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Land east of Keymer Road (Thakeham site), Burgess Hill, West Sussex

Geophysical Survey (Magnetic)

by Kyle Beaverstock

Site Code: KRB 23/92

(TQ 3214 1789)

Land east of Keymer Road (Thakeham site), Burgess Hill, West Sussex

Geophysical Survey (Magnetic) Report

For Thakeham Homes Limited

by Kyle Beaverstock

Thames Valley Archaeological Services Ltd

Site Code KRB 23/92

May 2023

Summary

Site name: Land east of Keymer Road (Thakeham site), Burgess Hill, West Sussex

Grid reference: TQ 3214 1789

Site activity: Magnetometer survey

Date and duration of project: 17 – 18 April 2023

Project coordinator: David Sanchez

Site supervisor: Kyle Beaverstock

Site code: KRB23/92

Area of site: c. 4.8ha

Summary of results: A single weak positive linear magnetic anomaly representing a possible field boundary and three sections of curvilinear positive anomaly were the only potential features of archaeological interest detected by the geophysical survey. A series of parallel positive and negative magnetic anomalies crossed the fields in north to south and east to west orientations and are likely indicative of modern agricultural activity.

Location of archive: The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

Report edited/checked by: Steve Ford✓ 11.05.23
Tim Dawson✓ 12.05.23

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Land east of Keymer Road (Thakeham site), Burgess Hill, West Sussex
A Geophysical Survey (Magnetic)

by Kyle Beaverstock

Report 23/92

Introduction

This report documents the results of a geophysical survey (magnetic) carried out at Keymer Road, Burgess Hill, West Sussex (TQ 3214 1789) (Fig. 1). The work was commissioned on behalf of Thakeham Homes Limited, Thakeham House, Summers Place, Stane Street, Billingshurst, West Sussex, RH14 9GN.

Planning permission (DM/22/3049) has been granted for the construction of 260 dwellings and associated facilities by Mid Sussex District Council. In preparation, a geophysical survey of part of the application site has been requested. This is in accordance with the *National Planning Policy Framework* (NPPF 2021), and the District's policies on archaeology. The fieldwork was undertaken by Kyle Beaverstock, on 17th and 18th April 2023 and the site code is KRB 23/92.

The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

Location, topography and geology

The 4.8ha site consists of three fields located on the southern edge of Burgess Hill (Fig. 1), bounded by residential structures to the north and west and fallow land to the east and south. The land has a general slope from 65m above Ordnance Datum (aOD) in the west to 55m aOD in the east. The three fields which comprise the site are currently being utilised as pasture land and each field is bounded by hedgerows and post-and-wire fencing. The underlying geology is stated as Weald Clay (BGS 1996).

Site history and archaeological background

A full archaeological background can be found in the desk-based assessment (Redclift 2022). To summarise, there are no known archaeological assets within the site area however a few archaeological deposits have been recorded in the vicinity including Prehistoric and Roman remains during the watching brief for the Ditchling to Wivelsfield Green pipeline as well as a Bronze Age axe recorded to the south. The site was likely within the informal parkland of the medieval 'Frekeberge' estate and as such would have been occupied by woodland or agricultural land at this time. Late post-medieval mapping shows the site as three fields beyond the southern limits of Burgess Hill with the surrounding land gradually being consumed by the expansion of the town through the 19th and 20th centuries.

Methodology

Sample interval

Data collection involved the traversing of the survey area along straight and parallel lines using two cart-mounted Bartington Grad601-2 fluxgate gradiometers. Even coverage was achieved with the use of regularly spaced markers at the ends of traverses and the real-time positional trace plot. Readings were taken at 0.13m intervals along traverses 1m apart, providing an appropriate methodology balancing cost and time with resolution. Traverses were walked at an alternating zig-zag pattern along an east to west orientation across the survey area. A few obstructions were encountered during the survey including field boundaries, vegetation and fencing. Conditions during the survey were dry and bright.

