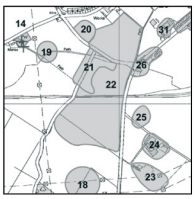
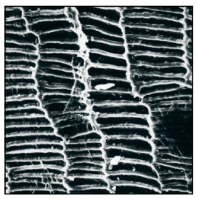
BANS19










LAND NORTH-WEST OF BANWELL NORTH SOMERSET

GEOPHYSICAL SURVEY

commissioned by Bloor Homes

June 2019

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

LAND NORTH-WEST OF BANWELL NORTH SOMERSET

GEOPHYSICAL SURVEY

commissioned by Bloor Homes

June 2019

This report adheres to the quality standard of ISO 9001:2015

PROJECT INFO:

HA Project Code **BANS19** / NGR **ST 3879 6058** / Parish **Banwell** / Local Authority **North Somerset** / OASIS Ref. **headland5-356864**

PROJECT TEAM:

Project Manager **David Harrison** / Author **David Harrison** / Fieldwork **Bethany Shenton, Krasimir Dyulgerski, Olivier Vansassenbrouck, Phoebe Utting, Richard McGregor Edwards, Ross Bishop** / Graphics **Beata Wieczorek-Oleksy, Krasimir Dyulgerski**

Approved by **David Harrison** D Harrison .....

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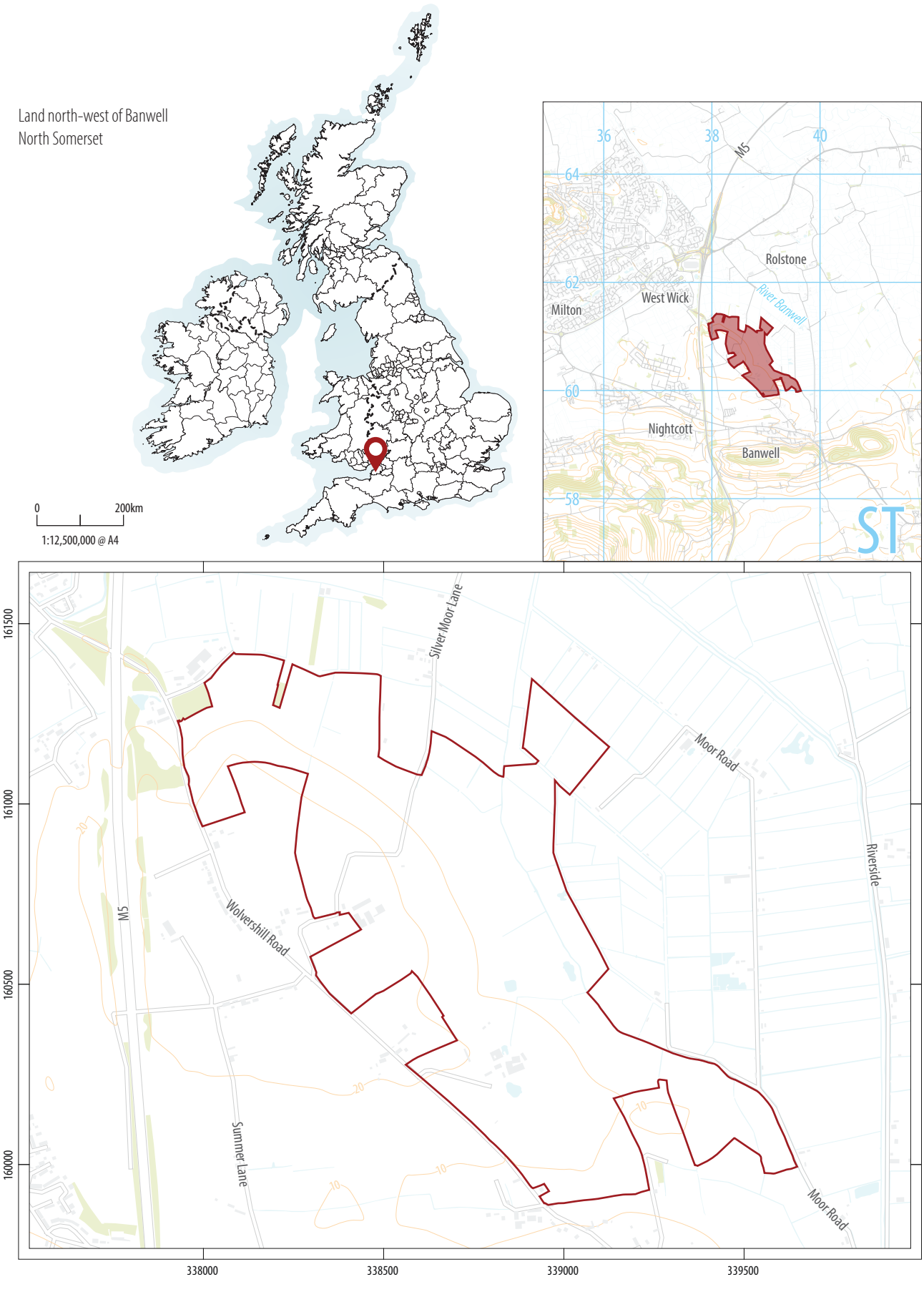
HEADLAND ARCHAEOLOGY

PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 100 hectare site north-west of Banwell, North Somerset, where a new residential development is proposed. The survey has identified four distinctive areas of archaeological activity on the margins of the Somerset Levels comprising dense clusters of linear and rectilinear anomalies. The anomalies are similar in morphology and topographical setting to fen-side Iron Age/Romano-British settlement and industrial activity which has recently been identified on an adjacent site, less than a kilometre to the north-west. It is considered likely that these anomalies are due to similar activity and they are therefore assessed as of high archaeological potential. A fifth cluster of anomalies within the former wetland itself is identified as of possible archaeological potential although here, archaeological interpretation is tentative. No anomalies of any archaeological potential have been identified over the more elevated western half of the site and therefore, on the basis of the geophysical survey, the archaeological potential across the majority of the proposed development area is assessed as low.

CONTENTS

LIST OF ILLUSTRATIONS



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ILLUS 1 Site location

LAND NORTH-WEST OF BANWELL

NORTH SOMERSET

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by The Environmental Dimension Partnership (The Consultant) on behalf of Bloor Homes (the Client), to undertake a geophysical (magnetometer) survey on land north of Banwell, North Somerset, where a new residential development is proposed. The results of the survey will inform future archaeological strategy at the site.

The work was undertaken in accordance with a Written Scheme of Investigation (Harrison 2019), with guidance within the National Planning Policy Framework (MHCLG 2018) and in line with current best practice (Chartered Institute for Archaeologists 2016, Europae Archaeologia Consilium 2016).

The survey was carried out between the 18th and 21st March 2019.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The Proposed Development Area (PDA) is located 5km east of Weston-Super-Mare and 1km north-west of the village of Banwell in North Somerset, centred on ST 3878 60062 (see Illus 1). It comprises 39 fields (F1–F39) of permanent pasture (Illus 2–4) within an irregularly-shaped block of land which is bound to the west by Wolvershill Road, to the north by Eton Lane, the south by residential properties and gardens on the northern periphery of Banwell and to the south-east by Moor Road. The eastern PDA boundary is defined by field boundaries and drainage ditches with the low-lying North Somerset Levels beyond (Illus 5). Two farms (Court Farm and Pool Farm) are included within the west of the PDA. The farms, outbuildings, yards etc were unsuitable for survey.

The PDA occupies the eastern half of a low ridge which rises to 30m Above Ordnance Datum (AOD) in the north-west of the site. From here, the land falls away gently to the south and more steeply to the east and north, levelling on the reclaimed fen at 5m AOD.

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Westbury Formation and Cotham Member (mudstone and limestone) in the west, and Mercia mudstone (mudstone and halite-stone) in the east (Illus 6). A curving band of Blue Anchor Formation (limestone) is recorded through the centre of the PDA. No superficial deposits are recorded over the majority of the PDA with Tidal Flat Deposits (clay, silt, sand and gravel) recorded over low-lying ground in the north and east (NERC 2019).

The soils over the higher ground in the west of the PDA are classified in the Soilscape 8 and Soilscape 9 Associations, being characterised as loams and clays with impeded drainage. The soils over the lower lying eastern half of the PDA are classified in the Soilscape 21 Association, characterised as loams and clays of coastal flats with naturally high groundwater (Cranfield University 2019).

2 ARCHAEOLOGICAL BACKGROUND

At the time of writing no detailed archaeological background is available. However, recent archaeological investigations on an adjacent site (Locking Parkway; Planning Ref 12/P/1266) and in the wider landscape has identified Iron Age/Romano-British settlement/fen-related industrial activity along the edge of the Levels (EDP *pers comm*).

ILLUS 2 F2, looking south-east

3 AIMS, METHODOLOGY AND PRESENTATION

The general aim of the geophysical survey was to provide sufficient information and 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 aims of the survey were to:

- provide information about the nature and possible interpretation of any magnetic anomalies identified;
- determine the likely presence/absence and extent of any buried archaeological features;
- produce a comprehensive site archive and report

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.

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 V3.0.35.1 (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 1:15,000. Illus 2–4 are site condition photographs. Illus 5 is a 1:7,500 survey location plan showing the direction of survey as GPS swaths. Illus 6 presents the bedrock geology and the superficial deposits at the same scale. The processed greyscale magnetometer data accompanied by an overall interpretation is also displayed at a 1:7,500 in Illus 7 and Illus 8, with the archaeological anomalies overlying the geology data in Illus 9. Large-scale, fully processed (greyscale) data, minimally processed data (XY traceplot) and accompanying interpretative plots are presented at a scale of 1:2,500 in Illus 10 to Illus 24 inclusive with more detailed (1:1,250) plots of the three areas of archaeological activity (AAA) presented in Illus 25 to Illus 33 inclusive.

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2

ILLUS 3 F15, looking north

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 Written Scheme of Investigation (Harrison 2019), with guidelines outlined by Europae Archaeologia Consilium (EAC 2016) and by the Chartered Institute for Archaeologists (CIfA 2016). 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

The ground conditions were soft on lower-lying ground but were generally good throughout (Illus 2–4) and contributed to a high standard of data throughout.

A relatively homogenous magnetic background has been detected across the majority of the PDA which is characterised by evenly dispersed low magnitude discrete anomalies. The magnetic background in the fields surrounding Court Farm (F27–F30) is notably elevated as a result of the spreading of magnetically enhanced material. Any low magnitude anomalies of archaeological potential within these fields may not be detected against this elevated background.

On the lower-lying northern and eastern parts of the PDA, the magnetic background is much more variable, being dominated by broad areas of enhanced magnetic readings which are clearly due to the nature of the reclaimed wetland and former episodes of tidal and fluvial inundation. Against these backgrounds, numerous linear and discrete anomalies of geological, agricultural and archaeological nature have been identified. These anomalies are discussed below and cross-referenced to specific examples on the interpretive figures, where appropriate.

4.1 FERROUS ANOMALIES

Ferrous anomalies, characterised as individual 'spikes', are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris is common on most sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious clustering to these ferrous anomalies which might indicate an archaeological origin. Far more probable is that the 'spike' responses are likely caused by the random distribution of ferrous debris in the upper soil horizons.

ILLUS 4 F33, looking south-east

Several buried service pipes have been identified by the survey as high magnitude dipolar linear anomalies on varying alignments (e.g. F20; Illus 16–18).

Broad areas of magnetic disturbance in the east of F15 (Illus 13–15) and the south of F26 (Illus 16-18) locate infilled ponds. The disturbance is caused by the material used to infill the ponds (e.g. brick, tile, rubble etc).

Magnetic disturbance around the field edges is due to ferrous material within, or adjacent to the boundaries and is of no archaeological interest.

4.2 AGRICULTURAL ANOMALIES

Analysis of historic OS mapping indicates that the pattern of enclosure has changed considerably since the publication of the first edition Ordnance Survey map in 1884 with the removal of several field boundaries to facilitate larger fields. These former boundaries manifest in the data as positive linear anomalies (e.g. F13; Illus 13–15 and F38; Illus 19–21) which are caused by the magnetic contrast between the former (now infilled) boundary ditch and the surrounding soils.

Broadly-spaced parallel linear trend anomalies have been identified on varying alignments throughout the PDA. These anomalies are characteristic of field drains.

4.3 GEOLOGICAL ANOMALIES

As discussed, a relatively homogenous magnetic background has been identified across the majority of the higher ground in the western part of the PDA characterised by evenly dispersed low magnitude discrete anomalies. Faint parallel curvilinear trends throughout the west reflect the contours of the hillside as well as the interface between the mudstone and limestone bedrock geology (Illus 6). The trends are due to near-surface geological variation.

