HRTK/01

# LAND OFF HAINE ROAD, THANET, KENT

## GEOPHYSICAL SURVEY

commissioned by WYG

June 2017

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

# LAND OFF HAINE ROAD, THANET, KENT

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project info

| | |
|---|---|
| **HA JOB NO.** | HRTK/01 |
| **NGR** | TR 3553 6736 |
| **PARISH** | Manston / Ramsgate |
| **LOCAL AUTHORITY** | Kent |
| **OASIS REF.** | Headland5-288433 |

project team

| | |
|---|---|
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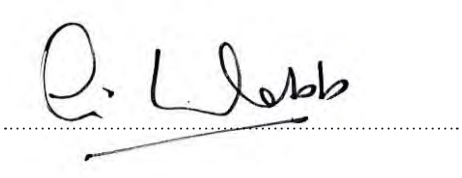
| **APPROVED BY** | Alistair Webb – Project Manager |



HEADLAND ARCHAEOLOGY



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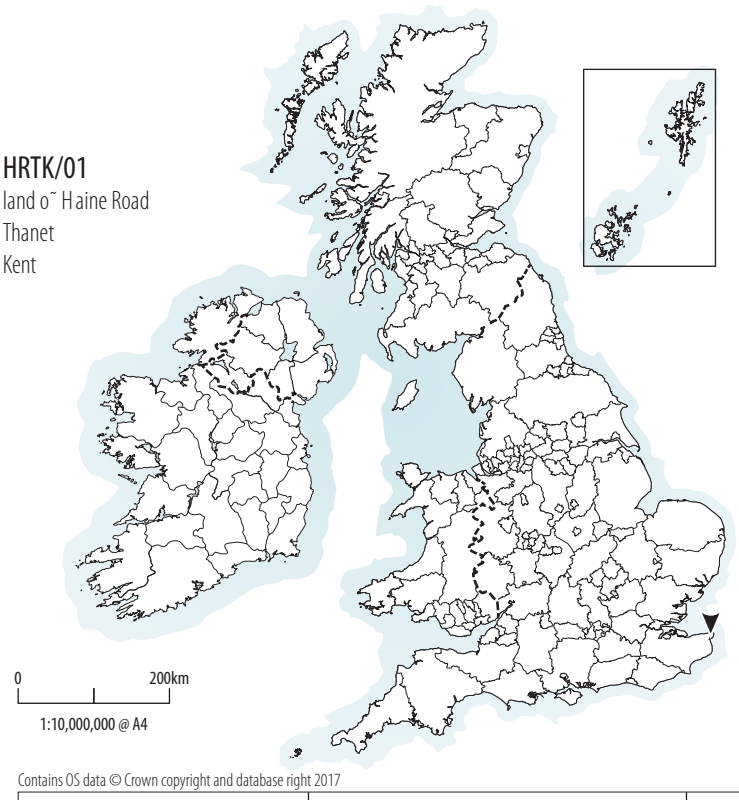
# PROJECT SUMMARY

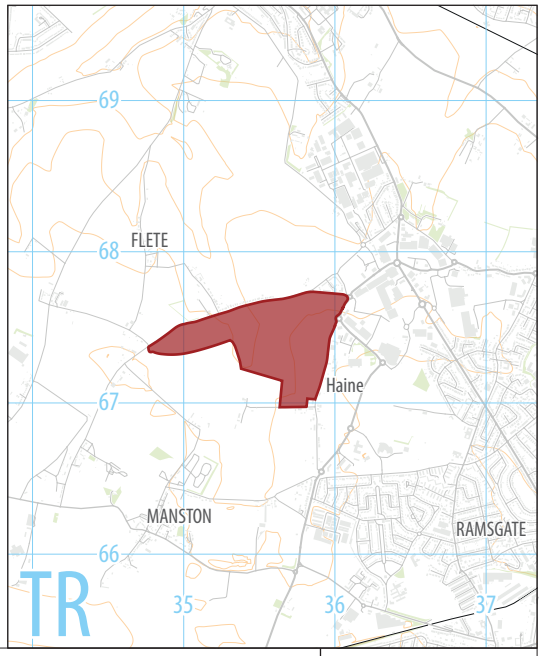
Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 47 hectare site off Haine Road, Thanet, Kent, as part of a baseline assessment of the heritage potential of the site. This information will help guide archaeological strategy in advance of a proposed mixed-use development. The survey has identified three distinct areas of clear archaeological activity including eight enclosures, three trackways and up to three ring-ditches, probably barrows. These areas are assessed as of high archaeological potential. The results of the survey confirm and enhance the archaeological potential of the site as recorded on the Kent Historic Environment Record (HER). A clear correlation has been demonstrated between the archaeological anomalies and the underlying geological conditions with no archaeological anomalies being identified over the Head superficial deposits. It is possible that there is insufficient magnetic contrast in these deposits, or that they are too deep, for soil-filled features to manifest as magnetic anomalies in the data. For this reason, the archaeological potential of the site may be greater than suggested by the survey.

# CONTENTS

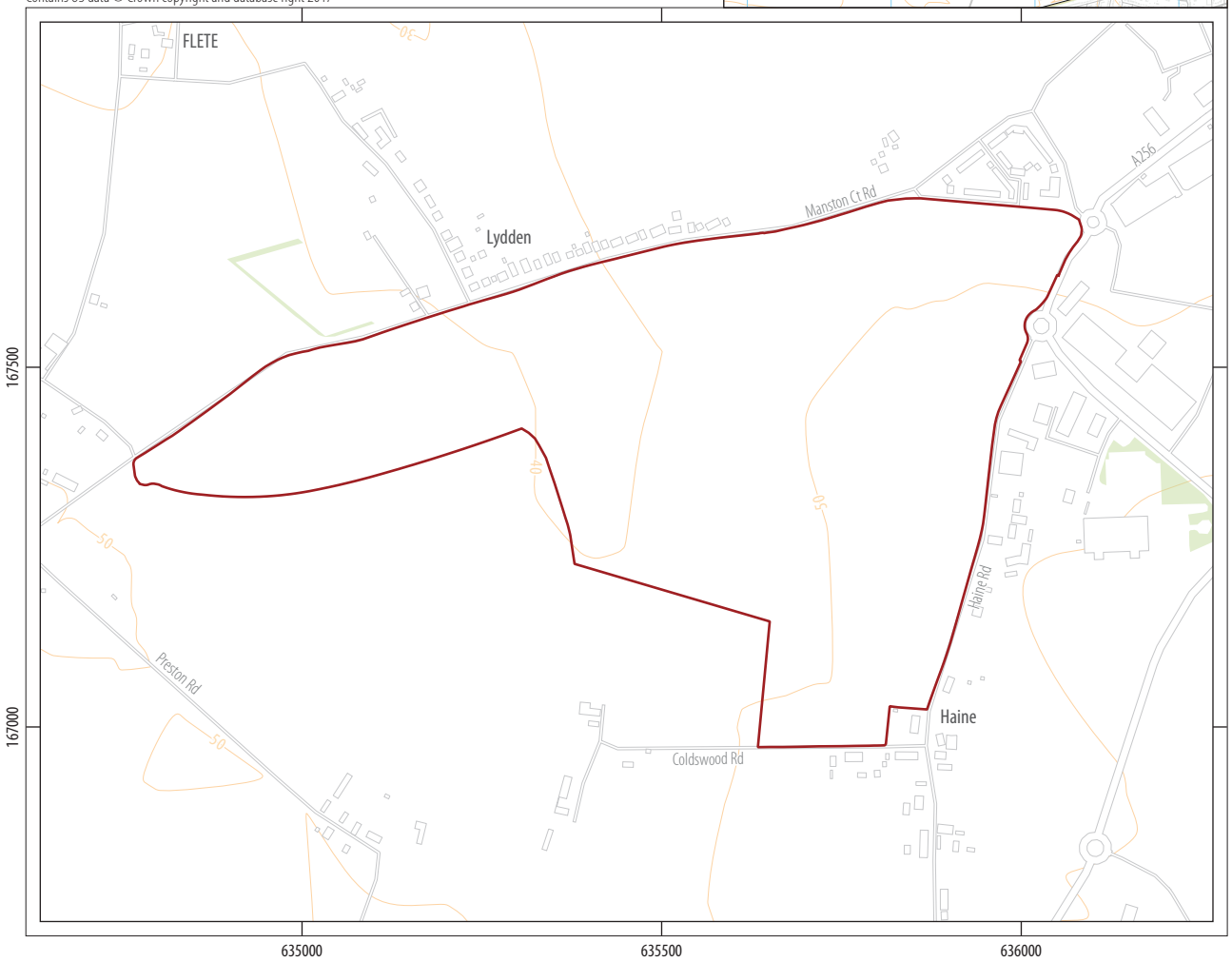
# LIST OF ILLUSTRATIONS

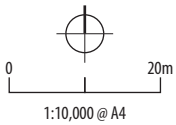
**HRTK/01**
land o˜ Haine Road
Thanet
Kent






proposed development area

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**ILLUS 1** Site location

# LAND OFF HAINE ROAD, THANET KENT

## GEOPHYSICAL SURVEY

## 1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by WYG (The Client), on behalf of Greenacre (Thanet) Ltd, to undertake a geophysical (magnetometer) survey of land off Haine Road, Thanet, where a large-scale mixed-use development is being proposed. The survey was carried out as part of a baseline study which aims to assess the heritage potential of the proposed development area (PDA), and therefore the impact of the proposed development on the historic environment. The survey was carried out to help guide the development proposals.

The work was undertaken in accordance with a Written Scheme of Investigation (Headland Archaeology 2017), and was undertaken in accordance 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 May 9th and May 11th 2017 in order to provide information on the archaeological potential of the PDA.

### 1.1 SITE LOCATION, LAND-USE AND TOPOGRAPHY

The PDA comprises six fields (F1–F6) within a contiguous but irregularly shaped block of land, centred at TR 3553 6736 (see Illus 1), to the south-west of Westwood Shopping Centre in Thanet, Kent. It is bound to the north by Marston Court Road, to the east by Haine Road, and to the south-east by Coldswood Road. The southern and western extents of the PDA are unbound and open onto arable farmland. At the time of the survey, the fields were under mixed arable cultivation (see Illus 2–Illus 5).

Generally, the PDA is characterised by flat open farmland ranging from approximately 52m above Ordnance Datum (AOD) at Haine Road in the east, falling to 40m AOD in the centre of the PDA rising to 48m AOD at Manston Court Road in the far west.

### 1.2 GEOLOGY AND SOILS

The underlying bedrock geology mainly comprises of Margate Chalk Member which is partially overlain by sedimentary sand, silt and clay belonging to the Thanet Formation (see Illus 10). This is overlain intermittently by broad subaerial (Head) deposits of clay and silt (NERC 2017).

The soils are characterised as freely draining loams being classified in the Soilscape 5 and Soilscape 6 associations (Cranfield University 2017).

