

TSBR17



LAND EAST OF LORRAINE WAY, BRAMFORD, SUFFOLK

GEOPHYSICAL SURVEY

commissioned by Archaeology Collective
on behalf of CEMEX UK Operations Ltd

February 2018

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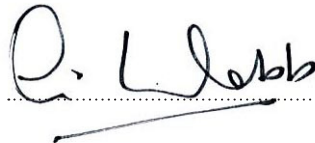
PROJECT INFO:

HA Project Code **TSBR17** / NGR **TM 1205 4746** / Parish **Bramford** / Local Authority **Suffolk County Council** / HER parish code **BRF 139** / OASIS Ref. **headland5-302202**

PROJECT TEAM:

Project Manager **Alistair Webb** / Author **Alistair Webb** / Fieldwork **Kevin Heaton, Olivier Vansassenbrouck** / Graphics **Caroline Norrman**

Approved by **Alistair Webb**



Headland Archaeology North
Unit 16 | Hillside | Beeston Rd | Leeds LS11 8ND
t 0113 387 6430
e north@headlandarchaeology.com
w www.headlandarchaeology.com



PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 13 hectare site, immediately east of Loraine Way, Bramford, to inform planning proposals for a proposed residential development for up to 225 dwellings. An elevated magnetic background due to the spreading of organic waste precludes identification of any anomalies of archaeological potential across much of the site and clearly identifiable cropmark features cannot be distinguished against this background. There has been no spreading of organic waste on the river floodplain and here a cluster of high magnitude anomalies may be anthropogenic in origin. On the basis of the magnetic survey the archaeological potential of the site is assessed as unknown, and the cropmark data is likely a better current indicator of the extent of archaeological remains on this site.

