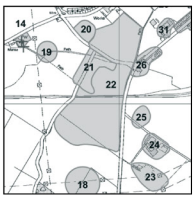
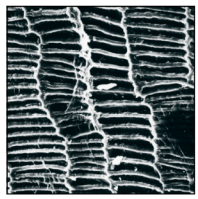
EHNL17










HALTON MARSHES WET GRASSLAND SITE, EAST HALTON, NORTH LINCOLNSHIRE

GEOPHYSICAL SURVEY
PLANNING REF. PA/2016/649

commissioned by Able UK Ltd

January 2018

HEADLAND ARCHAEOLOGY

REGISTERED ORGANISATION CIfA

HALTON MARSHES WET GRASSLAND SITE, EAST HALTON, NORTH LINCOLNSHIRE

GEOPHYSICAL SURVEY
PLANNING REF. PA/2016/649

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January 2018

This report adheres to the quality standard of ISO 9001:2008

PROJECT INFO:

HA Project Code **EHNL17** / NGR **TA 1523, 2155** / Parish **East Halton** / Local Authority **North Lincolnshire Council** / OASIS Ref. **headland5-306270**

PROJECT TEAM:

Project Manager **Sam Harrison** / Author **Alistair Webb** / Fieldwork **Kevin Heaton, Krasimir Dyulgerski, Olivier Vansassenbrouck, Ross Bishop** / Graphics **Beata Wieczorek-Oleksy, David Harrison, Mano Kapazoglou**

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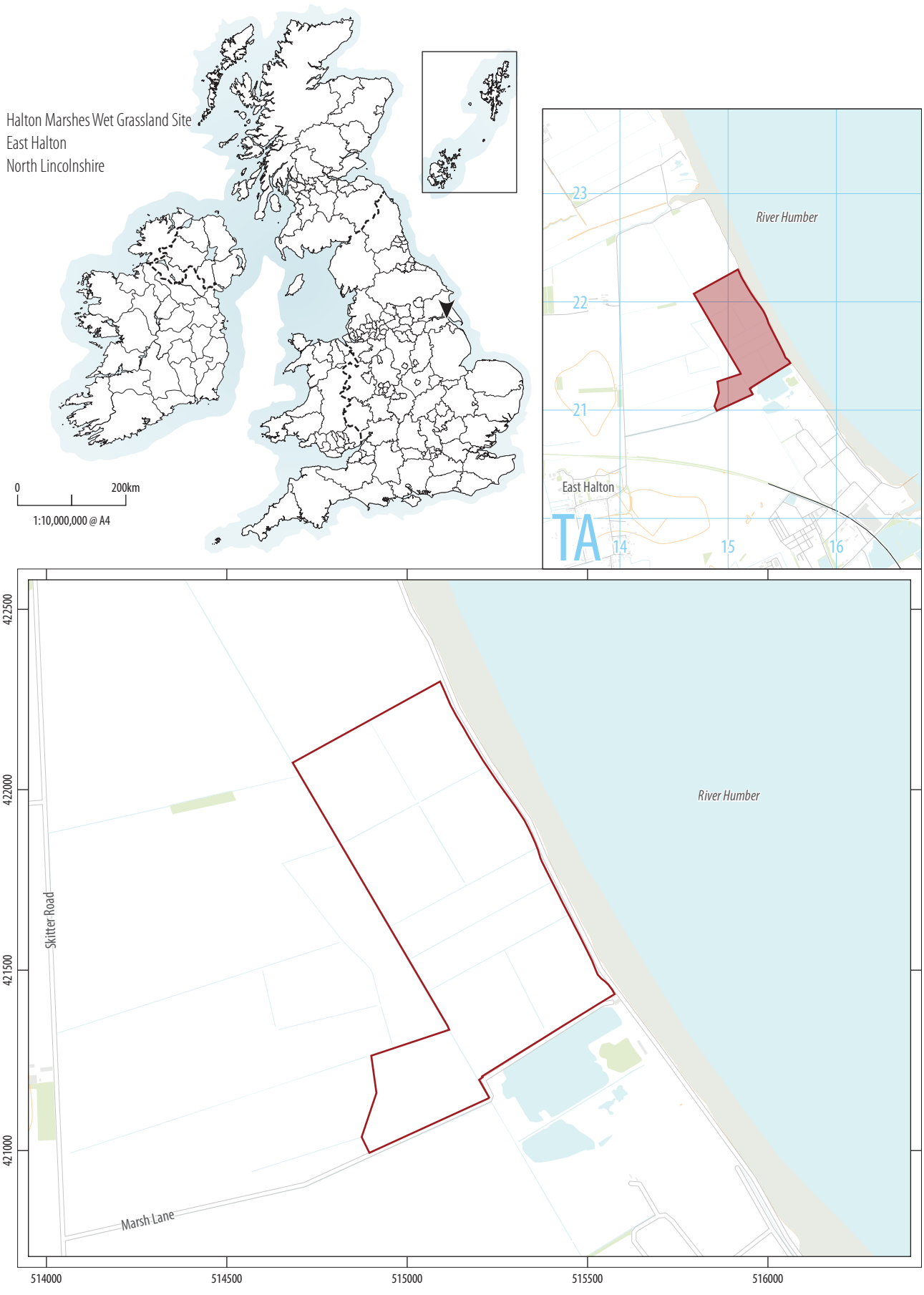
HEADLAND ARCHAEOLOGY

PROJECT SUMMARY

Headland Archaeology (UK) Ltd, undertook a geophysical (magnetometer) survey covering approximately 52 hectares, on Halton Marshes, North Lincolnshire, to inform archaeological mitigation works in advance of the consented creation of a wetland habitat which will offset land to be developed as part of the Able Marine Energy Park. The data is dominated by responses and anomalies indicative of coastal features which prevailed on this former marginal estuarine environment prior to reclamation. Two sinuous anomalies and broad areas of high magnetic response locate palaeochannels along the western boundary of the survey area. Linear trends in the data, parallel with the current shore, probably locate former beach lines or bars. No anomalies of obvious archaeological potential have been identified by the survey; any settlement activity is likely to be on slightly higher islands a little further inland. Therefore, on the basis of the geophysical survey, the archaeological potential of the application area is assessed as very low. However, the palaeochannels may have some geo-archaeological potential as previously reported.

CONTENTS

LIST OF ILLUSTRATIONS



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ILLUS 1 Site location

HALTON MARSHES WET GRASSLAND SITE, EAST HALTON, NORTH LINCOLNSHIRE

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Able UK Ltd, to undertake a geophysical (magnetometer) survey of a block of land at Halton Marshes (Illus 1), where Able UK Ltd have has been granted consent by North Lincolnshire Council (PA/2016/649) to develop land for the creation of a wetland habitat to offset land to be used for development within the Able Marine Energy Park (AMEP) at North and South Killingholme. The new wetland habitat will require the excavation of a series of scrapes and drains across the southern two thirds of the site which will combine with current low-lying areas to allow seasonal flooding. The application area also forms part of existing consented development, the Able Logistics Park (ALP), which covers approximately 380 hectares of land to the north-east of East Halton.

