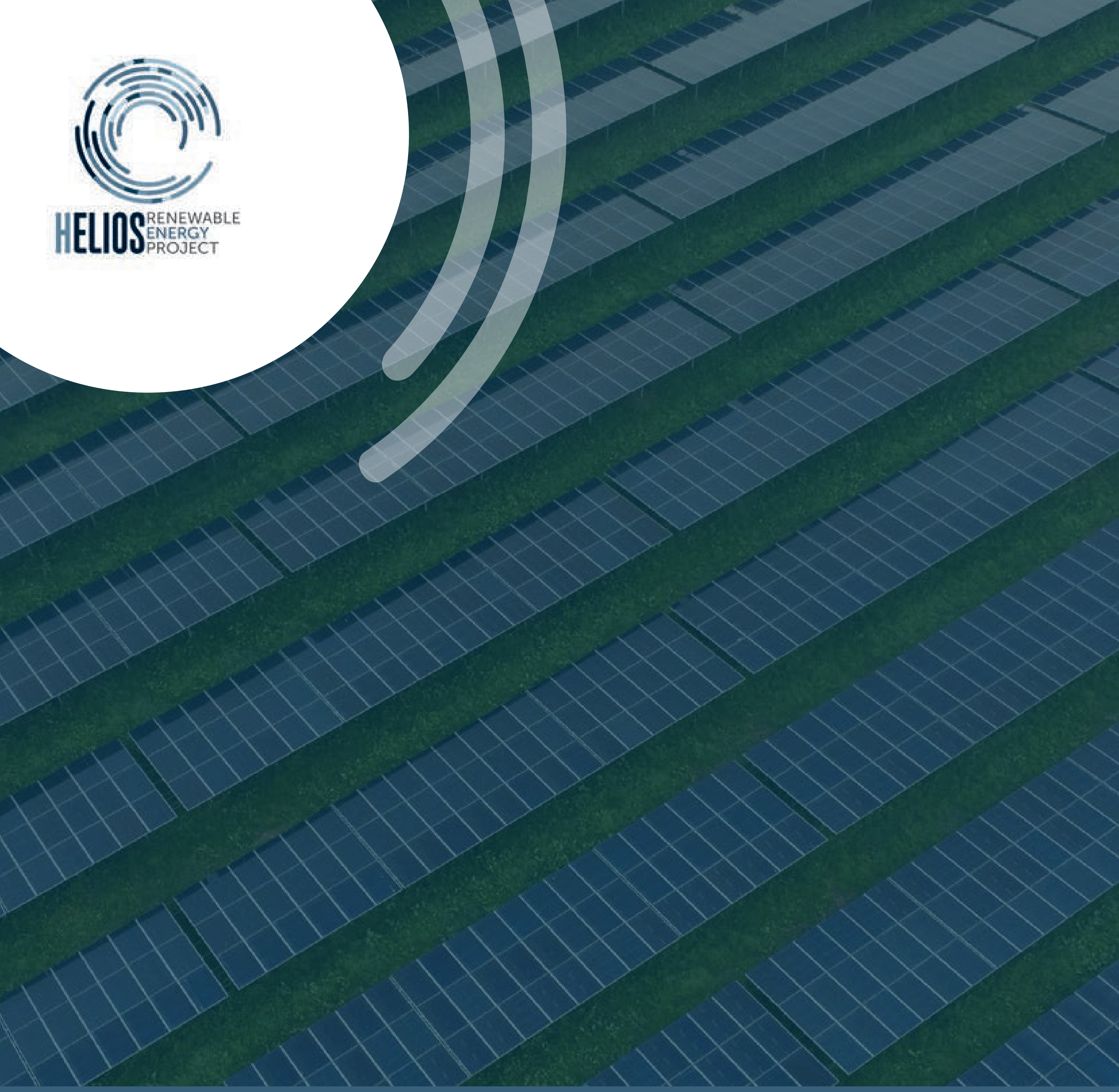

Preliminary Environmental Information Report

Volume 3: Technical Appendices

Chapter 6.3: Archaeological Services West Yorkshire Archaeological Service (ASWYAS) Geophysical Survey

WYAS Archaeological Services

Helios Renewable Energy Project, Camblesforth North Yorkshire

Geophysical Survey

Report no. 3975
September 2023

Client: Enso Energy

Helios Renewable Energy Project, Camblesforth, North Yorkshire

Geophysical Survey

Summary

A geophysical (magnetometer) survey was undertaken on approximately 530 hectares of land located to the northwest of Camblesforth known as the Helios Renewable Energy Project. The majority of the anomalies recorded are agricultural including field drains, medieval or post-medieval ridge and furrow cultivation, modern ploughing and former field boundaries. Archaeological and possible archaeological responses have been recorded within the study which comprise linear ditches and trends, rectilinear enclosures and sub-circular trends, perhaps indicative of settlement activity. Based on the geophysical survey, the archaeological potential of this Site is deemed to be high in the areas of likely settlement and low elsewhere.

WYAS Archaeological Services

Report Information

Client:	Enso Energy
Report Type:	Geophysical Survey
Location:	Camblesforth
County:	North Yorkshire
Grid Reference:	SE 64168 25505
Period(s) of activity:	?Prehistoric - modern
Report Number:	3975
Project Number:	XF70
Site Code:	HLO22
OASIS ID:	archaeol11-515749
Date of fieldwork:	July 2022 – January and Sugust 2023
Date of report:	September 2023
Project Management:	Emma Brunning BSc MCIfA
Fieldwork:	Emma Brunning Jake Freeman BA Amy Chatterton BSc MA Claire Stephens BA Jacob Hurst Myszor BA Haydyn Evans BA MA Alex Davies
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1 Introduction

Archaeological Services ASWYAS has been commissioned by Pegasus Group Ltd on behalf on Enso Energy to undertake a geophysical survey for the Helios Renewable Energy Project, Camblesforth, North Yorkshire. This was undertaken in line with current best practice (CIfA 2020; Schmidt *et al.* 2015). The survey was carried out between 21st July 2022 and 4th January 2023 with a return visit in August 2023 to complete the survey after harvest was completed.

Site location, topography and land-use

The Site is located at SE 64168 25505 (approximate centre), comprising 475.68ha in which 530ha of land (survey area) was surveyed due to changes of the Site boundary during the fieldwork. The Site is situated to the northwest of Camblesforth, North Yorkshire see Fig. 1).

The Site is primarily located to the northwest of Camblesforth village with land consisting of pasture, arable and rough ground. Railway lines lie to both the west and southeast of the Site with the A1401 to the north and Hirst Road to the south. The Site is relatively flat across its entirety laying between 3m and 6m aOD (above Ordnance Datum).

Soils and geology

The recorded bedrock geology comprises Triassic Rocks (undifferentiated), a sedimentary bedrock consisting of interbedded sandstone and conglomerate that formed approximately 200 to 251 million years ago in the Triassic Period. Superficial deposits have been recorded as Lacustrine Deposits – Clay, formed up to 3 million years ago in the Quaternary Period. (BGS 2022). Soils across site are variable, however the primary soil type is described as Everingham association (821a) which are typical sandy gley soils. Soil described as Sessay association (831a) which are typical cambic gley soils are present in the southwest of site, and to the east of site are soils described as Foggathorpe 2 association (712i), described as Pelo-stagnogley soils (SSEW 1983).

2 Archaeological Background

The following archaeological background has been summarised from available online sources (Heritage Gateway 2022) and previous investigations within a 1km radius, from the centre of the Site.

Previous works within the vicinity of Site include a geophysical survey by ASWYAS (Trace 2021) of approximately 110 hectares of land to the north of Camblesforth which detected a square enclosure and a small array of possible archaeological features including a possible ring ditch, in addition to former field boundaries and a former railway line.

Further geophysical survey was carried out in 2014, on land near the Site as part of the Thorpe Marsh gas pipeline (Lefort 2014) which identified a number of archaeological anomalies including a sub-rectangular enclosure, at least two ring ditches and several isolated pits.

There are several instances of cropmarks visible on aerial photographs, both within the boundaries of the Site and within 1km proximity. These are primarily of a proposed Romano-British or Iron Age date, with a small amount of possible medieval features. The first instance consists of an area of Possible medieval settlement in the form of toft property boundaries and associated field boundaries to the south of the A104. The second instance consists of an area of proposed Romano-British settlement to the west of Station Road, with features comprising a rectilinear enclosure, roughly square-shaped, measuring approximately 40m by 40m, with fragmentary remains of others to the east, and a ditched trackway on the west. Approximately 0.2km west of the second instance, just outside of the Site boundary, further similar cropmarks likely to be Iron Age or Roman fragmentary rectilinear ditched enclosures and associated boundaries are visible on aerial photographs.

To the north of Sandwith Lane, cropmarks show a possible linear settlement of Roman date to the west and east of Quosquo House. It shows as an elongated series of enclosures to the west of Quosquo House, approached by a wide funnel entrance from the east, and more fragmentary enclosures adjacent to Rosehill Farm. In places the enclosures are overlain by field boundaries of medieval date. Further cropmarks including an elongated rectilinear enclosure to the southeast of Quosquo Hall have been recorded on aerial photographs. The enclosure is of uncertain date and function, but it follows a different alignment to the adjacent medieval field boundaries, and is presumably of different date.

The moated grange of Drax Abbey (MID 57932) has been recorded to the north of the survey area, to the immediate northeast of Camblesforth. It was associated with the Augustinian order and has been lost under later developments.

To the east of Camela Lane, approximately 0.7km to the northeast of the survey area, a Royal Observer Corp monitoring post has been recorded (MID 1415781). During the Defence of Britain Survey, the condition of the structure was considered to be good.

3 Aims, Methodology and Presentation

The aims and objectives of the programme of geophysical survey were to gather sufficient information to establish the presence/absence, character and extent, of any archaeological remains within the specific area and to inform an assessment of the archaeological potential of the Site. To achieve this aim, a magnetometer survey covering all amenable parts of the Site was undertaken (see Fig. 2). At the time of survey, the majority of the fields had been recently harvested which made conditions for data collection good.

The general aims of the geophysical survey were:

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

Magnetometer survey

The cart-based survey was undertaken using an eight channel SenSYS MX V3 system containing eight FGM650 sensors. Readings are taken every 20MHz (between 0.05 and 0.1m). Data were recorded onto a device, using a Carlson GNSS Smart antenna, for centimetre accuracy. These readings were stored in the memory of the instrument and downloaded for processing and interpretation. DLMGPS and MAGNETO software, alongside bespoke in-house software was used to process and present the data. Further details are given in Appendix 1.

Reporting

A general Site location plan, incorporating the 1:50000 Ordnance Survey (OS) mapping, is shown in Figure 1. Figure 2 shows the location of the survey area at a scale of 1:12,500. Figures 3 to 14 show overviews of the data at a scale of 1:7500. Processed and minimally processed data, together with interpretation of the survey results are presented in Figures 15 to 80 inclusive at a scale of 1:1500.

Technical information on the equipment used, data processing and survey methodologies are given in Appendix 1. Technical information on locating the survey area is provided in Appendix 2. Appendix 3 describes the composition and location of the archive. A copy of the completed OASIS form is included in Appendix 4.

The survey methodology, report and any recommendations comply with guidelines outlined by the European Archaeological Council (Schmidt *et al*. 2015) and by the Chartered Institute for Archaeologists (CIfA 2020). All figures reproduced from Ordnance Survey mapping are with the permission of the controller of His Majesty’s Stationery Office (© Crown copyright).

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

4 Results and Discussion (see Figures 15 to 80)

Ferrous anomalies and magnetic disturbance

Ferrous anomalies, as individual ‘spikes’, or as large discrete areas 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 or material is common on rural sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious pattern or clustering to their distribution anywhere within the total survey area to suggest anything other than a random background scatter of ferrous debris in the plough-soil.

Magnetic disturbance along the limits and internal boundaries of the survey areas are due to metal fencing within the field boundaries and interference from the adjacent roads.

Linear dipolar[1] trends have been recorded in Fields 21-24 (Figs. 54-62), 37 and 38 (Figs. 75-80) which relate to service pipes. The magnetic halo which has been produced in Fields 24, 37 and 38 is quite large and as such will have masked any features, if present.

Overhead power cables have caused interference within the data which can be seen in the northwest of Field 17 (Figs. 39-41).

Geological anomalies

The survey has detected anomalies that have been interpreted as geological in origin. It is thought that the responses have been detected because of the variation in the composition and depth of the deposits of superficial material in which they derive.

Sinuous[2] responses in Fields 5 (Figs. 21-23), 9-10 (Figs. 24-32), 30 and 31 (Figs. 66-68) may be associated with former palaeochannels or natural drainage channels.

Agricultural anomalies

At least 59 former field boundaries (**FB1** – **FB59**) have been recorded throughout the survey area. Most of these boundaries correspond to historic mapping dating from 1908 and are still visible on the historic map published in 1958 (NLS 2023). Boundaries **FB11** and **FB12** in Field 9 (Figs. 24-26) do not appear on historic mapping but aerial imagery from 2022 (Google Earth 2023) clearly show a number of boundaries within this field, many of which haven’t been recorded within the magnetic data.

[1] Magnetically strong positive and negative responses

[2] Anomalies which twist and curve

Field drains can be seen within most of the fields. They are of differing magnetic strength which is likely to be associated with the construction material of the drains. Those that are particularly strong such as in Fields 7 (Figs. 27-29) and 18 (Figs. 42-47) are likely to be of a fired clay construction.

Possible medieval or post-medieval ridge and furrow cultivation has been recorded within Fields 18 (Figs 42-47), 20 (Figs 48-50), 24 (Figs. 6-62), 28-30 (Figs. 66-68) and 33 (Figs. 69-71).

Other parallel linear trends can be seen within all areas and are associated with modern ploughing. Only a selection of these have been highlighted on the interpretation diagrams to show the direction of the plough lines.

Uncertain anomalies

A handful of anomalies within the dataset have been interpreted as having an uncertain origin. Linear responses in Fields 1 (Figs. 21-23), 5 (Figs. 27-29), 12 (Figs. 33-35), and 38 (Figs. 78-80) are likely to represent former field boundaries pre-dating available historic mapping.

A number of responses (**U1**) in Field 9 (Figs. 24-32) have been difficult to interpret. These responses have a slightly different magnetic signature and are on a different alignment to the nearby drains, former field boundaries and possible archaeological responses, and may also be of archaeological origin. Their magnetic strength is stronger than the nearby possible archaeological responses and their shape is more distinctly linear which suggests these may be a much more modern anthropogenic feature, although an older archaeological or agricultural explanation cannot be ruled out.

Fragmentary linear parallel trends in the east of Field 24 (Figs. 60-62) are likely to be ploughing responses but as only a handful have been recorded and their alignments slightly differ, an uncertain interpretation has been given. They may also represent desiccation cracks within the soil.

Pit-like anomalies have been recorded along the length of **P12** within Field 24 (Figs. 60-62). The pit-like responses have a strong magnetic signature and may be of some archaeological interest although the interpretation remains uncertain due to how different the shape and magnetic signature are compared with those of **P12**. There is also a possibility that the pit-like anomalies may simply mask parts of **P12** and otherwise be unrelated.

A pair of rectilinear areas of increased response (**U2**) in Field 24 (Figs. 60-62) have a particularly strong response and clear rectangular character, although they are partially masked by the strong dipolar ‘halo’ caused by a service pipe directly to the north. These are not marked on any available mapping or visible on satellite imagery and may represent small enclosures, in-filled ponds, or even structural remains but no interpretation can be assigned with certainty.

Possible and definite archaeological anomalies

Anomalies of both a definite and possible archaeological origin have been recorded throughout the dataset, some of which correspond to known cropmarks, along with others adding further detail to the known archaeological record. These anomalies include enclosures and trackways, likely dating from the late prehistoric through to Romano-British period. Anomalies which have been highlighted on the interpretation diagrams are discussed below.

The most prominent archaeological responses are centred within the north of Field 8 (Figs. 21-23). The anomalies are visible as a pair of ‘D’ shaped enclosures with associated trackways and an appended rectangular enclosure. The first enclosure (**A1**) measures 32m by 37m and contains multiple internal features suggesting settlement activity. The eastern boundary of enclosure **A1** sits parallel to another linear approximately 4m to its east to form a short trackway which leads into a partial rectangular enclosure (**A2**) below. Rectangular enclosure **A2** measures approximately 28m by 33m and also contains internal features and is highly likely to be contemporaneous with **A1**. Directly north of **A1** a weakly responsive pair of linear anomalies that intersect to form a right angle have been detected (**P5**). These have only been given a possible designation despite their shape due to the weakness of their magnetic response, and their alignment and similarity with agricultural trends within the same field.

Northeast of **A1**, responses which form a second partial D shaped enclosure (**A3**) have been detected, measuring 30m by 38m. The eastern length of enclosure has a much stronger magnetic strength than either the southern or fragmentary northwestern lengths detected but are all very likely to be contemporaneous with each other and also with **A1** and **A2** due to similarities in their sizes, appearances, and character. Another short length of trackway is also visible within the northeast of Field 8 where a strongly magnetic linear approximately 7m to the east of **A3** forms the parallel alignment of trackway with the eastern length of **A3**.

Within Field 5 (Figs. 21-23), short well-defined linear anomalies (**A4**) and some weaker linear trends form a rectilinear pattern. These may represent part of a small enclosure appended to an old boundary which may be contemporaneous with features **A1**, **A2**, and **A3** within Field 8 to the east. The weaker responses here are roughly aligned with modern ploughing trends and share a similar magnetic strength, so a cautious ‘possible’ archaeological designation has been assigned to these. Within the eastern boundary of Field 8 (Figs. 21-23), a pair of magnetically positive linear responses (**P6**) form a right angled ‘corner’ measuring 20m along the SW-NE axis and 8m along the NW-SE axis. These responses line up very well with linear responses which make up both **A1** and **A2** across the western boundary of Field 8. Whilst it is likely this could be a continuation of these enclosures, the interference from the modern road that separates Field 5 and Field 8 prevents a firmer interpretation.

Within the north of Field 38 (Figs. 78-80), a sub-rectangular enclosure (**A5**) measuring approximately 50m by 22m has been detected. A strong circular response (**A6**) can be seen in the eastern corner of enclosure **A5** and measures approximately 4.5m in diameter. It is likely the response represents a contemporaneous internal ring ditch.

A trapezoid shaped set of linear responses (**A7**) measuring approximately 59m by 41m is located within Field 32 (Figs. 63-65), continuing over the western boundary of the field into Field 26, and is likely to represent an enclosure. A strong curvilinear response (**A8**) has been detected within the narrower southern end of the trapezoid linear responses and measures approximately 12m. It is likely the response represents a contemporaneous internal feature within **A7**. A short south aligned linear anomaly (**A9**) has been detected adjoined to the southern corner of **A7** and measures approximately 25m before petering out. The linear anomaly (**A9**) may continue although responses beyond the 25m stretch have been given a possible designation due to the change in magnetic strength and fragmentation of the linear beyond this point.

Two areas of possible archaeological activity (**P3**, and **P4**) have been detected within the intersections of Fields 2 and 3 (Figs. 15-17). These anomalies appear as linear and rectilinear alignments and are present within the southwestern corner of Field 2 (**P3**), and the northwestern corner of Field 3 (**P4**). Collectively they appear to form part of a small complex of possible archaeology. Whilst there are strongly magnetic anomalies within the responses here, there are also several weaker trends at the field edges which appear to form rectilinear patterns also. Due to the magnetic disturbance within the field boundaries, the variations in the strength and character of the detected anomalies, and both axes of the rectilinear responses aligning with modern ploughing regimes, only a possible archaeological designation can be reached.

Similar to the previously mentioned **P5** within Field 8, there are other faintly responsive intersecting linear anomalies across the survey area which intersect at a right angle creating what appears to be a corner of enclosure. These responses can be seen in **P6** (Field 9; Figs. 24-26)) and **P8** (Field 31; Figs. 66-68). Unlike **P5**, none of these are within proximity to definitive archaeological responses and an agricultural or other anthropogenic cause cannot be ruled out, however their magnetic strengths, shape and dimensions are all very similar to each other and as such they have been designated similarly.

A varied cluster of possible archaeological responses have been detected within Field 36 (Figs. 72-74). The majority of the responses here appear as fragmentary and magnetically weak intersecting linear anomalies (**P10**) with some individual ‘blotch’ responses that differ from nearby examples of ferrous responses. A semi-circular anomaly (**P9**) directly west of

P10 has also been designated as a possible archaeological response due to its shape and magnetic strength, although a geological or agricultural explanation cannot be ruled out.

Several linear anomalies have been detected across the entirety of site which have been assigned a possible archaeological designation due to a number of factors including their magnetic strength, shape and character, proximity to definitive archaeological responses, and their difference to other surrounding features. Each of **P1** (Field 1; Figs 15-17)), **P2** (Field 2; Figs. 15-17)), **P7** (Field 10; Figs 30-32), and **P12** (Field 23; Figs 60-62) fit within this definition, as these responses may have an archaeological explanation but cannot be ruled out as unmapped former field boundaries or stronger agricultural trends.

5 Conclusions

The geophysical survey has detected a number of magnetic anomalies associated mainly with an agricultural landscape including former field boundaries, medieval/post-medieval ridge and furrow cultivation, modern ploughing and land drains. Archaeological and possible archaeological responses have been recorded within the study which comprise linear ditches and trends, rectilinear enclosures and sub-circular trends, perhaps indicative of settlement activity.

Magnetic disturbance within the dataset can be attributed to adjacent modern buildings, demolition material and metal fencing within field boundaries. A large service pipe has also been recorded in the east of the survey area.

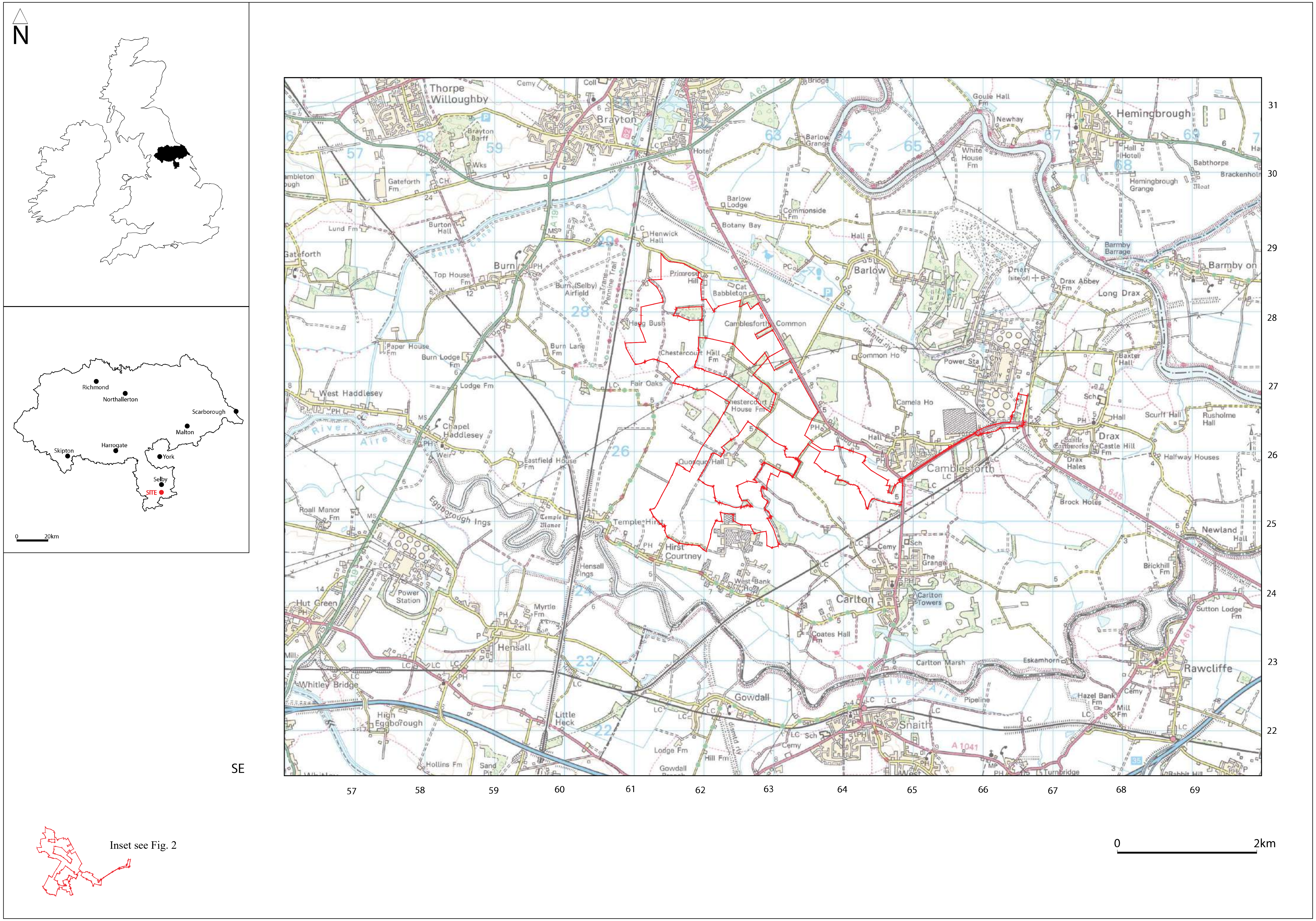
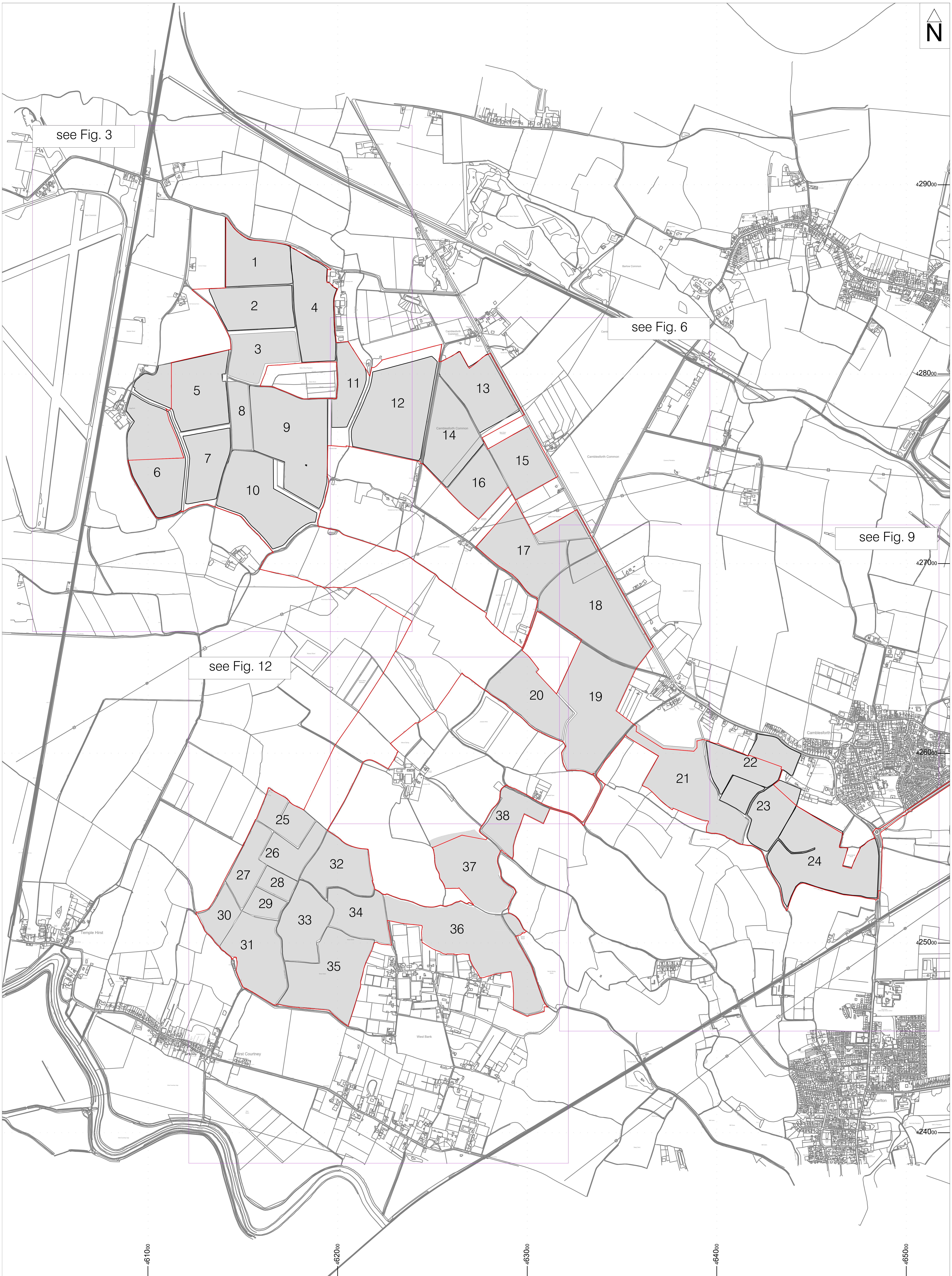