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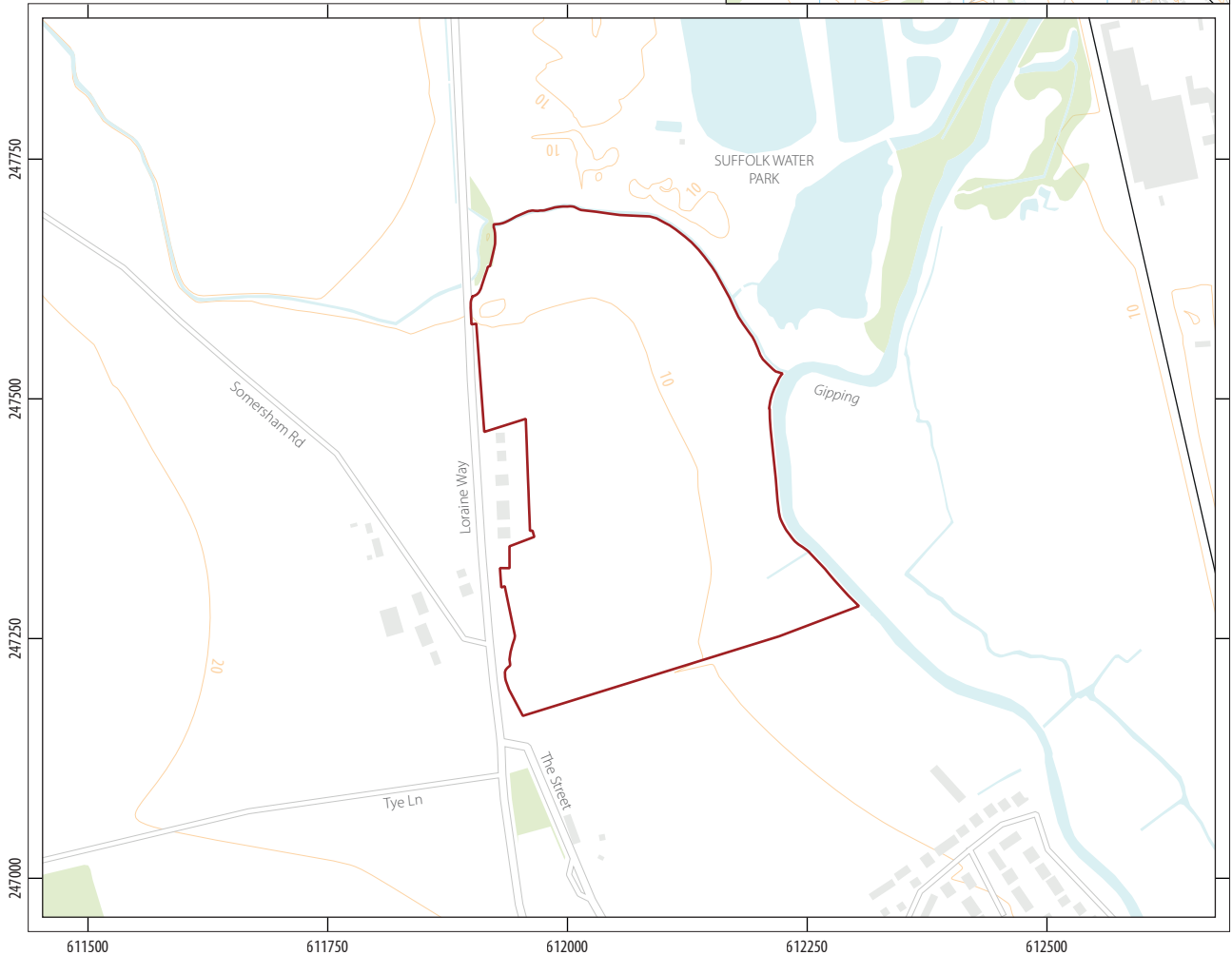
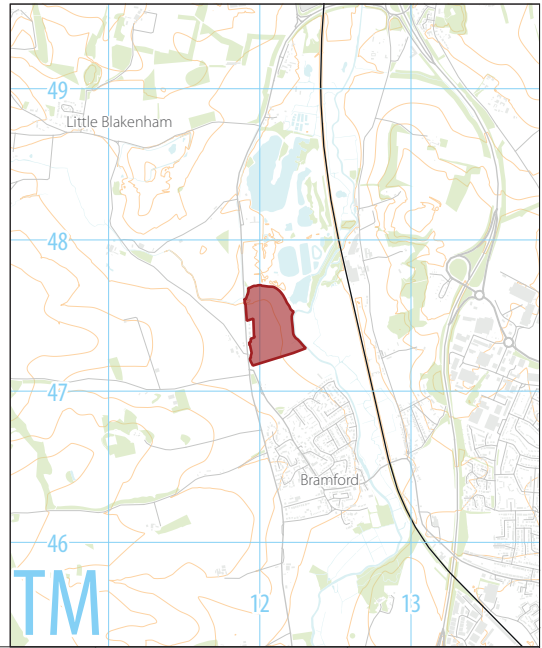
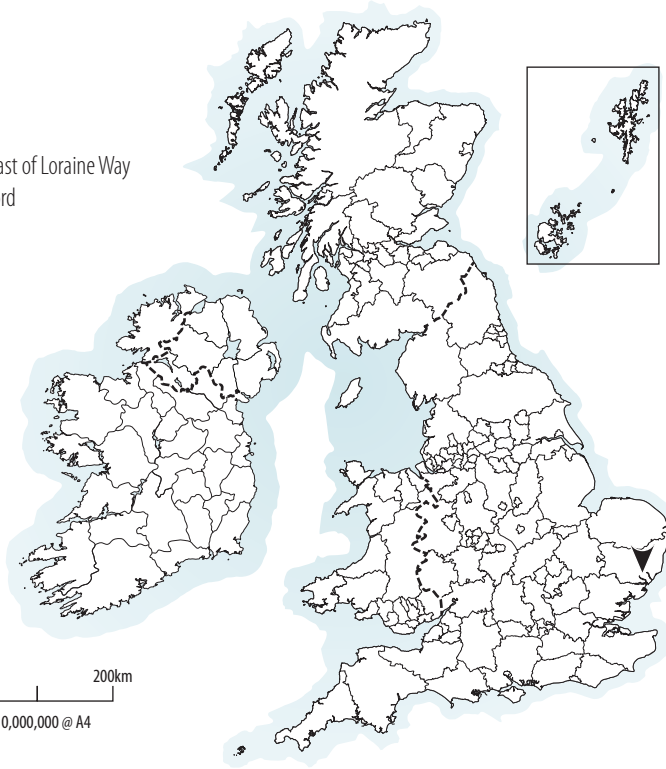
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Land east of Loraine Way
Bramford
Suffolk

0 200km
1:10,000,000 @ A4



0 150m
1:7,500 @ A4

 proposed development area

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Headland Archaeology North
Unit 16 | Hillside | Beeston Rd | Leeds LS11 8ND
t 0113 387 6430
e north@headlandarchaeology.com
w www.headlandarchaeology.com

ILLUS 1 Site location

LAND EAST OF LORAINIE WAY, BRAMFORD, SUFFOLK

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Archaeology Collective, on behalf of their client CEMEX UK Operations Ltd, to undertake a geophysical (magnetometer) survey on the north-western outskirts of Bramford, Suffolk, where a residential housing scheme (up to 225 dwellings), infrastructure and landscaping is proposed.

The work was undertaken in accordance with a Method Statement (Webb 2017) submitted to, and approved by Archaeology Collective, and with guidance contained in the National Planning Policy Framework (DCLG 2012). All work was undertaken in line with current best practice (Chartered Institute for Archaeologists 2014, English Heritage 2008).

The survey was carried out between October 23rd and October 24th 2017.

1.1 SITE LOCATION, LAND-USE AND TOPOGRAPHY

The proposed development area (PDA) occupies an irregular parcel of land covering approximately 13 hectares, centred on NGR 612052, 247463, to the east of Loraine Way (B1113), Bramford. The PDA is approximately 6km north-west of Ipswich (Illus 1) and comprises one large field, F1, which occupies the first river terrace and a linear strip of floodplain, F2, bordering the River Gipping and its tributary.