On the lower-lying northern and eastern parts of the PDA, the magnetic background is much more variable, being dominated by broad areas of enhanced magnetic readings which are clearly due to the nature of the reclaimed wetland and former episodes of tidal and fluvial inundation. These anomalies are roughly bound to the south and east by a sinuous negative anomaly (TF1; Illus 10–15) which corresponds closely to the interface between the two recorded tidal flat deposits.

4.4 AREAS OF ARCHAEOLOGICAL ACTIVITY

Unless specified all the linear anomalies described are likely to be due to soil filled cut features, such as ditches, forming clear patterns of enclosure and land division. Against a variable magnetic background, it is difficult to confidently discriminate between discrete anomalies which may be due to archaeological features, such as pits, which may be indicative of occupational activity, and those that are probably due to localised geological variation. For this reason, most of the

discrete anomalies within enclosures have been ascribed a possible archaeological origin with those outside, except where the responses are particularly broad or high in magnitude, interpreted as of non-archaeological origin.

Four distinctive areas of archaeological activity (AAA) have been identified, 500m apart, on tidal flat deposits at the edge of the former fen. It is notable that the four AAA's appear only on the older and westernmost Tidal Flats 1 superficial deposits (including gravel), with no clear AAA's identified on the easternmost Tidal Flats deposit (without gravel) (see Illus 9). It is possible that there is insufficient magnetic contrast within the latter deposit for soil-filled features to manifest in the data with clarity. These are discussed below.

AAA1 (Illus 25–27)

AAA1 comprises a band of linear and rectilinear anomalies along the edge of the tidal flat deposits in the centre of F2, centred on ST 3815 6127. It extends from the junction of Wolvershill Road and Eton Road for 240m and measures at least 40m in width. The southerly limits of several small conjoined rectilinear enclosures can be identified with numerous internal discrete anomalies probably locating pits. The northern extents of the complex are fainter and less-defined over the tidal flat deposits and it is possible that the archaeological remains here are more extensive than is currently suggested by the geophysical survey.

AAA2 (Illus 28–30)

This area comprises a cluster of high magnitude anomalies within the north of F6 and the west of F8, centred on ST 3858 6105. Whilst some of the anomalies within this cluster are almost certainly due to recent drainage practices, the high magnitude and linear/rectilinear form of others suggests an archaeological origin. AAA2 is likely to be due to a localised area of settlement and/or industrial activity.

AAA3 (Illus 31–33)

AAA3 comprises a linear band of high magnitude linear and rectilinear anomalies, centred on ST 3883 6071, and extending north/south for 180m across F23 and F25. The anomalies are frequently truncated by east/west field drains and appear to be appended to the eastern side of a curving negative anomaly, perhaps a trackway, although it is unclear whether this is a continuation of the tidal flat limit, TF1, seen further to the north. Clusters of discrete anomalies are identified throughout AAA3 which may be due to pits and/or spreads of archaeological material.

AAA4 (Illus 34–36)

AAA4 comprises a dense cluster of high magnitude anomalies at the fen edge in F36, centred on ST 3913 6028. The anomalies are bound to the south and west by fragmented linear and curvilinear anomalies likely to be caused by infilled enclosure ditches. AAA4 extends westwards, away from the tidal flat deposits, into F31 where it manifests as a series of linear and rectilinear anomalies which are due to infilled ditches and forming a clearer pattern of enclosure and land division. No clear internal anomalies have been identified within F31 to suggest the presence of settlement activity.

4.5 ANOMALIES OF POSSIBLE ARCHAEOLOGICAL POTENTIAL

A fifth cluster of high magnitude anomalies is clearly visible in the north of F10 (Illus 13–15), centred on ST 3893 6129. This cluster may also be due to archaeological activity and an archaeological origin should be considered. However, the anomalies do not share the same geographical setting as AAA1–AAA4 and are located away from the higher ground within the former fen. In the absence of any coherent archaeological pattern, it is possible that the cluster is due to modern ground disturbance and/or drainage practices.

Elsewhere, several linear anomalies have been identified within F33–35 (Illus 16–21) which may be archaeological in origin, perhaps being due to soil-filled ditches. However, the anomalies are mostly isolated and fragmented and no clear archaeological pattern is discernible. It is possible that the anomalies are due to field drains.

5 CONCLUSION

The survey has successfully evaluated the proposed development area providing evidence for at least four distinctive areas of archaeological activity on the margins of the North Somerset Levels. The areas are similar in morphology and topographical setting to fen-side Iron Age/Romano-British settlement and industrial activity which has recently been identified on an adjacent site, less than a kilometre to the north-west. It is considered likely that these anomalies are due to similar activity and they are therefore assessed as of high archaeological potential. A fifth cluster of anomalies within the former wetland itself is identified as of possible archaeological potential although here, archaeological interpretation is tentative. No anomalies of any archaeological potential have been identified over the more elevated western half of the site and therefore, on the basis of the geophysical survey, the archaeological potential across the majority of the proposed development area is assessed as low.

6 REFERENCES

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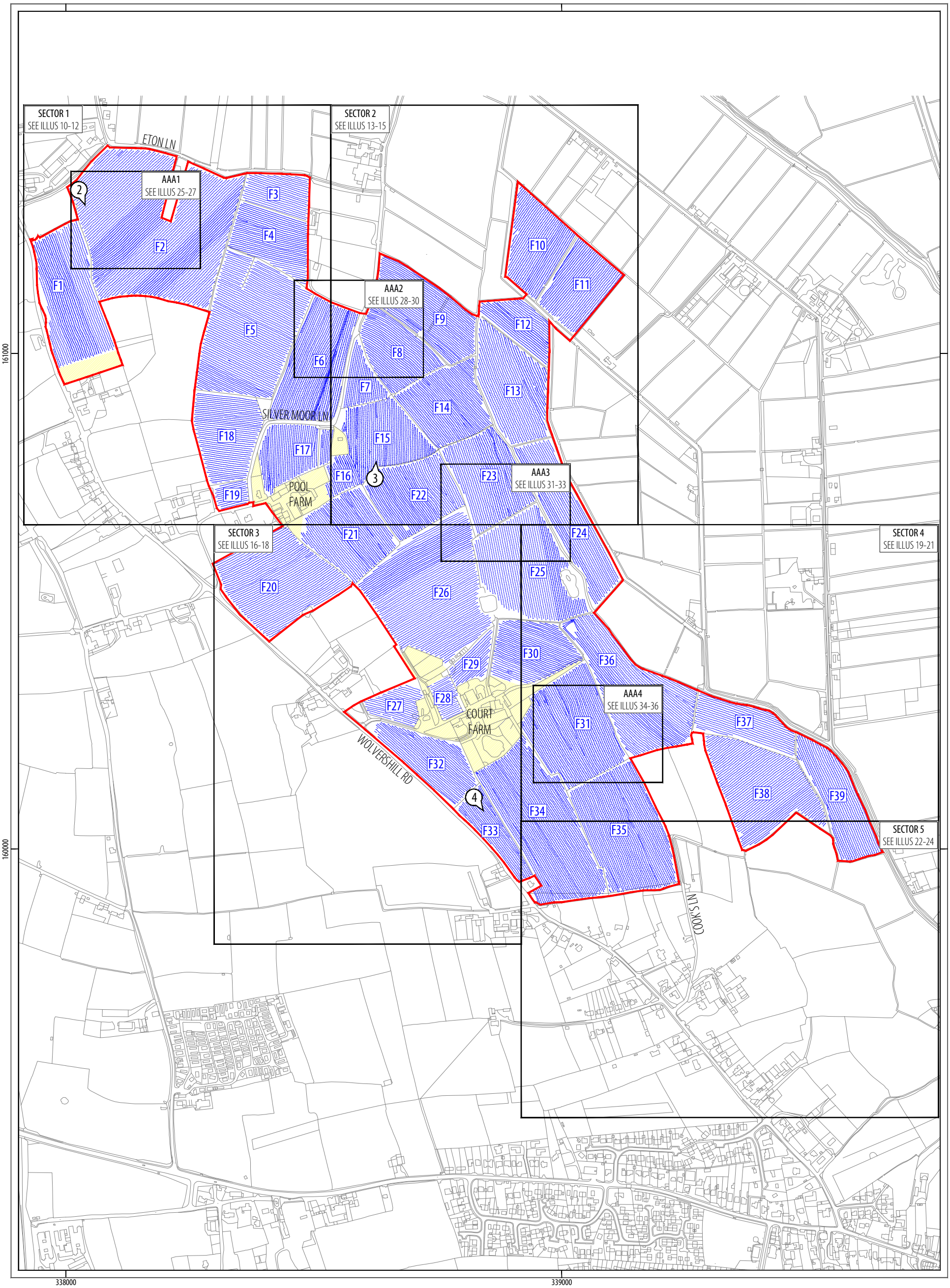
Ordnance Survey (1884) ***Somerset Sheet X [map] Surveyed 1883 to 1884 Published 1884 Southampton*** https://maps.nls.uk/view/101460439 accessed 10 April 2019



proposed development area
GPS swaths
area unsuitable for survey
location and direction of ILLUS 2-4

0 200m
1:7,500 @ A3

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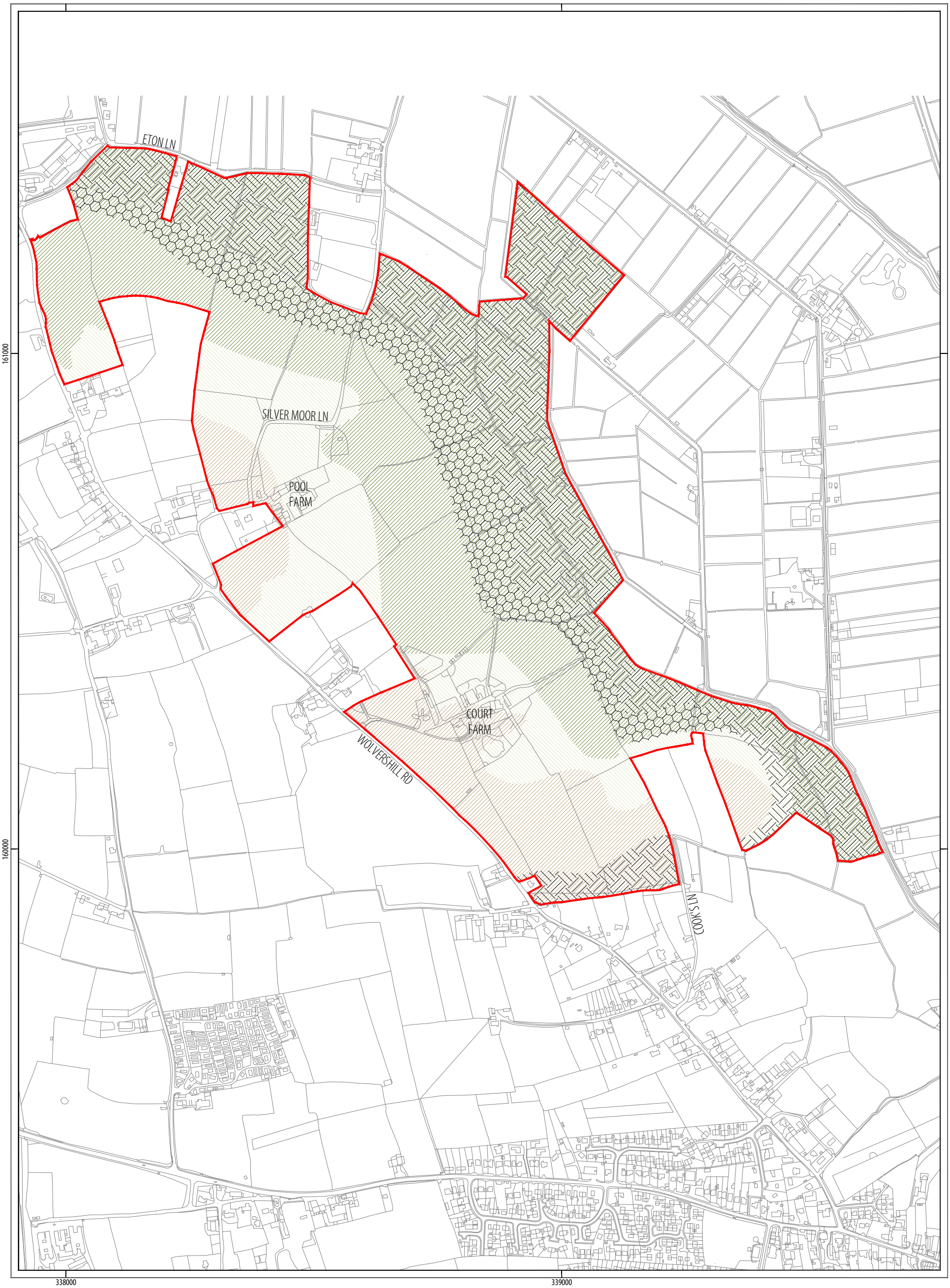
ILLUS 5 Survey location showing GPS swaths



