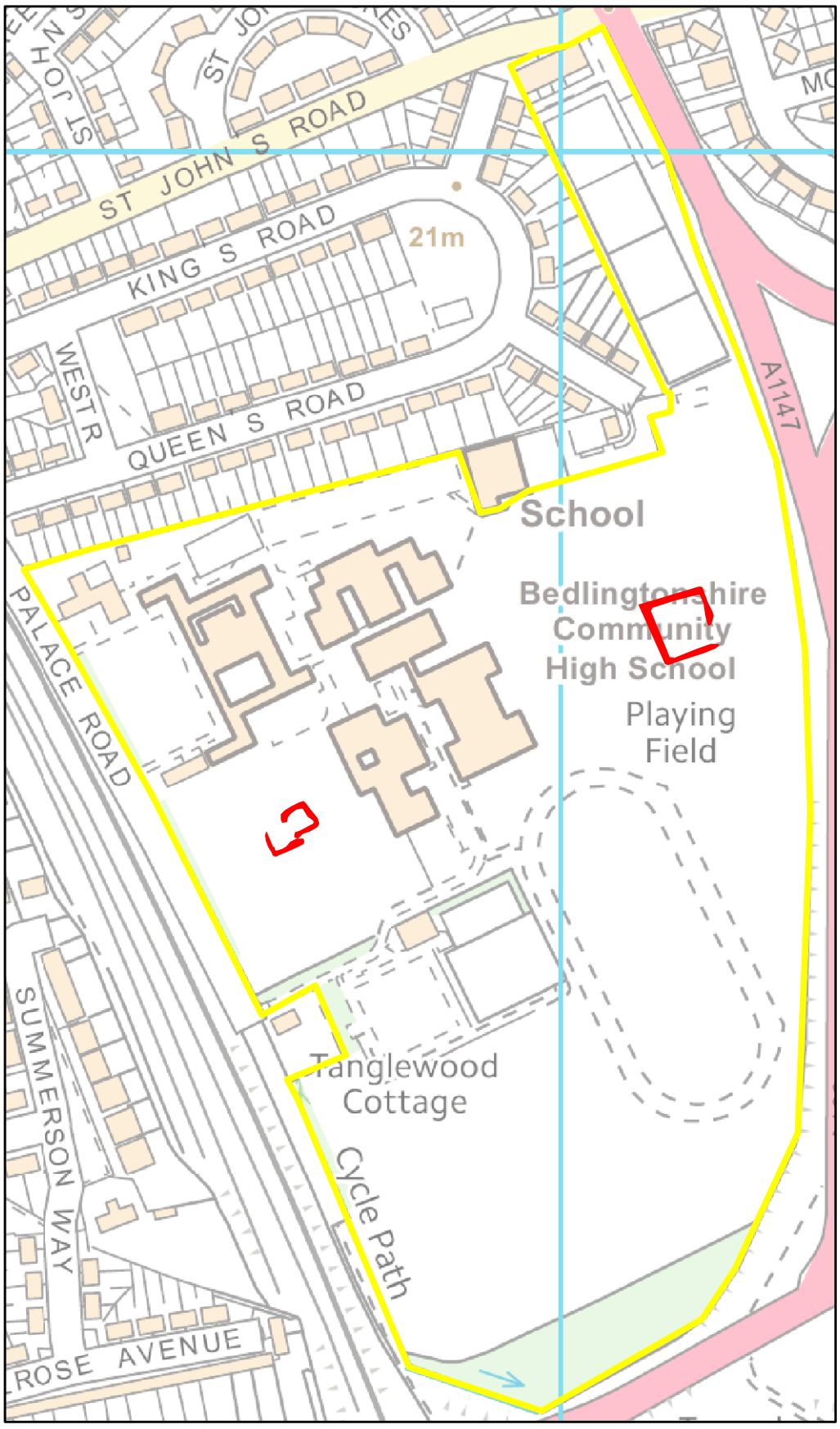

N

Legend

Possible Archaeology [AB1]

Site Boundary

Area Identification

Approximate Area Boundaries are shown in green

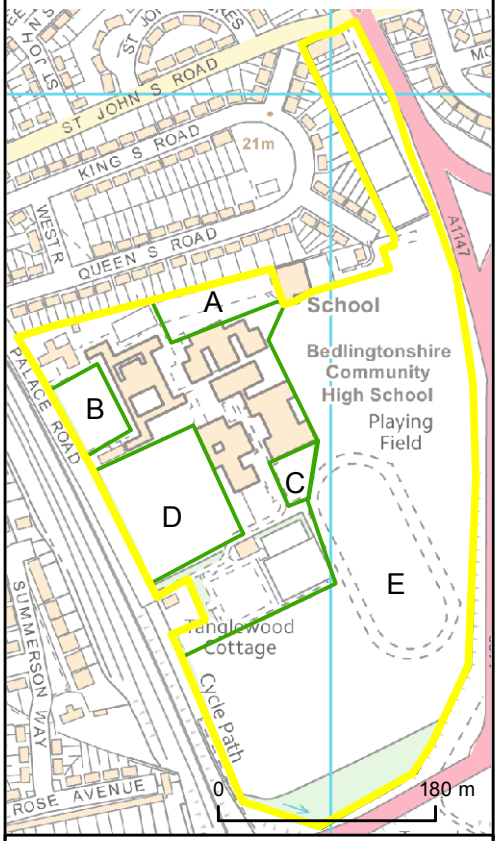

Figure 5: Interpretation of Archaeology

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