F1 had been recently been sown with winter wheat (see Illus 2). The flood plain land had been cultivated in the recent past but at the time of the survey was predominantly rough grazing, being completely overgrown in places which restricted the area which could be surveyed (Illus 3).

The PDA is bounded by Loraine Way and houses that front onto it to the west. The River Gipping forms the eastern boundary and a

tributary stream the northern edge. The southern boundary was defined by a field boundary.

Topographically the site slopes down to the east from the terrace edge to the flood plain ranging from a maximum height of approximately 12m above Ordnance Datum in the centre of the PDA to approximately 7m AOD on the floodplain.

1.2 GEOLOGY AND SOILS

The underlying solid geology comprises sedimentary bedrock of the Newhaven Chalk Formation. This is overlain by Lowestoft Formation sands and gravels to the west of the PDA, River Terrace Deposits of sand and gravel to the centre of the PDA and alluvial silts and clays on the flood plain nearest the river (NERC 2017).

The soils are classified in the Soilscape 6 association, characterised as freely draining slightly acid loamy soils to the west of the PDA and loamy and clayey floodplain soils with naturally high groundwater (Soilscape 20) adjacent to the river (Cranfield University 2017).

2 ARCHAEOLOGICAL BACKGROUND

The following is abstracted from an Archaeological Desk-based Assessment (Archaeology Collective 2017) from which further detailed information can be obtained.

There are no designated archaeological assets within the study area whose setting would be affected by the proposed development.

The cropmarks of several ring ditches, enclosures, linears and other features have been recorded within the application site. In the absence of archaeological investigation, they have been identified from their



ILLUS 2 Field 1, looking north

form and morphology. The rings are most likely to represent the ploughed-down remains of prehistoric (Bronze Age) burial mounds (barrows) and are assessed as being of medium significance. The linears and partial enclosures are likely to represent trackways and field systems. As they do not correspond with boundaries mapped since the middle of the 19th century, whose field names suggest enclosure from the extensive common land to the north, they may have an earlier (pre-common) origin, possibly a continuation of field systems revealed by geophysical survey and archaeological evaluation on land to the south of the application site, where both later prehistoric (Bronze Age-Iron Age) and medieval field systems have been identified. The archaeological significance of these prehistoric remains is assessed as being low as is the archaeological significance of the medieval field systems. There is a high probability for encountering the footprint of a post-medieval cottage mapped within the north-eastern part of the application site but this is assessed as being of low significance. A low potential for archaeological remains of low significance has been identified for all other periods.

3 AIMS, METHODOLOGY AND PRESENTATION

The general aim of the geophysical survey was to provide sufficient information to establish the presence/absence, character and extent

of any archaeological remains within the PDA. This will therefore enable an assessment to be made of the impact of the proposed development on any sub-surface archaeological remains, if present.

The specific archaeological objectives of the geophysical survey were:

- › to provide information about the nature and possible interpretation of any magnetic anomalies identified;
- › to therefore model the presence/absence and extent of any buried archaeological features; and
- › to prepare a report summarising the results of the survey.

3.1 MAGNETOMETER SURVEY

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. A feature such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney & Gater 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.



ILLUS 3 Field 2, looking north

The survey was undertaken using four Bartington Grad601 sensors mounted at 1m intervals (1m traverse interval) onto a rigid carrying frame. The system was programmed to take readings at a frequency of 10Hz (allowing for a 10–15cm sample interval) on roaming traverses (swaths) 4m apart. These readings were stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system was linked to a Trimble R8s Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point.

MLGrad601 and MultiGrad601 (Geomar Software Inc.) software was used to collect and export the data. Terrasurveyor V3.0.32.4 (DWConsulting) software was used to process and present the data.

3.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:7,500. Illus 2 and Illus 3 are site condition photographs. Illus 4 is a 1:4,000 scale survey location plan showing the GPS swath data. The National Mapping Programme (NMP) cropmark data is reproduced in Illus 5 overlying the six inch Ordnance Survey (OS) map (1888–1913), also at 1:4,000. Detailed data plots of the fully processed data (greyscale), the minimally processed data (XY traceplot) and an accompanying interpretative plot are presented at a scale of 1:2,000 in Illus 6, Illus 7 and Illus 8.

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 details the survey location information and Appendix 3 describes the composition and location of the site archive. Data processing details are presented in Appendix 4. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 5.

The survey methodology, report and any recommendations comply with the Method Statement (Webb 2017) and guidelines outlined by Historic England (English Heritage 2008) and by the Chartered Institute for Archaeologists (CifA 2014). All illustrations from Ordnance Survey mapping are reproduced with the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The illustrations in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All illustrations are presented to most suitably display and interpret the data from this site based on the experience and knowledge of management and reporting staff.