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. Under normal operating conditions it can be expected to identify buried features >0.5m in diameter. Features which can be detected include disturbed soil, such as the fill of a ditch, structures that have been heated to high temperatures (magnetic thermoremnance) and objects made from ferro-magnetic materials. The strength of the magnetic field is measured in nano Tesla (nT), equivalent to 10^{-9} Tesla, the SI unit of magnetic flux density.

Equipment

The purpose of the survey was to identify geophysical anomalies that may be archaeological in origin in order to inform a targeted archaeological investigation of the site prior to development. The survey and report generally follow the recommendations and standards set out by both European Archaeological Council (EAC 2015) and the Chartered Institute *for* Archaeologists (2002, 2014).

Magnetometry was chosen as a survey method as it offers the most rapid ground coverage and responds to a wide range of anomalies caused by past human activity. These properties make it ideal for the fast yet detailed surveying of an area.

The detailed magnetometry survey was carried out using two dual sensor Bartington Instruments Grad 601-2 fluxgate gradiometers mounted upon a Bartington non-magnetic cart. A two-wheeled lightweight structure pushed by hand, the cart consisted a bank of four vertically-mounted Bartington Grad601-2 magnetic sensor tubes at 1m apart and a Trimble R2 Receiver, centimetre edition GPS. Readings were collected by two Bartington

Grad601-2 loggers and collated using MLgrad601 software on a Geo 10 tablet running Windows 11 mounted at the rear of the cart. This enables readings to be taken of both the general background magnetic field and any localised anomalies with the difference being plotted as either positive or negative buried features. All sensors are calibrated to cancel out the local magnetic field and react only to anomalies above or below this base line. On this basis, strong magnetic anomalies such as burnt features (kilns and hearths) will give a high response as will buried ferrous objects. More subtle anomalies such as pits and ditches can be seen from their infilling soils containing higher proportions of humic material, rich in ferrous oxides, compared to the undisturbed subsoil. This will stand out in relation to the background magnetic readings and appear in plan following the course of a linear feature or within a discrete area.

The Trimble R2 Receiver, centimetre edition GPS system with centimetre real-time accuracy was used to tie the cart traverses into the Ordnance Survey national grid. This unit offers both real-time correction and post-survey processing; enabling a high level of accuracy to be obtained both in the field and in the final post-processed data.

Data gathered in the field was processed using the TerraSurveyor software package. This allows the survey data to be collated and manipulated to enhance the visibility of anomalies, particularly those likely to be of archaeological origin. The table below lists the processes applied to this survey, full survey and data information is recorded in Appendix 1.

Process	**Effect**
Clip from -2.94 to 2.35 nT	Enhance the contrast of the image to improve the appearance of possible archaeological anomalies.
De-stripe: median, all sensors	Removes the striping effect caused by differences in sensor calibration, enhancing the visibility of potential archaeological anomalies.
De-spike: threshold 1, window size 3×3	Compresses outlying magnetic points caused by interference of metal objects within the survey area.
De-stagger: all grids, both by -1 intervals	Cancels out effects of site's topography on irregularities in the traverse speed.

The raw data plot is presented as a greyscale plot shown in relation to the site (Fig. 2) with the processed data then presented as a second figure (Fig. 3), followed by a third plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 4). Anomalies are shown as colour-coded lines, points and polygons.

The greyscale plot of the processed data is exported from TerraSurveyor in a georeferenced portable network graphics (.PNG) format, a raster image format chosen for its lossless data compression and support for transparent pixels, enabling it to easily be overlaid onto an existing site plan. The data plot is combined with grid and site plans in QGIS 2.18.15 and exported again in .PNG format in order to present them in figure templates in Adobe

InDesign CS5.5, creating .INDD file formats. Once the figures are finalised, they are exported in .PDF format for inclusion within the finished report.

