

The Drovers Solar Farm

Appendix 8.4: Geophysical Survey Report (Part E)

Prepared by: GHC Heritage

Date: November 2025

PINS reference: EN0110013

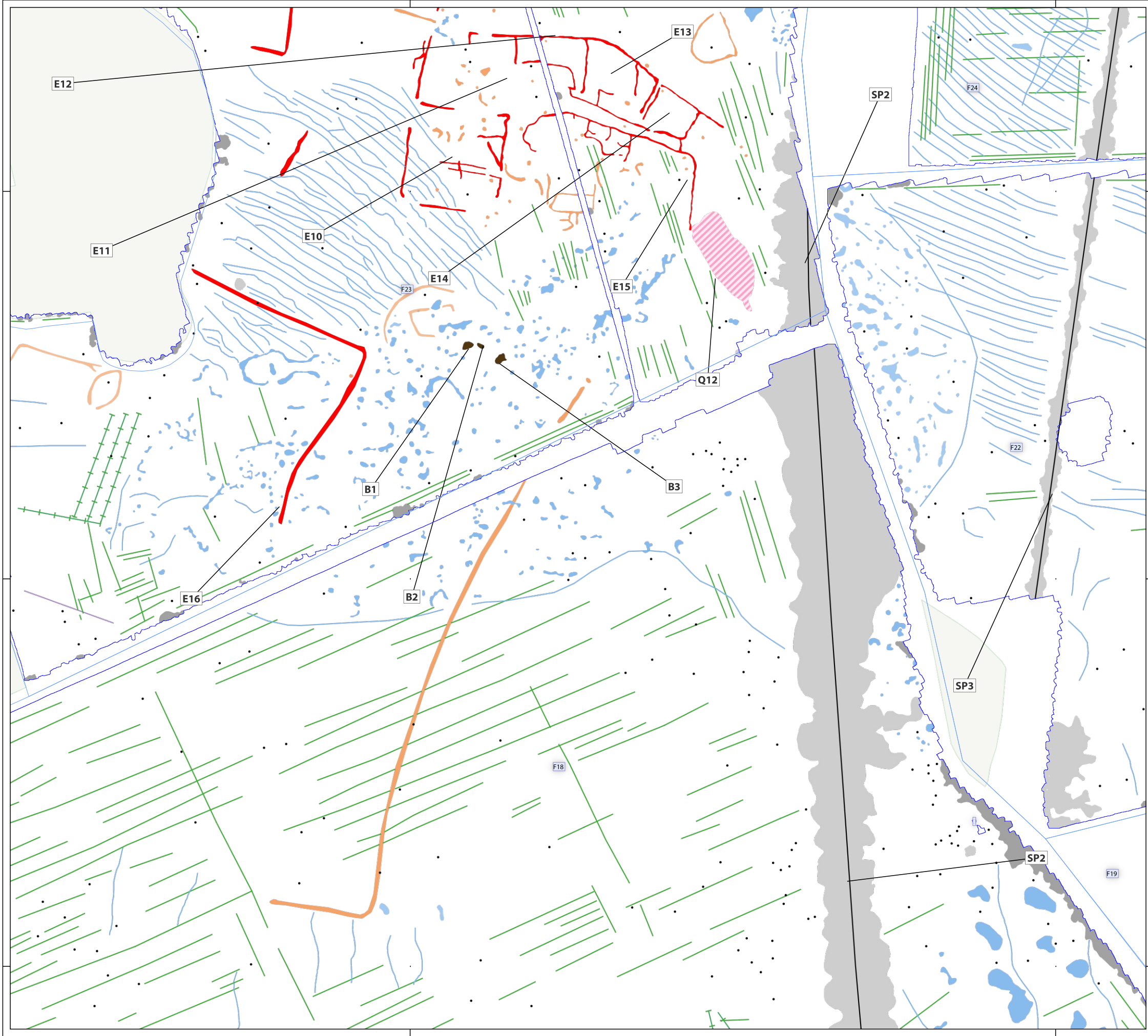
Document reference: APP/6.4 (Original)

APFP Regulation Reg 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009





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Key

- Survey Extent
- Ferrous Objects
- Agriculture
- Field Drain
- Natural
- Service
- Uncertain
- Archaeology
- Magnetic Disturbance (Above Ground)
- Magnetic Disturbance (Below Ground)
- Natural
- Possible Archaeology
- Quarry
- Burning

Abbreviation	
B	Burning
E	Enclosure
FB	Former Boundary
FB?	Former Boundary
FP	Former Pond
LIRM	Linear
Q	Quarrying
RD	Ring Ditch
SP	Service Pipe

04080

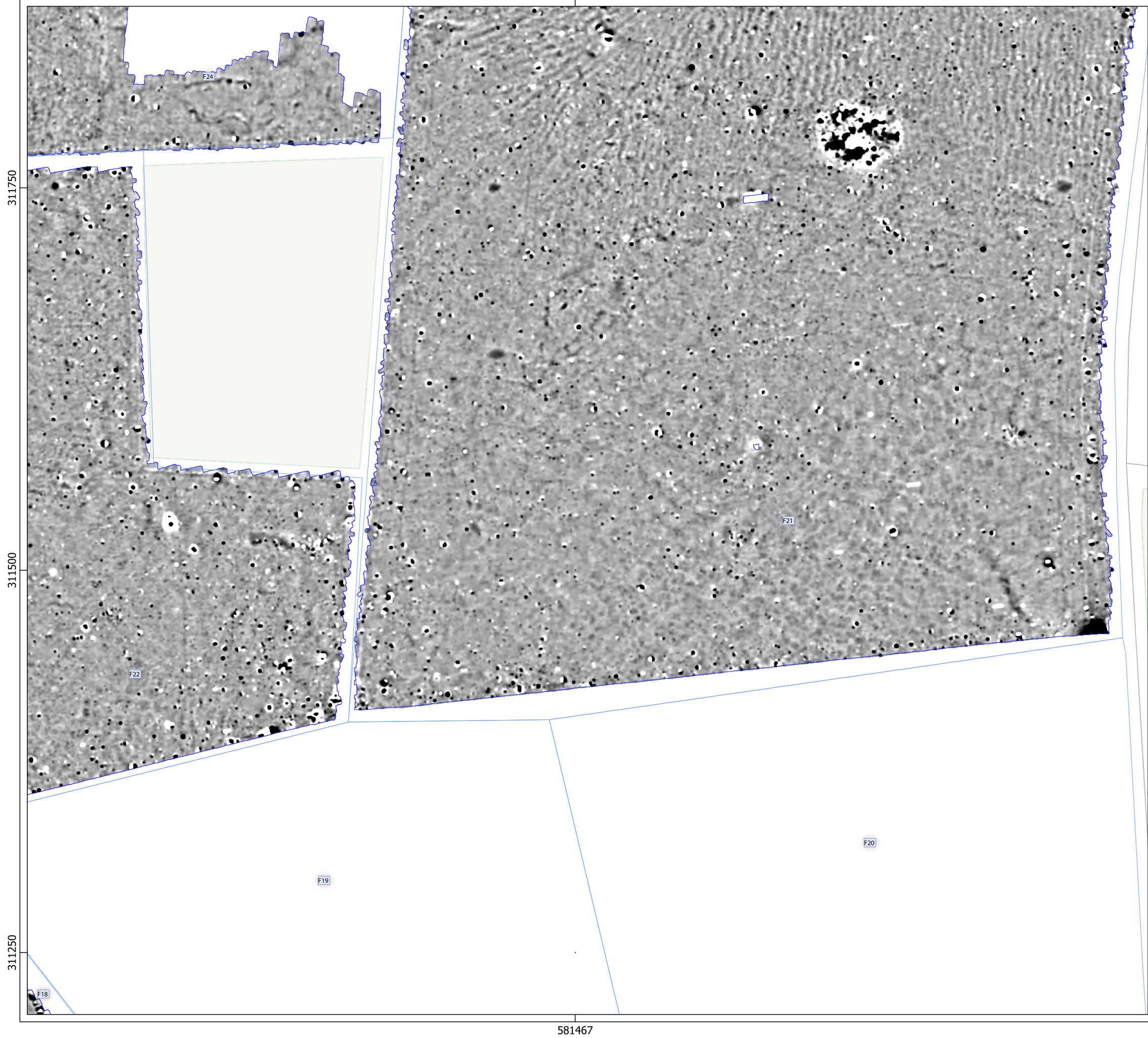
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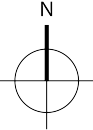
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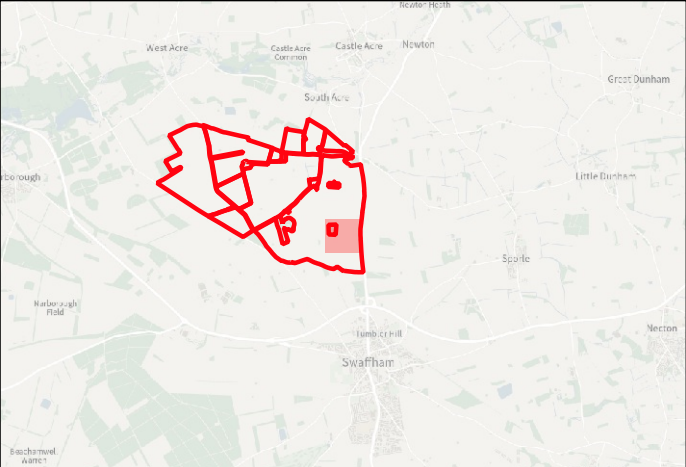








