Tritax Symmetry (Hinckley) Limited

HINCKLEY NATIONAL RAIL FREIGHT INTERCHANGE

The Hinckley National Rail Freight Interchange Development Consent Order

Project reference TR050007

Environmental Statement
Volume 2: Appendices

Appendix 13.3 - Geophysical Survey Report (Phase 1) [part 2 of 2]

Document reference: 6.2.13.3

Revision: 01

October 2022

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 Regulation 5(2)(a)

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 Regulation 14

This document forms a part of the Environmental Statement for the Hinckley National Rail Freight Interchange project.

Tritax Symmetry (Hinckley) Limited (TSH) has applied to the Secretary of State for Transport for a Development Consent Order (DCO) for the Hinckley National Rail Freight Interchange (HNRFI).

To help inform the determination of the DCO application, TSH has undertaken an environmental impact assessment (EIA) of its proposals. EIA is a process that aims to improve the environmental design of a development proposal, and to provide the decision maker with sufficient information about the environmental effects of the project to make a decision.

The findings of an EIA are described in a written report known as an Environmental Statement (ES). An ES provides environmental information about the scheme, including a description of the development, its predicted environmental effects and the measures proposed to ameliorate any adverse effects.

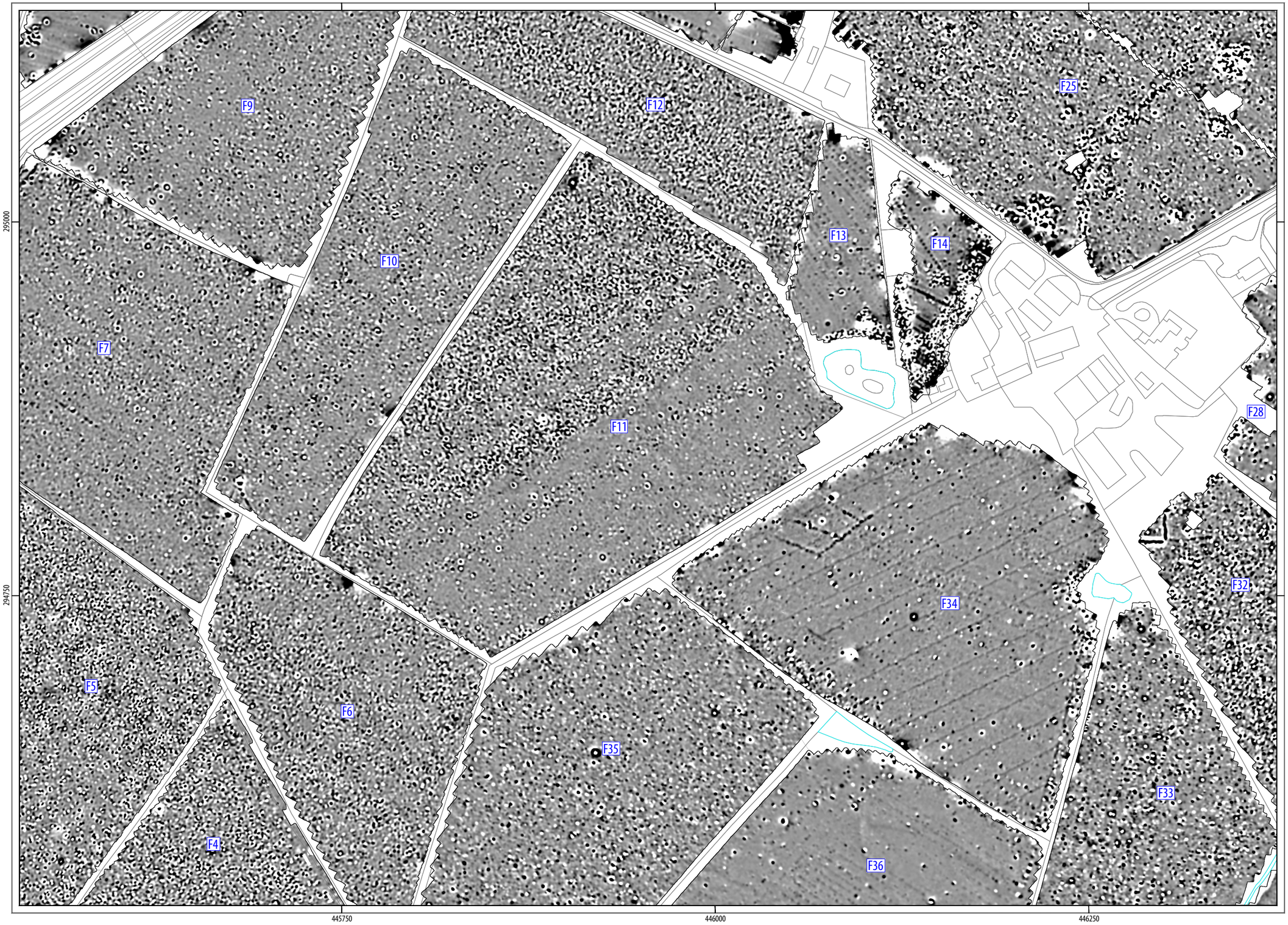
Further details about the proposed Hinckley National Rail Freight Interchange are available on the project website:

[redacted]

The DCO application and documents relating to the examination of the proposed development can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/projects/east-midlands/hinckley-national-rail-freight-interchange/

Appendix 13.3: This document was prepared by Headland Archaeology in 2018 as part of the baseline gathering exercise for the HNRFI. Since this report was prepared amendments have been made to the defined Order Limits as a result of design development. Nonetheless, the contents of this report continue to form a robust evidence base and as such this appendix is used to support the assessment in Chapter 13 (document Reference 6.1.13) of the ES.



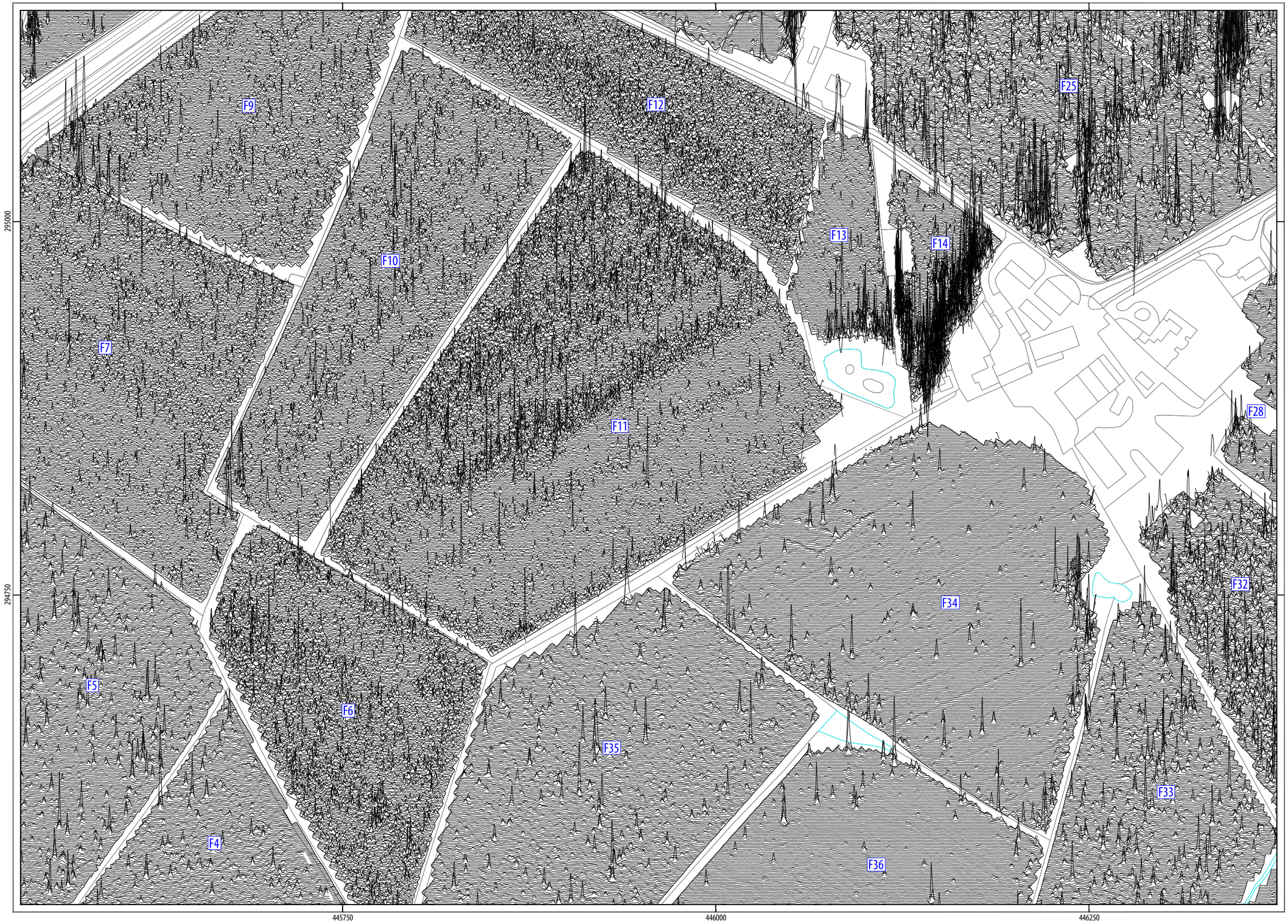
PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

