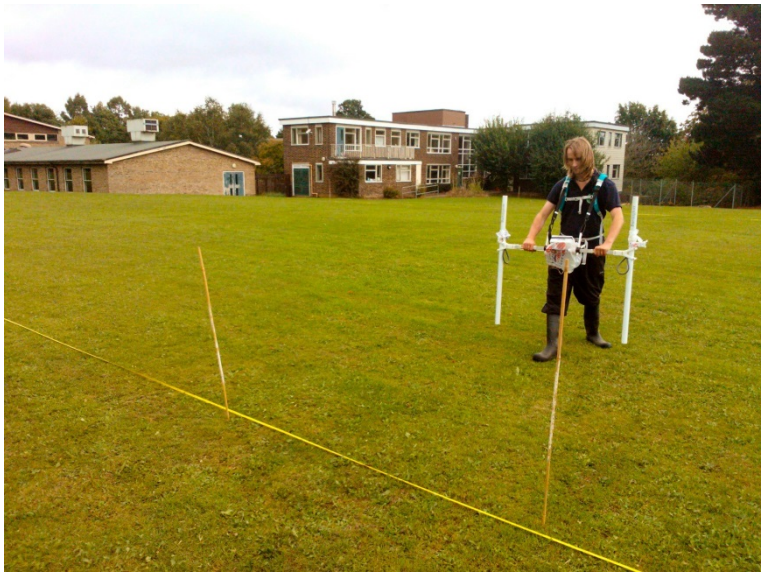
PLAYING FIELD, BELSTEAD SCHOOL, SPRITES LANE, IPSWICH, SUFFOLK

DETAILED MAGNETOMETER SURVEY



Report Number: 1039

October 2013

PLAYING FIELD, BELSTEAD SCHOOL, SPRITES LANE, IPSWICH, SUFFOLK

Detailed Magnetometer Survey

Prepared for:
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Site Code	BSD 018	**NGR**	TM 1306 4241
Planning Ref.	PL/0220/13	**OASIS**	britanni1-160358
Approved By	Matthew Adams	**DATE**	October 2013

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ABSTRACT

This detailed fluxgate gradiometer survey was successful in identifying a range of anomalies, some of which have a possible archaeological origin. One area of magnetic enhancement with a rectangular form, that is indicative of building remains was recorded. Located nearby was a negative linear trend (a ditch or possible boundary) on a similar alignment that could be associated with it. One positive curvilinear anomaly may also be of archaeological derivation, however a geological origin cannot be ruled out.

Further results include a strong dipolar linear trend that delineates a modern electric cable, a weak positive linear trend that is another possible service trench or land drain, five areas of magnetic disturbance caused by field boundaries, an all-weather cricket pitch and landscaping, and a plethora of isolated dipolar responses.

The subsequent trial trench evaluation will help to qualify the interpretations given within this report while determining whether these anomalies are unrecorded heritage assets.

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1.0 INTRODUCTION

On the 4th October 2013 Britannia Archaeology Ltd (BA) undertook a detailed fluxgate gradiometer survey over *c.*1 hectare at Belstead School, Sprites Lane, Ipswich, Suffolk (TM 1306 4241) currently used as a playing field. It was carried out on behalf of Dr Rhodri Gardner of Suffolk County Council Archaeological Service in response to a brief for a geophysical survey and a trenched archaeological evaluation from Suffolk County Council Archaeology Service/Conservation Team (Brudenell, M. dated 29th July 2013).

This geophysical survey was undertaken as part of a programme of archaeological investigations in advance of the construction of a new school with associated landscaping.

2.0 SITE DESCRIPTION

The survey was located in the south-western corner of Ipswich in an area dominated by an expansive modern housing estate, on one playing field to the south of the buildings that comprise Belstead School. The site is bordered by a trackway running parallel to the southern boundary, by houses that front onto Wilson Road to the west and by Sprites Lane located to the east.

The bedrock is described as Red Crag Formation Sand; a sedimentary bedrock formed approximately 2 to 4 million years ago in the Neogene Period when the local environment was dominated by shallow seas and siliciclastic sediments were deposited as mud, silt, sand and gravel (BGS, 2013).

The superficial deposits are described as Lowestoft Formation sand and gravel, formed up to 2 million years ago in the Quaternary Period. The local environment was dominated by ice age conditions when glaciers scoured the landscape depositing moraines of till with outwash sand and gravel from seasonal and post glacial meltwaters (BGS, 2013).