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Key

 Survey Extent



+2nT
-1nT

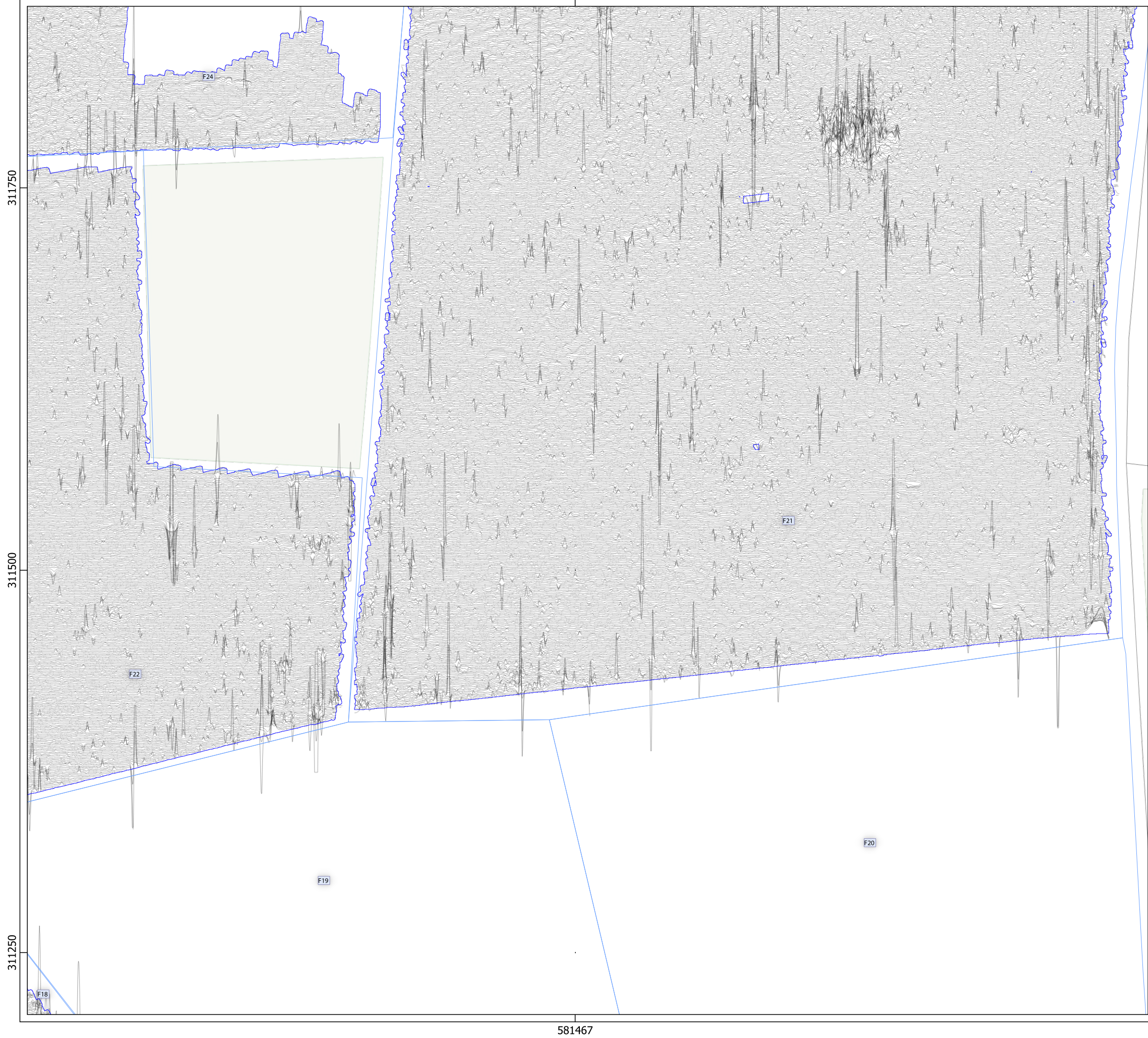
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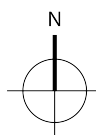
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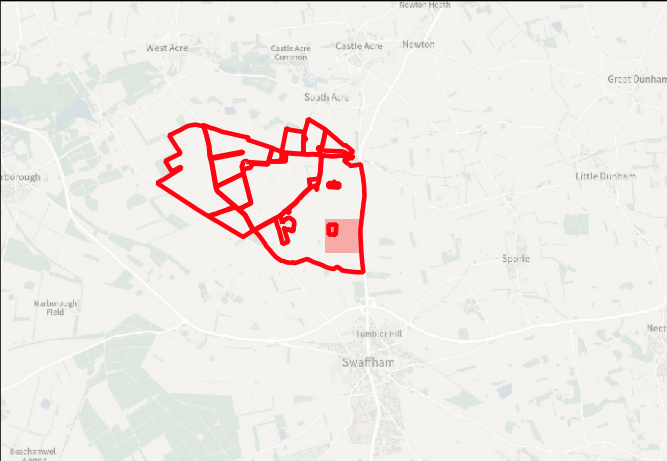








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Key
 Survey Extent
 XY Trace (25nT/cm)

