The Drax Power (Generating Stations) Order

Land at, and in the vicinity of, Drax Power Station, near Selby, North Yorkshire

Environmental Statement
Appendix 8.2 – Geophysical Survey Results

The Planning Act 2008
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 – Regulation 5(2)(a)

Drax Power Limited

Drax Repower Project

Applicant:	DRAX POWER LIMITED
Date:	May 2018
Document Ref:	6.2.8.2
PINS Ref:	EN010091

GEOPHYSICAL SURVEY REPORT

GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Drax Repower Project

Client
WSP
For
Drax Power Ltd

Survey Report
11968

Date
January 2018

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GEOPHYSICAL SURVEY REPORT

Project name:
Drax Repower Project

SUMO Job reference:
11968

Client:
WSP
For:
Drax Power Ltd

Survey date:
30 Oct – 10 Nov 2017;
03 Jan -12 Jan 2018

Report date:
31 January 2018

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TABLE OF CONTENTS

LIST OF FIGURES

DIGITAL CONTENT (Archive Data CD/DVD)

- Minimally Processed Greyscale Images and XY Trace Plots in DWG format
- Digital Copies of Report Text and Figures (both PDF and native formats)

1 SUMMARY OF RESULTS

A magnetic survey was carried out over 100 ha of land to the east of the Drax Power station. The results indicate the presence of two small archaeological complexes made up of enclosures, one of which includes ring ditches and associated settlement features.

2 INTRODUCTION

2.1 Background synopsis

SUMO Geophysics were commissioned to undertake a geophysical survey of an area outlined for re-development of the power station. This survey forms part of an archaeological investigation being undertaken by **WSP** on behalf of **Drax Power Ltd**.

2.2 Site details

NGR / Postcode	SE 669 277 / YO8 8NG
Location	The survey areas are located in several fields immediately east of the existing power station complex at Drax, Selby, North Yorkshire.
HER/SMR	North Yorkshire
District	Selby
Parish	Long Drax CP; Newland CP and Drax CP
Topography	Generally level
Current Land Use	Arable / Pasture
Weather	Variable
Geology	Solid: Sherwood Sandstone Group - sandstone. Superficial: Hemingbrough Glaciolacustrine Formation - clay, silt; Warp - clay and silt. Breighton Sand Formation – sand; Alluvium - clay, silt, sand and gravel (BGS 2018).
Archaeology	As part of the Asselby to Aberford Pipeline project, trenching within the footprint of pipeline option B produced clear evidence for Late Iron Age through to the early Roman period in the form of fragments of a beehive quern, a possible enclosure, ditches, pits and postholes. The old course of the River Aire located to the south of the Site, extended around Hawday Lane and into the River Ouse to the north of the Site. It is postulated that this old channel was navigable in the Romano-British period and further investigation is likely to reveal the remains of a landing stage (MNY10103) along Hawday Lane. After silting up the lane may have been the course along which boats were dragged overland. Hawday Lane and the possible landing stage extends into the site of Pipeline B. (WSP 2017/8)
Survey Methods	Magnetometer survey (fluxgate gradiometer)
Study Area	100 ha

2.3 Aims and Objectives

To locate and characterise any anomalies of possible archaeological interest within the study area.

3 METHODS, PROCESSING & PRESENTATION

3.1 Standards & Guidance

This report and all fieldwork have been conducted in accordance with the latest guidance documents issued by Historic England (EH 2008) (then English Heritage), the Chartered Institute for Archaeologists (CIfA 2014) and the European Archaeological Council (EAC 2016).

3.2 Survey methods

Detailed magnetic survey was chosen as an efficient and effective method of locating archaeological anomalies.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1.0m	0.25m

More information regarding this technique is included in Appendix A.

3.3 Data Processing

The following basic processing steps have been carried out on the data used in this report:

De-stripe; de-stagger; interpolate

3.4 Presentation of results and interpretation

. The presentation of the results for each site involves a grey-scale plot of processed data. Magnetic anomalies are identified, interpreted and plotted onto the 'Interpretation' drawings. The minimally processed data are provided as a greyscale image in the Archive Data Folder with an XY trace plot in CAD format. A free viewer is available: https://viewer.autodesk.com

When interpreting the results, several factors are taken into consideration, including the nature of archaeological features being investigated and the local conditions at the site (geology, pedology, topography etc.). Anomalies are categorised by their potential origin. Where responses can be related to other existing evidence, the anomalies will be given specific categories, such as: *Abbey Wall* or *Roman Road*. Where the interpretation is based largely on the geophysical data, levels of confidence are implied, for example: *Probable*, or *Possible Archaeology*. The former is used for a confident interpretation, based on anomaly definition and/or other corroborative data such as cropmarks. Poor anomaly definition, a lack of clear patterns to the responses and an absence of other supporting data reduces confidence, hence the classification *Possible*.

4 RESULTS

The survey has been divided into twenty-one survey areas (Areas 1-21 including subdivisions 7 North and 7 South) and specific anomalies have been given numerical labels [1] [2] *which appear in the text below, as well as on the Interpretation Figure(s).*

4.1 *Probable / Possible Archaeology*

4.1.1 Area 16. There is a well-defined rectilinear enclosure [1] measuring approximately 37m east-west and 27m (maximum) north-south; internally, two- large pit-like anomalies are visible and there are very tentative hints of an oval-shaped feature. Further, less clear enclosures lie to the north and east, and there is a trackway running between them on an east-west alignment. Unfortunately, the results are confused by a number of land drains, many of which are on the same alignment as the ditches.

4.1.2 Areas 17 and 18: The survey has identified a small complex of archaeological features which are cut by a large pipeline which masks many of the responses. The results include several, conjoined rectilinear enclosures containing numerous internal features, the most striking of which comprise three central ring ditches [2, 3 and 4]. Based on the layout of the enclosures, the features are thought to represent part of an Iron Age / Romano-British settlement. This interpretation fits will with the evidence from excavation work during the laying of the pipeline when artefacts and features from this period were identified (WSP 2017/18). The enclosures clearly extend to the east, beyond the survey footprint.

4.2 *Uncertain*

4.2.1 It is inevitable that on a survey of such size, there will be numerous responses that are difficult to interpret with high degrees of confidence; they could be archaeological, agricultural, modern or natural. As a consequence, such responses are assigned to this category – *Uncertain*. While they are not generally thought to represent archaeological features, the fact that certain areas have clear concentrations of archaeological responses (many of which appear to be plough damaged) means that an archaeological interpretation cannot be ignored. This is particularly true for the responses [5] which are unusual in their form.

4.3 *Former Field Boundary*

4.3.1 A number of old field boundaries have been identified; where there is supporting map evidence they are recorded as ‘corroborated’ otherwise, even though they follow clear field divisions, they are conjectural.

4.4 *Agricultural – Ploughing / Land Drains*

4.4.1 Parallel trends in the data in some of the fields reflect modern ploughing; apart from in Area 21, there is no evidence for any ridge and furrow cultivation practices in the results.

4.4.2 Numerous land drains are visible in the data from many of the survey areas and they are usually depicted by lines of small dipole anomalies, either isolated or in small groups. The drains form clear networks and in some instances follow a ‘classic’ herringbone pattern.

4.5 *Natural / Geological / Pedological*

4.5.1 Localised variations in the magnetic properties of the differing superficial deposits result in changes in the ‘background’ levels of magnetic ‘noise’. Sometimes the differences are subtle

but on other occasions the results have a marked effect on the data. For example, close to the River Ouse in Areas 7N, 8 and 19 the alluvial deposits clearly reflect the meandering courses of the river, whereas elsewhere the responses are more amorphous. One location where the results are particularly unusual is in Areas 14 and 15; the very strong curving responses, which seem to converge with each other. The fact they respect the alignment of the eastern field boundaries and road, suggests a modern origin rather than meandering river deposits. The most likely explanation is that ploughing has cut into naturally magnetic flood deposits and created the resultant pattern.