The work was undertaken in accordance with a Brief prepared by AC Archaeology (Cox 2017) submitted to, and approved by North Lincolnshire Council, and with guidance contained in the National Planning Policy Framework (DCLG 2012). All work was undertaken in line with current best practice (Chartered Institute for Archaeologists 2014, English Heritage 2008).

The survey was carried out between November 8th and November 24th, 2017.

1.1 SITE LOCATION, LAND-USE AND TOPOGRAPHY

The application area comprises nine arable fields on the southern side of the Humber Estuary, North Lincolnshire, centred at TA 1523 2155 (see Illus 1). It comprises approximately 52 hectares of former arable farmland (now largely uncultivated) on reclaimed marshland approximately 2km north-east of the village of East Halton and is bound to the east by the Humber estuary, to the south by a lake and by drainage ditches on all other sides, separating the site from the surrounding farmland.

Fields 5 to 12 were not cultivated and had regrown as scrubby grassland (Illus 2). Field 17 was sown with rape (Illus 3).

The site is flat ranging from approximately 1m above Above Ordnance Datum (AOD) on the estuary to 3m AOD on the western edge of the survey area.

1.2 GEOLOGY AND SOILS

The underlying bedrock geology consists of Burnham Chalk which is overlain by Tidal Flat Deposits, clay and silt, which formed up to 2 million years ago in the Quaternary Period in a local environment previously dominated by shorelines. These sedimentary deposits are shallow-marine in origin, detrital, generally coarse-grained forming beaches and bars in a coastal setting. (NERC 2017)

The soils are classified in the Soilscape 21 association, characterised as loamy and clayey soils of coastal flats with naturally high groundwater (Cranfield University 2017).

2 ARCHAEOLOGICAL BACKGROUND

Previous archaeological investigations on the site have included geophysical survey and geo-archaeological investigations immediately south of Skitter (NAA 2000), in an area unaffected by current proposals. Prior to the grant of consent, an auger survey was undertaken to assess the geo-archaeological potential of the current

ILLUS 2 Field 2 (north), looking east

survey area (Allen Archaeology; Stage 1 Palaeoenvironmental survey report). While there was found to be some potential for significant deposits, relating to the former coastline within the western side of the application area that could indicate the area was conducive to early human settlement, it was considered likely that these were at sufficient depth to be unaffected by the new drainage works. The recent discovery of a WW2 barrage balloon site to the south-west also raises the possibility of there being near-surface archaeological deposits of a more recent origin that might be detectable by geophysical survey.

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

The specific archaeological objectives of the geophysical survey were:

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

3.1 MAGNETOMETER SURVEY

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

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

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

ILLUS 3 Field 17 (east), looking south

3.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:15,000. Illus 2, and 3 are site condition photographs. Illus 4 is a 1:6,000 scale survey location plan showing the GPS swaths. Detailed data plots of the fully processed data and accompanying interpretative plot are produced, also at 1:6,000, as Illus 5 and Illus 6. The fully processed (greyscale) data, minimally processed data (XY traceplot) and accompanying interpretative plots are presented at a scale of 1:2,500 in Illus 7 to Illus 15 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 Brief (Cox 2017) and guidelines outlined by Historic England (English Heritage 2008) and by the Chartered Institute for Archaeologists (ClfA 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 application area were generally good and consequently, the overall quality of the data collected was good throughout.

The survey has detected a variable magnetic background characterised by faint curvilinear trends and broader bands of magnetic enhancement which are orientated parallel with the current shoreline.

Against this background, numerous anomalies have been identified. 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. There is no obvious clustering to these ferrous anomalies which might indicate an archaeological origin. Far more probable is that the 'spike' responses are likely caused by the random distribution of ferrous debris in the upper soil horizons. Clusters of 'spike' anomalies at the entrances to fields are caused by tipping or infilling of modern material, possibly bricks or other fired or highly magnetic material.

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

Analysis of historic OS mapping indicates that the division and layout of land within the application area has remained unchanged at least since the publication of the first edition Ordnance Survey map in 1888.

Closely-spaced faint parallel linear anomalies are identified across most of the application area. These are mostly aligned parallel with the surrounding field boundaries and are caused by modern ploughing. More widely-spaced parallel linear anomalies such as those throughout F6 (see Illus 7–12), are characteristic of field drains. Also typical of field drains are the isolated linear anomalies within F9 and F10 (see Illus 10–15). The clear curvilinear anomaly in the east of F17 is 'speckled' in appearance, another characteristic typical of field drains (see Illus 13–15).

4.3 GEOLOGICAL ANOMALIES

The data is dominated by anomalies, trends and large areas of enhanced magnetic readings which are clearly due to the former nature of this land which is reclaimed coastal marshland. In the north-western corner of F5, a sinuous curvilinear anomaly locates the line of a former channel or creek (see Illus 7–9). A second palaeochannel is also identified to the south in F11 on a broadly easterly orientation (see Illus 13–15). The broad areas of enhanced magnetic readings in the west of F5, F8 and F11 demarcates the extent of the former wetland. Throughout the remainder of the survey area, vague linear trends and linear bands of discrete anomalies have been identified parallel with the current shoreline. These are caused by the accumulation of sediments along former beach lines or bars.

Elsewhere, discrete areas of magnetic enhancement and faint curvilinear trends are numerous. These are due to localised variations in the depth and composition of the soils and the tidal flat deposits from which they derive.

5 CONCLUSION

The survey has successfully evaluated the survey area identifying anomalies reflective of the prevailing marginal estuarine environment prior to reclamation. Two palaeochannels are located in the west of the application area whilst linear trends in the data, parallel with the current shore, probably locate former beach lines or bars. No anomalies of obvious archaeological potential have been identified by the survey; any settlement activity is likely to be on slightly higher islands a little further inland. Therefore, on the basis of the geophysical survey, the archaeological potential of the application area is assessed as very low. However, the palaeochannels may have some geo-archaeological potential.

6 REFERENCES

Chartered Institute for Archaeologists (CIfA) 2014 ***Standard and guidance for archaeological geophysical survey*** (Reading) http://www.archaeologists.net/sites/default/files/CIfAS&Geophysics_1.pdf accessed 1 December 2017

Cox P 2017 ***Proposed Halton Marshes Wet Grassland Site, East Halton, North Lincolnshire; Brief for Undertaking Archaeological Mitigation*** [unpublished client document] AC Archaeology, Ref. ACW904/3/0

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Gaffney C & Gater J 2003 ***Revealing the Buried Past: Geophysics for Archaeologists*** Stroud