04080 m

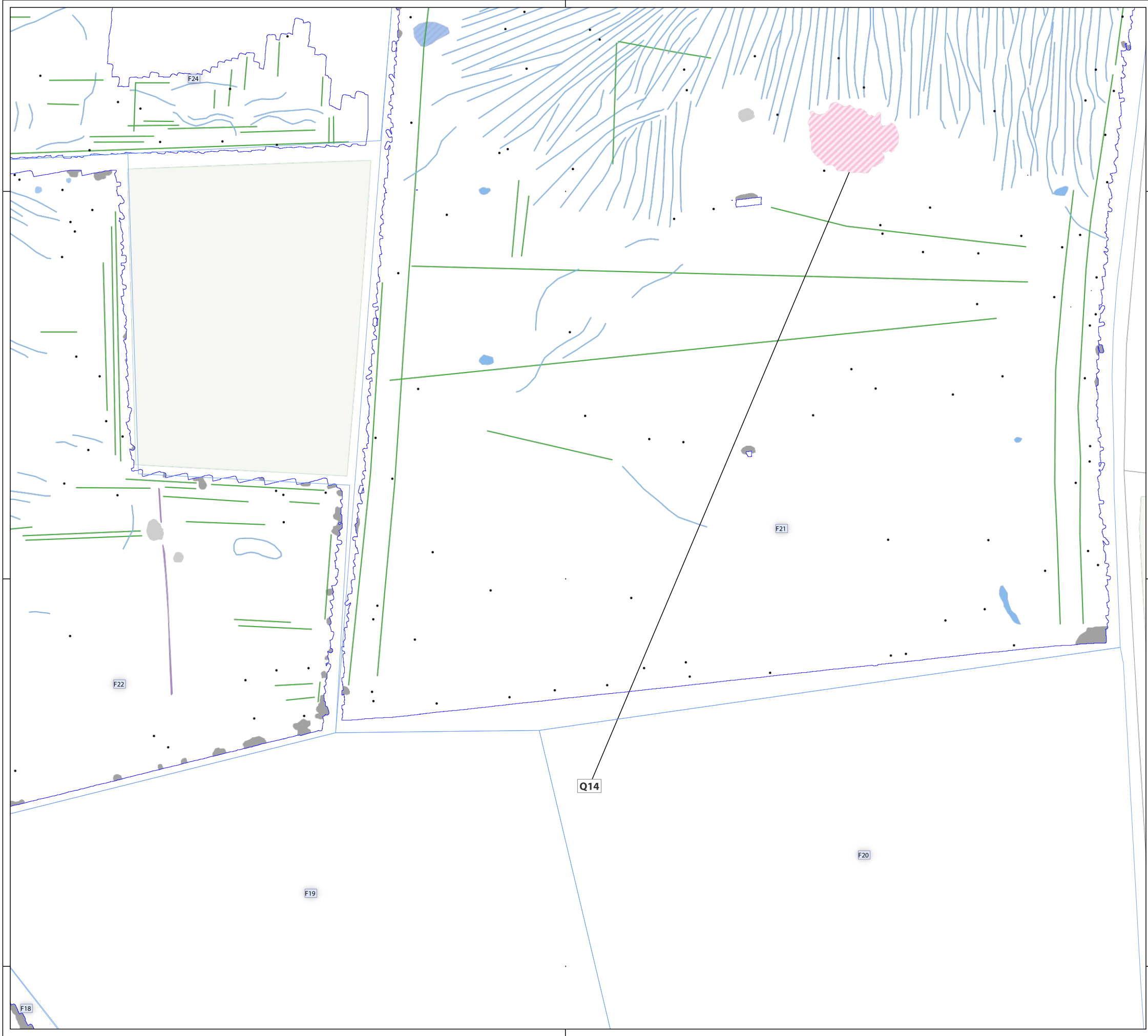
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Illus - 73 XY trace plot of minimally processed magnetometer data; Sector 21



N

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Key

Survey Extent

Ferrous Objects

Agriculture

Natural

Magnetic Disturbance (Above Ground)

Magnetic Disturbance (Below Ground)

Natural

Quarry

Uncertain

Abbreviation	
B	Burning
E	Enclosure
FB	Former Boundary
FB?	Former Boundary
FP	Former Pond
LIRM	Linear
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RD	Ring Ditch
SP	Service Pipe

04080

m

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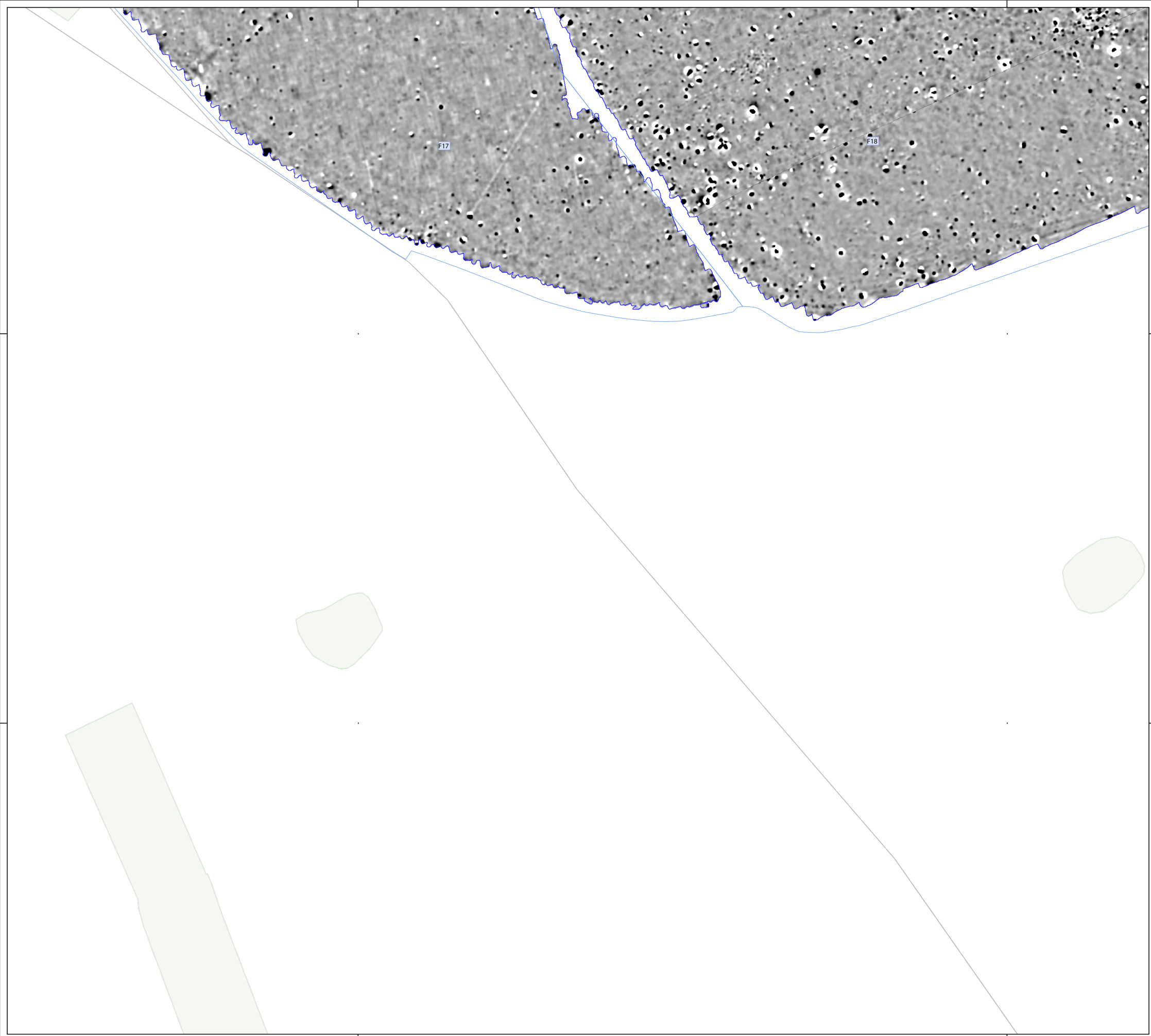
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311500

311250

581467

Illus - 74 Interpretation of magnetometer data; Sector 21

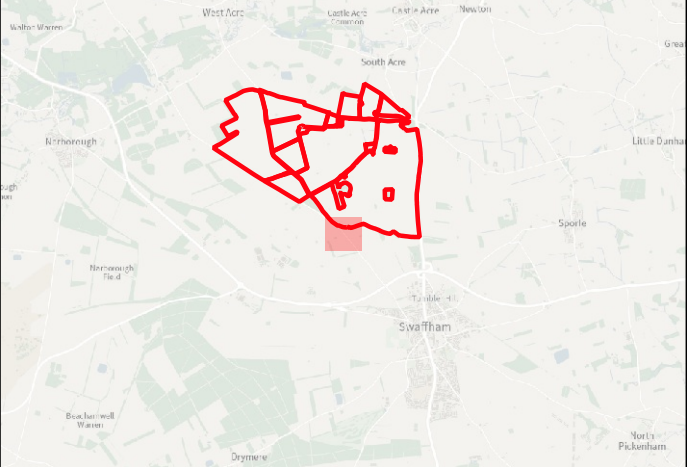




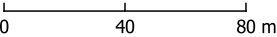
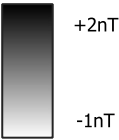