3.0 PLANNING POLICIES

This archaeological investigation was carried out on the recommendation of the local planning authority, following guidance laid down by the National Planning and Policy Framework (NPPF, DCLD 2012) which replaces Planning Policy Statement 5: Planning for the Historic Environment (PPS5, DCLG 2010). The relevant local development plan is the Babergh Development Framework Core Strategy (2011-2031) Submission Draft.

3.1 National Planning Policy Framework (NPPF, DCLG March 2012)

The NPPF recognises that 'heritage assets' are an irreplaceable resource and planning authorities should conserve them in a manner appropriate to their significance when considering development. It requires developers to record and advance understanding of

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the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible. The key areas for consideration are:

- The significance of the heritage asset and its setting in relation to the proposed development;
- The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance;
- Significance (of the heritage asset) can be harmed or lost through alteration or destruction, or development within its setting. As heritage assets are irreplaceable, any harm or loss should require clear and convincing justification;
- Local planning authorities should not permit loss of the whole or part of a heritage asset without taking all reasonable steps to ensure the new development will proceed after the loss has occurred;
- Non-designated heritage assets of archaeological interest that are demonstrably of equivalent significance to scheduled monuments, should be considered subject to the policies for designated heritage assets.

3.2 Babergh Development Framework Core Strategy (2011-2031) Submission Draft

The local development framework for Babergh states the following:

- Careful consideration of the character of other, unlisted, historic assets is important and that developments which may affect historic assets make a positive contribution to local character and distinctiveness (3.35 & 3.3.6).

4.0 ARCHAEOLOGICAL BACKGROUND

A detailed magnetometer survey was undertaken over *c.*1 hectare of land used for playing fields. A significant degree of ground disturbance is expected during the development of the new school and the associated landscaping, which has the potential to damage existing archaeological deposits (Brief 3.1).

The site lies in an area of archaeological potential overlooking the valley of Belstead Brook which is topographically favourable for early occupation. An evaluation and an excavation located 550m to the north identified 17 urned and two un-urned Middle Bronze Age Cremations and a small 3m ring ditch (SPT 035). A scatter of Roman pottery (WSH 003) located on a south facing slope is present 300m to the west. Roman pottery, a ditch and Early Anglo-Saxon animal bones were recorded during an evaluation (WSH012) 475m to the north-west. The site of the Medieval vicarage at Felchurch is present 700m to the north-west and 560m to the north-west is the site of a milestone monument (WSH 015).

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5.0 PROJECT AIMS

A geophysical survey and linear trenched evaluation is required of the development area to enable the archaeological resource, both in quality and extent, to be accurately quantified.

6.0 METHODOLOGY

6.1 Instrument Type Justification

Britannia Archaeology Ltd employed a Bartington Dual Grad 601-2 fluxgate gradiometer to undertake the survey, because of its high sensitivity and rapid ground coverage. The surveyors noted that that the site had a fairly low magnetic background susceptibility possibly due to the nature of the glacial till that is predominant in this area.

6.2 Instrument Calibration

One hour was allowed in the morning for the magnetometers sensors to settle before the start of the first grid. The instrument was zeroed after every three grids to minimise the effect of sensor drift. An area with a relatively low magnetic reading was chosen to calibrate the instrument; this same point was used to zero the sensors throughout the survey providing a common zero point. Sensor drift was noted throughout the day due to outbreaks of sunshine.

6.3 Sampling Interval and Grid Size

The sampling interval was set at 0.25m along 1m traverse intervals, providing 4 readings a metre, the magnetometer survey was undertaken on 20 x 20m grids.

6.4 Survey Grid Location

The survey grid was set out to the Ordnance Survey OSGB36 datum to an accuracy of ±0.1m employing a Leica Viva Glonnass Smart Rover GS08 differential global positioning system (DGPS). Data were then converted to the National Grid Transformation OSTN02 and the instrument was regularly tested using stations with known ETRS89 coordinates. The grids were positioned on a NNW-SSE alignment (Figure 1).

6.5 Data Capture

Instrument readings were recorded on an internal data logger that were downloaded to a laptop at lunchtime and then also at the end of the day. The grid order was recorded on a BA pro-forma to aid in the creation of the data composites. Data were filed in job specific folders. These data composites were checked for quality on site by BA, allowing grids to be re-surveyed if necessary. The data were backed up onto an external storage device in the office and finally a remote server at the end of the day. A five metre exclusion zone was left between the boundaries and the survey area to reduce the

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amount of field boundary magnetic disturbance. Trees present along the western boundary slightly reduced the area available for survey.

