

GEOPHYSICAL SURVEY REPORT

Thorney, Peterborough

Client

Pigeon Investment Management Ltd

Survey Report

04444

OASIS Ref. No.

sumogeop1-503694

HER Ref. No.

EPB1096

Date

January 2022



Survey Report 04444: Thorney, Peterborough

Survey dates	17 – 30 November 2021 1– 3 December 2021
Field co-ordinator	Robert Knight BA MA Jay Griffiths BA
Field Team	Robert Ottolangui MSc Kristina Heath MSc Jordan Morris BA
Report Date	6 January 2022
CAD Illustrations	Thomas Cockcroft MSc
Report Author	Thomas Cockcroft MSc
Project Manager	Simon Haddrell BEng AMBCS PCIfA
Report approved	Dr John Gater BSc DSc(Hon) MCIfA FSA

SUMO Geophysics Ltd
Cowburn Farm
Market Street
Thornton
Bradford
BD13 3HW

T: 01274 835016

SUMO Geophysics Ltd
Vineyard House
Upper Hook Road
Upton upon Severn
Worcestershire
WR8 0SA

T: 01684 592266

www.sumoservices.com
geophysics@sumoservices.com

TABLE OF CONTENTS

1	LIST OF FIGURES	2
2	SURVEY TECHNIQUE	2
3	SUMMARY OF RESULTS	3
4	INTRODUCTION	3
5	RESULTS	4
6	DATA APPRAISAL & CONFIDENCE ASSESSMENT	5
7	CONCLUSION	5
8	REFERENCES	6
9	ARCHIVE	6
Appendix A	Technical Information: Magnetometer Survey Methods, Processing and Presentation	
Appendix B	Technical Information: Magnetic Theory	
Appendix C	OASIS Data Collection Sheet	

1. LIST OF FIGURES

Figure 01	NTS	Site Location
Figure 02	1:4500	Magnetometer Survey - Greyscale Plots
Figure 03	1:4500	Magnetometer Survey - Colour Plots
Figure 04	1:4500	Magnetometer Survey - Interpretation
Figure 05	1:3000	Magnetometer Survey - Greyscale Plots [Areas 1 - 4]
Figure 06	1:3000	Magnetometer Survey - Colour Plots [Areas 1 - 4]
Figure 07	1:3000	Magnetometer Survey - Interpretation [Areas 1 - 4]
Figure 08	1:3000	Magnetometer Survey - Greyscale Plots [Areas 2 - 7]
Figure 09	1:3000	Magnetometer Survey - Colour Plots [Areas 2 - 7]
Figure 10	1:3000	Magnetometer Survey - Interpretation [Areas 2 - 7]
Figure 11	1:3500	Magnetometer Survey - Greyscale Plots [Areas 8 - 11]
Figure 12	1:3500	Magnetometer Survey - Colour Plots [Areas 8 - 11]
Figure 13	1:3500	Magnetometer Survey – Interpretation [Areas 8 - 11]
Figure 14	1:4500	1959 National Grid Mapping
Figure 15	1:4500	2020 Aerial Imagery
Figure 16	1:4500	LiDAR Data Plot
Figure 17	1:4500	Minimally Processed Data - Greyscale Plots
Figure 18	1:3000	XY Trace Plots (clipped at +/-15nT) [Areas 1 - 4]
Figure 19	1:3000	XY Trace Plots (clipped at +/-15nT) [Areas 2 - 7]
Figure 20	1:3500	XY Trace Plots (clipped at +/-15nT) [Areas 8 - 11]

2. SURVEY TECHNIQUE

Detailed magnetic survey (magnetometry) was chosen as the most efficient and effective method of locating the type of archaeological anomalies which might be expected at this site.

Bartington Cart System Traverse Interval 1.0m Sample Interval 0.125m

The only processes performed on data are the following unless specifically stated otherwise:

Zero Mean Traverse	This process sets the background mean of each traverse within each grid to zero. The operation removes instrument 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.

3 SUMMARY OF RESULTS

- 3.1 A magnetometer survey of 93 ha of land has recorded a couple of magnetic responses that have been interpreted as being of possible archaeological interest. Possible ring-ditches and other ditch-like response have been recorded which roughly correspond to the location of Roman field systems that are noted in the HER. Uncertain responses are visible throughout the dataset and are likely to be due to a combination of underlying natural and modern agricultural processes. Former field boundaries, ploughing and land drains have also been mapped in the survey.

4 INTRODUCTION

- 4.1 **SUMO Geophysics Ltd** were commissioned to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation being undertaken by **Pigeon Investment Management Ltd**.

4.2 Site details

NGR / Postcode	TF 32735 06086 / PE6 0TP
Location	The site is located 12km north-east of Peterborough and 4km north-east of Thorney. Wallace's Drove bounds Areas 6 and 7 to the south and Scolding Drove passes through the centre of the site on a north-south alignment. The survey Area is situated around Nutsgrove Farm.
HER	Peterborough HER
HER No.	EPB1096
OASIS Ref. No.	sumogeop1-503694
District	Peterborough
Parish	Thorney Civil Parish
Topography	Flat
Current Land Use	Agriculture
Geology (BGS 2022)	Bedrock: Oxford Clay Formation - Mudstone Superficial: Tidal Flat Deposits, 1 - Sand and Silt Tidal Flat Deposits, 1 - Clay and Silt
Soils (CU 2022)	Soilscape 21: Loamy and clayey soils of coastal flats with naturally high groundwater.
Archaeology (HG 2022)	A search of heritage gateway has revealed that a Roman field system is recorded in the north of the survey area (Area 1) in the HER. In addition, excavations due east of the survey area have recorded Roman and post-medieval features (NWFC11).
Survey Methods	Magnetometer survey (fluxgate gradiometer)
Study Area	93 ha

4.3 Aims and Objectives

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

5 RESULTS

The survey has been divided into twelve survey areas (Areas 1-12). Straw bales had been stacked in Area 12 which rendered this field unsurveyable.

5.1 **Possible Archaeology**

5.1.1 A couple of linear trends and curvilinear responses have been detected in Area 2 and assigned to the category of *Possible Archaeology*. The anomalies are magnetically weak and ordinarily would not warrant such a categorisation; however, a Roman field system is recorded in the vicinity of Areas 1 and 2. The circular responses could be ring-ditches while the other linear trends could form an enclosure. The interpretation is tentative as the anomalies could also be due to modern agricultural processes.

5.2 **Uncertain**

5.2.1 Numerous anomalies have been categorised as *Uncertain* which is to be expected for a survey of this size. Linear trends throughout the survey are probably due to agricultural processes, possibly land drains or uncorroborated field boundaries. The curvilinear responses could be a result of the underlining geological / pedological variations. However, as stated above (see 5.1 the uncertain responses in east of Areas 1 and 2 could be associated the possible archaeological anomalies.

5.3 **Former Field Boundary - Corroborated / Conjectural**

5.3.1 Several linear responses are visible in the dataset that correspond with the locations of former field boundaries that are recorded on historic mapping (see Figure 14). Other linear anomalies which have a comparable magnetic signature have been categorised as conjectural former field boundaries, but these could also be due to modern agricultural processes.

5.4 **Agricultural – Ploughing / Land Drains**

5.4.1 Numerous closely spaced and generally weak linear responses have been detected though the survey and are evidence of relatively modern ploughing.

5.4.2 Evenly spaced, linear responses that are generally oriented north to south have been recorded in Areas 1, 2, 4, 5 and 8 which mark a network of land drains.

5.5 **Natural / Geological / Pedological**

5.5.1 Numerous amorphous and sinuous responses have been detected throughout the dataset and are due to variations in the underlying geology. These anomalies are visible in aerial imagery and the Lidar data plot (see Figure 15 and 16).

5.6 **Green Waste**

5.6.1 Green waste has affected most of the survey areas with differing levels of severity. Area 11 is the worst affected, however, the increased levels of background noise could be partly due to a spread of debris from the demolition of a couple of buildings that were once located in the field (see 5.7.1). Green waste can have a marked effect on the results from magnetic surveys and has been recognised as an issue for some time (Gerrard *et al* 2015). However, not all green waste is the same, so it is impossible to predict in advance any potentially detrimental effects; it depends on the quantity of inorganic contaminants, including batteries, pieces of metal cans and other ferrous items which result in spurious anomalies or 'noise'.