4 RESULTS AND DISCUSSION

4.1 THE MAIN SITE

The ground conditions across the main field (F1), which comprises approximately 75% of the PDA, were good. This field had been ploughed and re-seeded following a recent harvest. However, from the appearance of the data it appears that organic waste has been spread across the whole of this area and mixed into the upper soil horizons as a soil conditioner (subsequently confirmed by a local resident). This has resulted in a highly elevated and variable magnetic background with the data having a speckled appearance throughout (Illus 6). This response is not fully understood but is thought to be caused by the presence of magnetic compounds in the soil created during decomposition processes, and also by frequent ferrous contaminants within the waste material. Against this background it is not possible to clearly distinguish any anomalies which may be of archaeological origin. Even though cropmarks of at least two barrows and several linear ditch features can be clearly seen on recent satellite images, only one short linear trend (D1; Illus 8) has been tentatively identified in the south-eastern corner of the field which may correspond with part of a cropmark.

Three other linear trends, all aligned south-south-west/north-north-east, are also tentatively identified. FB1 immediately east of the two electricity pylons, locates part of a track and boundary leading to a cottage (now demolished – see Section 2) mapped on the 1888-1913 six inch OS map (Illus 5).

The other two trends (FB2 and FB3) mark the boundaries of a linear strip of allotments clearly visible on a 1945 vertical aerial photograph which survived, at least partially, until the early 1960s, having been recorded on the 1963 25-inch OS map. Two high magnitude ferrous anomalies are also recorded on the line of the northern allotment boundary and are likely caused by ferrous debris left from the abandonment of the allotments.

4.2 THE FLOODPLAIN

In contrast to the data from F1 the data recorded on the floodplain is relatively homogenous (typical of an alluvial soil), with the exception of the anomalies described below. This part of the site had not been cultivated recently and is best described as overgrown/fallow. The northernmost third was completely overgrown and was not suitable for survey.

In the northernmost survey parcel the only anomaly of note is a speckled linear anomaly (FB4) aligned north-west/south-east, which is caused by former field boundary ditch.

In the central survey parcel a cluster of very high magnitude anomalies is identified in a linear band which aligns with and matches the width of the strip of allotments that are recorded to the west. Neither the air photographs nor the 20th century OS mapping suggest that the allotments extended down the terrace edge and across the floodplain but the co-incidence in location and alignment might suggest that they did. The anomalies are certainly more likely to be anthropogenic than natural in origin but probably modern.

High magnitude anomalies are also recorded on the southern edge of the southern block. As the anomalies are so close to the edge of the survey area it is impossible to give a confident interpretation. A natural (geological) or modern cause are most likely.