BEDROCK GEOLOGY

- Westbury Formation and Cotham Member (undifferentiated) - Mudstone and Limestone
- Blue Anchor Formation - Limestone
- Mercia Mudstone Group - Mudstone and Halite-stone

SUPERFICIAL DEPOSITS

- Tidal Flat Deposits - Clay, Silt and Sand
- Tidal Flat Deposits 1 - Clay, Silt, Sand and Gravel

0 200m

1:7,500 @ A3

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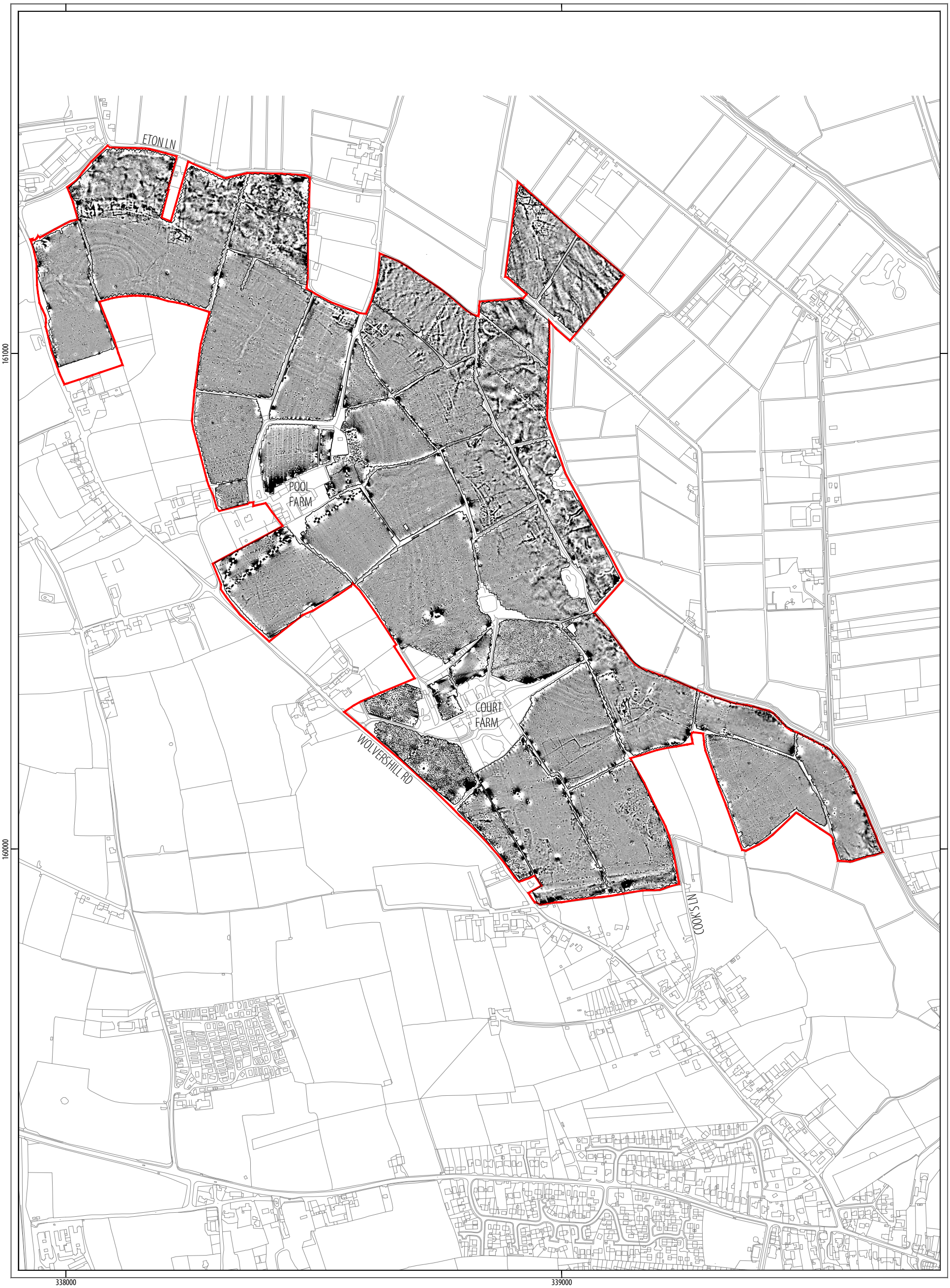
ILLUS 6 Survey location showing geology data



proposed development area

nT
-1.0
2.0

0
200m
1:7,500 @ A3

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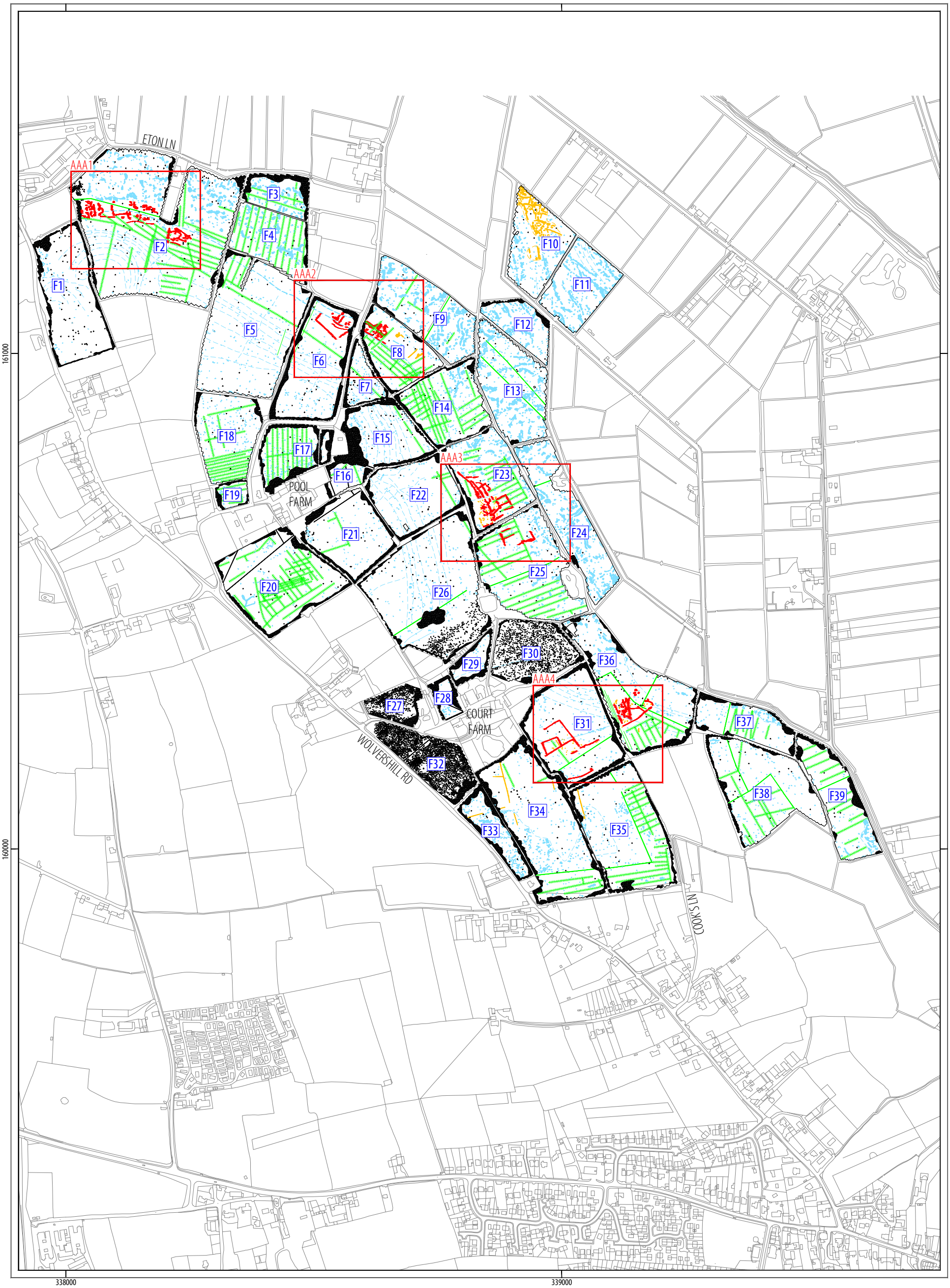
ILLUS 7 Processed greyscale magnetometer data



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
linear trend	agricultural
linear trend	field drain
linear	former field boundary

TYPE OF ANOMALY	INTERPRETATION
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 200m

1:7,500 @ A3

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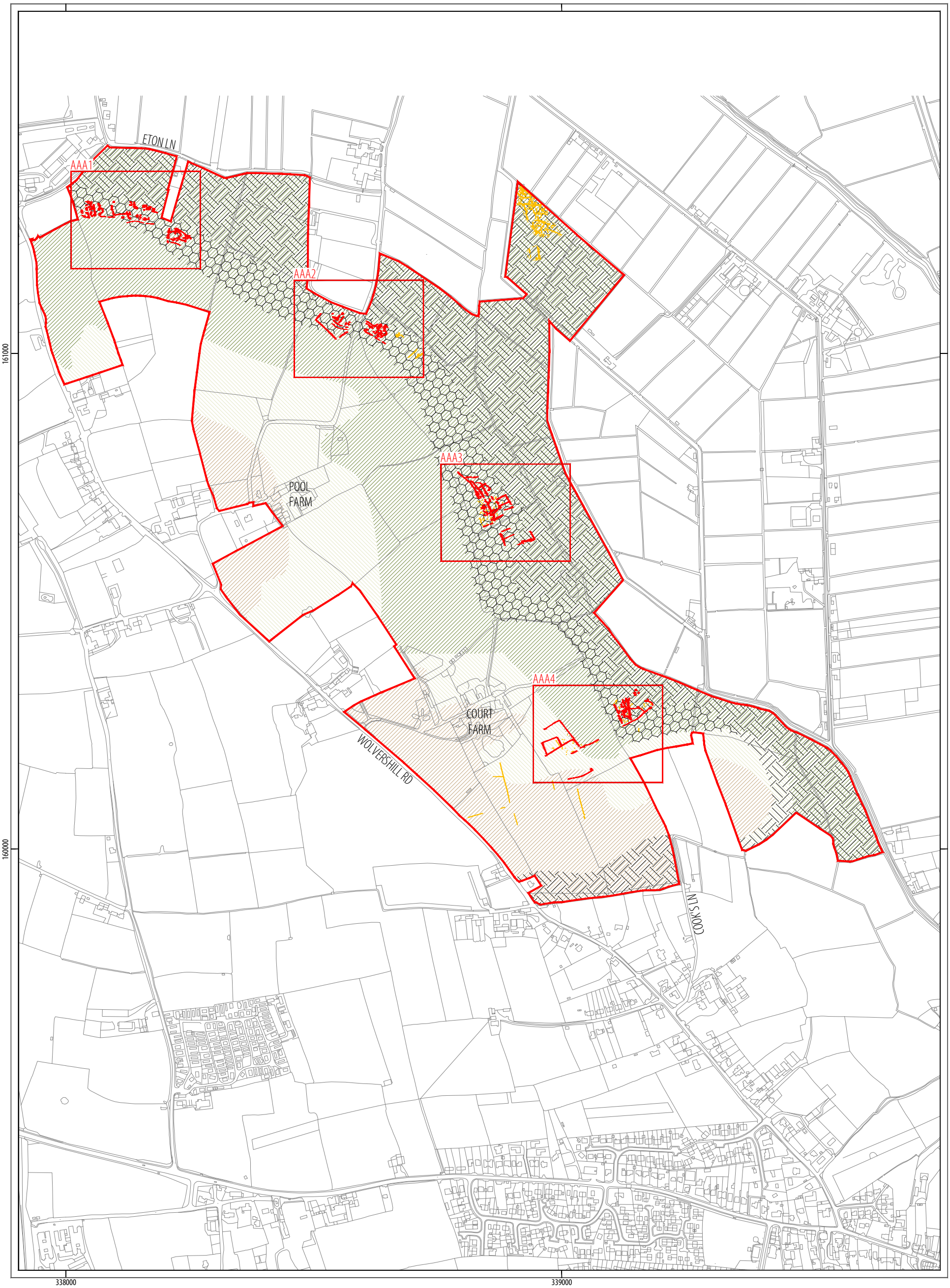
ILLUS 8 Interpretatation of magnetometer data



proposed development area
archaeology?
archaeology

BEDROCK GEOLOGY
Westbury Formation and Cotham Member (undifferentiated) - Mudstone and Limestone
Blue Anchor Formation - Limestone
Mercia Mudstone Group - Mudstone and Halite-stone
SUPERFICIAL DEPOSITS
Tidal Flat Deposits - Clay, Silt and Sand
Tidal Flat Deposits 1 - Clay, Silt, Sand and Gravel

nT
-1.0 2.0

0 200m
1:7,500 @ A3

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ILLUS 9 Archaeological anomalies showing geology data

nT
-1.0 2.0

0 50m
1:2,500 @ A3

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ILLUS 10 Processed greyscale magnetometer data; Sector 1