6 ***Ferrous / Magnetic Disturbance***

4.6.1 Area 1: two parallel pipelines run through this field into the compound. An existing pylon is responsible for the gap in the survey and the four strong ferrous responses to the east mark the location of an old pylon base which has been left in the ground.

4.6.2 Area 2: the gap corresponds to an existing pylon.

4.6.3 Area 3: a pipeline runs along the northern edge of the survey block.

4.6.4 Areas 15, 18, 20 and 21: a pipeline cross through these survey areas and a smaller pipe runs through Area 21.

4.6.5 Ferrous responses close to boundaries are due to adjacent fences and gates. Smaller scale ferrous anomalies ("iron spikes") are present throughout the data and their form is best illustrated in the XY trace plots. These responses are characteristic of small pieces of ferrous debris (or brick / tile) in the topsoil and are commonly assigned a modern origin. Only the most prominent of these are highlighted on the interpretation diagram.

5 DATA APPRAISAL & CONFIDENCE ASSESSMENT

5.1 Historic England guidelines (EH 2008) Table 4 states that the average magnetic response on the local geologies is poor to good. The results from this survey demonstrate that the technique has successfully identified archaeological features; more ephemeral features may be masked by the land drains and the pipelines will have made identification of remain impossible along the corridors they follow.

6 CONCLUSION

6.1 The magnetic survey has identified two small archaeological complexes. The first comprises rectilinear enclosures set either side of a trackway, but no clear settlement evidence apart from a couple of possible pits and a very poorly defined oval trend. The second area of interest again comprises a series of conjoined enclosures, three of which contain clear ring ditch features. There are also a number of pit-like responses. The results provide a plan of an Iron Age / Romano-British complex, first identified during construction of a pipeline which bisects the features. Small incomplete ‘square’ anomalies are of uncertain origin; an archaeological cause cannot be dismissed. Naturally magnetic responses visible in the data are associated with alluvial and differing superficial deposits; ploughing effects have also been detected as have a network of land drains. Several pipelines cross the survey areas.

7 REFERENCES

BGS 2018 British Geological Survey, Geology of Britain viewer [accessed 12/01/2018] *website*: (http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps)

CIfA 2014 *Standard and Guidance for Archaeological Geophysical Survey.* Amended 2016. CIfA Guidance note. Chartered Institute for Archaeologists, Reading http://www.archaeologists.net/sites/default/files/CIfAS%26GGeophysics_2.pdf

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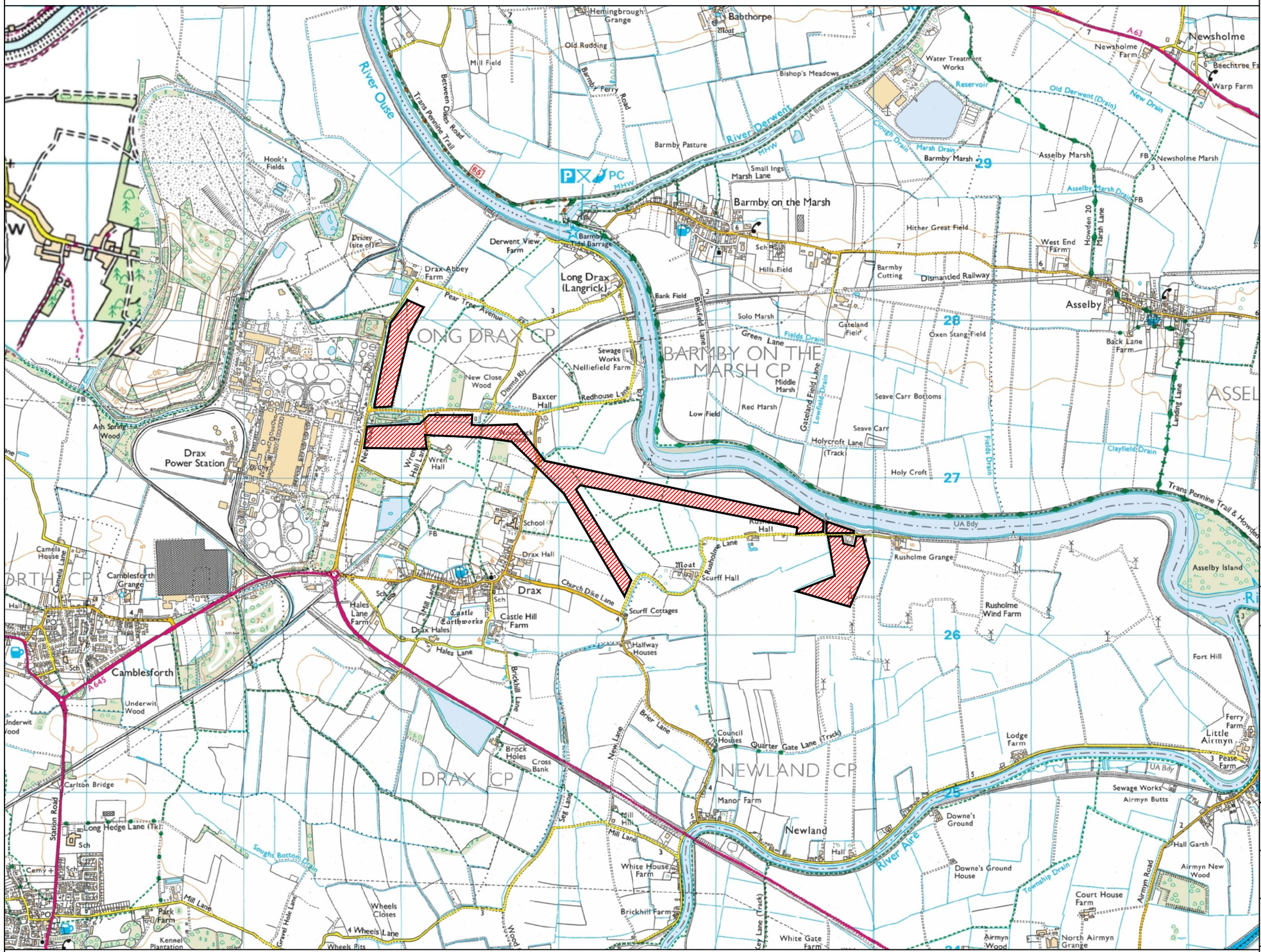
EH 2008 *Geophysical Survey in Archaeological Field Evaluation.* English Heritage, Swindon https://content.historicengland.org.uk/images-books/publications/geophysical-survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf/

WSP 2017/18 *Drax Repowering Project, Historic Environment Desk-Based Assessment,* WSP draft report, Project no. 70037047



N

Site Location

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title: Site Location Diagram

