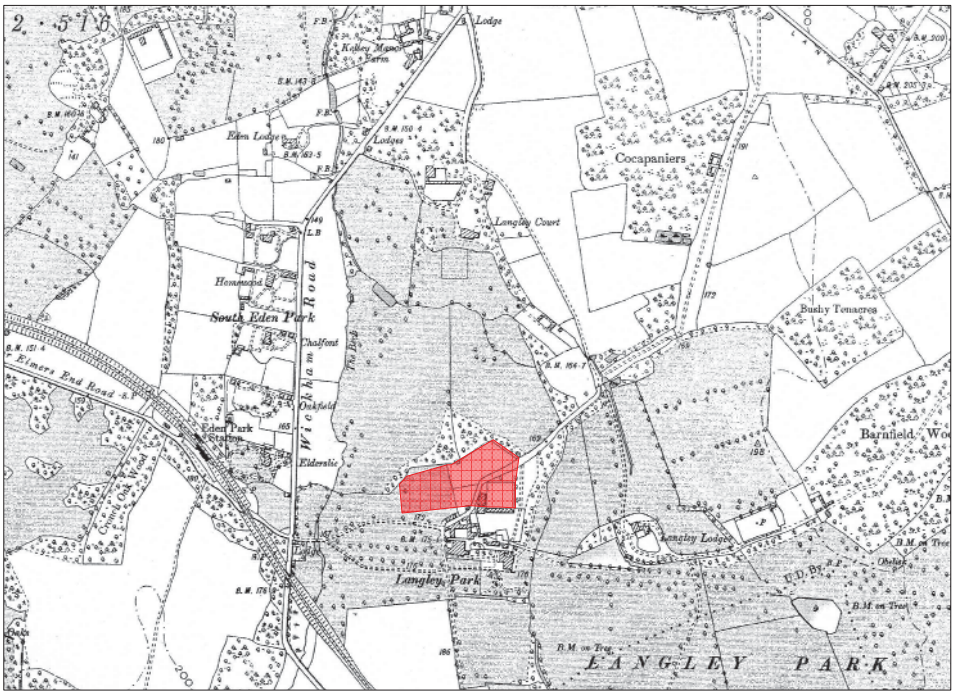
ARCHAEOLOGICAL EVALUATION REPORT:

FLUXGATE GRADIOMETER SURVEY AT LANGLEY PARK SCHOOL FOR BOYS, HAWKSBROOK LANE, BECKENHAM, LONDON BOROUGH OF BROMLEY

Planning Reference: 08/01372

NGR: TQ 37922 67403



Report prepared for

Frankham Consultancy Group Ltd.
On behalf of Langley Park School for Boys

by

Allen Archaeological Associates and Grid Nine Geophysics

AAA Report Number: 2008/055

October 2008

GRID NINE
FREELANCE ARCHAEOLOGICAL GEOPHYSICS
(FLUXGATE GRADIOMETER & RESISTANCE)

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Element	Name	Date
Report prepared by:	Dave Hibbitt and Mark Allen	12/10/2008
Report edited by:	Mark Allen	13/10/2008
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Cover image: First Edition Ordnance Survey map of Beckenham (1898) with site outlined in red

Summary

A geophysical survey was undertaken on land at the Langley Park School for Boys, off Hawksbrook Lane in Beckenham by Grid Nine Geophysics, in partnership with Allen Archaeological Associates for Frankham Consultancy Group Limited. The survey was undertaken as a result of a planning condition issued by the London Borough of Bromley Council for a proposed new school.

The site is currently used as a sports field for the school. Existing sports equipment (e.g. rugby goalposts), service/drain covers and boundaries have caused some distortion to the dataset; however the survey has revealed a number of anomalies, the majority of which can be attributed to known boundaries and features, as shown on various historical maps and aerial photographs. These include a former track, the remains of a demolished nursery, and former boundaries.

Two curvilinear anomalies may be of archaeological significance as they do not appear on any known mapping and do not conform to existing or known former boundaries.

There are many dipolar responses which are likely to have been caused by modern ferrous detritus.