50.0nT/cm

0 50m

1:2,500 @ A3

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ILLUS 11 XY trace plot of minimally processed magnetometer data; Sector 1

AAA1
SEE ILLUS 25-27

AAA2
SEE ILLUS 28-30

F1
F2
F3
F4
F5
F6
F17
F18
F19
F21

161500
161250
161000
160750
338000
338250
338500

TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
linear trend	agricultural
linear trend	field drain
linear	former field boundary

TYPE OF ANOMALY	INTERPRETATION
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 50m
1:2,500 @ A3

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ILLUS 12 Interpretation of magnetometer data; Sector 1

161500
161250
161000
160750
338750
339000
F6
F7
F8
F9
F10
F11
F12
F13
F14
F15
F16
F21
F22
F23
F24
F25
F26
nT
-1.0
2.0
0
50m
1:2,500 @ A3
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ILLUS 13 Processed greyscale magnetometer data; Sector 2

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ILLUS 13 XY trace plot of minimally processed magnetometer data; Sector 2

161500
161250
161000
160750
338750
339000
AAA2
SEE ILLUS 28-30
AAA3
SEE ILLUS 31-33
F6
F7
F8
F9
F10
F11
F12
F13
F14
F15
F16
F21
F22
F23
F24
F25
F26

TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
linear trend	field drain
linear	former field boundary
linear trend	geological variation

TYPE OF ANOMALY	INTERPRETATION
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 50m
1:2,500 @ A3

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ILLUS 13 XY trace plot of minimally processed magnetometer data; Sector 2

nT
-1.0
2.0

0
50m
1:2,500 @ A3

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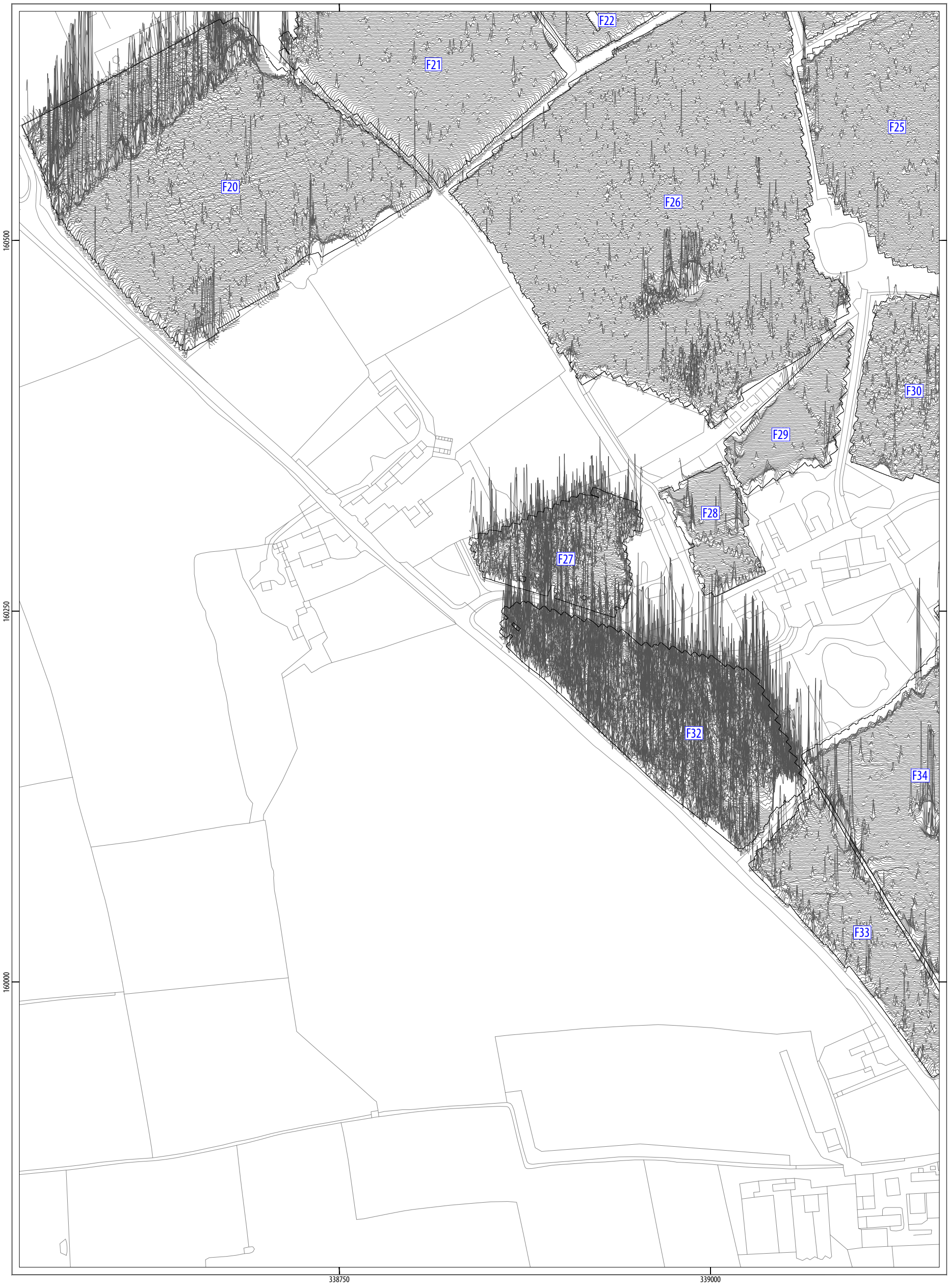
ILLUS 16 Processed greyscale magnetometer data; Sector 3



50.0nT/cm

0 50m

1:2,500 @ A3

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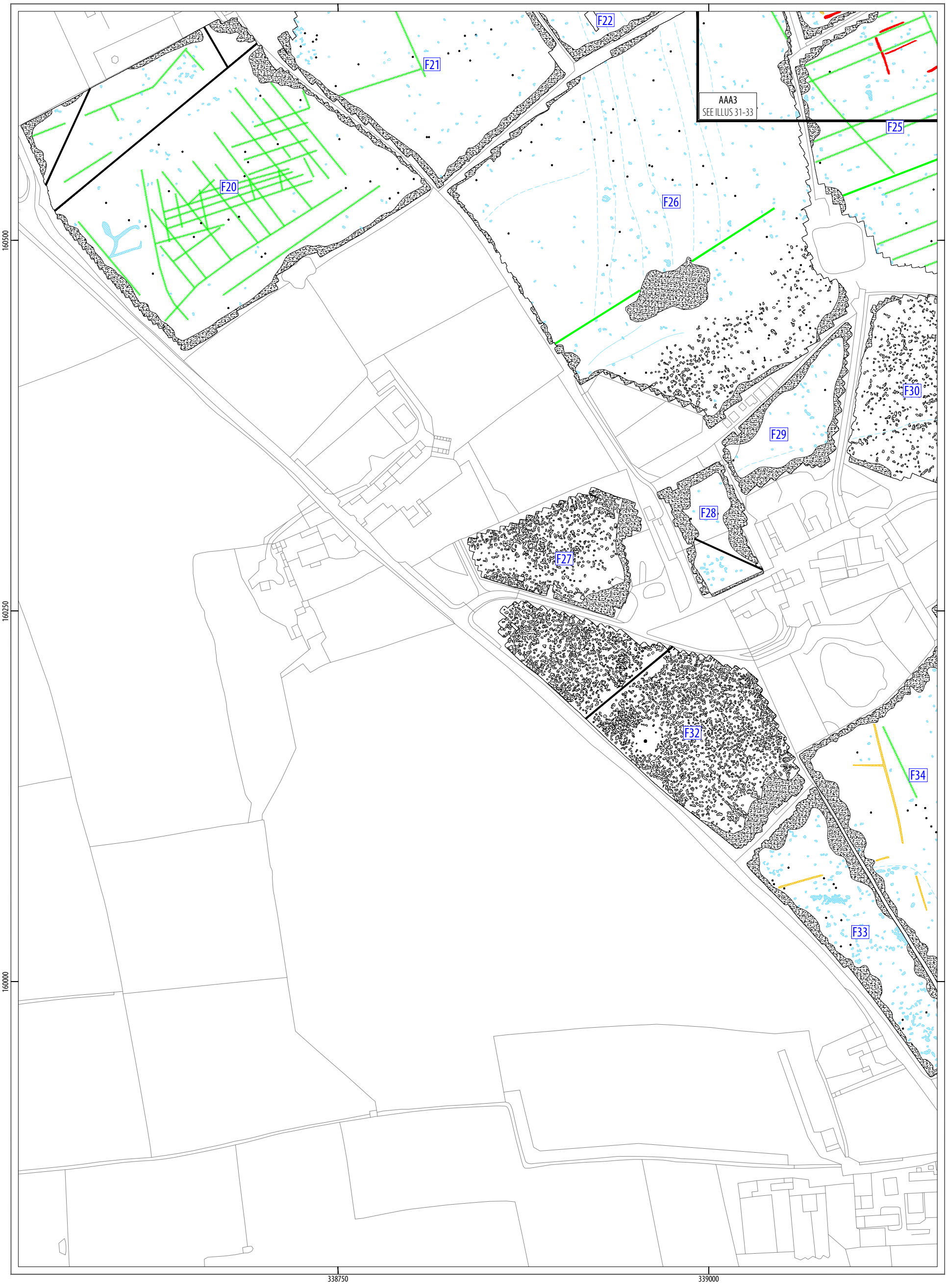
ILLUS 17 XY trace plot of minimally processed magnetometer data; Sector 3



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
linear trend	field drain
linear	former field boundary
linear trend	geological variation

TYPE OF ANOMALY	INTERPRETATION
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 50m
1:2,500 @ A3

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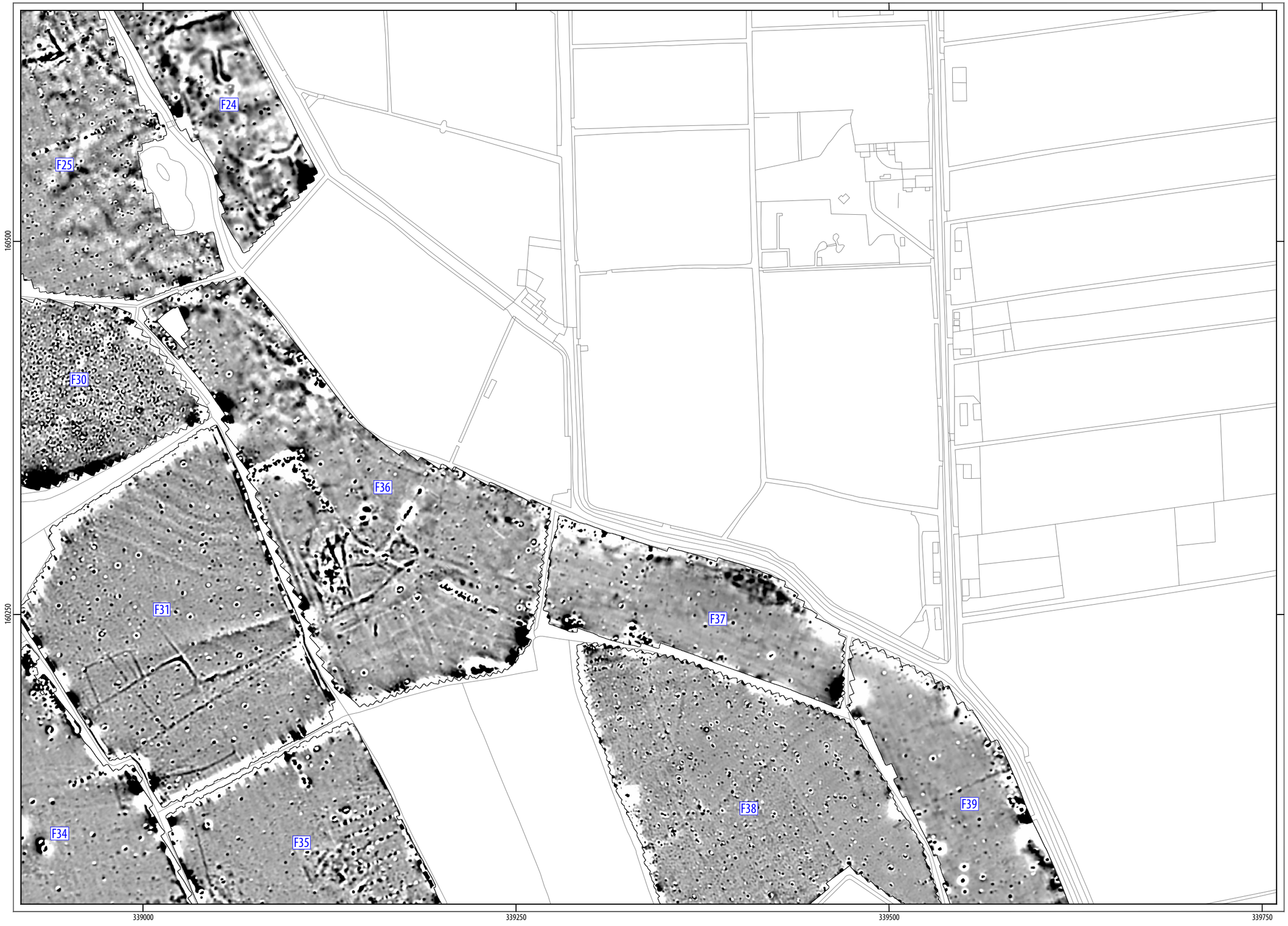
ILLUS 18 Interpretation of magnetometer data; Sector 3