6.6 Data Presentation and Processing

Data are presented in both raw and processed data plots in greyscale format (Figures 2 and 3). An XY trace plot of the processed data has also been included (Figure 4). The raw data is presented with no processing, and was clipped to produce a uniform greyscale plot. The processed data schedule is displayed below.

Raw Data:
Data Clipping: 1 standard deviation.

Processed Data:
De-spike: X diameter = 3, Y diameter = 3, Threshold = 1, centre value=mean, replace with = mean;
Data Clipping: 1 standard deviation;
De-stripe: Traverse, Median, X (Horizontal).

An interpretation plan characterising the anomalies recorded can be found at Figure 5, it draws together the evidence collated both from the greyscale and XY trace plots (Figures 2, 3, and 4). All figures are tied into the National Grid and printed at an appropriate scale.

6.7 Software

Raw data were downloaded using Bartington software Grad601 and will be stored in this format as raw data. The software used to process the data and produce the composites was DW Consulting's Archeosurveyor v2.0. Datasets were exported into AutoCAD and placed onto the local survey grid. An interpretation plot was then produced using AutoCAD.

6.8 Grid Restoration

Britannia Archaeology Ltd did not position any reference stations in the field due to its use as a playing field. The grid can be relocated using the geo-referenced stations printed in Figure 1, this can also enable the accurate location of the geophysical anomalies.

7.0 RESULTS & DISCUSSION (Figures 2 – 5)

The surveyors noted that the sites overall magnetic background was relatively low, causing little difficulty in locating a suitable zero station to set-up the instruments sensors. Isolated dipolar ('iron spike') responses were most numerous and probably caused by modern ferrous cultural debris being introduced into the topsoil, rather than

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resulting from the presence of buried archaeological artefacts. These responses seem to be fairly evenly spaced throughout the fields with no apparent concentration.

Two areas of magnetic disturbance (yellow hatching) were recorded, one of which was caused by the close proximity of the ferrous boundary fence in the south-eastern corner of the field. The second is present to the north-east of the first above an area that appears to have been landscaped. Two further areas of magnetic disturbance (magenta hatching) have been recorded in the dataset, to the north and south of the plot. It is likely that both anomalies are related to a phase of landscaping that occurred during and after the construction of the school to level the grounds and playing field.

The rectangular strong dipolar response (dark blue hatching) recorded in the centre of the plot demarcates the location of an all-weather cricket wicket.

A weak positive linear trend (green line) is present running parallel with the western boundary (orientated NNE-SSW), it may indicate the presence of a buried service or land drain or equally may record ferrous material present near to the field boundary.

One strong dipolar linear trend (dark blue line) present in the northern half of the plot and orientated approximately east to west, delineates the location of a modern electricity service cable.

One weak negative linear trend (light blue hatching) has been recorded in the dataset and is orientated north-east to south-west. These negative readings may have been caused by up-cast natural drift geology located in the top of a potential ditch type feature. The anomaly also appears to be related to a similarly aligned area of magnetic enhancement present to its north-east.

The area of magnetic enhancement (orange hatching) has a coherent rectangular form that may represent the former remains of a building structure. It is of a similar orientation and possibly related to the negative linear trend is recorded to the south-west.

A positive curvilinear anomaly (orange curvilinear hatching) present in the centre-east of the dataset is of possible archaeological derivation, however a geological origin cannot be ruled out.

8.0 CONCLUSION

The detailed fluxgate gradiometer survey was successful in identifying a range of anomalies, some of which have a possible archaeological origin. It would be prudent to target the area of magnetic enhancement and the negative linear trend and the positive curvilinear anomaly with the subsequent trial trench evaluation. This will help qualify the interpretations given within this report while determining whether these anomalies are unrecorded heritage assets.

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9.0 PROJECT ARCHIVE AND DEPOSITION

A full archive will be prepared for all work undertaken in accordance with guidance from the *Selection, Retention and Dispersion of Archaeological Collections,* Archaeological Society for Museum Archaeologists, 1993. Arrangements will be made for the archive to be deposited with the relevant museum/HER Office.

10.0 ACKNOWLEDGEMENTS

Britannia Archaeology Ltd would like to thank Dr Rhodri Gardner of Suffolk County Council Archaeological Service for funding the project and for arranging site access, and to Matthew Brudenell of Suffolk County Council Archaeology Service/Conservation Team for writing the brief.