Results

A number of magnetic anomalies were detected by the geophysical survey (Figs. 2 and 3) including a number of parallel positive and negative linear anomalies **[Fig. 4: 1]** running north to south and east to west with a regular spacing of 10m (north-south) and 25-30m (east-west). These most likely represent field drains or other similar agricultural activity. Along the field boundaries are areas of magnetic disturbance **[2]**, which are represented by relatively high positive and negative responses and are likely caused by ferrous material in the surrounding fencing. In the south-east quadrant of the western field is a weak linear positive anomaly **[3]** which runs from the eastern boundary towards the south-west for 60m before turning to the north-west for 48m. This most likely represents a field boundary pre-dating the current field layout. Approximately 15m to the south-west are three fragmentary sections of curvilinear positive anomalies **[4]** which, if related, together may form a larger feature *c*.30m in diameter. This is of potential archaeological interest and may represent an agricultural enclosure pre-dating the post-medieval landscape layout.

Conclusion

A small number of magnetic anomalies were detected by the geophysical survey. These mostly consist of linear anomalies that are likely to be of agricultural origin. A single L-shaped weak linear positive anomaly that may represent part of a previous agricultural field system and three curvilinear fragments of a possible circular enclosure, all located in the western field, were the only anomalies detected of potential archaeological interest. All three survey areas were characterised by strong magnetic noise in the background readings, making interpretation of potential smaller discrete anomalies problematic. This noise is potentially caused by the underlying geology.

References

BGS, 1996, *British Geological Survey*, 1:50,000, Sheet 318/333, Bedrock and Superficial Edition, Keyworth

CI*f*A, 2014, 'Standard and Guidance for archaeological geophysical survey', Reading

EAC, 2015, *EAC Guidelines for the use of Geophysics in Archaeology: Questions to Ask and Points to Consider*, EAC Guidelines 2, Namur

IFA, 2002, 'The Use of Geophysical Techniques in Archaeological Evaluation', IFA Paper No. 6, Reading

NPPF, 2021, *National Planning Policy Framework*, Ministry of Housing, Communities and Local Govt, London

Redclift, 2022, 'Land east of Keymer Road and south of Folders Lane, Burgess Hill; Archaeological desk-based assessment', Orion report PN3287/DBA3, Hove

Appendix 1. Survey and data information

Programme:
Name: TerraSurveyor
Version: 3.0.25.0

Raw data
Filename: Burgess Hill A RAW.xcp
Instrument Type: MLgrad Import
Units:
UTM Zone: 30
Survey corner coordinates (X/Y):
Northwest corner: 531928.693027552, 117993.763365313 m
Southeast corner: 532072.083027552, 117830.093365313 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions
Survey Size (meters): 143 m x 164 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 56759, Recorded: 56759

Stats
Max: 102.81
Min: -109.72
Std Dev: 5.89
Mean: 0.05
Median: 0.38
Composite Area: 2.3469 ha
Surveyed Area: 1.8873 ha

Filename: Burgess Hill B RAW.xcp
Instrument Type: MLgrad Import
Units:
UTM Zone: 30
Survey corner coordinates (X/Y):
Northwest corner: 532074.999692723, 118002.67680769 m
Southeast corner: 532230.089692723, 117852.78680769 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions
Survey Size (meters): 155 m x 150 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 46335, Recorded: 46335

Stats
Max: 107.55
Min: -109.76
Std Dev: 5.45
Mean: 0.89
Median: 1.26
Composite Area: 2.3246 ha
Surveyed Area: 1.6743 ha

Filename: Burgess Hill C RAW.xcp
Instrument Type: MLgrad Import
Units:
UTM Zone: 30
Survey corner coordinates (X/Y):
Northwest corner: 532235.470737026, 118015.072040438 m
Southeast corner: 532330.630737026, 117923.162040438 m
Direction of 1st Traverse: 90 deg
Collection Method: Parallel
Sensors: 2 @ 1 m spacing.
Dummy Value: 32702