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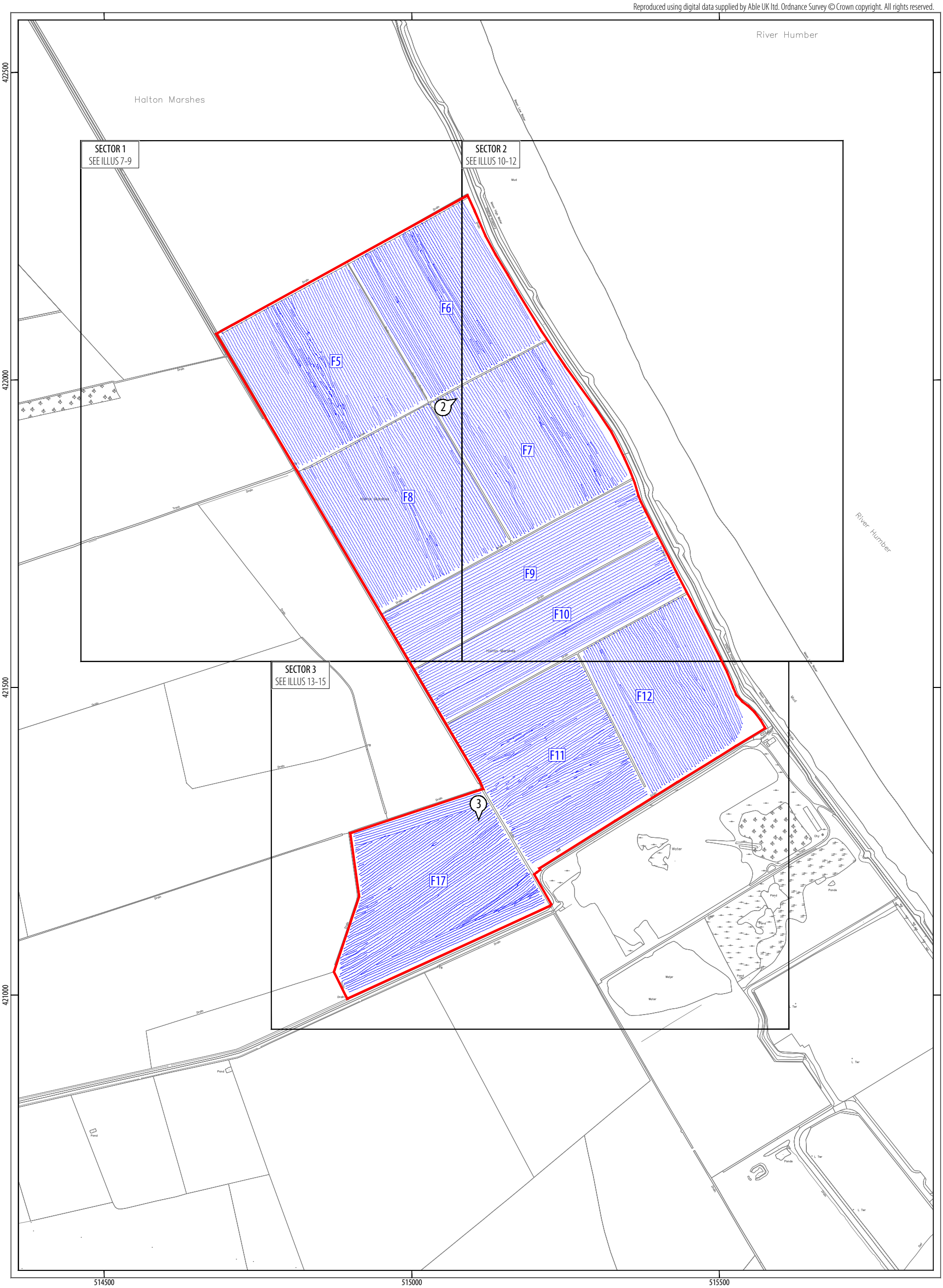

application boundary

GPS swaths

location and direction of ILLUS 2-3

0 150m

1:6,000 @ A3

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East Halton

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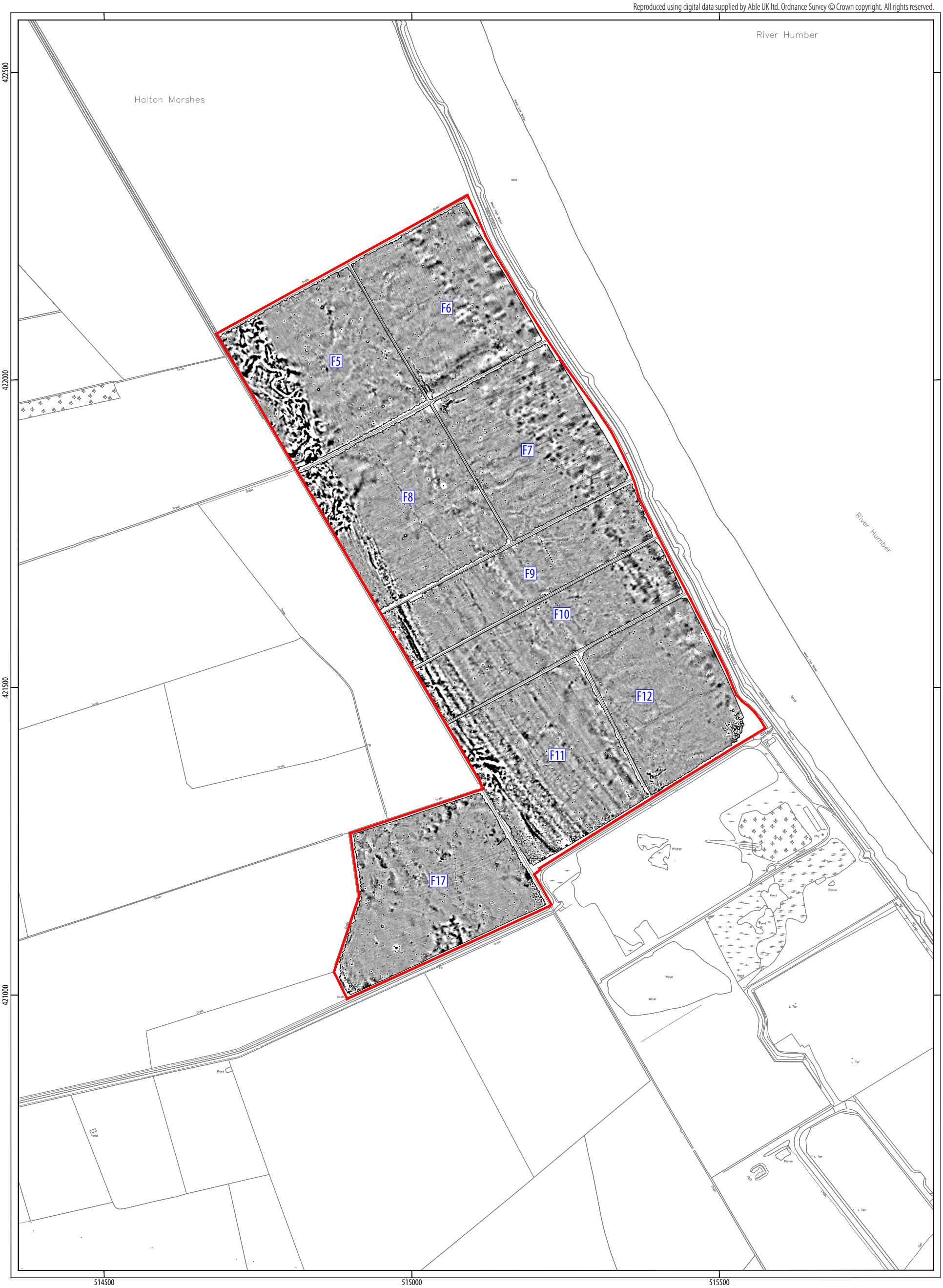
ILLUS 4 Survey location showing GPS swaths