ILLUS 19 Processed greyscale magnetometer data; Sector 4



50.0nT/cm

0 50m

1:2,500 @ A3

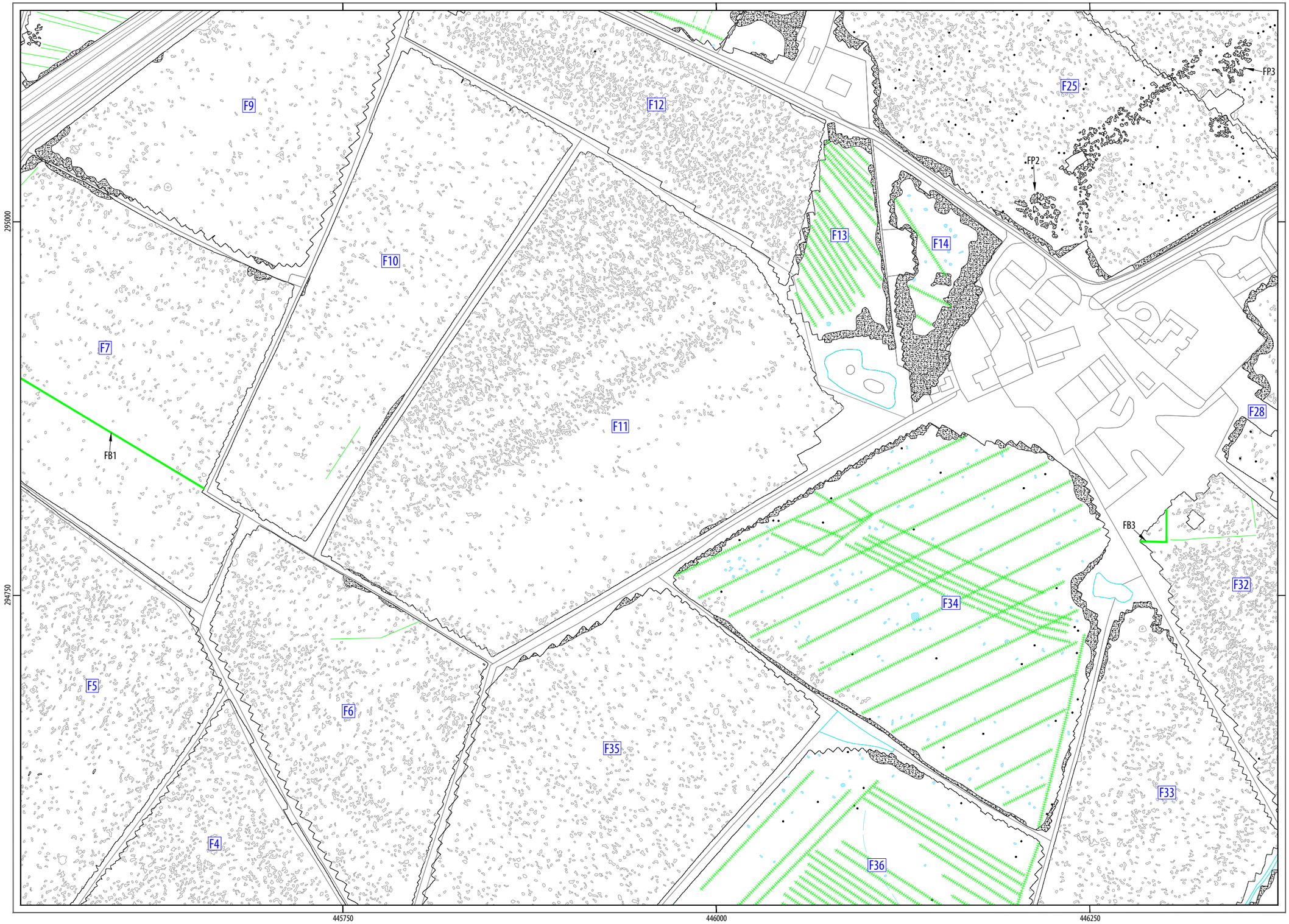
PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

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



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

ABBREVIATIONS

FB former boundary

FP former pond

0 50m

1:2,500 @ A3

PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

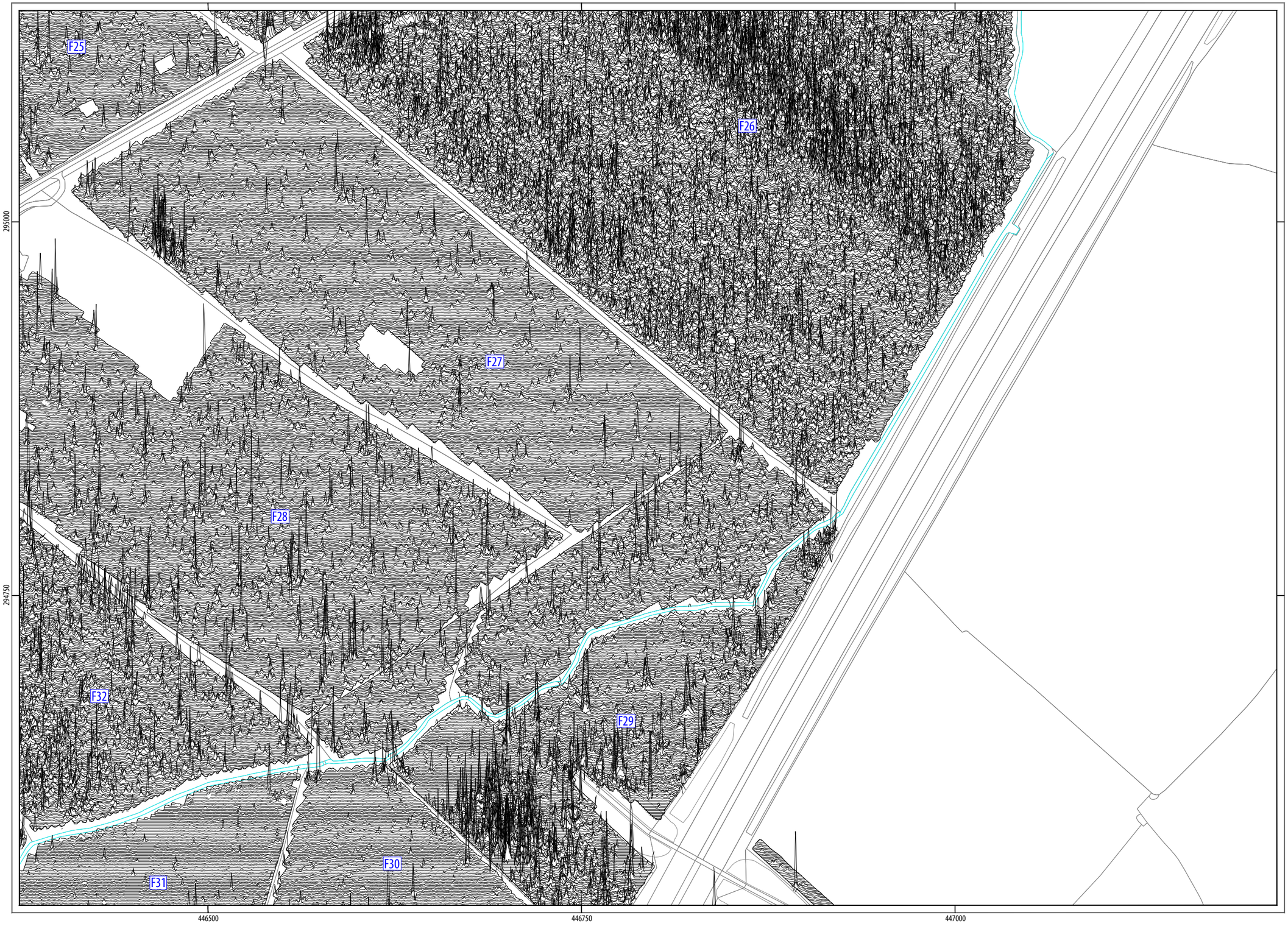
HEADLAND ARCHAEOLOGY

NOR [redacted]