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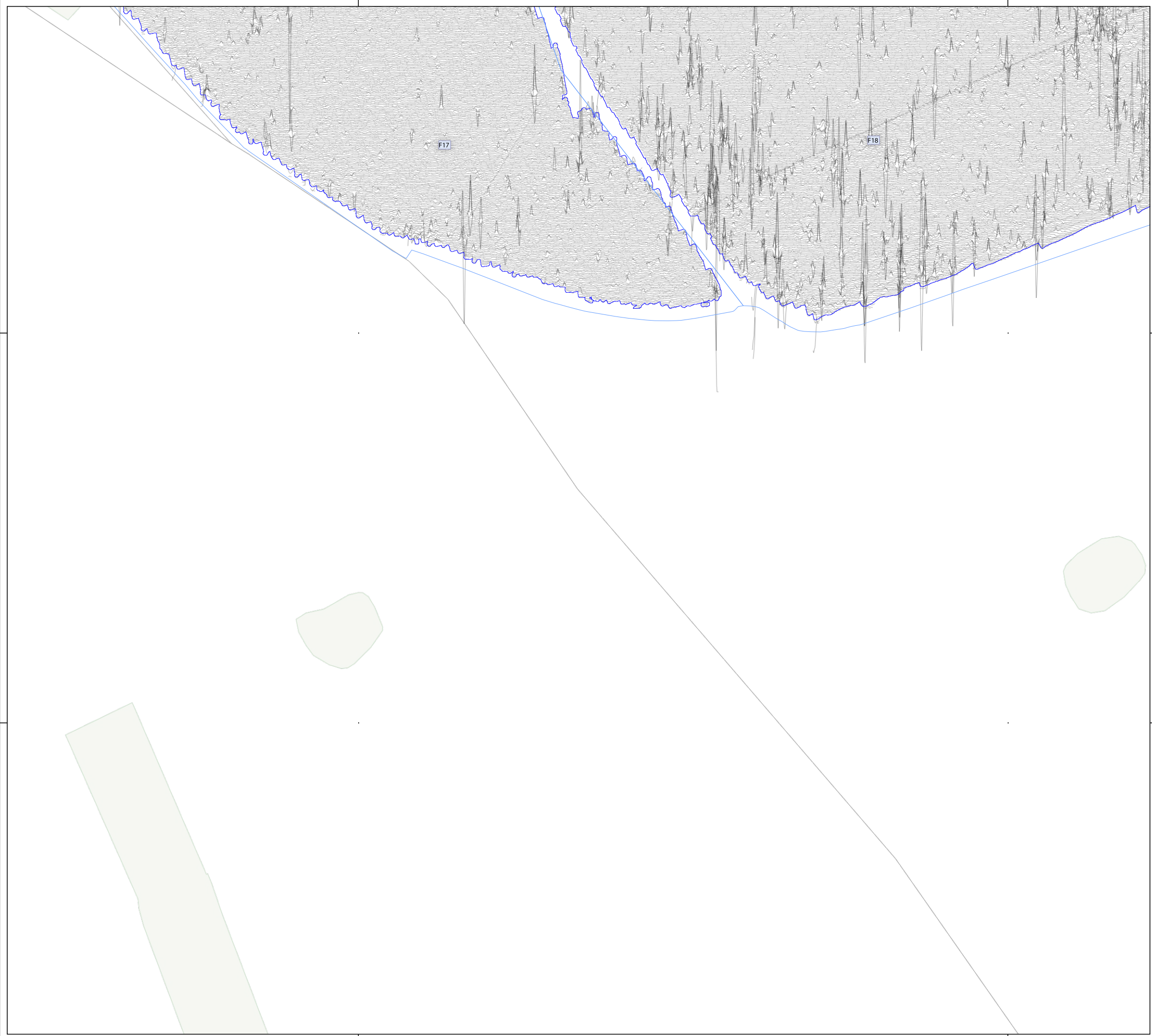


Key
 Survey Extent



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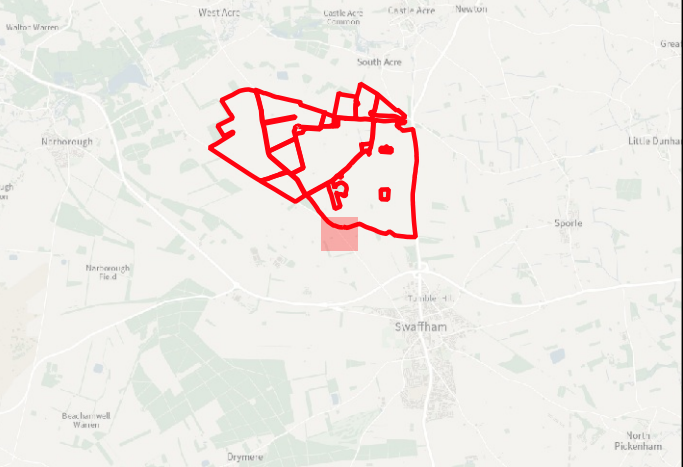
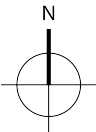