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Appendix 1 – Technical Details

Magnetometer Survey

The magnetometer differs from the 'active' magnetic susceptibility meter by being a 'passive' instrument. Rather than injecting a signal into the ground it detects slight variations in the Earth's magnetic field caused by cultural and natural disturbance (Clark).

Thermoremanent magnetism is produced when a material containing iron oxides is strongly heated. Clay for example has a high iron oxide content that in a natural state is weakly magnetic, when heated these weakly magnetic compounds become highly magnetic oxides that a magnetometer can detect.

The demagnetisation of iron oxides occurs above a temperature known as the Curie point; for example haematite has a Curie point of 675 Celsius and magnetite 565C. At the time of cooling the iron oxides become permanently re-magnetised with their magnetic properties re-aligned in the direction of the Earth's magnetic field (Gaffney and Gater). The direction of the Earth's magnetic field shifts over time and these subtle alignment differences can be recorded. Kilns, hearths, baked clay and ovens can reach Curie point temperatures, and are the strongest responses apart from large iron objects that can be detected. Other cultural anomalies that can be prospected include occupation areas, pits, ditches, furnaces, sunken feature buildings, ridge and furrow field systems and ritual activity (David, 2011). Commonly recorded anomalies include modern ferrous service pipes, field drainage pipes, removed field boundaries, perimeter fences and field boundaries.

Fluxgate Gradiometers

Fluxgate gradiometers are sensitive instruments that utilise two sensors placed in a vertical plane, spaced 1 metre apart. The sensor above reads the Earth's magnetic (background) response while the sensor below records the local magnetic field. Both sensors are carefully adjusted to read zero before survey commences at a 'zeroing' point, selected for its relatively 'quiet' magnetic background reading. When differences in the magnetic field strength occur between the two sensors a positive or negative reading is logged. Positive anomalies have a positive magnetic value and conversely negative anomalies have a negative magnetic value relative to the site's magnetic background. Examples of positive magnetic anomalies include hearths, kilns, baked clay, areas of burning, ferrous material, ditches, sunken feature buildings, furrows, ferrous service pipes, perimeter fences and field boundaries. Negative magnetic anomalies include earthwork embankments, plastic water pipes and geological features.

The instruments are usually held approximately 0.30m to 0.50m above the ground surface and can detect to a depth of between 1-2metres. Best practice dictates that the optimal direction of traverse in Britain is east to west.

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Magnetic Anomalies

Linear trends

Linear trends can be both positive and negative magnetic responses. If they are broad, relatively weak or negative in nature they may be of agricultural or geological origin, for example periglacial channels, land drains or ploughing furrows. If the responses are strong positive trends they are more likely to be of archaeological origin. Archaeological settlement ditches tend to be rich in highly magnetic iron oxides that accumulate in them via anthropogenic activity and humic backfills. Conversely surviving banks will be negative in nature, the material is derived from subsoil deposits that is less likely to be positively magnetic. Curvilinear trends can also be recorded and are indicative of archaeological structures such as drip-gullies.

Discrete anomalies

Discrete anomalies appear as increased positive responses present within a localised area. They are caused by a general increase in the amount of magnetic iron oxides present within the humic back-fill of for example a rubbish pit.

'Iron spike' anomalies

These strong isolated dipolar responses are usually caused by ferrous material present in the topsoil horizon. They can have an archaeological origin but are usually introduced into the topsoil during manuring.

Areas of magnetic disturbance

An area of magnetic disturbance is usually associated with material that has been fired. For example areas of burning, demolition (brick) rubble or slag waste spreads. They can also be caused by ferrous material, e.g. close proximity to barbwire or metal fences and field boundaries, buried services, pylons and modern rubbish deposits.