ILLUS 21 Interpretation of magnetometer data; Sector 4

F25
F26
F27
F28
F29
F30
F31
F32
295000
294750
446500
446750
447000
-2.0
nT
3.0
0
50m
1:2,500 @ A3
PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire
CLIENT db symmetry
HEADLAND ARCHAEOLOGY
NOR

ILLUS 22 Processed greyscale magnetometer data; Sector 5



50.0nT/cm

0 50m

1:2,500 @ A3

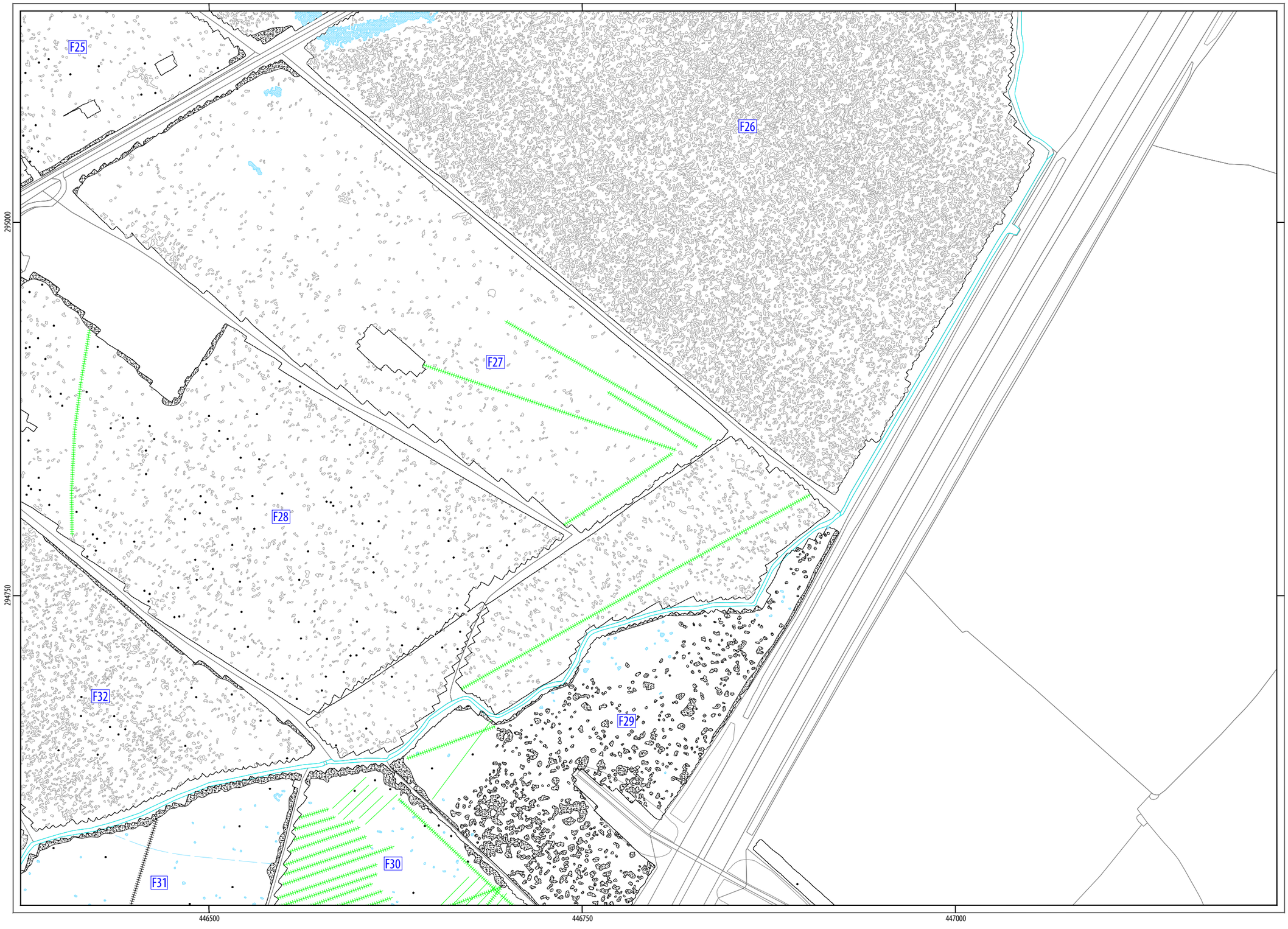
PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

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



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
magnetic disturbance	green waste
dipolar linear	fence
linear trend	agricultural
linear trend	field drain
magnetic enhancement	geology

0 50m
1:2,500 @ A3

PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire
CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

ILLUS 24 Interpretation of magnetometer data; Sector 5

PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

ILLUS 25 Processed greyscale magnetometer data; Sector 6

F4
F6
F35
F33
F38
F3
F36
F37
F39
F40
F41
F43

294500
294250
294000
445750
446000
446250

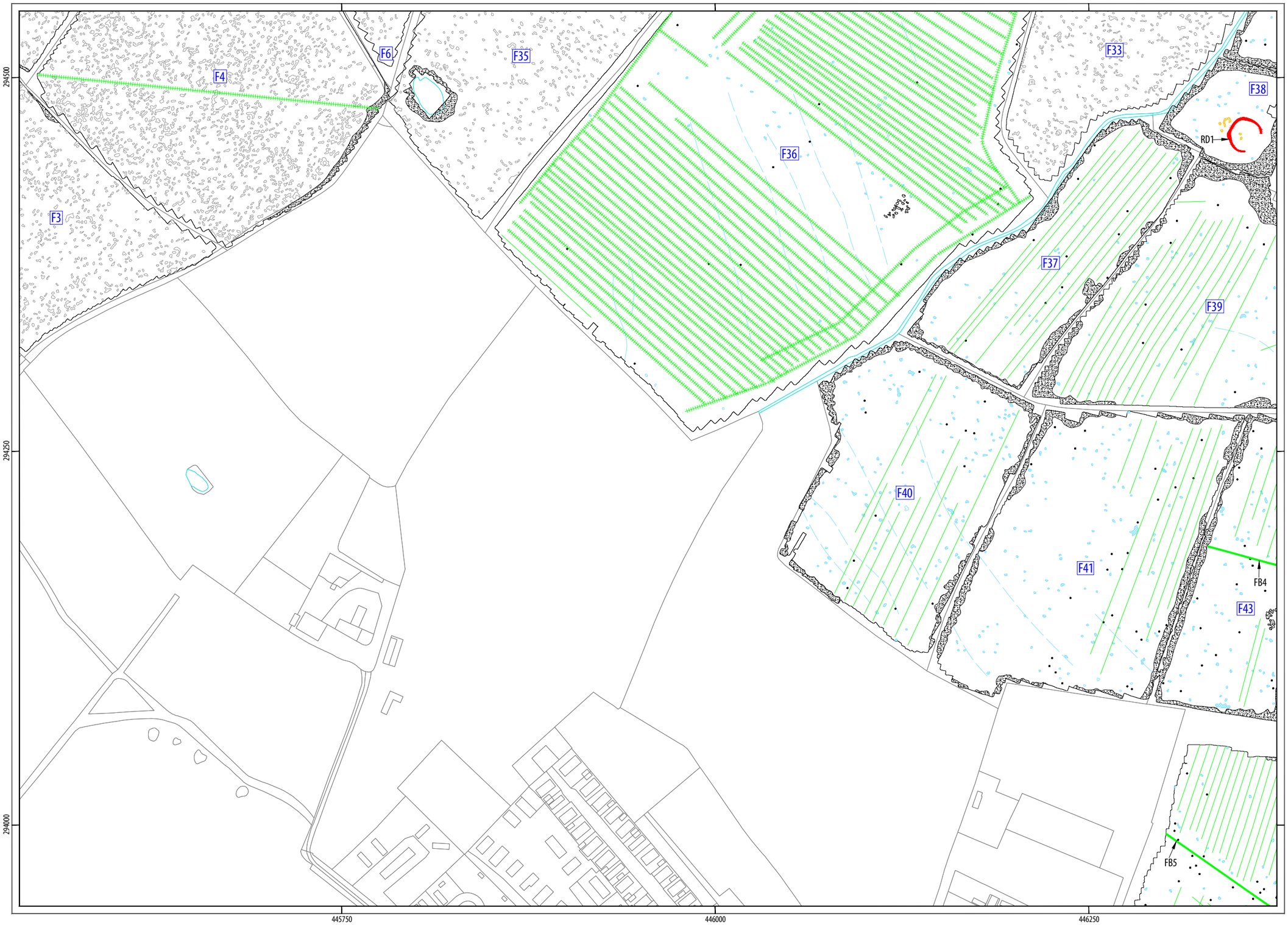
50.0nT/cm
0
50m
1:2,500 @ A3

PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire
CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