application boundary

nT
-1.0
2.0

0
150m
1:6,000 @ A3

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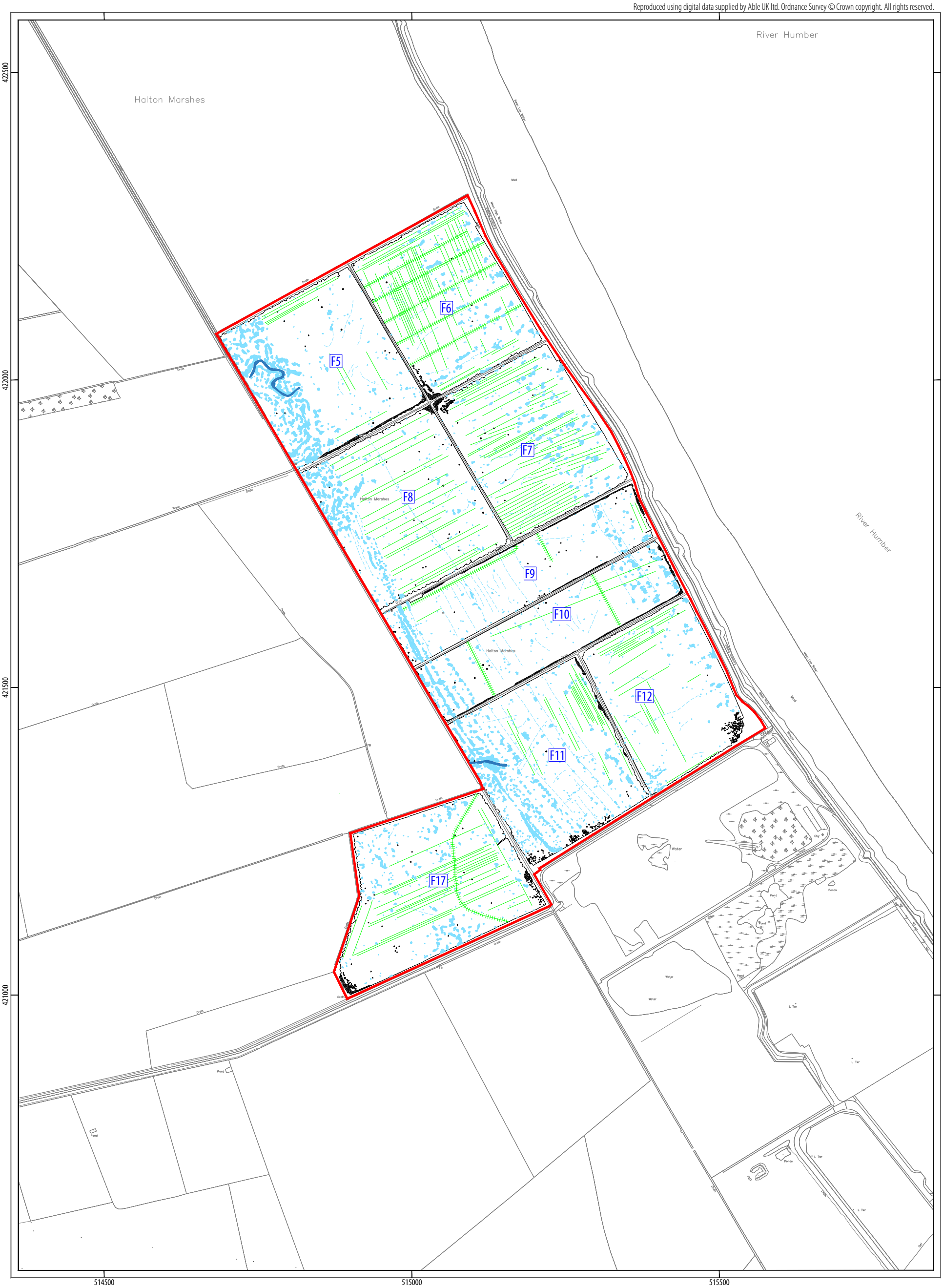
ILLUS 5 Processed greyscale magnetometer data



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

TYPE OF ANOMALY	INTERPRETATION
curvilinear negative	palaeochannel

0 150m
1:6,000 @ A3

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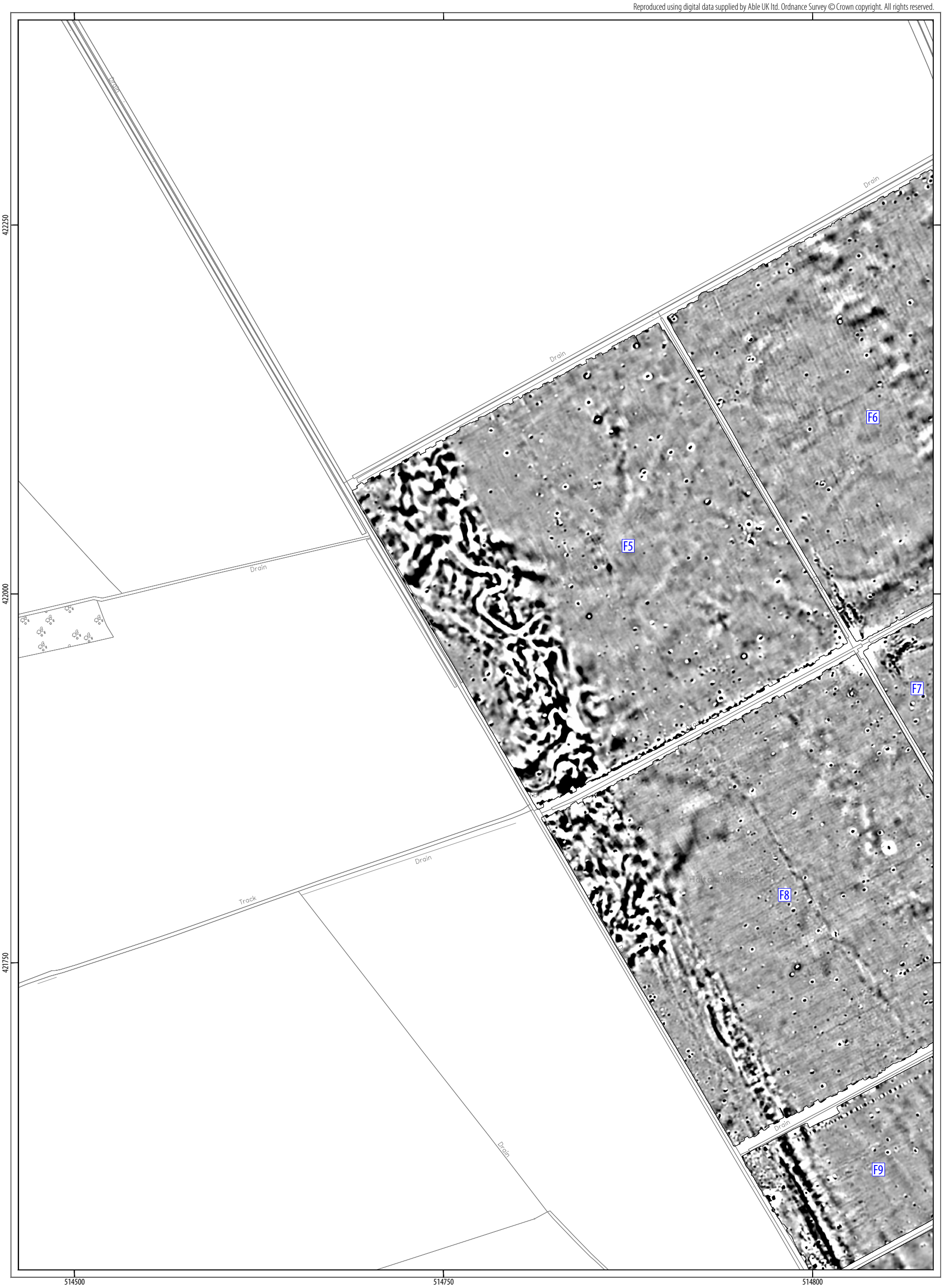
ILLUS 6 Interpretation of magnetometer data