Client: WSP

Project: 11968 Drax Repower Project

Scale: 0 metres 1250
1:25000 @ A3

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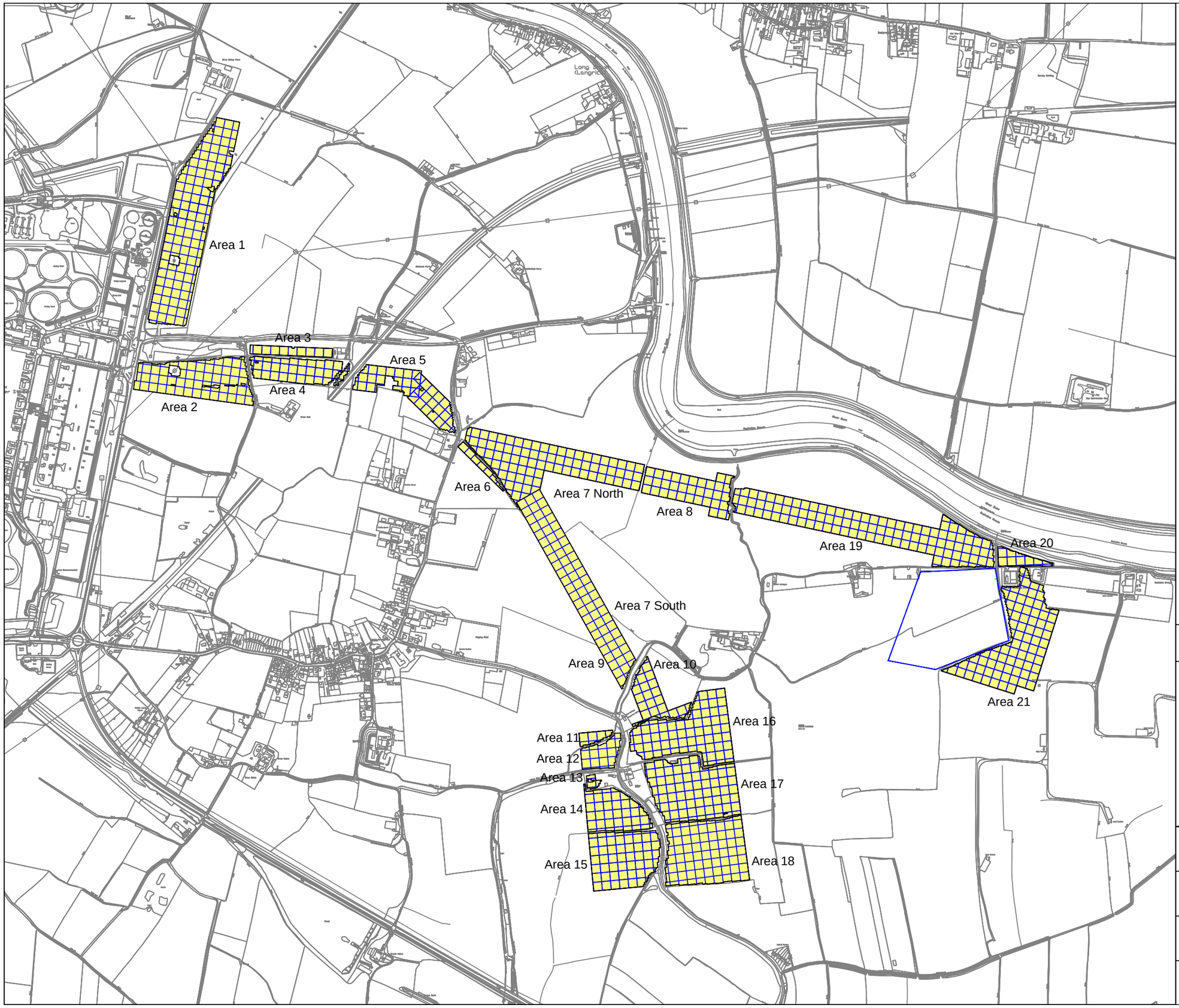

N

Magnetometer Survey Area showing 30m grids

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Location of Survey Areas

Client:
WSP

Project:
11968 Drax Repower Project

Scale:
0 metres 625
1:12500 @ A3

Fig No:
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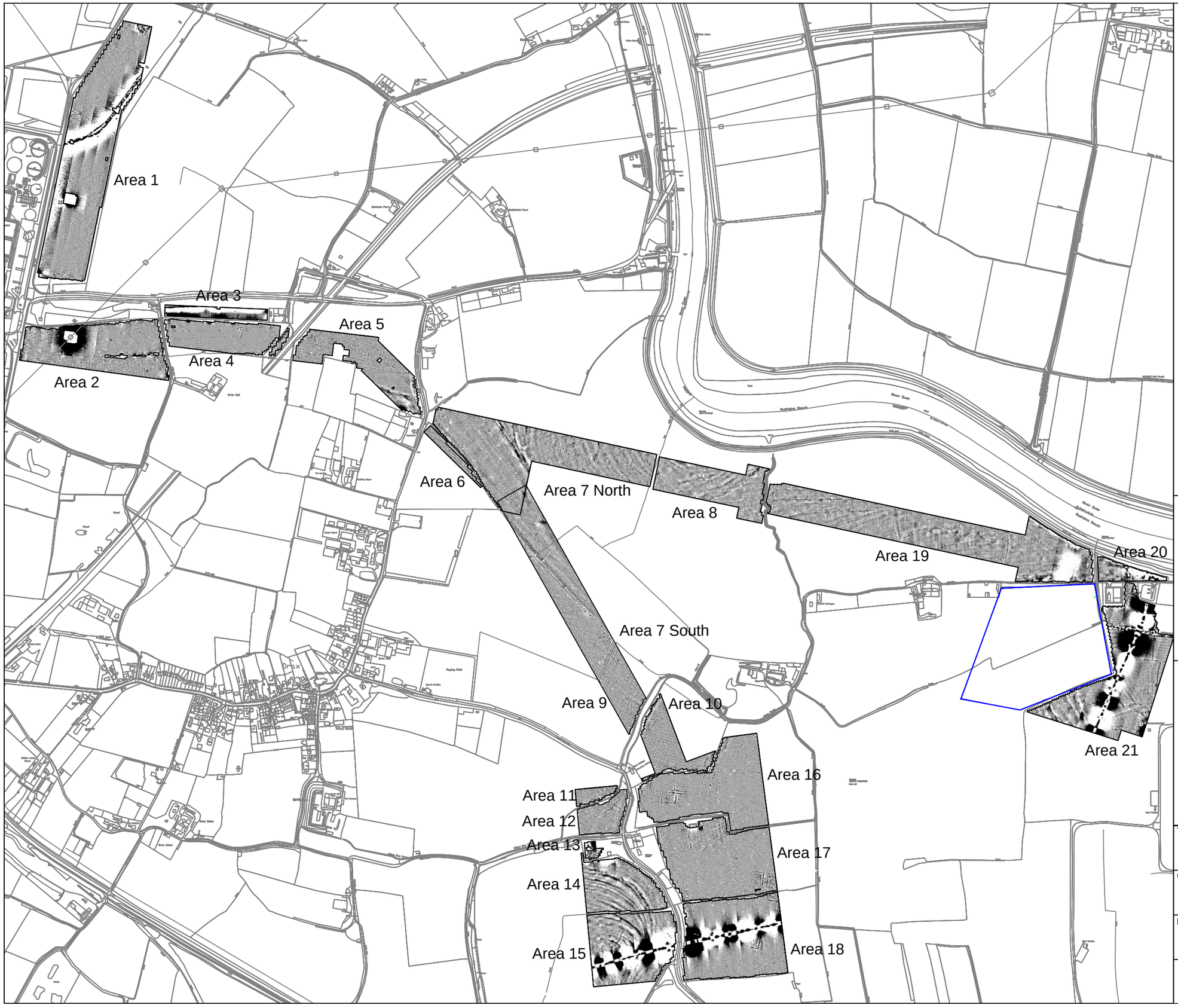

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sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Magnetometer Survey [All Areas]
Greyscale Plots