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Appendix 2 – OASIS Form

OASIS ID: britanni1-160358

Project details

Project name	Playing Field, Belstead School, Ipswich, Suffolk, Detailed Magnetometer Survey
Short description of the project	This detailed fluxgate gradiometer survey was successful in identifying a range of anomalies, some of which have a possible archaeological origin. One area of magnetic enhancement with a rectangular form, that is indicative of building remains was recorded. Located nearby was a negative linear trend (a ditch or possible boundary) on a similar alignment that could be associated with it. One positive curvilinear anomaly may also be of archaeological derivation, however a geological origin cannot be ruled out. Further results include a strong dipolar linear trend that delineates a modern electric cable, a weak positive linear trend that is another possible service trench or land drain, five areas of magnetic disturbance caused by field boundaries, an all-weather cricket pitch and landscaping, and a plethora of isolated dipolar responses. The subsequent trial trench evaluation will help to qualify the interpretations given within this report while determining whether these anomalies are unrecorded heritage assets.
Project dates	**Start:** 04-10-2013 **End:** 04-10-2013
Previous/future work	Not known / Yes
Any associated project reference codes	P1044 - Contracting Unit No. R1039 - Contracting Unit No. BSD 018 - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Other 14 - Recreational usage
Monument type	NONE None
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Public building (e.g. school, church, hospital, medical centre, law courts etc.)
Prompt	National Planning Policy Framework – NPPF
Position in the planning process	After full determination (eg. As a condition)
Solid geology	(other) Red Crag Formation Sand
Drift geology	GLACIAL SAND AND GRAVEL
Techniques	Magnetometry

Project location

Country	England
Site location	SUFFOLK BABERGH BELSTEAD Belstead School, Ipswich, Suffolk
Study area	1.00 Hectares
Site coordinates	TM 1306 4241 52 1 52 02 18 N 001 06 24 E Point
Height OD /Depth	**Min:** 35.00m **Max:** 35.00m

Project creators

Name of Organisation	Britannia Archaeology Ltd
Project brief originator	Local Planning Authority (with/without advice from County/District Archaeologist)
Project design originator	Timothy Schofield
Project director/ manager	Timothy Schofield
Project supervisor	Timothy Schofield
Type of sponsor/ funding body	District Council
Name of sponsor/ funding body	Suffolk County Council Archaeological Service

Project archives

Physical Archive Exists?	No
Digital Archive recipient	Suffolk HER
Digital Contents	"Survey"

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Digital Media available	"Geophysics", "Images raster / digital photography" ,"Images vector", "Survey", "Text"
Paper Archive recipient	Suffolk HER
Paper Contents	"Survey"
Paper Media available	"Drawing", "Map", "Microfilm", "Photograph", "Plan", "Report", "Survey", "Unpublished Text"
Entered by	Tim Schofield (tim@britannia-archaeology.com)
Entered on	4 November 2013

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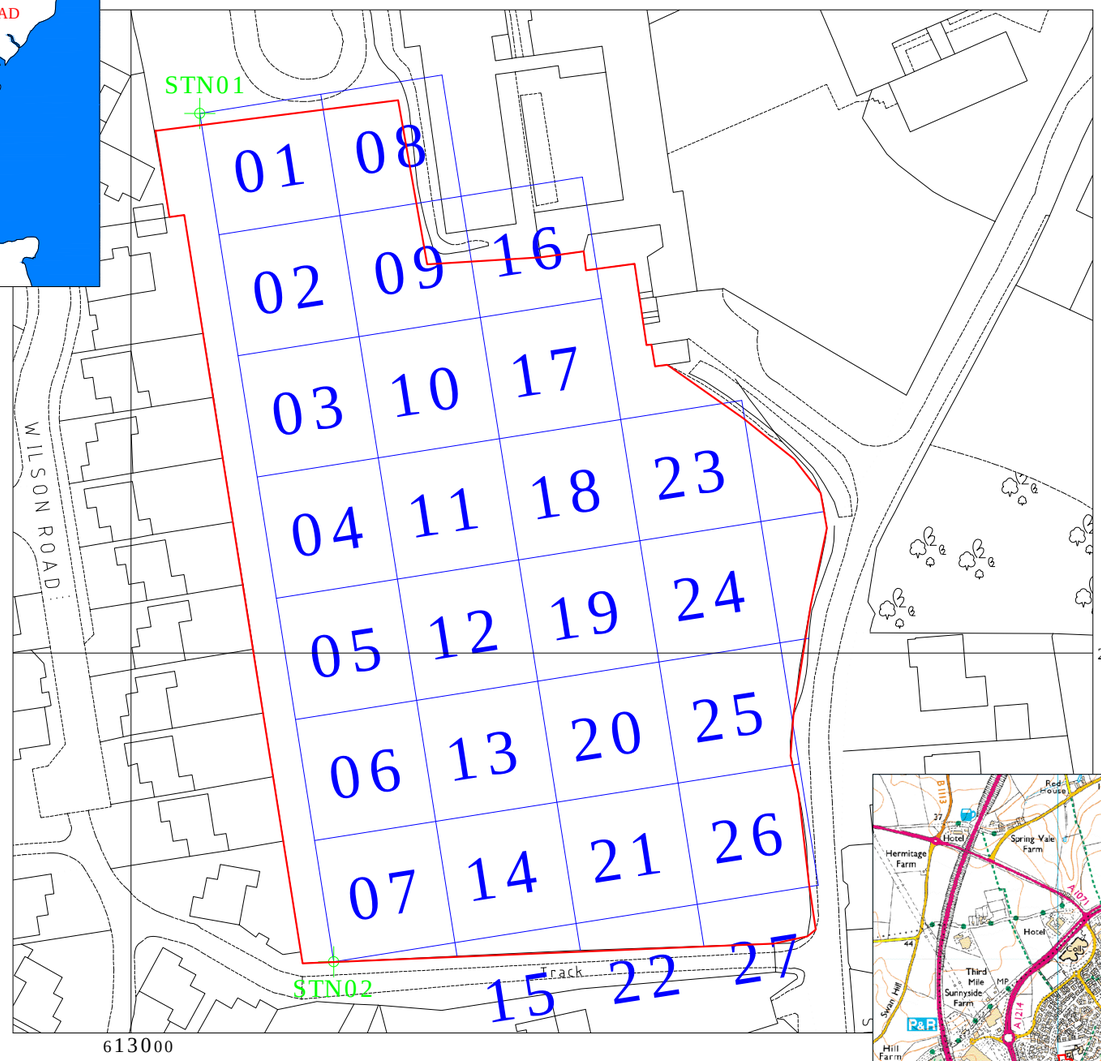