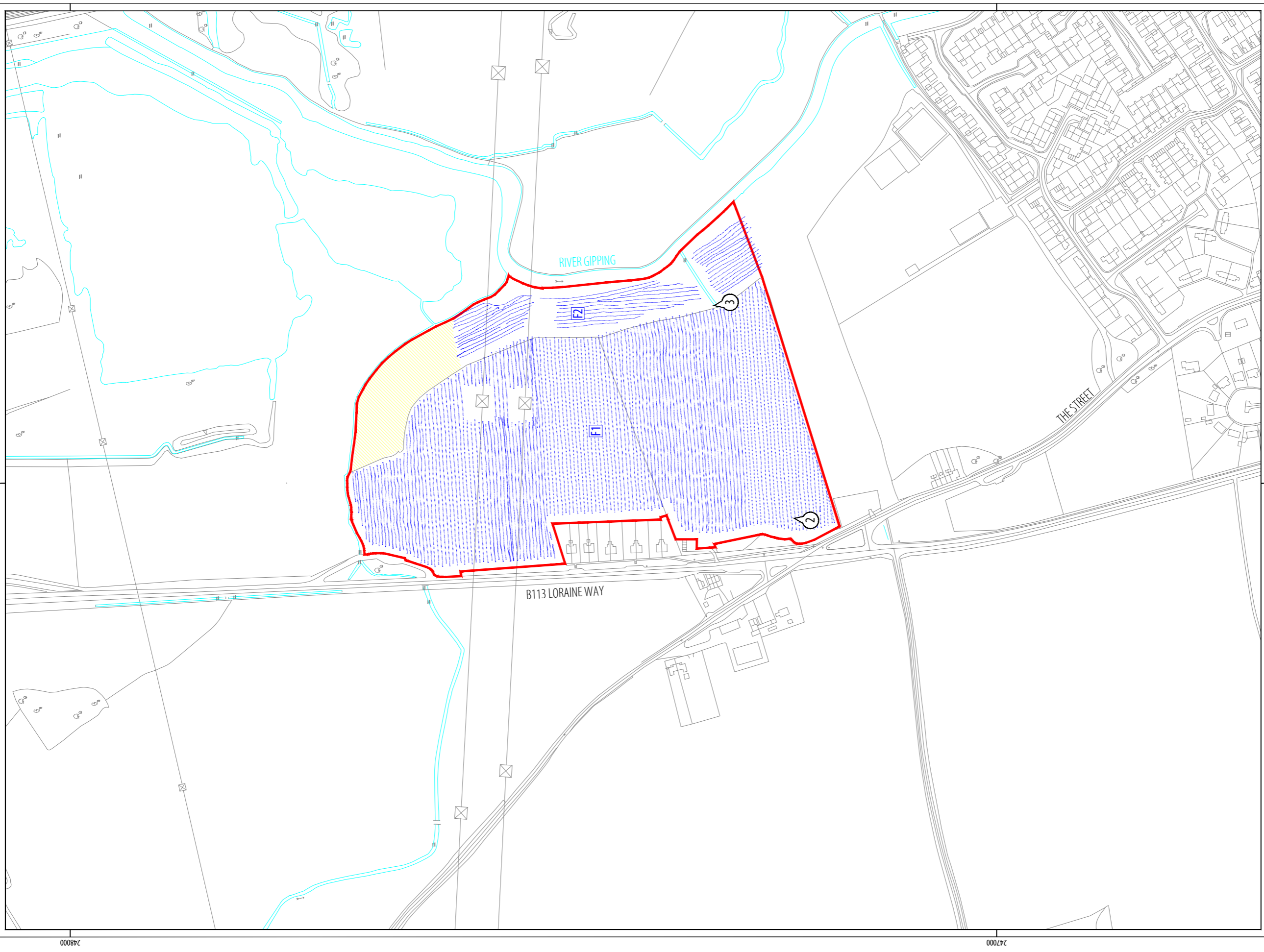
5 CONCLUSION

Due to the presence of organic waste across the majority of the site it has not been possible to evaluate the archaeological potential of the site based on the results of the magnetic survey. In this respect the desk-based assessment (and specifically the cropmarks) are likely to give a much better assessment of the likely archaeological resource on this site.

On the floodplain, where the organic waste has not been spread, anomalies of uncertain origin have been identified. However, on the balance of probability these anomalies are considered likely to be of modern origin. Therefore, on the basis of the geophysical survey, the archaeological potential of the PDA remains unknown.

6 REFERENCES

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- proposed development area
- ▨ GPS swaths
- 3 location and direction of ILLUS 2-3
- area unsuitable for survey

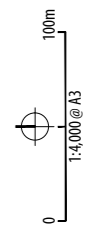
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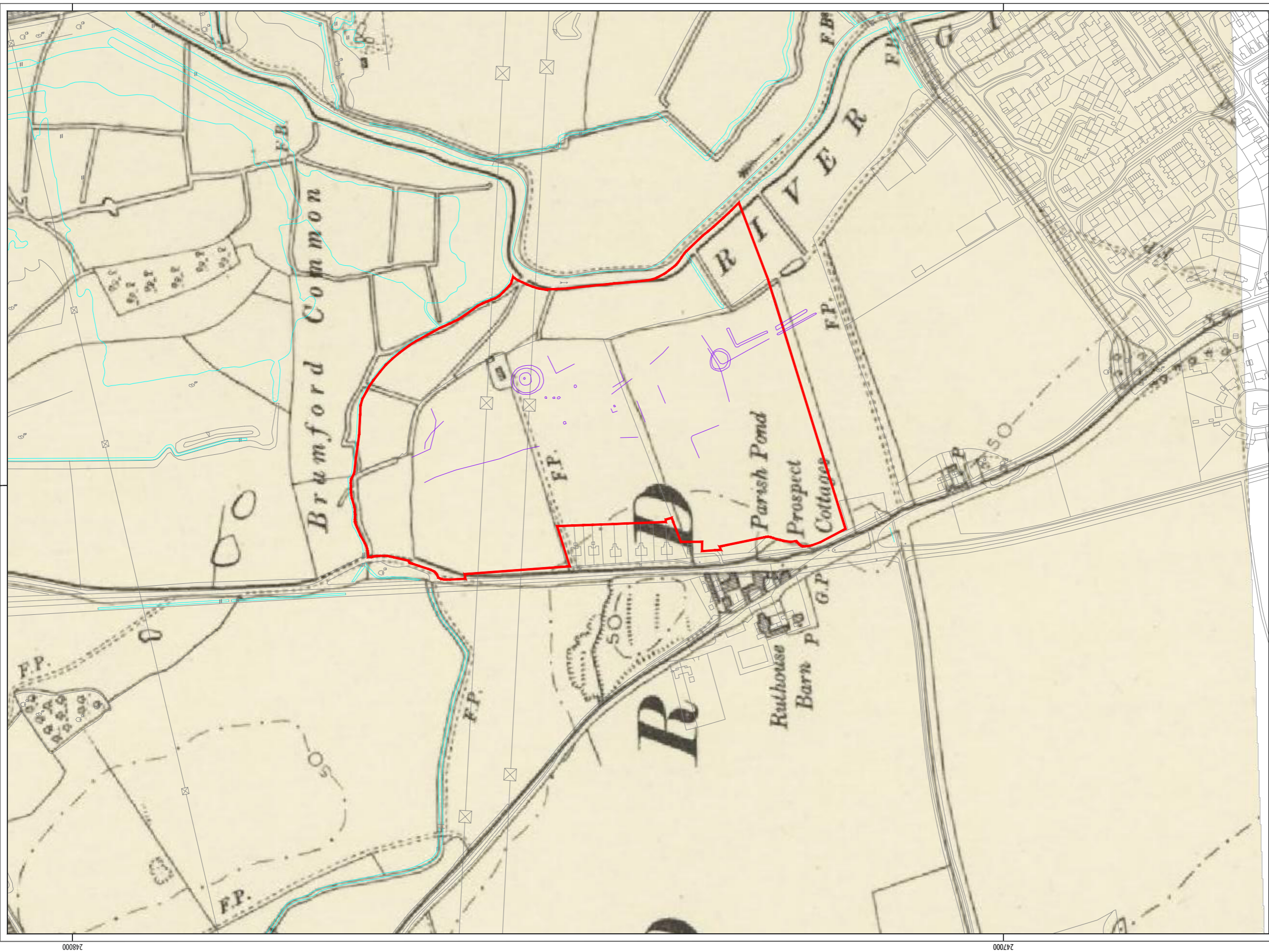
NORTH