nT
-1.0 2.0

0 50m
1:2,500 @ A3

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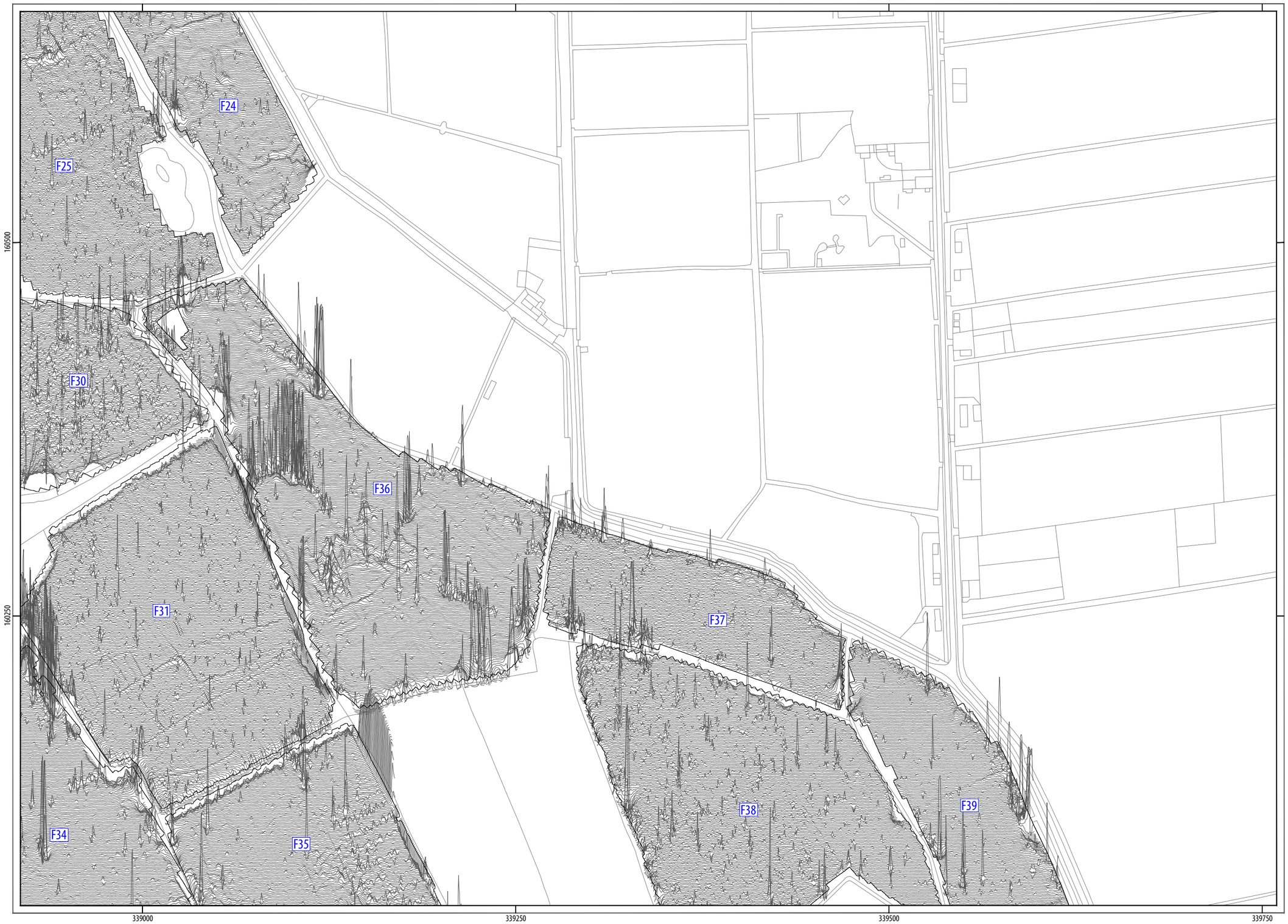
ILLUS 19 Processed greyscale magnetometer data; Sector 4



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ILLUS 20 XY trace plot of minimally processed magnetometer data; Sector 4

AAA2
SEE ILLUS 28-30

AAA3
SEE ILLUS 31-33

F24
F25
F30
F31
F34
F35
F36
F37
F38
F39

160500
160250
339000
339250
339500
339750

TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	service pipe
linear trend	field drain
linear	former field boundary
linear trend	geological variation
magnetic enhancement	geology
magnetic enhancement	archaeology?
magnetic enhancement	archaeology

0 50m
1:2,500 @ A3

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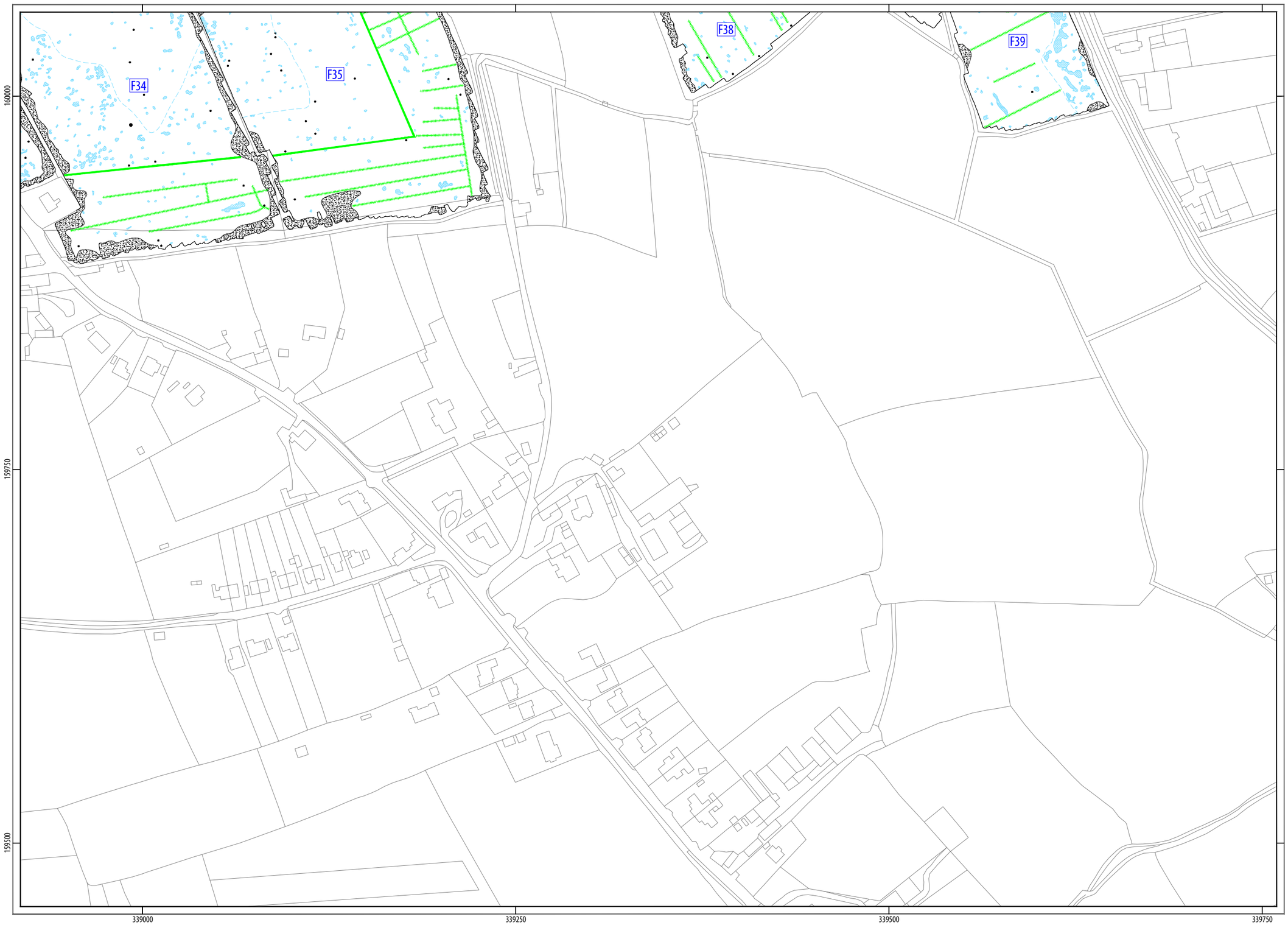
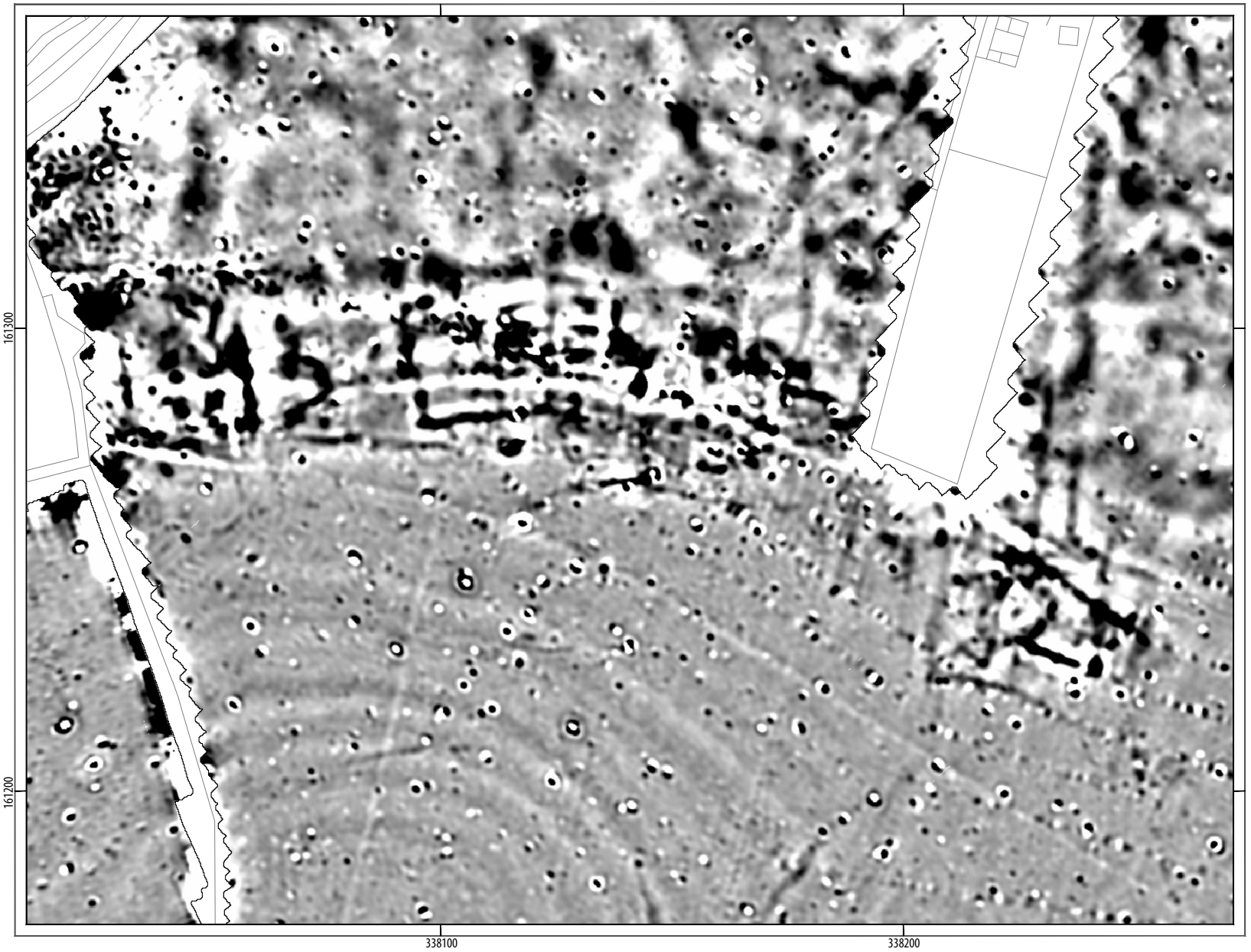
ILLUS 21 Interpretation of magnetometer data; Sector 4