5.7 **Ferrous / Magnetic Disturbance**

5.7.1 Magnetic disturbance has been recorded in the north-west of Area 11, this has likely to have been caused by the spread of demolition debris from former buildings that are recorded on historic mapping (see Figure 14).

5.7.2 Ferrous responses close to boundaries are due to adjacent fences and gates. Smaller scale ferrous anomalies ("iron spikes") are present throughout the data and are characteristic of small pieces of ferrous debris (or brick / tile) in the topsoil; they are commonly assigned a modern origin. Only the most prominent of these are highlighted on the interpretation diagram.

6 **DATA APPRAISAL & CONFIDENCE ASSESSMENT**

6.1 Historic England guidelines (EH 2008) Table 4 states that the typical magnetic response on the local soils / geology is generally variable. The results from this survey indicate the presence of possible ditches and a possible ring-ditch; as a consequence, there is no *a priori* reason why archaeological features would not have been detected, if present, though green waste may have masked weaker responses.

7 **CONCLUSION**

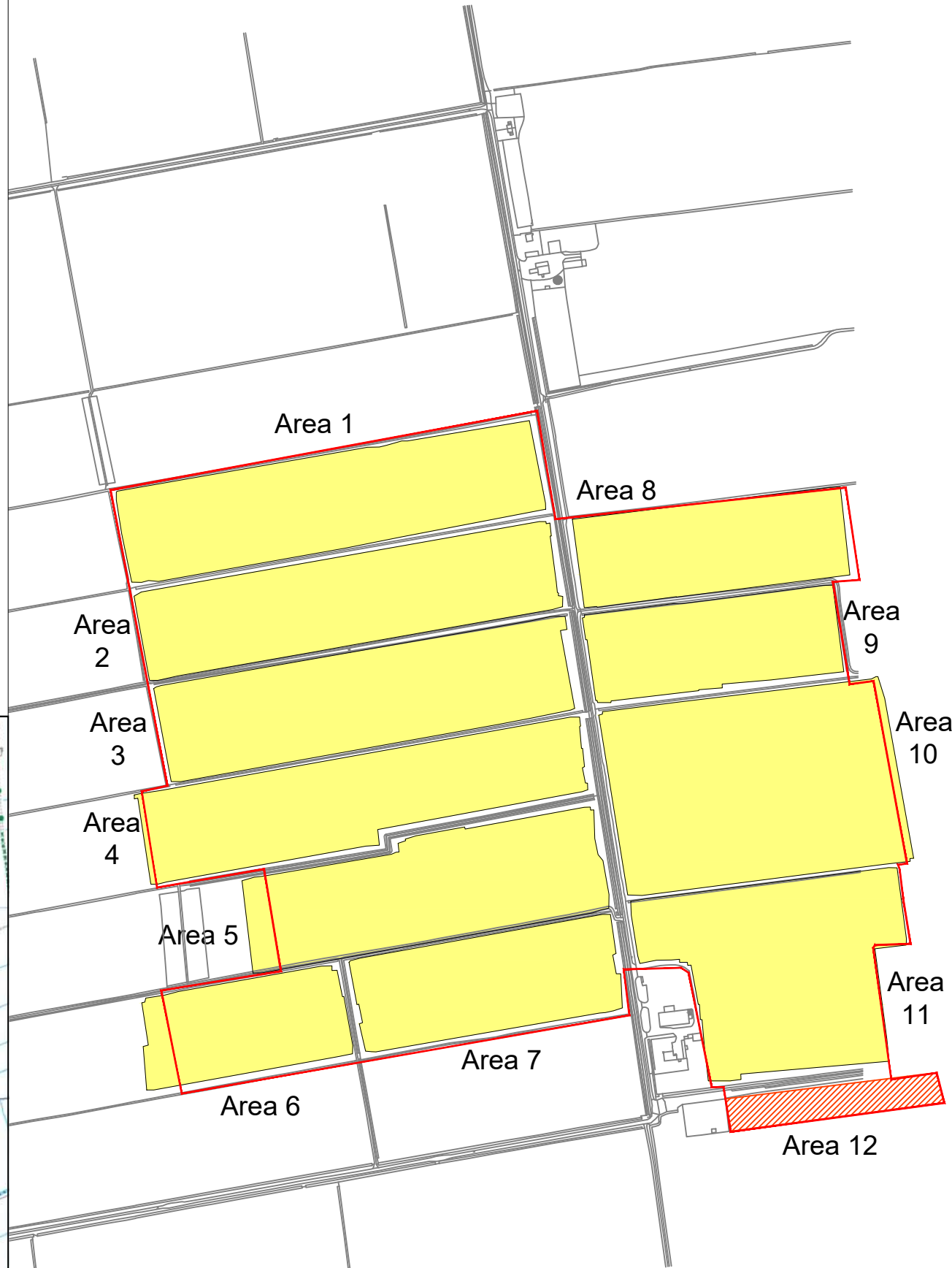
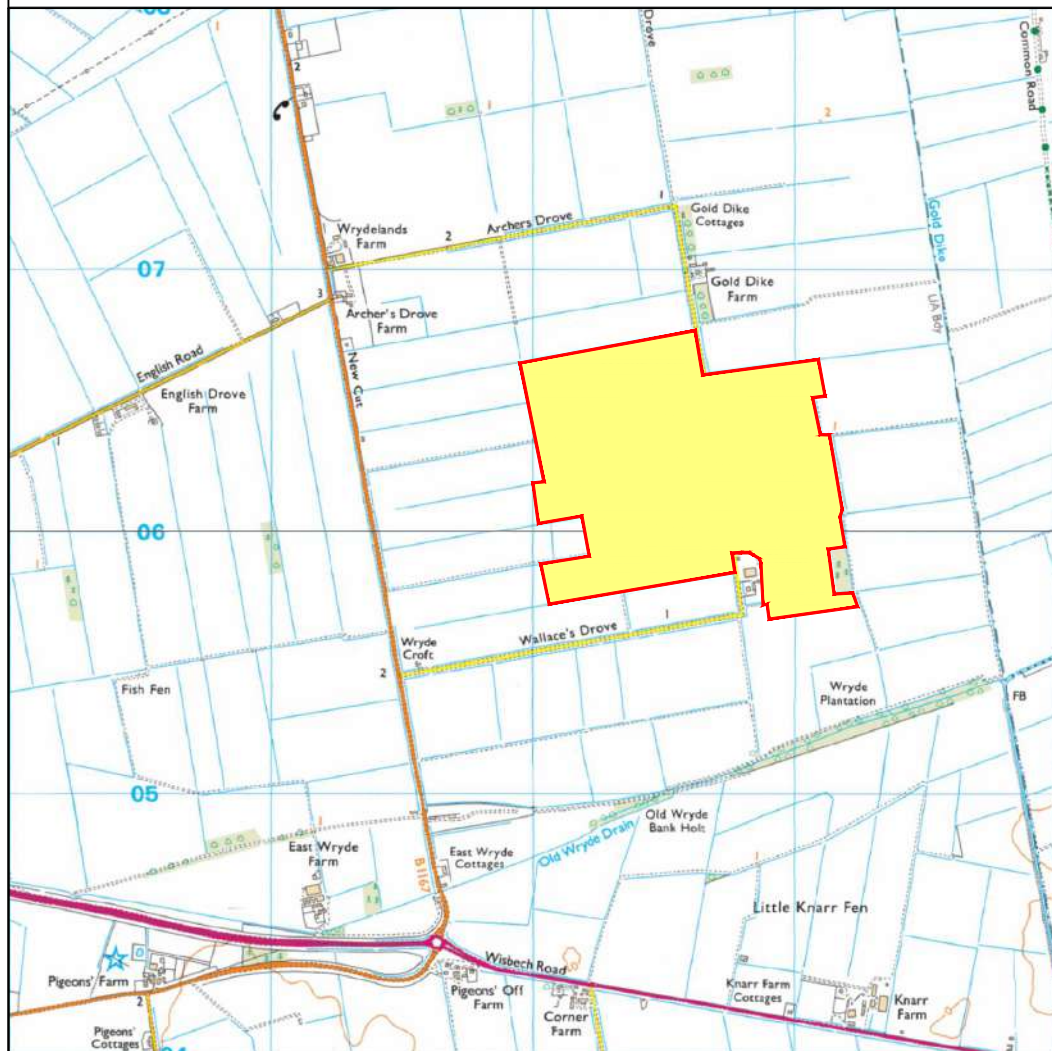
7.1 The magnetometer survey has recorded a couple of magnetic responses that have been interpreted as being of possible archaeological interest. Possible ring-ditches and other ditch-like response have been recorded which roughly correspond to the location of a Roman field system that is noted in the HER. The anomalies are magnetically weak but given the context archaeological origins cannot be dismissed. A number of linear responses have been interpreted as being of uncertain origin; they are likely to be due to a combination of underlying natural and modern agricultural processes. Former field boundaries, ploughing and land drains have also been mapped in the survey. The spreading of green waste across the site has caused an increase in the level magnetic background 'noise' with Area 11 being the worst affected.