Fig. 1. Site location



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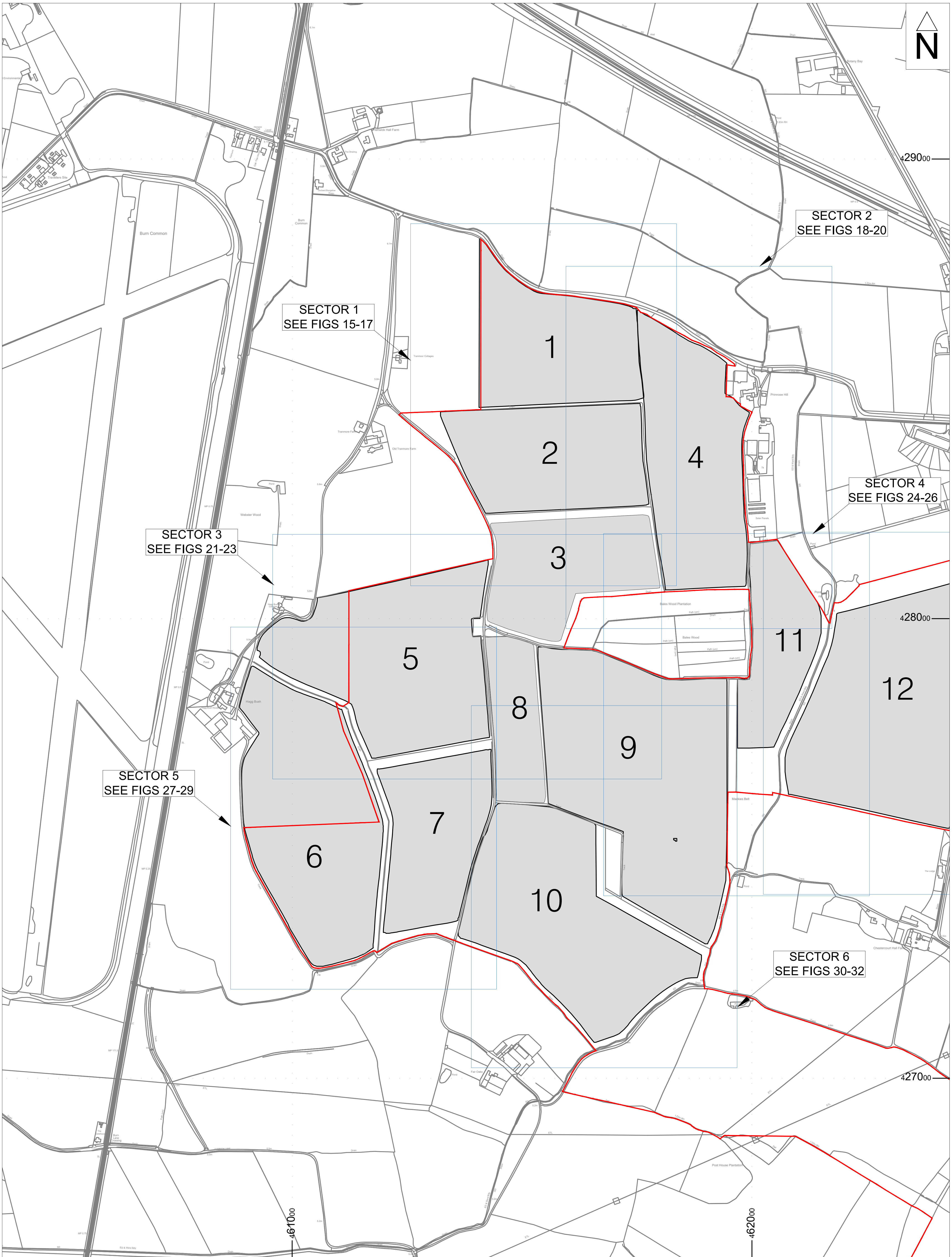
Project ID: XF70_HLO22

Location of survey areas

Fig. 2

Title

(red box)	DEVELOPMENT AREA
12	FIELD NUMBERS
(blue box)	SECTOR BOUNDARY
(purple box)	PARCEL AREA



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Location of survey areas 1 - 11

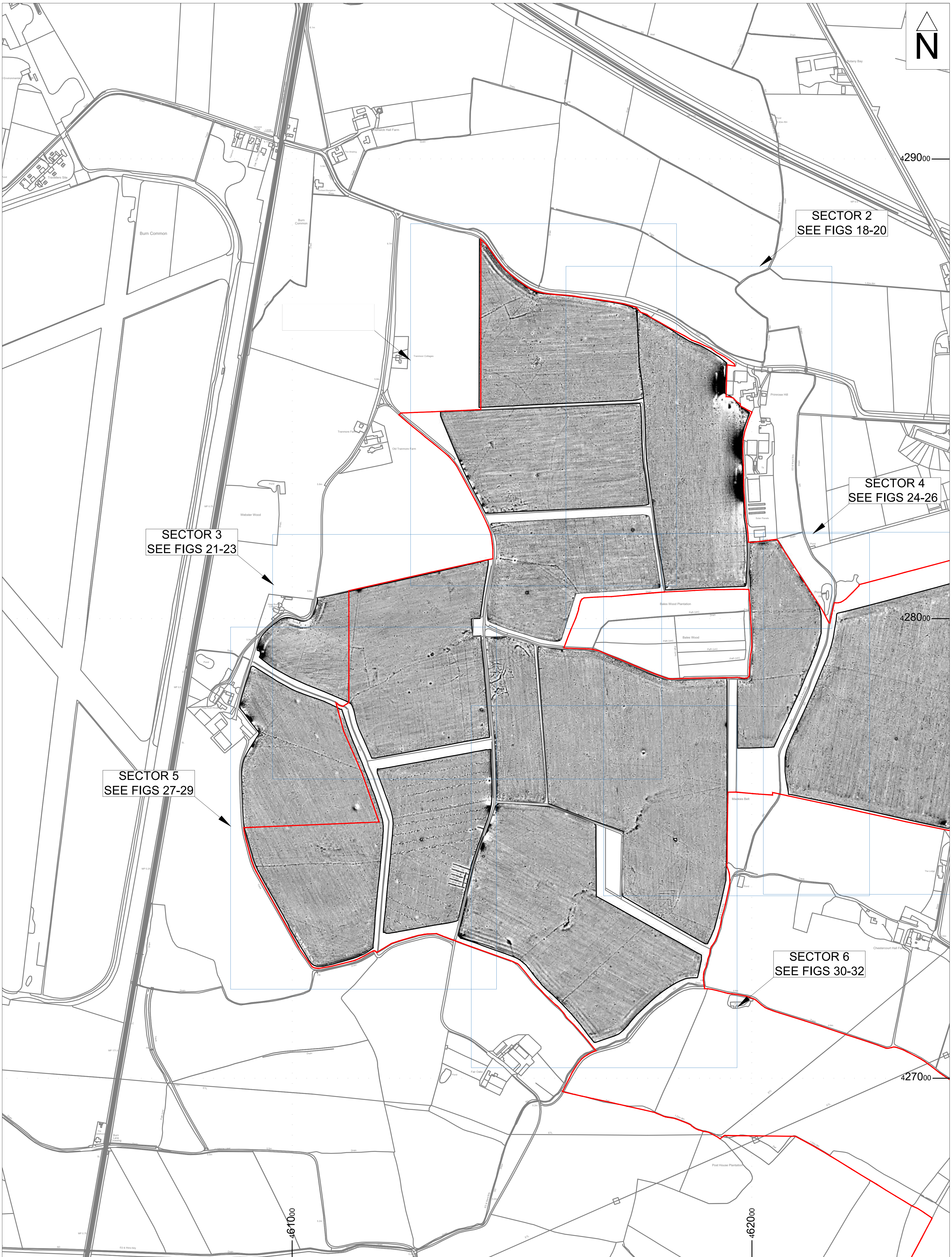
Fig. 3

Title

	DEVELOPMENT AREA
12	FIELD NUMBERS
	SECTOR BOUNDARY

0 250m

1:7500 @ A3



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Processed greyscale magnetometer data: Areas 1 - 11

Fig. 4

Title

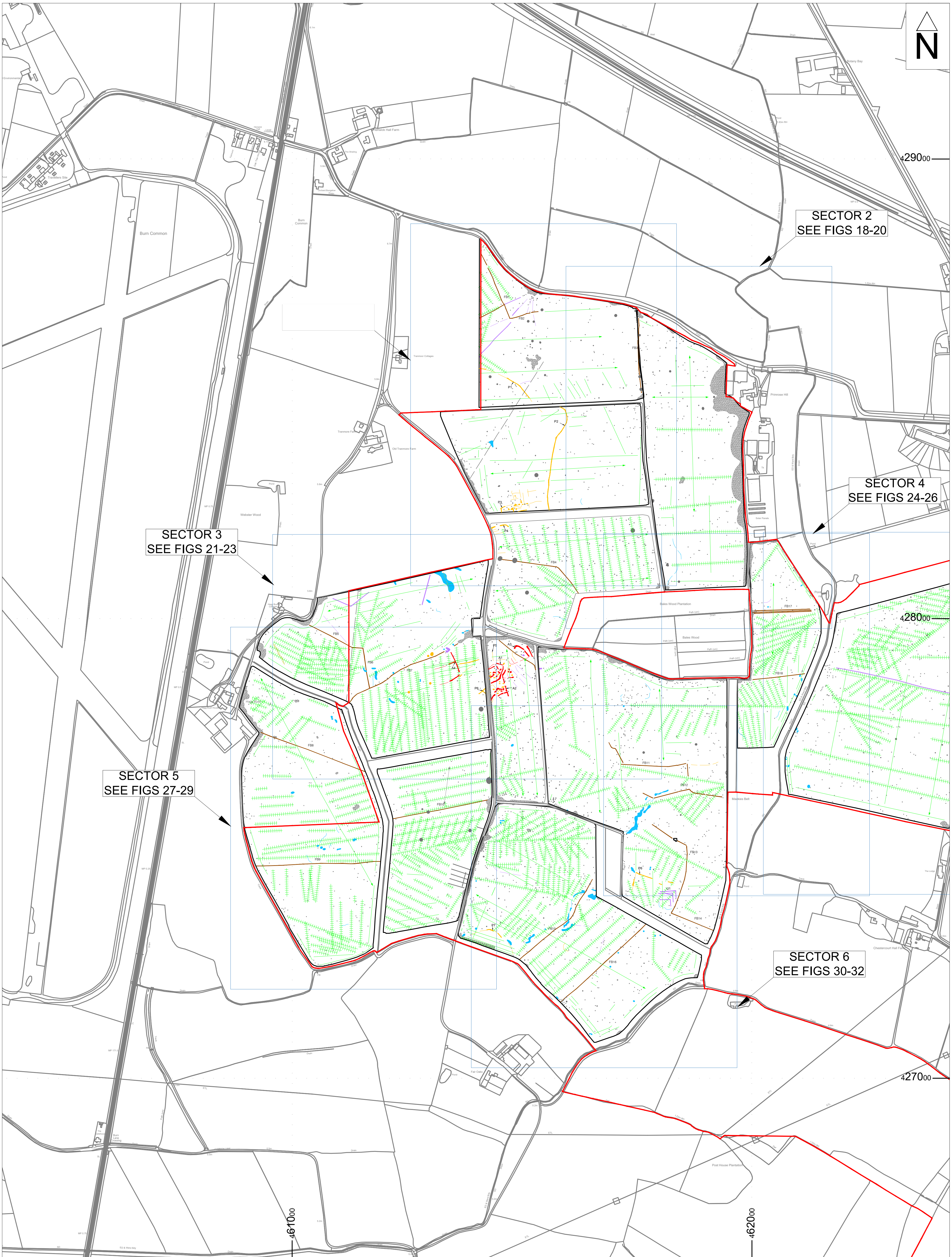
DEVELOPMENT AREA

SECTOR BOUNDARY

nT -1.0 2.0

0 250m

1:7500 @ A3



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Interpretation of magnetometer data: Areas 1 - 11

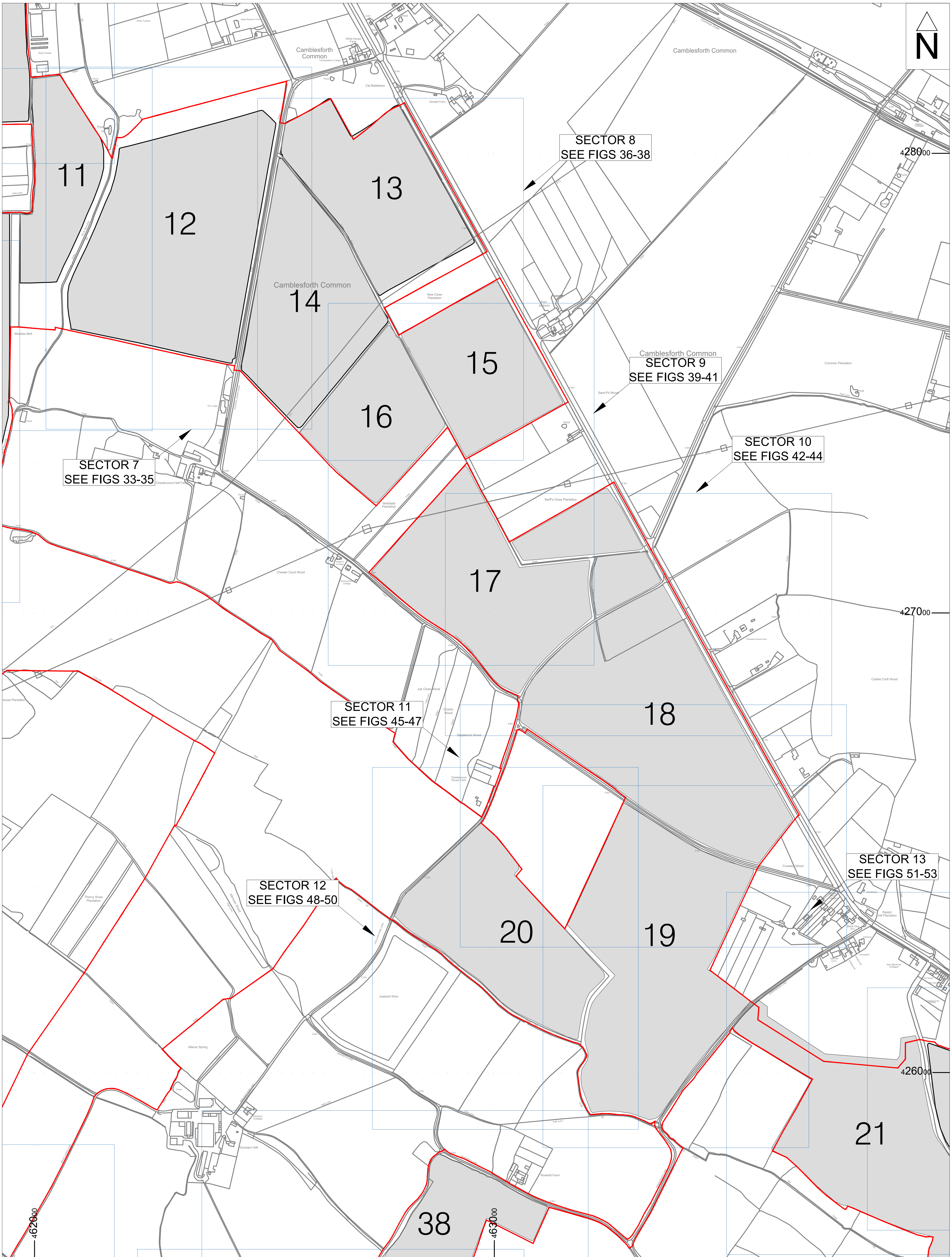
Fig. 5

Interpretation

FERROUS	AGRICULTURAL	UNCERTAIN
SERVICE PIPE	FORMER FIELD BOUNDARY	ARCHAEOLOGY?
MAGNETIC DISTURBANCE	GEOLOGY	ARCHAEOLOGY
FIELD DRAIN		

0 250m

1:7500 @ A3



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Location of survey areas 12 - 20

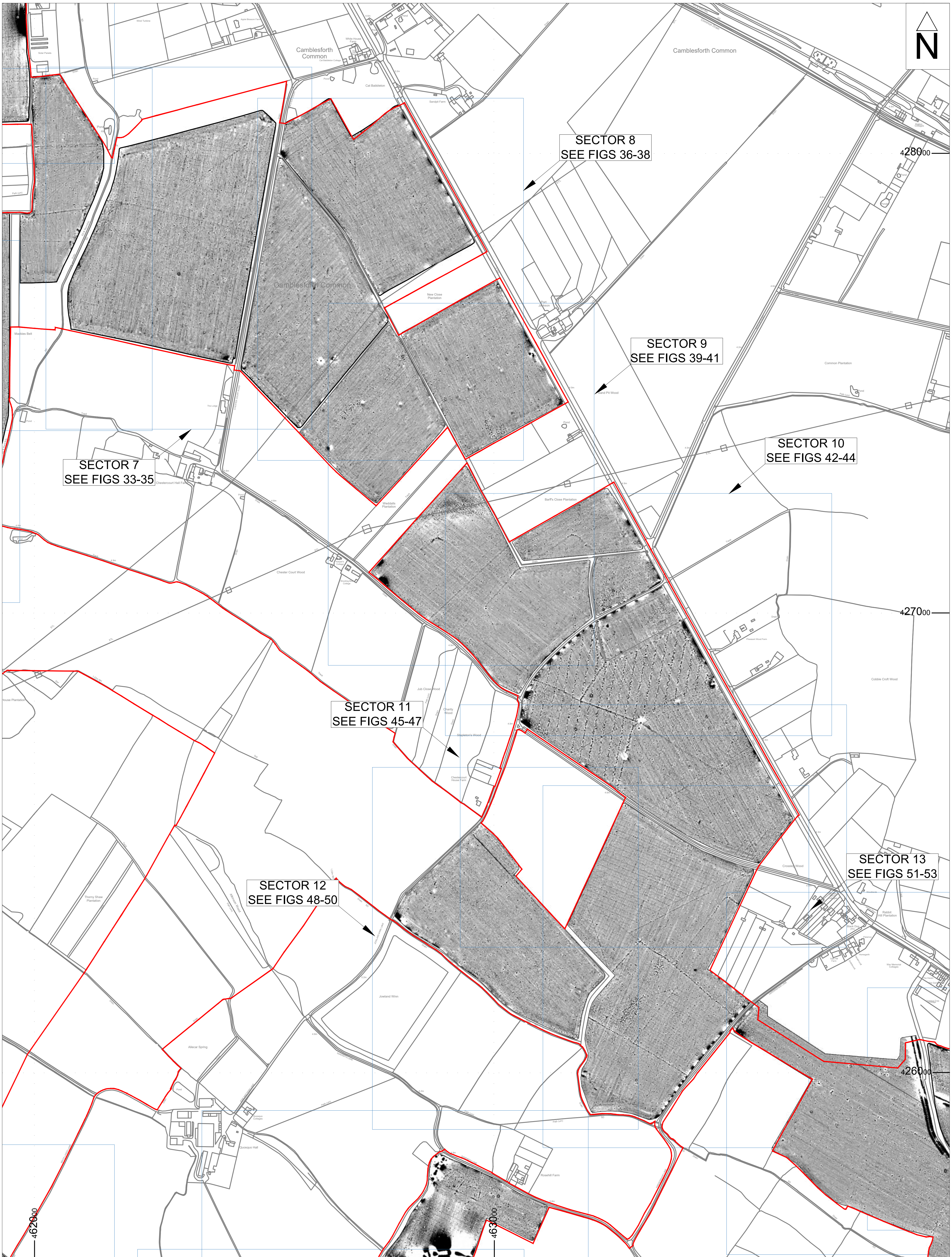
Fig. 6

Title

	DEVELOPMENT AREA
12	FIELD NUMBERS
	SECTOR BOUNDARY

0 250m

1:7500 @ A3



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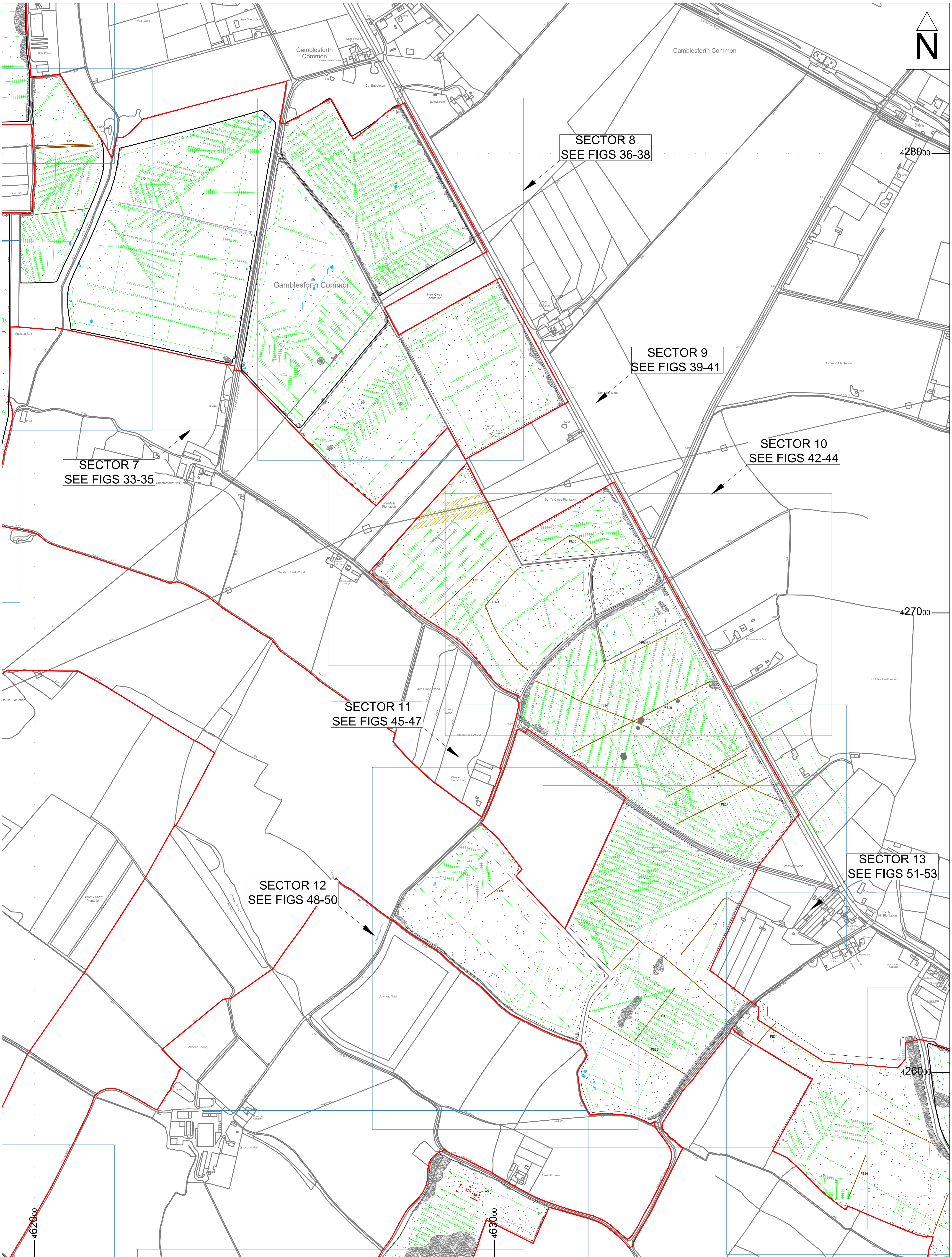
Processed greyscale magnetometer data: Areas 12 - 20

Fig. 7



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Interpretation of magnetometer data: Areas 12 - 20

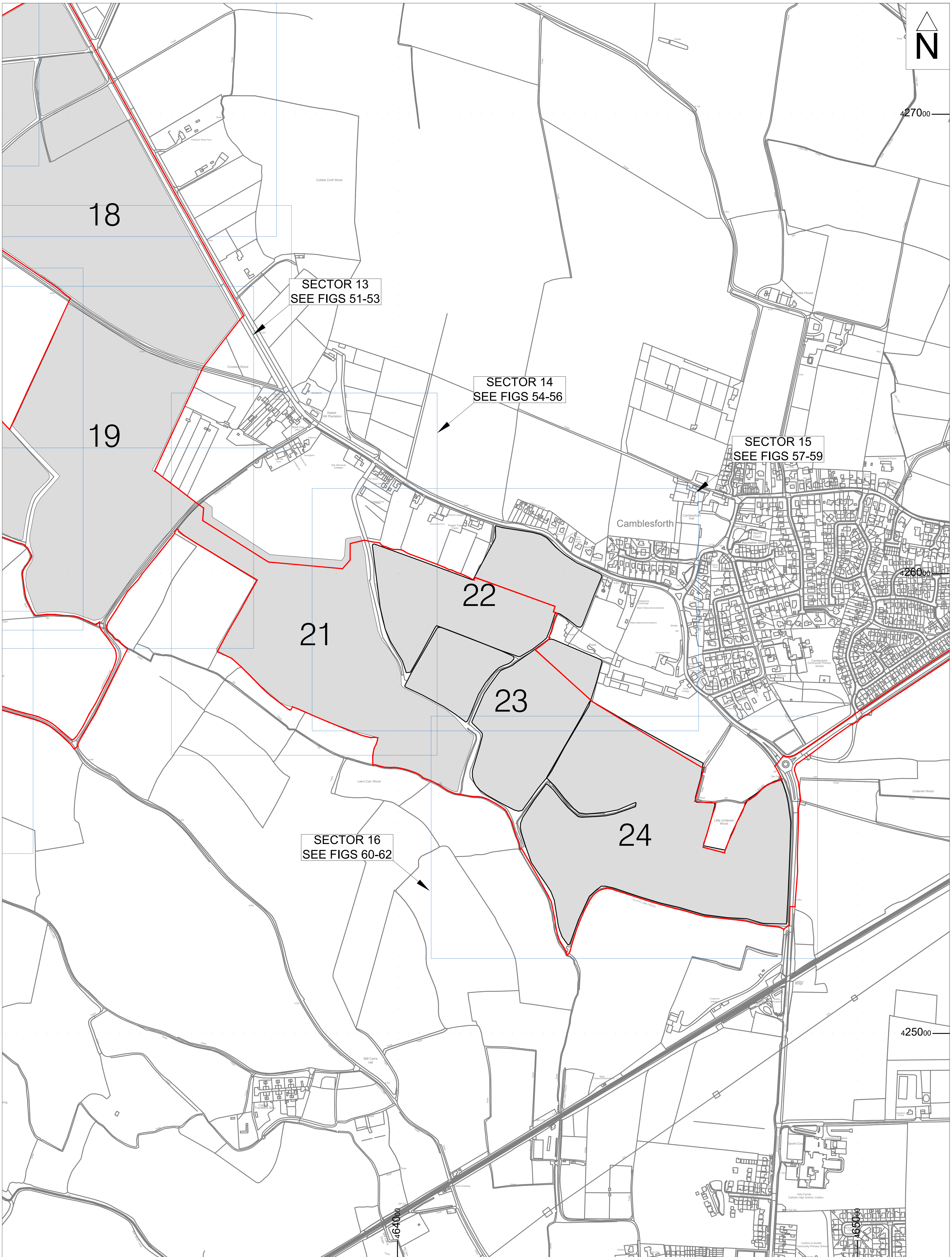
Fig. 8

Interpretation

FERROUS	RIDGE & FURROW	GEOLOGY
SERVICE PIPE	FIELD DRAIN	UNCERTAIN
MAGNETIC DISTURBANCE	AGRICULTURAL	ARCHAEOLOGY?
OVERHEAD CABLES	FORMER FIELD BOUNDARY	ARCHAEOLOGY