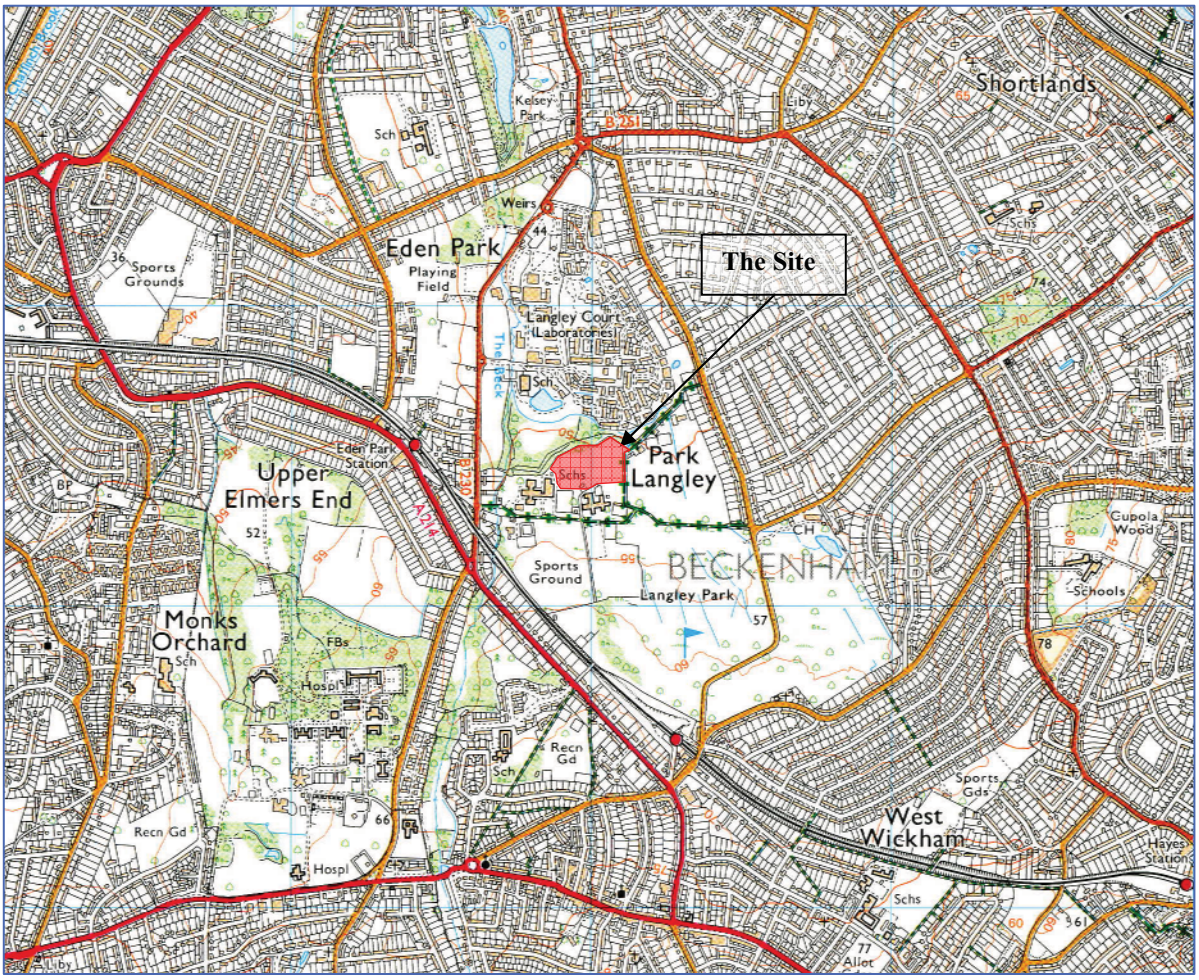

Figure 1: Location of proposed development area in red at scale 1:25,000

1.0 Introduction

1.1 Allen Archaeological Associates (AAA), in partnership with Grid Nine Geophysics, was commissioned by Frankham Consultancy Group to carry out a detailed gradiometer survey in advance of a new school development at Langley School for Boys in Beckenham, London Borough of Bromley.

1.2 The site works and reporting conform to current national guidelines, as set out in the Institute for Field Archaeologists '*Standards and guidance for archaeological evaluations*' (IFA 2001), the English Heritage document '*Geophysical Survey in Archaeological Field Evaluation*' (2008) and a specification prepared by Allen Archaeological Associates (AAA 2008).

2.0 Site location and description

2.1 Beckenham is situated in south-east London, in the Borough of Bromley. The site lies some 2km to the south of Beckenham town centre, with the existing buildings and playing fields of Langley Park School for Boys located on the north side of Hawksbrook Lane. A small watercourse, The Beck, defines the western boundary of the school grounds, while an area of woodland runs along the northern site boundary. Langley Park School for Girls is to the east of the existing boys' school, and the eastern boundary of the playing field is defined by a lane running north – south: St. Dunstan's Lane.

2.2 The local superficial geology comprises sand and gravel of the Blackheath Beds, overlying a solid geology of Cretaceous chalk (British Geological Survey 1974).

3.0 Planning background

3.1 A planning application for the construction of a new secondary school development was submitted earlier this year, and subsequently approved with conditions (Planning Application Reference 08/01372). The outline application was approved subject to conditions, including the undertaking of a programme of archaeological evaluation to characterise the nature and extent of the archaeological resource within the proposed development area.

4.0 Archaeological and historical background

4.1 A detailed synopsis of the archaeological and historical background of the site is not included here as this has already been undertaken as part of the desk-based assessment (Clay 2007).

4.2 There is little known prehistoric evidence in the surrounding local landscape, with a single hoard of metalwork attesting to Bronze Age activity approximately 800m to the south-west of the school. The Roman period also shows little impact upon the area, although it is believed that the Roman Road that ran between London and Lewes in East Sussex may cross the site, or run close-by. A number of Roman artefacts have been recovered along the line of the road; however none have been recorded within 1km of the site.

4.3 Beckenham appears to have formed as a settlement in the 9th or 10th century, with a number of quarry pits containing pottery of this date having been uncovered on Beckenham High Street. The site lies within the former estate of Langley, a manor that was first documented

in the 13th century. A later manor associated with the estate (Langley Court) still survives at Langley Court Laboratories to the north of the site.

4.4 The school was founded in 1901 as Beckenham and Penge Technical Institute, moving to Penge in the 1920s, before moving to its current site in 1969.

5.0 Methodology

5.0.1 A Level II magnetometer survey (Gaffney and Gater 1993) using a fluxgate gradiometer was chosen as the most appropriate geophysical technique to use. Although there can be no preferred recommendation of which technique to use until the merits of the individual site have been assessed, magnetometer survey should usually be the prime consideration (English Heritage 2008). Magnetometer survey was chosen on this occasion due to the nature of the potential archaeology likely to be exposed within the survey area.

5.0.2 The superficial geology is sand and gravel, and the solid geology is Cretaceous chalk. Sand and gravel deposits can give very variable results depending on the material from which it has been derived. The response over chalk is good, especially Cretaceous chalk (with few significant distorting factors), which is true of most sedimentary parent rocks (Gaffney and Gater 2003; Clark 1996). With chalk being a type of limestone however; natural cracking and solution holes can occur and show in the data which can be easily misinterpreted as potential archaeological anomalies.