8 REFERENCES




- BGS 2022 British Geological Survey, Geology of Britain viewer [accessed 05/01/2022] *website:* (<http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps>)
- ClfA 2014 *Standard and Guidance for Archaeological Geophysical Survey*. Amended 2016. ClfA Guidance note. Chartered Institute for Archaeologists, Reading
http://www.archaeologists.net/sites/default/files/ClfAS%26GGeophysics_2.pdf
- CU 2022 The Soils Guide. Available: www.landis.org.uk. Cranfield University, UK. [accessed 05/01/2022] *website:* <http://mapapps2.bgs.ac.uk/ukso/home.html>
- EAC 2016 *EAC Guidelines for the Use of Geophysics in Archaeology*, European Archaeological Council, Guidelines 2.
- 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/>
- Gerrard et al 2015 *Green Waste and Archaeological Geophysics*, Gerrard, James; Caldwell, Liz and Kennedy, Alisa, *Journal of Archaeological Prospection*, 22, 139–142 (Wiley)
- HG 2022 *Heritage Gateway online viewer* [accessed 05/01/2022] *website:* <https://www.heritagegateway.org.uk/gateway/>

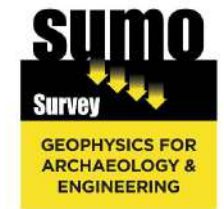
9 ARCHIVE

- 9.1 The minimally processed data, data images, XY traces and a copy of this report are stored in **SGL**'s digital archive, on an internal RAID configured NAS drive in the Midland's Office. These data are also backed up to the Cloud for off-site storage.
- 9.2 The Grey Literature will be archived with OASIS and the relevant HER within a period of 12 months

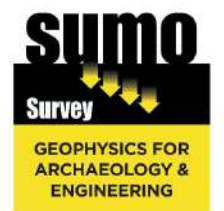
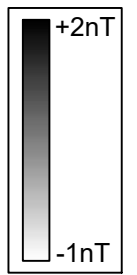
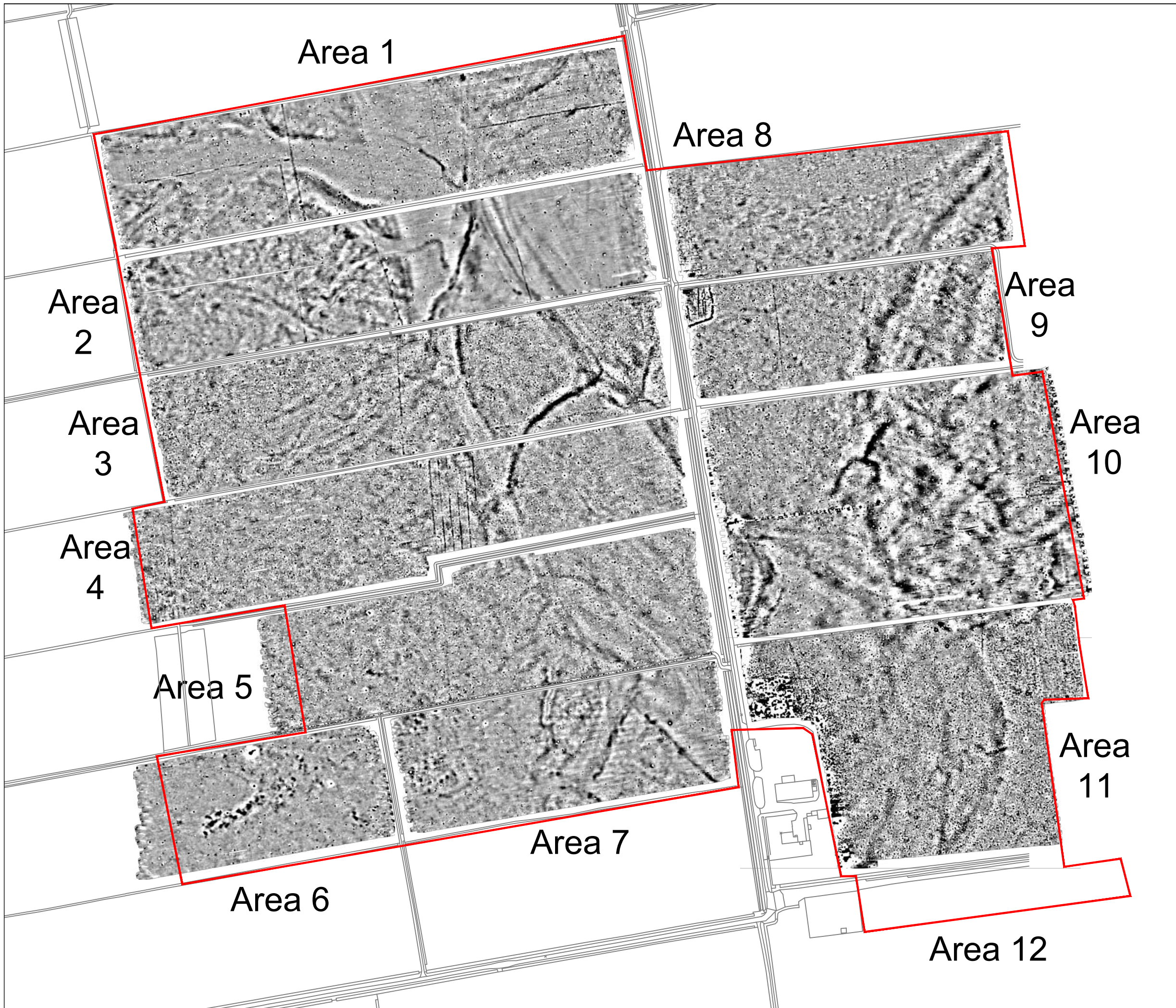


Reproduced from Ordnance Survey's 1:25 000 map of 1998 with the permission of the controller of Her Majesty's Stationery Office. Crown Copyright reserved. Licence No: 100018665

	Survey Areas	
	Unsurveyable	



Title:	Site Location	
Client:	Pigeon Investment Management Ltd	
Project:	04444 - Thorney, Peterborough	
Scale:	NOT TO SCALE	Fig No: 01