Dimensions
Survey Size (meters): 95.2 m x 91.9 m
X&Y Interval: 0.13 m
Source GPS Points: Active: 16847, Recorded: 16847

Stats
Max: 105.47
Min: -108.41
Std Dev: 6.76
Mean: 0.58
Median: 1.04
Composite Area: 0.87462 ha
Surveyed Area: 0.59753 ha

Processed data
Filename: Burgess Hill A.xcp
Stats
Max: 2.35
Min: -2.94
Std Dev: 0.90
Mean: 0.00
Median: 0.02
Composite Area: 2.2855 ha
Surveyed Area: 1.8142 ha

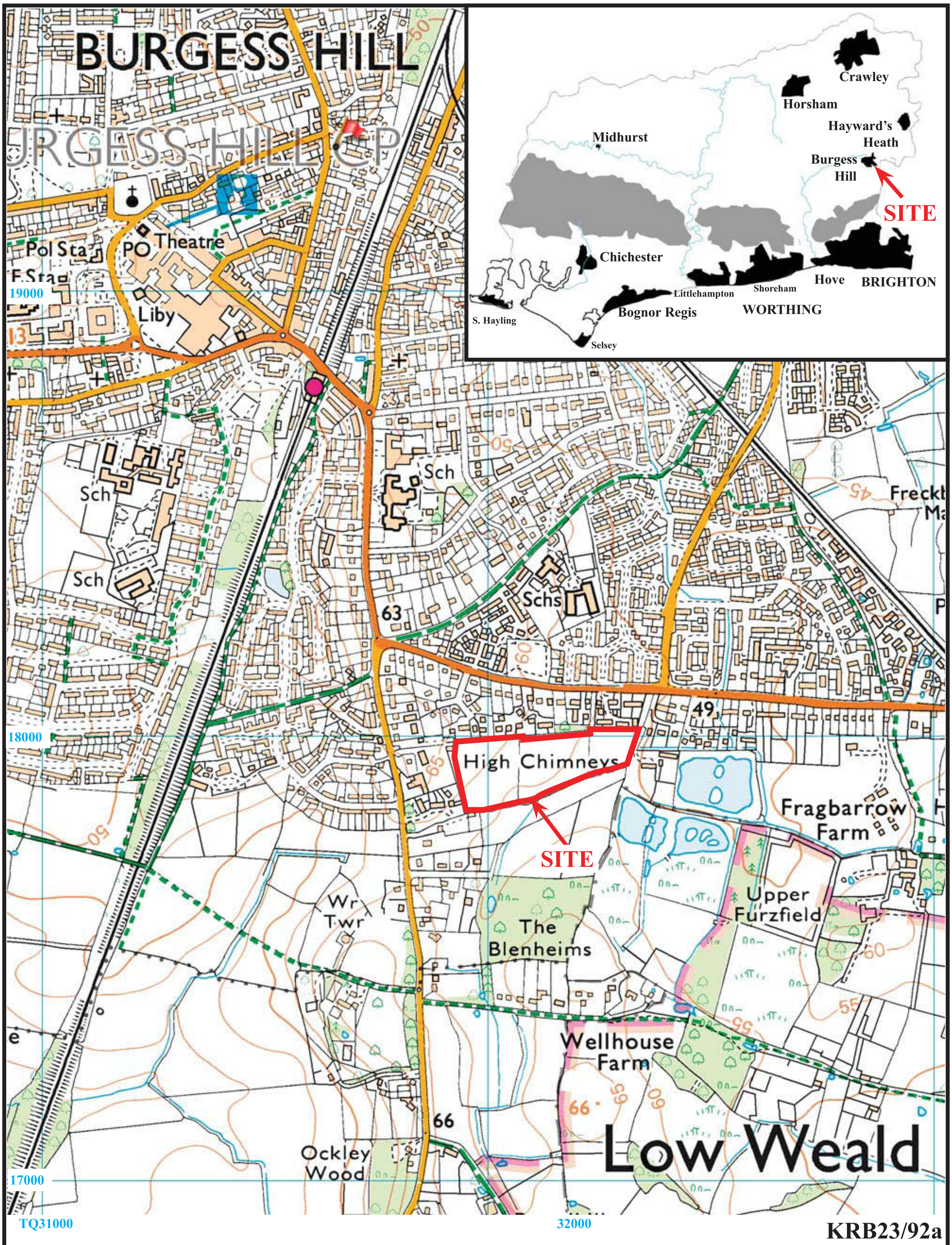
GPS based Proce5
1. *Base Layer.*
2. *Unit Conversion Layer (Lat/Long to UTM).*
3. *DeStripe Median Traverse:*
4. *Clip at 1.00 SD*
5. *Clip from -2.70 to 2.10*