0 250m

1:7500 @ A3



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Location of survey areas 21 - 24

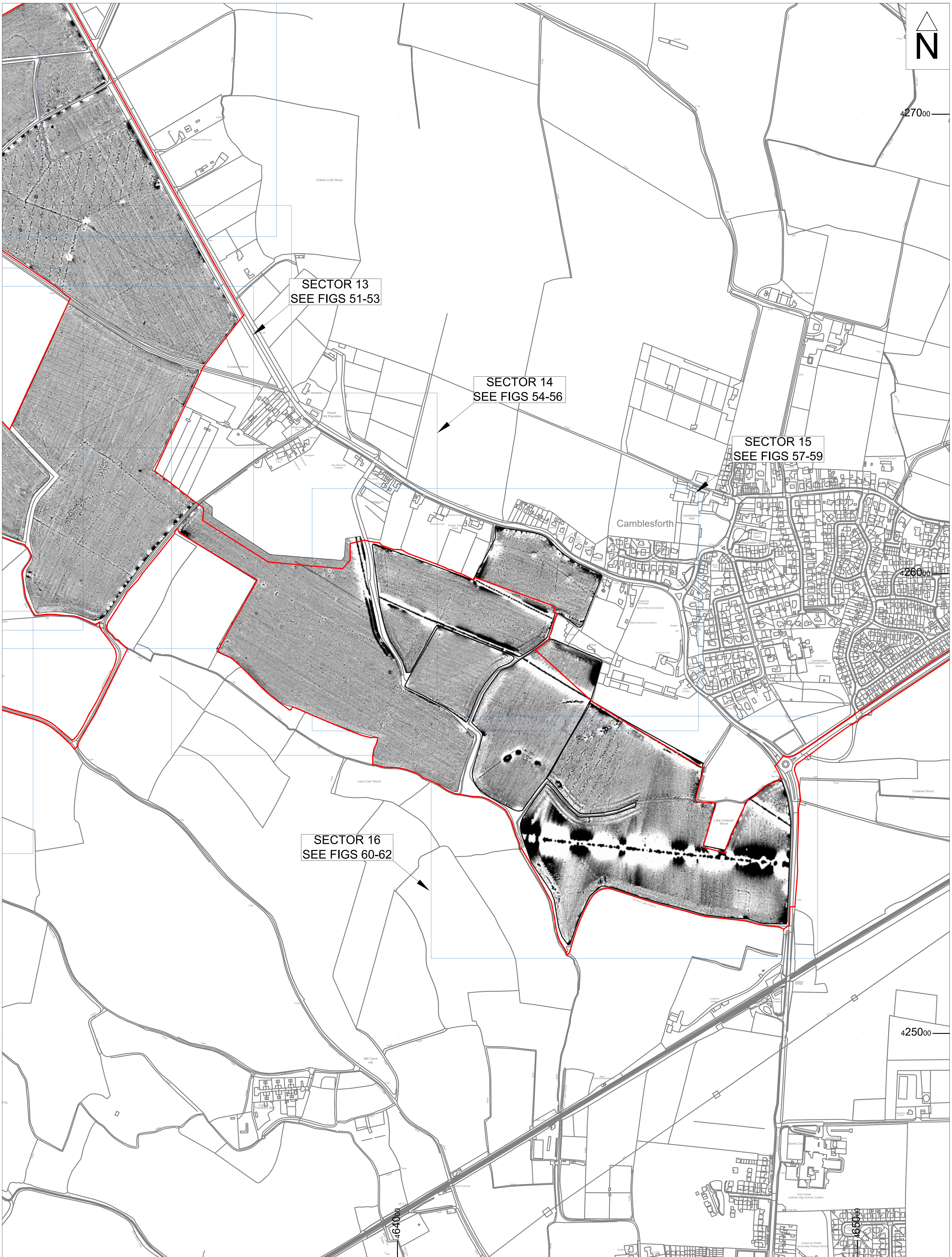
Fig. 9

Title

	DEVELOPMENT AREA
12	FIELD NUMBERS
	SECTOR BOUNDARY

0 250m

1:7500 @ A3



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Processed greyscale magnetometer data: Areas 21 - 24

Fig. 10

Title

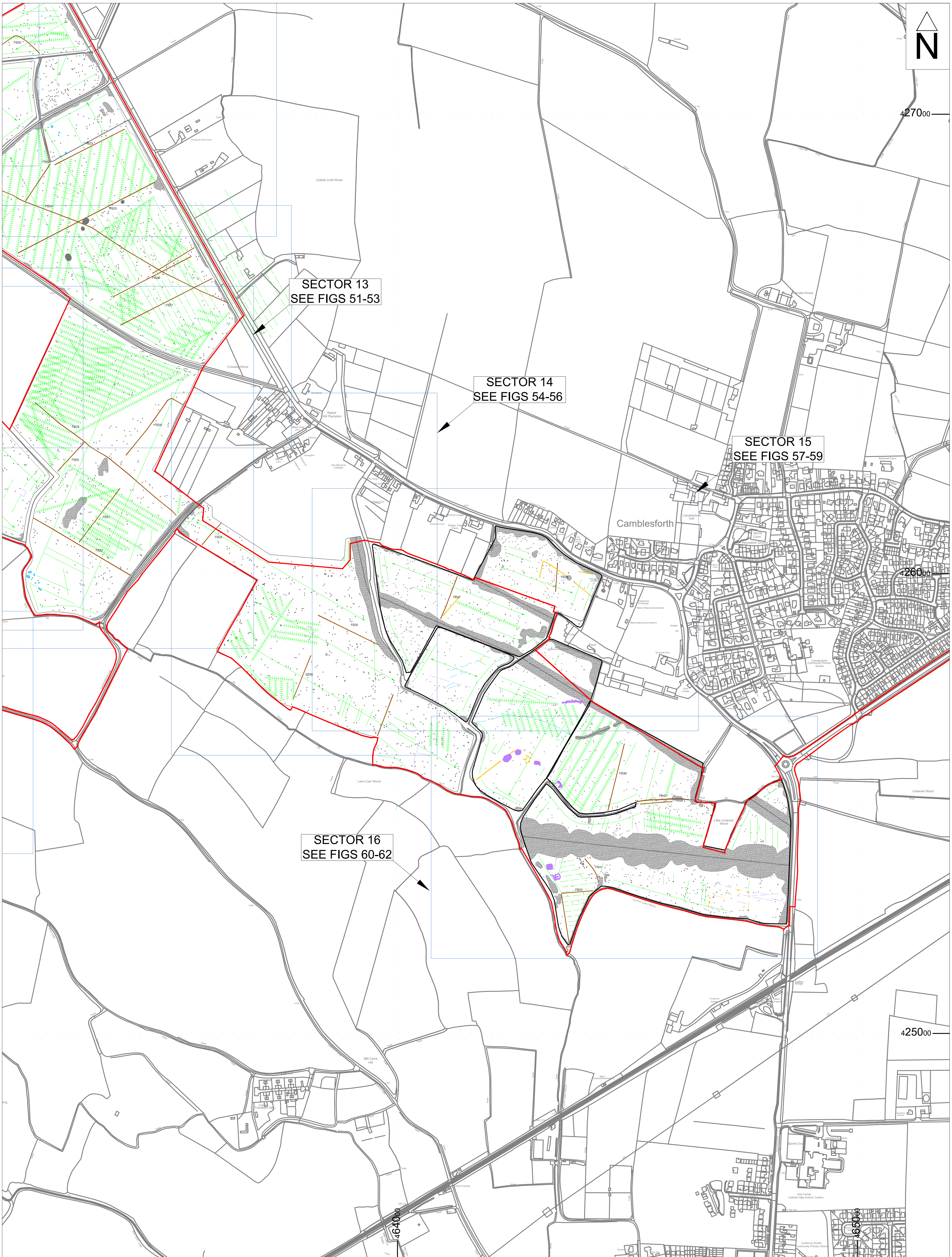
DEVELOPMENT AREA

SECTOR BOUNDARY

nT -1.0 2.0

0 250m

1:7500 @ A3



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Interpretation of magnetometer data: Areas 21 - 24

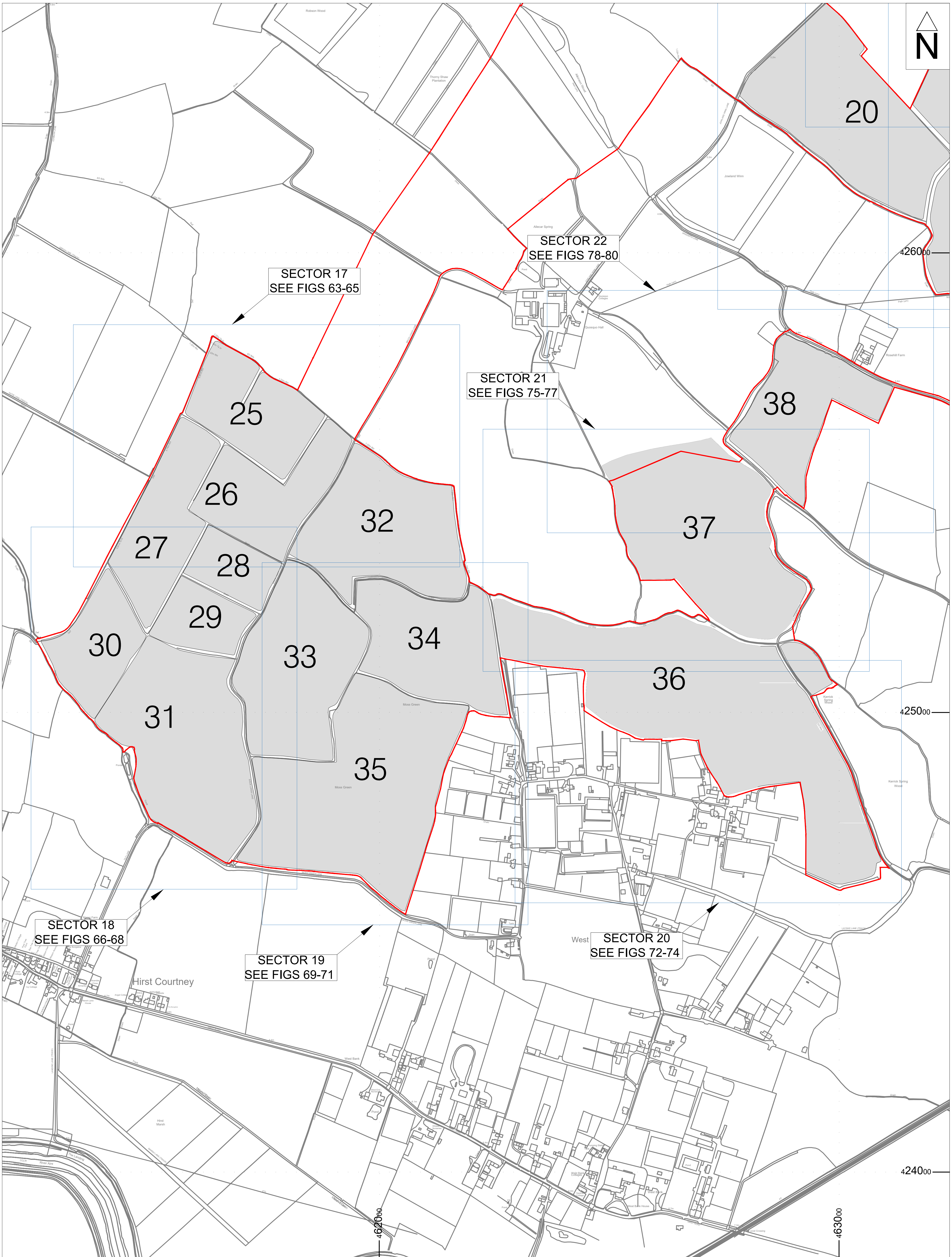
Fig. 11

Interpretation

FERROUS	FIELD DRAIN	UNCERTAIN
SERVICE PIPE	AGRICULTURAL	ARCHAEOLOGY?
MAGNETIC DISTURBANCE	FORMER FIELD BOUNDARY	
RIDGE & FURROW	GEOLOGY	

0 250m

1:7500 @ A3



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Location of survey areas 25 - 38

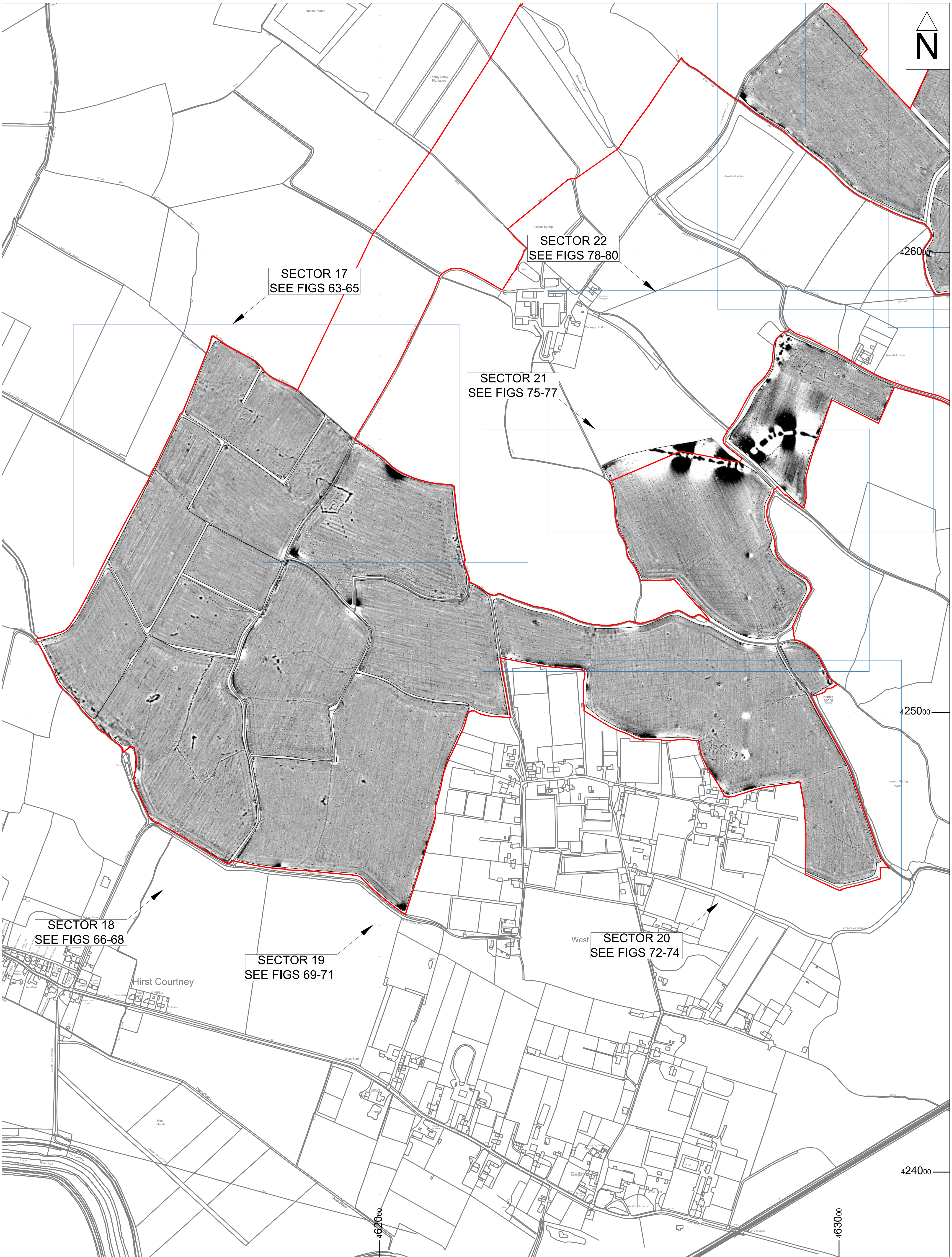
Fig. 12

Title

	DEVELOPMENT AREA
12	FIELD NUMBERS
	SECTOR BOUNDARY

0 250m

1:7500 @ A3



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Processed greyscale magnetometer data: Areas 25 - 38

Title

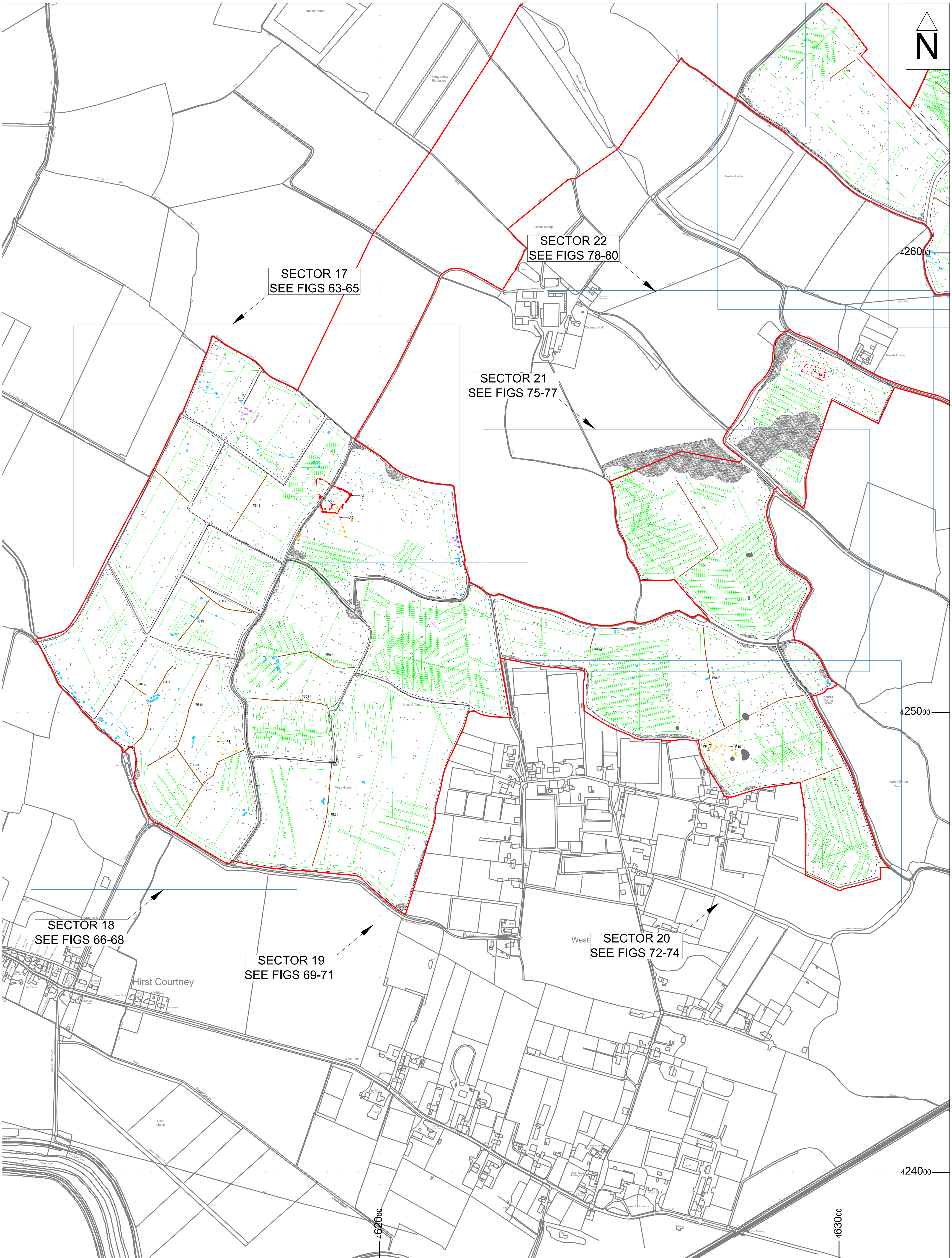
(red)	DEVELOPMENT AREA
(blue)	SECTOR BOUNDARY

nT -1.0 2.0

0 250m

1:7500 @ A3

Fig. 13



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Tel: 0113 535 0163 Email: archaeology@wyjs.org.uk www.aswyas.com

Project ID: XF70_HLO22

Interpretation of magnetometer data: Areas 25 - 38

Fig. 14

Interpretation

FERROUS	RIDGE & FURROW	GEOLOGY
SERVICE PIPE	FIELD DRAIN	UNCERTAIN
MAGNETIC DISTURBANCE	AGRICULTURAL	ARCHAEOLOGY?
	FORMER FIELD BOUNDARY	ARCHAEOLOGY

0 250m

1:7500 @ A3

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Processed greyscale magnetometer data: Sector 1

Fig. 15

Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2

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XY trace plot of minimally processed magnetometer data: Sector 1

Fig. 16

Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2

Title

SECTOR BOUNDARY

Interpretation

FERROUS	RIDGE & FURROW	UNCERTAIN
SERVICE PIPE	AGRICULTURAL	ARCHAEOLOGY?
MAGNETIC DISTURBANCE	FORMER FIELD BOUNDARY	
FIELD DRAIN	GEOLOGY	

0 50m

1:1,500 @ A2

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Interpretation of magnetometer data: Sector 1

Fig. 17

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Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 2

Fig. 18

Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2

Project ID: XF70_HLO22

XY trace plot of minimally processed magnetometer data: Sector 2

Fig. 19

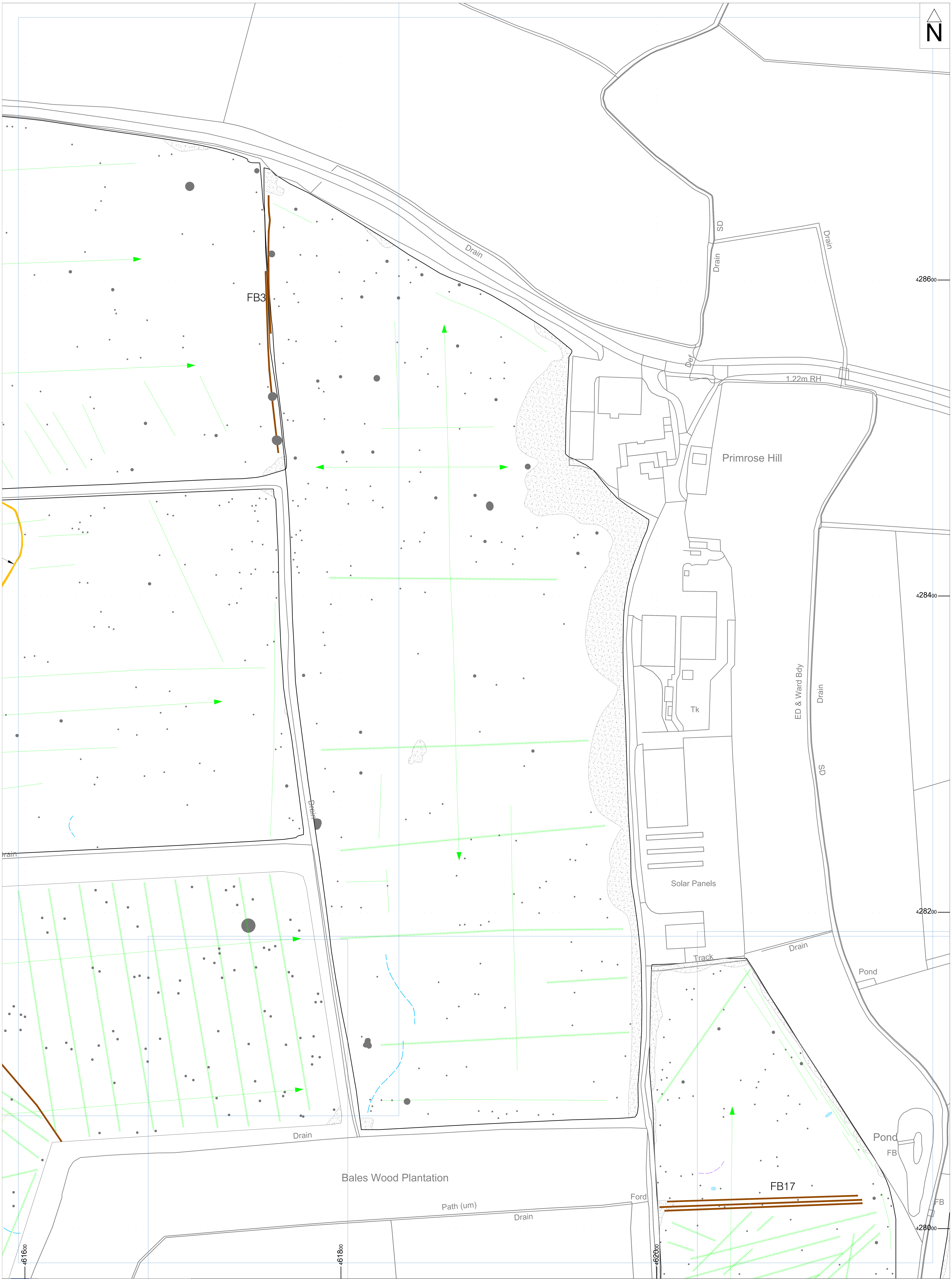
Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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Interpretation of magnetometer data: Sector 2

Fig. 20

Title

- SECTOR BOUNDARY

Interpretation

- FERROUS
- SERVICE PIPE
- MAGNETIC DISTURBANCE
- FIELD DRAIN
- RIDGE & FURROW
- AGRICULTURAL
- FORMER FIELD BOUNDARY
- GEOLOGY
- UNCERTAIN
- ARCHAEOLOGY?