## 2 ARCHAEOLOGICAL BACKGROUND

An archaeological Desk-Based Assessment (WYG 2017) has established that the site lies within a landscape of high archaeological potential as recorded on the Kent HER (see Illus 7). Known heritage assets within the PDA include: a number of probable prehistoric round barrows visible as cropmarks, including double concentric ring ditches (MKE91349 and MKE7633). A large circular ditch enclosure/ring ditch potentially contains secondary Saxon inhumations (MKE7666). Cropmarks indicating undated pits and linear features have also been recorded across the central part of the site (MKE7685). Within the north-east of the site, a rectangular enclosure visible as a cropmark (MKE78396) may relate to a series of medieval enclosures previously investigated to the west of Westwood Cross. Further evidence for an extensive Romano-British landscape within the site and wider area were recently excavated as part of the Margate to Weatherlees Hill Wastewater Works Pipeline by Wessex Archaeology, which runs through the PDA on a north/south axis (MKE97608-10).

Analysis of historical mapping (Old-maps 2017) indicates that the division and layout of land within the PDA has changed little since the publication of the first edition Ordnance Survey (OS) map in 1873, albeit with the removal of a single east/west aligned track crossing F3 and F5.

## 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

2

3

**ILLUS 2** Field 2, looking south **ILLUS 3** Field 5 (north), looking east

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 and 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 V3.0.31.4 (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 1:10,000. Illus 2–5 inclusive are site condition photographs. Illus 6 is a 1:5,000 scale survey location plan showing the GPS swath data. The Kent HER and cropmark data is presented at the same scale in Illus 7.

The processed greyscale data and an overall interpretation plot are also presented at 1:5,000 on Illus 8 and Illus 9 with the possible archaeological anomalies and probable archaeological anomalies shown overlying the geology data on Illus 10. 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 1:2,500 in Illus 11 to Illus 16 inclusive, with more detailed (1:1,000) plots of the areas of archaeological activity (AAA) in Illus 17 to Illus 25 inclusive.

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 Written Scheme of Investigation (Headland Archaeology 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

The ground conditions across the PDA were good and the overall quality of the data collected was good throughout. The survey



**ILLUS 4** Field 3, looking north **ILLUS 5** Field 5, looking north-east

has detected a variable magnetic background across the PDA with broad areas of variation particularly prevalent across the east of F2/F3, F4 and the east of F5. This is thought to be due to variation in the depth and composition of the Head superficial deposits.

Against this background numerous anomalies have been identified. Those anomalies with modern, agricultural or geological origins are discussed first followed by those anomalies with a possible or probable archaeological cause. All are discussed below and cross-referenced to specific anomalies on the interpretative drawings, where appropriate.

## 4.1 FERROUS AND MODERN 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.

High magnitude linear dipolar anomalies (Illus 9; SP1 and SP2) skirting the northern edge of the PDA and the western edge of F5/F6 locate sub-surface pipes.

A north-south alignment of ferrous spike anomalies (TP) within the east of F2/F3/F4 locates a series of telegraph poles carrying overhead wires.

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

## 4.2 AGRICULTURAL ANOMALIES

A slightly curvilinear anomaly across the south of F3/F5 (Illus 9; FT1) corresponds to a former track which is shown on the first edition OS map published in 1873. The anomaly is caused by magnetically enhanced material (eg brick and tile) within the buried surface of the track. Elsewhere, occasional closely-spaced, parallel linear trend anomalies are identified, mainly across the centre of the PDA. These are generally aligned parallel with the long axis of the current field system and are caused by modern cultivation.

## 4.3 GEOLOGICAL ANOMALIES

Numerous low magnitude discrete anomalies and faint curvilinear trends are identified across the PDA. These are due to minor variations in the composition of the soils and the superficial deposits. The anomalies increase in frequency and density across the east of F2/F3, F4 and the east of F5 corresponding closely to the mapped location of superficial deposits of Head – clays and silts.

## 4.4 QUARRYING ANOMALIES

Five broad sub-circular areas of magnetic enhancement (Illus 9; Q1–Q5) have been identified across F2/F3 and F5. The anomalies are characteristic of former quarry pits, being caused by the magnetic contrast between the materials used to infill the quarry and the surrounding soils. Several quarry pits are shown on historical mapping in the surrounding landscape including one within the PDA in an area unsuitable for survey, immediately south of Q1.

## 4.5 ARCHAEOLOGICAL AND POSSIBLE ARCHAEOLOGICAL ANOMALIES

Unless specified all the linear anomalies within the areas of archaeological activity (AAA) are likely to be due to soil-filled cut features, such as ditches, forming clear patterns of enclosure and land division. Against the prevailing 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.

Three distinct areas of archaeological activity have been identified which are discussed below.

### AAA1 (Illus 17–19)

A series of high magnitude anomalies has been identified along the north-western edge of F1 corresponding to clear cropmarks visible on recent satellite images (Landsat/Copernicus 2017) and to prehistoric and Roman heritage assets recorded on the Kent HER (Illus 7). The anomalies extend 170m east/west and include at least one probable enclosure (E1). Numerous high magnitude discrete anomalies are thought to locate archaeological activity such as pits, post-holes and spreads of enhanced archaeological material.

### AAA2 (Illus 20–22)

This area defines a clear complex of linear and rectilinear anomalies across F2, centred at TR 3551 6759, and broadly aligned north/south. The anomalies correspond closely with cropmarks recorded on the Kent HER (Illus 8) and include a rectangular enclosure (E2) on the western side of the complex which is only partially recorded as a cropmark. The complex measures 180m east/west by 180m north/south and comprises at least three enclosures (E2–E5) and two trackways (TR1–TR2) which are defined by parallel linear anomalies (soil-filled ditches). Numerous anomalies are identified within the interior of the enclosures which are thought to be due to pits. Broader rectangular high magnitude anomalies are also identified, perhaps locating larger pits or structures. A faint circular trend (RD1) on the north-eastern edge of the complex corresponds to a clear circular cropmark (Illus 7) and is interpreted as a ring-ditch, perhaps a barrow. The possible ring-ditch measures 23m in diameter.

### AAA3 (Illus 23–25)

AAA3 comprises a series of faint and fragmented linear anomalies, aligned north-east/south-west and extending 300m across F3 and F5. The anomalies define at least three enclosures (E6–E8) appended to the southern side of a trackway (TR3). Numerous anomalies in the interior of the enclosures may be due to settlement activity such as pits and post-holes. The anomalies confirm and enhance the cropmark data on the Kent HER (Illus 7).

Towards the south of F3 fragmented concentric circular anomalies (RD2), centred at TR 3552 6731, correspond to cropmarks recorded on the Kent HER as a double ring-ditch (TR36 NE652). The ring-ditch, a probable barrow, measures 28m in diameter. A second smaller ring-ditch is recorded as a circular cropmark 22m north-east of RD2 but has not been detected by the survey. It is likely that there is insufficient magnetic contrast in the soils in the locality of the cropmark for the ring-ditch to manifest as a magnetic anomaly. Immediately west of RD2, a broad sub-circular area of magnetic enhancement (RD3) has been detected. The enhancement is similar in diameter to the adjacent ring-ditch and, for this reason, an archaeological origin should be considered. However, the lack of any clear form may indicate alternative origins, perhaps an area of localised extraction.

Two rectilinear anomalies (Illus 14–16; D1 and D2) are identified in F6, in the south-east of the PDA. The anomalies may be of archaeological interest, perhaps being caused by soil-filled ditches, but no clear pattern is discernible and it is possible that they are caused by localised geological variation. It is notable that both anomalies are identified in areas with no recorded superficial deposits (see Illus 10).

## 5 CONCLUSION

The geophysical survey has successfully evaluated the site, confirming and enhancing the Kent HER with the identification of three distinct areas of archaeological activity including eight enclosures, three trackways and up to three ring-ditches, probably defining barrows. These areas are assessed as of high archaeological potential. A clear correlation has been demonstrated between the archaeological anomalies and the underlying geological conditions with no archaeological anomalies being identified over the Head superficial deposits. It is possible that there is insufficient magnetic contrast in these deposits, or that they are too deep, for soil-filled features to manifest as magnetic anomalies in the data. For this reason, the archaeological potential of the site may be greater than suggested by the survey.

## 6 REFERENCES

Chartered Institute for Archaeologists (ClfA) 2014 ***Standard and guidance for archaeological geophysical survey*** [online document] Accessed 2 June 2017 from http://www.archaeologists.net/sites/default/files/ClfAS&GGeophysics_1.pdf

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Landsat/Copernicus 2017 ***Google Earth V 7.1.5.1557 (image date September 7 2013)*** [online] Manston Court Rd (51° 21'29.87'N, 1° 22'35.50'E, Eye alt 606m. Accessed 2 June 2017 from http://www.earth.google.com

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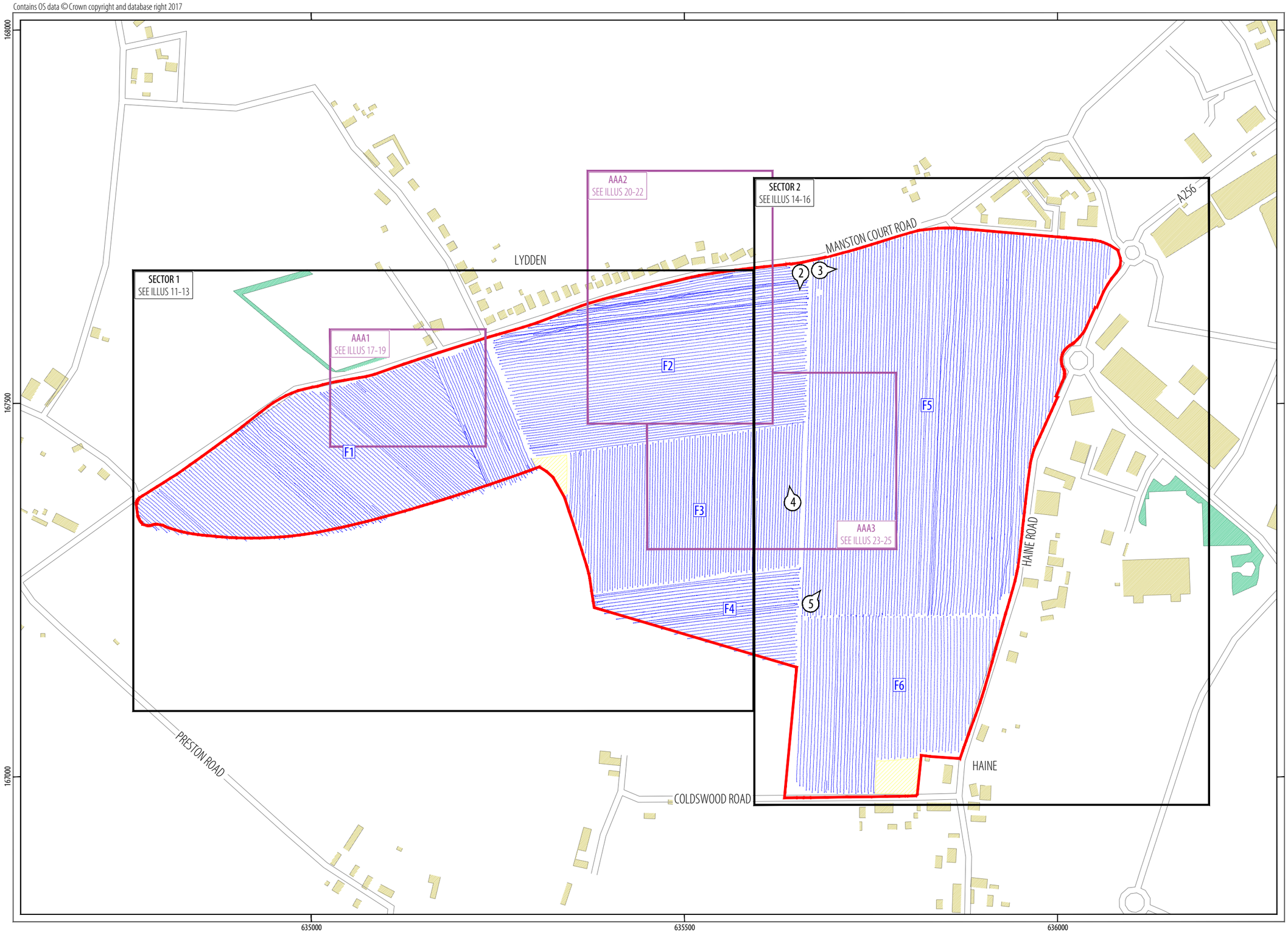


proposed development area
GPS swaths
location and direction of ILLUS 2-5
area unsuitable for survey