5.0.3 The geology is common and results from magnetic surveys over these geologies are well documented. Many survey reports encountering these types of geologies are held by the English Heritage Geophysical Survey Database (EHGSD). A cursory, but specific search of the EHGSD for surveys over similar geologies resulted in twenty four reported surveys.

5.0.4 Magnetic surveying measures very small changes in the Earth's magnetic field which can be created by man-made or geological changes in the magnetic properties of the soil and/or underlying geology.

5.0.5 Magnetic surveying can usually detect magnetically enhanced features such as areas of anthropogenic activity, pits, ditches, hearths and kilns. It will also react to buried 'modern' items such as nails, agricultural equipment fragments, wire fences and generally any ferrous material in the immediate area. The geology of the site can play an important role in how successful a magnetic survey will be. If the local geology is inherently magnetic then it may not be practicable or possible to undertake a magnetic survey. Similarly, buried services can have an adverse effect on the data. Magnetic surveying is non-destructive and non-intrusive.

5.0.6 The magnetic ‘signature’ from certain anomalies, for example from a ditch or kiln, is often very characteristic to that type of known feature. This can assist with providing an informed, but quantative rather than qualitative interpretation to certain anomalies.

5.0.7 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.

5.1 Summary of survey parameters

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 2.3.0.X
Weather conditions:	Dry, bright and moderately warm
Surface conditions:	Playing field with associated features
Surveyors	David Charles Hibbitt PIFA and Angela Hazel Hibbitt
Data interpretation:	David Charles Hibbitt PIFA and Mark Allen MIFA
Date of survey:	2nd October 2008

5.2 Data collection and processing

5.2.1 The site was marked out with a series of 20m x 20m grids aligned broadly N-S using the 'fitted to the field' methodology (Clark 1996). Any enhancement to the magnetic field caused by buried features is mapped increasingly stronger the closer the traverse direction can get to a magnetic north – south direction (Scollar et al. 1990). Data was collected by making successive parallel traverses across each grid in a zigzag pattern, as close to a magnetic north – south alignment as practicable. In this instance the traverses were roughly north-south. The location of the survey grid baseline was marked with a plastic ground marker flush with the ground surface. The location of this ground marker and the survey base line were also tied in to the adjacent school buildings and other features using the supplied 1:1250 map.

5.2.2 The data collected from the survey has been analysed using the latest version of ArchaeoSurveyor 2 (2.3.0.X). The resulting data set plot is presented with positive nT mapped as black and negative nT mapped as white. The data has been subjected to processing using the following filters:

De-spike
DeStagger
De-stripe (also known as Zero Mean Traverse or ZMT)
DeSlope

5.2.3 The de-spike process is used to remove spurious or extreme high intensity anomalies or datapoint values. These are often caused by small ferrous objects (such as modern surface or sub-surface 'rubbish', ferrous fence posts or buried services) which may affect subsequent filter use, data enhancement and interpretation. Due to magnetic interference from the plethora of 'modern' features throughout the survey, the data was subjected to de-spiking using a uniform weighted window interval size of 21 on both the x and y axis with a threshold setting of 1.0 based on the mean centre value which was subsequently replaced with the median value.

5.2.4 The DeStagger filter compensates for small data collection errors caused by the operator starting recording of a traverse too early or too late. It shifts the traverse to be corrected forwards (and/or backwards) by a specified number of intervals or distance. The data set has been DeStaggered by 0.5 metres (the equivalent of two data points).

5.2.5 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 (such as off-axis surveying or heading errors) and delays between surveying adjacent grids. The destripe process is used with care as it can sometimes have an adverse effect on linear features that run parallel to the orientation of the process.

5.2.6 The DeSlope filter corrects errors in the magnetometer data caused by large metal objects near to, or within the survey area. On this occasion the rugby goal posts were the major and unavoidable contributing factor which necessitated the use of the DeSlope filter.

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 separate (David 1995) simplified graphical interpretation of the main magnetic anomalies detected.

6.0 Results (See Figures 3 – 8; numbered anomalies in bold are shown on Figures 6 and 8)

6.1 A series of linears **[1]** are almost certainly elements of an extensive land drainage system**,** likely to relate to the construction of the playing field. The strong linear form is characteristic of modern fired clay sectional type of land drains.

6.2 Several areas of intense magnetic noise **[2]** have been recorded, mainly adjacent to the eastern and south-eastern limits of the survey. The cause of the intense magnetic noise is likely to be a combination of interference from the present school buildings immediately south of the survey, dumped materials associated with the construction of the school and also possibly from former structures on the site including a sports pavilion and nursery, both of which are shown on the 1968 Ordnance Survey map (Clay 2007, Figure 5). Other intense anomalies can be identified with more confidence: **[2A]** follows the former course of St. Dunstan's Lane, **[2B]** is an existing artificial cricket crease, **[2C]** may reflect the location of a former cricket square and **[2D]** is an area of tarmac or similar surfacing material that was visible at the time of the survey.

6.3 A likely cultivation trend can be seen running roughly NNW to SSE and is represented in the data as thin well-defined positive and negative linear striations **[3].** The eastern extent of the cultivation trend may correlate with the western boundary of the parkland as shown on the 1898 Ordnance Survey 6" map (Clay 2007, Figure 3). It also appears clearly as a crop mark on the April 1966 aerial photograph, as part of a broader series of cultivation trends on several different alignments (Clay 2007, 7). This trend evidences cultivation activities that pre-date the construction of the school. If these comprise ridge and furrow features, then there is some potential that earlier archaeological deposits may be preserved beneath the ridges.