ILLUS 22 Processed greyscale magnetometer data; Sector 5

ILLUS 23 XY trace plot of minimally processed magnetometer data; Sector 5



ILLUS 24 Interpretation of magnetometer data; Sector 5



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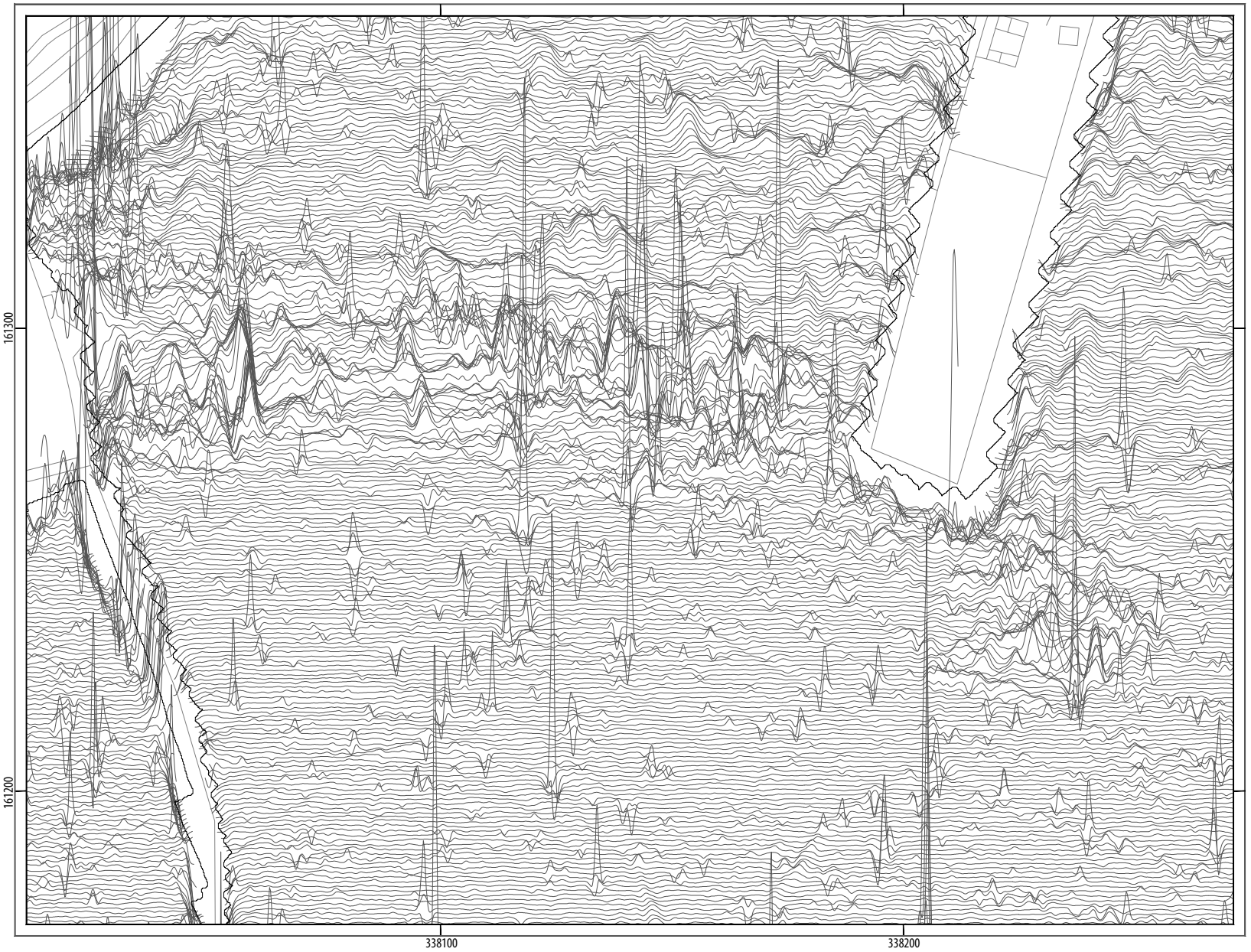
ILLUS 25 Processed greyscale magnetometer data; AAA1



25.0nT/cm

0 25m

1:1,250 @ A4

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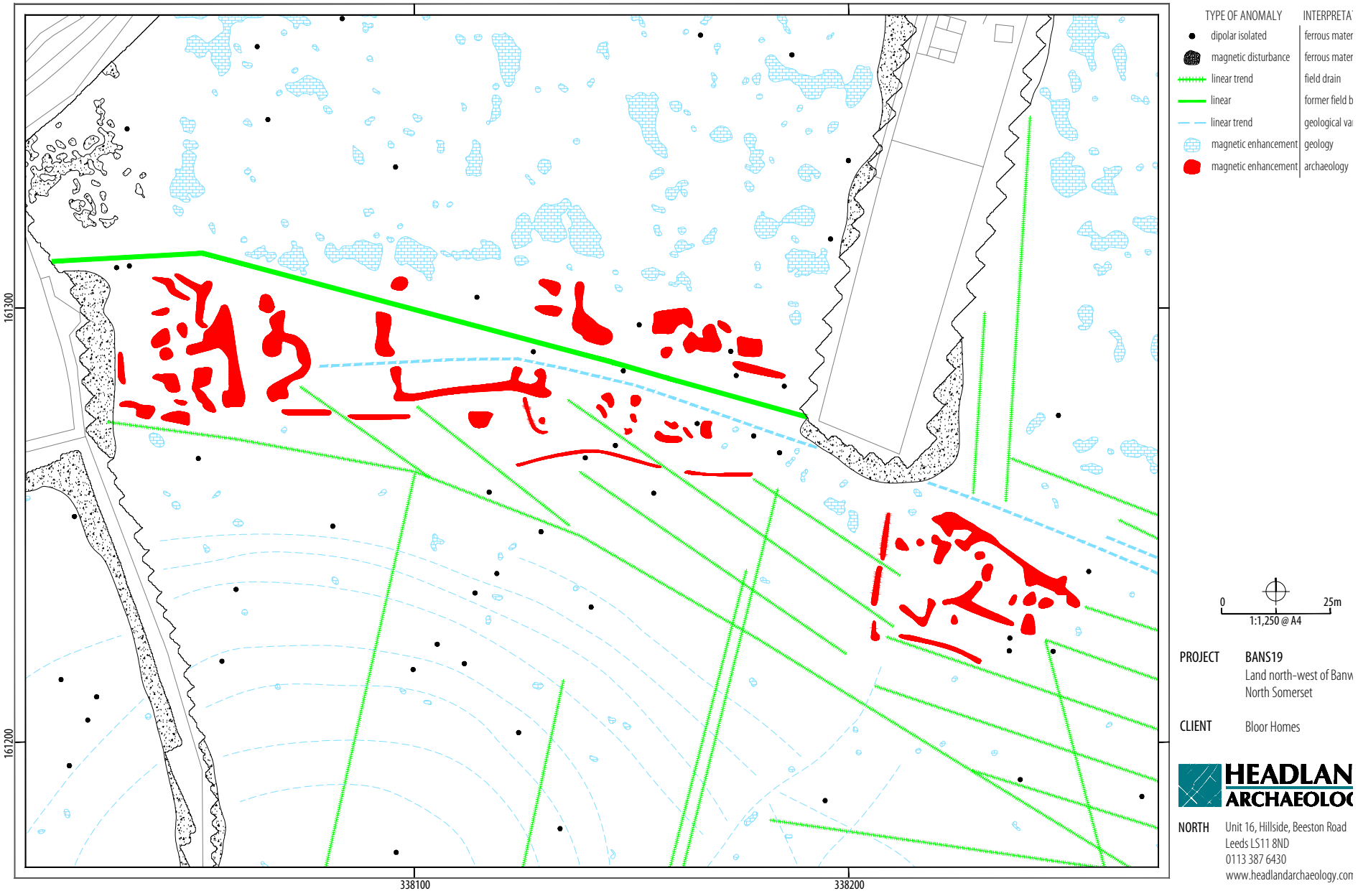
ILLUS 26 XY trace plot of minimally processed magnetometer data; AAA1



ILLUS 27 Interpretation of magnetometer data; AAA1

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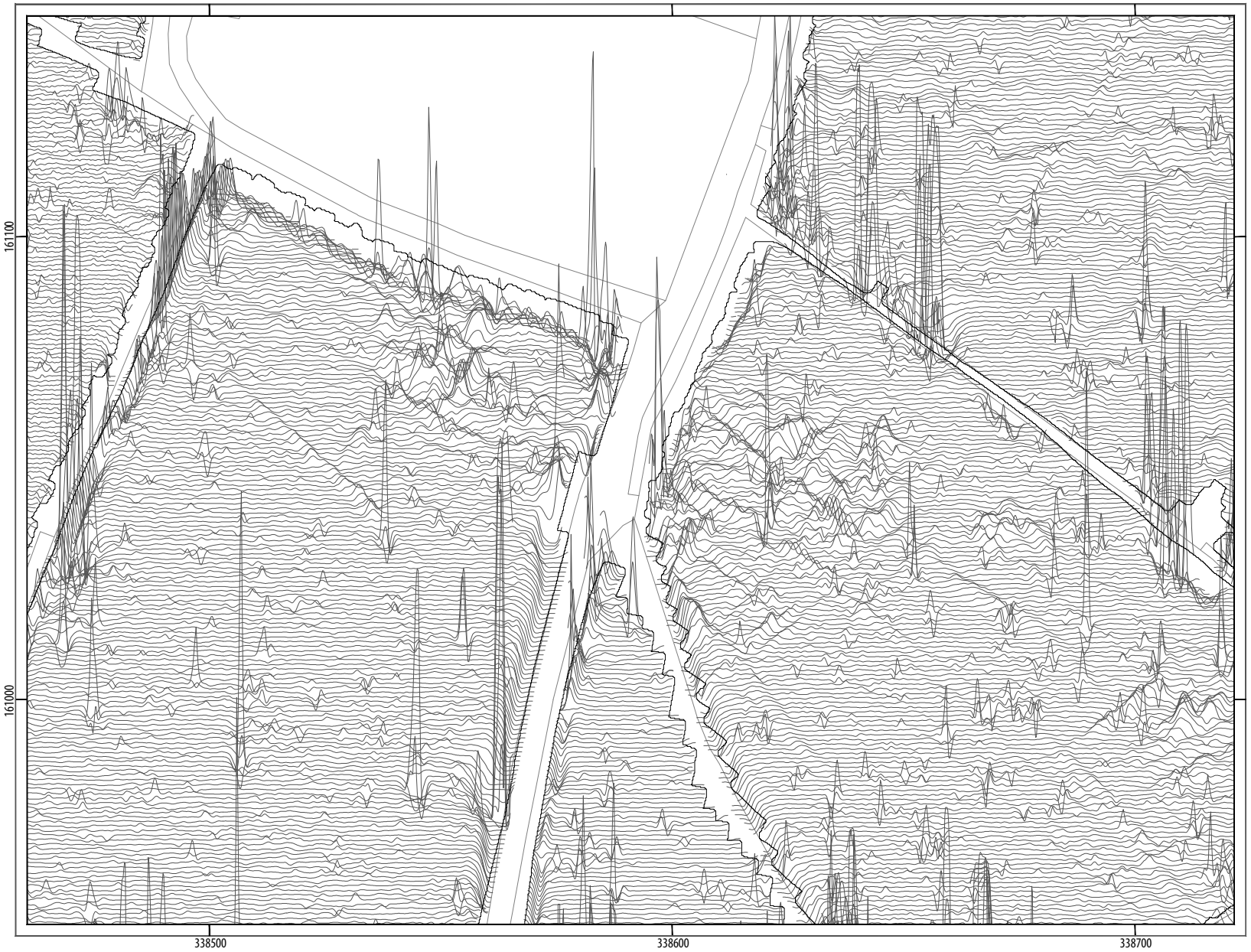
ILLUS 28 Processed greyscale magnetometer data; AAA2