N
0 100m
scale 1:5,000 @ A3

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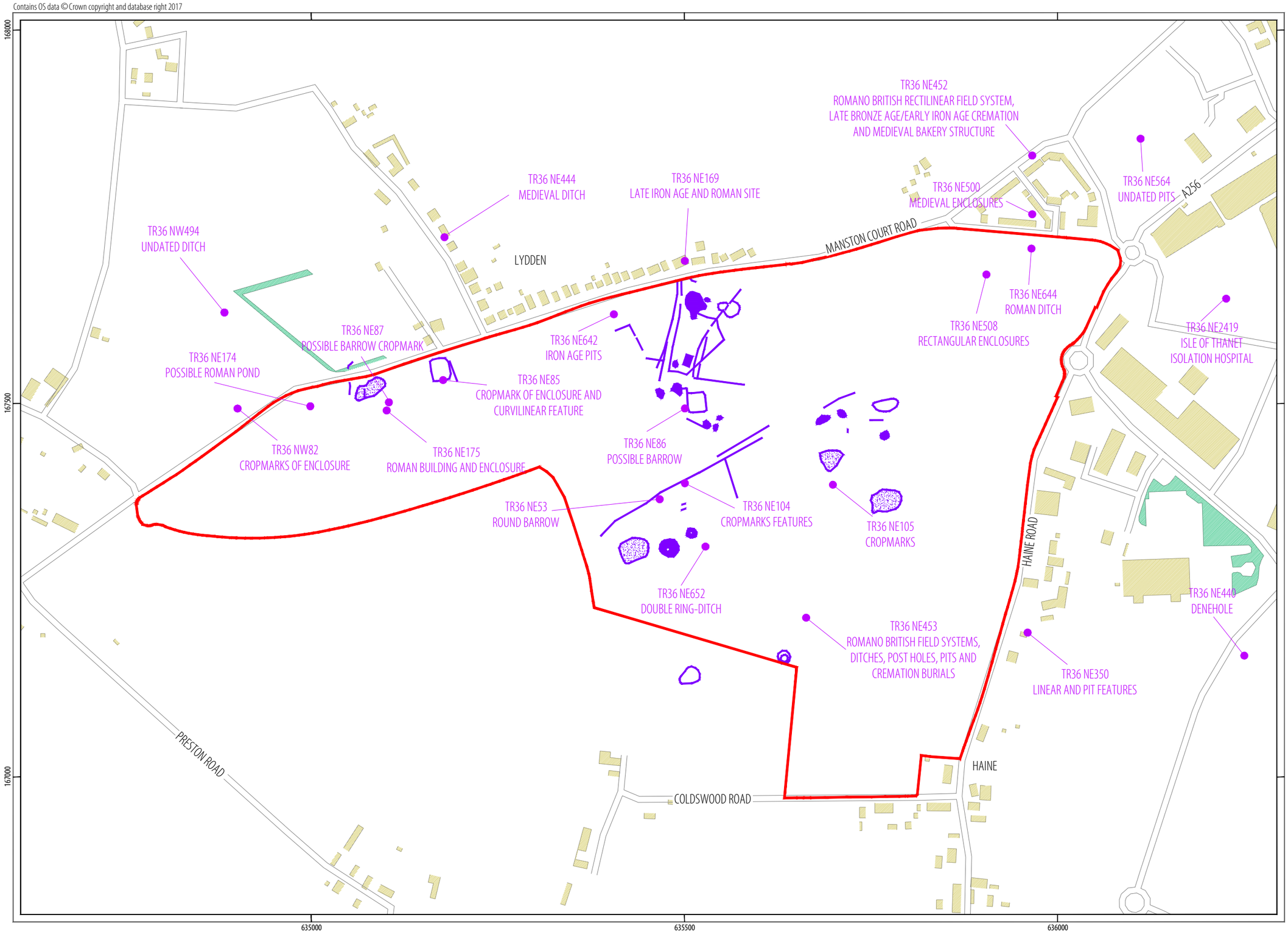
**ILLUS 6** Survey location showing GPS swaths




proposed development area
Kent HER data
cropmark data

N
0 100m
scale 1:5,000 @ A3

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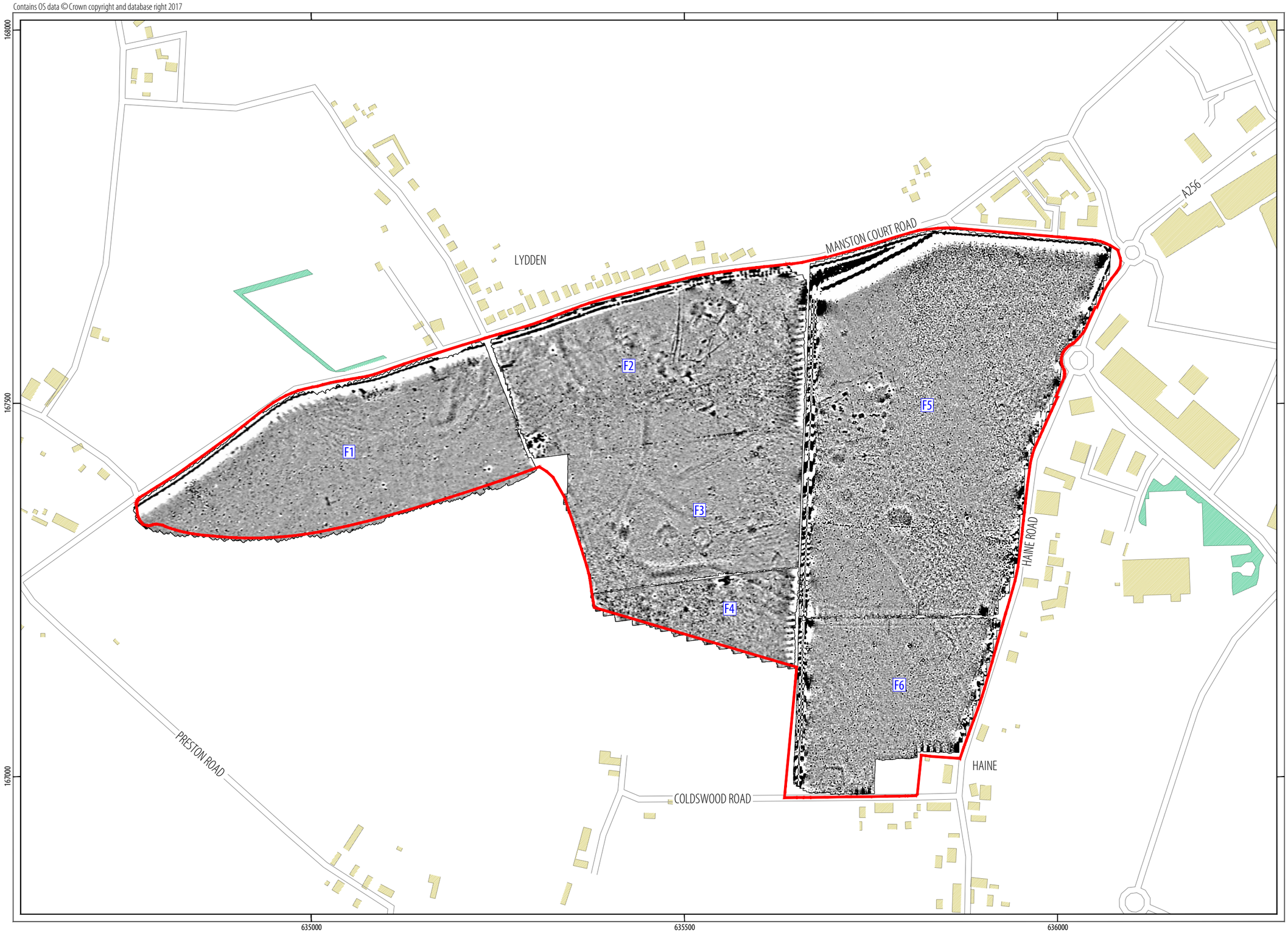
**ILLUS 7** Survey location showing Kent HER and cropmark data




proposed development area

nT
-1.0 2.0

N

0 100m
scale 1:5,000 @ A3

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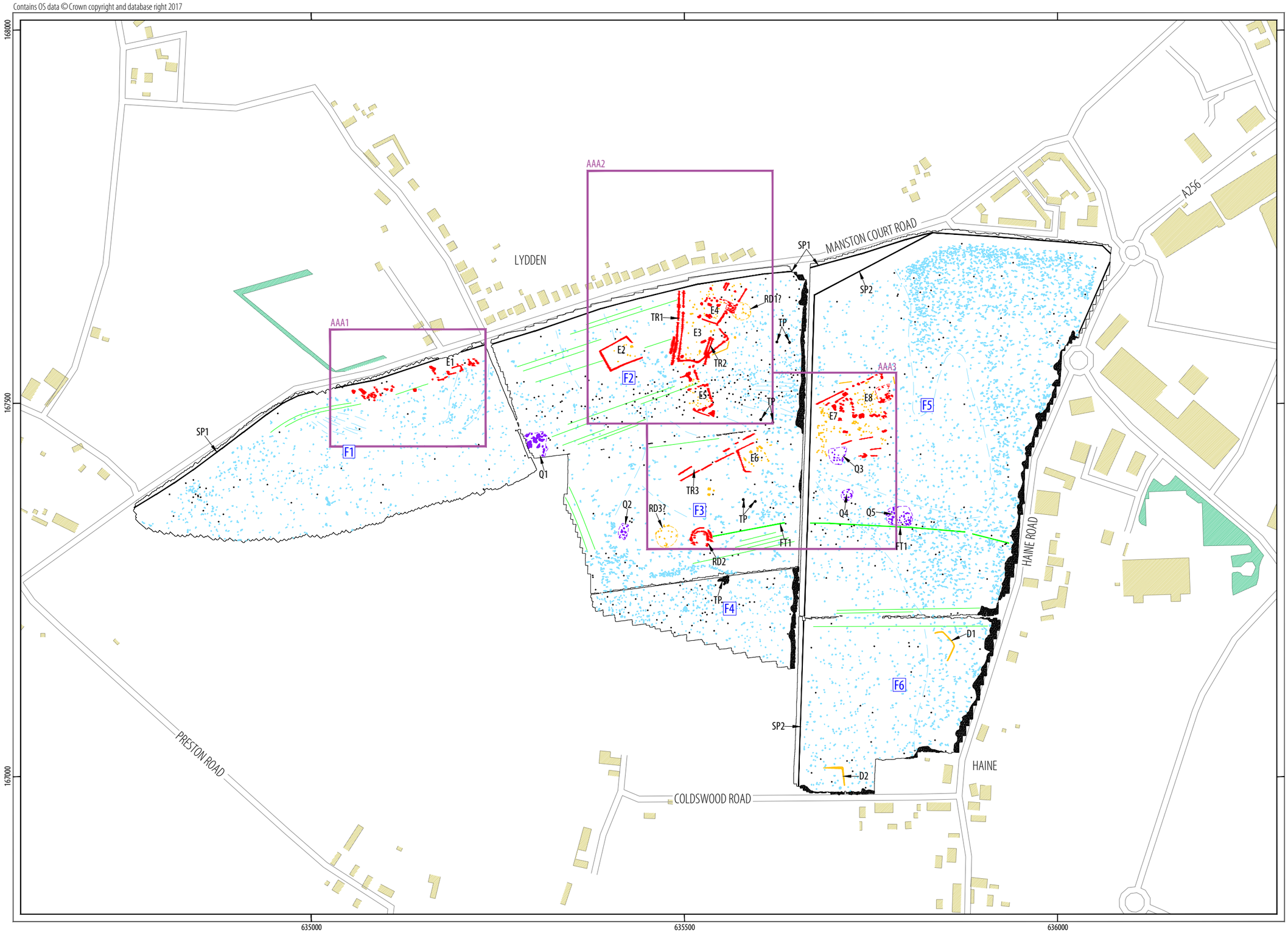
**ILLUS 8** Overall processed greyscale magnetometer data