6.4 Anomalies **[4]** and **[5]** are likely to be the responses from former field boundaries. These appear on the 1838 Tithe map of Beckenham Parish (Clay 2007, Figure 2) and on the 1898 Ordnance Survey 6" map (Clay 2007, Figure 3). They also appear in part on the 1938 and 1968 Ordnance Survey 6" maps (Clay 2007, Figures 4 and 5 respectively).

6.5 Of potential archaeological interest, as they do not appear to relate to the other non-archaeological anomalies and are not visible on the cartographic information shown on the previous archaeological desk-based assessment (Clay 2007), are the curvilinear anomaly **[6]** and the reversed 'C' shaped anomaly **[7]**. The magnitude of both these anomalies peaks at around 6nT/m. It is possible that **[6]** may be a curving land drain, as its peak magnitude is close to that of other land drains on the site which generally peak at around 8~10nT/m. Anomaly **[7]** does not appear to conform to the usual land drain

pattern, and although an archaeological cause should not be ruled out it is possible that this anomaly may be an ephemeral geomorphological variation rather than a true archaeological anomaly.

6.6 The probable response to a former pond **[8]** can be seen in the data as an area of magnetic disturbance. This pond appears on the 1898 and 1938 Ordnance Survey 6" map (Clay 2007, Figures 3 and 4 respectively).

6.7 Scattered throughout the data are numerous weak dipolar responses. The peak magnitude of these anomalies is generally less than 10nT, with most being much less at around 3nT. These responses are likely to be caused by modern ferrous detritus (some visible at the time of the survey) scattered over the field as the result of its use by the school and its associated activities.

6.8 A number of strong dipolar responses have been recorded scattered randomly throughout the data. The characteristic dipole response of pairs of positive and negative 'spikes' suggests near-surface ferrous metal or other highly fired material (Clarke 1996). The ferrous rugby goal posts have caused intense spikes and are noted on the interpretation.

7.0 Conclusions

7.1 The archaeological interpretation of the geophysical data has been made difficult by relatively recent use of the site and also by widespread contamination and a high level of superficial recent disturbance from modern activities, some of which are still on-going such as the use of the site as a sports field by the school.

7.2 The rugby goal posts have significantly distorted the data around them, compromising areas of data and making it unusable in those locations. A similar situation has occurred along the eastern and western limits of the survey where the response to the course of a former road, former and extant structures has also compromised the data. Additionally, access covers (with a ferrous content) to various services and very recent boreholes and water table monitoring equipment have also contributed to localised contamination of the data.

7.3 It should also be noted however, that the mapping from the previous archaeological desk-based assessment of the site (Clay 2007) has contributed significantly to the interpretation of the anomalies from during the geophysical survey, with a former road, nursery, pond and former boundaries all being identified.

7.3 Significant archaeological anomalies appear to be scarce, with only two possibly identified by the surveyor. The areas of magnetic disturbance may however mask or obscure more subtle underlying archaeological remains. Furthermore it should also be stressed that the lack of an obvious or even subtle response to archaeological features should not be taken as absolute evidence that such features do not exist in the survey area. For example, highly significant archaeological features such as postholes are usually too small to be detectable and larger pits may easily be masked by ferrous detritus close by or even by their physical surroundings. Additionally such features may be too deeply buried to be detected by conventional geophysical means, although in this instance borehole data kindly supplied by the client indicates that there is only approximately 0.5m of soil overlying head deposits across the development area.

8.0 Effectiveness of methodology

8.1 The non-intrusive evaluation methodology employed was appropriate to the scale, nature and time constraints of the proposed development. Despite the high level of superficial interference and subsequent compromised areas of data, magnetometry surveying was the prospection technique best suited to the investigation. Other techniques may have proved too time consuming or cost-prohibitive given the size of the development area.

9.0 Acknowledgements

9.1 Allen Archaeological Associates and Grid Nine Geophysics would like to thank Frankham Consultancy Group for this commission.

10.0 References

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1838 Tithe map for Beckenham Parish
1898 6” Ordnance Survey map
1938 6” Ordnance Survey map
1968 6” Ordnance Survey map