Title: Magnetometer Survey - Greyscale Plots

Client: Pigeon Investment Management Ltd

Project: 04444 - Thorney, Peterborough

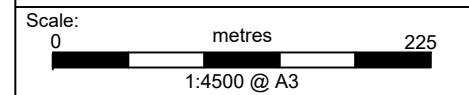
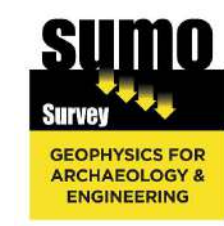
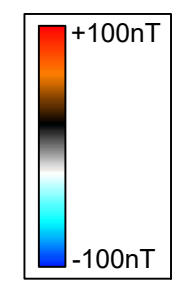
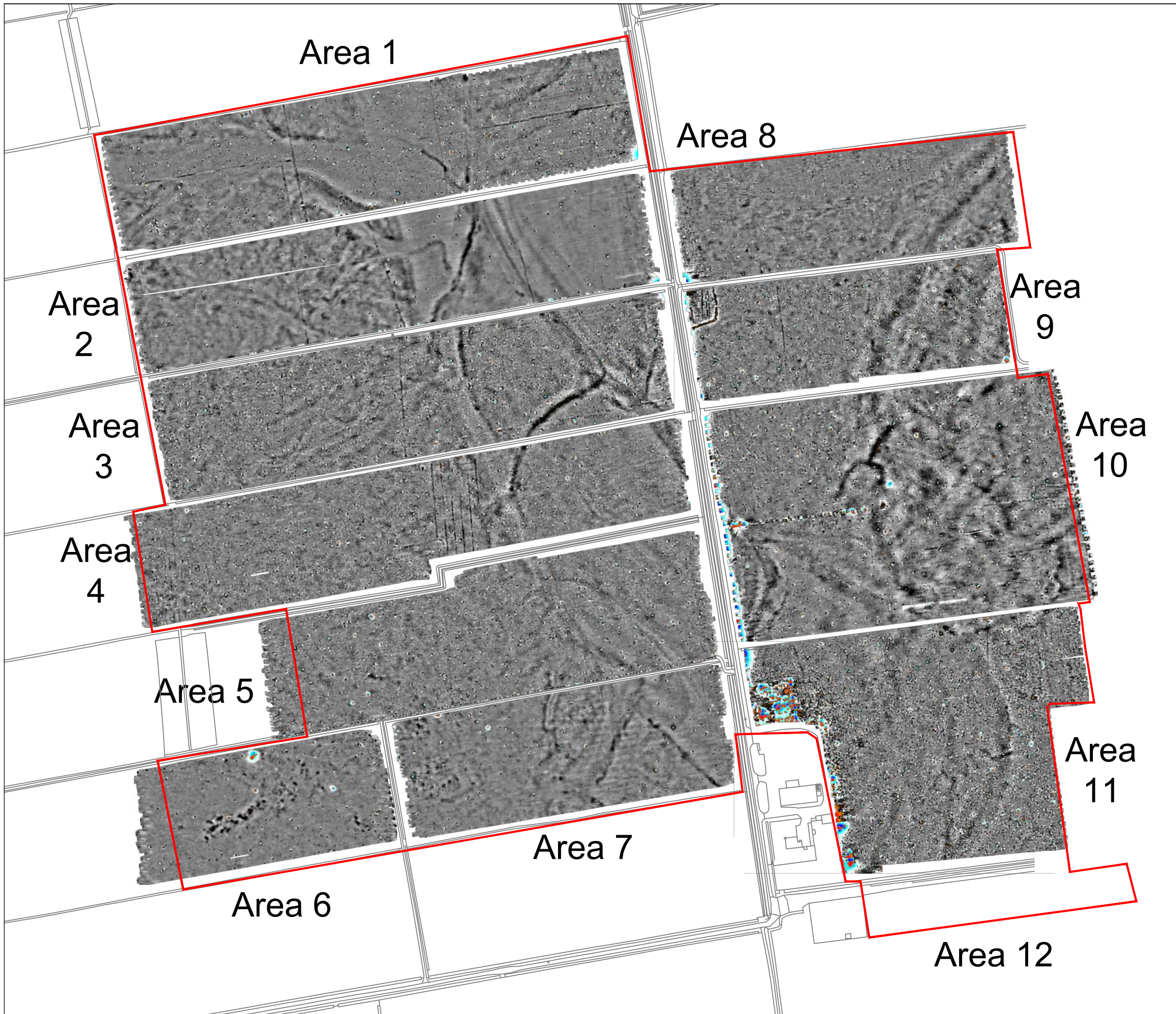
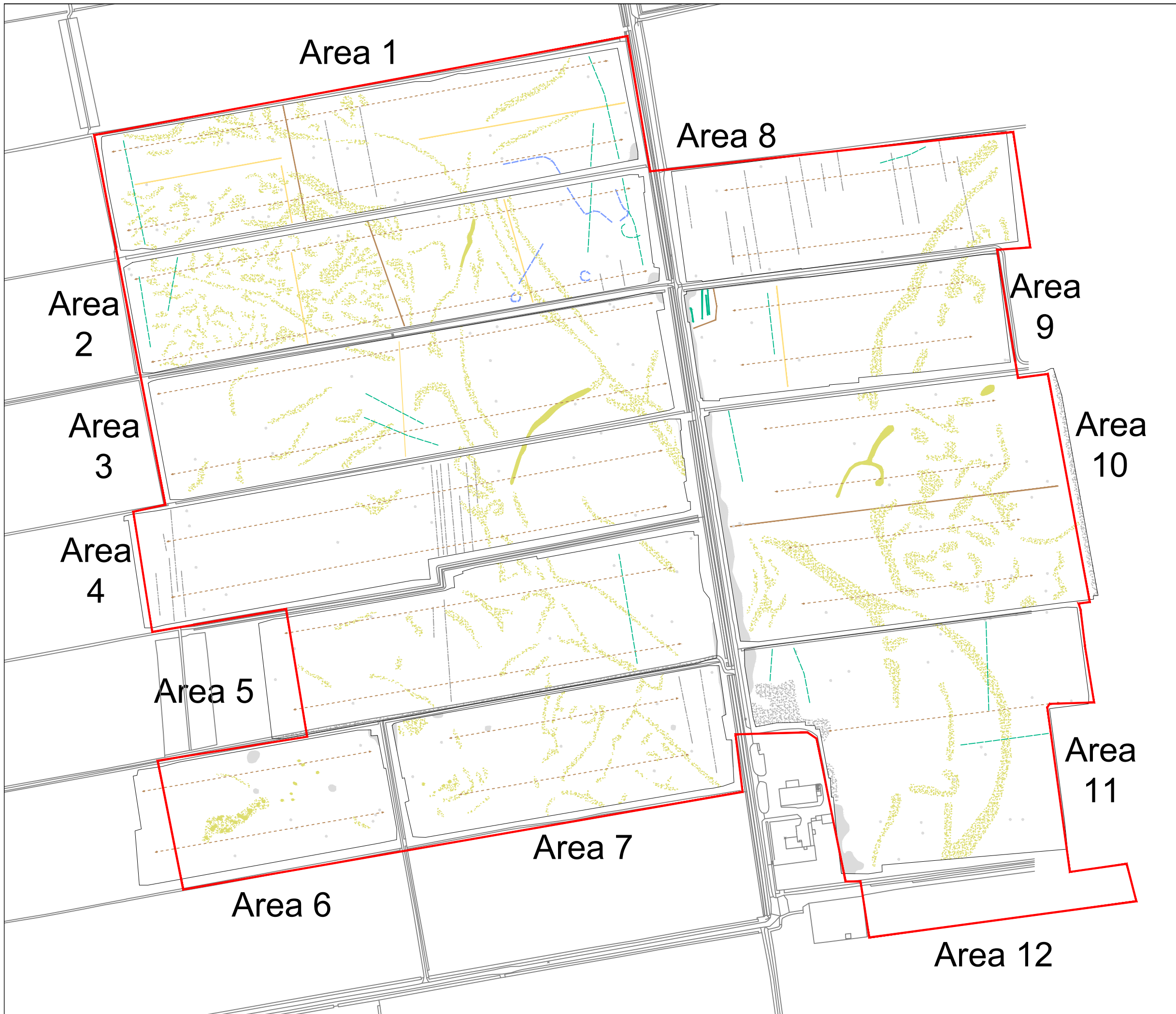


Fig No: 02

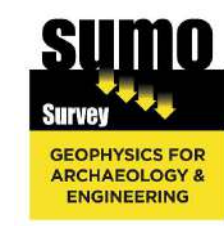


Title:	Magnetometer Survey - Colour Plots	
Client:	Pigeon Investment Management Ltd	
Project:	04444 - Thorney, Peterborough	
Scale:	 0 metres 225 1:4500 @ A3	Fig No: 03