0 50m

1:1,500 @ A2

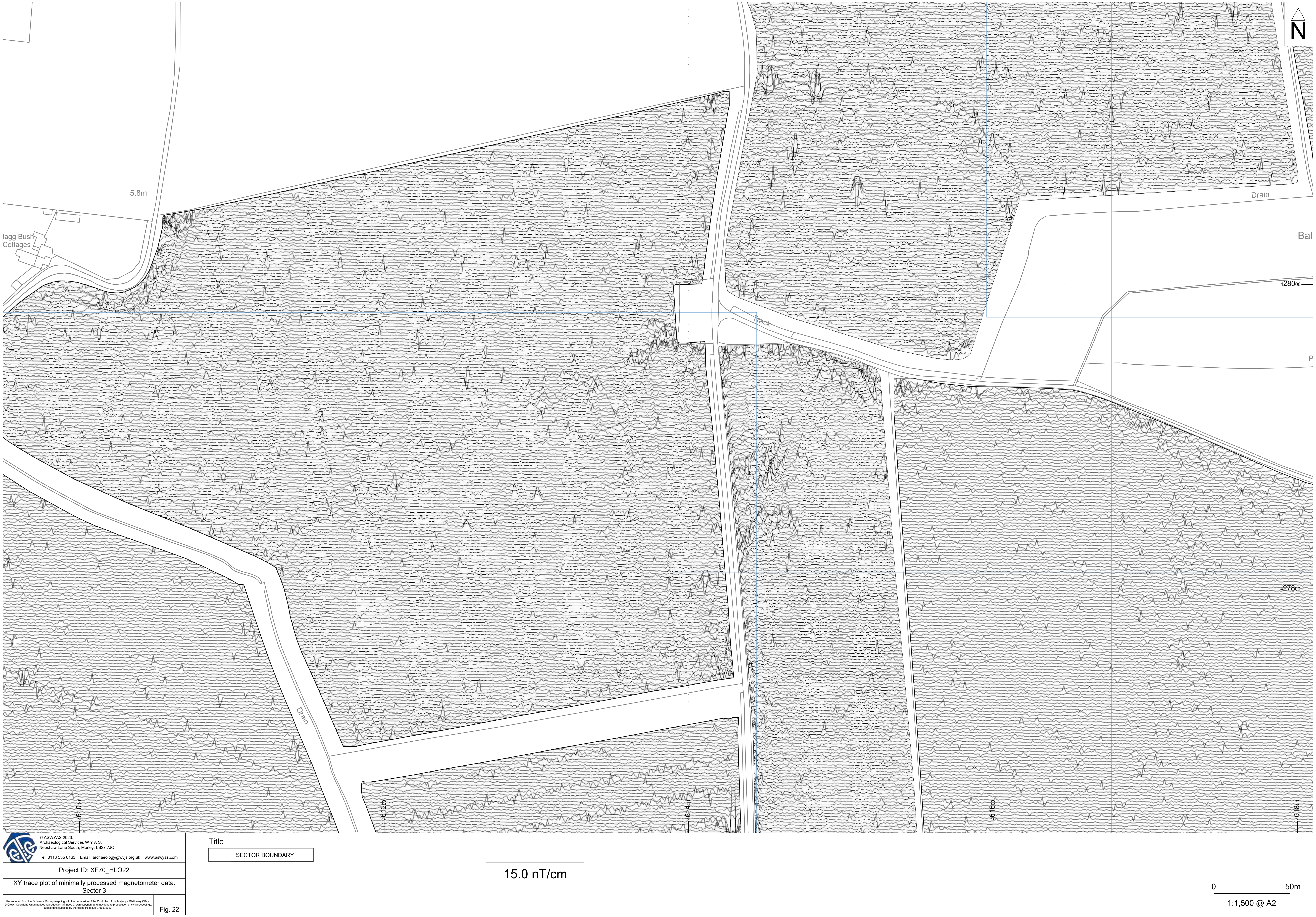
Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 3

Fig. 21

Title

	SECTOR BOUNDARY



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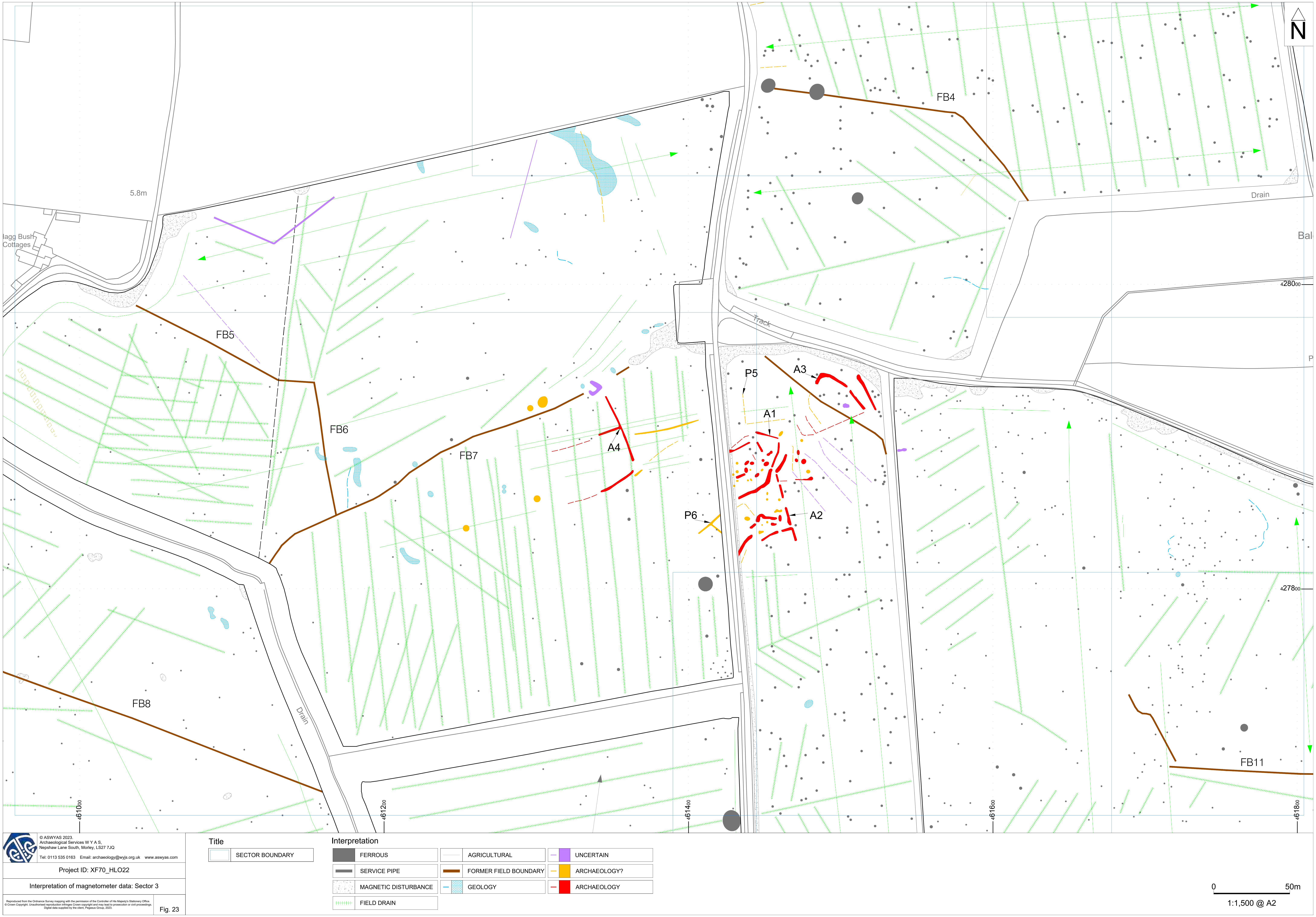
XY trace plot of minimally processed magnetometer data: Sector 3

Fig. 22



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Interpretation of magnetometer data: Sector 3

Fig. 23

Title

	SECTOR BOUNDARY

Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 4

Fig. 24

Title

	SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2

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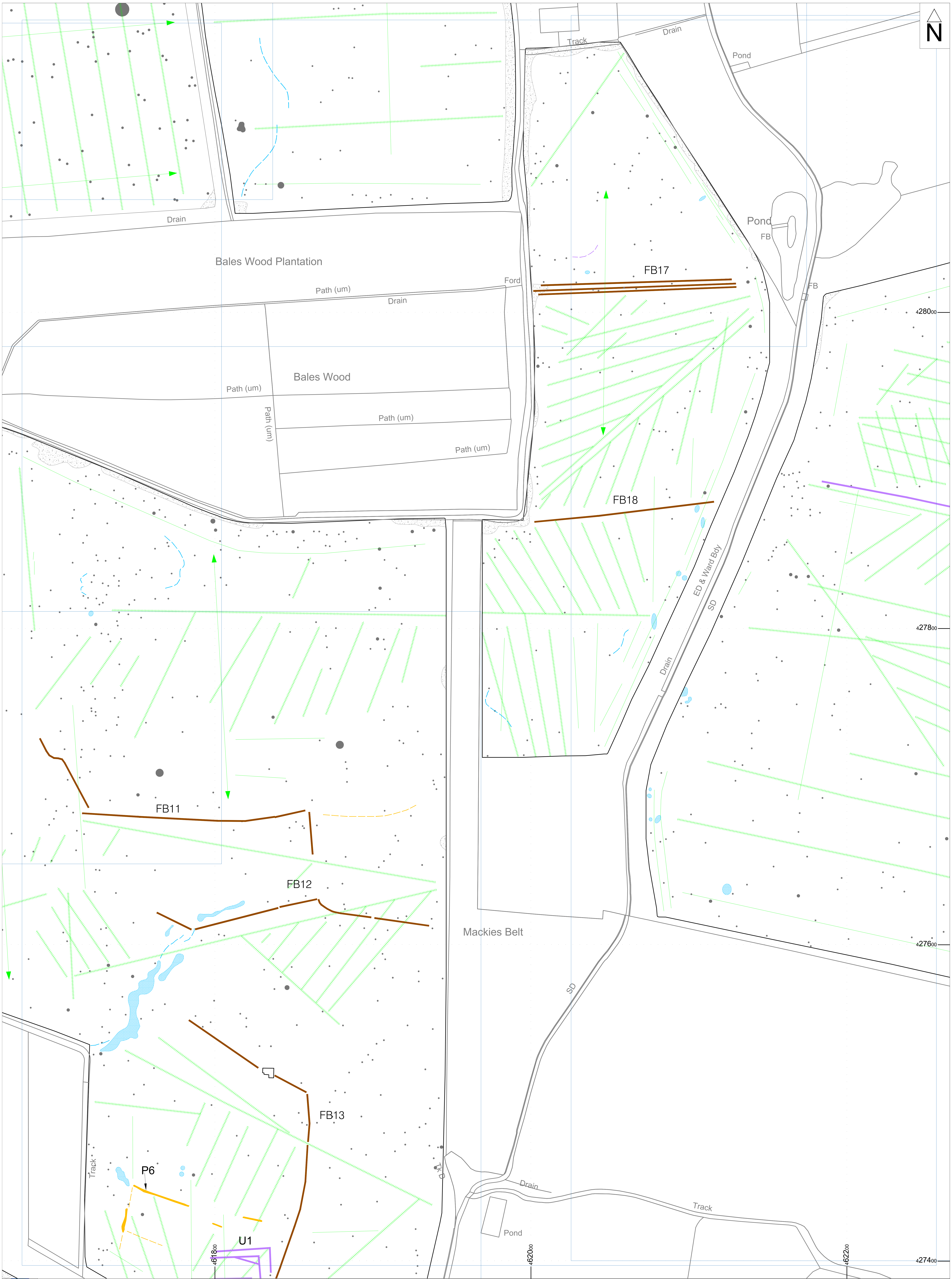
XY trace plot of minimally processed magnetometer data: Sector 4

Fig. 25



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Project ID: XF70_HLO22

Interpretation of magnetometer data:
Sector 4

Fig. 26

Title

SECTOR BOUNDARY

Interpretation

FERROUS
MAGNETIC DISTURBANCE
FIELD DRAIN
AGRICULTURAL
FORMER FIELD BOUNDARY
GEOLOGY
UNCERTAIN
ARCHAEOLOGY?

0 50m
1:1,500 @ A2

Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2

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Processed greyscale magnetometer data: Sector 5

Fig. 27

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XY trace plot of minimally processed magnetometer data: Sector 5

Fig. 28

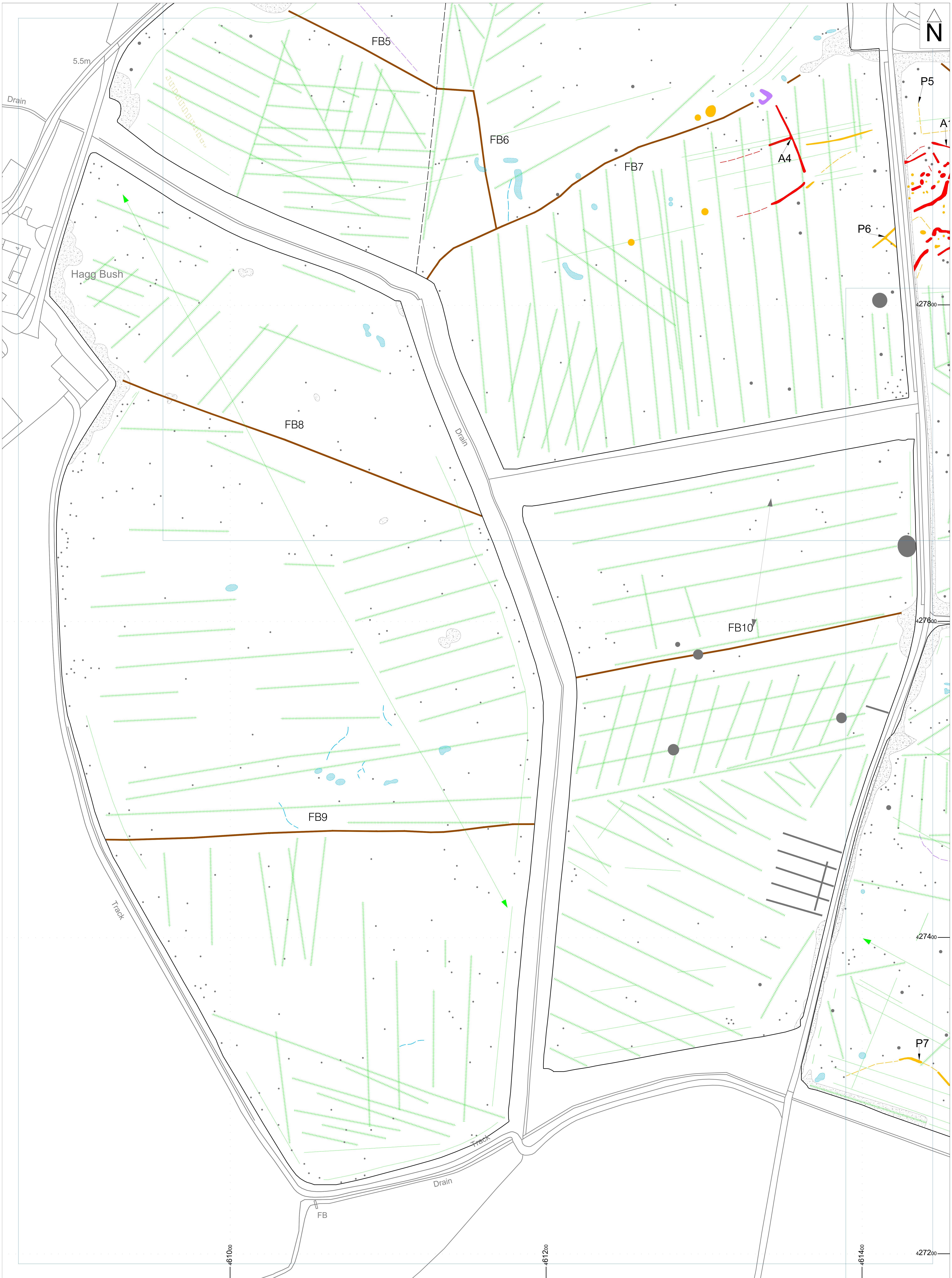
Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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Interpretation of magnetometer data: Sector 5

Fig. 29

Title

SECTOR BOUNDARY

Interpretation

FERROUS
SERVICE PIPE
MAGNETIC DISTURBANCE
FIELD DRAIN
AGRICULTURAL
FORMER FIELD BOUNDARY
GEOLOGY
UNCERTAIN
ARCHAEOLOGY?
ARCHAEOLOGY

0 50m
1:1,500 @ A2

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Processed greyscale magnetometer data: Sector 6

Fig. 30

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XY trace plot of minimally processed magnetometer data: Sector 6

Fig. 31

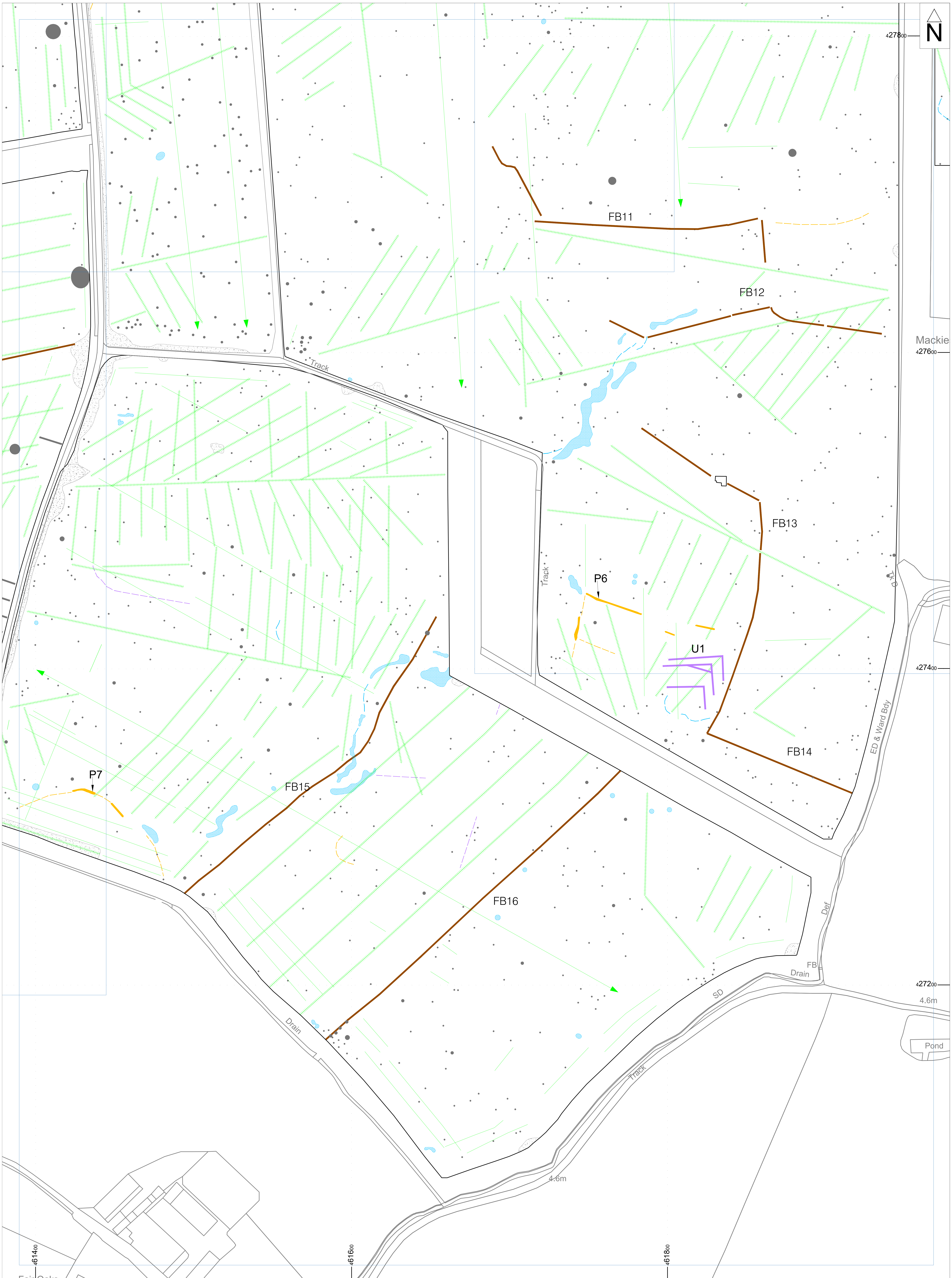
Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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Project ID: XF70_HLO22

Interpretation of magnetometer data: Sector 6

Fig. 32

Title

- SECTOR BOUNDARY

Interpretation

- FERROUS
- SERVICE PIPE
- MAGNETIC DISTURBANCE
- FIELD DRAIN
- AGRICULTURAL
- FORMER FIELD BOUNDARY
- GEOLOGY
- UNCERTAIN
- ARCHAEOLOGY?

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Processed greyscale magnetometer data: Sector 7

Fig. 33

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XY trace plot of minimally processed magnetometer data: Sector 7

Fig. 34

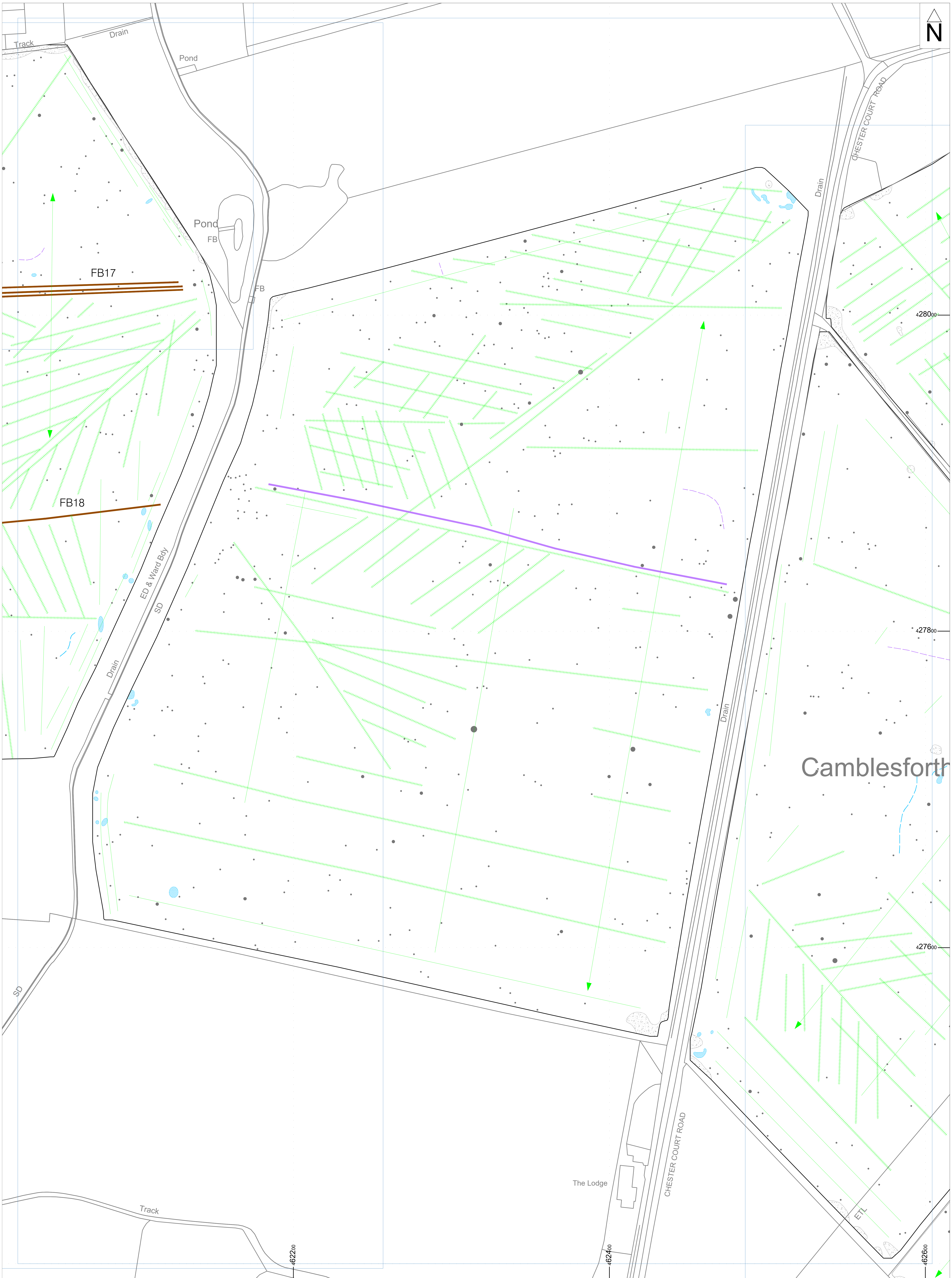
Title

	SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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Interpretation of magnetometer data: Sector 7

Fig. 35

Title
- SECTOR BOUNDARY

Interpretation
- FERROUS
- SERVICE PIPE
- MAGNETIC DISTURBANCE
- FIELD DRAIN
- AGRICULTURAL
- FORMER FIELD BOUNDARY
- GEOLOGY
- UNCERTAIN

0 50m

1:1,500 @ A2

Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 8

Fig. 36

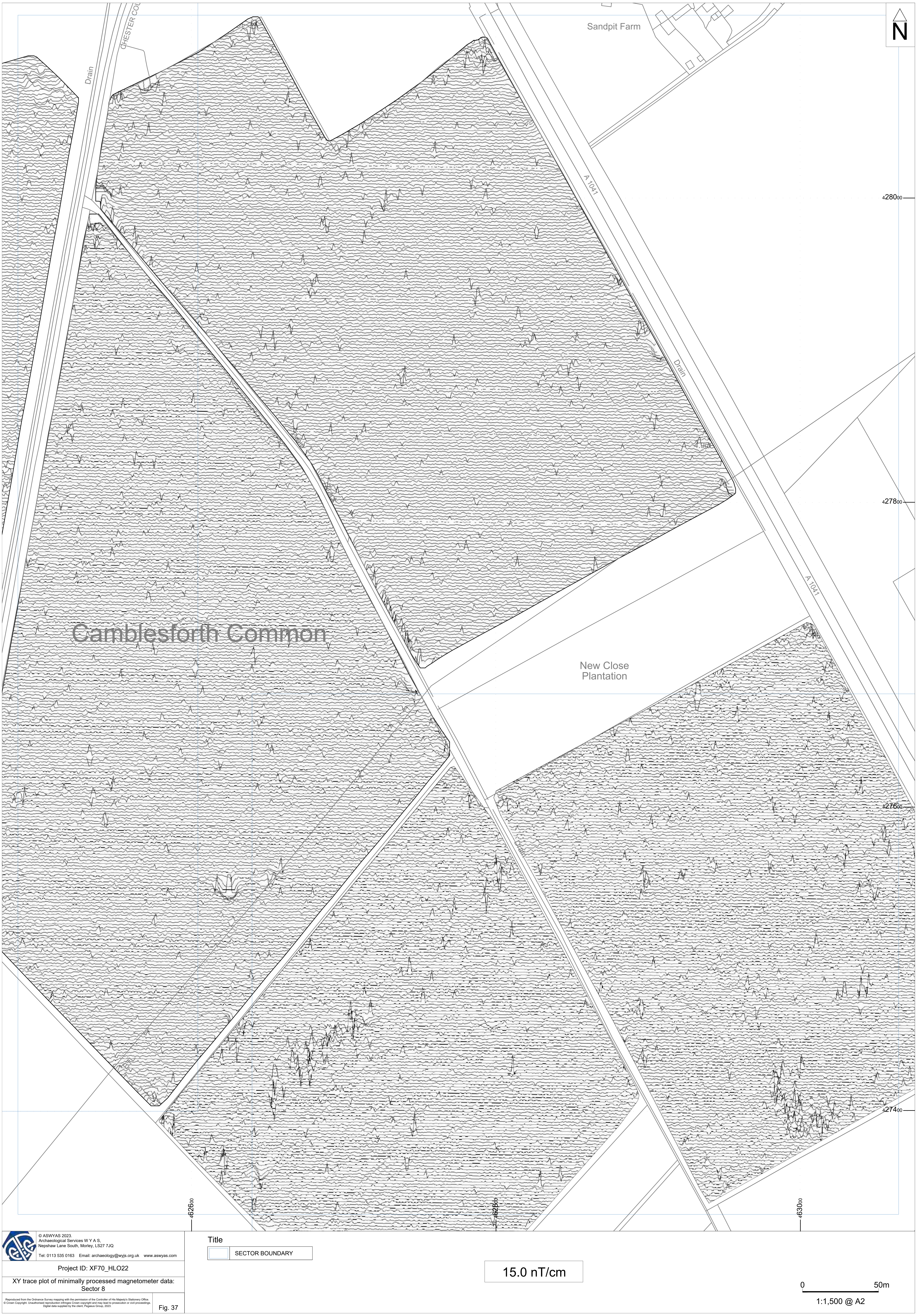
Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2