nT
-1.0 2.0

0 50m
1:2,500 @ A3

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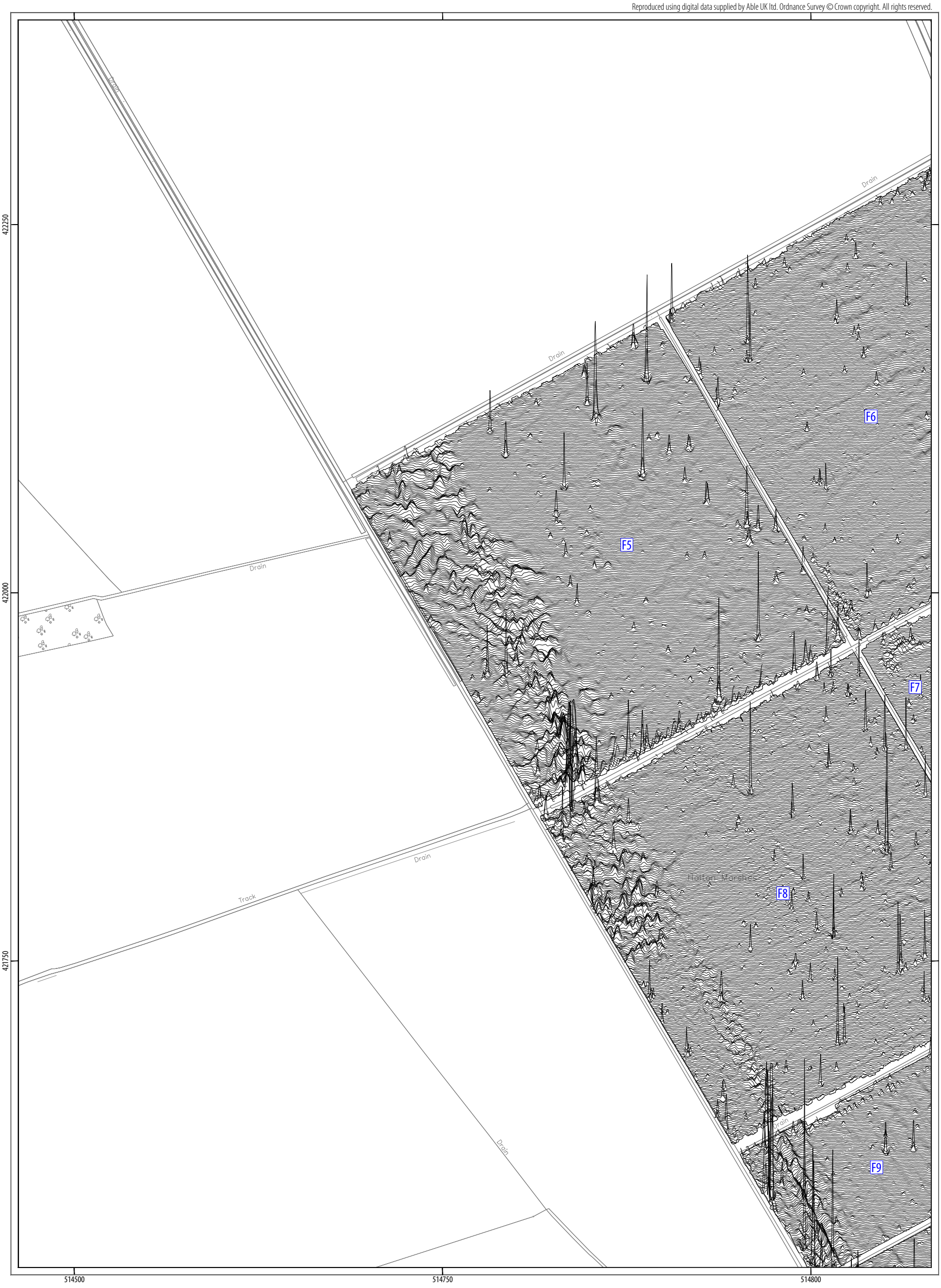
ILLUS 7 Processed greyscale magnetometer data; Sector 1