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580633

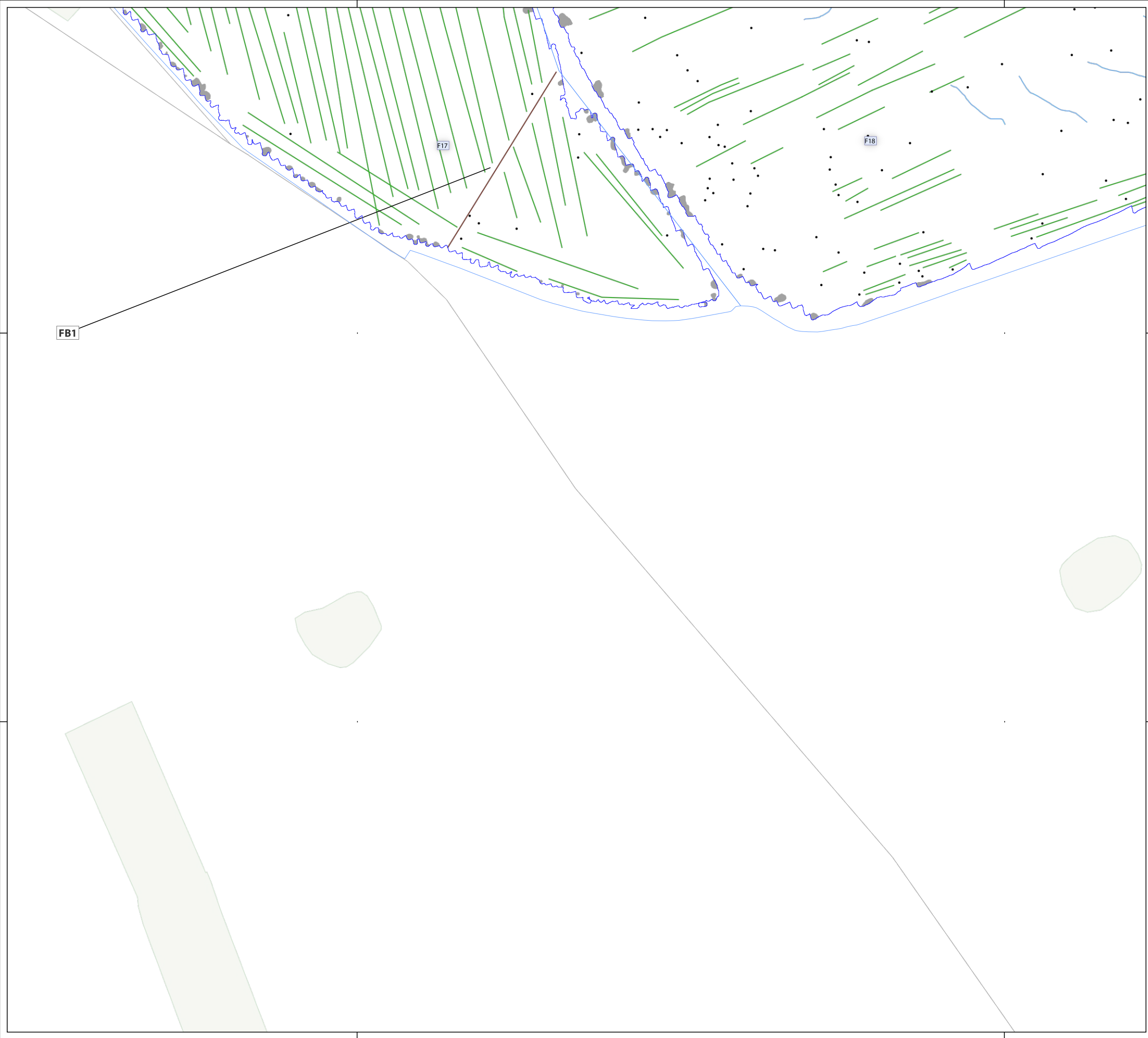


Key
Survey Extent
XY Trace (25nT/cm)

0 40 80 m

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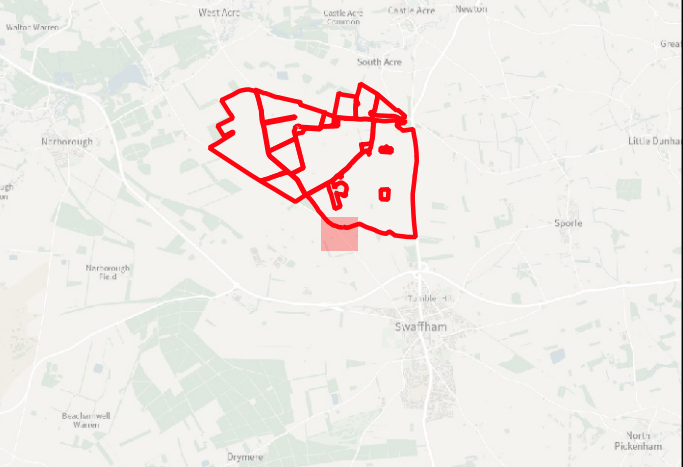












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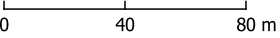
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Key

-  Survey Extent
-  Ferrous Objects
-  Agriculture
-  Field Boundary
-  Natural
-  Magnetic Disturbance (Above Ground)

	Abbreviation
B	Burning
E	Enclosure
FB	Former Boundary
FB?	Former Boundary
FP	Former Pond
LIRM	Linear
Q	Quarrying
RD	Ring Ditch
SP	Service Pipe

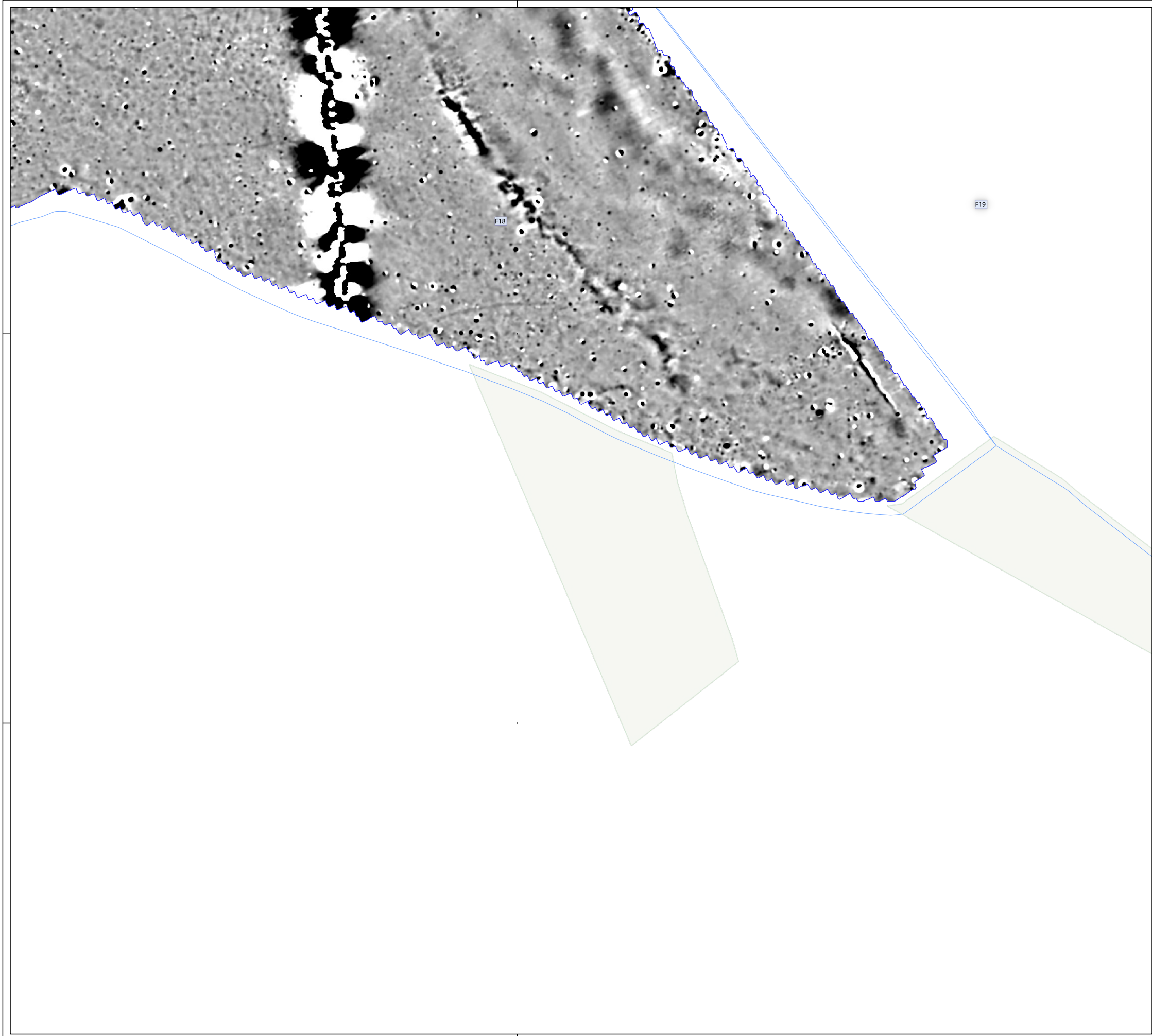


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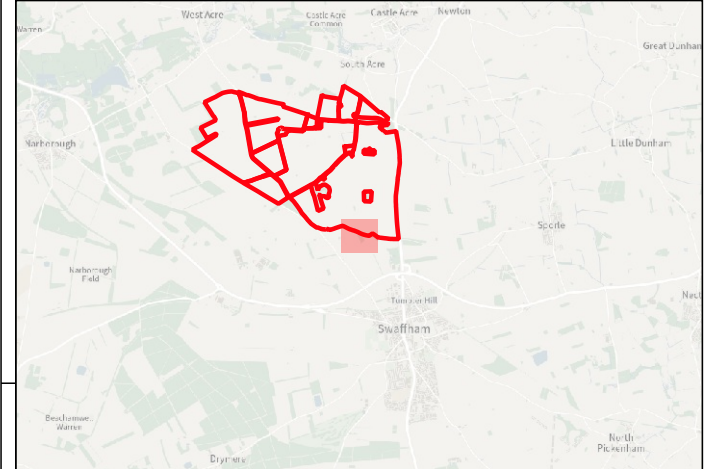
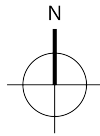
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311000