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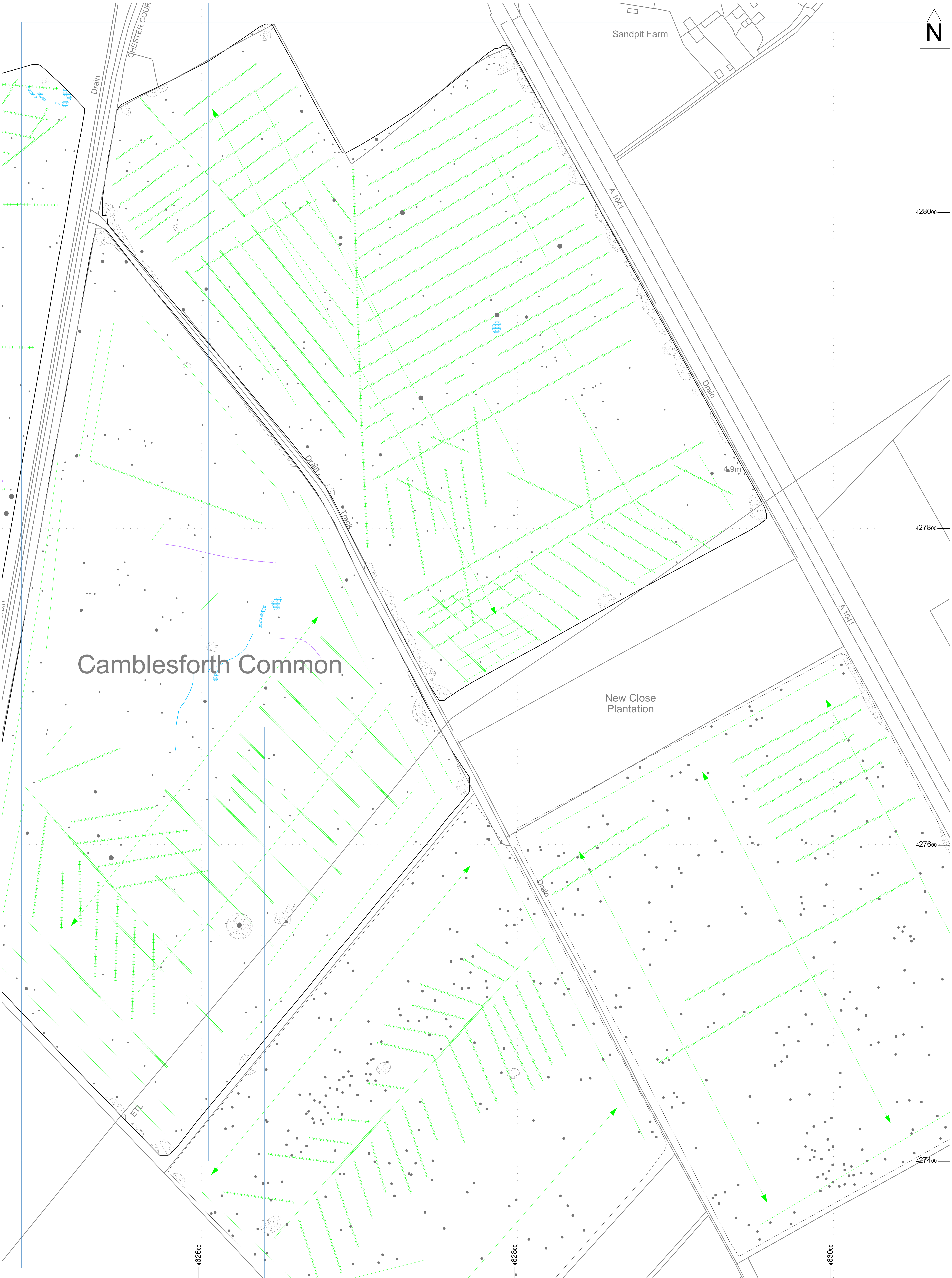
XY trace plot of minimally processed magnetometer data: Sector 8

Fig. 37



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Interpretation of magnetometer data: Sector 8

Fig. 38

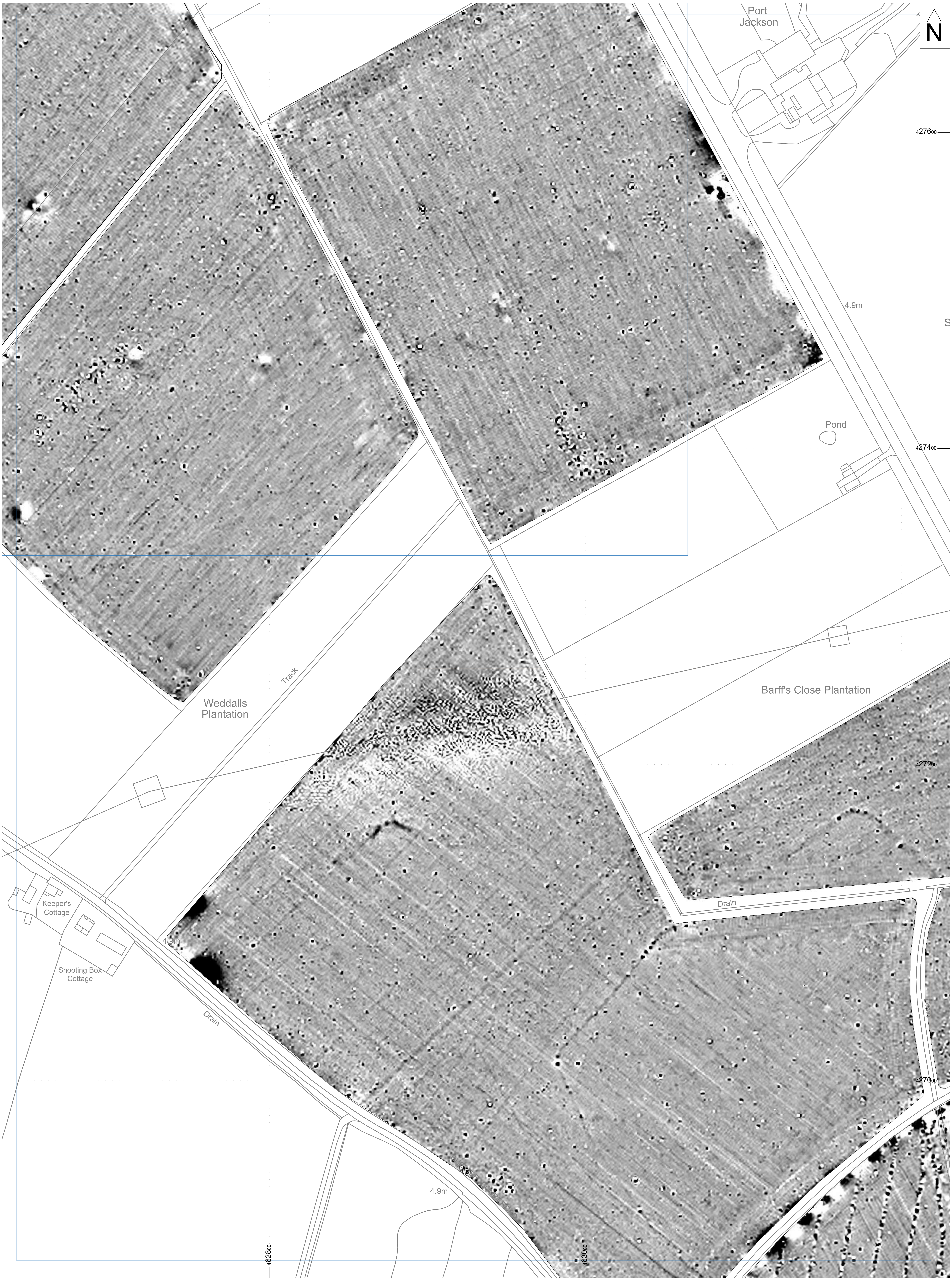
Title

SECTOR BOUNDARY

Interpretation

FERROUS
SERVICE PIPE
MAGNETIC DISTURBANCE
FIELD DRAIN
AGRICULTURAL
FORMER FIELD BOUNDARY
GEOLOGY
UNCERTAIN

0 50m
1:1,500 @ A2



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Processed greyscale magnetometer data: Sector 9

Fig. 39

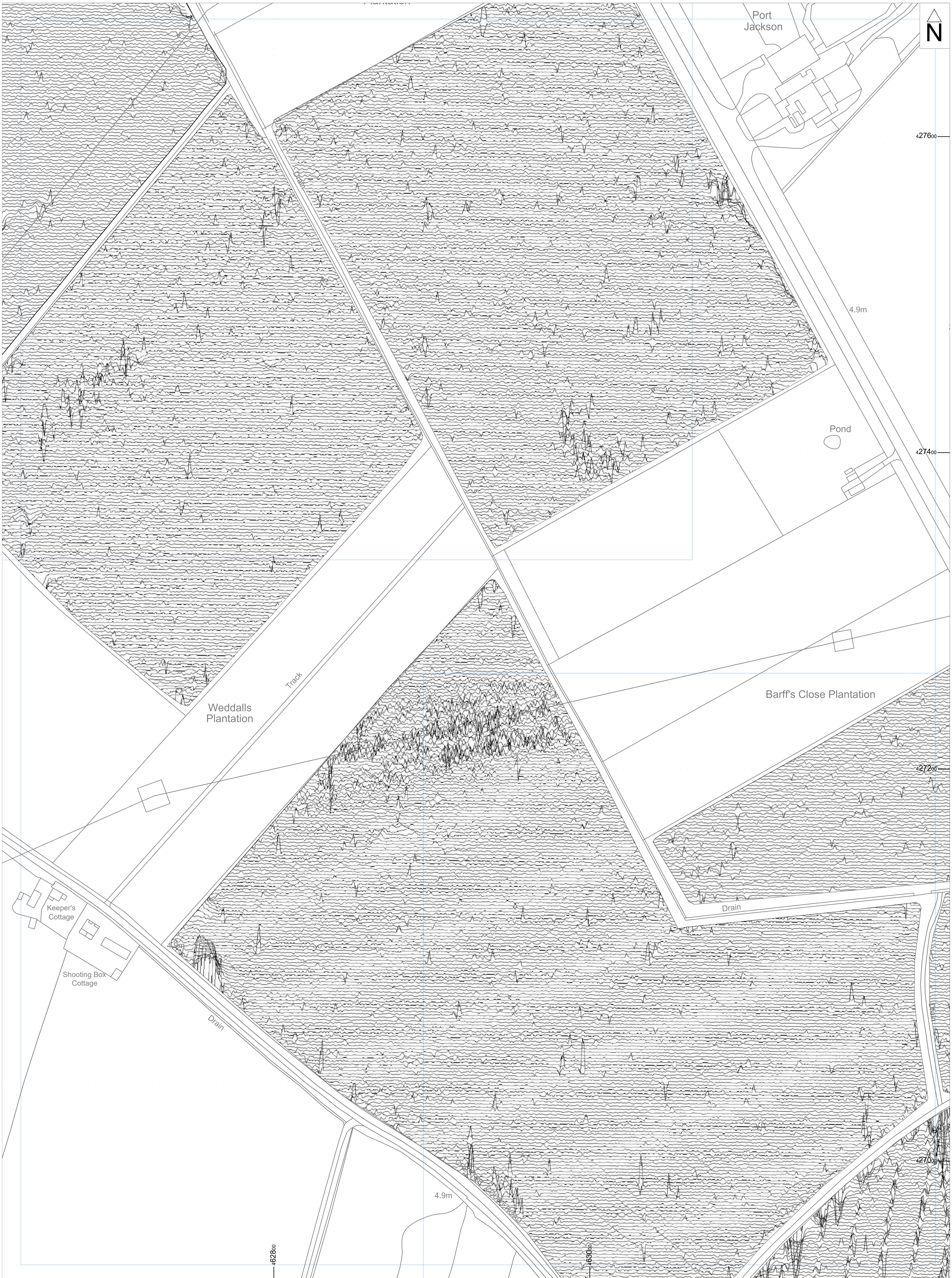
Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2



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XY trace plot of minimally processed magnetometer data:
Sector 9

Fig. 40

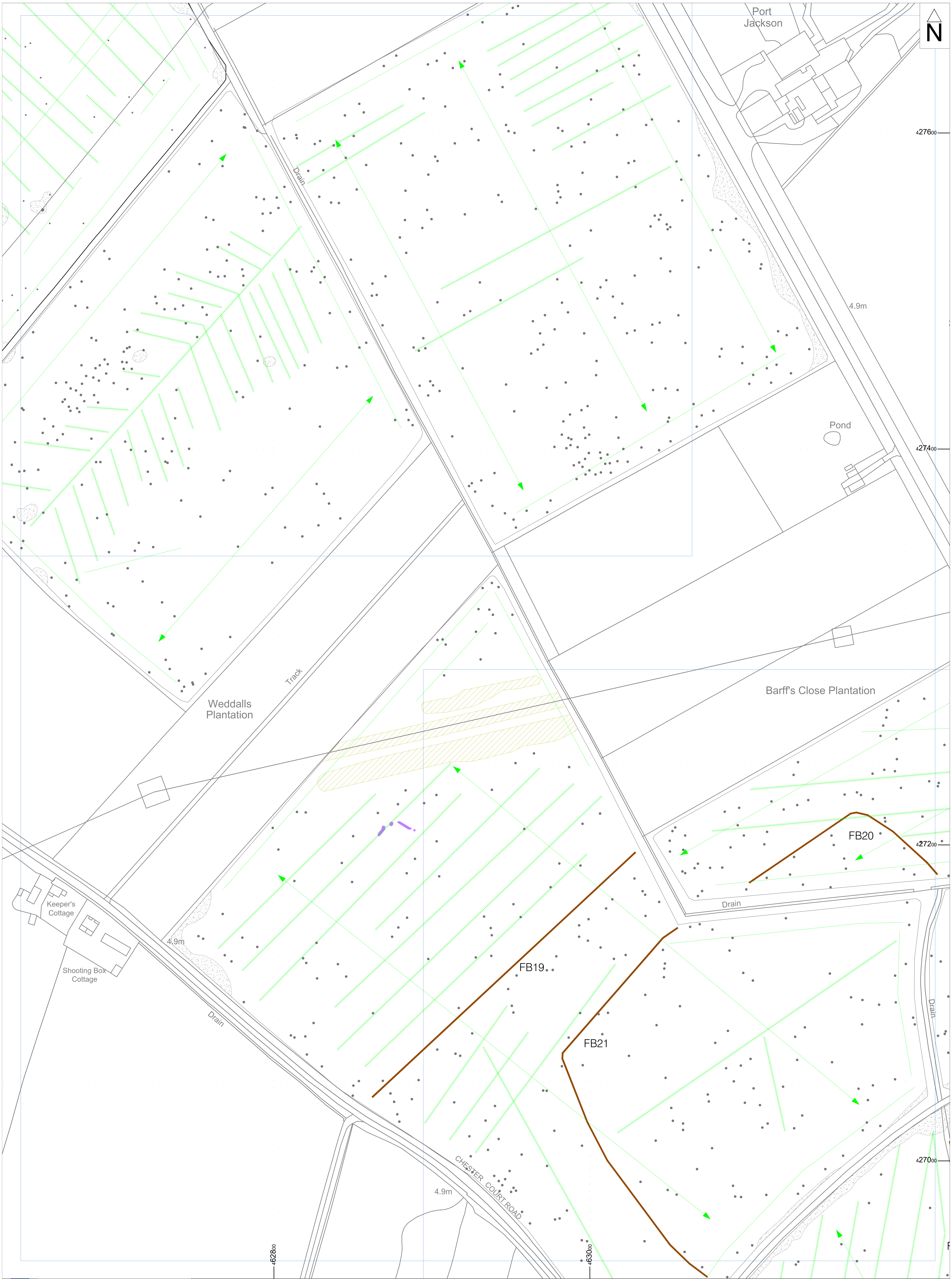
Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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Interpretation of magnetometer data: Sector 9

Fig. 41

Title

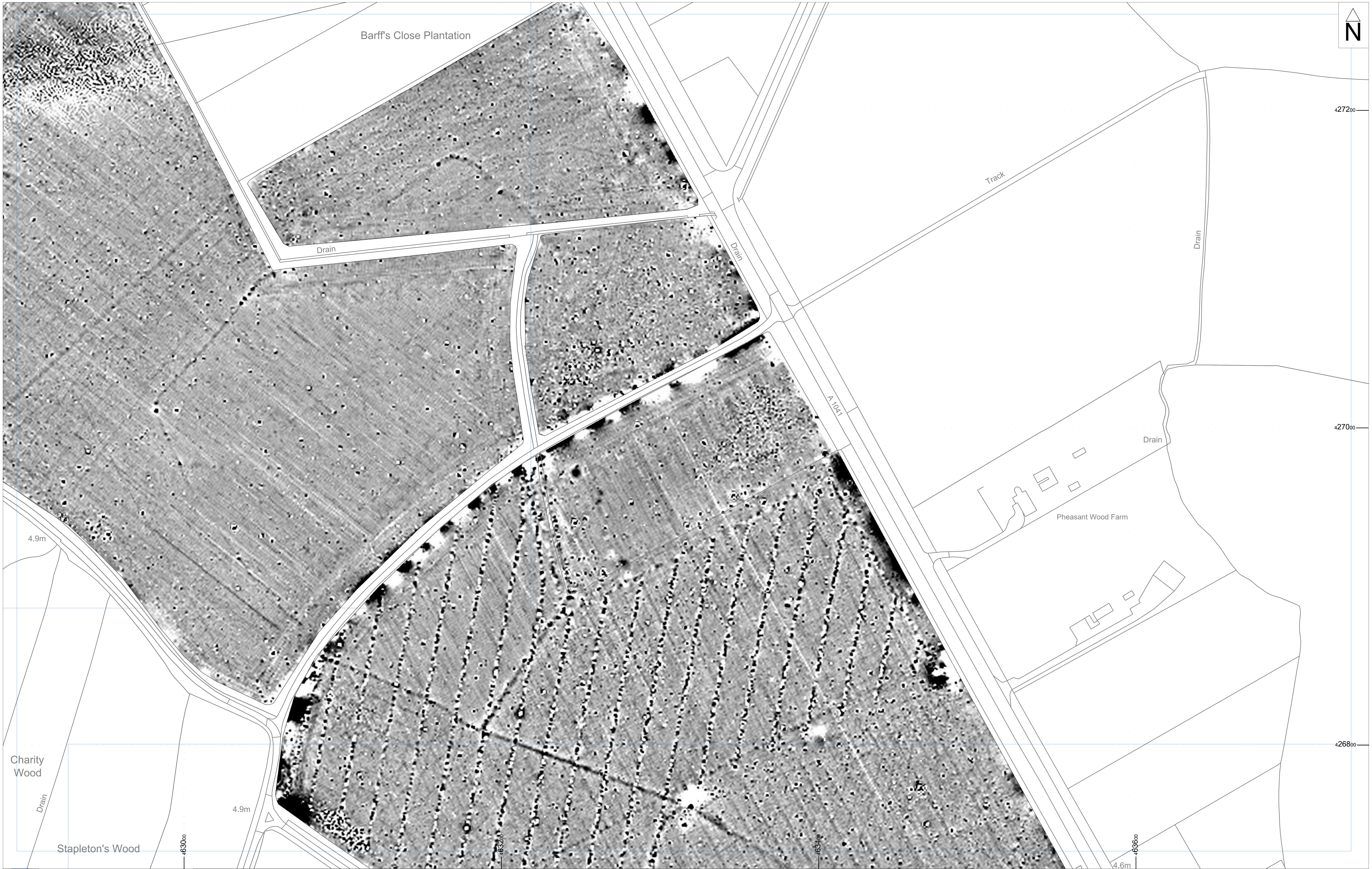
SECTOR BOUNDARY

Interpretation

FERROUS
MAGNETIC DISTURBANCE
OVERHEAD CABLES
FIELD DRAIN
AGRICULTURAL
FORMER FIELD BOUNDARY
GEOLOGY
UNCERTAIN

0 50m

1:1,500 @ A2



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Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 10

Fig. 42

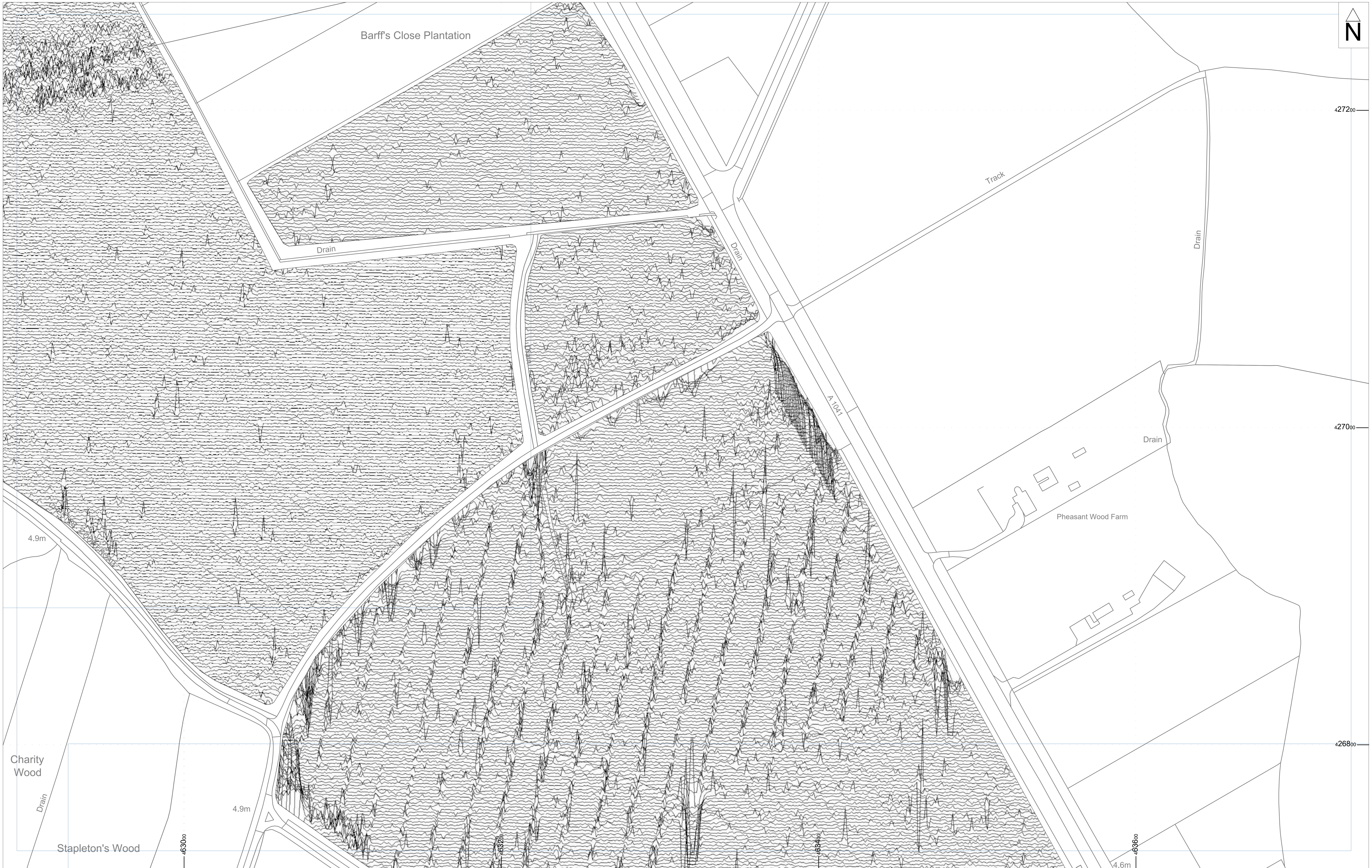
Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2



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Project ID: XF70_HLO22

XY trace plot of minimally processed magnetometer data: Sector 10

Fig. 43

Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2

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Interpretation of magnetometer data: Sector 10

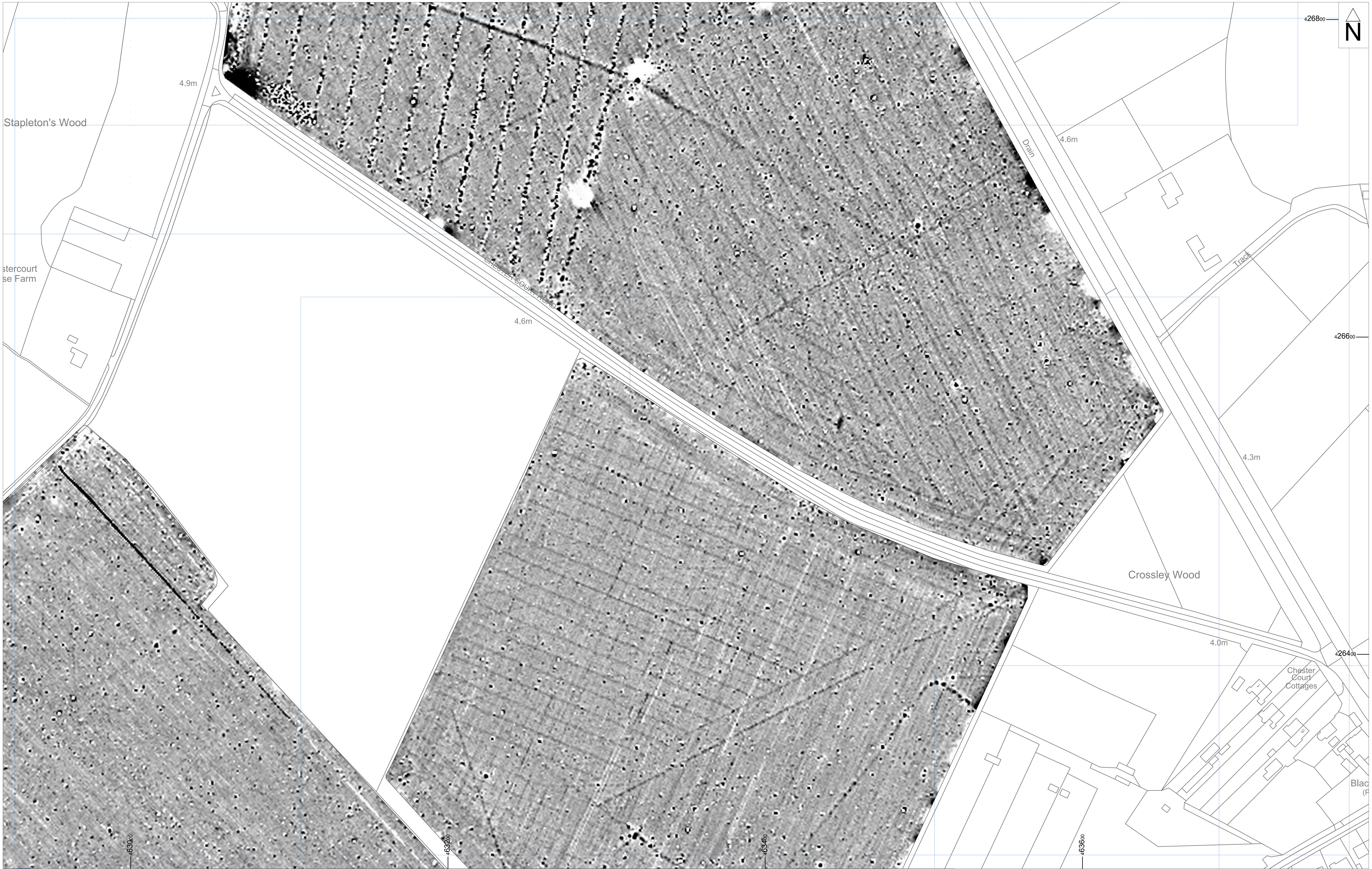
Fig. 44

Title

- SECTOR BOUNDARY

Interpretation

- FERROUS
- MAGNETIC DISTURBANCE
- OVERHEAD CABLES
- FIELD DRAIN
- RIDGE & FURROW
- AGRICULTURAL
- FORMER FIELD BOUNDARY
- GEOLOGY



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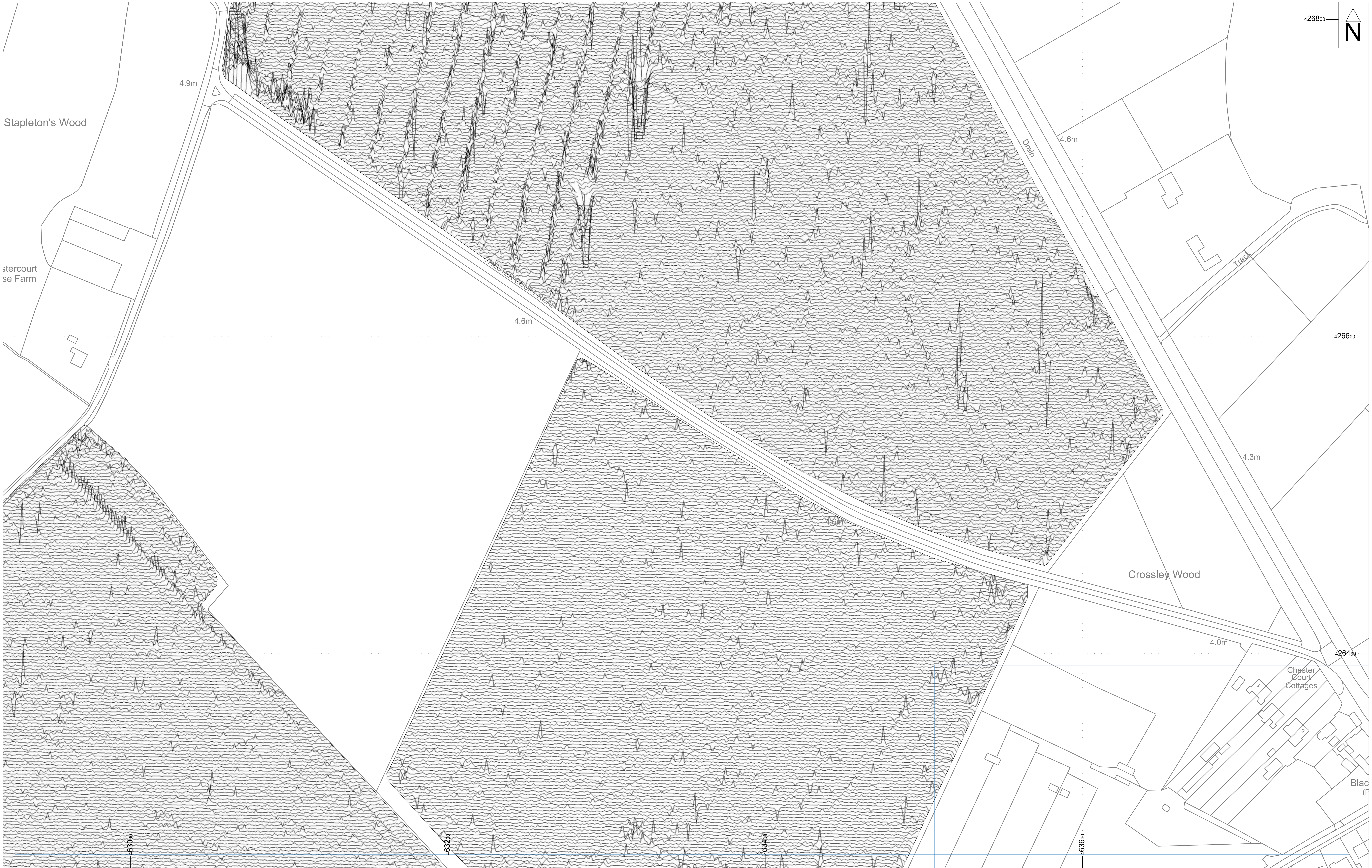
Processed greyscale magnetometer data: Sector 11