KEY

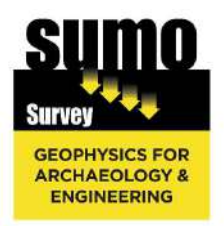
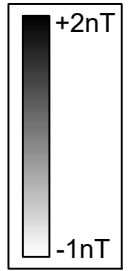
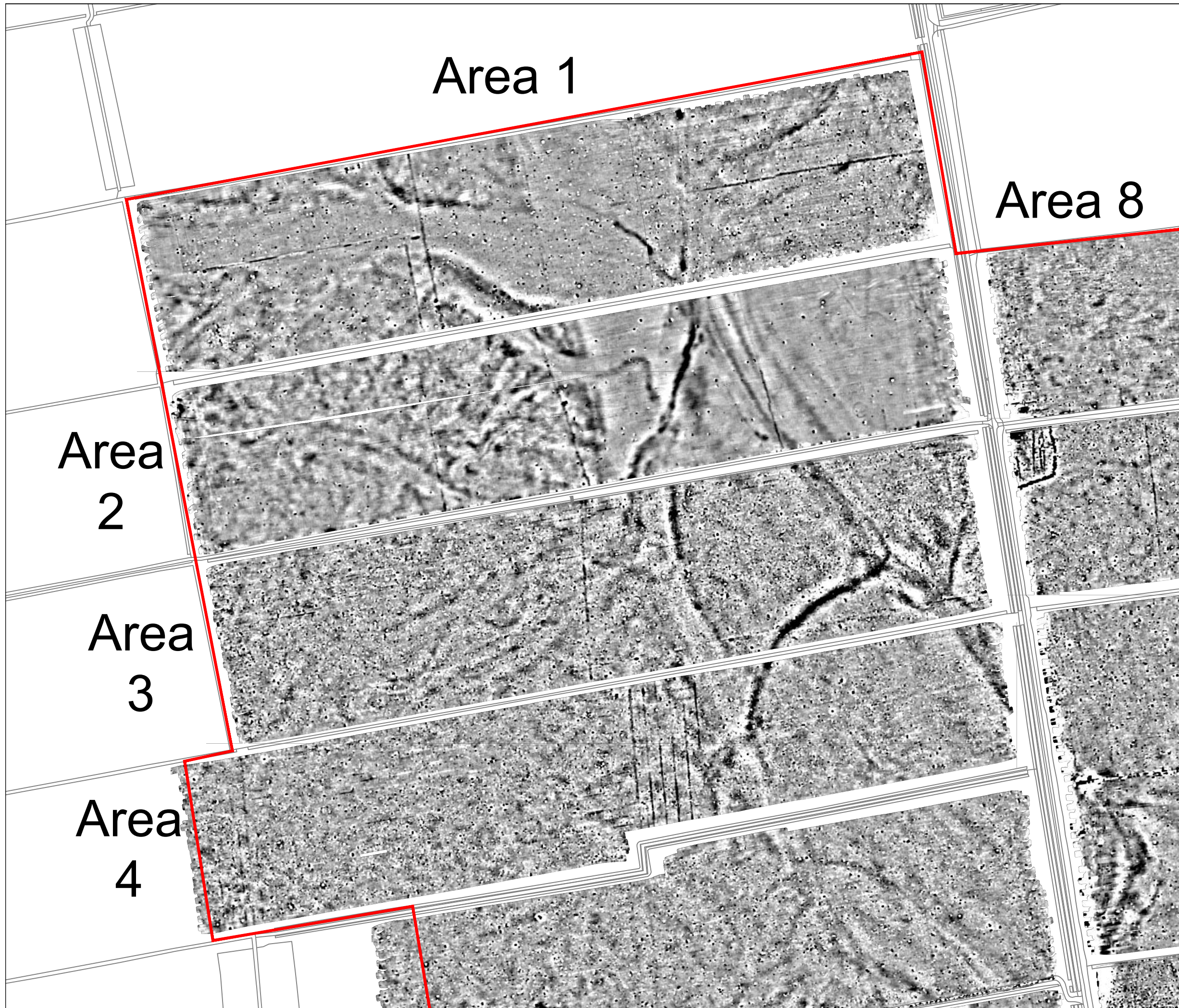
	Possible archaeology (trend)
	Uncertain Origin (discrete anomaly / trend)
	Former field boundary (corroborated)
	Former field boundary (conjectural)
	Agriculture (plough)
	Land drain
	Natural
	Magnetic disturbance
	Ferrous



Title: Magnetometer Survey - Interpretation
 Client: Pigeon Investment Management Ltd
 Project: 04444 - Thorney, Peterborough

Scale: 0 metres 225
 1:4500 @ A3

Fig No: 04



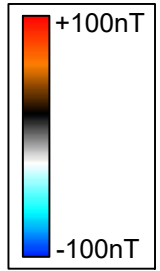
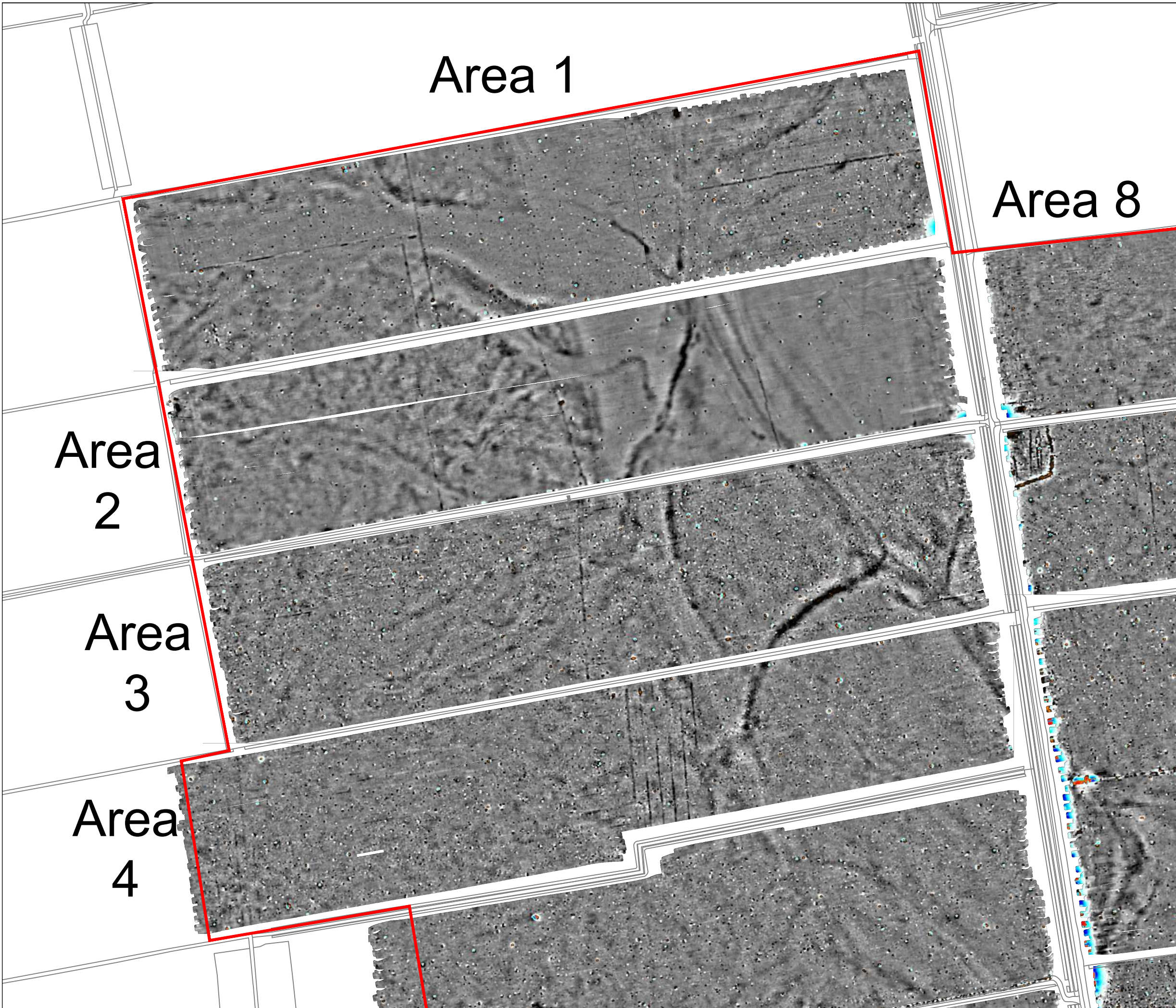
Title: Magnetometer Survey - Greyscale Plots
[Areas 1 - 4]