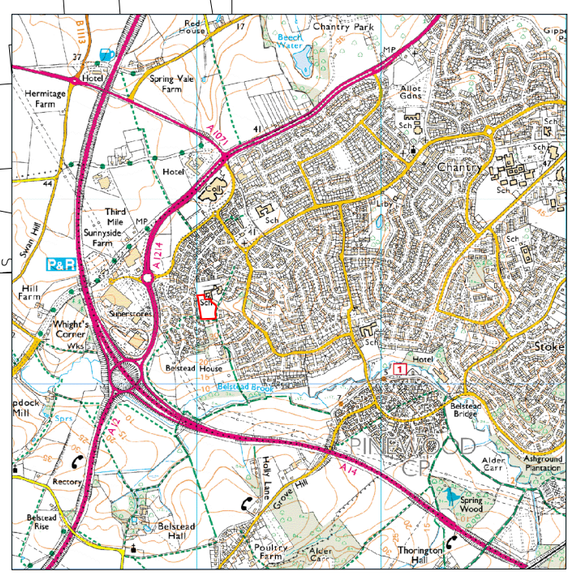

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N

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02	613033.068	242349.682

Site Boundary

NGR: 613060 242415

REPORT NUMBER: 1039

PROJECT:
PLAYING FIELD, BELSTEAD SCHOOL, SPRITES LANE, IPSWICH, SUFFOLK, DETAILED MAGNETOMETER SURVEY

CLIENT:
Suffolk County Council

DESCRIPTION:
SITE, SURVEY GRID & REFERENCING INFORMATION

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SCALE: 1:1000 (0 – 40m)

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DATE:	AUTHOR:	FIGURE:
OCT 2013	TPS	01

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N

+12.08nT

-14.28nT

Site Boundary

NGR: 613060 242415

REPORT NUMBER: 1039

PROJECT: PLAYING FIELD, BELSTEAD SCHOOL, SPRITES LANE, IPSWICH, SUFFOLK, DETAILED MAGNETOMETER SURVEY

CLIENT: Suffolk County Council

DESCRIPTION: RAW MAGNETOMETER GREYSCALE PLOT

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SCALE: 1:500 (0 – 20m)