Fig. 45



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XY trace plot of minimally processed magnetometer data: Sector 11

Fig. 46

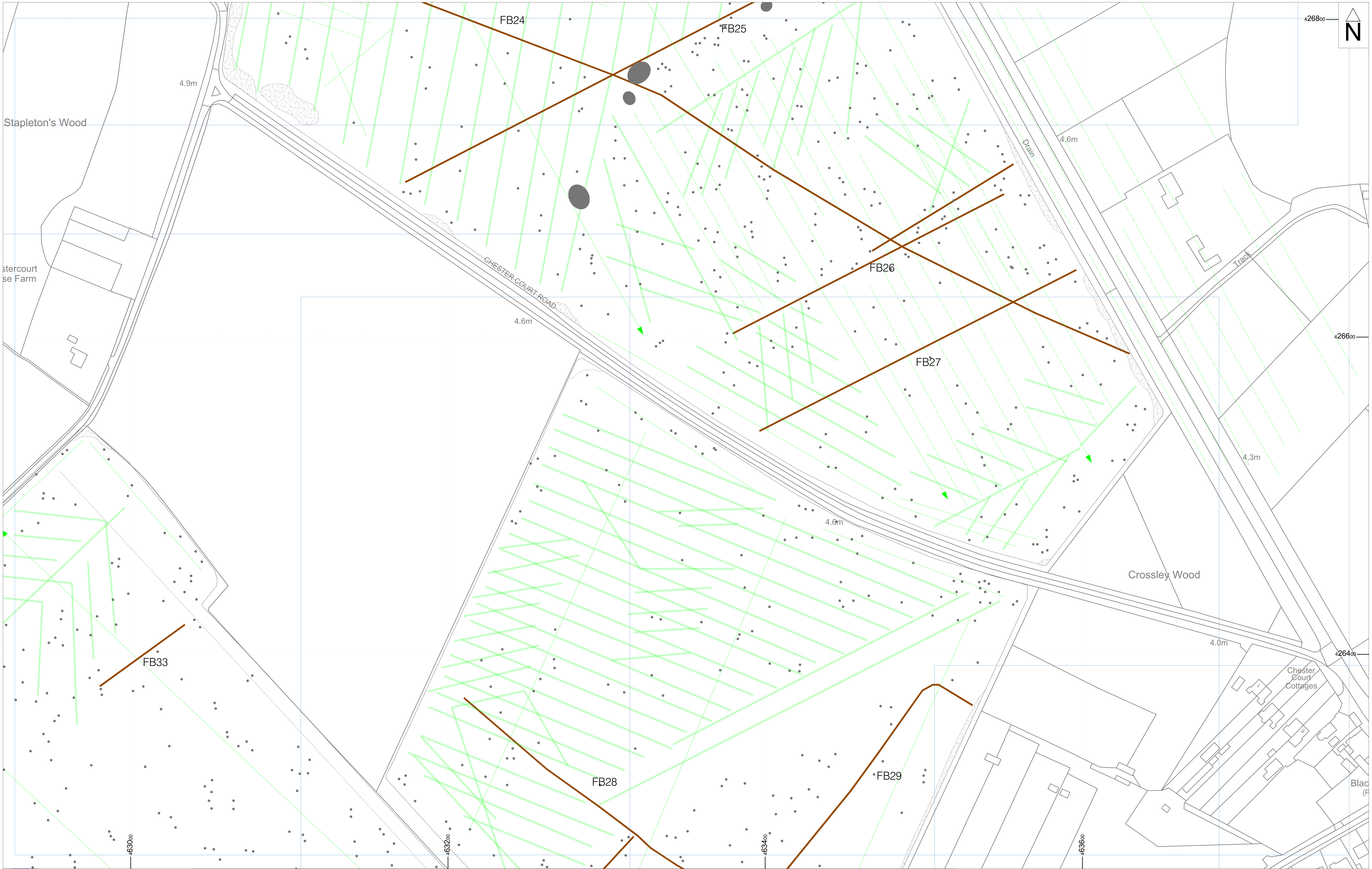
Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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Project ID: XF70_HLO22

Interpretation of magnetometer data: Sector 11

Fig. 47

Title

- SECTOR BOUNDARY

Interpretation

- FERROUS
- MAGNETIC DISTURBANCE
- FIELD DRAIN
- RIDGE & FURROW
- AGRICULTURAL
- FORMER FIELD BOUNDARY
- GEOLOGY

0 50m

1:1,500 @ A2

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Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 12

Fig. 48

Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2

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XY trace plot of minimally processed magnetometer data: Sector 12

Fig. 49

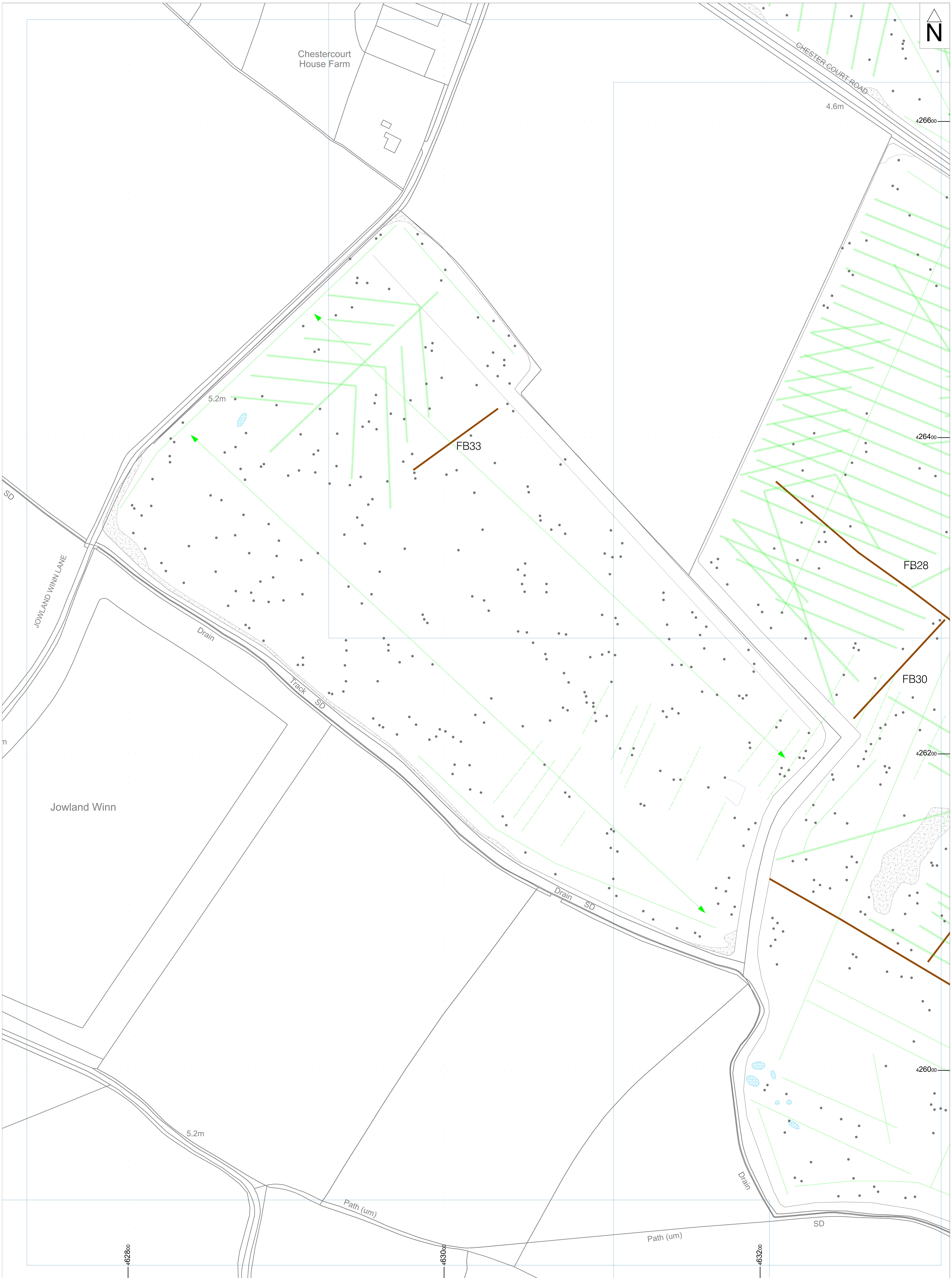
Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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Project ID: XF70_HLO22

Interpretation of magnetometer data: Sector 12

Fig. 50

Title

SECTOR BOUNDARY

Interpretation

FERROUS
MAGNETIC DISTURBANCE
FIELD DRAIN
RIDGE & FURROW
AGRICULTURAL
FORMER FIELD BOUNDARY
GEOLOGY
UNCERTAIN

0 50m

1:1,500 @ A2

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Processed greyscale magnetometer data: Sector 13

Fig. 51

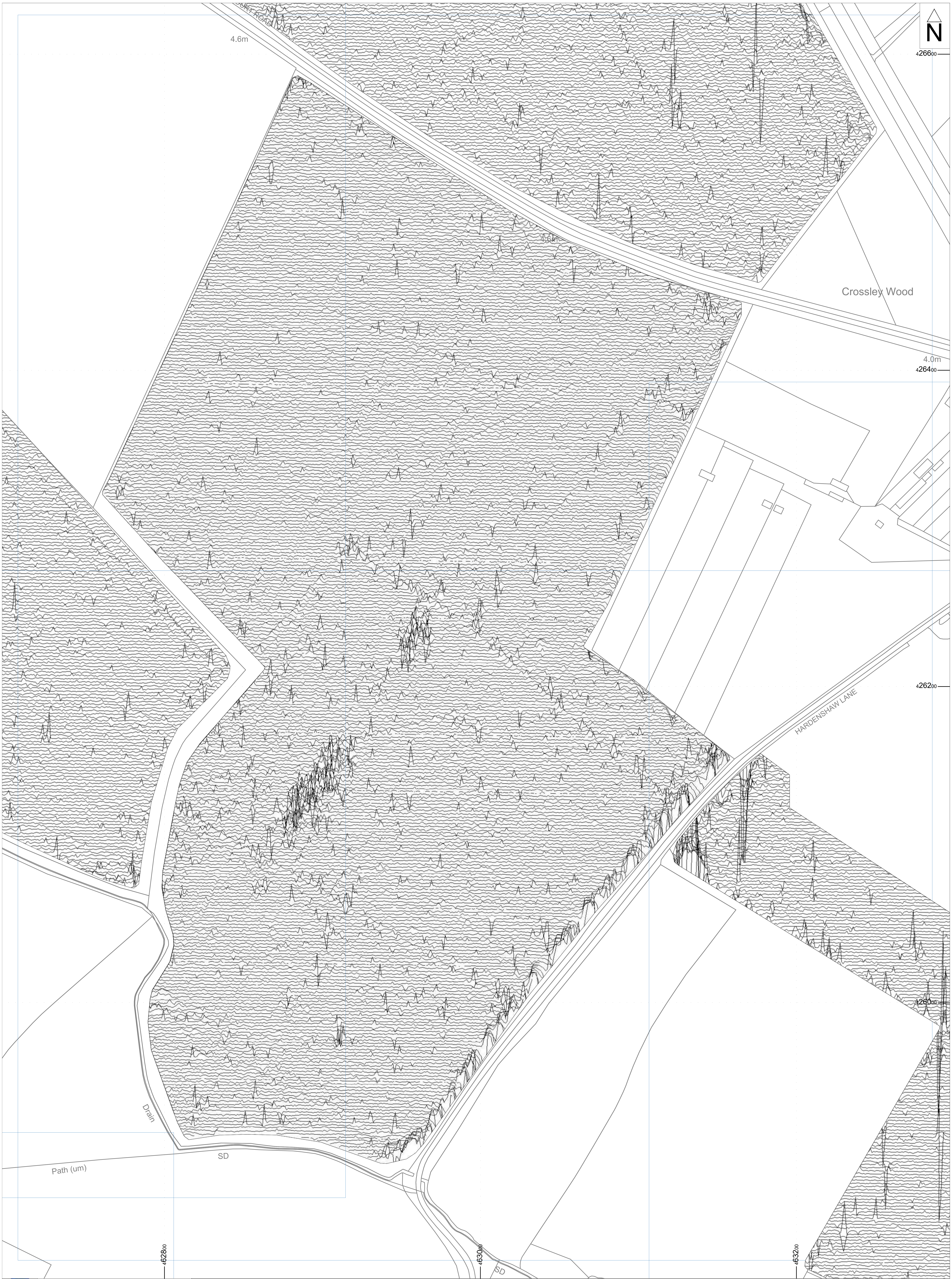
Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2



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Project ID: XF70_HLO22

XY trace plot of minimally processed magnetometer data: Sector 13

Fig. 52

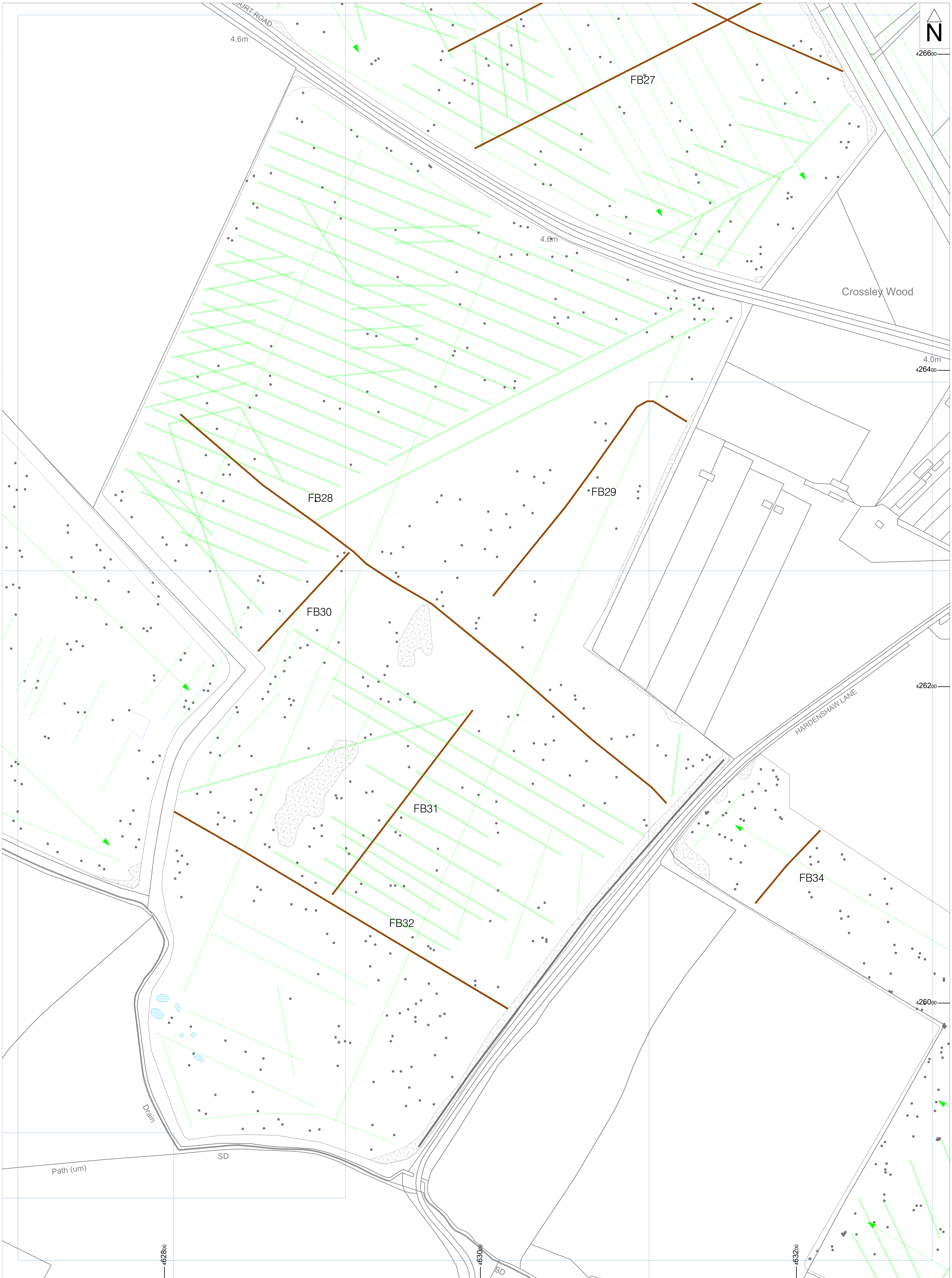
Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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Project ID: XF70_HLO22

Interpretation of magnetometer data: Sector 13

Fig. 53

Title

	SECTOR BOUNDARY

Interpretation

FERROUS	RIDGE & FURROW	GEOLOGY
MAGNETIC DISTURBANCE	AGRICULTURAL	UNCERTAIN
FIELD DRAIN	FORMER FIELD BOUNDARY	

0 50m

1:1,500 @ A2

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Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 14

Fig. 54

Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2

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XY trace plot of minimally processed magnetometer data: Sector 14

Fig. 55

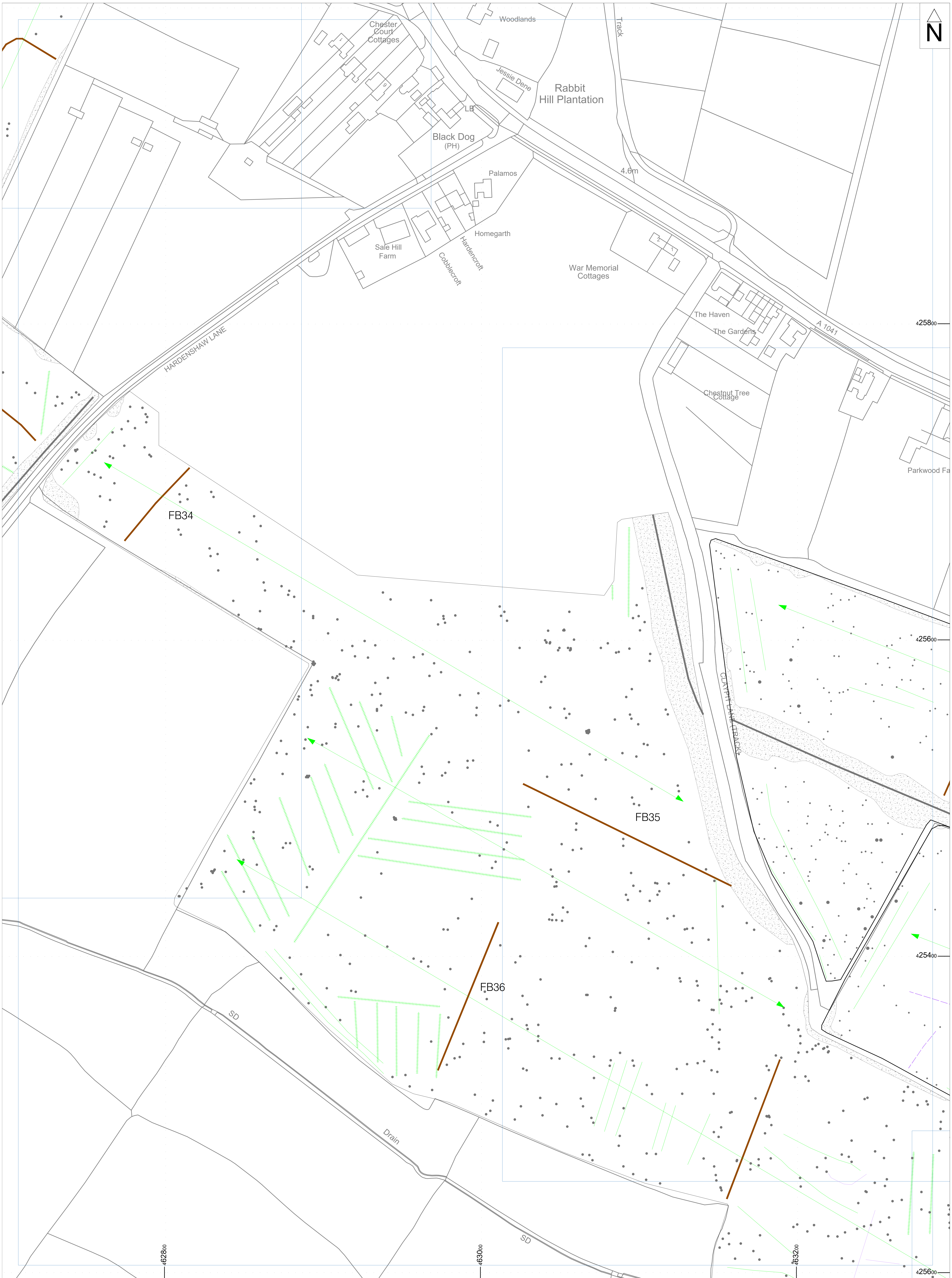
Title

	SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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Project ID: XF70_HLO22

Interpretation of magnetometer data: Sector 14

Fig. 56

Title
- SECTOR BOUNDARY

Interpretation
- FERROUS
- SERVICE PIPE
- MAGNETIC DISTURBANCE
- FIELD DRAIN
- RIDGE & FURROW
- AGRICULTURAL
- FORMER FIELD BOUNDARY
- GEOLOGY
- UNCERTAIN

0 50m

1:1,500 @ A2

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Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 15

Fig. 57

Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2

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XY trace plot of minimally processed magnetometer data: Sector 15

Fig. 58

Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2

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Project ID: XF70_HLO22

Interpretation of magnetometer data: Sector 15

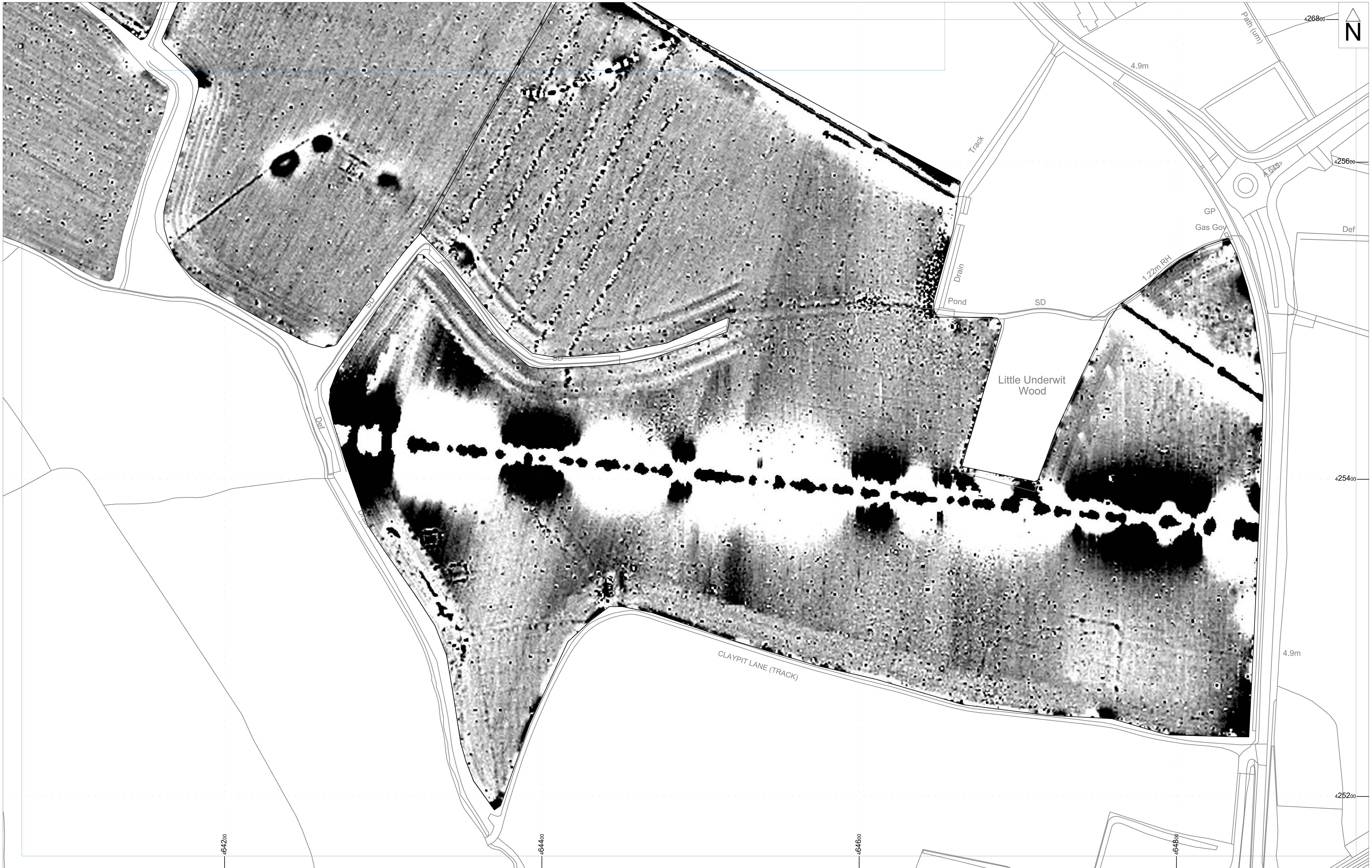
Fig. 59

Title

SECTOR BOUNDARY

Interpretation

- FERROUS
- SERVICE PIPE
- MAGNETIC DISTURBANCE
- FIELD DRAIN
- AGRICULTURAL
- FORMER FIELD BOUNDARY
- GEOLOGY
- UNCERTAIN
- ARCHAEOLOGY?