100.0nT/cm

0 50m

1:2,500 @ A3

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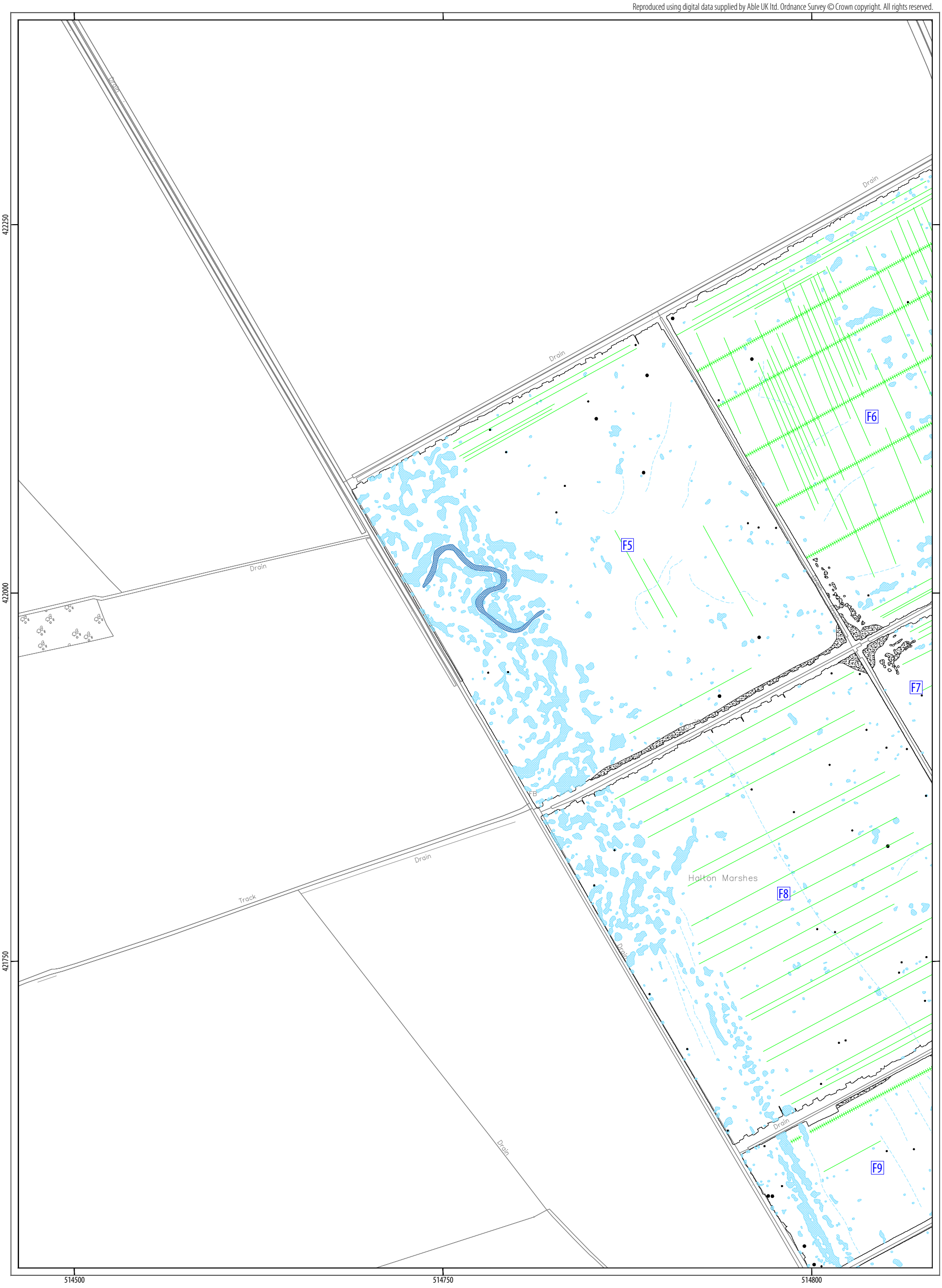
ILLUS 8 XY trace plot of minimally processed magnetometer data; Sector 1



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

TYPE OF ANOMALY	INTERPRETATION
curvilinear negative	palaeochannel

0 50m
1:2,500 @ A3

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ILLUS 9 Interpretation of magnetometer data; Sector 1

-1.0 nT 2.0

0 50m

1:2,500 @ A3

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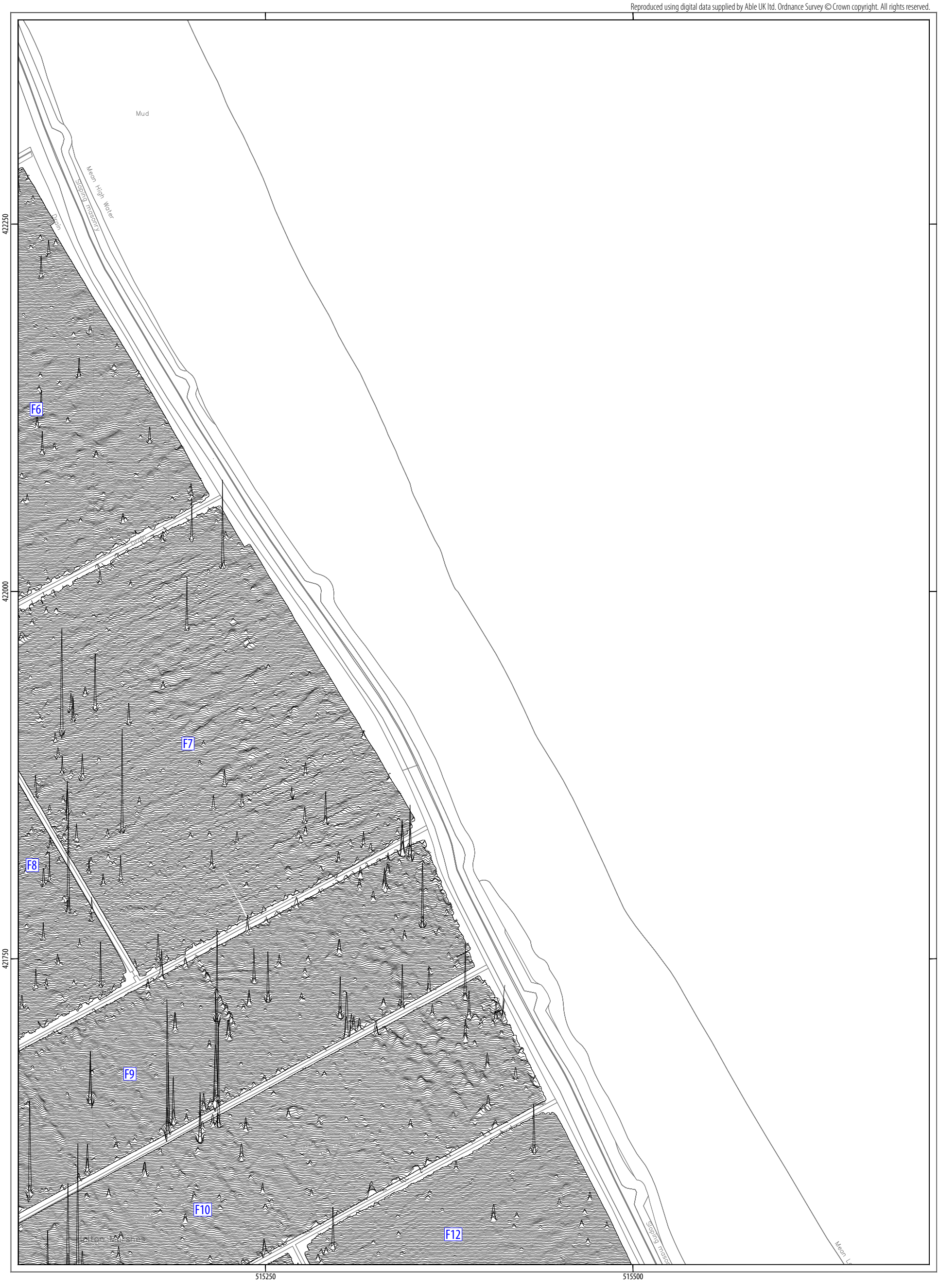
ILLUS 10 Processed greyscale magnetometer data; Sector 2