310750

581050



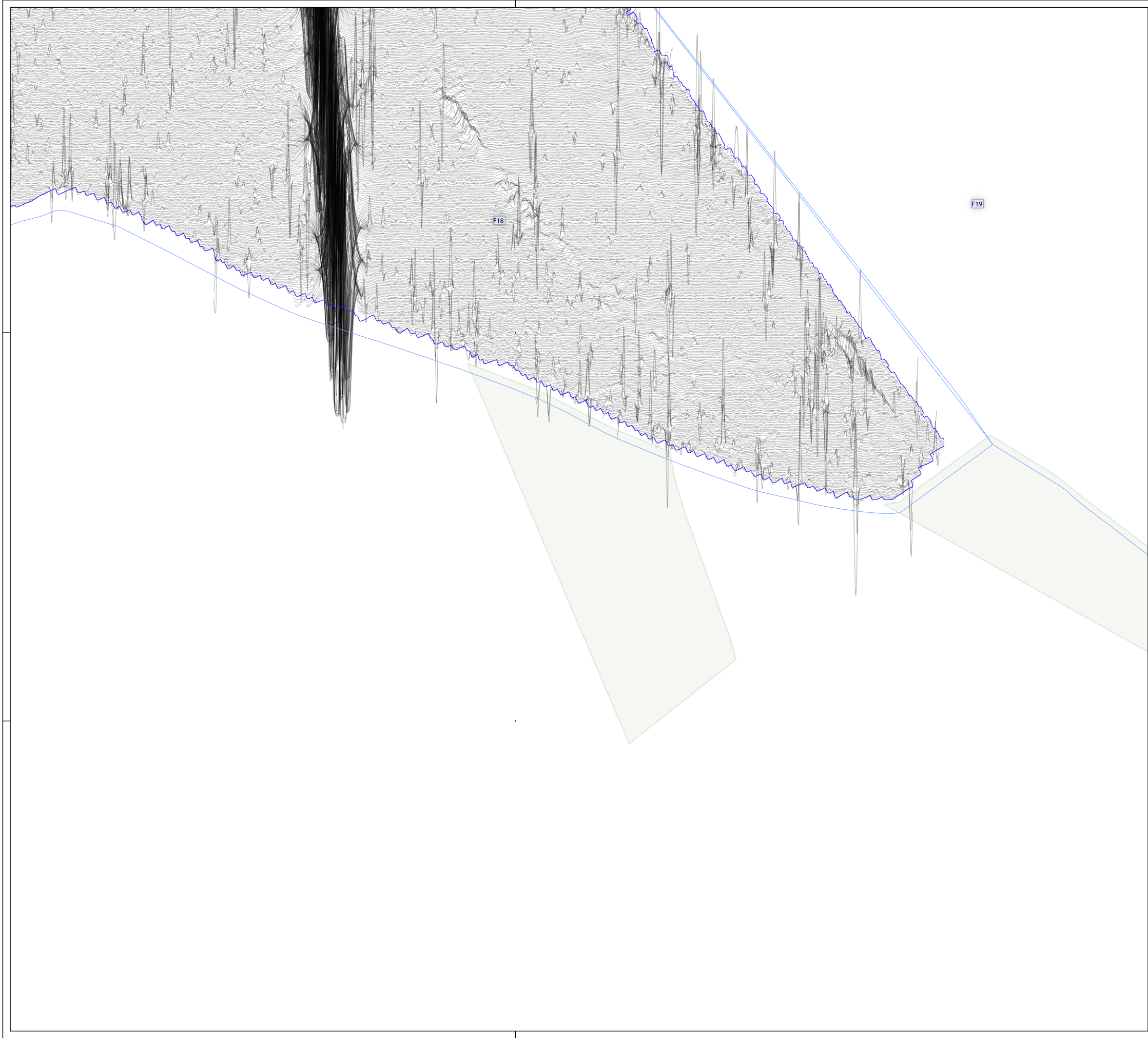
Key
Survey Extent

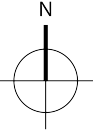



0 40 80 m

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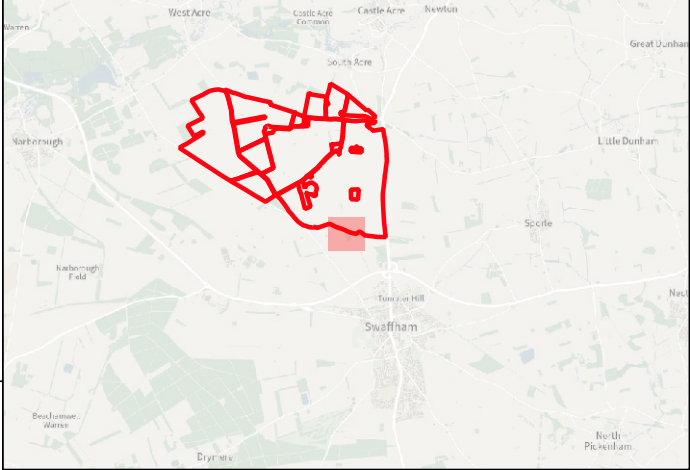








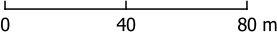
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Key

-  Survey Extent
-  XY Trace (25nT/cm)



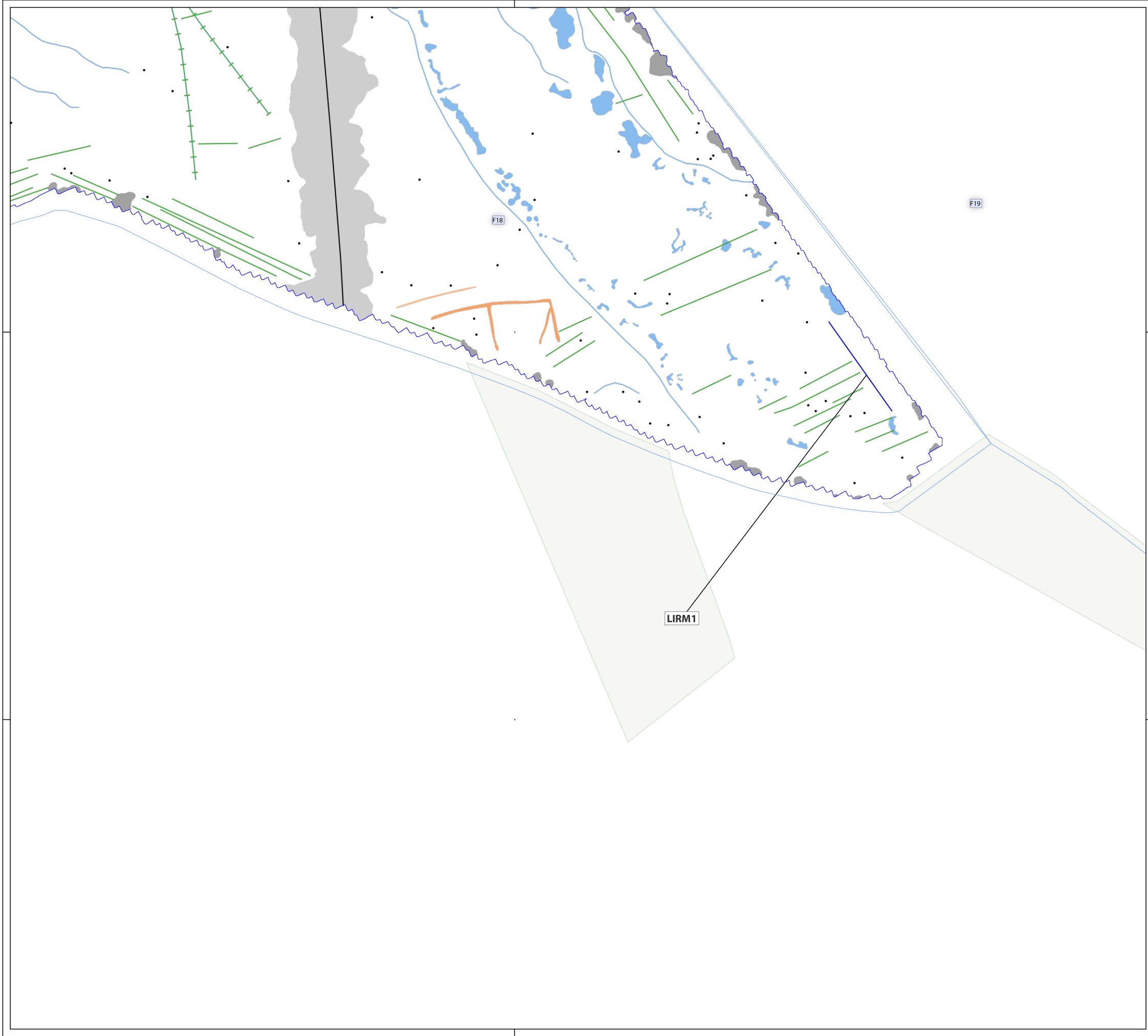
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Illus - 79 XY trace plot of minimally processed magnetometer data; Sector 23