Client:
WSP

Project:
11968 Drax Repower Project

Scale:
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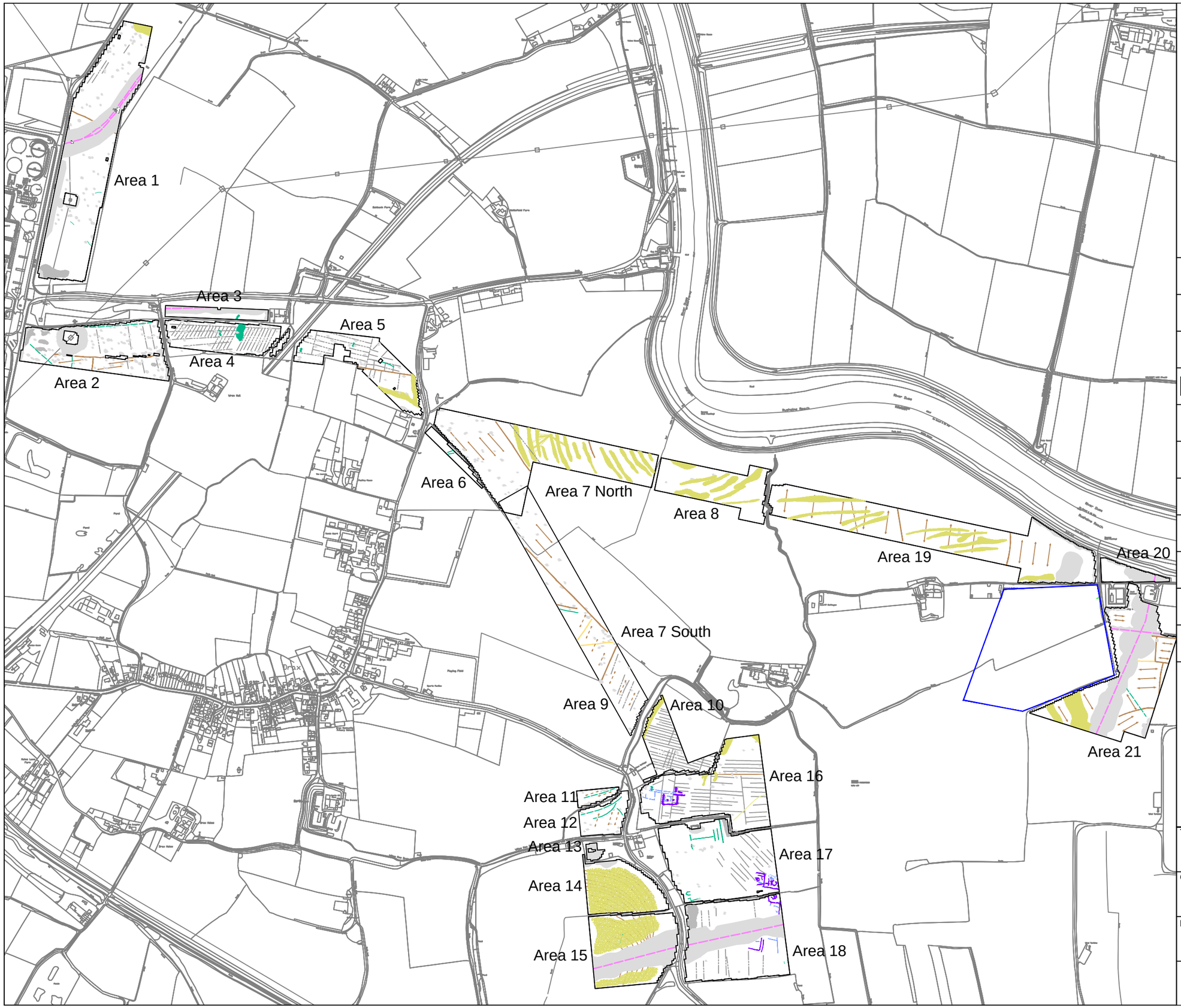
Fig No:
03



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KEY

	Probable Archaeology
	Possible Archaeology (discrete / trend)
	Uncertain Origin (discrete / trend / increased response)
	Natural
	Former Field Boundary (corroborated / conjectural)
	Ploughing
	Drain
	Pipe / Service
	Magnetic Disturbance
	Ferrous

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Magnetometer Survey [All Areas]
Interpretation

Client:
WSP

Project:
11968 Drax Repower Project

Scale:
0 metres 500
1:10000 @ A3

Fig No:
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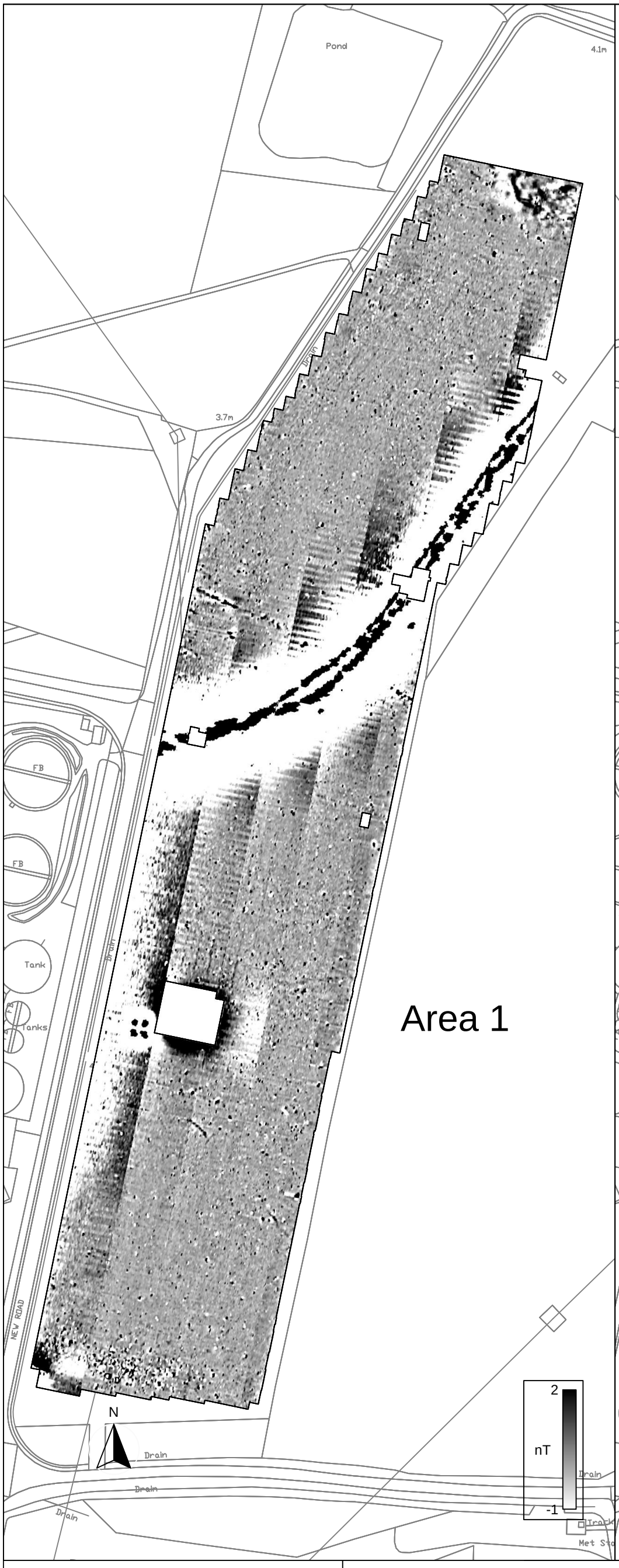