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Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 16

Fig. 60

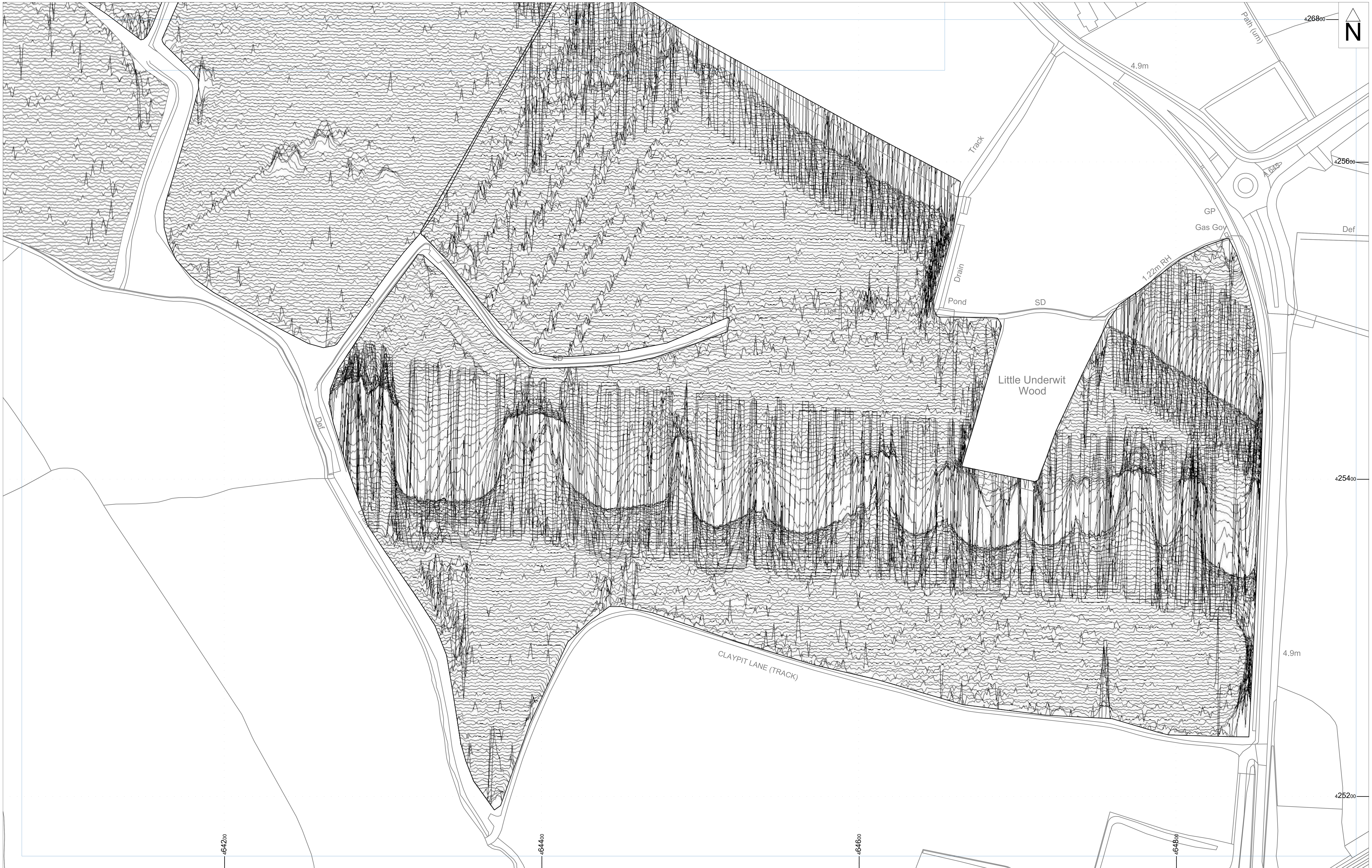
Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2



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Tel: 0113 535 0163 Email: archaeology@wyjs.org.uk www.aswyas.com

Project ID: XF70_HLO22

XY trace plot of minimally processed magnetometer data: Sector 16

Fig. 61

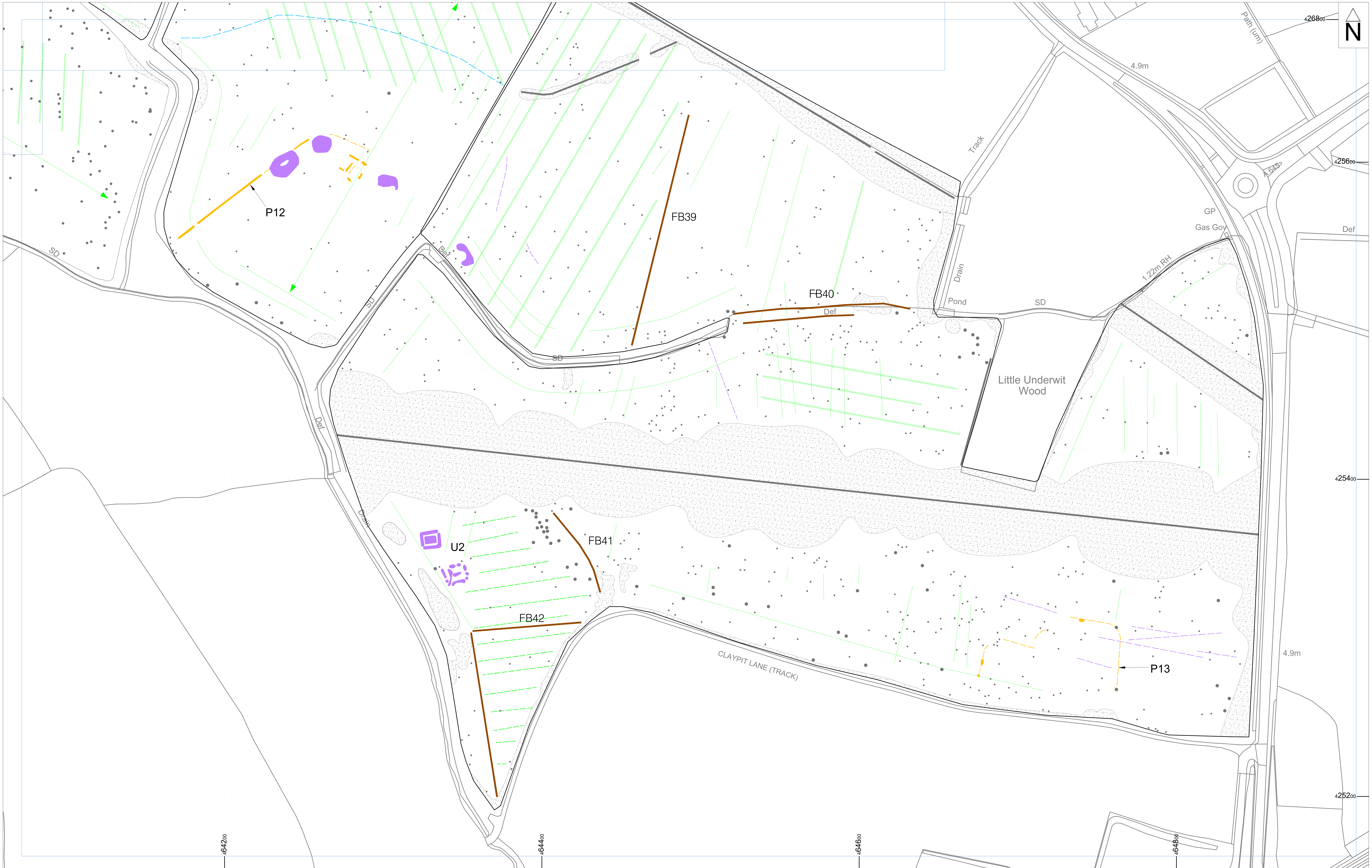
Title

	SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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Interpretation of magnetometer data: Sector 16

Fig. 62

Title

SECTOR BOUNDARY

Interpretation

FERROUS	RIDGE & FURROW	UNCERTAIN
SERVICE PIPE	AGRICULTURAL	ARCHAEOLOGY?
MAGNETIC DISTURBANCE	FORMER FIELD BOUNDARY	
FIELD DRAIN	GEOLOGY	

0 50m

1:1,500 @ A2

Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2

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Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 17

Fig. 63

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Project ID: XF70_HLO22

XY trace plot of minimally processed magnetometer data: Sector 17

Fig. 64

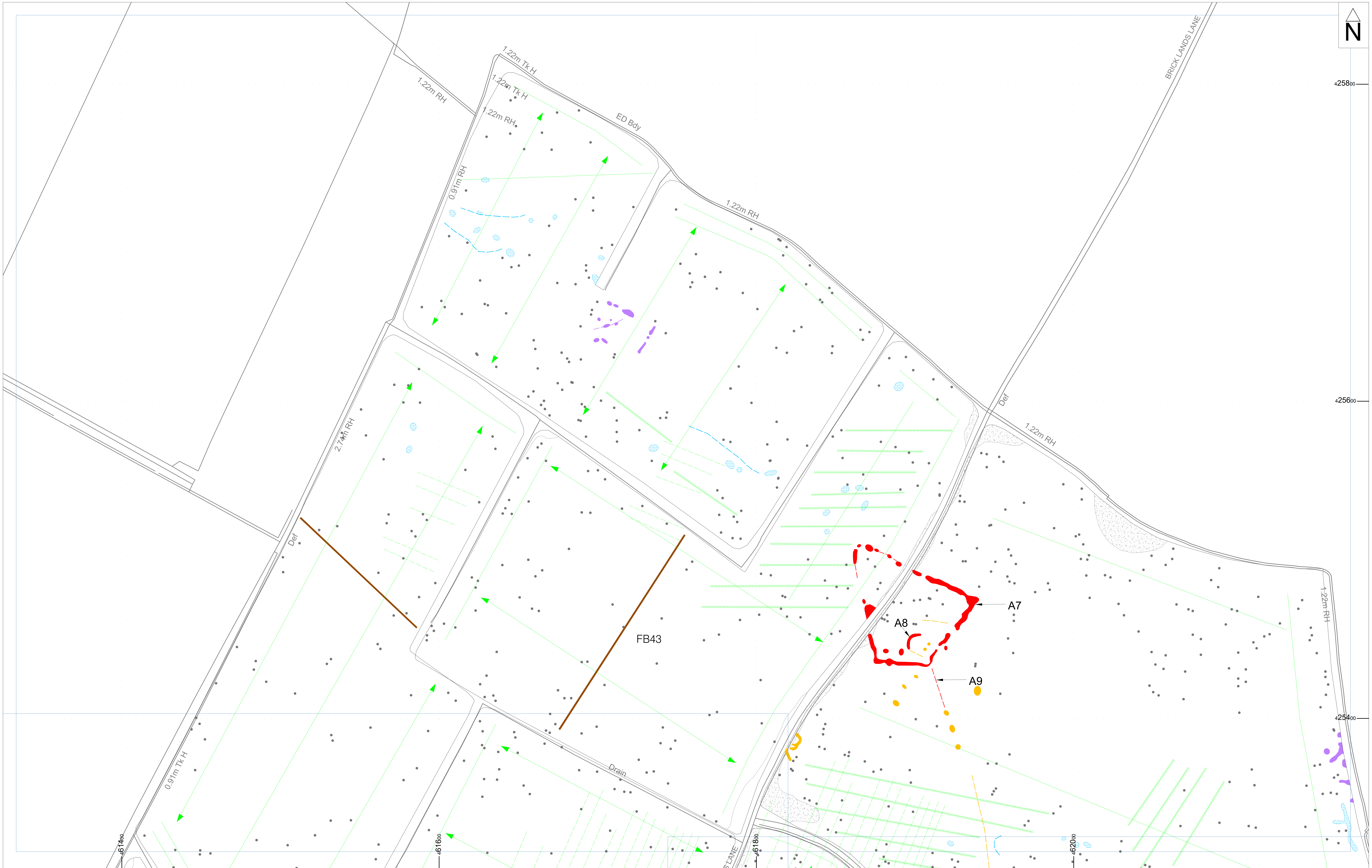
Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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Project ID: XF70_HLO22

Interpretation of magnetometer data: Sector 17

Fig. 65

Title

	SECTOR BOUNDARY

Interpretation

FERROUS	RIDGE & FURROW	UNCERTAIN
MAGNETIC DISTURBANCE	AGRICULTURAL	ARCHAEOLOGY?
FIELD DRAIN	FORMER FIELD BOUNDARY	ARCHAEOLOGY
	GEOLOGY	

0 50m

1:1,500 @ A2

Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2

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Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 18

Fig. 66

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Project ID: XF70_HLO22

XY trace plot of minimally processed magnetometer data: Sector 18

Fig. 67

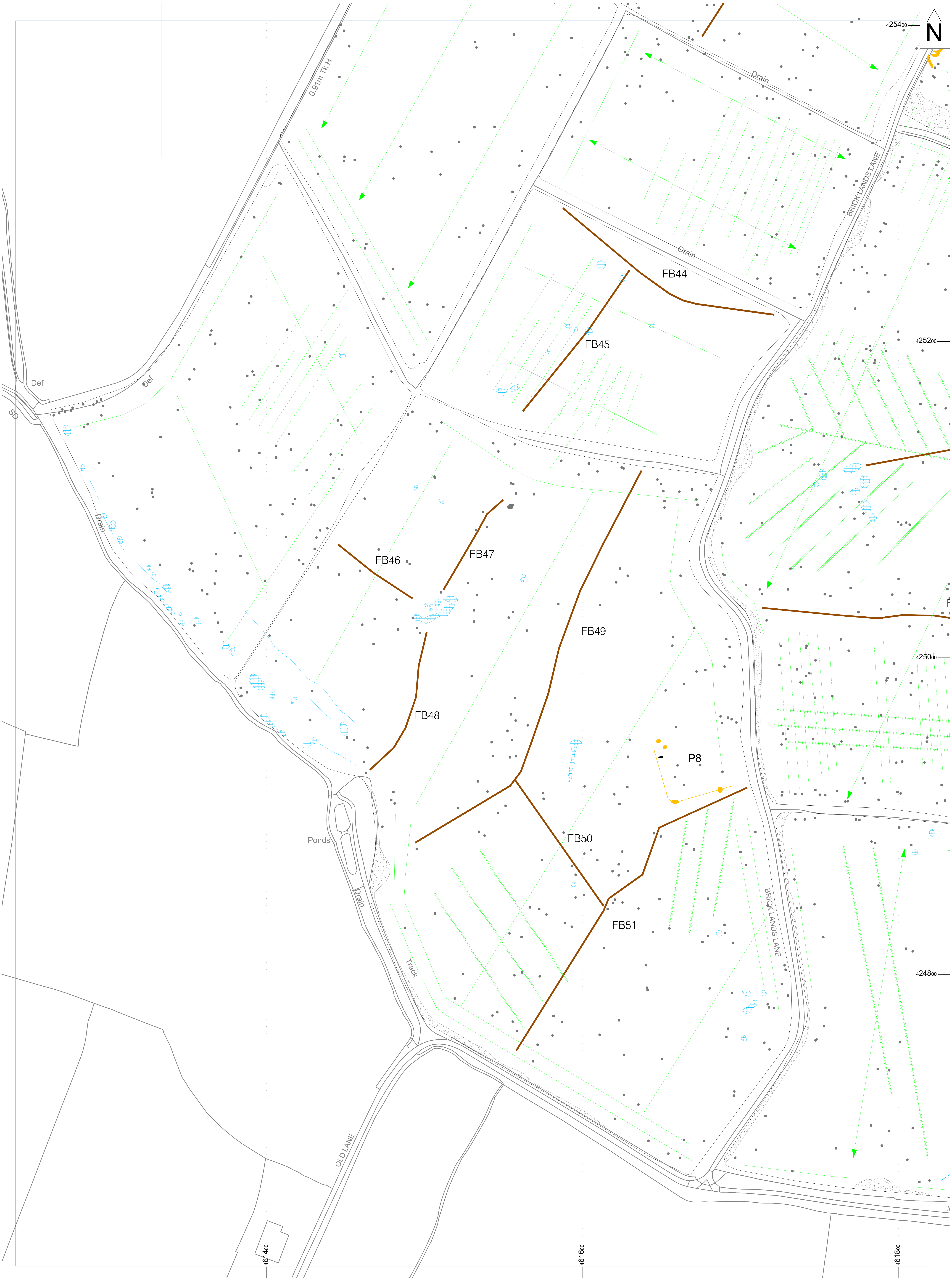
Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



Title

	SECTOR BOUNDARY

Interpretation

	FERROUS		RIDGE & FURROW		GEOLOGY
	MAGNETIC DISTURBANCE		AGRICULTURAL		UNCERTAIN
	FIELD DRAIN		FORMER FIELD BOUNDARY		ARCHAEOLOGY?

0 50m

1:1,500 @ A2

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Project ID: XF70_HLO22

Interpretation of magnetometer data: Sector 18

Fig. 68

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Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 19

Fig. 69

Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2

Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2

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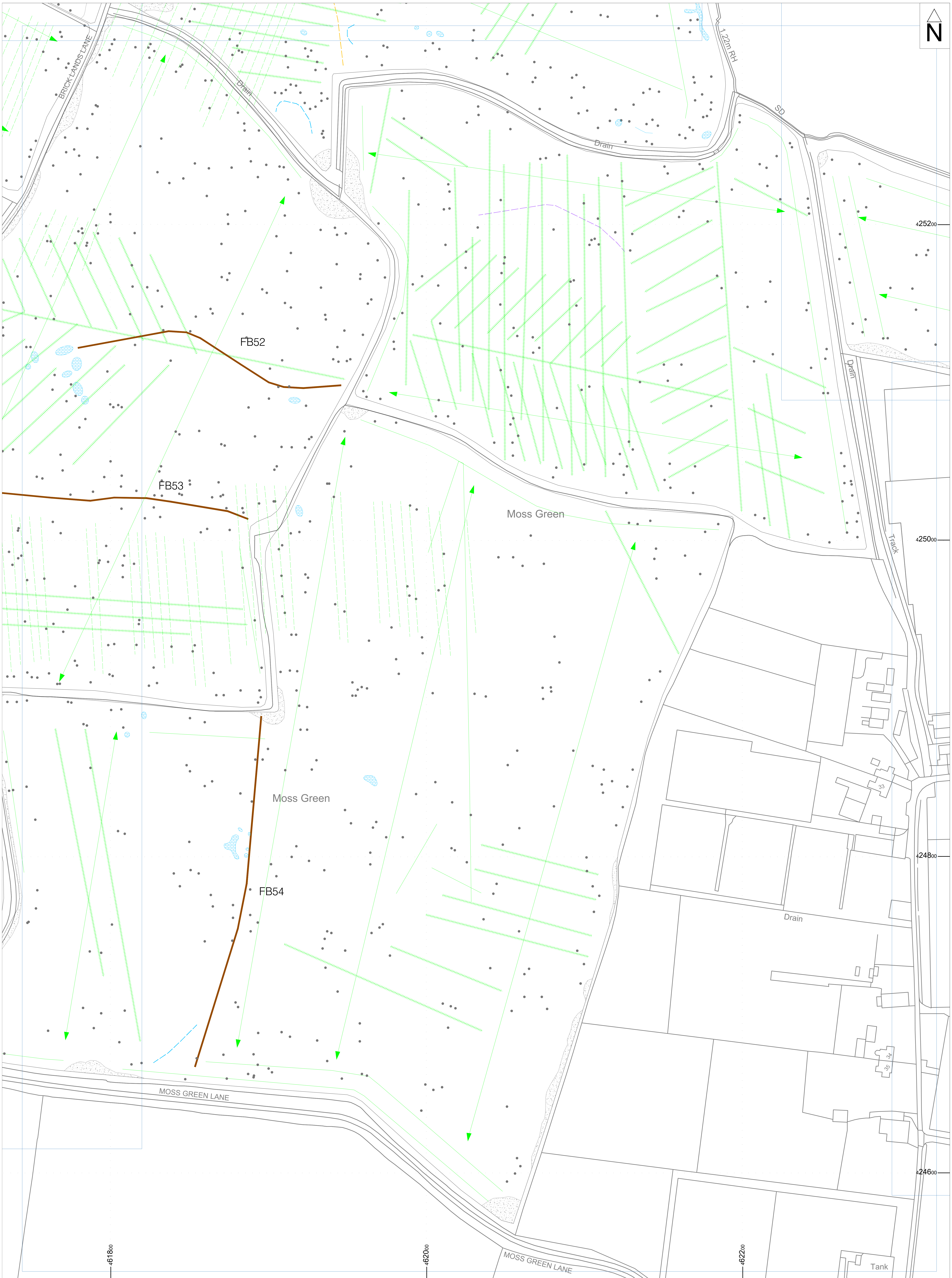
Project ID: XF70_HLO22

XY trace plot of minimally processed magnetometer data: Sector 19

Fig. 70



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Project ID: XF70_HLO22

Interpretation of magnetometer data: Sector 19

Fig. 71

Title

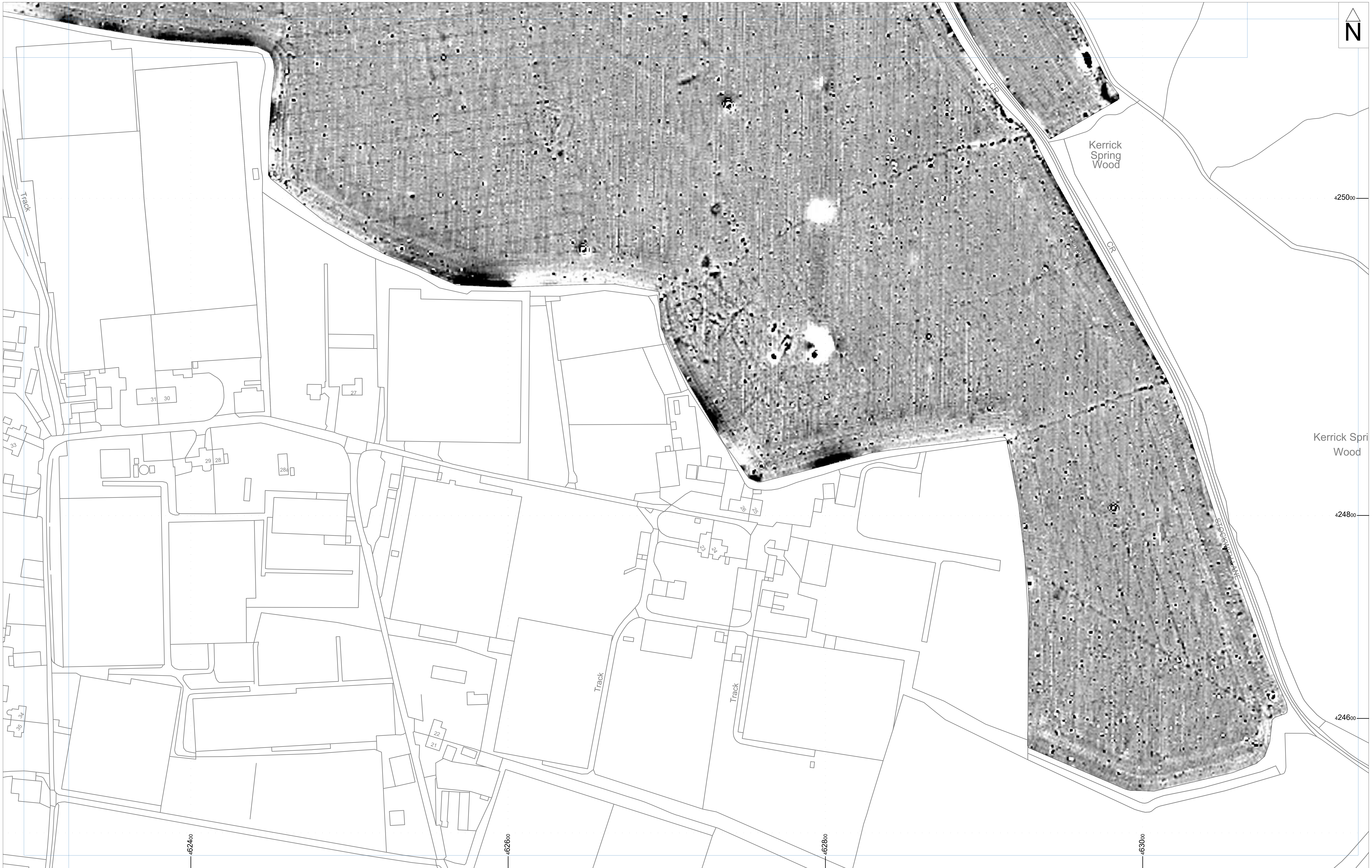
- SECTOR BOUNDARY

Interpretation

- FERROUS
- MAGNETIC DISTURBANCE
- FIELD DRAIN
- RIDGE & FURROW
- AGRICULTURAL
- FORMER FIELD BOUNDARY
- GEOLOGY
- UNCERTAIN
- ARCHAEOLOGY?

0 50m

1:1,500 @ A2



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Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 20

Fig. 72

Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2

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Project ID: XF70_HLO22

XY trace plot of minimally processed magnetometer data: Sector 20

Fig. 73

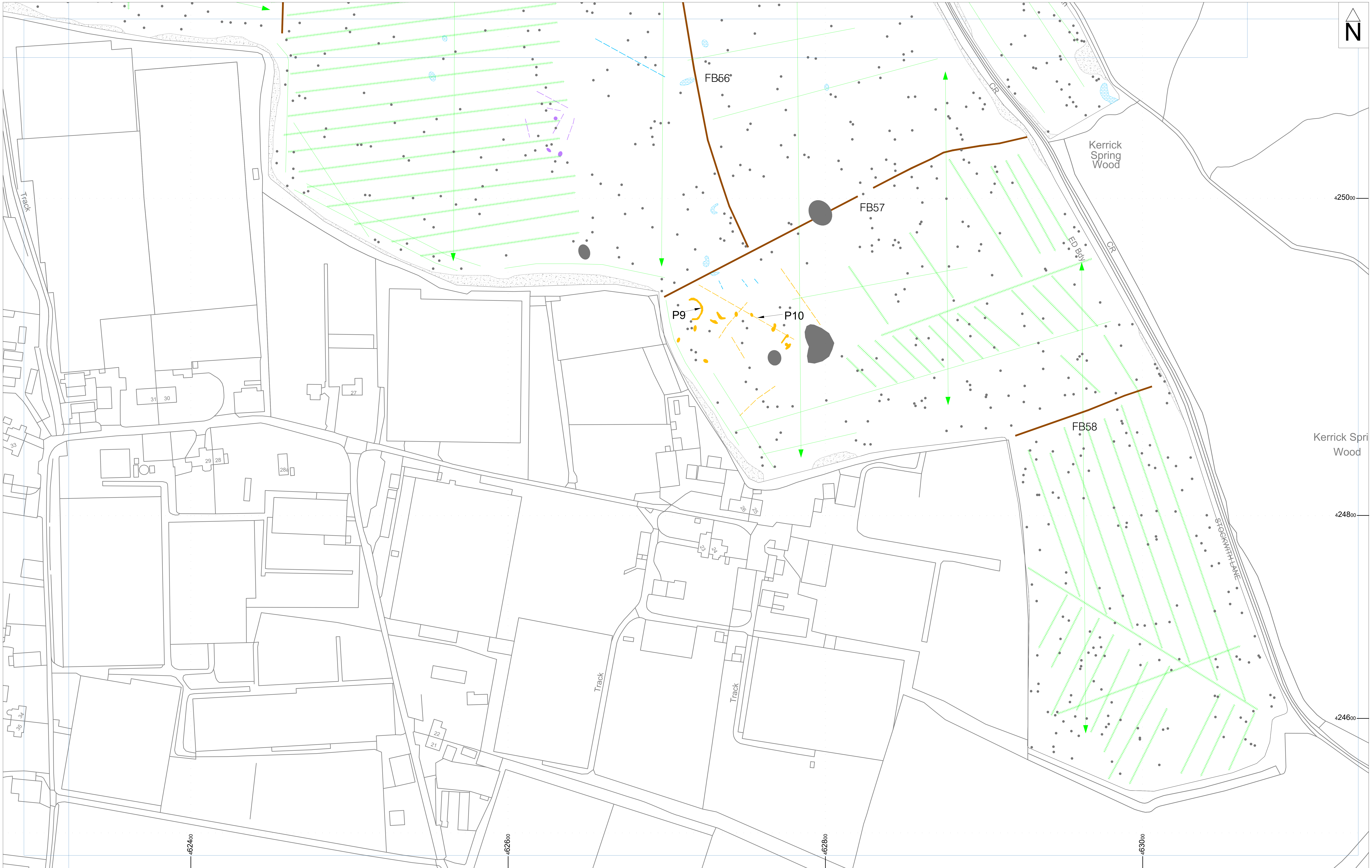
Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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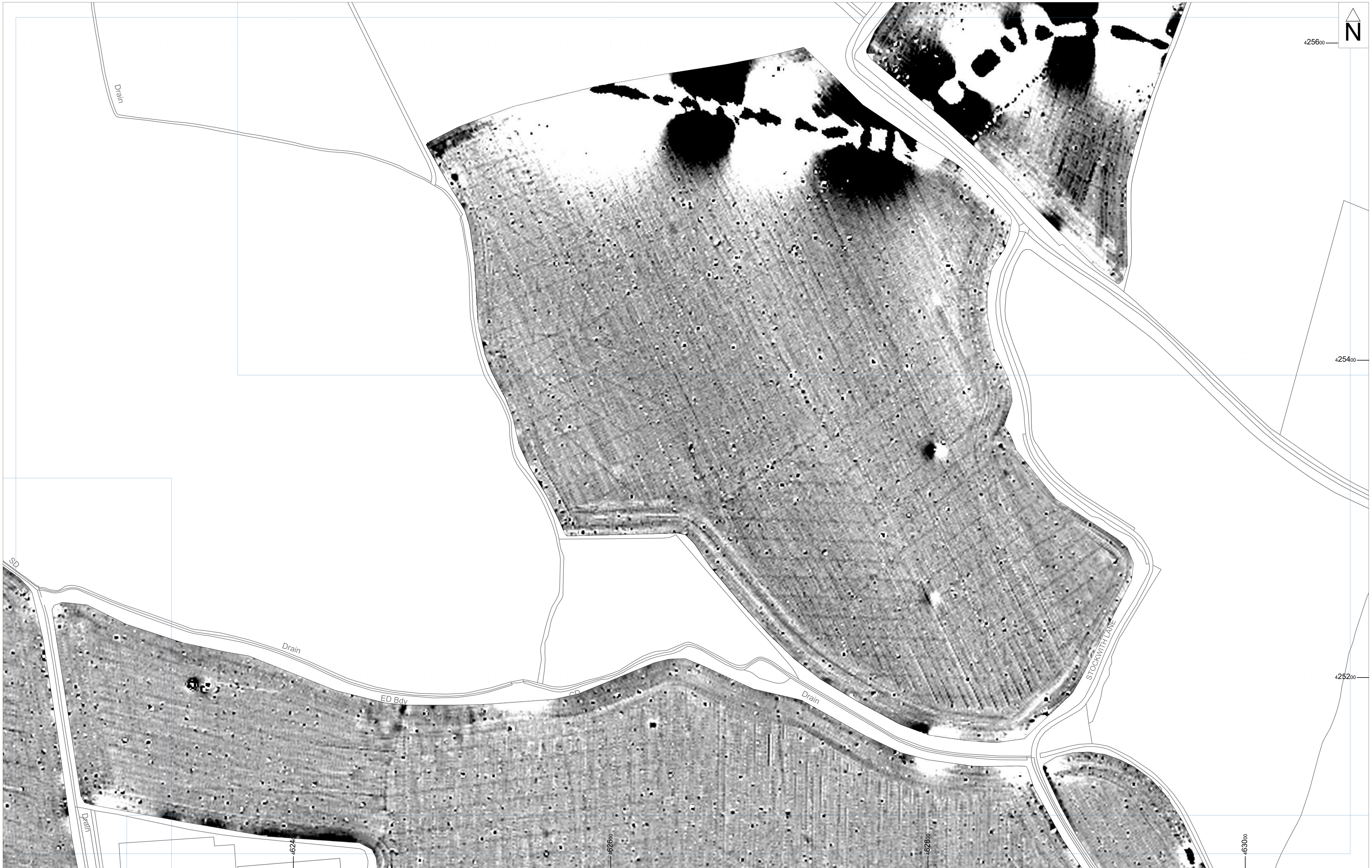
Project ID: XF70_HLO22

Interpretation of magnetometer data: Sector 20

Fig. 74

Title
- SECTOR BOUNDARY

Interpretation
- FERROUS
- MAGNETIC DISTURBANCE
- FIELD DRAIN
- AGRICULTURAL
- FORMER FIELD BOUNDARY
- GEOLOGY
- UNCERTAIN
- ARCHAEOLOGY?