Client: Pigeon Investment Management Ltd

Project: 04444 - Thorney, Peterborough

Scale: 0 metres 150
1:3000 @ A3

Fig No: 05



Title: Magnetometer Survey - Colour Plots
[Areas 1 - 4]

Client: Pigeon Investment Management Ltd

Project: 04444 - Thorney, Peterborough

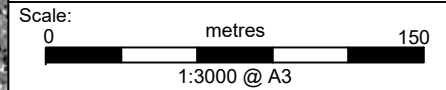









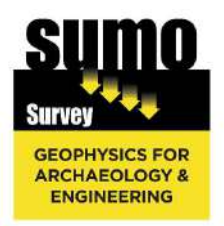


Fig No: 06



KEY

	Possible archaeology (trend)
	Uncertain Origin (discrete anomaly / trend)
	Former field boundary (corroborated)
	Former field boundary (conjectural)
	Agriculture (plough)
	Land drain
	Natural
	Magnetic disturbance
	Ferrous



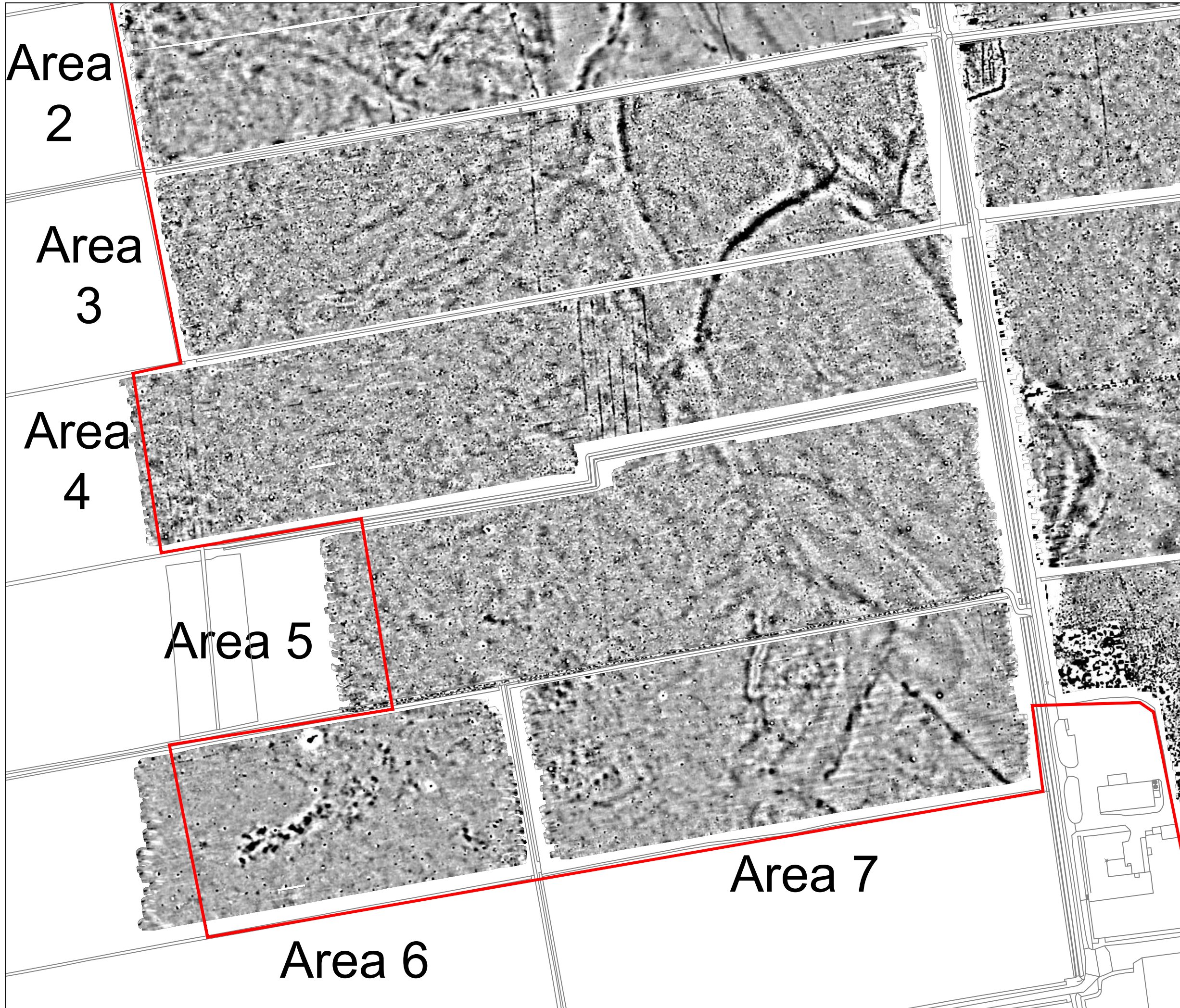
Title: Magnetometer Survey - Interpretation
[Areas 1 - 4]

Client: Pigeon Investment Management Ltd

Project: 04444 - Thorney, Peterborough

Scale: 0 metres 150
1:3000 @ A3

Fig No: 07



Area
2

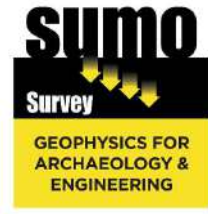
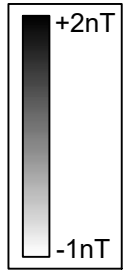
Area
3

Area
4

Area 5

Area 6

Area 7



Title: Magnetometer Survey - Grayscale Plots
[Areas 2 - 7]

Client: Pigeon Investment Management Ltd

Project: 04444 - Thorney, Peterborough

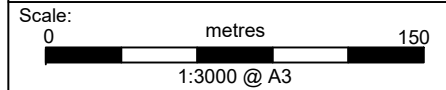
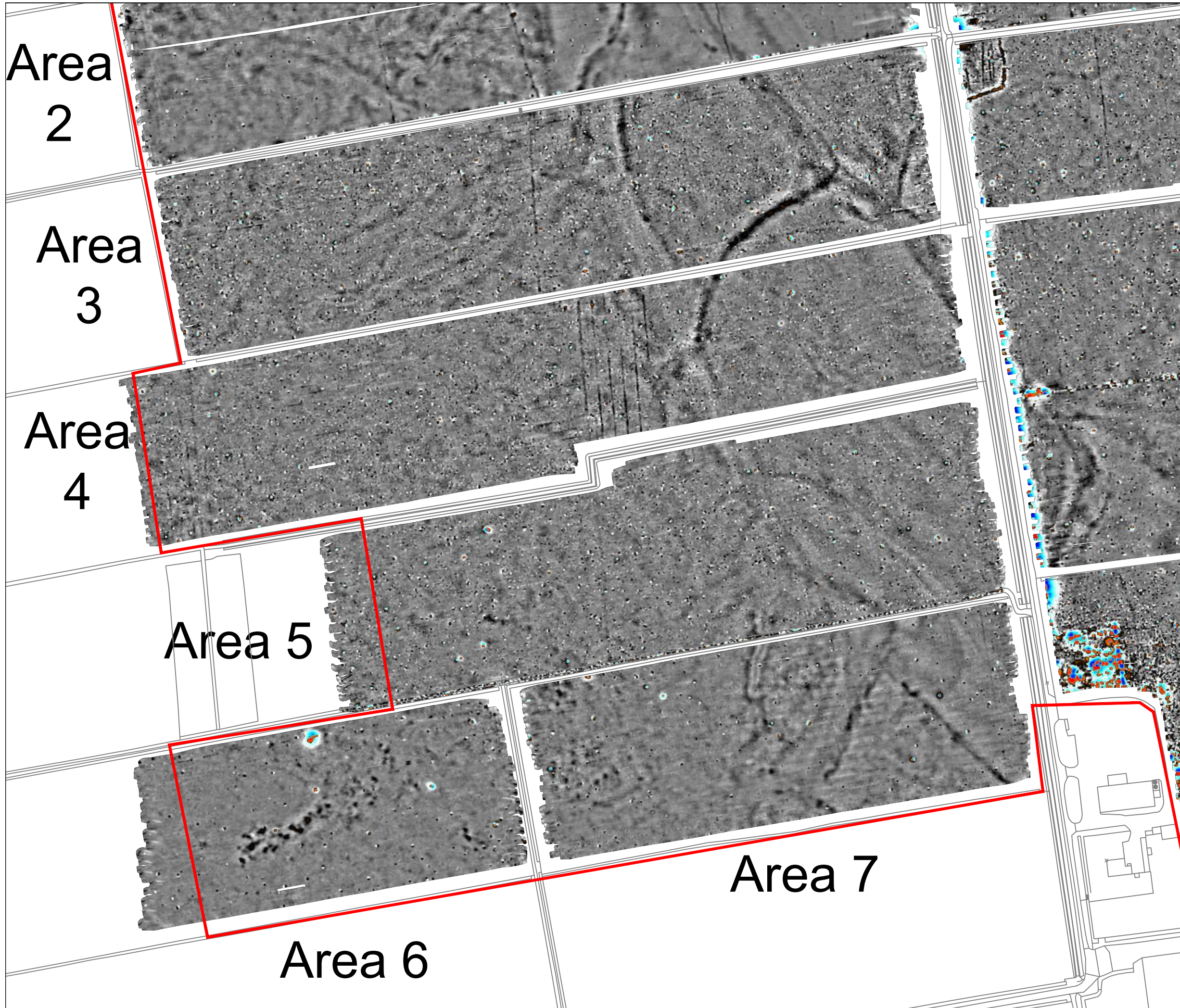