| TYPE OF ANOMALY | INTERPRETATION |
|---|---|
| dipolar isolated | ferrous material |
| magnetic disturbance | ferrous material |
| dipolar linear | service pipe |
| linear trend | agricultural |
| linear | former track |
| linear trend | geological variation |
| magnetic enhancement | geology |
| magnetic enhancement | quarrying? |
| magnetic enhancement | archaeology? |
| magnetic enhancement | archaeology |

ABBREVIATIONS

- **AAA** area of archaeological activity
- **D** ditch
- **E** enclosure
- **FT** former track
- **Q** quarry
- **RD** ring-ditch
- **SP** service-pipe
- **TP** telegraph pole
- **TR** trackway

N

0 100m

scale 1:5,000 @ A3

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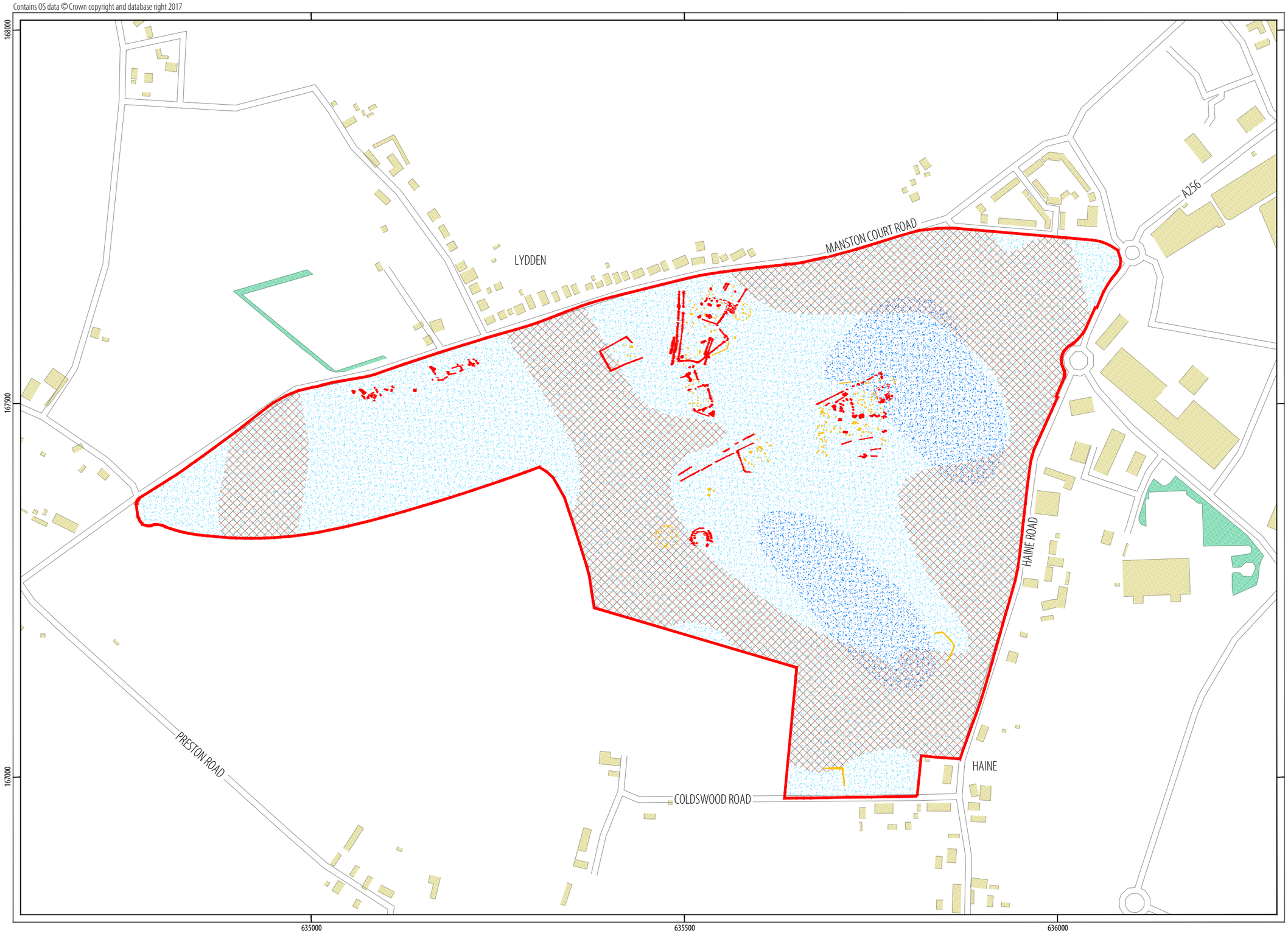
**ILLUS 9** Overall interpretation of magnetometer data




proposed development area
possible archaeology
probable archaeology

BEDROCK GEOLOGY
Margate Chalk Member - chalk
Thanet Formation - sand, silt and clay

SUPERFICIAL GEOLOGY
Head - clay and silt

N
0 100m
scale 1:5,000 @ A3

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**ILLUS 10** Geology data (after NERC 2017) showing possible and probable archaeological anomalies

167500

F1

F2

F3

F4

635000

635500

nT
-1.0 2.0

N
0 50m
scale 1:2,500 @ A3

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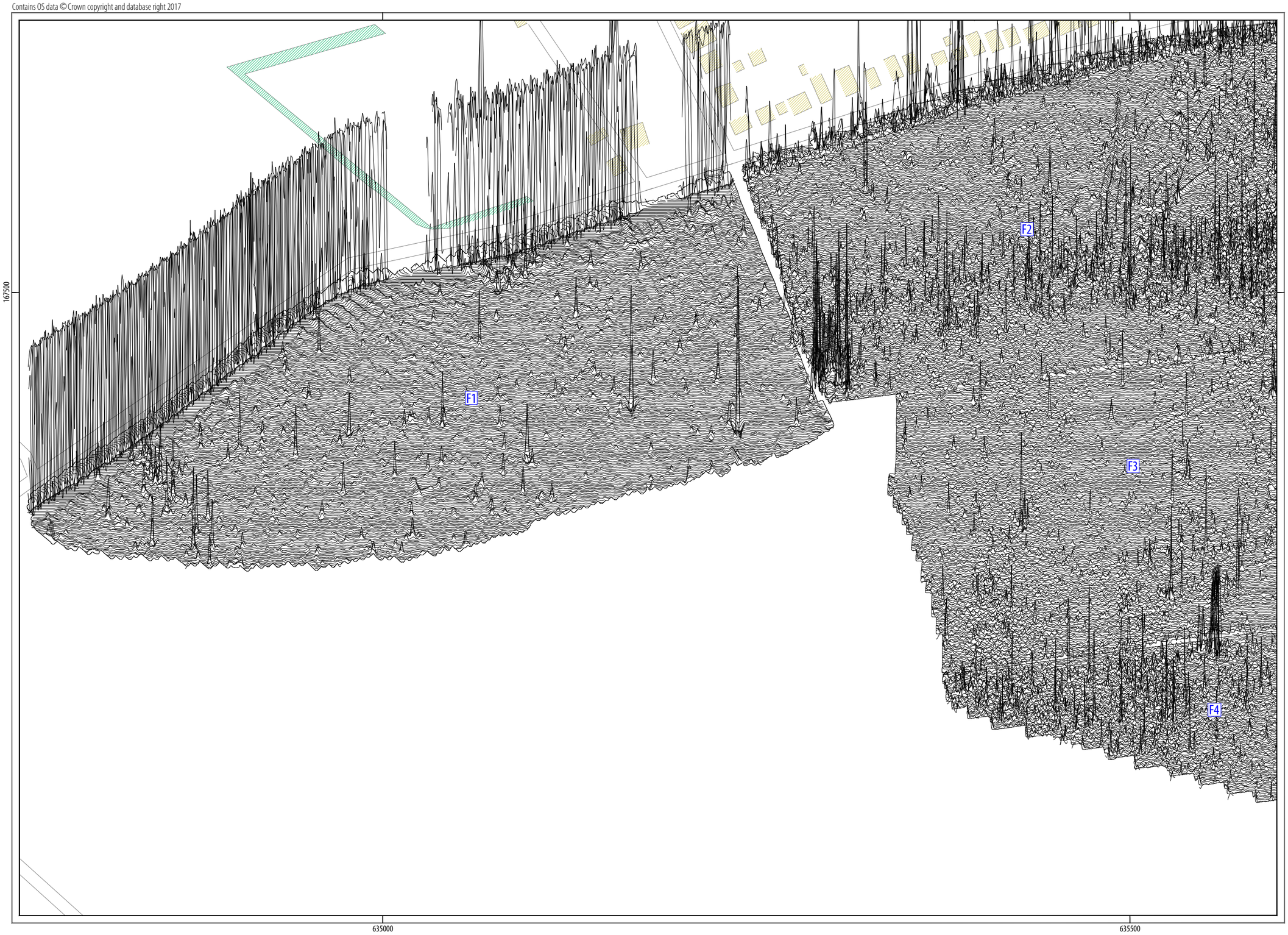
**ILLUS 11** Processed greyscale magnetometer data; Sector 1