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Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 21

Fig. 75

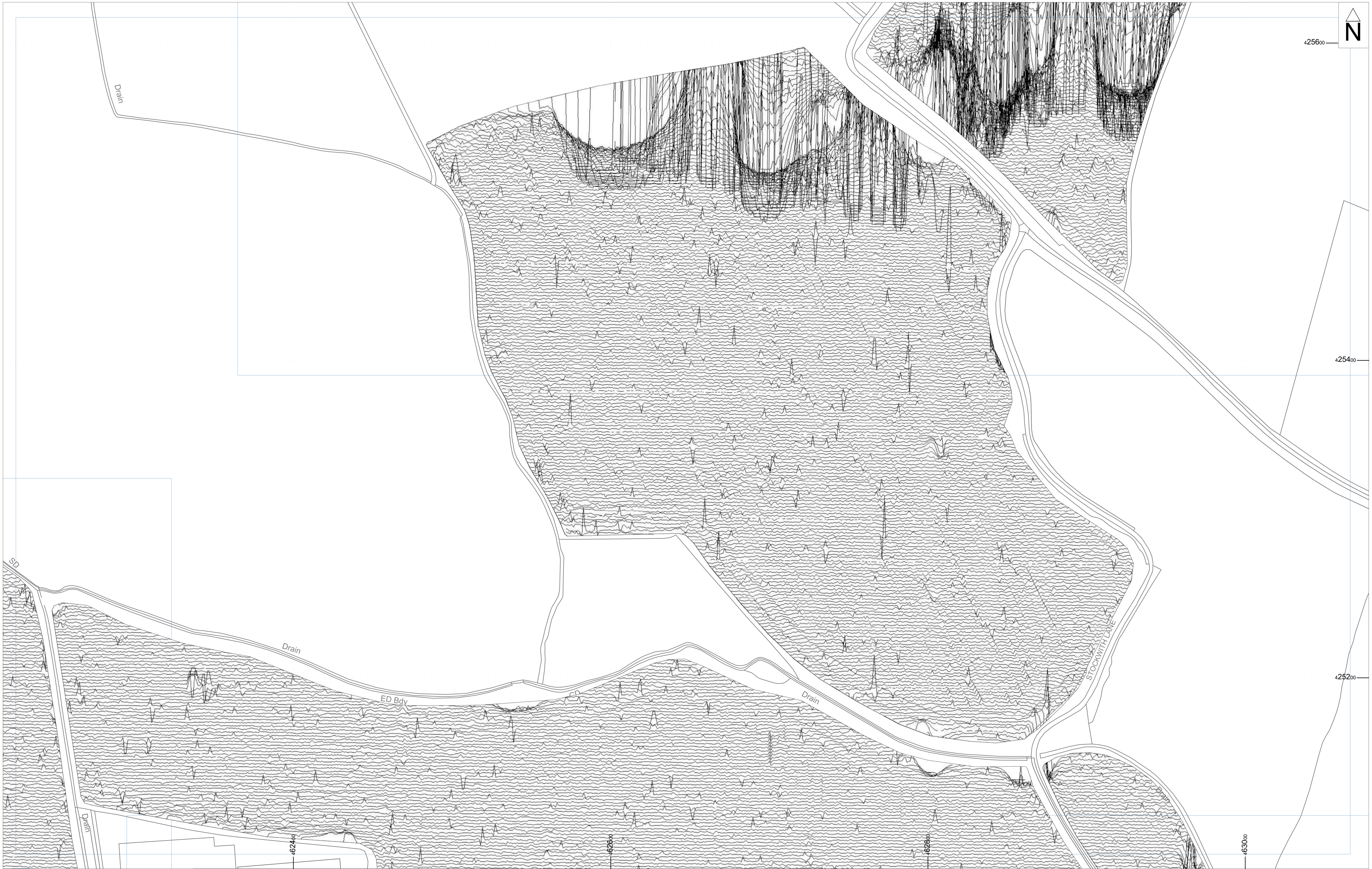
Title

SECTOR BOUNDARY

nT -1.0 2.0

0 50m

1:1,500 @ A2



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Project ID: XF70_HLO22

XY trace plot of minimally processed magnetometer data: Sector 21

Fig. 76

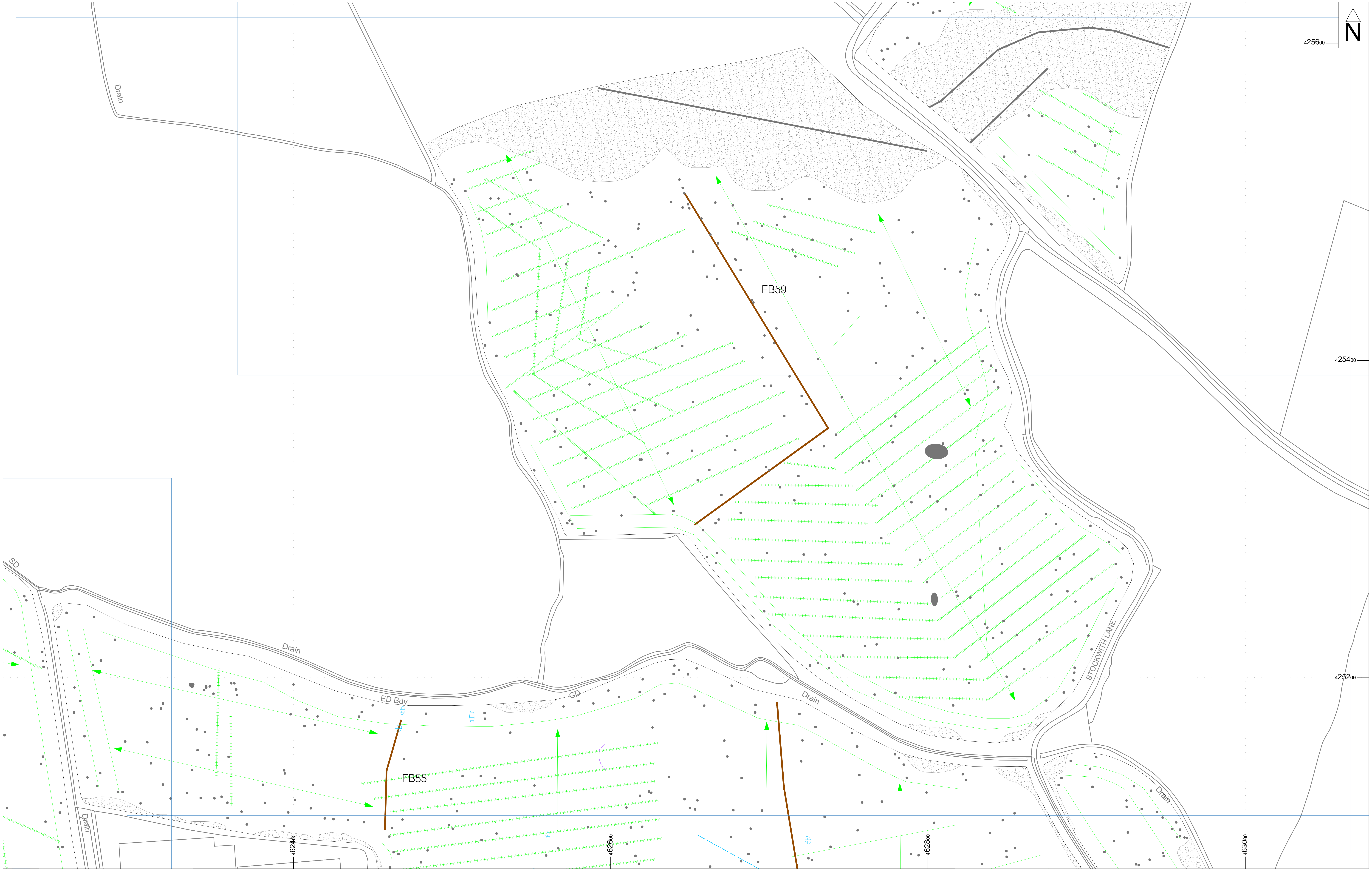
Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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Project ID: XF70_HLO22

Interpretation of magnetometer data: Sector 21

Fig. 77

Title

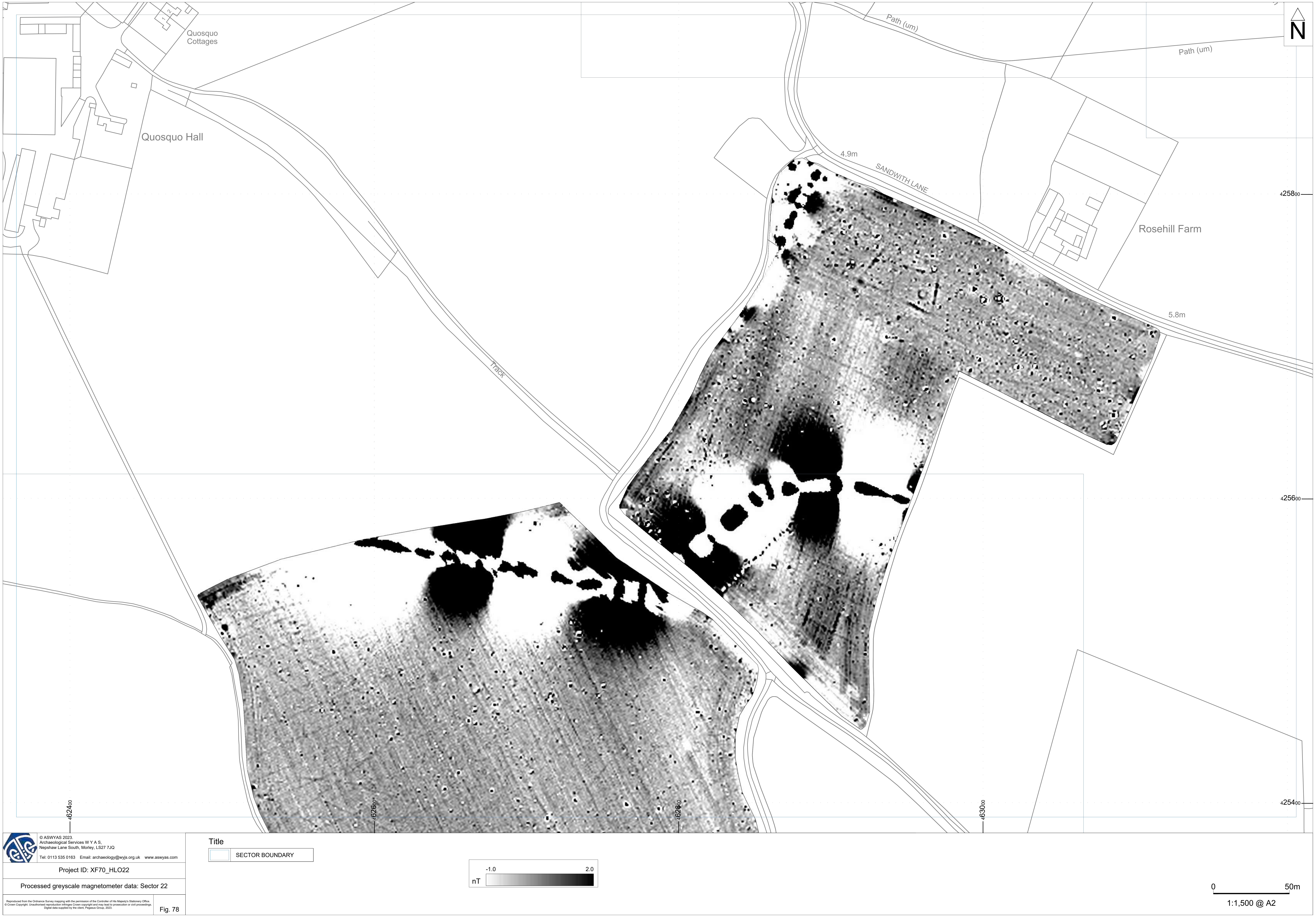
	SECTOR BOUNDARY

Interpretation

	FERROUS		AGRICULTURAL		UNCERTAIN
	MAGNETIC DISTURBANCE		FORMER FIELD BOUNDARY		
	FIELD DRAIN		GEOLOGY		

0 50m

1:1,500 @ A2



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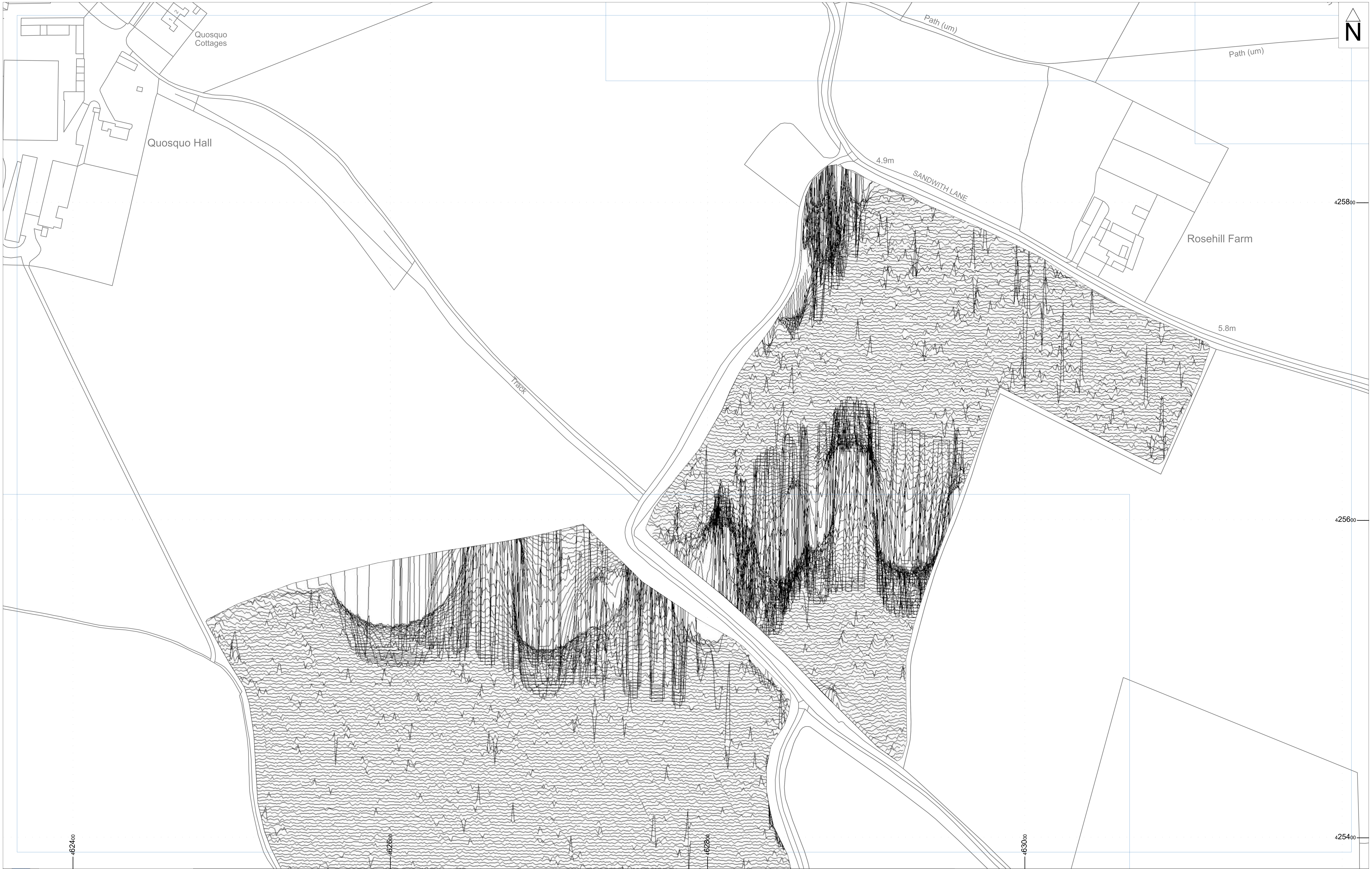
Project ID: XF70_HLO22

Processed greyscale magnetometer data: Sector 22

Fig. 78



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Project ID: XF70_HLO22

XY trace plot of minimally processed magnetometer data: Sector 22

Fig. 79

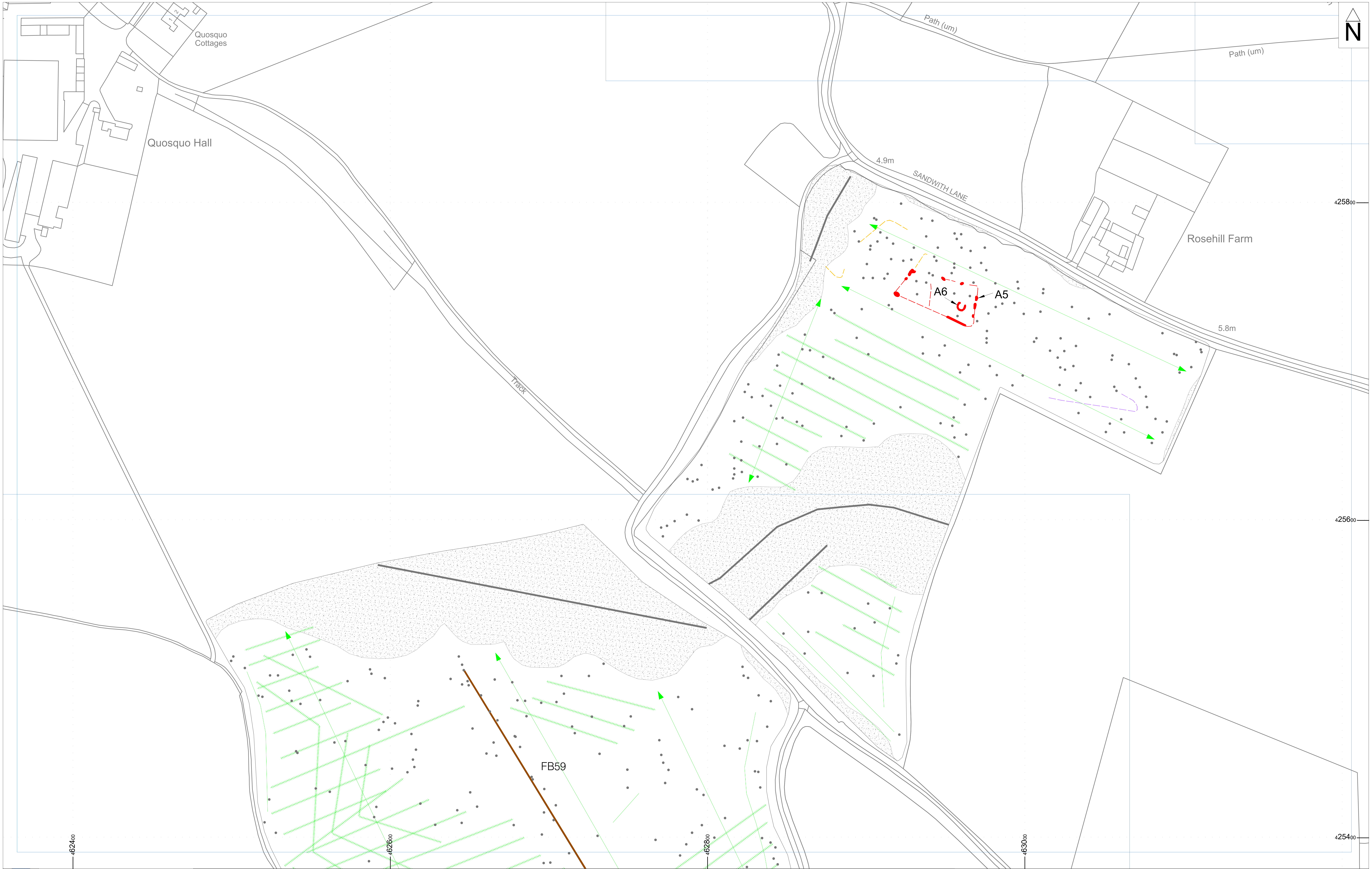
Title

SECTOR BOUNDARY

15.0 nT/cm

0 50m

1:1,500 @ A2



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Project ID: XF70_HLO22

Interpretation of magnetometer data: Sector 22

Fig. 80

Title

SECTOR BOUNDARY

Interpretation

FERROUS
SERVICE PIPE
MAGNETIC DISTURBANCE
FIELD DRAIN
AGRICULTURAL
FORMER FIELD BOUNDARY
GEOLOGY
UNCERTAIN
ARCHAEOLOGY?
ARCHAEOLOGY

0 50m

1:1,500 @ A2

Appendix 1: Magnetic survey - technical information

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 haemetite. 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. Areas of human occupation or settlement can then be identified by measuring the magnetic susceptibility of the topsoil because 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 and the fermentation and bacterial effects associated with rubbish decomposition. The area of enhancement is usually quite large, mainly due to the tendency of discard areas to extend beyond the limit of the occupation site itself, and spreading by the plough.

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 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.

Methodology: Gradiometer Survey

The main method of using the fluxgate gradiometer for commercial evaluations is referred to as ***detailed survey*** and requires the surveyor to walk at an even pace carrying the instrument within a grid system. A sample trigger automatically takes readings at predetermined points, typically at 0.25m intervals, on traverses 1m apart. These readings are stored in the memory of the instrument and are later dumped to computer for processing and interpretation.

During this survey an eight channel Sensys MX V3 system containing eight FGM650 sensors was also used which was towed across the area using an ATV. Readings were taken every 20MHz (between 0.05 and 0.1m). Data was be recorded onto a device, using a Carlson GNSS Smart antenna, for centimetre accuracy. These readings were stored in the memory of the instrument and downloaded for processing and interpretation.

The gradiometer data have been presented in this report in processed greyscale format. The data in the greyscale images have been interpolated and selectively filtered to remove the effects of drift in instrument calibration and other artificial data constructs and to maximise the clarity and interpretability of the archaeological anomalies.

Appendix 2: Survey location information

An initial survey station was established using a Trimble VRS differential Global Positioning System (Trimble R6 model). The data was geo-referenced using the geo-referenced survey station with a Trimble RTK differential Global Positioning System (Trimble R6 model). The accuracy of this equipment is better than 0.01m. The survey grids 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 co-ordinates are measured off hard copies of the mapping rather than using the digital co-ordinates.

Archaeological Services WYAS cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

Appendix 3: Geophysical archive and metadata

The geophysical archive comprises:-

- an archive disk containing compressed (WinZip 8) files of the raw data, report text (Microsoft Word 2003), and graphics files (Adobe Illustrator CS6 and AutoCAD 2017) files; and
- a full copy of the report.

At present the archive is held by Archaeological Services WYAS although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (i.e. available for consultation in the North Yorkshire Historic Environment Record).

Appendix 4: Oasis form

OASIS Summary for archaeol11-515749

OASIS ID (UID)	archaeol11-515749
Project Name	Geophysical Survey at Helios Renewable Energy Scheme
Sitename	Helios Renewable Energy Scheme
Sitecode	HLO22
Project Identifier(s)	
Activity type	Geophysical Survey, MAGNETOMETRY SURVEY
Planning Id	
Reason For Investigation	Planning: Pre application
Organisation Responsible for work	Archaeological Services WYAS
Project Dates	21-Jul-2022 - 11-Aug-2023
Location	Helios Renewable Energy Scheme NGR : SE 64168 25505 LL : 53.722015079752296, -1.029036540433109 12 Fig : 464168,425505
Administrative Areas	Country : England County : North Yorkshire District : Selby Parish : Carlton
Project Methodology	The cart-based survey was undertaken using an eight channel SenSYS MX V3 system containing eight FGM650 sensors. Readings are taken every 20MHz (between 0.05 and 0.1m). Data were recorded onto a device, using a Carlson GNSS Smart antenna, for centimetre accuracy. These readings were stored in the memory of the instrument and downloaded for processing and interpretation. DLMGPS and MAGNETO software, alongside bespoke in-house software was used to process and present the data.
Project Results	A geophysical (magnetometer) survey was undertaken on approximately 530 hectares of land located to the northwest of Camblesforth known as the Helios Renewable Energy Project. The majority of the anomalies recorded are agricultural including field drains, medieval or post-medieval ridge and furrow cultivation, modern ploughing and former field boundaries. Archaeological and possible archaeological responses have been recorded within the study which comprise linear ditches and trends, rectilinear enclosures and sub-circular trends, perhaps indicative of settlement activity. Based on the geophysical survey, the archaeological potential of this Site is deemed to be high in the areas of likely settlement and low elsewhere.
Keywords	Enclosure - UNCERTAIN - FISH Thesaurus of Monument Types
Funder	Private or public corporation Enso Energy
HER	North Yorkshire HER - unRev - STANDARD
Person Responsible for work	
HER Identifiers	
Archives	

Report generated on: 28 Sep 2023, 15:44

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