Filename: Burgess Hill B.xcp
Stats
Max: 2.35
Min: -2.94
Std Dev: 0.81
Mean: -0.01
Median: 0.01
Composite Area: 2.2636 ha
Surveyed Area: 1.5981 ha

GPS based Proce5
1. *Base Layer.*
2. *Unit Conversion Layer (Lat/Long to UTM).*
3. *DeStripe Median Traverse:*
4. *Clip at 1.00 SD*
5. *Clip from -2.70 to 2.10*

Filename: Burgess Hill C.xcp
Stats
Max: 2.35
Min: -2.94
Std Dev: 0.97
Mean: 0.04
Median: 0.03
Composite Area: 0.83852 ha
Surveyed Area: 0.55479 ha

GPS based Proce5
1. *Base Layer.*
2. *Unit Conversion Layer (Lat/Long to UTM).*
3. *DeStripe Median Traverse:*
4. *Clip at 1.00 SD*
5. *Clip from -2.70 to 2.10*



Land east of Keymer Road (Thakeham site), Burgess Hill, West Sussex

Geophysical (magnetic) Survey

Figure 1. Location of site within Burgess Hill and West Sussex.

Reproduced under licence from Ordnance Survey Explorer Digital mapping at 1:12500

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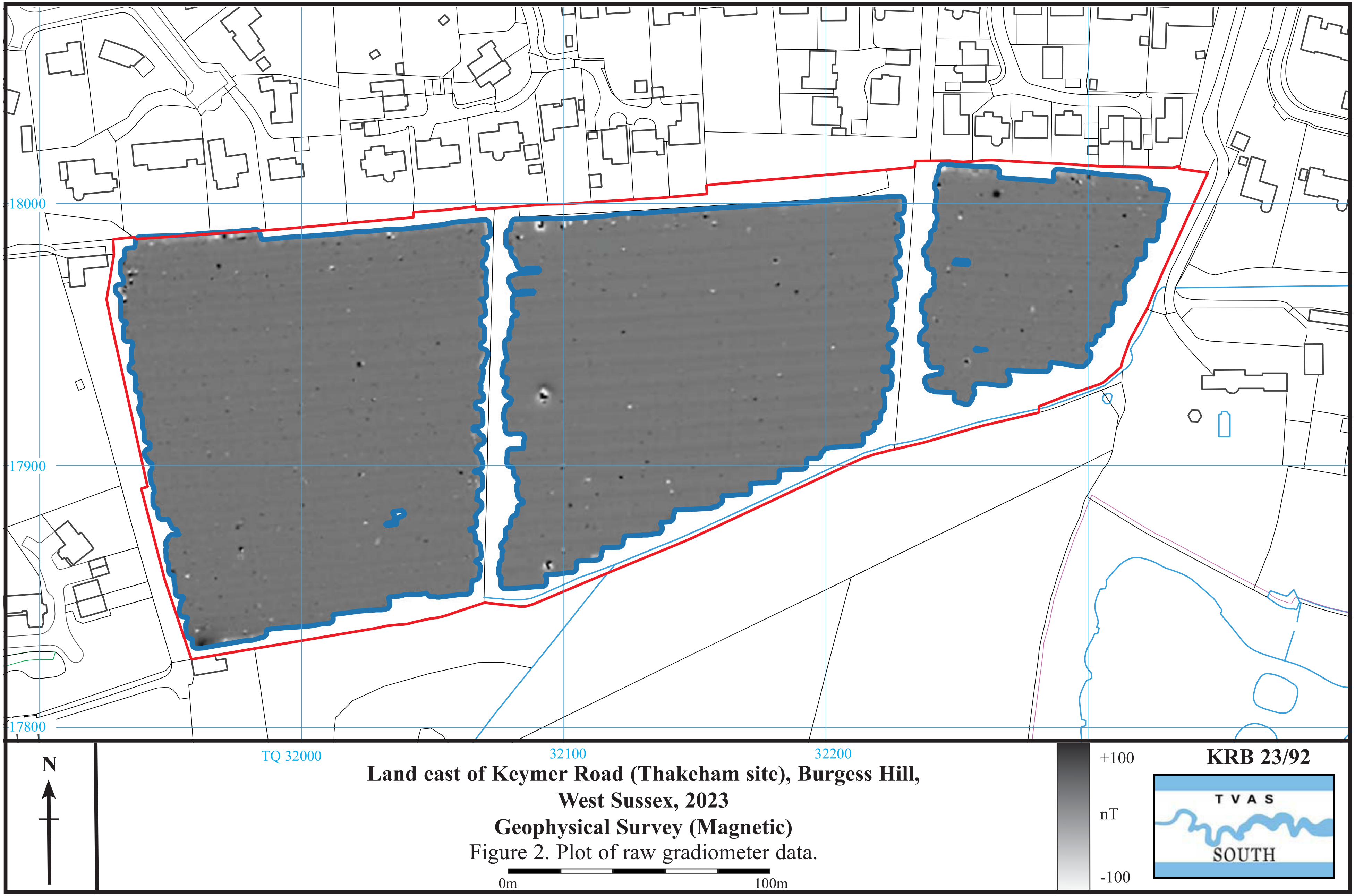