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Key

Survey Extent

Ferrous Objects

Agriculture

Field Drain

Natural

Service

LIRM

Magnetic Disturbance (Above Ground)

Magnetic Disturbance (Below Ground)

Natural

Possible Archaeology

Abbreviation	
B	Burning
E	Enclosure
FB	Former Boundary
FB?	Former Boundary
FP	Former Pond
LIRM	Linear
Q	Quarrying
RD	Ring Ditch
SP	Service Pipe

0

40

80 m

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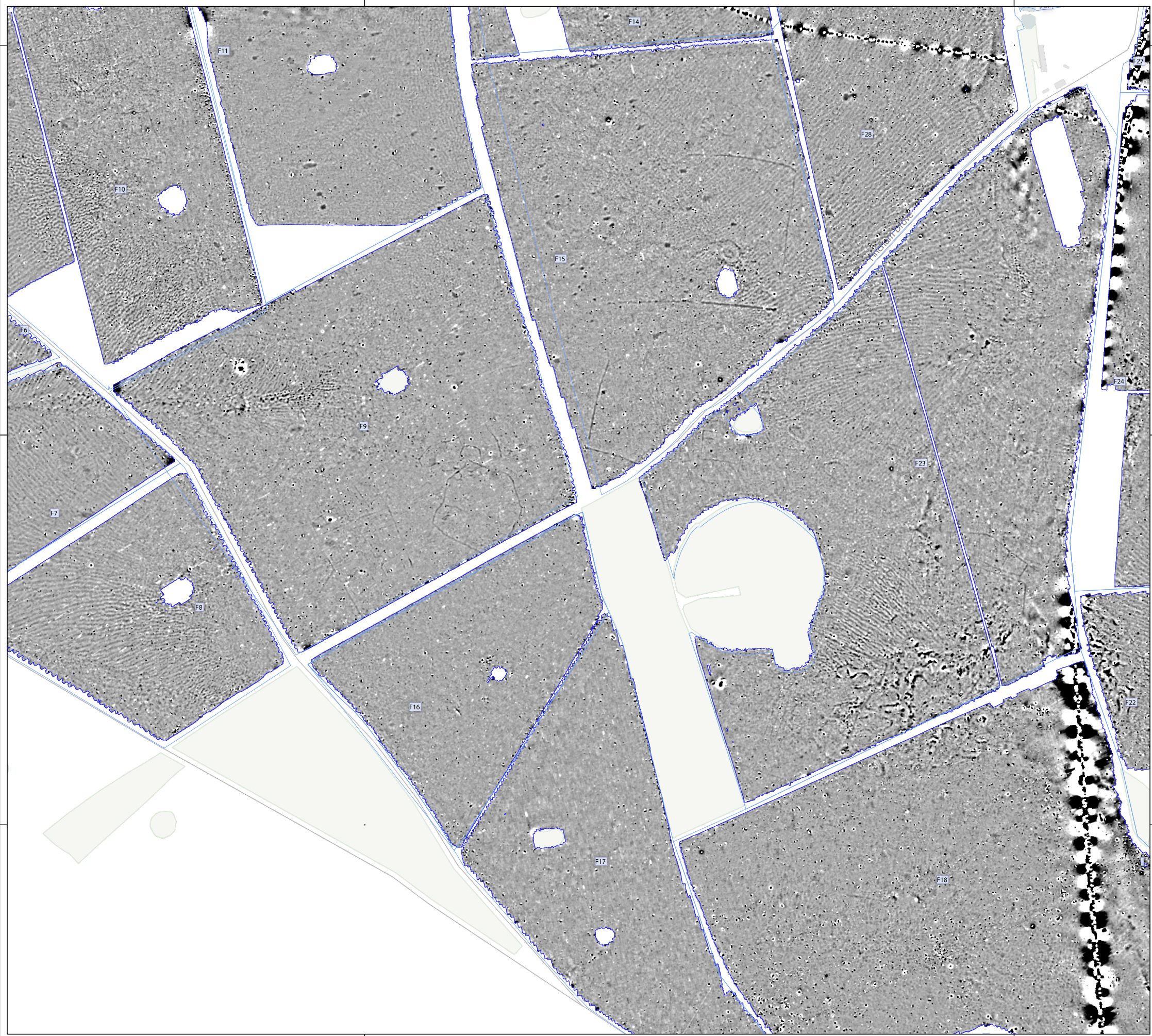
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581050

Illus - 80 Interpretation of magnetometer data; Sector 23



N

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Key

Survey Extent

+2nT

-1nT

0

100

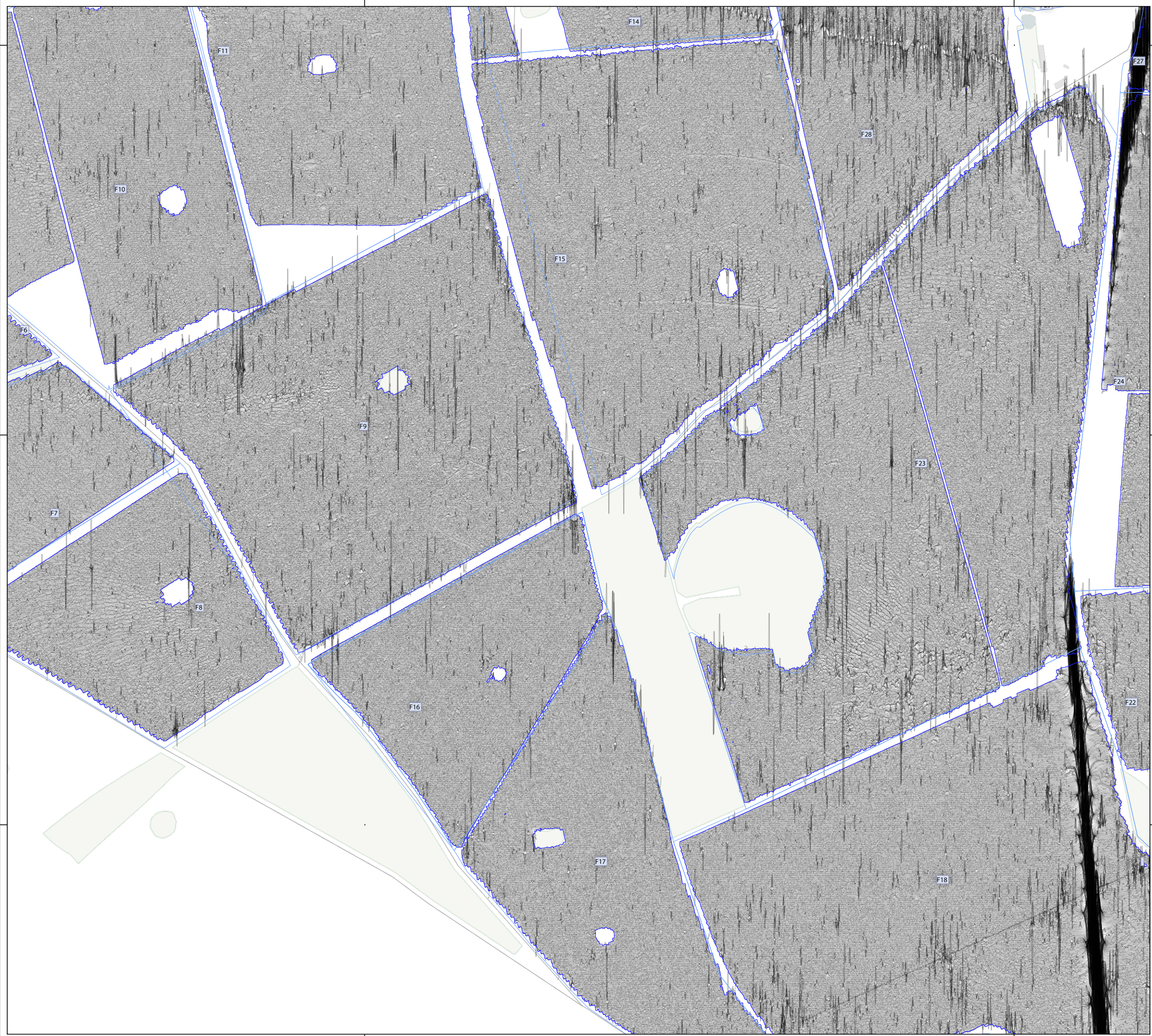
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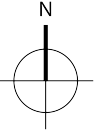
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312600
312000
311400