ILLUS 26 XY trace plot of minimally processed magnetometer data; Sector 6



TYPE OF ANOMALY | INTERPRETATION

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

ABBREVIATIONS

FB former boundary

RD ring-ditch

0 50m

1:2,500 @ A3

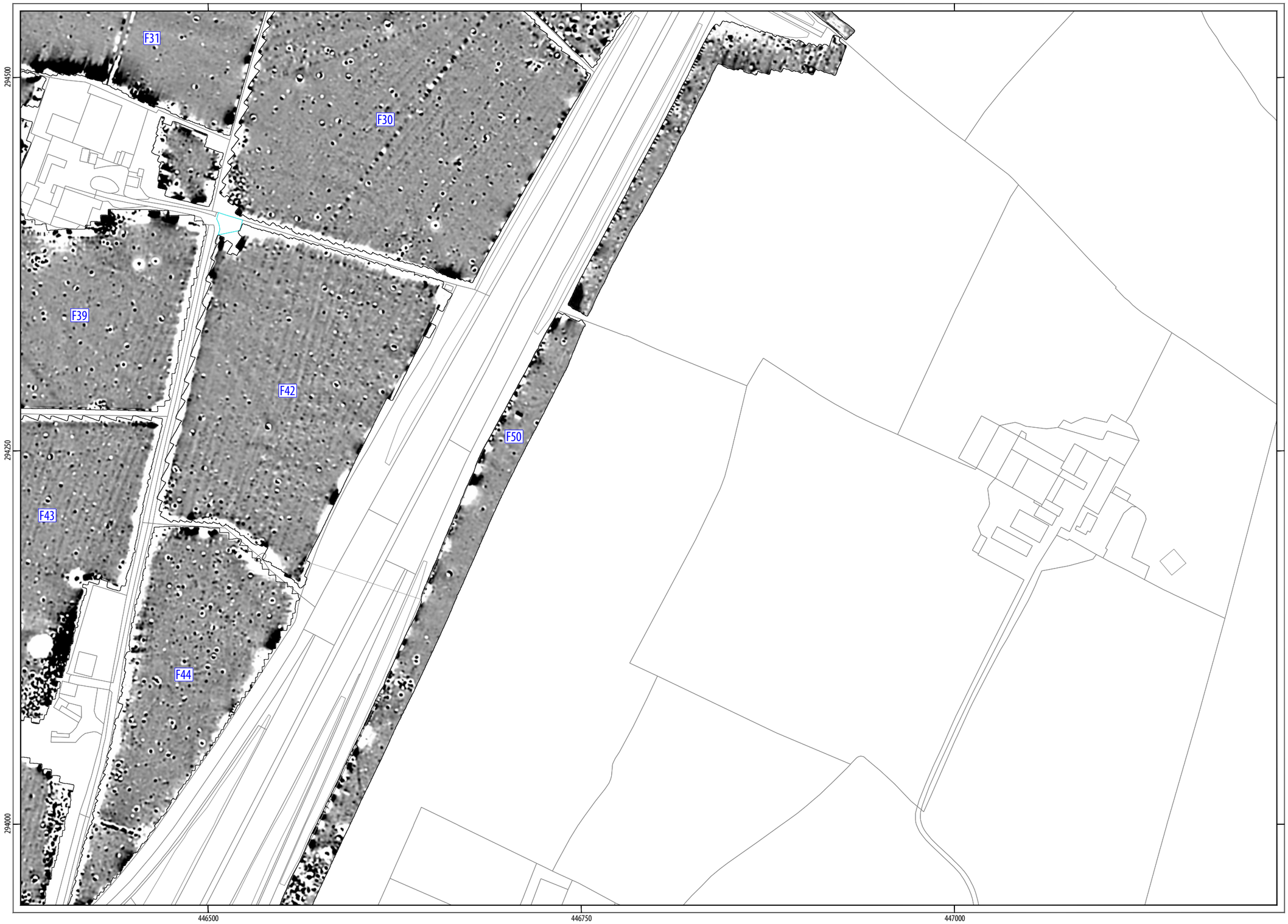
PROJECT **HRFI18**
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

ILLUS 27 Interpretation of magnetometer data; Sector 6



-2.0 nT 3.0

0 50m
1:2,500 @ A3

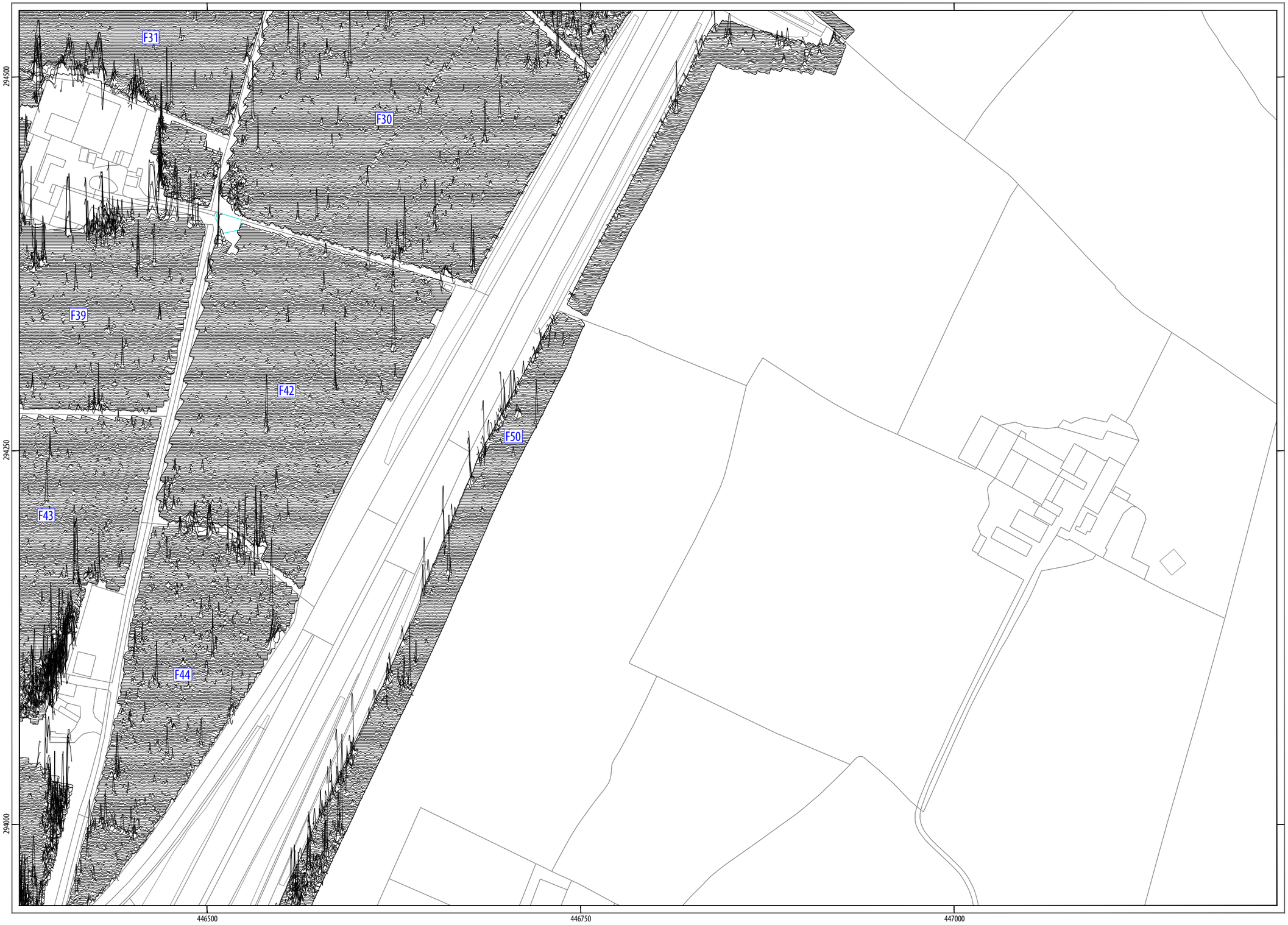
PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