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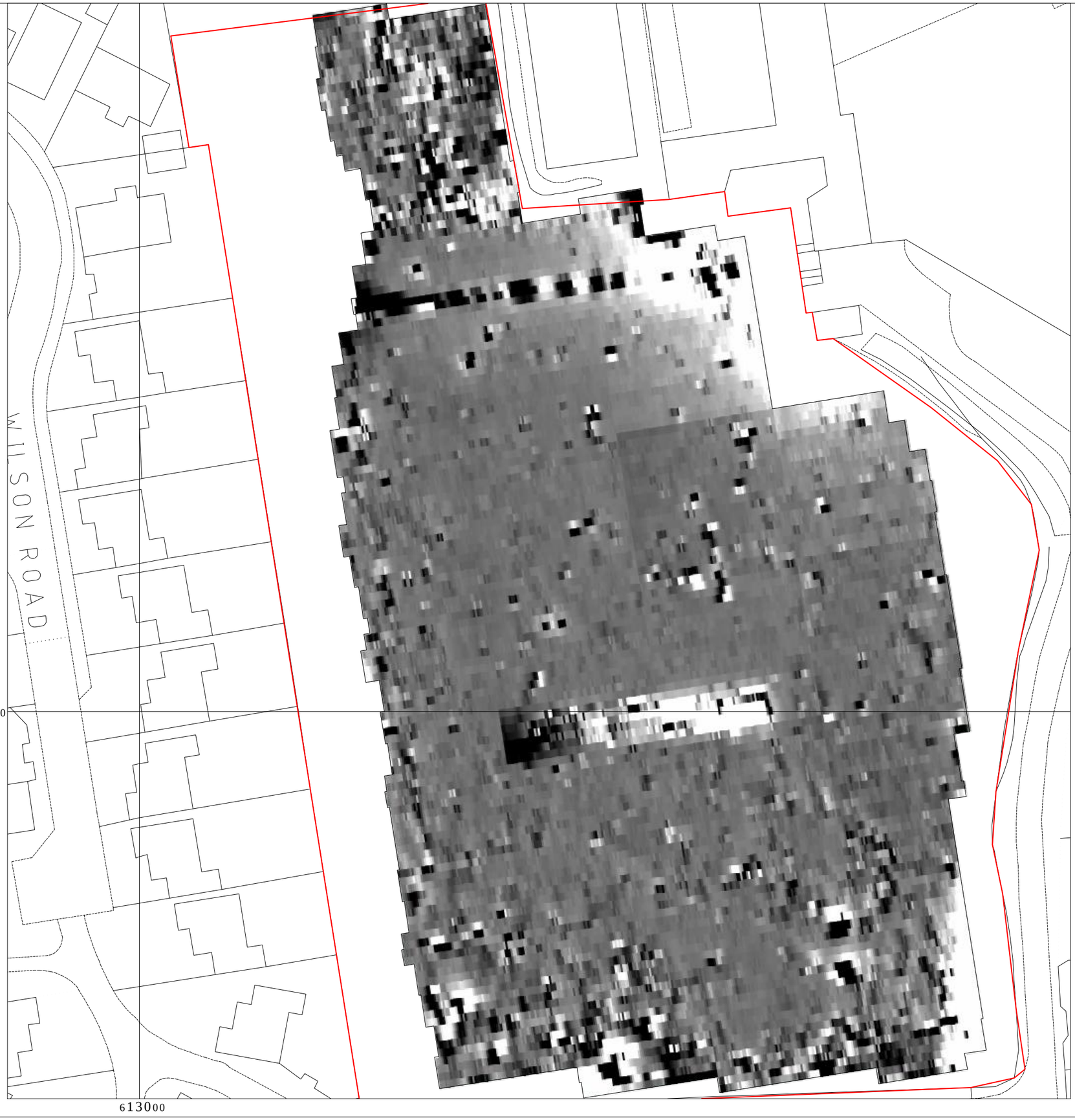