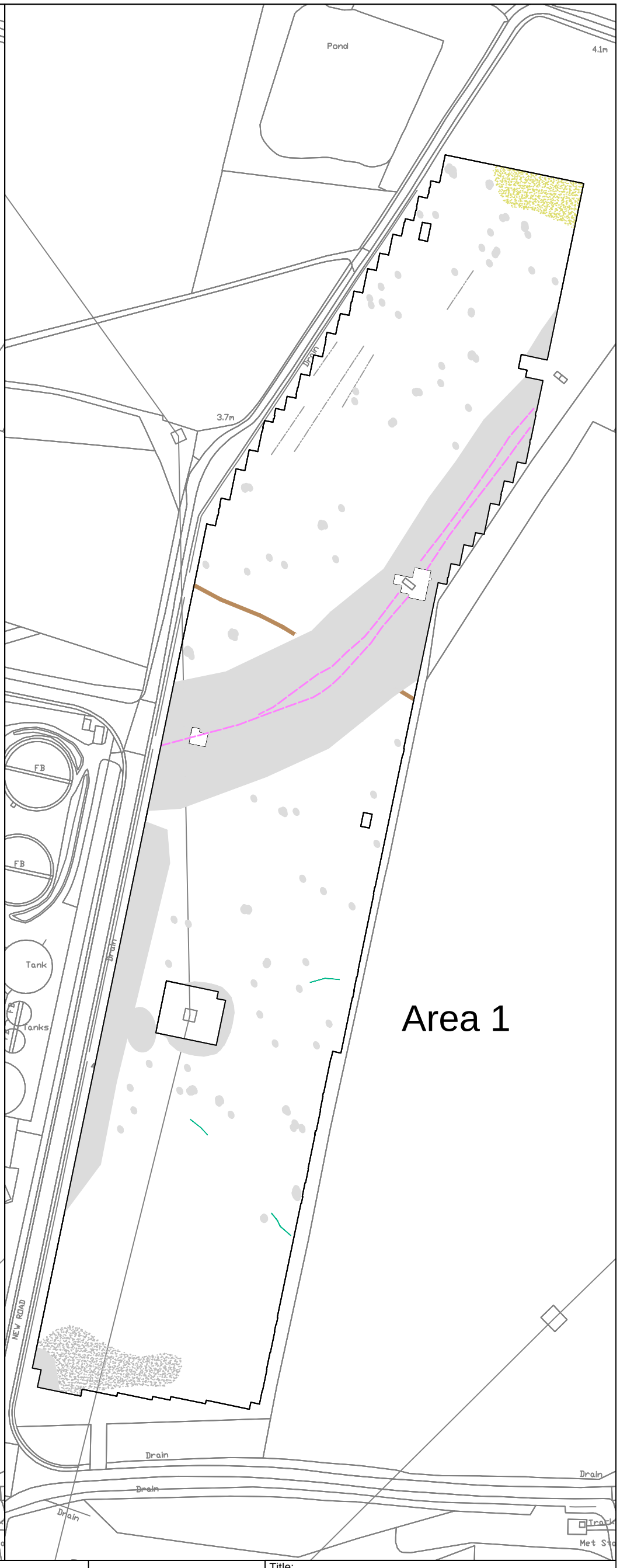

KEY

	Uncertain Origin (trend)		Drain
	Natural		Pipe/ Service
	Former Field Boundary (corroborated)		Magnetic Disturbance
			Ferrous

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Magnetometer Survey [Area 1]
Greyscale Plot and Interpretation

Client:
WSP

Project:
11968 Drax Repower Project

Scale:
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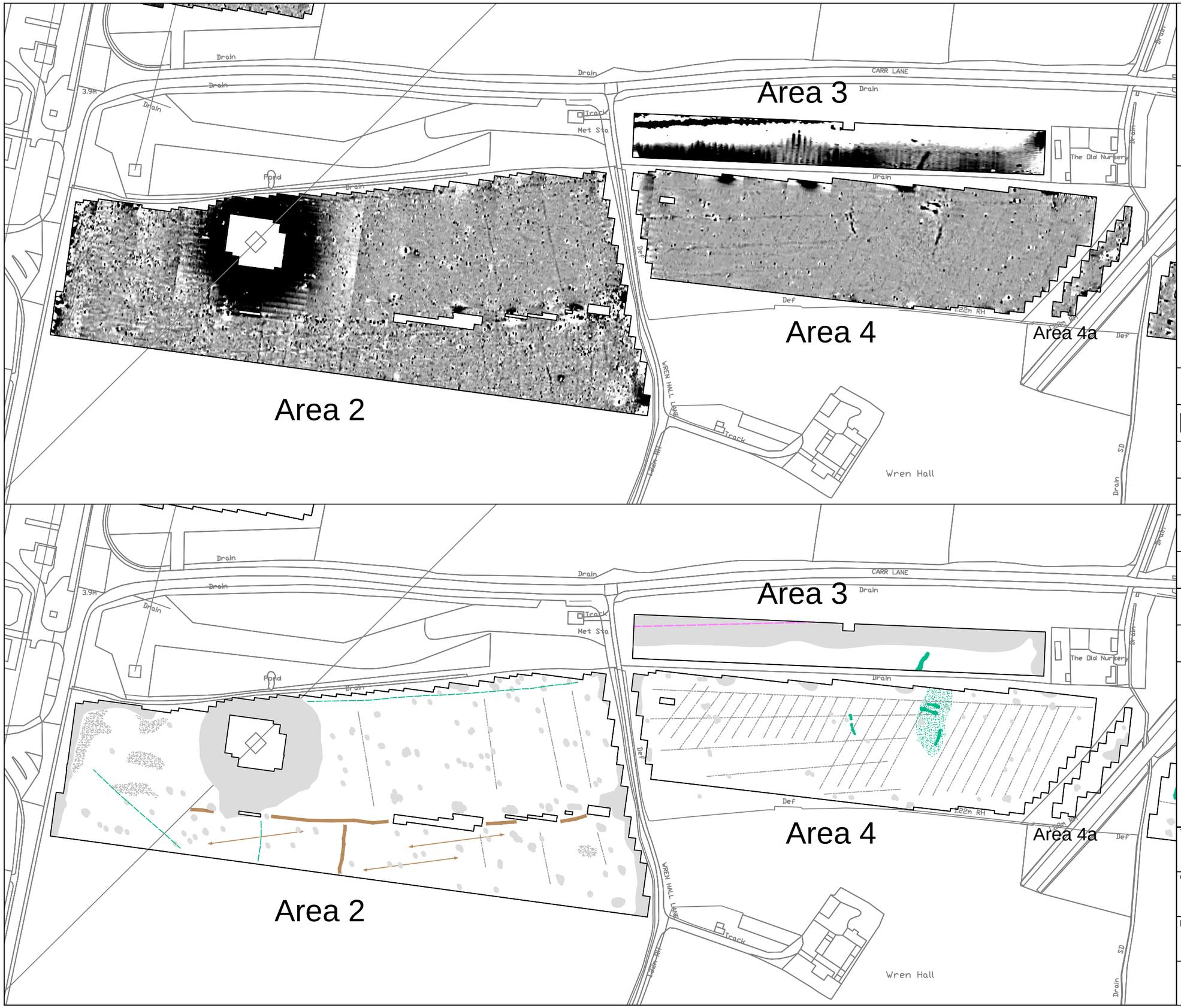
Fig No:
05