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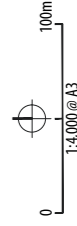
ILLUS 4 Survey location showing GPS swaths (1:4,000)



 proposed development area
 NMP cropmarks

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 TSB17/01
 Land east of Loraine Way
 Bramford
 Suffolk
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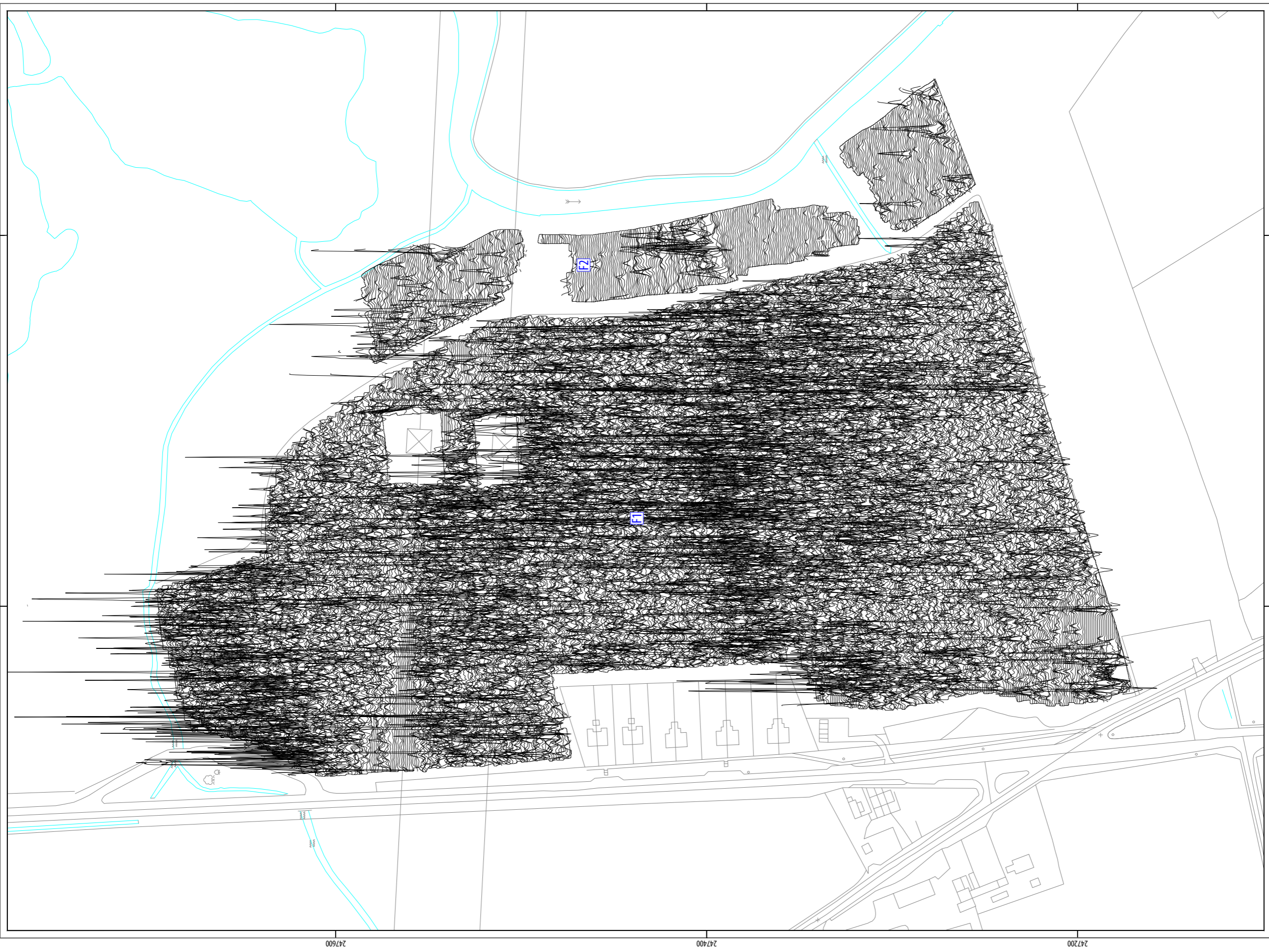
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ILLUS 5 Survey location showing cropmarks overlying 1888-1913 six inch OS map (1:4,000)