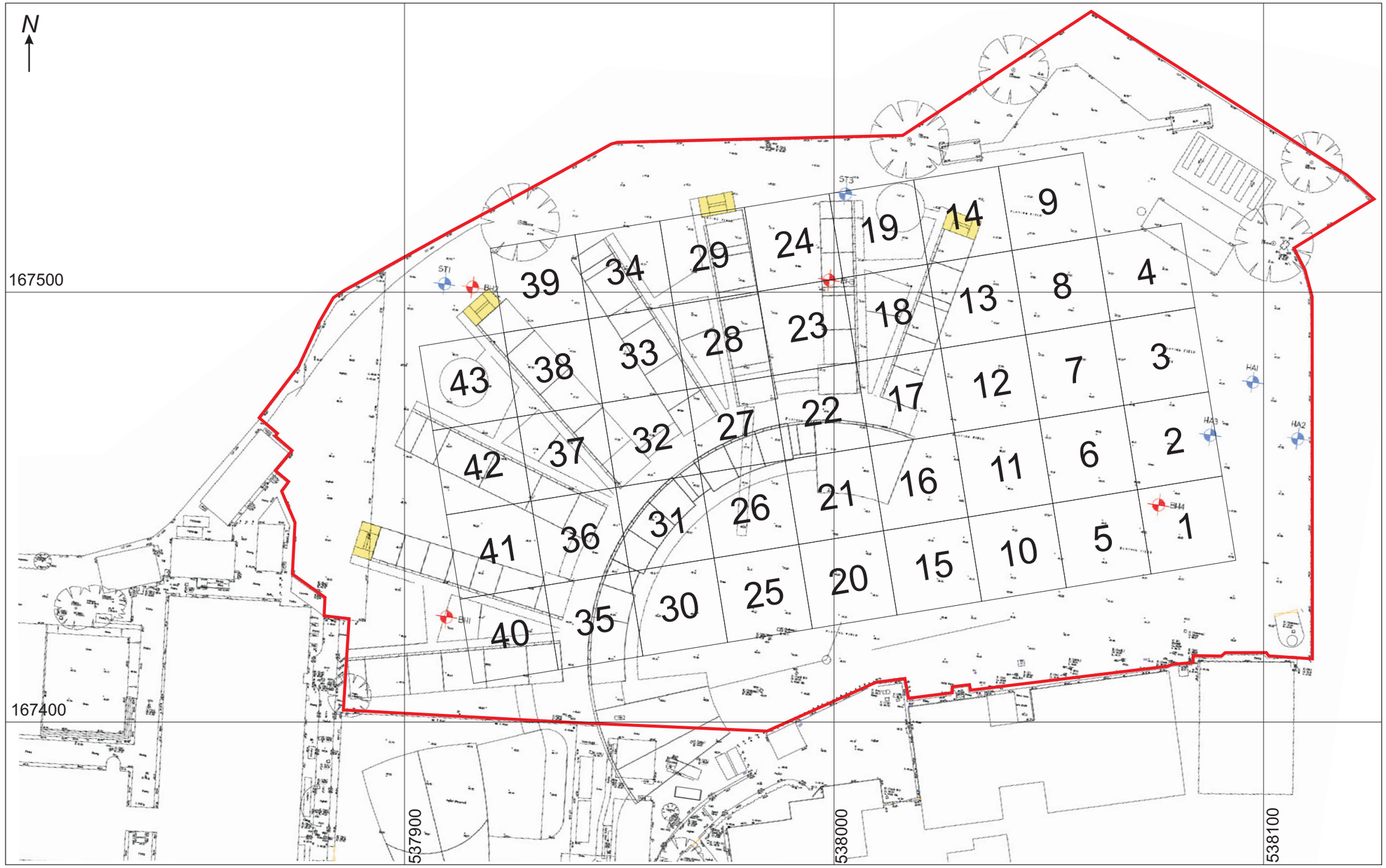


Figure 2: Location of development area outlined in red with geophysical survey grid locations, at scale 1:1000