ILLUS 28 Processed greyscale magnetometer data; Sector 7



50.0nT/cm

0 50m

1:2,500 @ A3

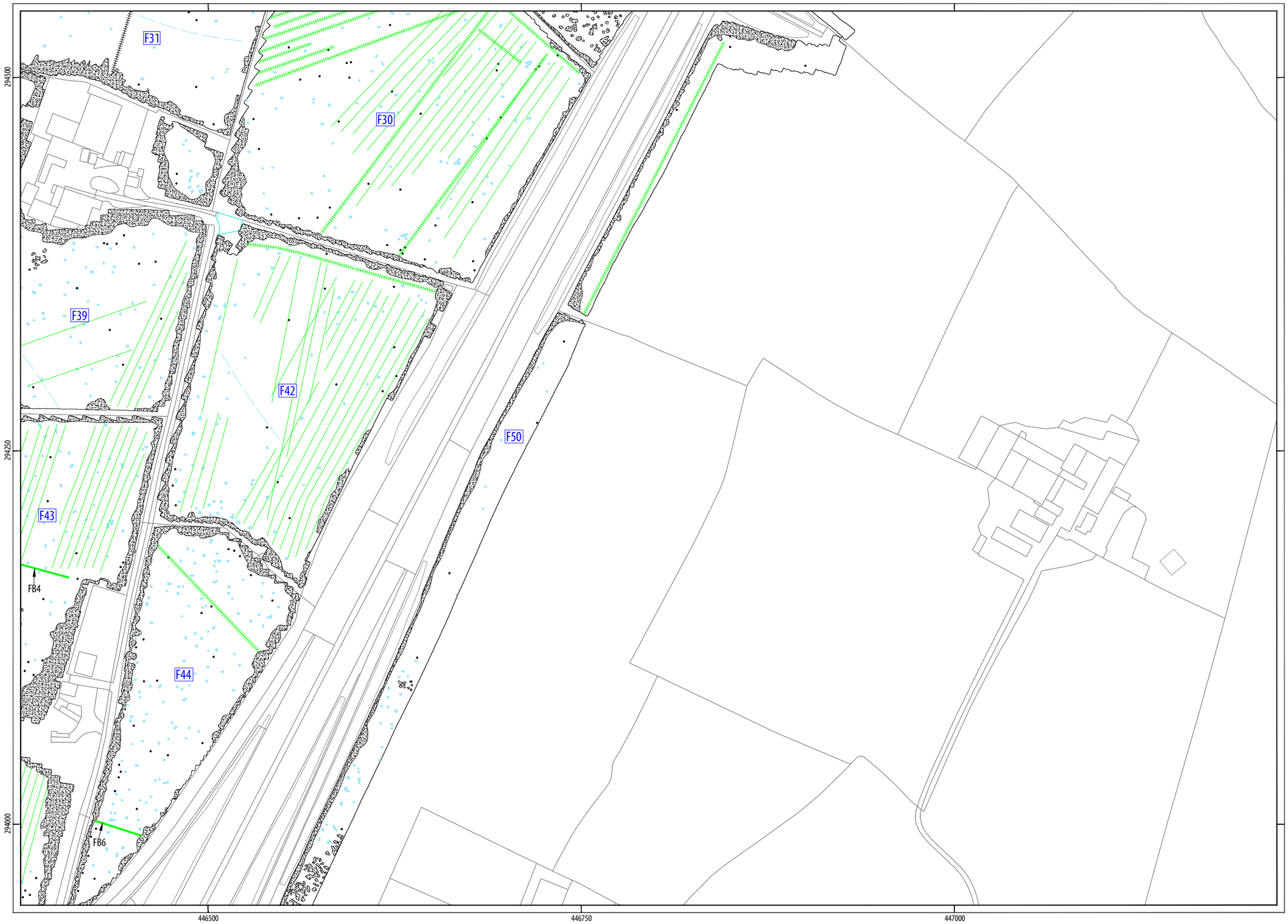
PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

ILLUS 29 XY trace plot of minimally processed magnetometer data; Sector 7



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
dipolar linear	fence
linear trend	agricultural
linear trend	field drain
linear	former field boundary
linear trend	geological variation
magnetic enhancement	geology

ABBREVIATIONS

FB former boundary

RD ring-ditch

0 50m

1:2,500 @ A3

PROJECT **HRFI18**
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

ILLUS 30 Interpretation of magnetometer data; Sector 7

-2.0 nT 3.0

0 50m
1:2,500 @ A3

PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

ILLUS 31 Processed greyscale magnetometer data; Sector 8

50.0nT/cm

0 50m

1:2,500 @ A3

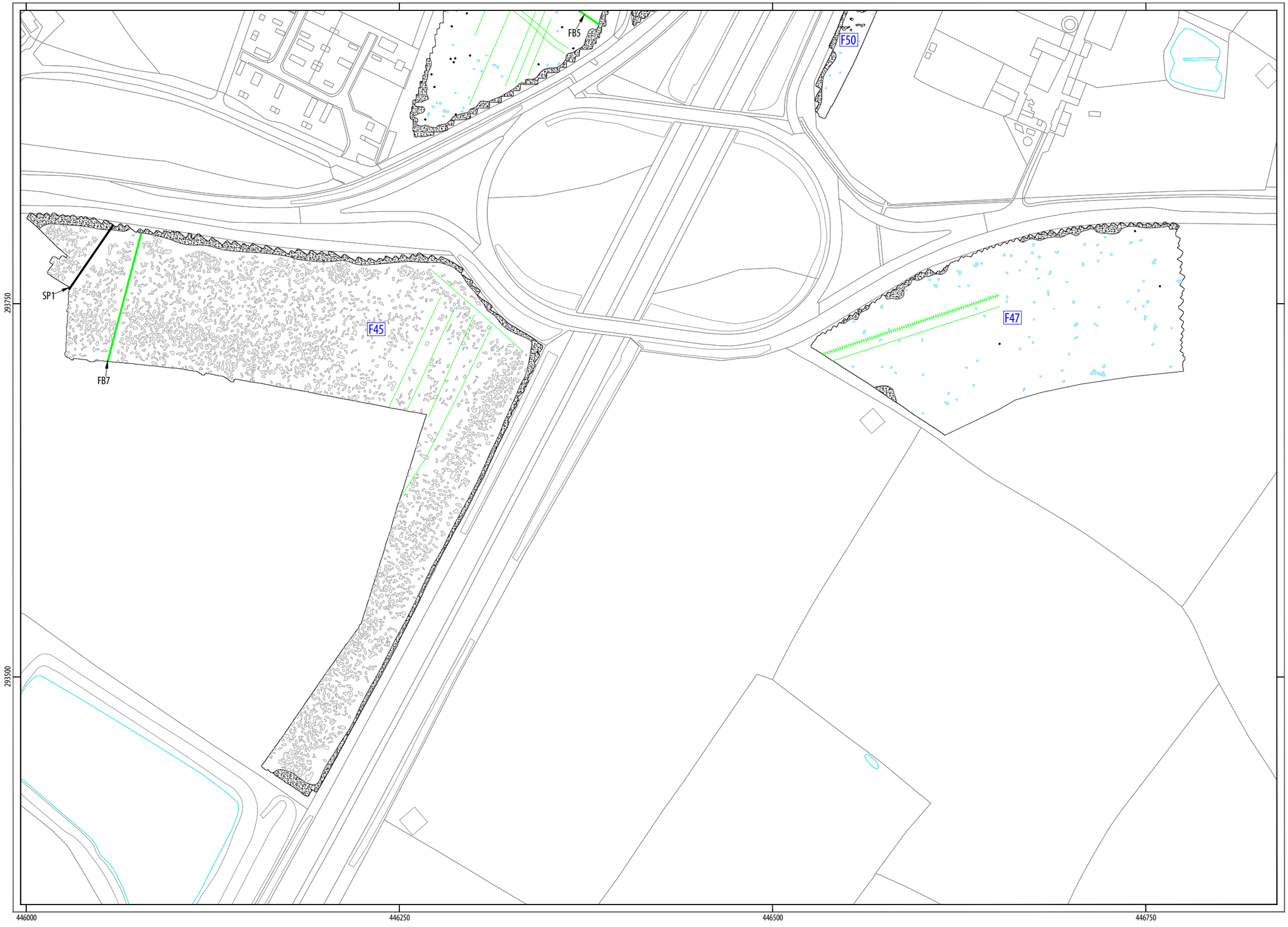
PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