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-1

KEY

	Uncertain Origin (discrete / trend / increased response)
	Former Field Boundary (corroborated)
	Ploughing
	Drain
	Pipe / Service
	Magnetic Disturbance
	Ferrous

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Magnetometer Survey [Areas 2, 3 and 4]
Greyscale Plots and Interpretation

Client:
WSP

Project:
11968 Drax Repower Project

Scale:
0 metres 125
1:2500 @ A3

Fig No:
06

Area 5

Area 4a

Area 4

Wren Hall

The Old Nursery

Baxter Hall

The Hayloft

Pond

Drain

Def

SD

1.22m RH

N

2
nT
-1

KEY

	Uncertain Origin (discrete / trend / increased response)
	Natural
	Former Field Boundary (corroborated)
	Ploughing
	Drain
	Ferrous

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Magnetometer Survey [Area 5]
Greyscale Plot and Interpretation

Client:
WSP

Project:
11968 Drax Repower Project

Scale:
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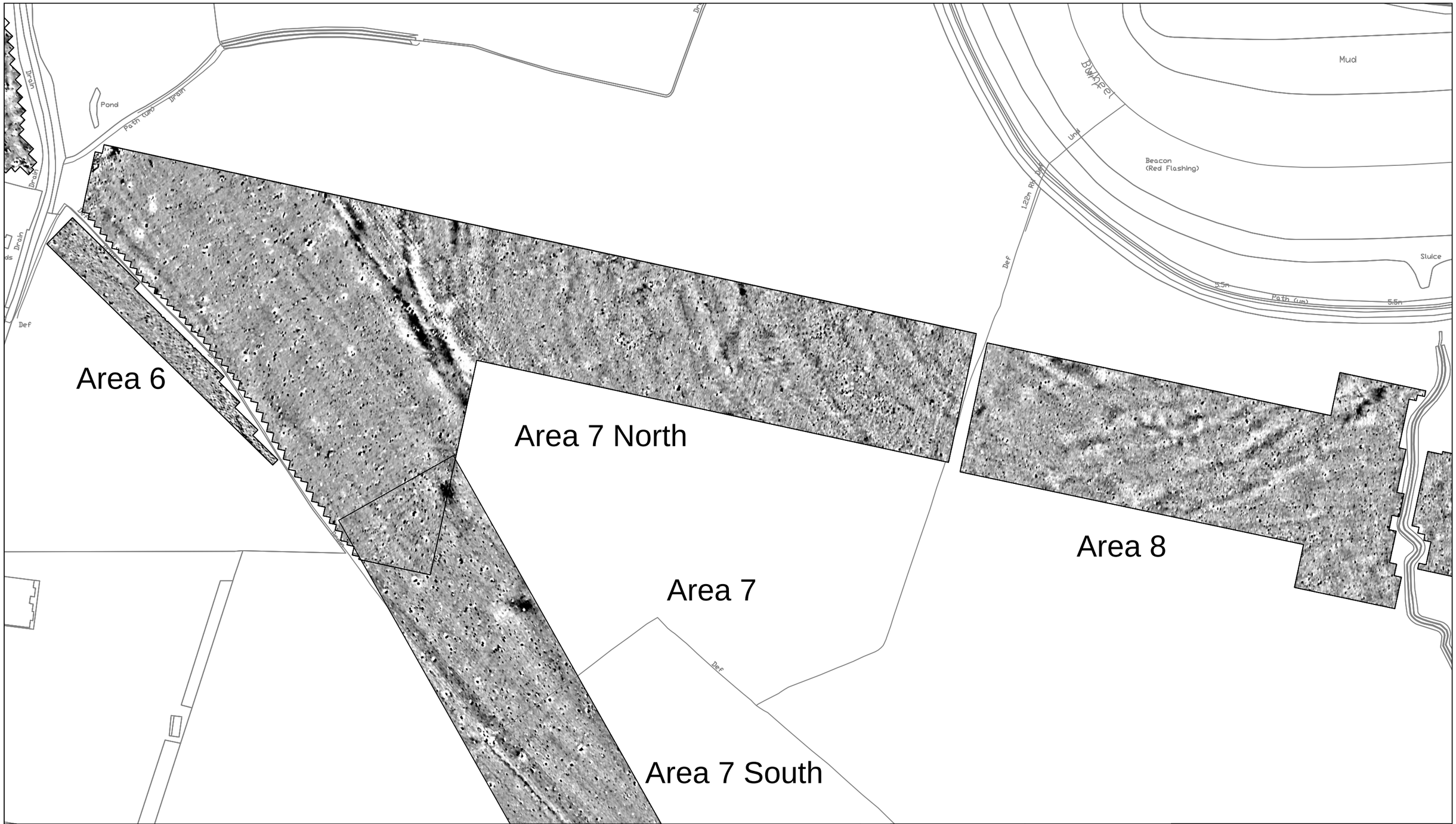
1:2500 @ A3

Fig No:
07



N

2
nT
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sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Magnetometer Survey [Areas 6, 7 North and 8]
Greyscale Plots

Client:
WSP

Project:
11968 Drax Repower Project

Scale:
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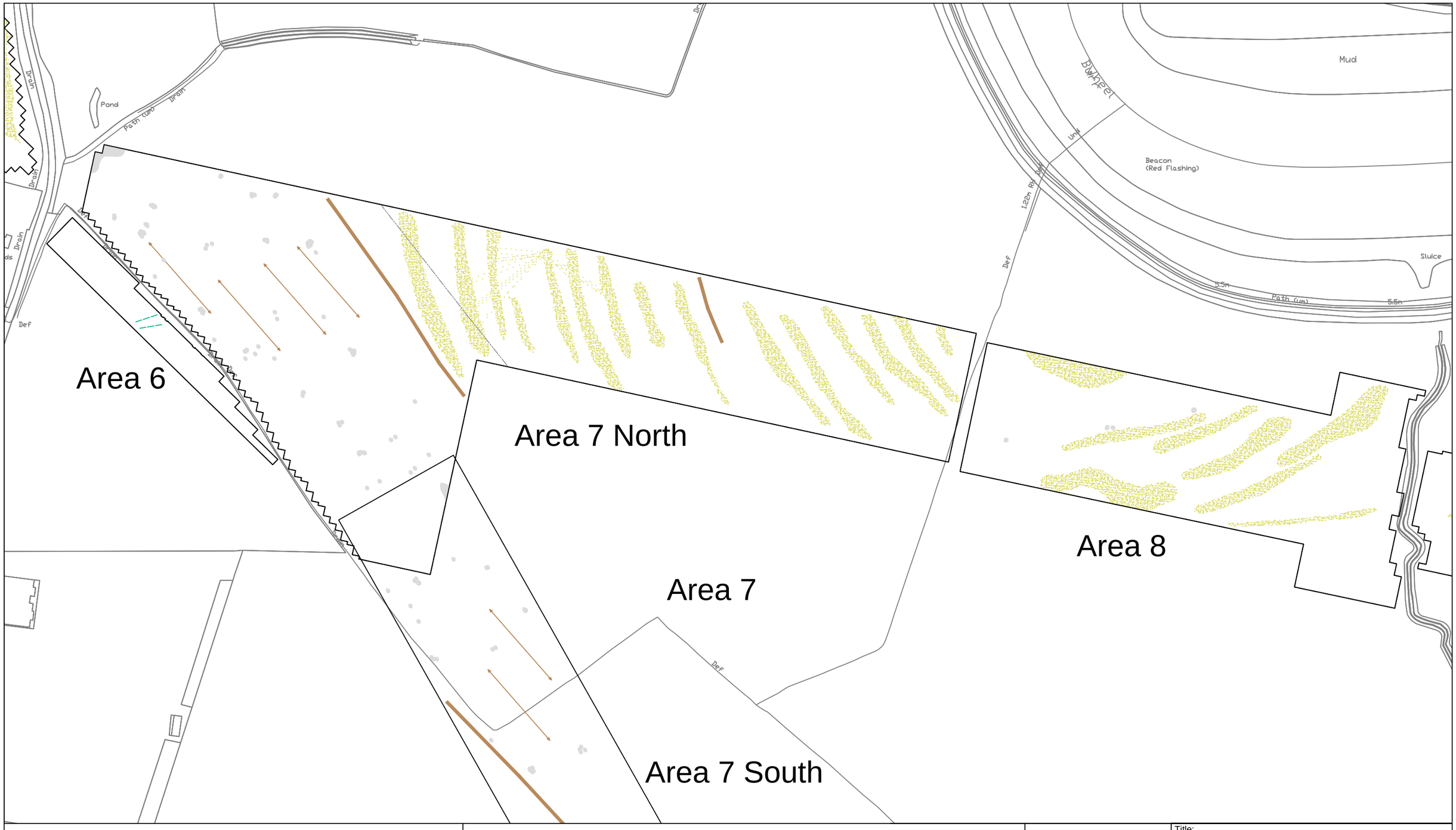
1:2500 @ A3