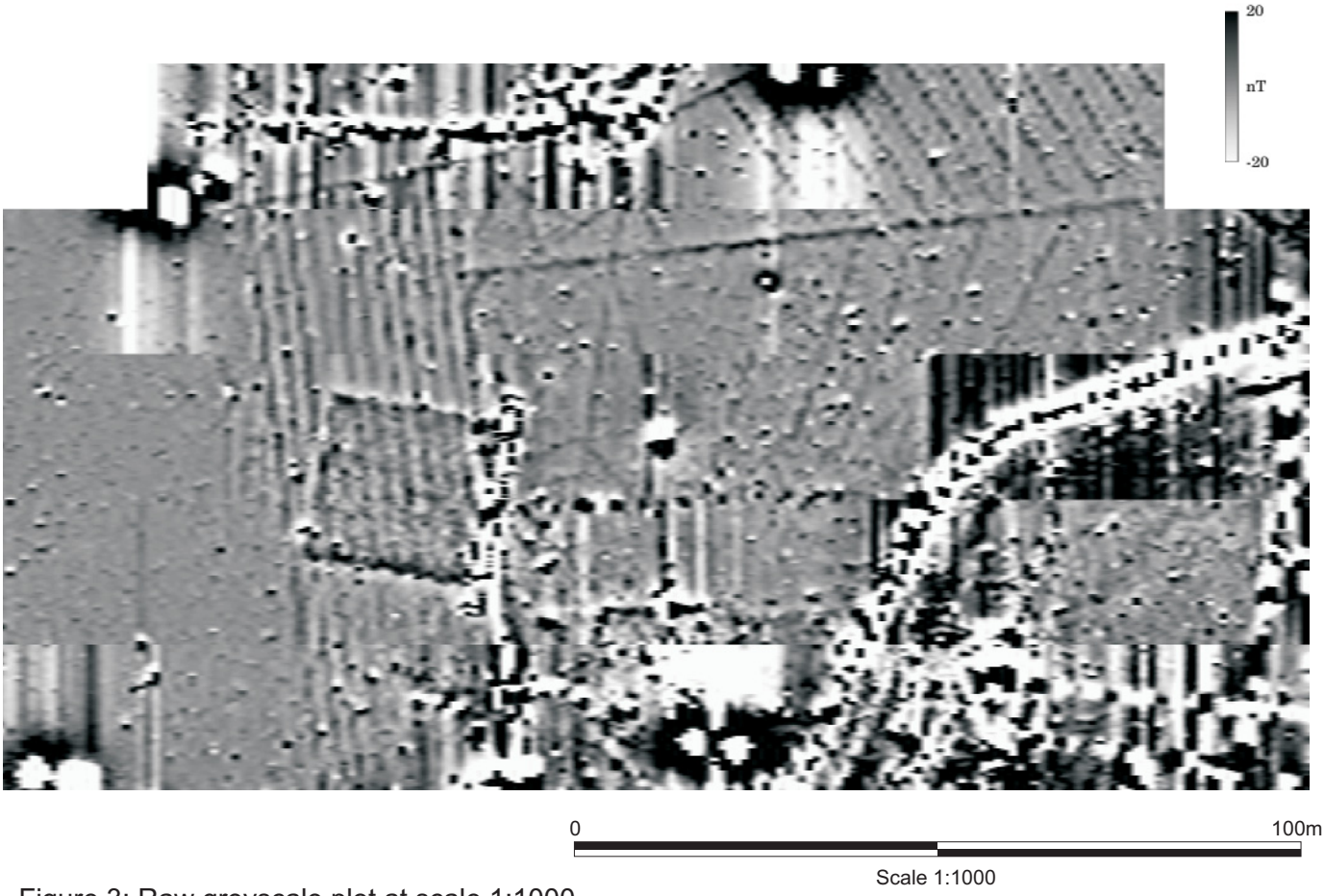


Figure 3: Raw greyscale plot at scale 1:1000

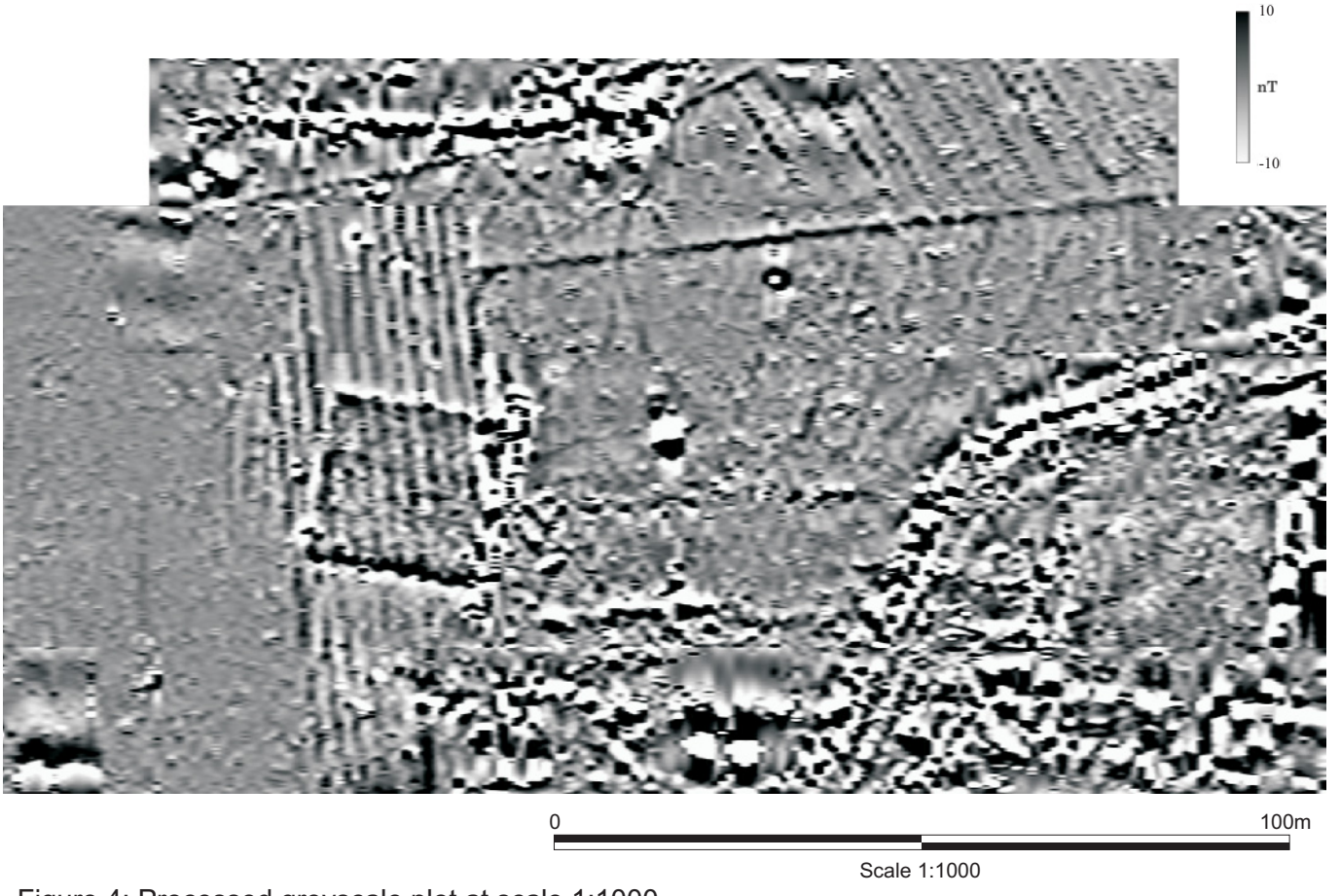