ILLUS 32 XY trace plot of minimally processed magnetometer data; Sector 8



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

ABBREVIATIONS

FB former boundary

SP service pipe

0 50m

1:2,500 @ A3

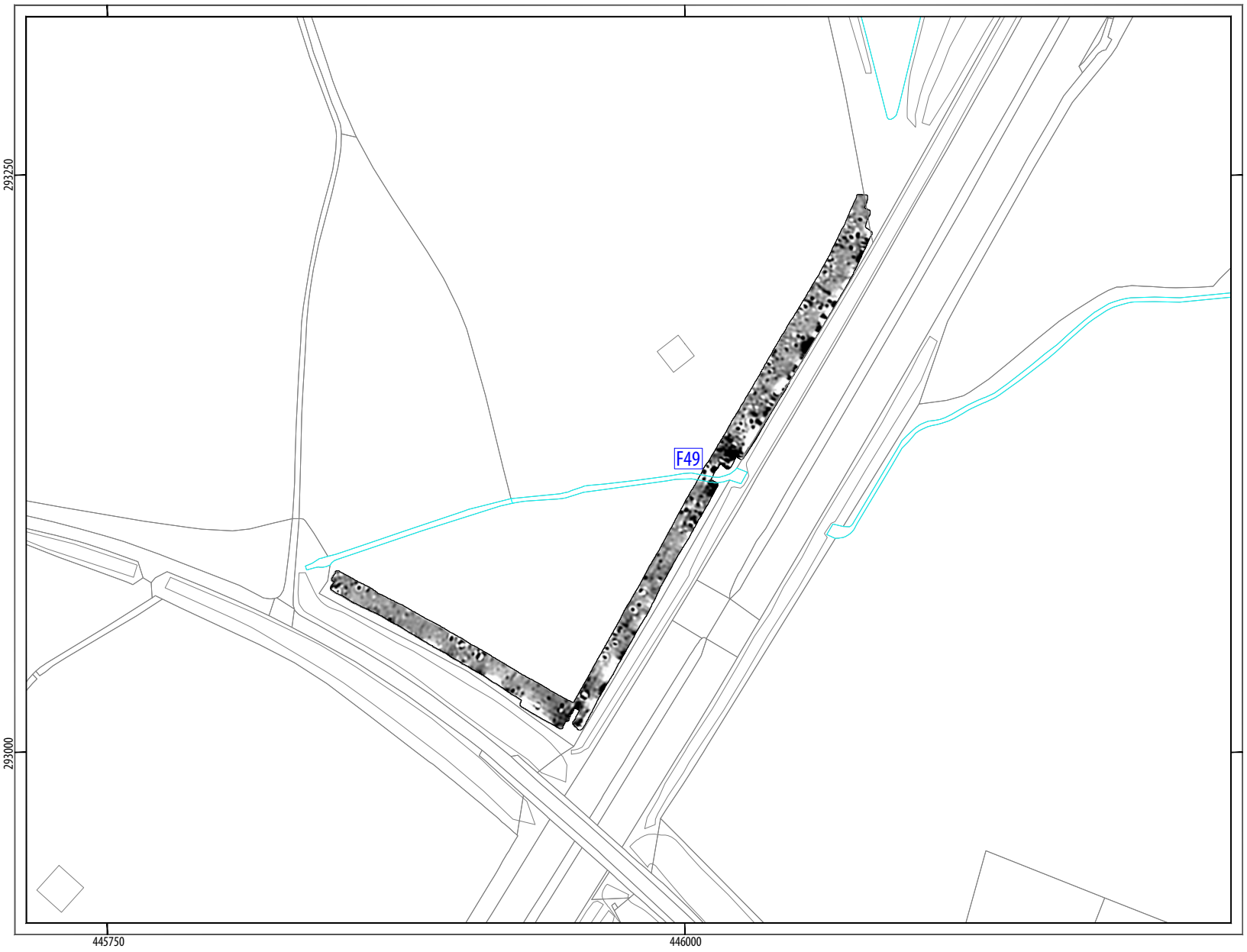
PROJECT **HRFI18**
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

ILLUS 33 XY trace plot of minimally processed magnetometer data; Sector 8



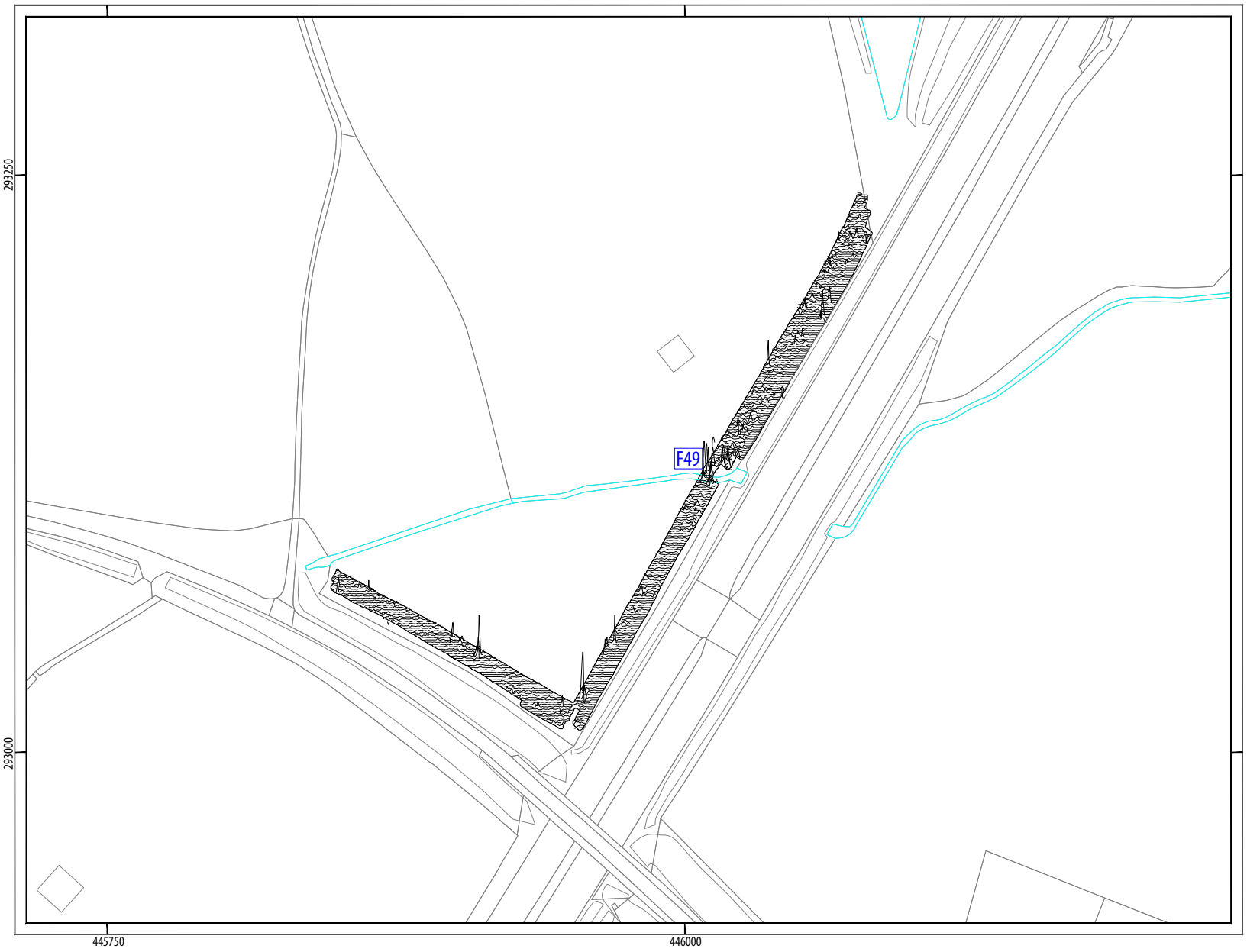
PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NOR [redacted]