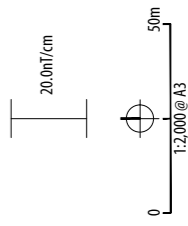
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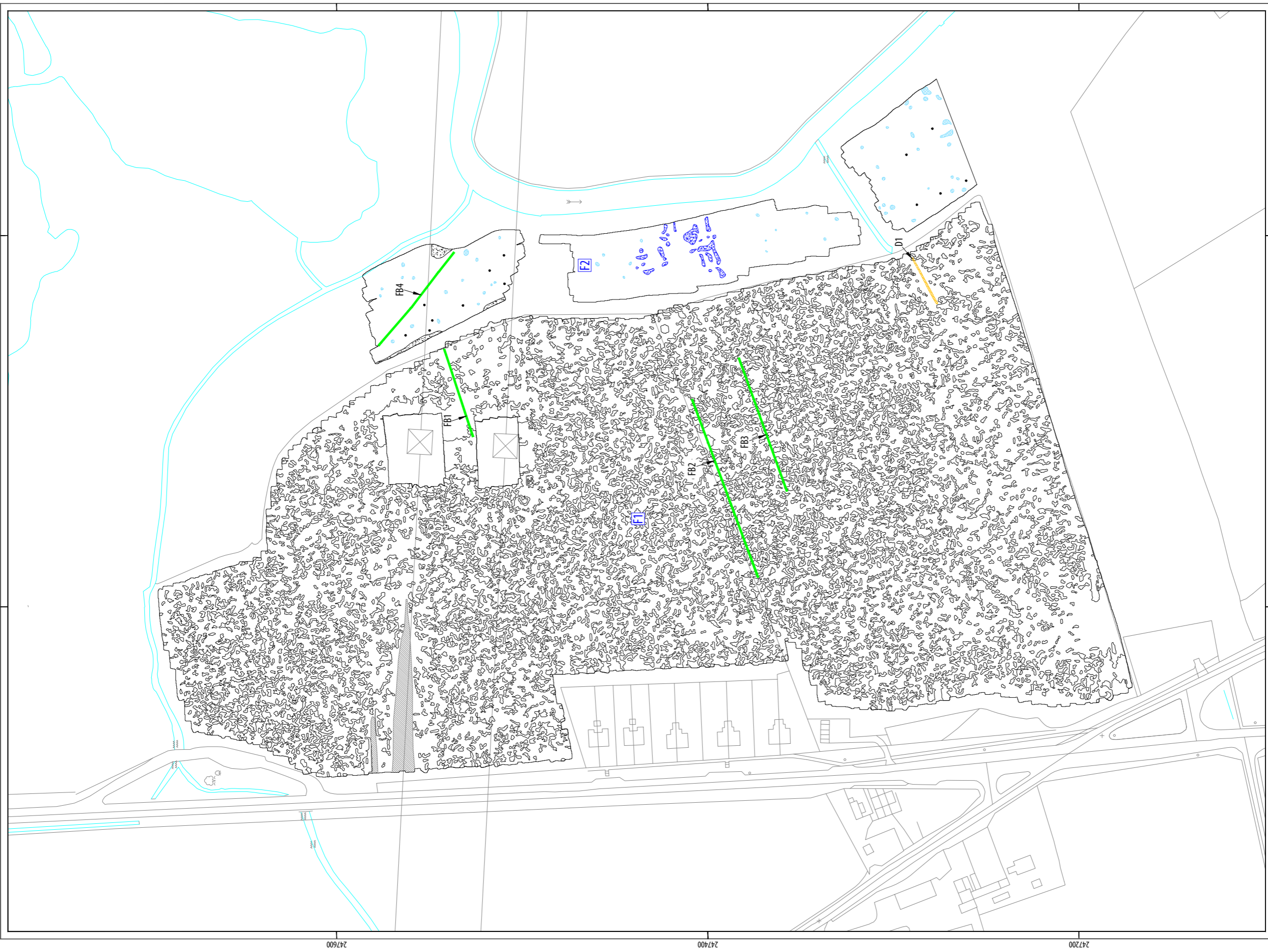
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0113 387 6430
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ILLUS 7 XY trace plot of minimally processed magnetometer data (1:2,000)



TYPE OF ANOMALY	INTERPRETATION
•	ferrous material
○	ferrous material
○	overhead cables
○	modern?
—	former field boundary
—	geology

TYPE OF ANOMALY	INTERPRETATION
⊗	magnetic enhancement
—	archaeology?