Fig No:
08



Area
2

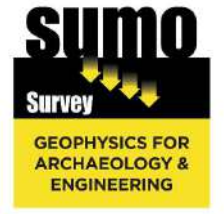
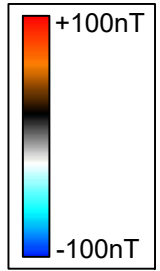
Area
3

Area
4

Area 5

Area 6

Area 7



Title: Magnetometer Survey - Colour Plots
[Areas 2 - 7]

Client: Pigeon Investment Management Ltd

Project: 04444 - Thorney, Peterborough

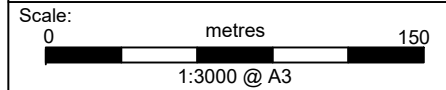
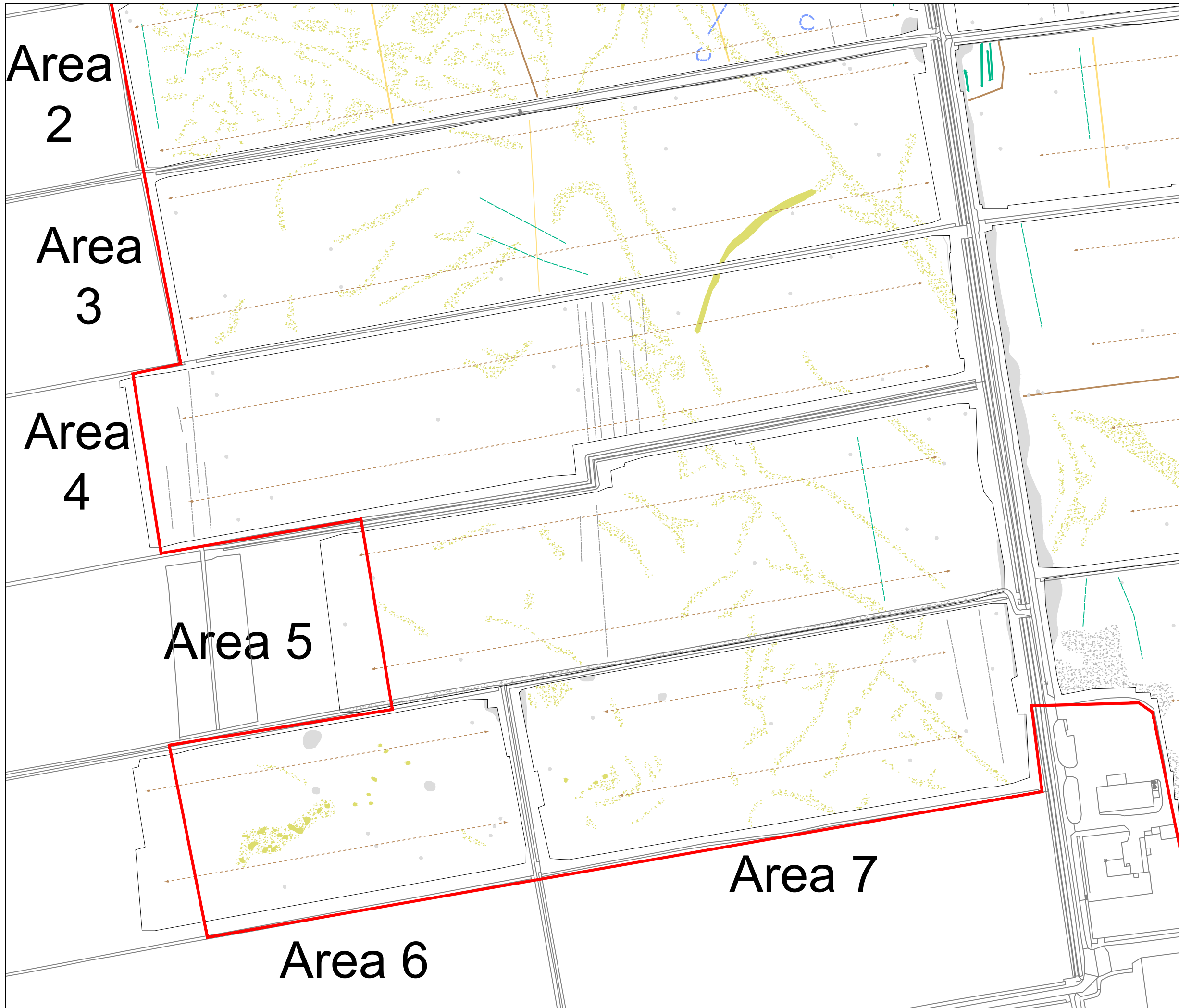