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N

+8.55nT

-10.89nT

Site Boundary

NGR: 613060 242415

REPORT NUMBER: 1039

PROJECT: PLAYING FIELD, BELSTEAD SCHOOL, SPRITES LANE, IPSWICH, SUFFOLK, DETAILED MAGNETOMETER SURVEY

CLIENT: Suffolk County Council

DESCRIPTION: PROCESSED MAGNETOMETER GREYSCALE PLOT

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N

60 nT/cm — Scale Interval

Site Boundary

NGR: 613060 242415

REPORT NUMBER: 1039

PROJECT:
PLAYING FIELD, BELSTEAD SCHOOL, SPRITES LANE, IPSWICH, SUFFOLK, DETAILED MAGNETOMETER SURVEY

CLIENT:
Suffolk County Council

DESCRIPTION:
PROCESSED MAGNETOMETER XY TRACE PLOT

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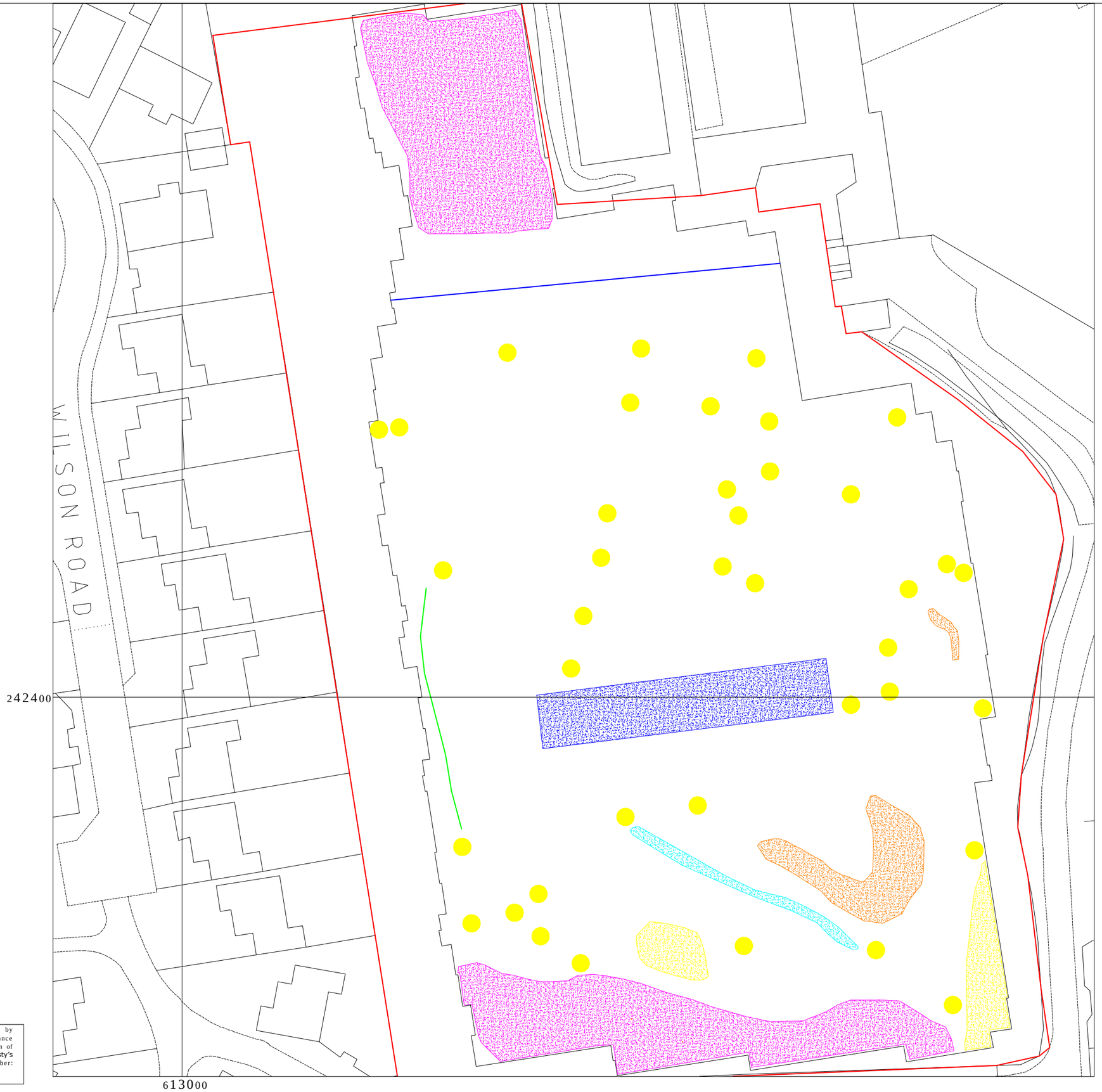

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N

	Area of Magnetic Enhancement, Archaeology?
	Positive Curvilinear Anomaly, Archaeology?
	Positive Linear Trend, Service?
	Negative Linear Trend, Service?
	Area of Magnetic Disturbance, Landscaped Material
	Dipolar Linear Trend, Modern Ferrous Cable
	All Weather Cricket Pitch
	Area of Magnetic Disturbance
	Isolated Dipolar Responses
	Site Boundary

NGR: 613060 242415

REPORT NUMBER: 1039

PROJECT:
PLAYING FIELD, BELSTEAD SCHOOL, SPRITES LANE, IPSWICH, SUFFOLK, DETAILED MAGNETOMETER SURVEY

CLIENT:
Suffolk County Council

DESCRIPTION:
INTERPRETATION PLOT OF MAGNETOMETER ANOMALIES

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SCALE: 1:500 (0 – 20m)

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DATE: OCT 2013	AUTHOR: TPS	FIGURE: 05