ABBREVIATIONS	
D	ditch
FB	former boundary

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ILLUS 8 Interpretation of magnetometer data (1:2,000)

7 APPENDICES

APPENDIX 1 MAGNETOMETER SURVEY

Magnetic susceptibility and soil magnetism

Iron makes up about 6% of the earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haematite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected.

The magnetic susceptibility of a soil can also be enhanced by the application of heat. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

Types of magnetic anomaly

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes) These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an XY trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

APPENDIX 2 SURVEY LOCATION INFORMATION

An initial survey base station was established using a Trimble VRS differential Global Positioning System (dGPS). The magnetometer data was georeferenced using a Trimble RTK differential Global Positioning System (Trimble R8s model).

Temporary sight markers were laid out using a Trimble VRS differential Global Positioning System (Trimble R8s model) to guide the operator and ensure full coverage. The accuracy of this dGPS equipment is better than 0.01m.

The survey data were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if coordinates are measured off hard copies of the mapping rather than using the digital coordinates.

Headland Archaeology cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE

The geophysical archive comprises an archive disk containing the raw data in XYZ format, a raster image of each greyscale plot with associated world file, and a PDF of the report.

The project will be archived in-house in accordance with recent good practice guidelines (http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_3). The data will be stored in an indexed archive and migrated to new formats when necessary.

APPENDIX 4 DATA PROCESSING

The gradiometer data has been presented in this report in processed greyscale and minimally processed XY trace plot format.

Data collected using RTK GPS-based methods cannot be produced without minimal processing of the data. The minimally processed data has been interpolated to project the data onto a regular grid and de-striped to correct for slight variations in instrument calibration drift and any other artificial data.

A high pass filter has been applied to the greyscale plots to remove low frequency anomalies (relating to survey tracks and modern agricultural features) in order to maximise the clarity and interpretability of the archaeological anomalies.

The data has also been clipped to remove extreme values and to improve data contrast.

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: *headland5-302202*

Project details	
Project name	Land east of Loraine Way, Bramford, Suffolk
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 13 hectare site, immediately east of Loraine Way, Bramford, to inform planning proposals for a proposed residential development for up to 225 dwellings. An elevated magnetic background due to the spreading of organic waste precludes identification of any anomalies of archaeological potential across much of the site and clearly identifiable cropmark features cannot be distinguished against this background. There has been no spreading of organic waste on the river floodplain and here a cluster of high magnitude anomalies may be anthropogenic in origin. On the basis of the magnetic survey the archaeological potential of the site is assessed as unknown, and the cropmark data is likely a better current indicator of the extent of archaeological remains on this site.
Project dates	Start: 23-10-2017 End: 24-10-2017
Previous/future work	Not known / Not known
Any associated project reference codes	TSBR-01 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	N/A None
Monument type	N/A None
Significant Finds	N/A None
Significant Finds	N/A None
Methods & techniques	"Geophysical Survey"
Development type	Housing estate
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology	CHALK (INCLUDING RED CHALK)
Drift geology	RIVER TERRACE DEPOSITS
Drift geology	ALLUVIUM
Drift geology	SAND AND GRAVEL OF UNCERTAIN AGE OR ORIGIN
Techniques	Magnetometry
Project location	
Country	England
Site location	SUFFOLK MID SUFFOLK BRAMFORD Land east of Loraine Way, Bramford, Suffolk
Postcode	IP8 4JS
Study area	13 Hectares
Site coordinates	TM 1205 4746 52.084280790304 1.095322327683 52 05 03 N 001 05 43 E Point
Project creators	
Name of Organisation	Headland Archaeology
Project brief originator	Archaeology Collective
Project design originator	Headland Archaeology
Project director/manager	Webb, A.
Project supervisor	Vansassenbrouck, O.

Type of sponsor/funding body	Developer
Project archives	
Physical Archive Exists?	No
Digital Archive recipient	In house
Digital Contents	"Survey"
Digital Media available	"Geophysics"
Paper Archive Exists?	No
Project bibliography 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Land east of Loraine Way, Bramford, Suffolk; Geophysical Survey
Author(s)/Editor(s)	Webb, A.
Date	2017
Issuer or publisher	Headland Archaeology
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Entered on	27 November 2017



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Headland Archaeology South & East
Building 68C | Wrest Park | Silsoe | Bedfordshire MK45 4HS
t 01525 861 578
e southandeast@headlandarchaeology.com

Headland Archaeology Midlands & West
Unit 1 | Clearview Court | Ivyford Rd | Hereford HR2 6JR
t 01432 364 901
e midlandsandwest@headlandarchaeology.com

Headland Archaeology North
Unit 16 | Hillside | Beeston Rd | Leeds LS11 8ND
t 0113 387 6430
e north@headlandarchaeology.com

Headland Archaeology Scotland
13 Jane Street | Edinburgh EH6 5HE
t 0131 467 7705
e scotland@headlandarchaeology.com

www.headlandarchaeology.com