40.0nT/cm

N

0 50m

scale 1:2,500 @ A3

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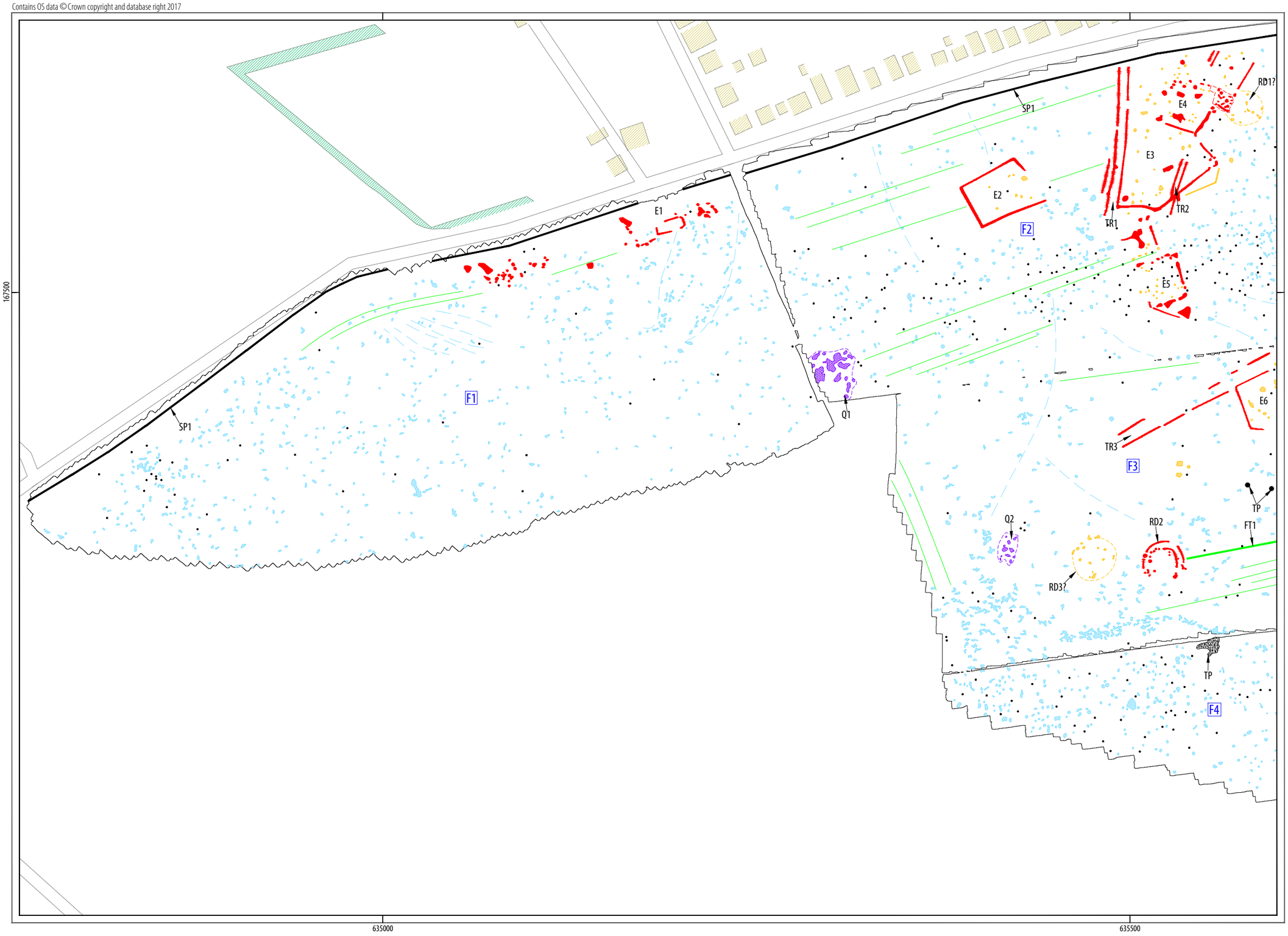
**ILLUS 12** XY trace plot of minimally processed magnetometer data; Sector 1




| TYPE OF ANOMALY | INTERPRETATION |
|---|---|
| dipolar isolated | ferrous material |
| magnetic disturbance | ferrous material |
| dipolar linear | service pipe |
| linear trend | agricultural |
| linear | former track |
| linear trend | geology |
| magnetic enhancement | geology |
| magnetic enhancement | quarrying? |
| magnetic enhancement | archaeology? |
| magnetic enhancement | archaeology |

ABBREVIATIONS

| | |
|---|---|
| E | enclosure |
| FT | former track |
| Q | quarry |
| RD | ring-ditch |
| SP | service-pipe |
| TP | telegraph pole |
| TR | trackway |

N

0 50m

scale 1:2,500 @ A3

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**ILLUS 13** Interpretation of magnetometer data; Sector 1

F2
F3
F4
F5
F6

176500
167000
636000

nT
-1.0
2.0

N
0
50m
scale 1:2,500 @ A3

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**ILLUS 14** Processed greyscale magnetometer data; Sector 2


40.0nT/cm

N

0 50m

scale 1:2,500 @ A3

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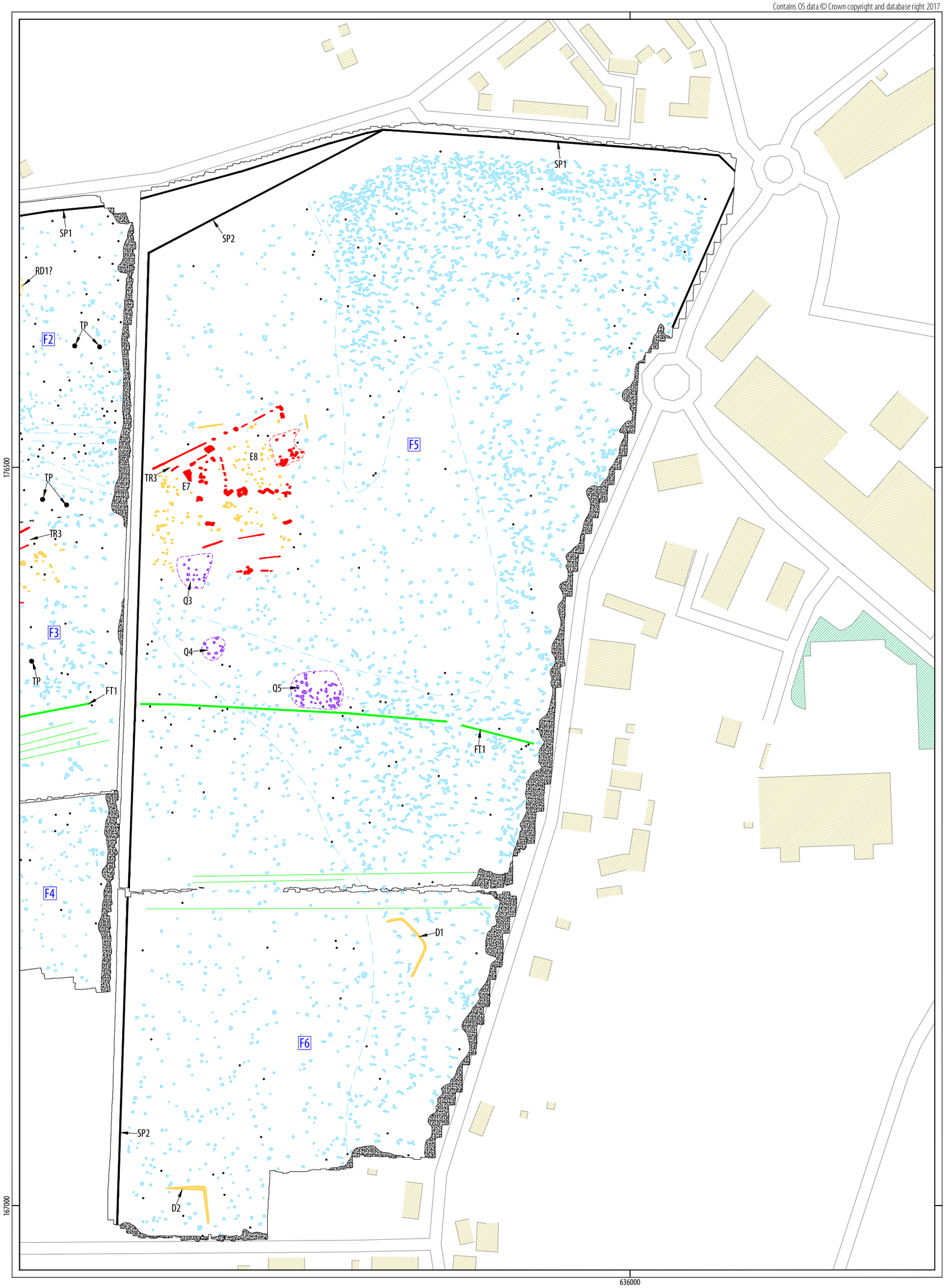
**ILLUS 15** XY trace plot of minimally processed magnetometer data; Sector 2




| TYPE OF ANOMALY | INTERPRETATION |
|---|---|
| dipolar isolated | ferrous material |
| magnetic disturbance | ferrous material |
| dipolar linear | service pipe |
| linear trend | agricultural |
| linear | former track |
| linear trend | geological variation |

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

ABBREVIATIONS

| | |
|---|---|
| E | enclosure |
| FT | former track |
| Q | quarry |
| RD | ring-ditch |
| SP | service-pipe |
| TP | telegraph pole |
| TR | trackway |

N

0 50m

scale 1:2,500 @ A3

PROJECT HRTK/01
Land off Haine Road
Thanet
Kent

CLIENT WYG

HEADLAND ARCHAEOLOGY

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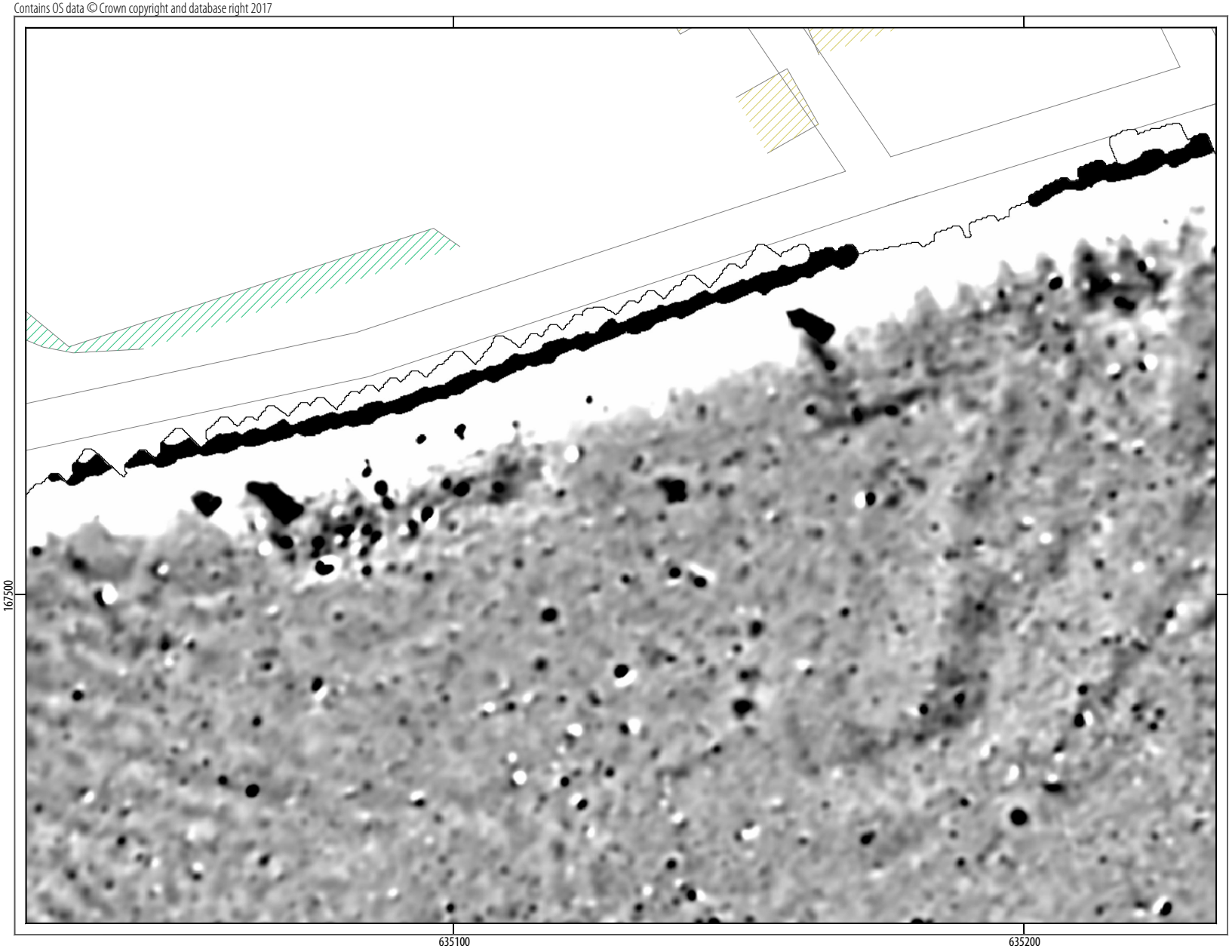
**ILLUS 16** Interpretation of magnetometer data; Sector 2