Fig No:
08



N

KEY

	Uncertain Origin (trend)		Ploughing
	Natural		Ferrous
	Former Field Boundary (corroborated)		

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title: Magnetometer Survey [Areas 6, 7 North and 8] Greyscale Plots

Client: WSP

Project: 11968 Drax Repower Project

Scale: 0 metres 125
1:2500 @ A3

Fig No: 09

Area 7 North

Area 8

Area 7

Area 7 South

Area 9

Area 10

Area 11

Def

Drain

1.22m RH

4.0m

CHURCH DIKE LANE

Rose Cottage

Steverley Cottage

OR

BRANE

N

2

nT

-1

sumo Survey

GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Magnetometer Survey [Areas 7 South and 9]
Greyscale Plots

Client:
WSP

Project:
11968 Drax Repower Project

Scale:
0 metres 125
1:2500 @ A3

Fig No:
10

Area 7 North

Area 8

Area 7

Area 7 South

Area 7 South

Area 9

Area 10

Area 11

Drain

Def

1.22m RH

4.0m

CHURCH DIKE LANE

Rose Cottage

Steverley Cottage

BR

N

KEY

	Uncertain Origin (trend)		Ploughing
	Former Field Boundary (corroborated / conjectural)		Drain
	Use this as a template if running over into two lines		Ferrous

sumo Survey

GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title: Magnetometer Survey [Areas 7 South and 9] Interpretation

Client: WSP

Project: 11968 Drax Repower Project

Scale: 0 metres 125

1:2500 @ A3

Fig No: 11

N

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nT
-1

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Magnetometer Survey [Areas 10 - 18]
Greyscale Plots

Client:
WSP

Project:
11968 Drax Repower Project

Scale:
0 metres 125
1:2500 @ A3

Fig No:
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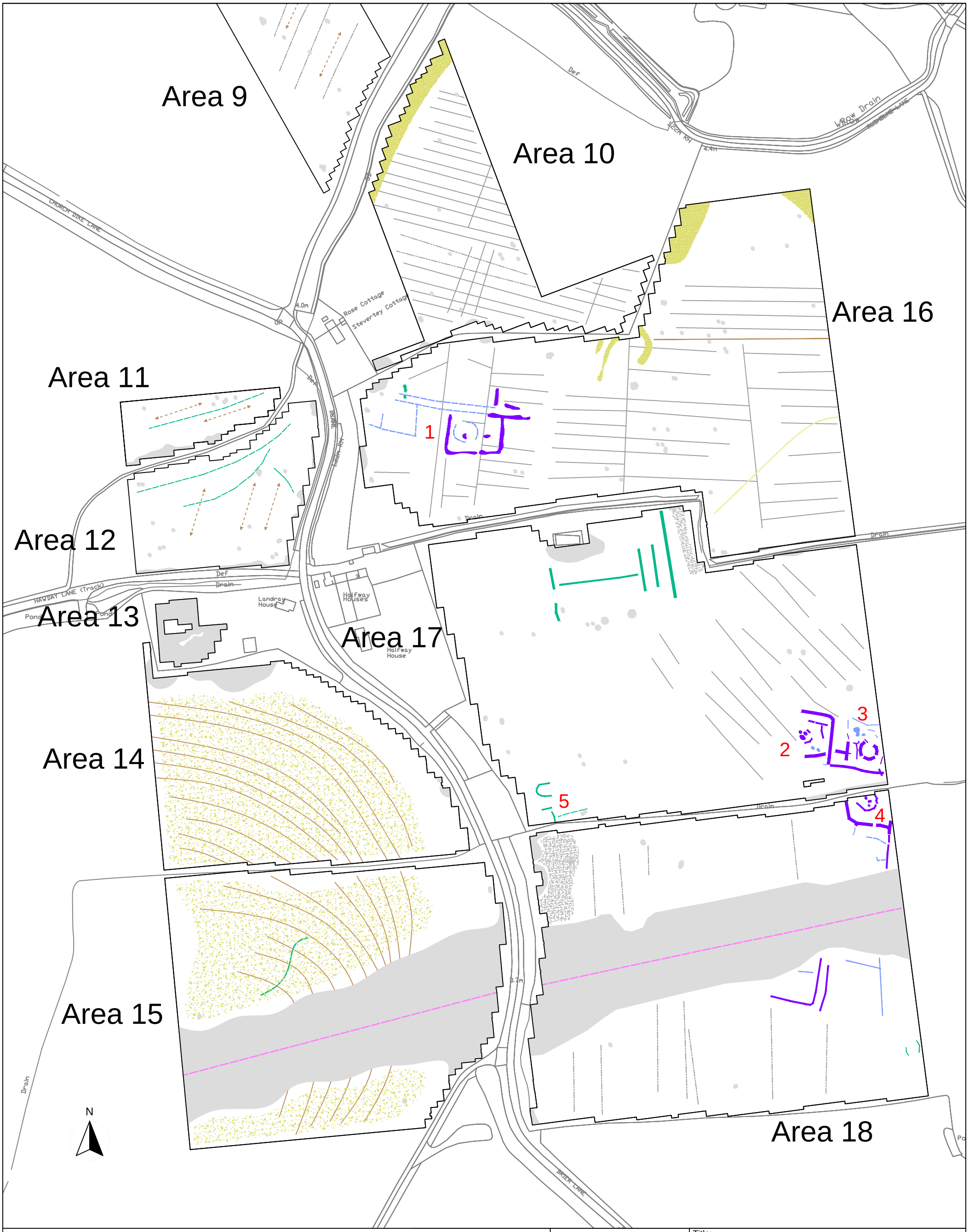

KEY

	Probable Archaeology		Former Field Boundary (corroborated / conjectural)
	Possible Archaeology (discrete / trend)		Ploughing
	Uncertain Origin (discrete / trend)		Drain
	Natural		Ferrous / Magnetic Disturbance

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title: Magnetometer Survey [Areas 10 - 18] Interpretation