Figure 4: Processed greyscale plot at scale 1:1000

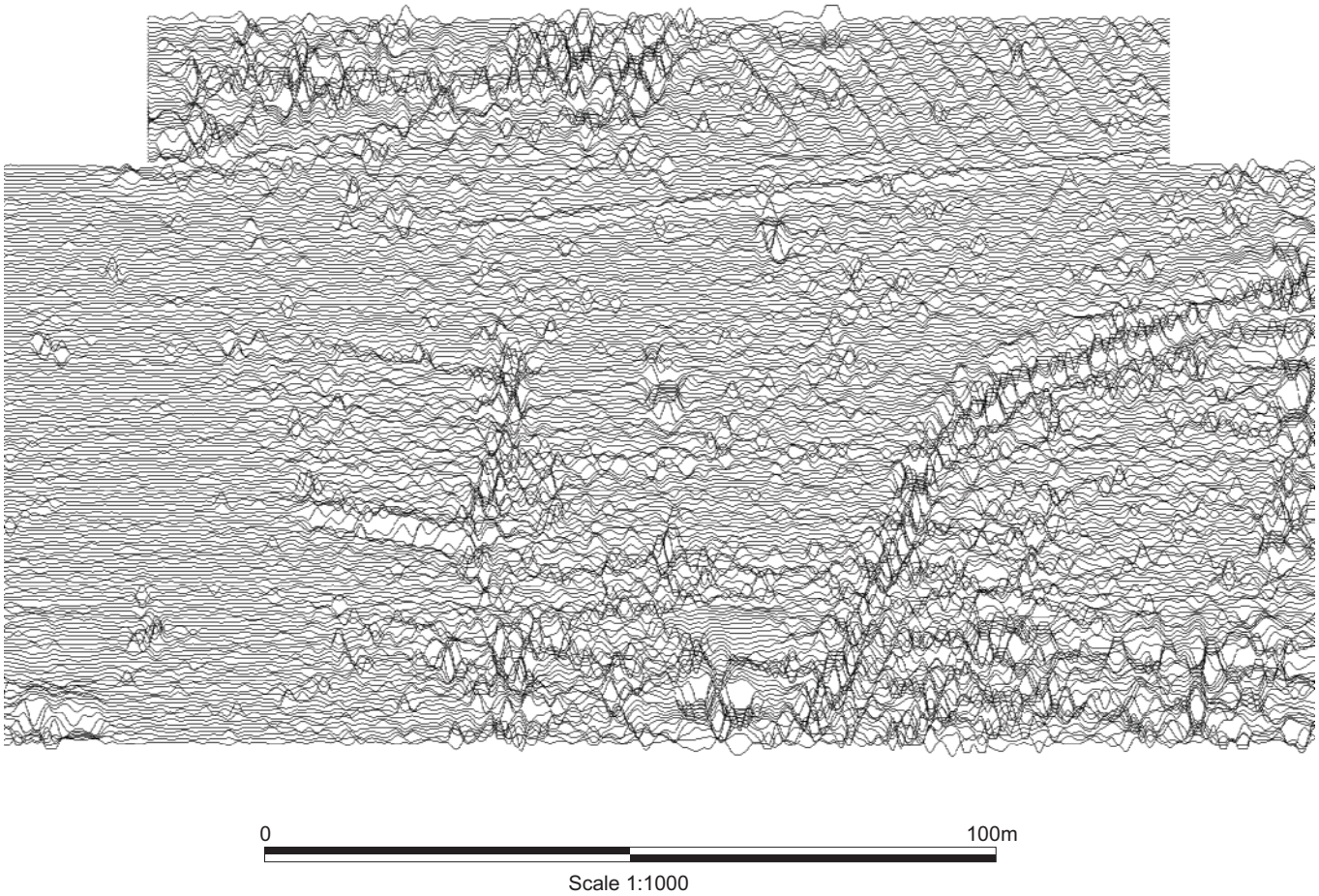
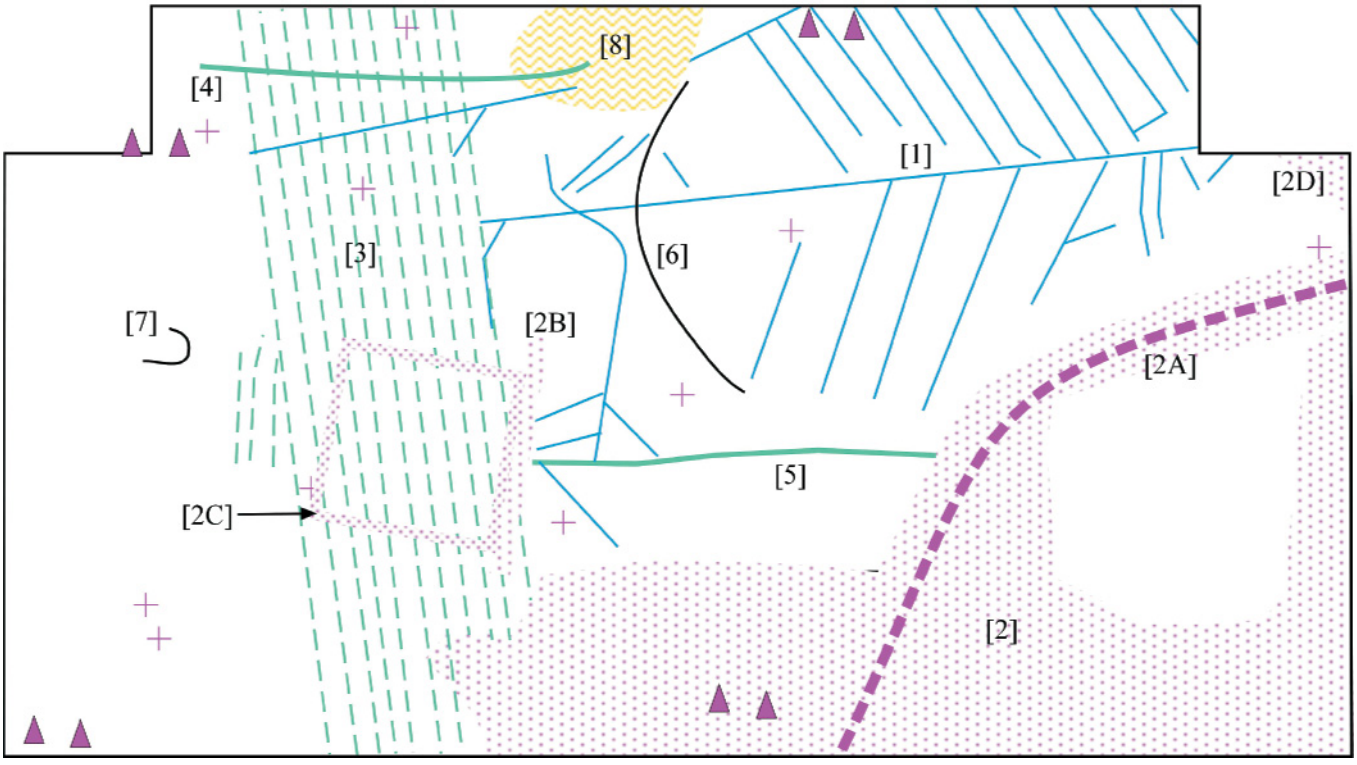