100.0nT/cm

0 50m

1:2,500 @ A3

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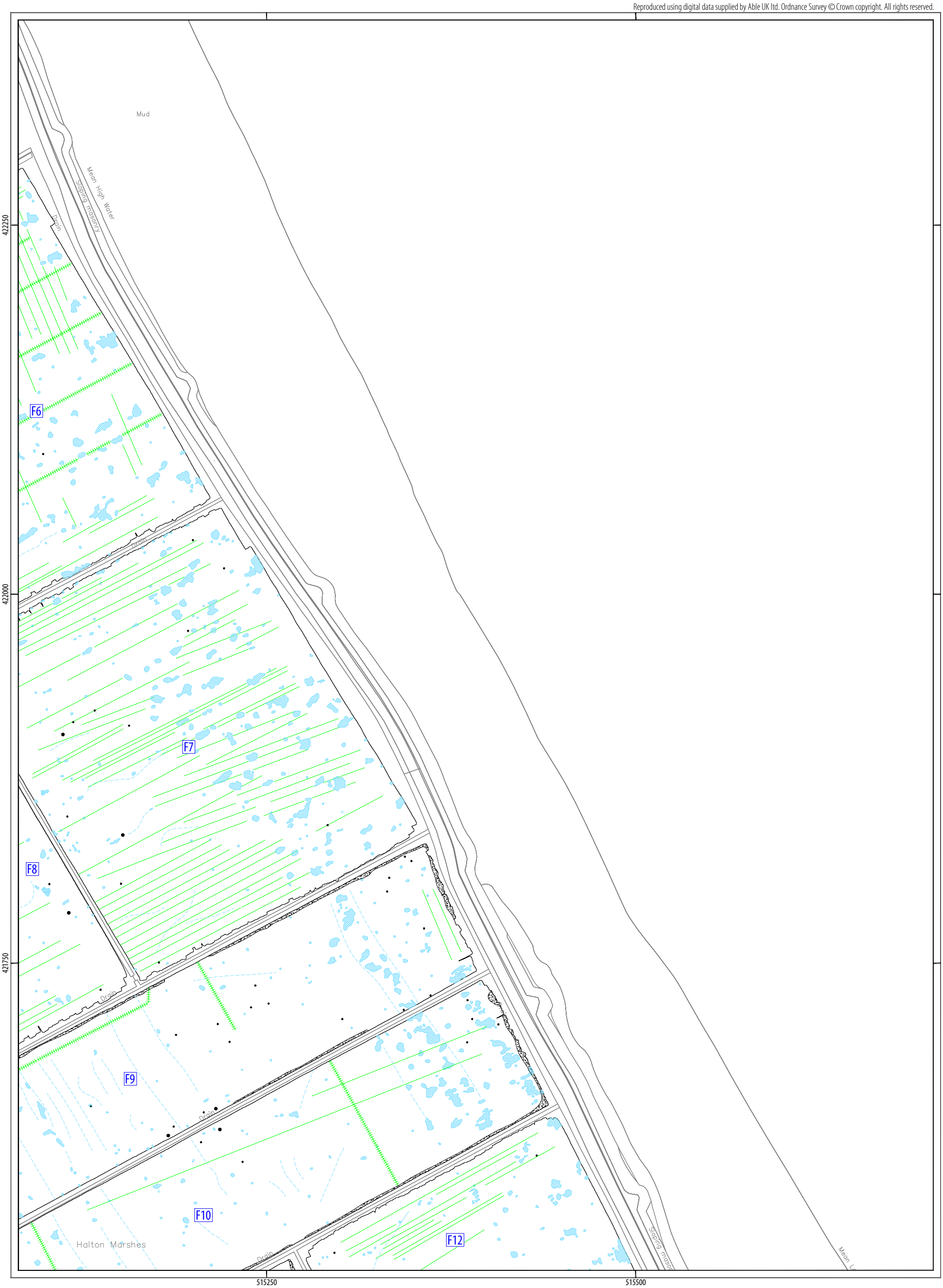
ILLUS 11 XY trace plot of minimally processed magnetometer data; Sector 2



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

0 50m
1:2,500 @ A3

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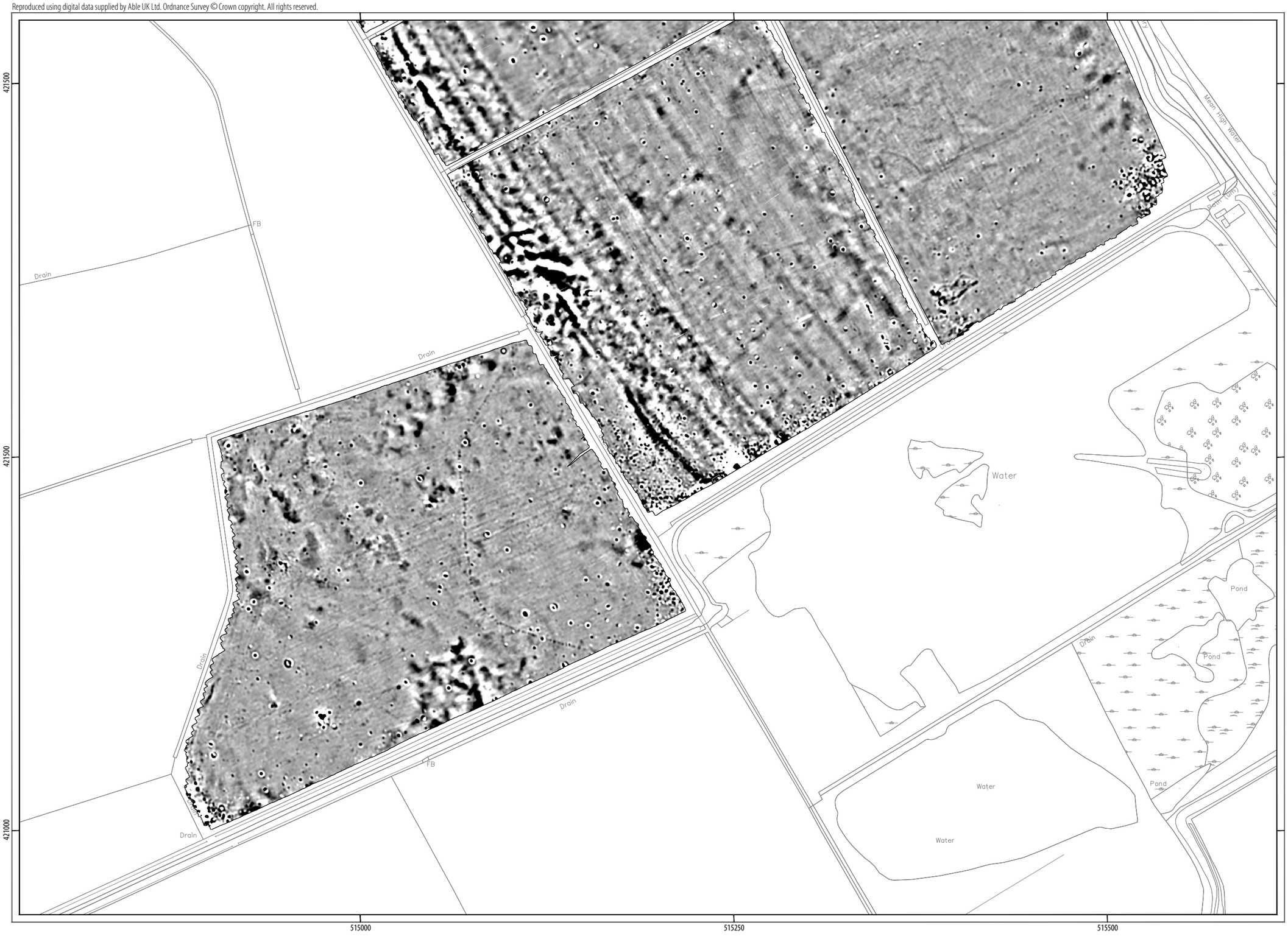
ILLUS 12 Interpretation of magnetometer data; Sector 2