nT
-1.0 2.0

N
0 25m
scale 1:1,000 @ A4

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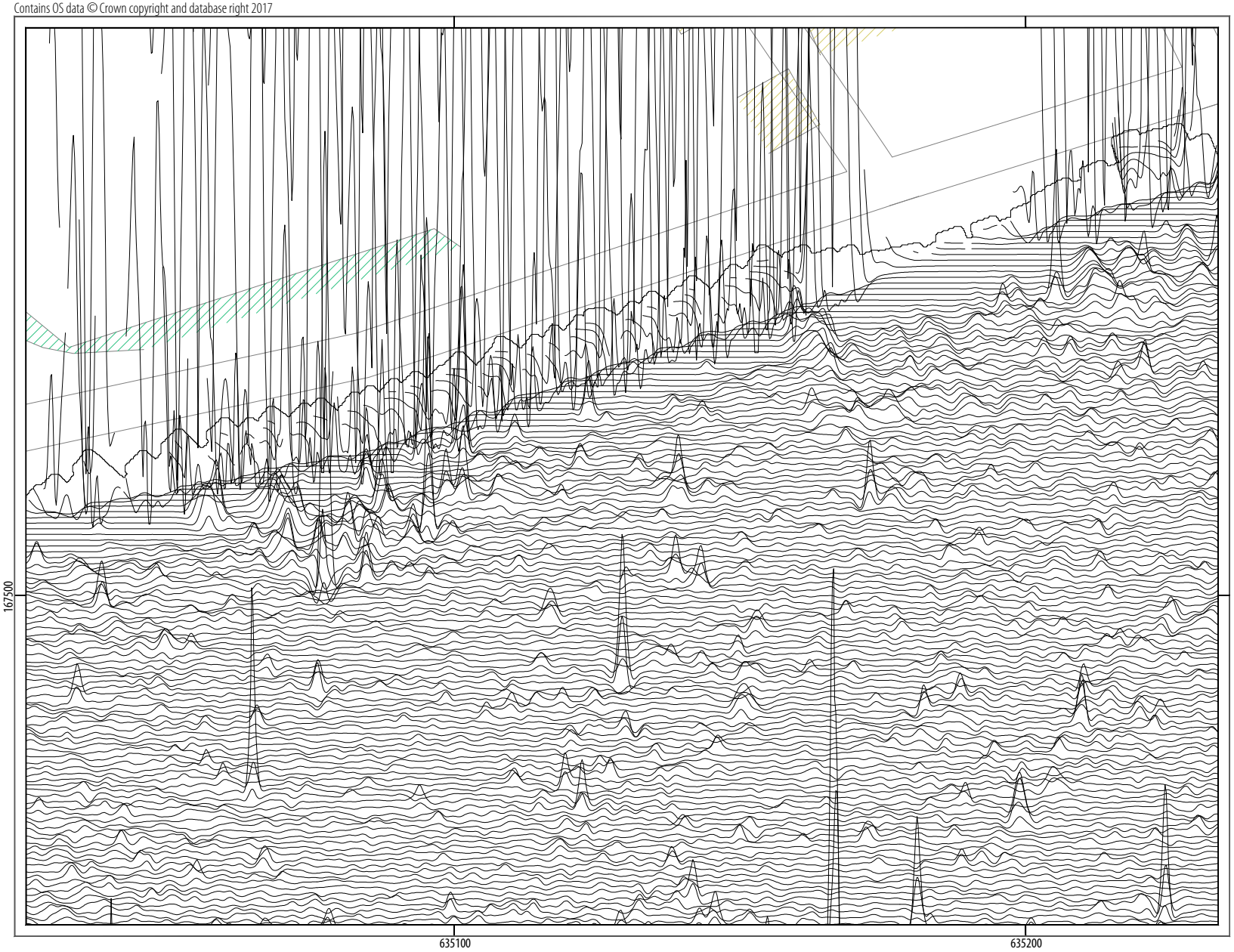
**ILLUS 17** Processed greyscale magnetometer data; AAA1




15.0nT/cm

N

0 25m

scale 1:1,000 @ A4

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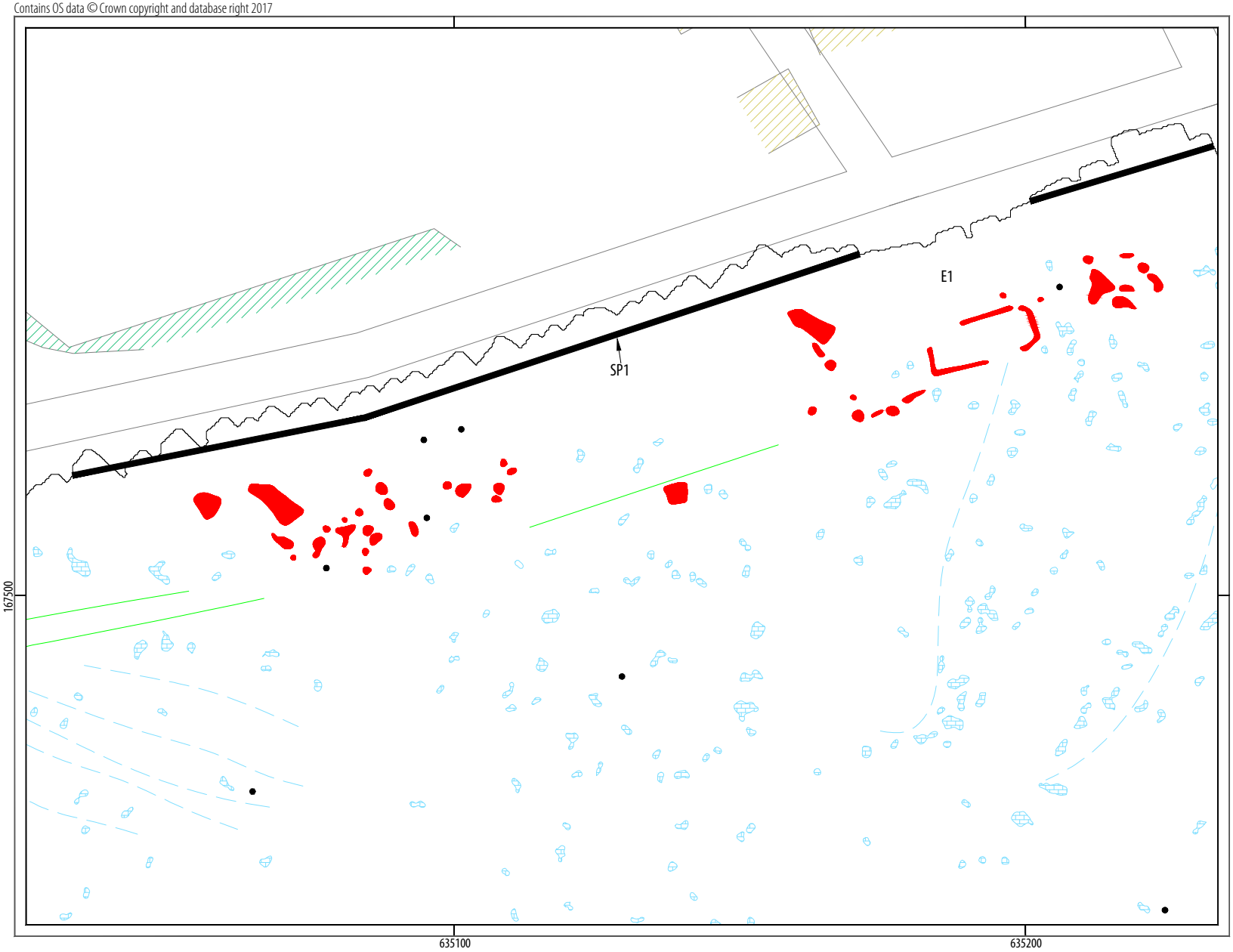
**ILLUS 18** XY trace plot of minimally processed magnetometer data; AAA1




| TYPE OF ANOMALY | INTERPRETATION |
|---|---|
| dipolar isolated | ferrous material |
| magnetic disturbance | ferrous material |
| dipolar linear | service pipe |
| linear trend | agricultural |
| linear trend | geological variation |
| magnetic enhancement | geology |
| magnetic enhancement | archaeology |

ABBREVIATIONS

E enclosure

SP service-pipe

N

0 25m

scale 1:1,000 @ A4

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**ILLUS 19** Interpretation of magnetometer data; AAA1