25.0nT/cm

0 25m

1:1,250 @ A4

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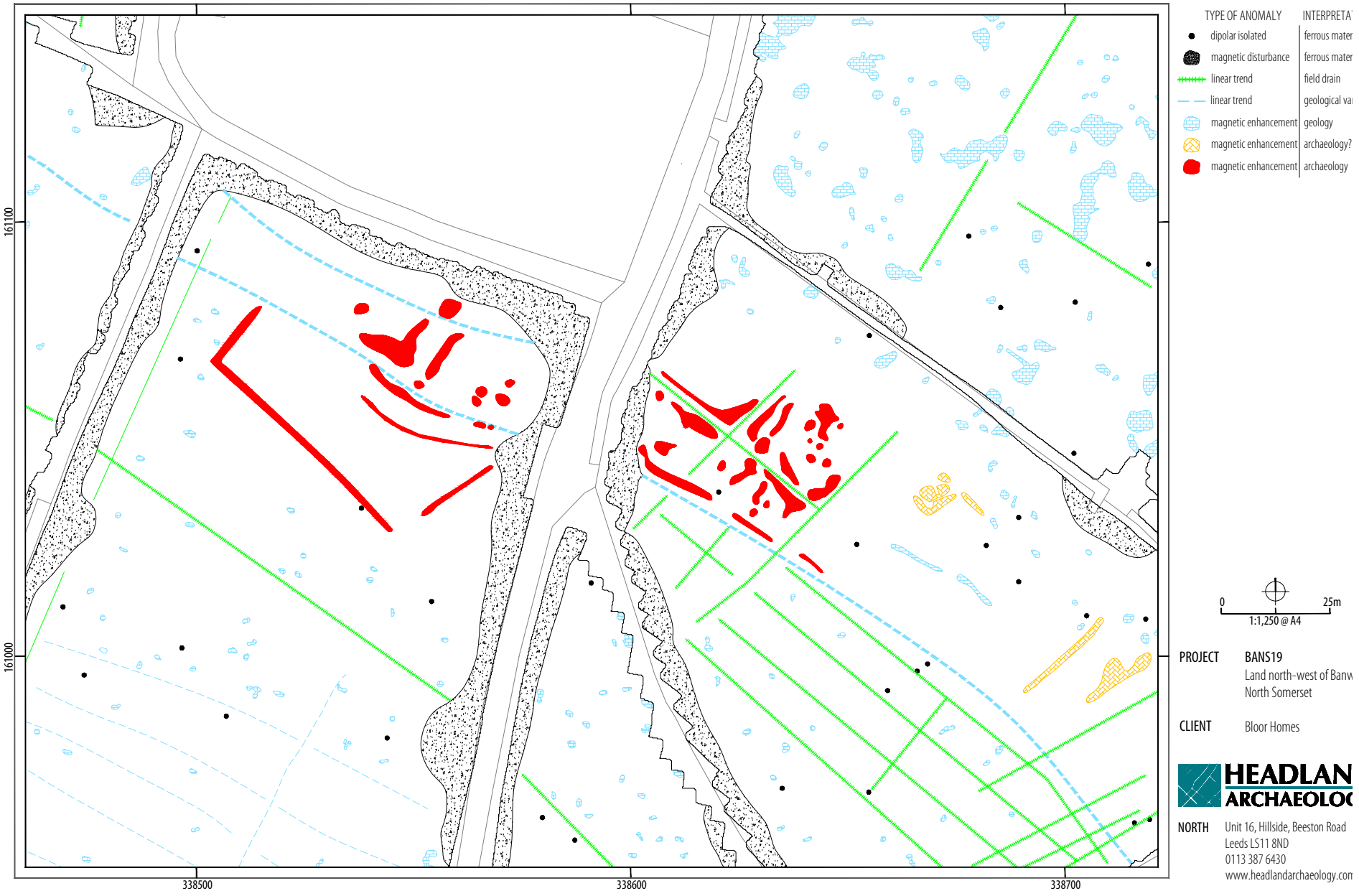
ILLUS 29 XY traceplot of minimally processed magnetometer data; AAA2



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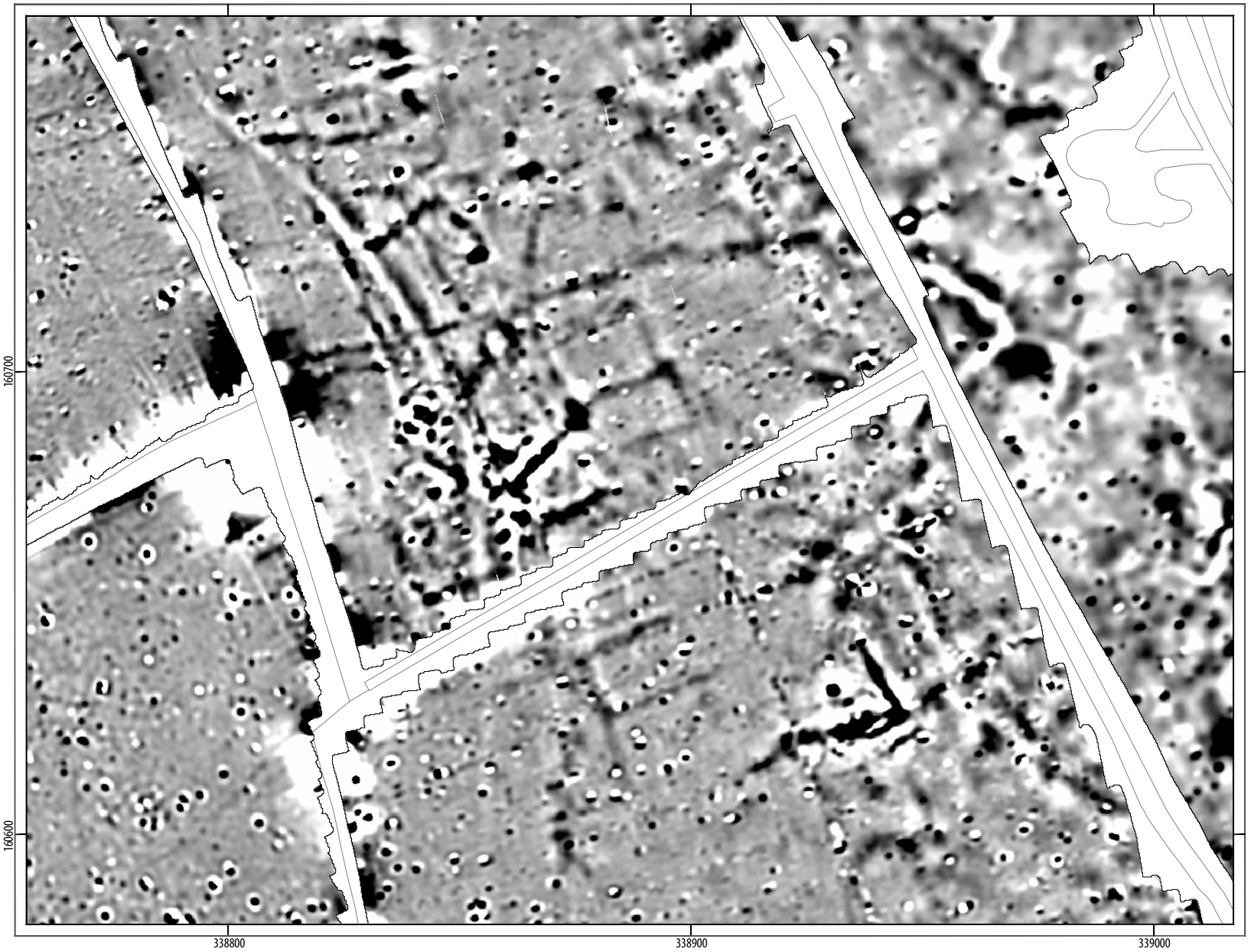
ILLUS 30 Interpretation of magnetometer data; AAA2



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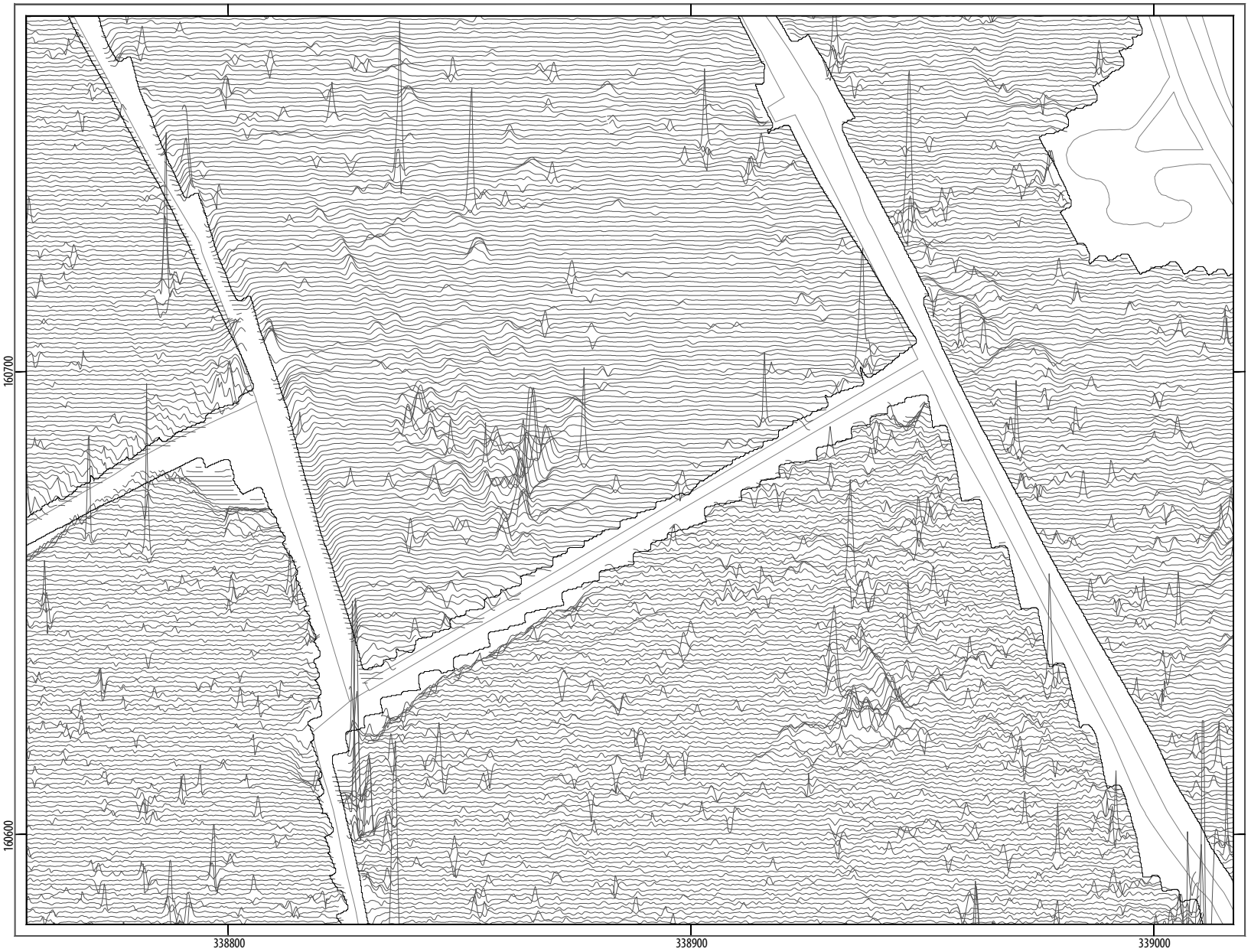
ILLUS 31 Processed greyscale magnetometer data; AAA3