ILLUS 34 Processed greyscale magnetometer data; Sector 9



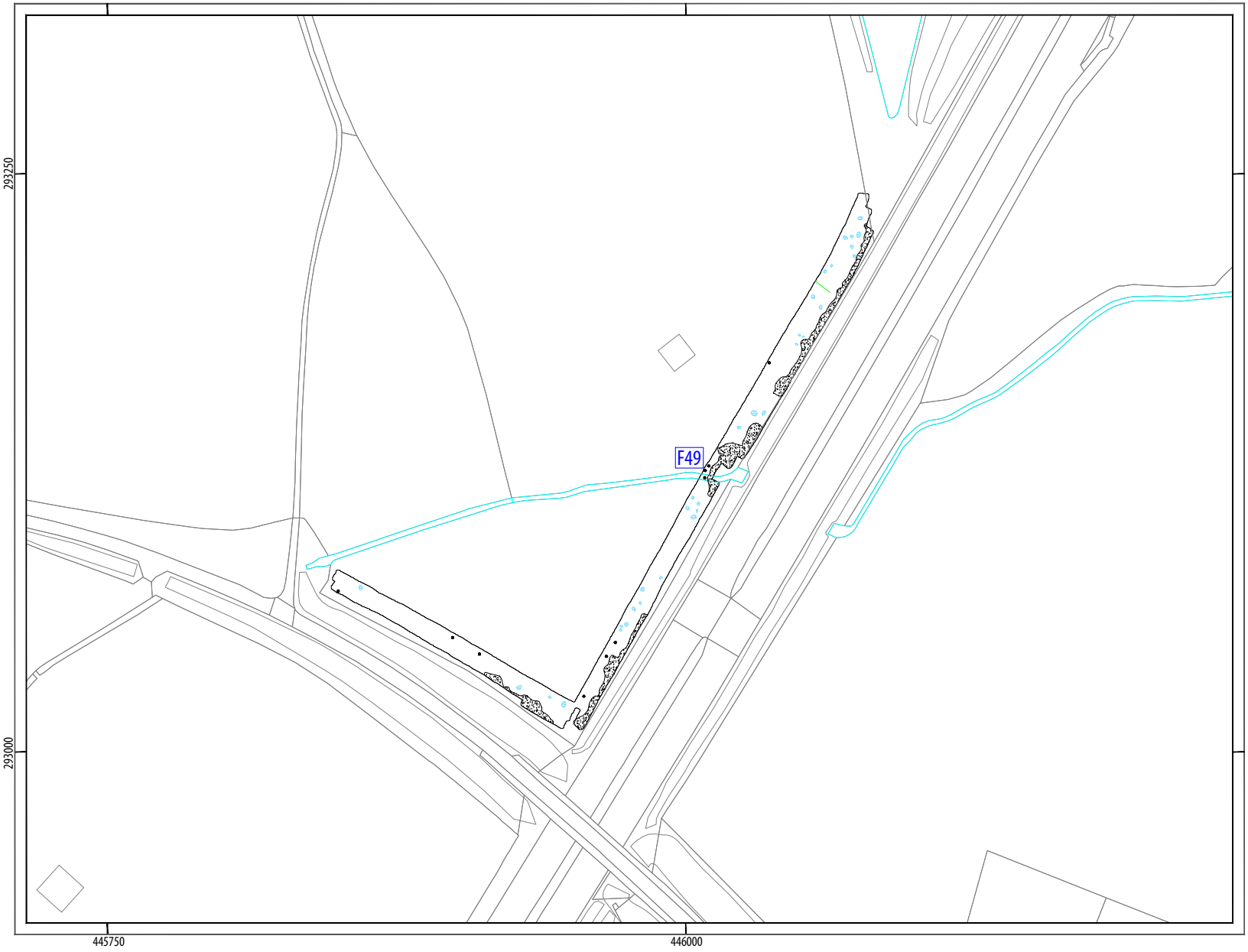
PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NORT [redacted]

ILLUS 35 XY trace plot of minimally processed magnetometer data; Sector 9



TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	agricultural
magnetic enhancement	geology

0 50m
1:2,500 @ A4

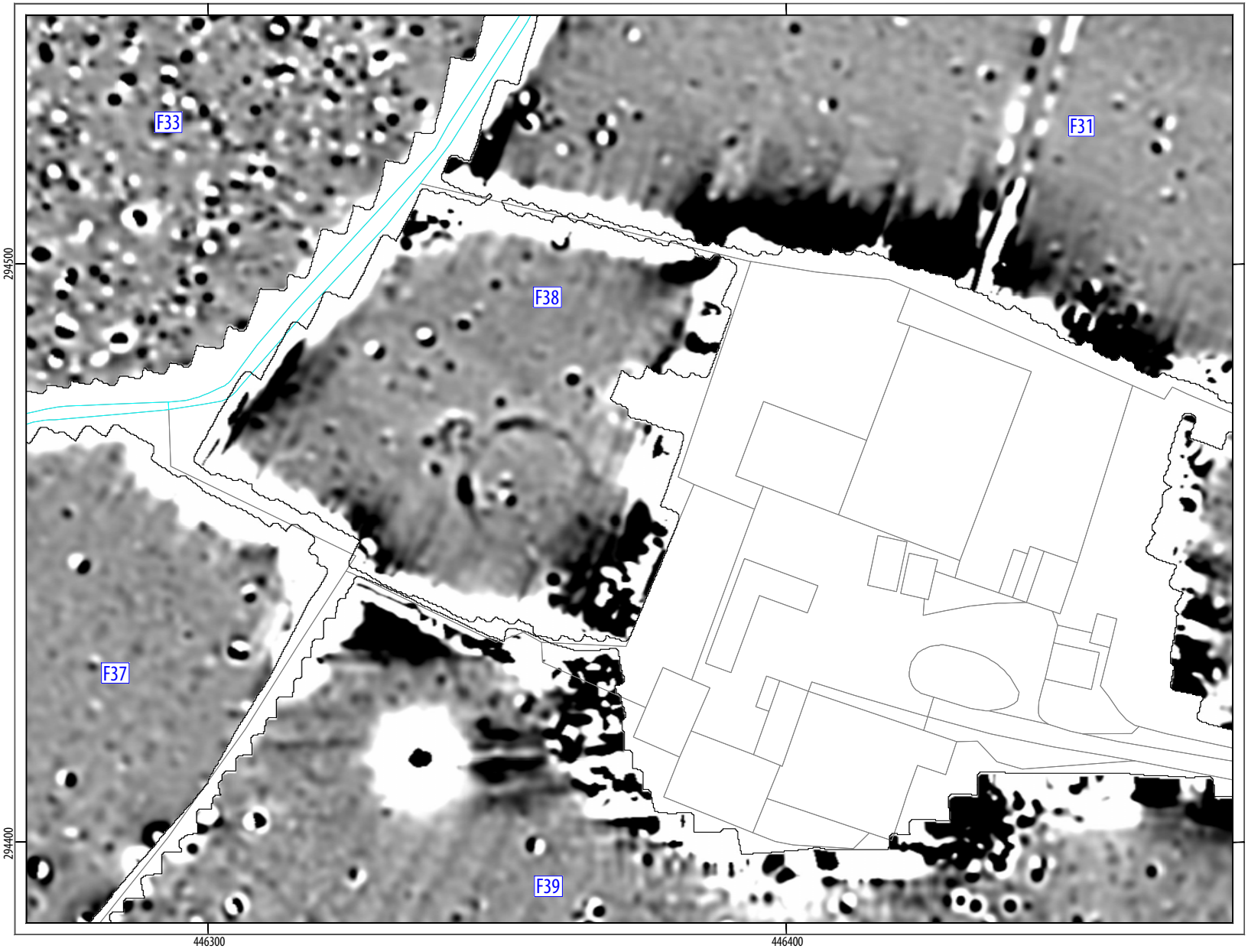
PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

[redacted]

ILLUS 36 Interpretation of magnetometer data; Sector 9



nT
-2.0
3.0

0
25m
1:1,000 @ A4

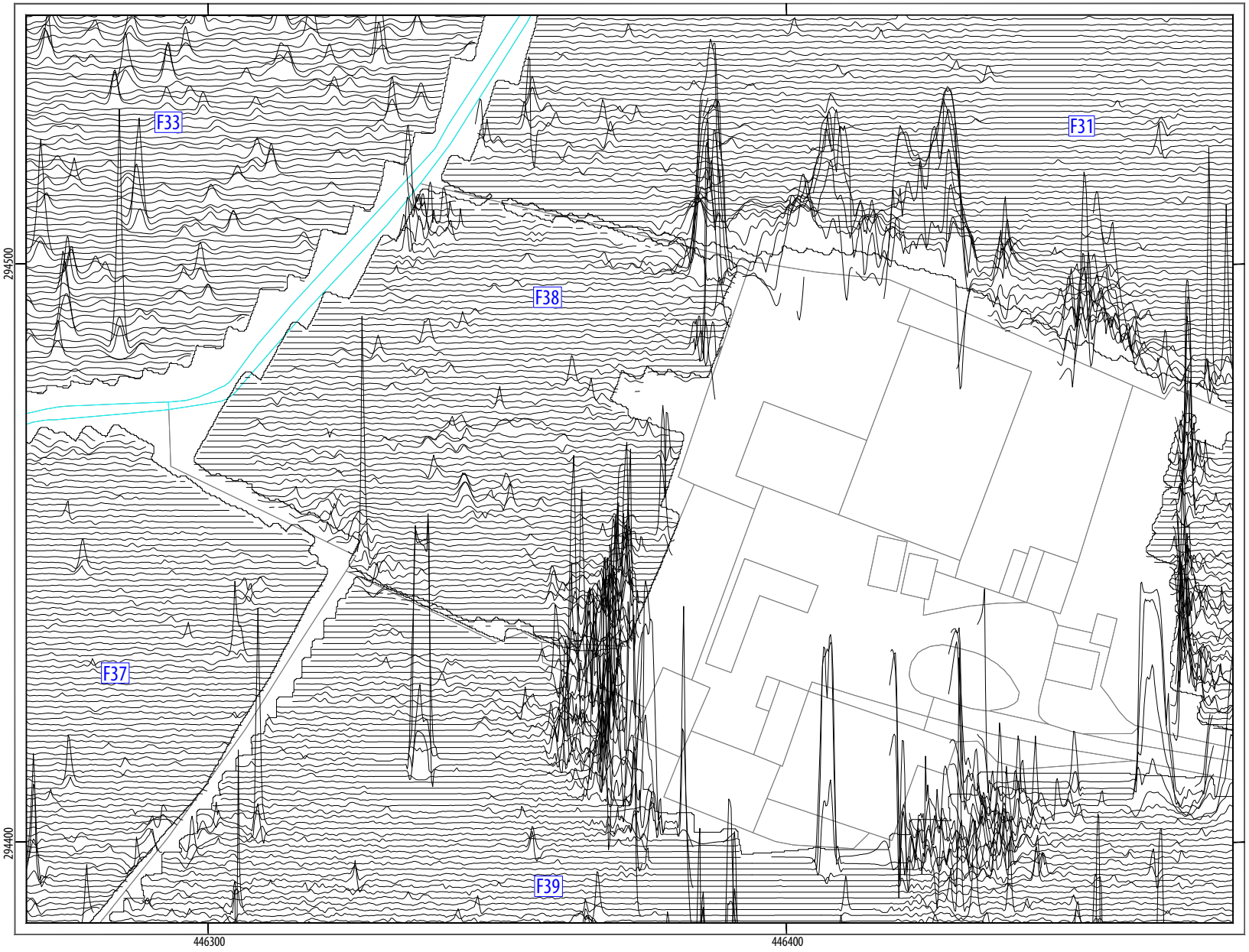
PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