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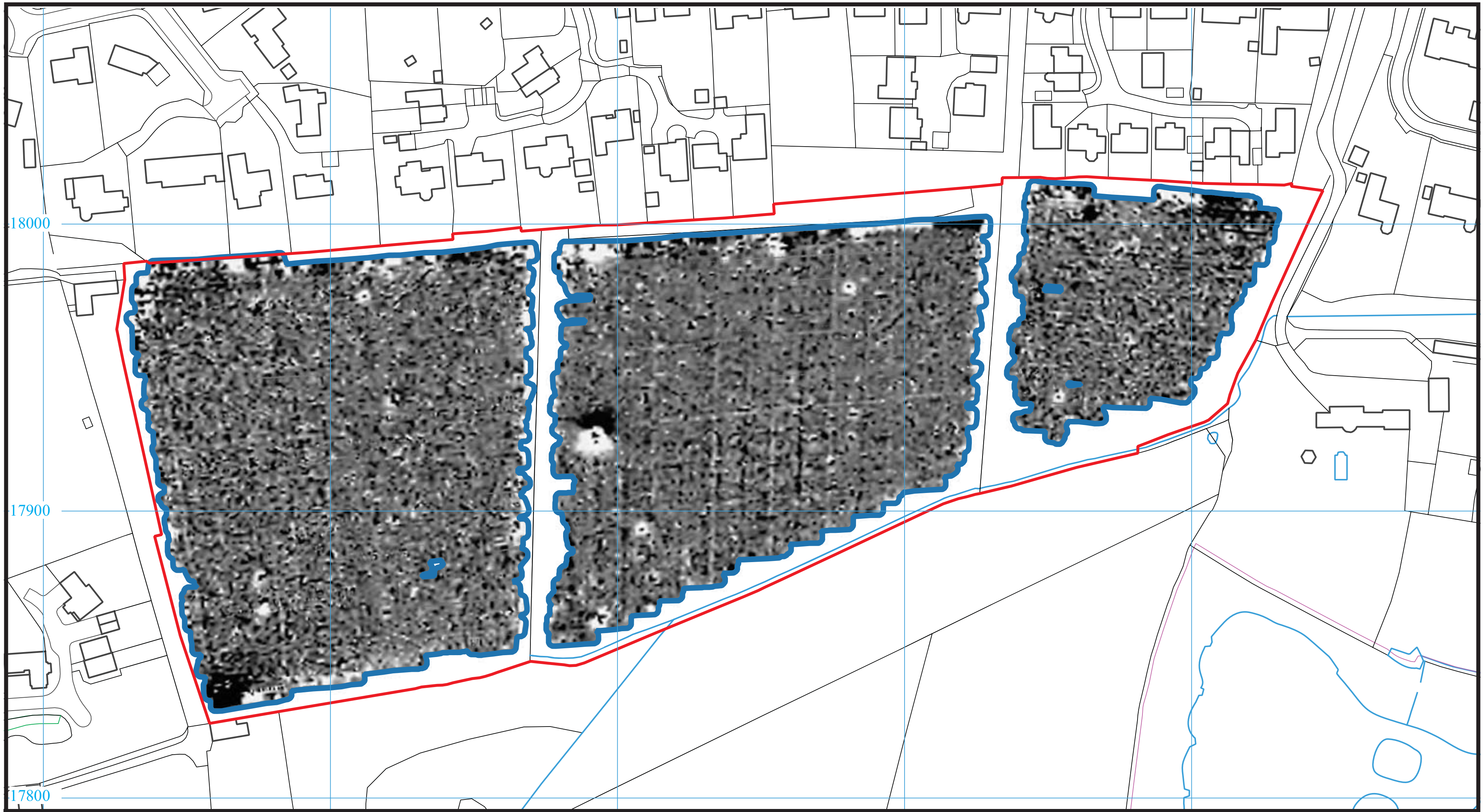
Land east of Keymer Road (Thakeham site), Burgess Hill, West Sussex, 2023

Geophysical Survey (Magnetic)

Figure 2. Plot of raw gradiometer data.