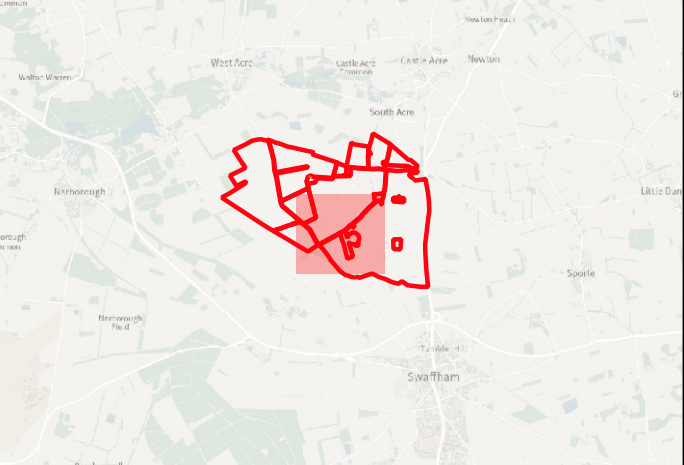
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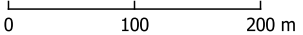
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Key

-  Survey Extent
-  XY Trace (25nT/cm)



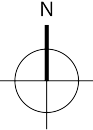
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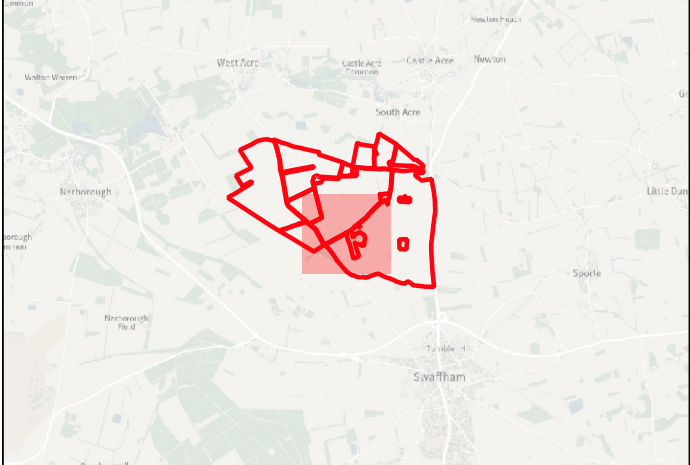






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Key

- Survey Extent
- Uncertain
- Archaeology
- Possible Archaeology
- Uncertain
- Burning

Abbreviation	
B	Burning
E	Enclosure
FB	Former Boundary
FB?	Former Boundary
FP	Former Pond
LIRM	Linear
Q	Quarrying
RD	Ring Ditch
SP	Service Pipe

0100200 m

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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 the topsoil, subsoil, and rock, 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 most 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 introduced into the topsoil during 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 and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Lightning-induced remnant magnetisation (LIRM)

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

Linear trend

This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on

an XY trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

APPENDIX 2 SURVEY LOCATION INFORMATION

An initial survey base station was established using a Trimble VRS differential Global Positioning System (dGPS). The magnetometer data was georeferenced using a Trimble RTK differential Global Positioning System (Trimble R10 model).

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

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

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

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE

The geophysical archive comprises an archive disk containing the raw data in XYZ format, a raster image

of each greyscale plot with associate world file, and a PDF of the report.

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

APPENDIX 4 DATA PROCESSING

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

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

A high pass filter has been applied to the greyscale plots to remove low frequency anomalies (relating to survey tracks and modern agricultural features) 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 ARCHIVE

OASIS Summary for headland1-531405

OASIS ID (UID)	headland1-531405
Project Name	Geophysical Magnetometry Survey at Drovers Solar Farm, Swaffham, Norfolk
Sitename	Drovers Solar Farm, Swaffham, Norfolk
Sitecode	KLSF24
Project Identifier(s)	p24-069
Activity type	Geophysical Survey, Magnetometry Survey, MAGNETOMETRY SURVEY
Planning Id	
Reason For Investigation	Planning requirement
Organisation Responsible for work	Headland Archaeology (UK) Ltd
Project Dates	08-Apr-2024 - 21-Aug-2024
Location	Drovers Solar Farm, Swaffham, Norfolk NGR : TF 80186 12390 LL : 52.67924099142908, 0.663948750543864 12 Fig : 580186,312390
Administrative Areas	Country : England County/Local Authority : Norfolk Local Authority District : Breckland Local Authority District : King's Lynn and West Norfolk
Project Methodology	The survey was undertaken using four Bartington Grad601 or Sensys FGM650 sensors mounted at 1m intervals (1m traverse interval) onto a rigid frame. The system was programmed to take readings at a frequency of 10Hz for the Bartington Grad601 and 300Hz for the Sensys FGM650 (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 R12 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. Anomaly GeoSurvey v1.12.3 (Lichenstone Geoscience) and QGIS v.3.28.5 software was used to process and present the data respectively.

Project Results	<p>As well as recording anomalies of modern, agricultural and geological origin, the survey has recorded anomalies of clear archaeological origin, including two well-defined areas of archaeological activity, as well as several small clusters and discrete anomalies that are also interpreted as of possible archaeological origin.</p> <p>The largest area of archaeological activity borders Fincham Drove, a former Roman road located in the centre-south of the site. Numerous enclosures with divisions and internal features have been recorded either side of Fincham Drove on an area of slightly higher ground as indicated by LiDAR data. The varying orientation, size and alignment of the enclosures are likely indicative of differing function and period. A second much smaller area of archaeological activity has been identified in the north-east of the site.</p> <p>As well as the two areas of archaeological activity several other isolated weak and discontinuous anomalies have been recorded and are ascribed a possibly archaeological or uncertain origin based on factors such as their morphology and proximity to archaeological assets previously recorded on the local historic environment record.</p> <p>In general, the archaeological anomalies in all parts of the site are of low magnitude and often discontinuous in nature owing to the likely low magnetic contrast of the sandy Breckland soils. The weak and discontinuous nature of the archaeological anomalies possibly indicates that the archaeological remains may be more extensive than recorded with the low magnetic contrast combined with potential degradation of the below-ground remains by modern farming practices leading to poor resolution of the sub-surface remains. However, it is considered likely that all main areas of archaeological activity have been identified by the survey.</p>
Keywords	Ditched Enclosure - UNCERTAIN - FISH Thesaurus of Monument Types
Funder	Private or public corporation Drovers Solar Farm Limited
HER	Norfolk HER - unRev - STANDARD
Person Responsible for work	Alistair Webb
HER Identifiers	
Archives	



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SOLAR FARM