Figure 5: Trace Plot at scale 1:1000



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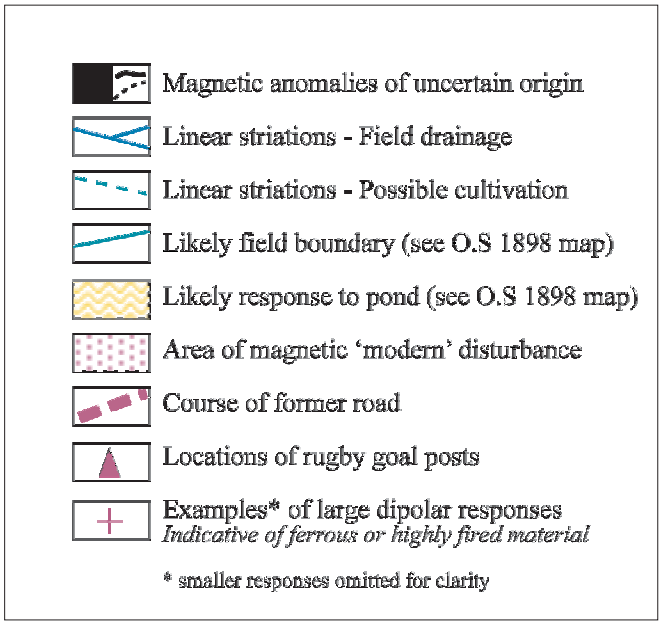

Figure 6 Simplified graphic interpretation at scale 1:1000

Figure 7: Location of development area outlined in red with geophysical survey interpretation, at scale 1:1000

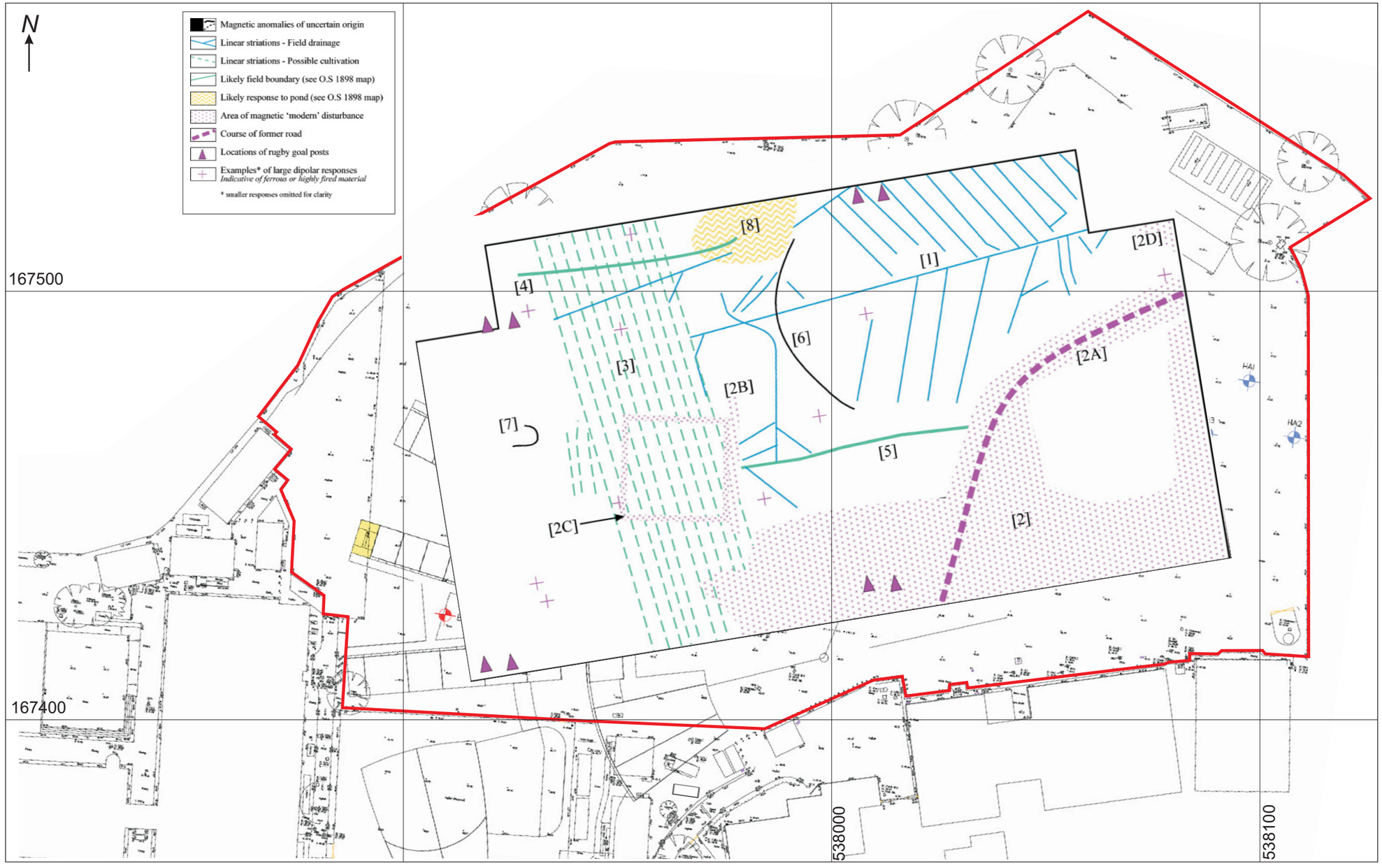

Figure 8: Location of development area outlined in red with graphic interpretation of geophysical survey, at scale 1:1000