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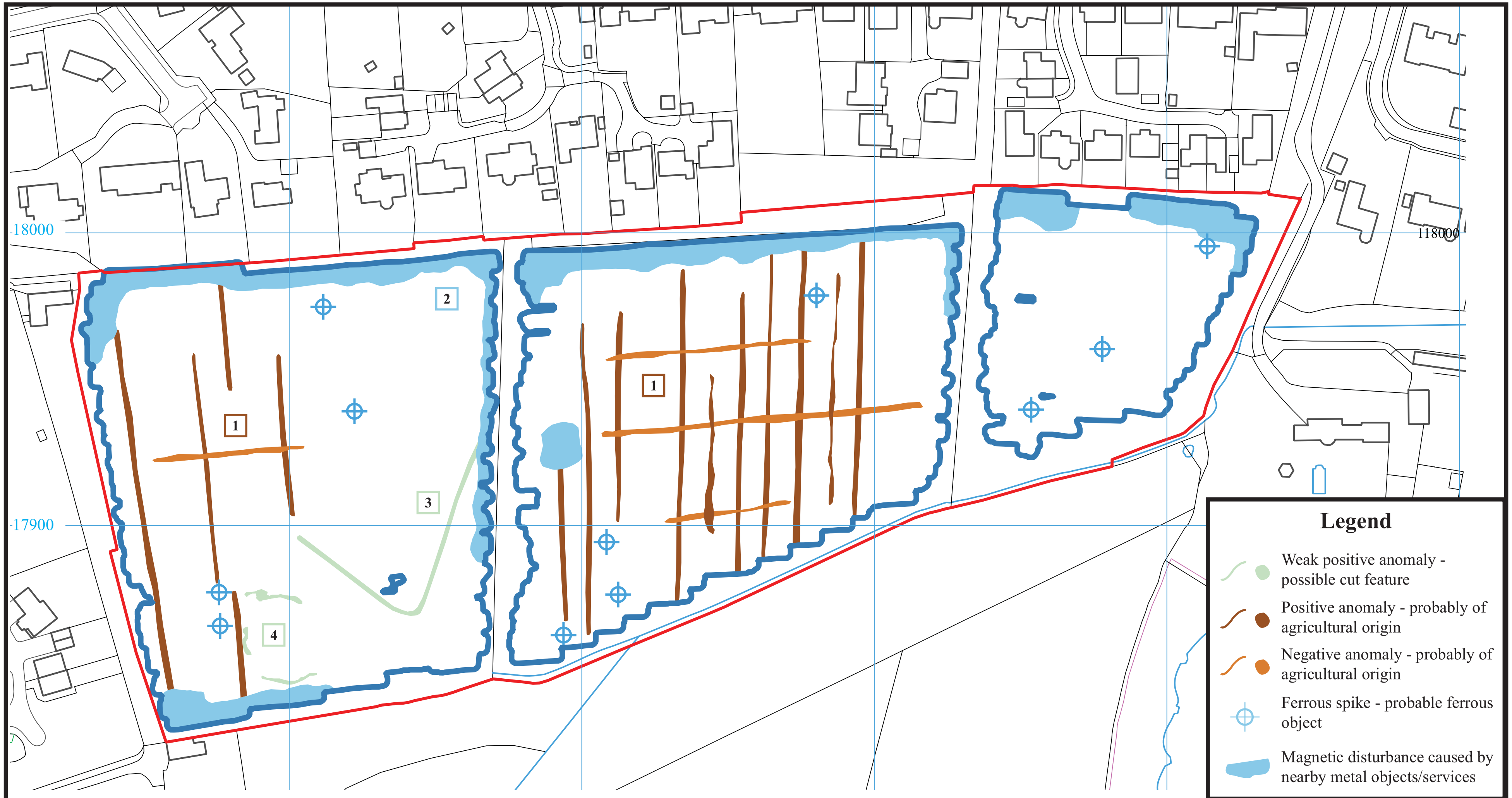
Land east of Keymer Road (Thakeham site), Burgess Hill, West Sussex, 2023

Geophysical Survey (Magnetic)

Figure 3. Plot of processed gradiometer data.



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Land east of Keymer Road (Thakeham site), Burgess Hill, West Sussex, 2023

Geophysical Survey (Magnetic)

Figure 4. Interpretation plot.


Plate 1. Western Field looking east.


Plate 2. Central field looking south-east.


Plate 3. Eastern field looking east.

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Land east of Keymer Road (Thakeham site), Burgess Hill, West Sussex, 2023
Geophysical Survey (magnetic)
Plates 1 to 3.

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TIME CHART

	Calendar Years
Modern	AD 1901
Victorian	AD 1837
Post Medieval	AD 1500
Medieval	AD 1066
Saxon	AD 410
Roman	AD 43
	AD 0 BC
Iron Age	750 BC
Bronze Age: Late	1300 BC
Bronze Age: Middle	1700 BC
Bronze Age: Early	2100 BC
Neolithic: Late	3300 BC
Neolithic: Early	4300 BC
Mesolithic: Late	6000 BC
Mesolithic: Early	10000 BC
Palaeolithic: Upper	30000 BC
Palaeolithic: Middle	70000 BC
Palaeolithic: Lower	2,000,000 BC

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