nT
-1.0 2.0

N
0 100m
scale 1:1,000 @ A3

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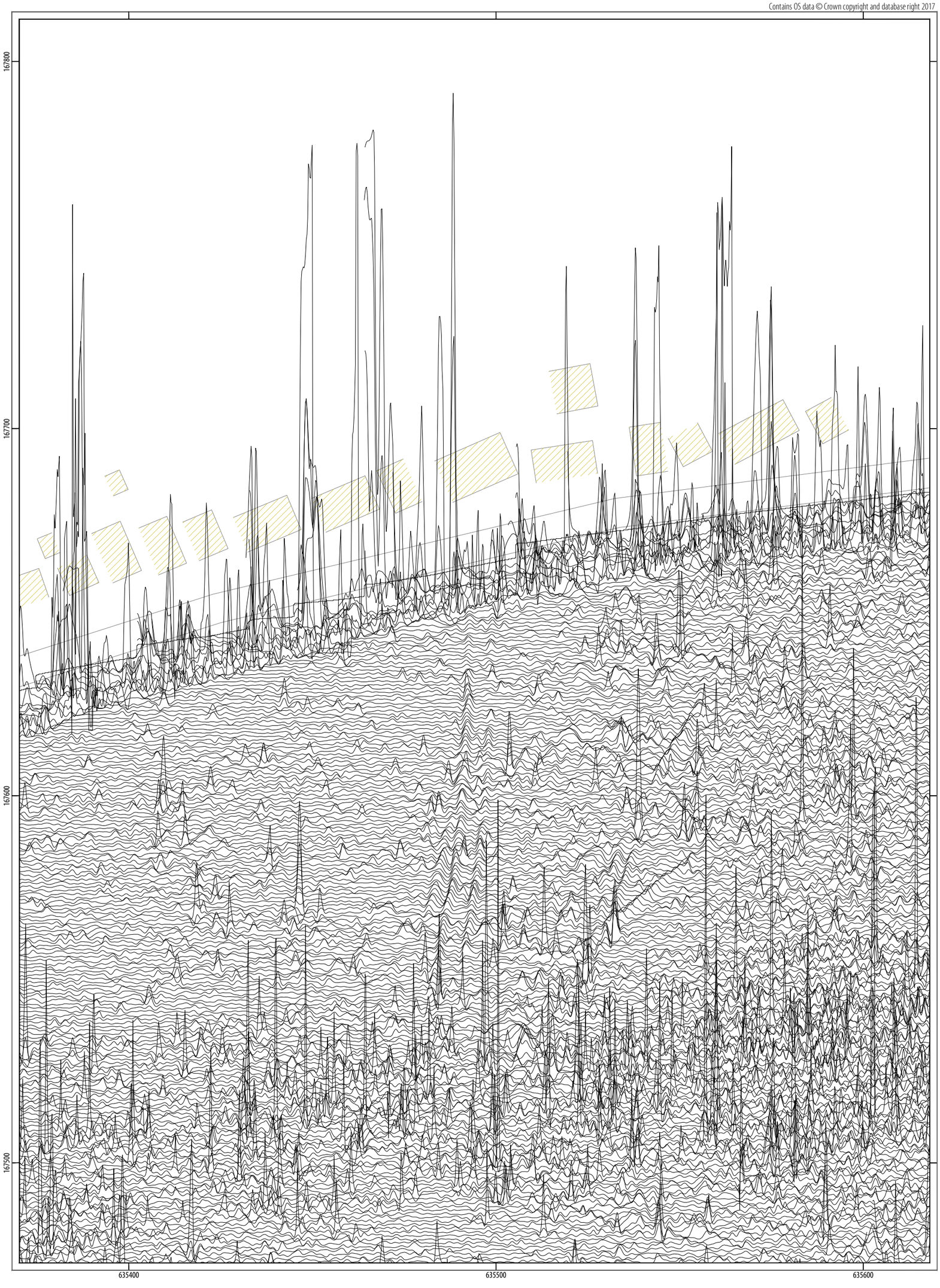
**ILLUS 20** Processed greyscale magnetometer data; AAA2




15.0nT/cm

N

0 100m

scale 1:1,000 @ A3

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Land off Haine Road
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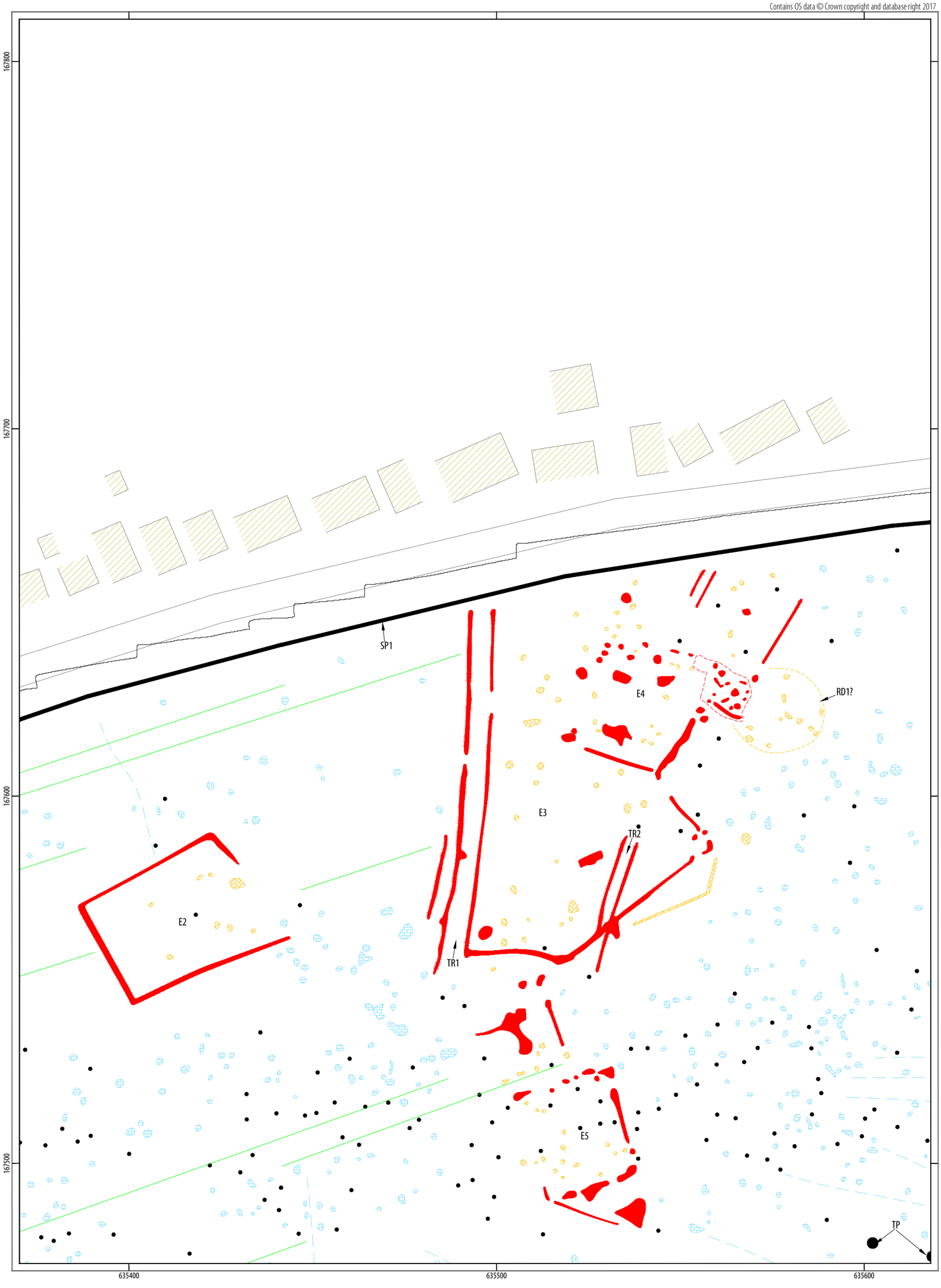
**ILLUS 21** XY trace plot of minimally processed magnetometer data; AAA2




| TYPE OF ANOMALY | INTERPRETATION |
|---|---|
| dipolar isolated | ferrous material |
| dipolar linear | service pipe |
| linear trend | agricultural |
| linear trend | geological variation |
| magnetic enhancement | geology |
| magnetic enhancement | archaeology? |

| TYPE OF ANOMALY | INTERPRETATION |
|---|---|
| magnetic enhancement | archaeology |

| ABBREVIATIONS | |
|---|---|
| E | enclosure |
| RD | ring-ditch |
| SP | service-pipe |
| TP | telegraph pole |
| TR | trackway |

N

0 100m

scale 1:1,000 @ A3

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Land off Haine Road
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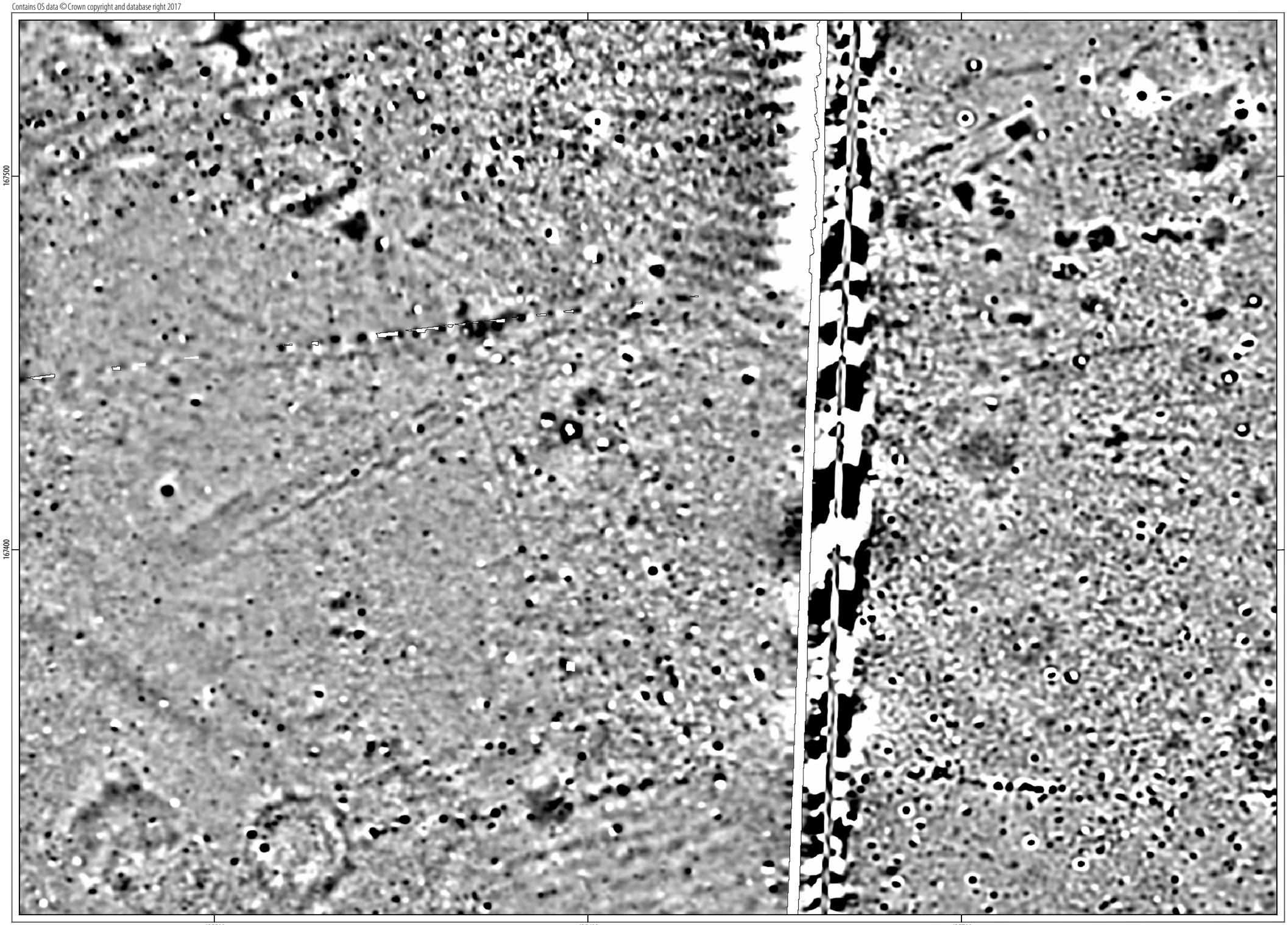
**ILLUS 22** Interpretation of magnetometer data; AAA2