[redacted]

ILLUS 37 Processed greyscale magnetometer data; AAA1



20.0nT/cm

0 25m

1:1,000 @ A4

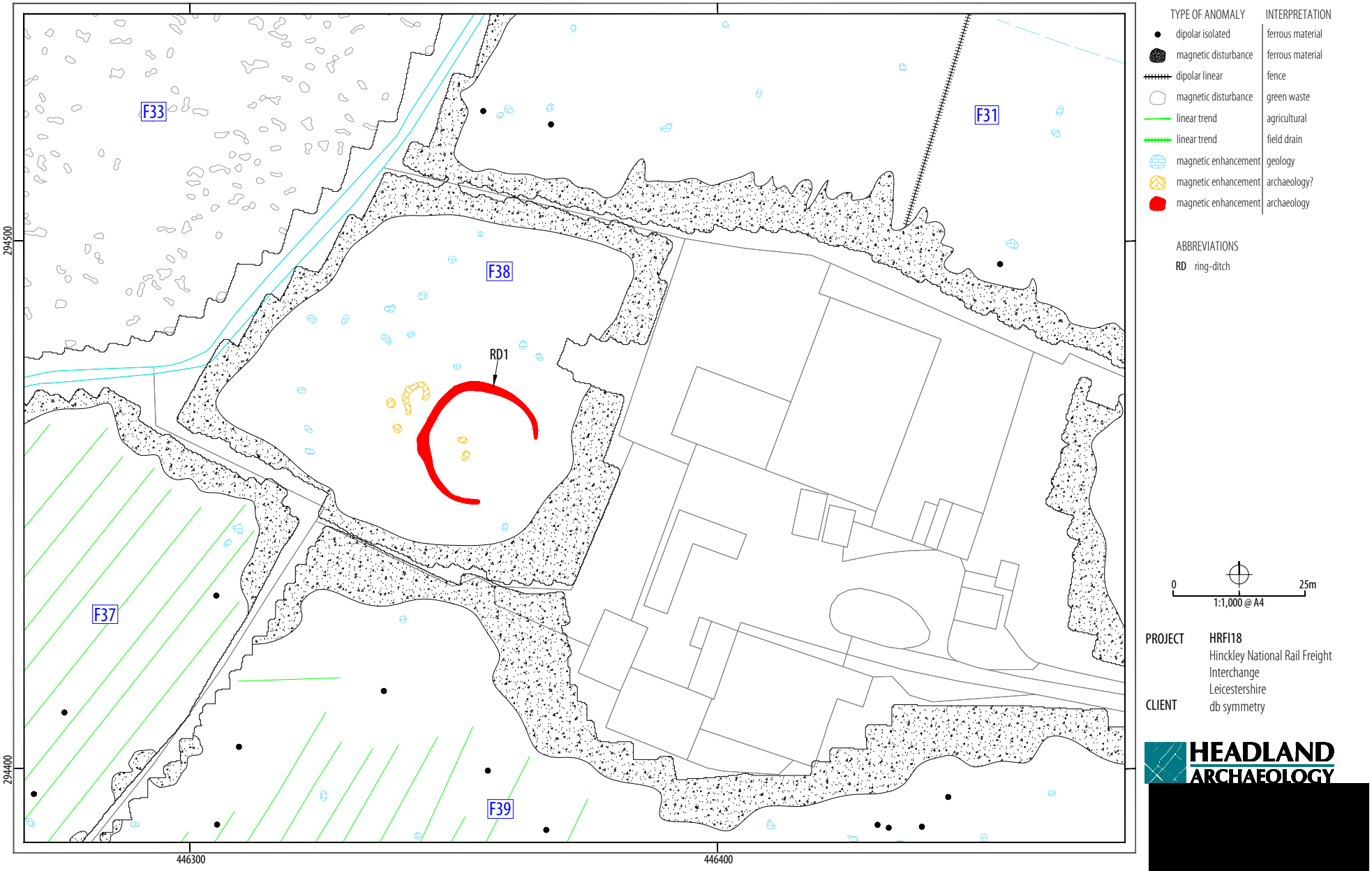
PROJECT HRFI18
Hinckley National Rail Freight Interchange
Leicestershire

CLIENT db symmetry

HEADLAND ARCHAEOLOGY

NO [redacted]

ILLUS 38 XY trace plot of minimally processed magnetometer data; AAA1



ILLUS 39 Interpretation of magnetometer data; AAA1

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 [redacted]). 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: headland5-317763

Project details	
Project name	Hinckley National Rail Freight Interchange
Short description of the project	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey, covering a 190 hectare site at Hinckley, Leicestershire, where a new strategic rail freight interchange (SRFI) is proposed. Evaluation of the proposed development area has been notably affected by the extensive application of green waste as soil conditioner over 75% of the site. This has resulted in a widespread elevated magnetic background against which any low magnitude anomalies of archaeological potential, if present, may be masked. For this reason, the archaeological potential over the affected fields remains uncertain although it is thought that any extensive areas of enclosed settlement, if present, would have been detected, at least in part, over the majority of the geophysical survey area. A single localised ring-ditch has been identified at Hobbs Hayes Farm in an area unaffected by green waste. This anomaly is ascribed high archaeological potential and probably locates a round barrow. No further anomalies of archaeological potential have been identified over the 25% of fields where green waste has not been applied and, in these fields, the archaeological potential is assessed as low.
Project dates	Start: 05-03-2018 End: 06-04-2018
Previous/future work	Not known / Not known
Any associated project reference codes	HRFI18 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Grassland Heathland 5 - Character undetermined
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	Rail links/railway-related infrastructure (including Channel Tunnel)
Prompt	National Policy Statement for National Networks
Position in the planning process	Not known / Not recorded
Solid geology (other)	Mercia Mudstone Group
Drift geology	GLACIAL SAND AND GRAVEL
Drift geology	ALLUVIUM
Drift geology (other)	Diamicton
Techniques	Magnetometry
Project location	
Country	England
Site location	LEICESTERSHIRE BLABY ELMESTHORPE Hinckley National Rail Freight Interchange
Study area	190 Hectares
Site coordinates	SP 4624 9494 52.54997886317 -1.317985292236 52 32 59 N 001 19 04 W Point
Project creators	
Name of Organisation	Headland Archaeology
Project brief originator	The Environmental Dimension Partnership
Project design originator	Headland Archaeology
Project director/manager	Harrison, S

Project supervisor	Bishop, R
Type of sponsor/funding body	Developer
Project archives	
Physical Archive Exists?	No
Digital Archive recipient	In house
Digital Contents	"Survey"
Digital Media available	"Geophysics"
Paper Archive Exists?	No
Project bibliography 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	HINCKLEY NATIONAL RAIL FREIGHT INTERCHANGE, LEICESTERSHIRE; GEOPHYSICAL SURVEY
Author(s)/Editor(s)	Harrison, D.
Date	2018
Issuer or publisher	Headland Archaeology
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Entered on	22 May 2018

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