25.0nT/cm

0 25m

1:1,250 @ A4

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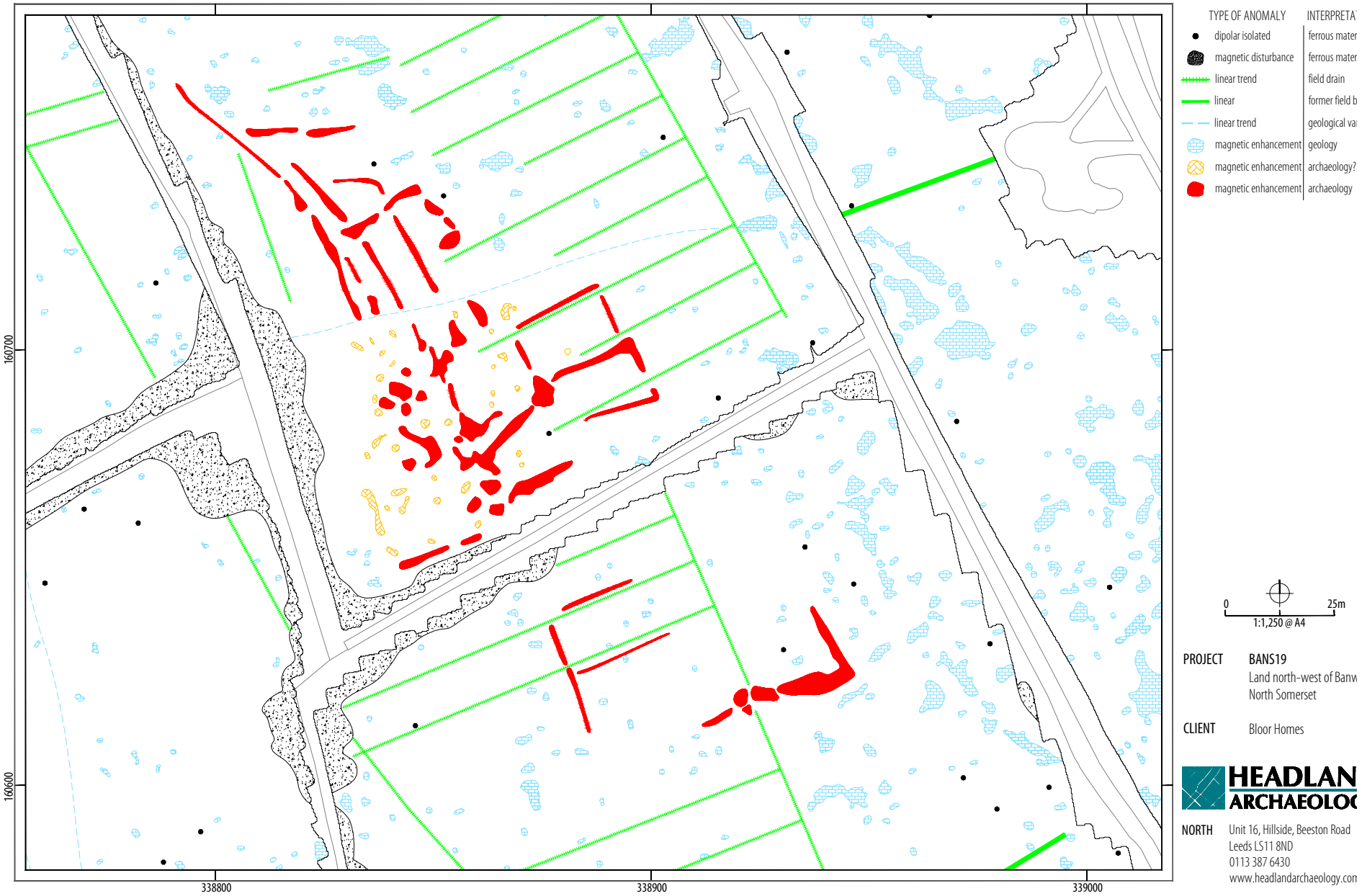
ILLUS 32 XY trace plot of minimally processed magnetometer data; AAA3



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ILLUS 33 Interpretation of magnetometer data; AAA3

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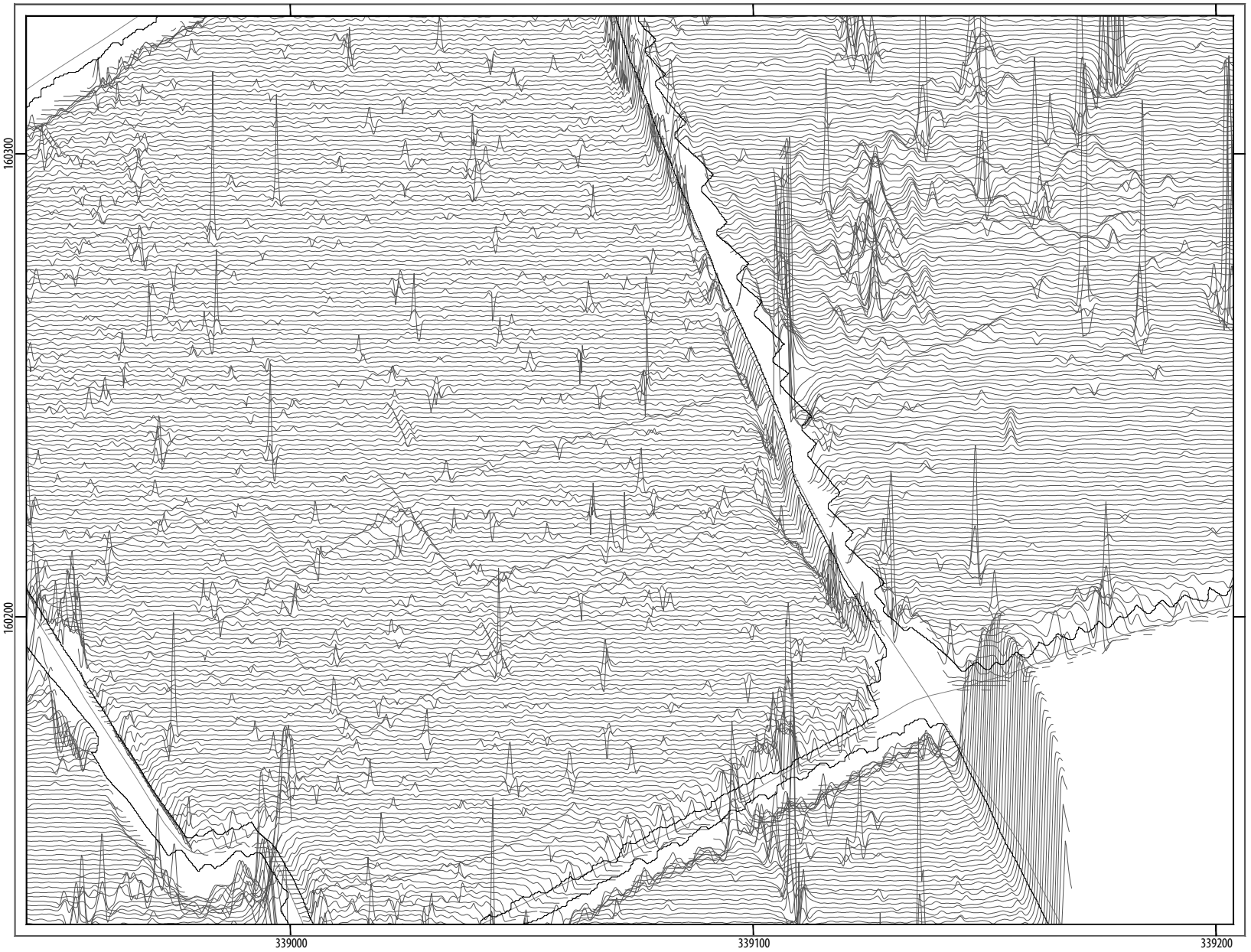
ILLUS 34 Processed greyscale magnetometer data; AAA4



25.0nT/cm

0 25m

1:1,250 @ A4

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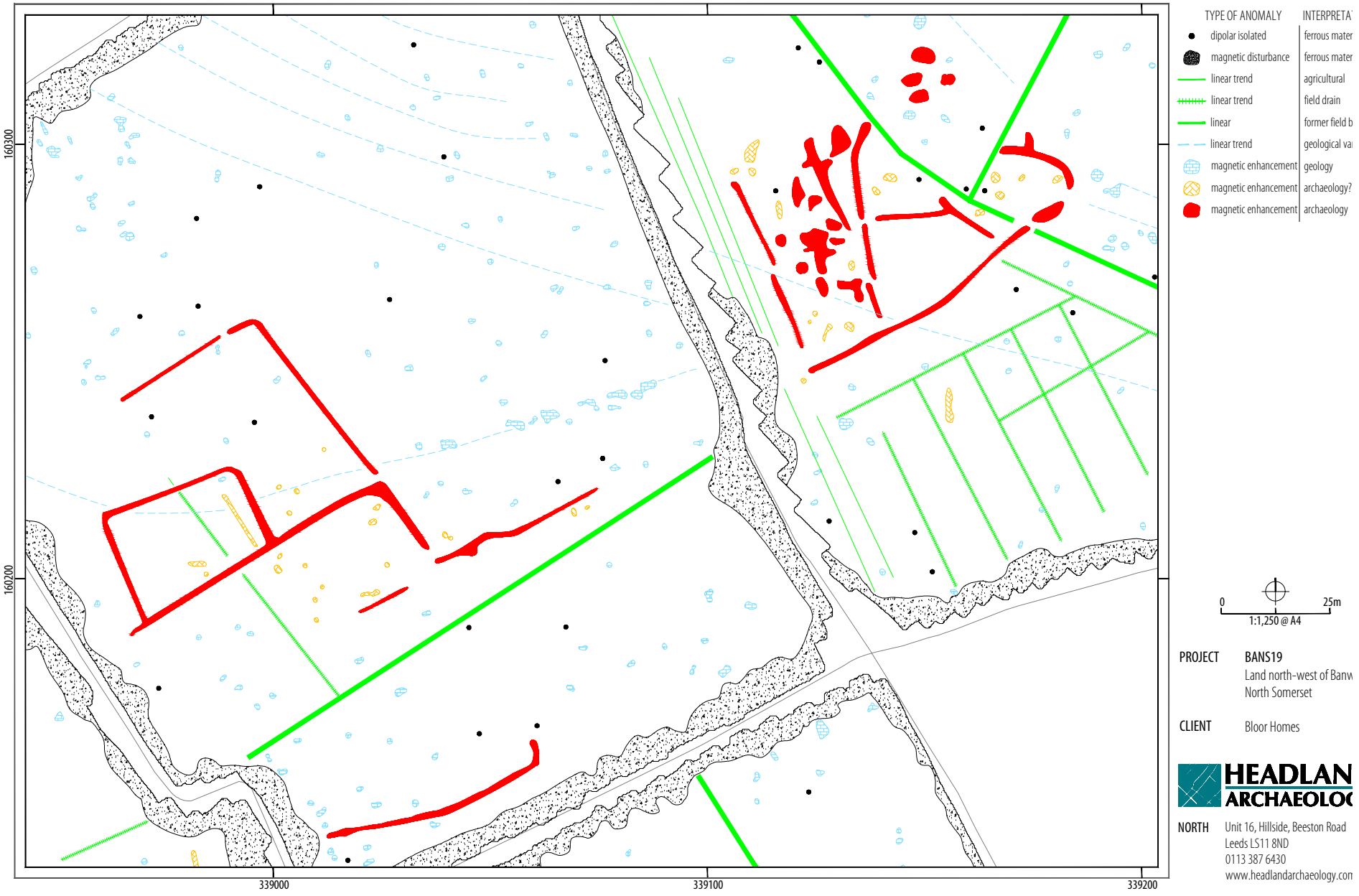
ILLUS 35 XY traceplot of minimally processed magnetometer data; AAA4



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ILLUS 36 Interpretation of magnetometer data; AAA4

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.

Lightning-induced remnant magnetisation (LIRM) LIRM anomalies are thought to be caused in the near surface soil horizons by the flow of an electrical currents associated with lightning strikes. These observed anomalies have a strong bipolar signal which decreases with distance from the spike point and often appear as linear or radial in shape.

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 associate 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: headland5-356864

PROJECT DETAILS	
Project name	Land north-west of Banwell, North Somerset
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 100 hectare site north-west of Banwell, North Somerset, where a new residential development is proposed. The survey has identified four distinctive areas of archaeological activity on the margins of the Somerset Levels comprising dense clusters of linear and rectilinear anomalies. The anomalies are similar in morphology and topographical setting to fen-side Iron Age/ Romano-British settlement and industrial activity which has recently been identified on an adjacent site, less than a kilometre to the north-west. It is considered likely that these anomalies are due to similar activity and they are therefore assessed as of high archaeological potential. A fifth cluster of anomalies within the former wetland itself is identified as of possible archaeological potential although here, archaeological interpretation is tentative. No anomalies of any archaeological potential have been identified over the more elevated western half of the site and therefore, on the basis of the geophysical survey, the archaeological potential across the majority of the proposed development area is assessed as low.
Project dates	Start: 18-03-2019 End: 21-03-2019
Previous/future work	No / Not known
Any associated project reference codes	BANS19 - Contracting Unit No.
Type of project	Field evaluation
Site status	N/A
Current Land use	Grassland Heathland 5 - Character undetermined
Monument type	N/A
Monument type	N/A
Significant Finds	N/A
Significant Finds	N/A
Methods & techniques	"Geophysical Survey"
Development type	Housing estate
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology (other)	Westbury Formation and Cotham Member, Mercia Mudstone, Blue Anchor Formation
Drift geology (other)	Tidal Flat deposits
Techniques	Magnetometry

PROJECT LOCATION	
Country	England
Site location	North Somerset North Somerset Banwell Land north-west of Banwell
Study area	100 Hectares
Site coordinates	ST 3879 6058 51.340505077714 -2.878854649827 51 20 25 N 002 52 43 W Point

PROJECT CREATORS	
Name of Organisation	Headland Archaeology
Project brief originator	The Environmental Dimension Partnership
Project design originator	Headland Archaeology
Project director/manager	Harrison, D
Project supervisor	Bishop, R

Type of sponsor/funding body	Developer
PROJECT ARCHIVES	
Physical Archive Exists?	N/A
Digital Archive recipient	In house
Digital Contents	"none"
Digital Media available	"Geophysics","Text"
Paper Archive Exists?	N/A
PROJECT BIBLIOGRAPHY 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Land north-west of Banwell, North Somerst; Geophysical Survey
Author(s)/Editor(s)	Harrison, D.
Date	2019
Issuer or publisher	Headland Archaeology
Place of issue or publication	Leeds
Description	PDF[A]
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Entered on	21 June 2019

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