-1.0 nT 2.0

N

0 100m

scale 1:1,000 @ A3

PROJECT HRTK/01
Land off Haine Road
Thanet
Kent

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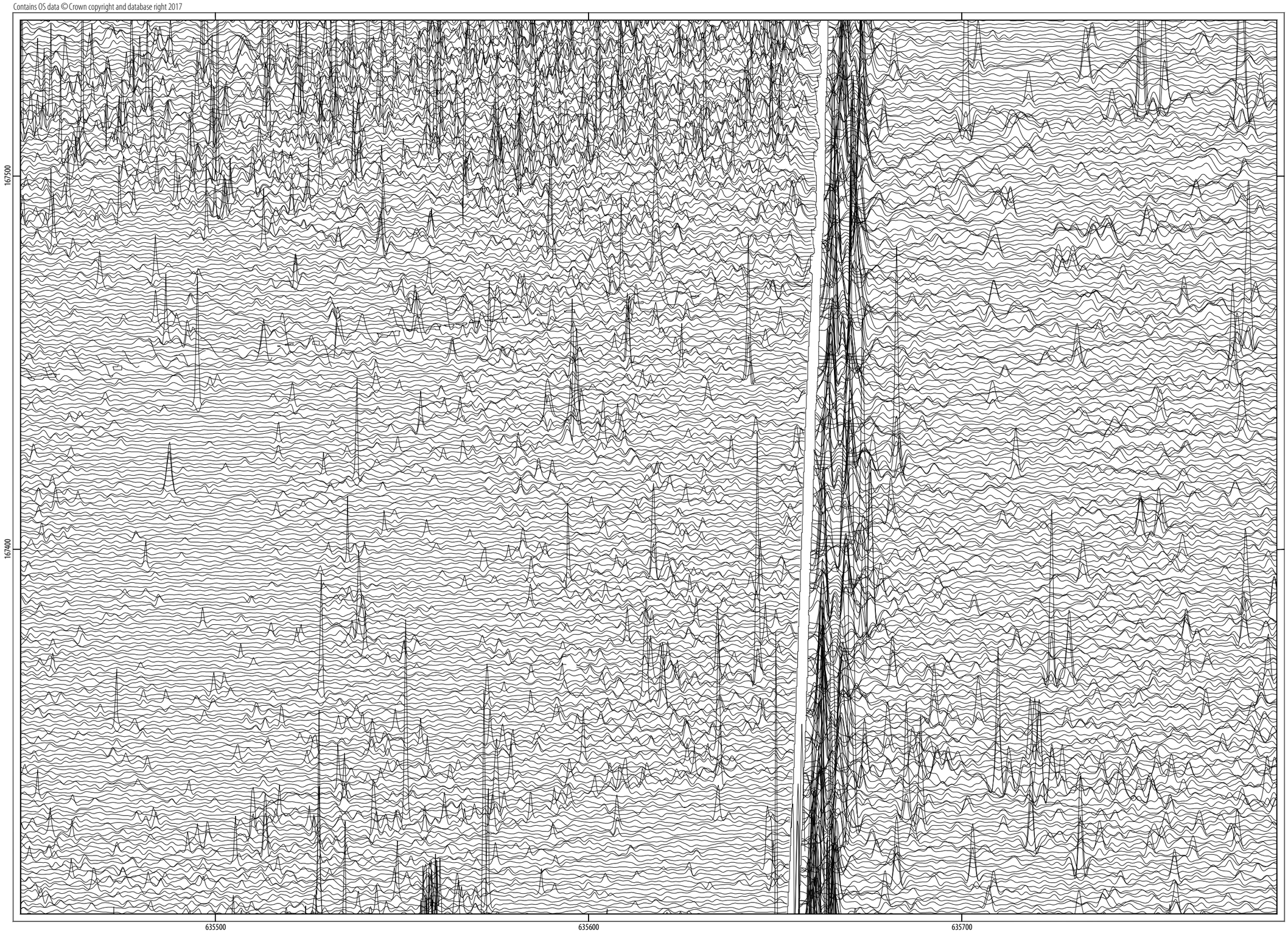
**ILLUS 23** Processed greyscale magnetometer data; AAA3




15.0nT/cm

N

0 100m

scale 1:1,000 @ A3

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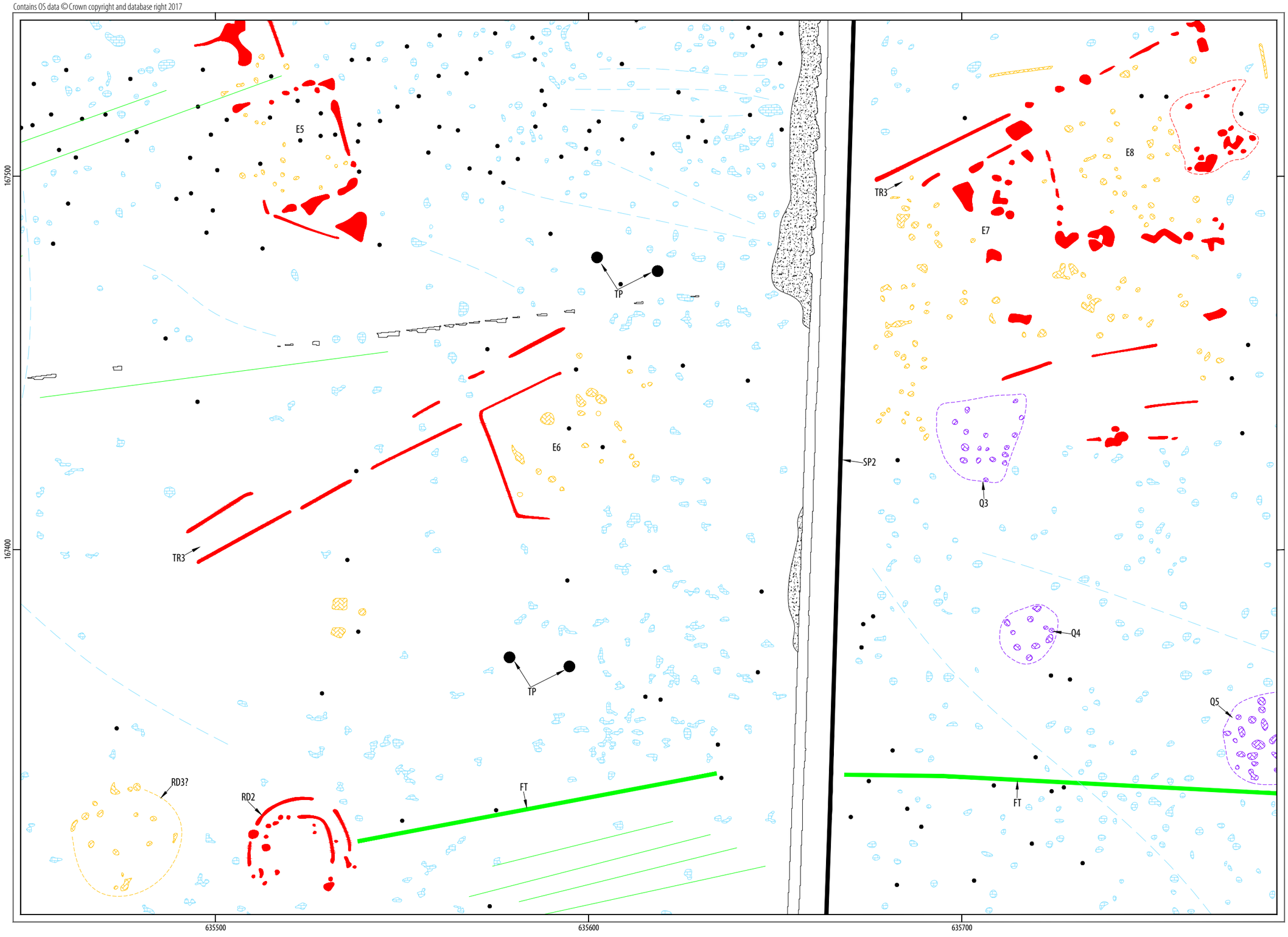
**ILLUS 24** XY trace plot of minimally processed magnetometer data; AAA3




| TYPE OF ANOMALY | INTERPRETATION |
|---|---|
| dipolar isolated | ferrous material |
| magnetic disturbance | ferrous material |
| dipolar linear | service pipe |
| linear trend | agricultural |
| linear | former track |
| linear trend | geology |
| magnetic enhancement | geology |
| magnetic enhancement | quarrying? |
| magnetic enhancement | archaeology? |
| magnetic enhancement | archaeology |

ABBREVIATIONS

| | |
|---|---|
| E | enclosure |
| FT | former track |
| Q | quarry |
| RD | ring-ditch |
| SP | service-pipe |
| TP | telegraph pole |
| TR | trackway |

N

0 100m

scale 1:1,000 @ A3

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Thanet
Kent

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**ILLUS 25** Interpretation of magnetometer data; AAA3

# 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 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: headland5-288433

| PROJECT DETAILS | |
|---|---|
| Project name | LAND OFF HAINE ROAD, THANET |
| Short description of the project | Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey of a 47 hectare site off Haine Road, Thanet, Kent, as part of a baseline assessment of the heritage potential of the site. This information will help guide archaeological strategy in advance of a proposed mixed-use development. The survey has identified three distinct areas of clear archaeological activity including eight enclosures, three trackways and up to three ring-ditches, probably barrows. These areas are assessed as of high archaeological potential. The results of the survey confirm and enhance the archaeological potential of the site as recorded on the Kent Historic Environment Record (HER). A clear correlation has been demonstrated between the archaeological anomalies and the underlying geological conditions with no archaeological anomalies being identified over the Head superficial deposits. It is possible that there is insufficient magnetic contrast in these deposits, or that they are too deep, for soil-filled features to manifest as magnetic anomalies in the data. For this reason, the archaeological potential of the site may be greater than suggested by the survey. |
| Project dates | Start: 09-05-2017 End: 11-05-2017 |
| Previous/future work | Not known / Not known |
| Any associated project reference codes | HRTK - Sitecode |
| 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 (other) | Thanet formation; Head |
| Techniques | Magnetometry |

| PROJECT LOCATION | |
|---|---|
| Country | England |
| Site location | KENT THANET MANSTON LAND OFF HAINE ROAD, THANET |
| Postcode | CT12 5AB |
| Study area | 47 Hectares |
| Site coordinates | TR 3553 6736 51.355749137728 1.383284761596 51 21 20 N 001 22 59 E Point |

| PROJECT CREATORS | |
|---|---|
| Name of Organisation | Headland Archaeology |
| Project brief originator | WYG |

| | |
|---|---|
| Project design originator | Headland Archaeology |
| Project director/manager | Webb, A. |
| Project supervisor | Bishop, R |
| Type of sponsor/funding body | Developer |

| PROJECT ARCHIVES | |
|---|---|
| Physical Archive Exists? | No |
| Digital Archive recipient | In house |
| Digital Contents | "other" |
| Digital Media available | "Geophysics" |
| Paper Archive Exists? | No |

PROJECT BIBLIOGRAPHY 1

| PUBLICATION TYPE | GREY LITERATURE (UNPUBLISHED DOCUMENT/MANUSCRIPT) |
|---|---|
| Title | Land off Haine Road, Thanet, Kent; Geophysical Survey |
| Author(s)/Editor(s) | Harrison, D. |
| Date | 2017 |
| Issuer or publisher | Headland Archaeology |
| Place of issue or publication | Leeds |
| Description | A4 bound report |
| | |
| Entered by | David Harrison (david.harrison@headlandarchaeology.com) |
| Entered on | 26 June 2017 |

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