Client: WSP

Project: 11968 Drax Repower Project

Scale: 0 metres 125
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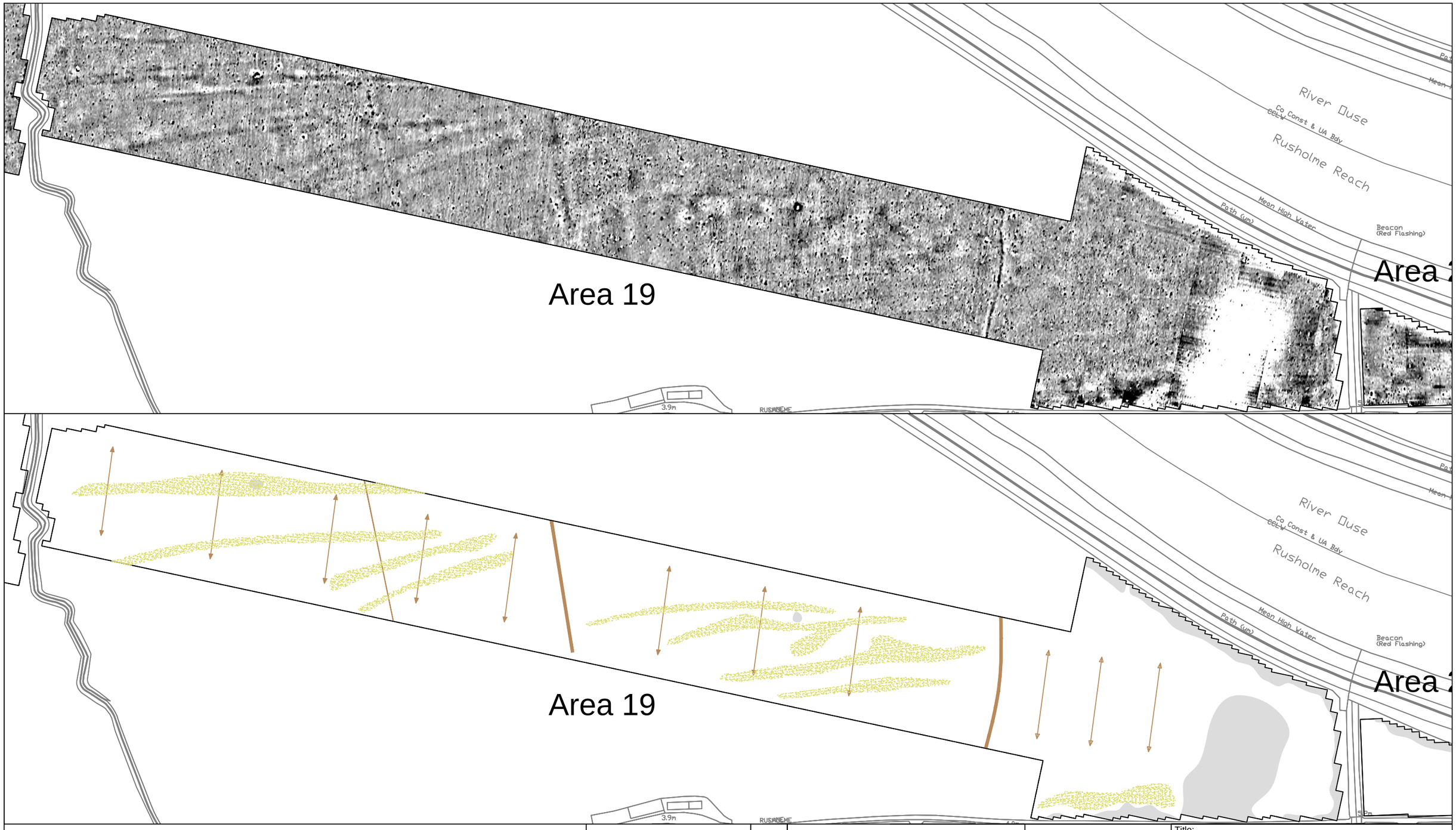
Fig No: 13



N

2
nT
-1

KEY

	Natural
	Former Field Boundary (corroborated)
	Ploughing
	Ferrous

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title: Magnetometer Survey [Area 19] Greyscale Plot and Interpretation

Client: WSP

Project: 11968 Drax Repower Project

Scale: 0 metres 125
1:2500 @ A3

Fig No: 14

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Magnetometer Survey [Areas 20 and 21]
Greyscale Plots

Client:
WSP

Project:
11968 Drax Repower Project

Scale:
0 metres 125
1:2500 @ A3

Fig No:
15

Area 20

Area 21

N

KEY

	Uncertain Origin (trend)
	Natural
	Former Field Boundary (corroborated / conjectural)
	Ploughing / Ridge and Furrow
	Ferrous

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
Magnetometer Survey [Areas 20 and 21]
Interpretation

Client:
WSP

Project:
11968 Drax Repower Project

Scale:
0 metres 125
1:2500 @ A3

Fig No:
16

Appendix A - Technical Information: Magnetometer Survey Method

Grid Positioning

For hand held gradiometers the location of the survey grids has been plotted together with the referencing information. Grids were set out using a Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS GPS system.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. This results in an accuracy of around 0.01m.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1m	0.25m

Instrumentation: Bartington *Grad* 601-2

Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted vertically, set 1.0m apart. The fluxgate gradiometer suppresses any diurnal or regional effects. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method, though strongly magnetic objects may be visible at greater depths. The Bartington instrument can collect two lines of data per traverse with gradiometer units mounted laterally with a separation of 1.0m. The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each site survey, data is transferred to the office for processing and presentation.

Data Processing

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set.
Step Correction (De-stagger)	When gradiometer data are collected in 'zig-zag' fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors.

Display

Greyscale/ Colourscale Plot	This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly, all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.

Interpretation Categories

In certain circumstances (usually when there is corroborative evidence from desk-based or excavation data) very specific interpretations can be assigned to magnetic anomalies (for example, *Roman Road, Wall,* etc.) and where appropriate, such interpretations will be applied. The list below outlines the generic categories commonly used in the interpretation of the results.

Archaeology / Probable Archaeology	This term is used when the form, nature and pattern of the responses are clearly or very probably archaeological and /or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.
Possible Archaeology	These anomalies exhibit either weak signal strength and / or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.
Industrial / Burnt-Fired	Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal-working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.
Former Field Boundary (probable & possible)	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions. Possible denotes less confidence where the anomaly may not be shown on historic mapping but nevertheless the anomaly displays all the characteristics of a field boundary.
Ridge & Furrow	Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases, the response may be the result of more recent agricultural activity.
Agriculture (ploughing)	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
Land Drain	Weakly magnetic linear anomalies, quite often appearing in series forming parallel and herringbone patterns. Smaller drains may lead and empty into larger diameter pipes, which in turn usually lead to local streams and ponds. These are indicative of clay fired land drains.
Natural	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
Magnetic Disturbance	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present.
Service	Magnetically strong anomalies, usually forming linear features are indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) or the fill of the trench can cause weaker magnetic responses which can be identified from their uniform linearity.
Ferrous	This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.
Uncertain Origin	Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning gives little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of *Possible Archaeology* / *Natural* or (in the case of linear responses) *Possible Archaeology* / *Agriculture*; occasionally they are simply of an unusual form.

Where appropriate some anomalies will be further classified according to their form (positive or negative) and relative strength and coherence (trend: weak and poorly defined).

Appendix B - Technical Information: Magnetic Theory

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.1 nanoTeslas (nT) in an overall field strength of 48,000 (nT), can be accurately detected.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremanent* material.

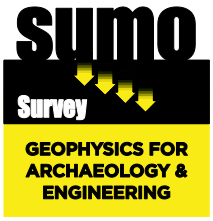
Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and kilns; material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried feature. The difference between the two sensors will relate to the strength of a magnetic field created by this feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity and disturbance from modern services.



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