ILLUS 13 Processed greyscale magnetometer data; Sector 3

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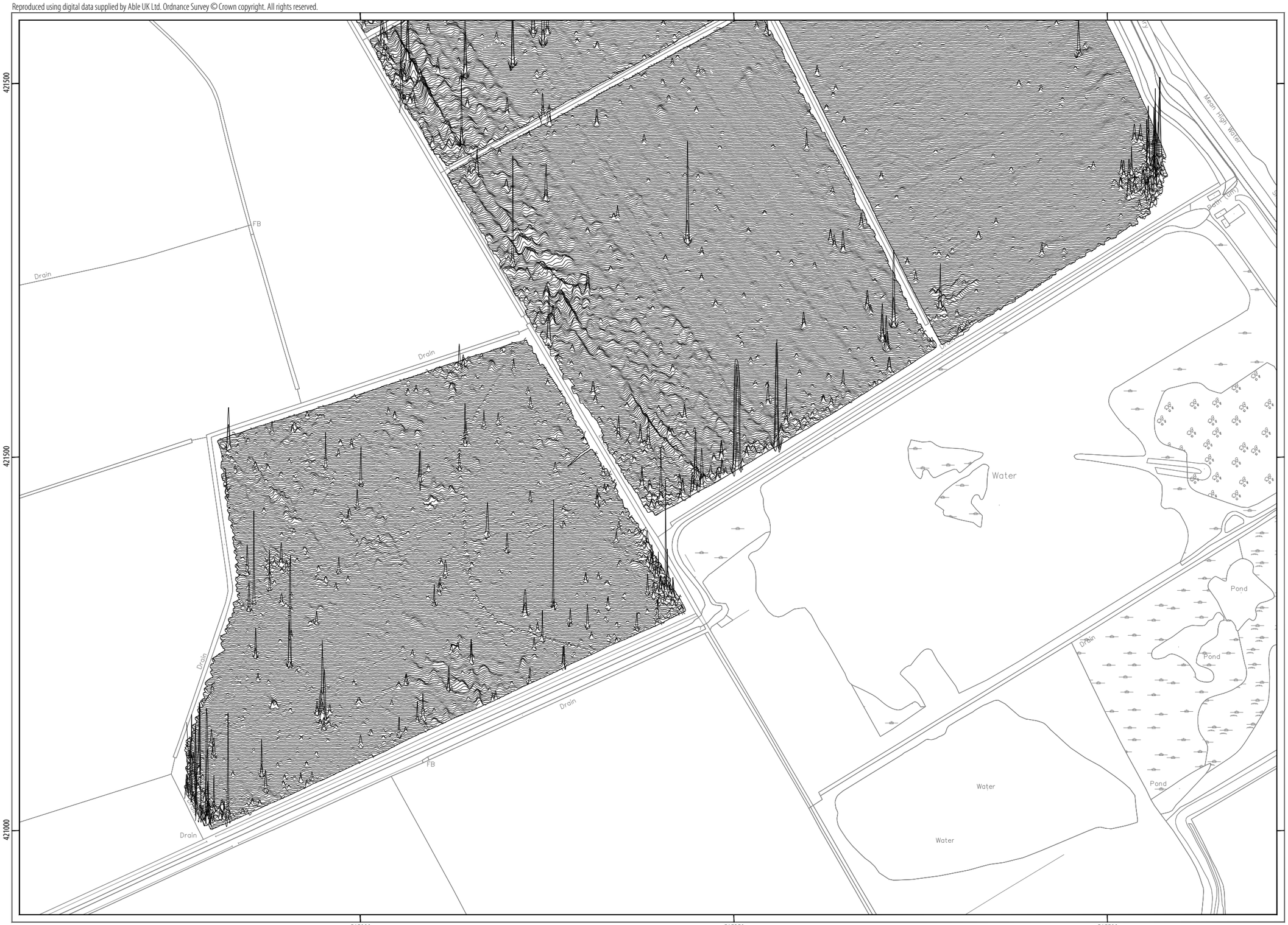

ILLUS 14 XY trace plot of minimally processed magnetometer data; Sector 3

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TYPE OF ANOMALY	INTERPRETATION
dipolar isolated	ferrous material
magnetic disturbance	ferrous material
linear trend	agricultural
linear trend	field drain
linear trend	geological variation
magnetic enhancement	geology
curvilinear negative	palaeochannel

0 50m
1:2,500 @ A3

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ILLUS 15 Interpretation of magnetometer data; Sector 3

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 features, 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 were georeferenced using a Trimble RTK differential Global Positioning System (Trimble R8s model).

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

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

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

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE

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

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

APPENDIX 4 DATA PROCESSING

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

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

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

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

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: headland5-306270

Project details	
Project name	East Halton Marshes Wet Grassland Site, East Halton, North Lincolnshire
Short description of the project	Headland Archaeology (UK) Ltd, undertook a geophysical (magnetometer) survey covering approximately 52 hectares, on Halton Marshes, North Lincolnshire, to inform archaeological mitigation works in advance of the consented creation of a wetland habitat which will offset land to be developed as part of the Able Marine Energy Park. The data is dominated by responses and anomalies indicative of coastal features which prevailed on this former marginal estuarine environment prior to reclamation. Two sinuous anomalies and broad areas of high magnetic response locate palaeochannels along the western boundary of the survey area. Linear trends in the data, parallel with the current shore, probably locate former beach lines or bars. No anomalies of obvious archaeological potential have been identified by the survey; any settlement activity is likely to be on slightly higher islands a little further inland. Therefore, on the basis of the geophysical survey, the archaeological potential of the application area is assessed as very low. However, the palaeochannels may have some geo-archaeological potential as previously reported.
Project dates	Start: 08-11-2017 End: 24-11-2017
Previous/future work	Not known / Not known
Any associated project reference codes	EHNL/01 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Coastland 3 - Above high water
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	Port Development
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	After full determination (eg. As a condition)
Solid geology	CHALK (INCLUDING RED CHALK)
Drift geology	LACUSTRINE CLAYS, SILTS AND SANDS
Drift geology	ALLUVIUM
Techniques	Magnetometry

Project location	
Country	England
Site location	NORTH LINCOLNSHIRE NORTH LINCOLNSHIRE EAST HALTON East Halton Marshes Wet Grassland Site
Postcode	DN40 3PX
Study area	52 Hectares
Site coordinates	TA 1523 2155 53.677452242344 -0.255300885875 53 40 38 N 000 15 19 W Point

Project creators	
Name of Organisation	Headland Archaeology
Project brief originator	AC Archaeology
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	East Halton Marshes Wet Grassland Site, East Halton, North Lincolnshire; Geophysical Survey
Author(s)/Editor(s)	Webb, A.
Date	2017
Issuer or publisher	Headland Archaeology
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