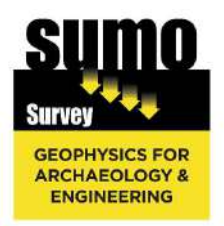


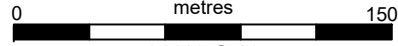
Fig No:
09

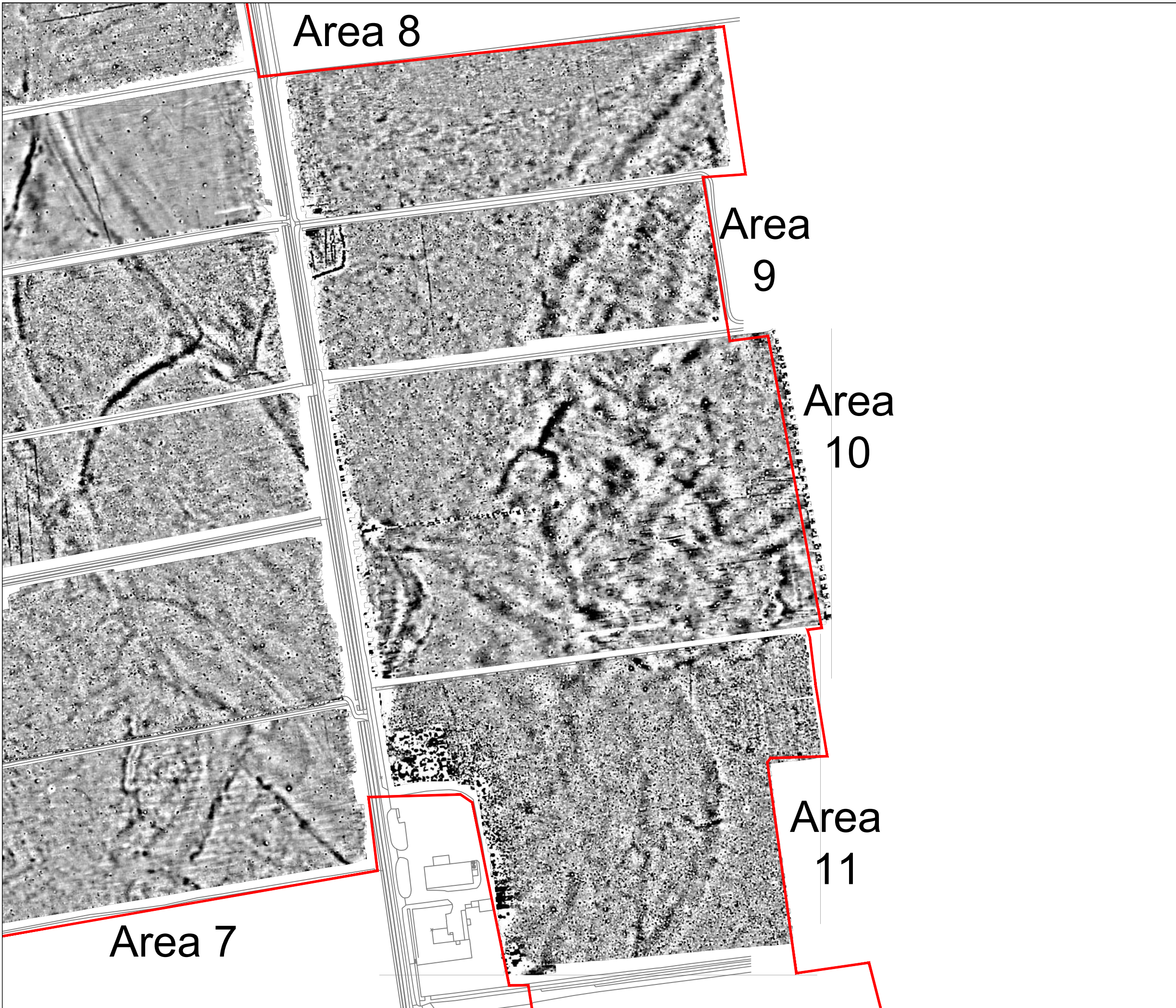


KEY

	Possible archaeology (trend)
	Uncertain Origin (discrete anomaly / trend)
	Former field boundary (corroborated)
	Former field boundary (conjectural)
	Agriculture (plough)
	Land drain
	Natural
	Magnetic disturbance
	Ferrous



Title:	Magnetometer Survey - Interpretation [Areas 2 - 7]	
Client:	Pigeon Investment Management Ltd	
Project:	04444 - Thorney, Peterborough	
Scale:	 1:3000 @ A3	Fig No: 10



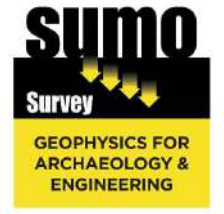
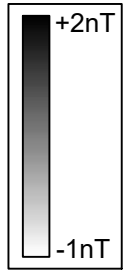
Area 8

Area 9

Area 10

Area 11

Area 7



Title: Magnetometer Survey - Grayscale Plots [Areas 8 - 11]

Client: Pigeon Investment Management Ltd

Project: 04444 - Thorney, Peterborough

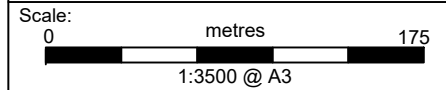
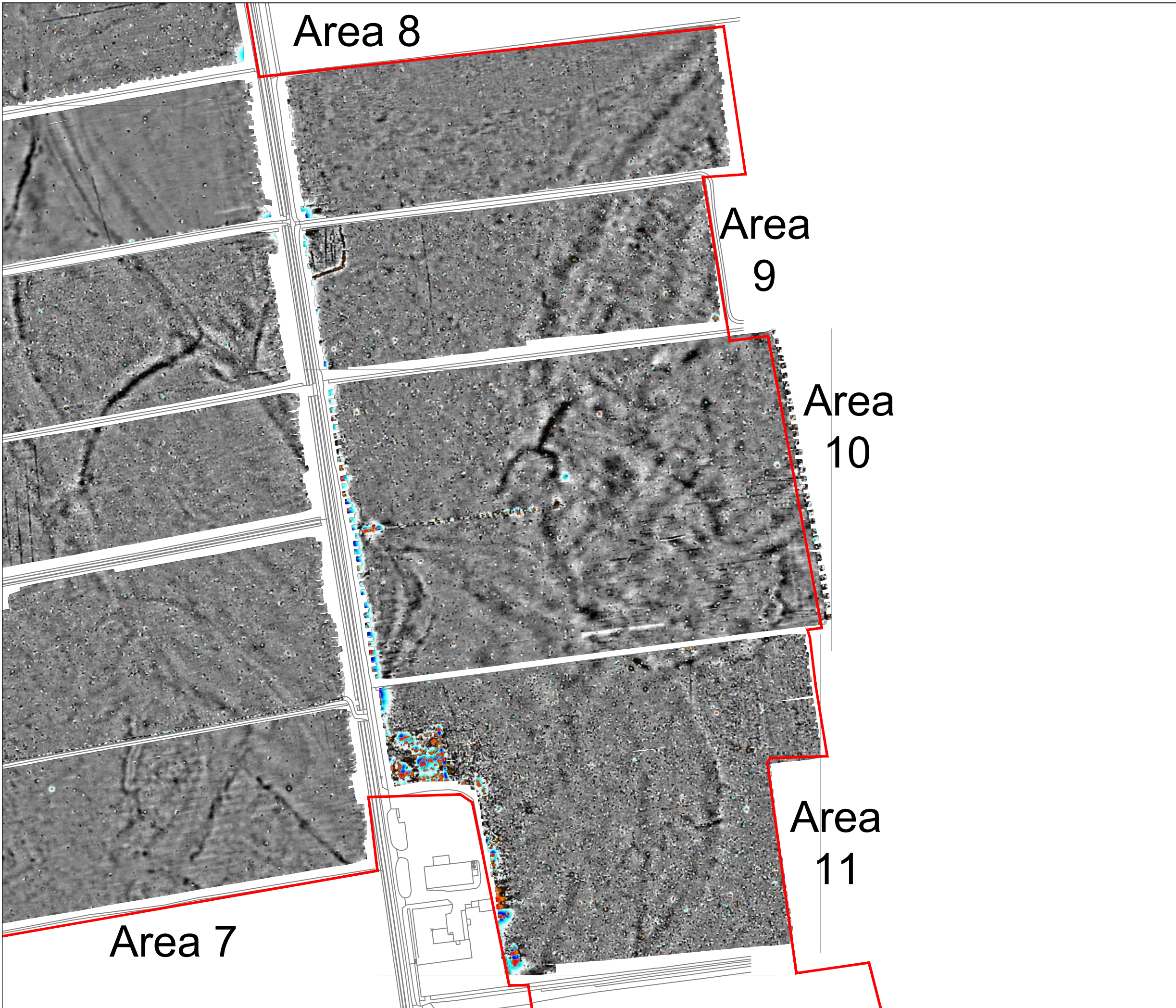


Fig No: 11



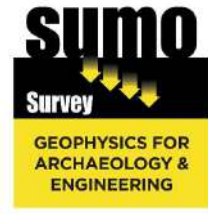
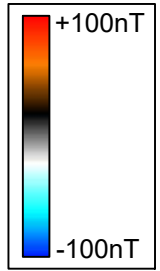
Area 8

Area 9

Area 10

Area 11

Area 7



Title: Magnetometer Survey - Colour Plots
[Areas 8 - 11]

Client: Pigeon Investment Management Ltd

Project: 04444 - Thorney, Peterborough

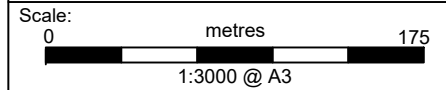
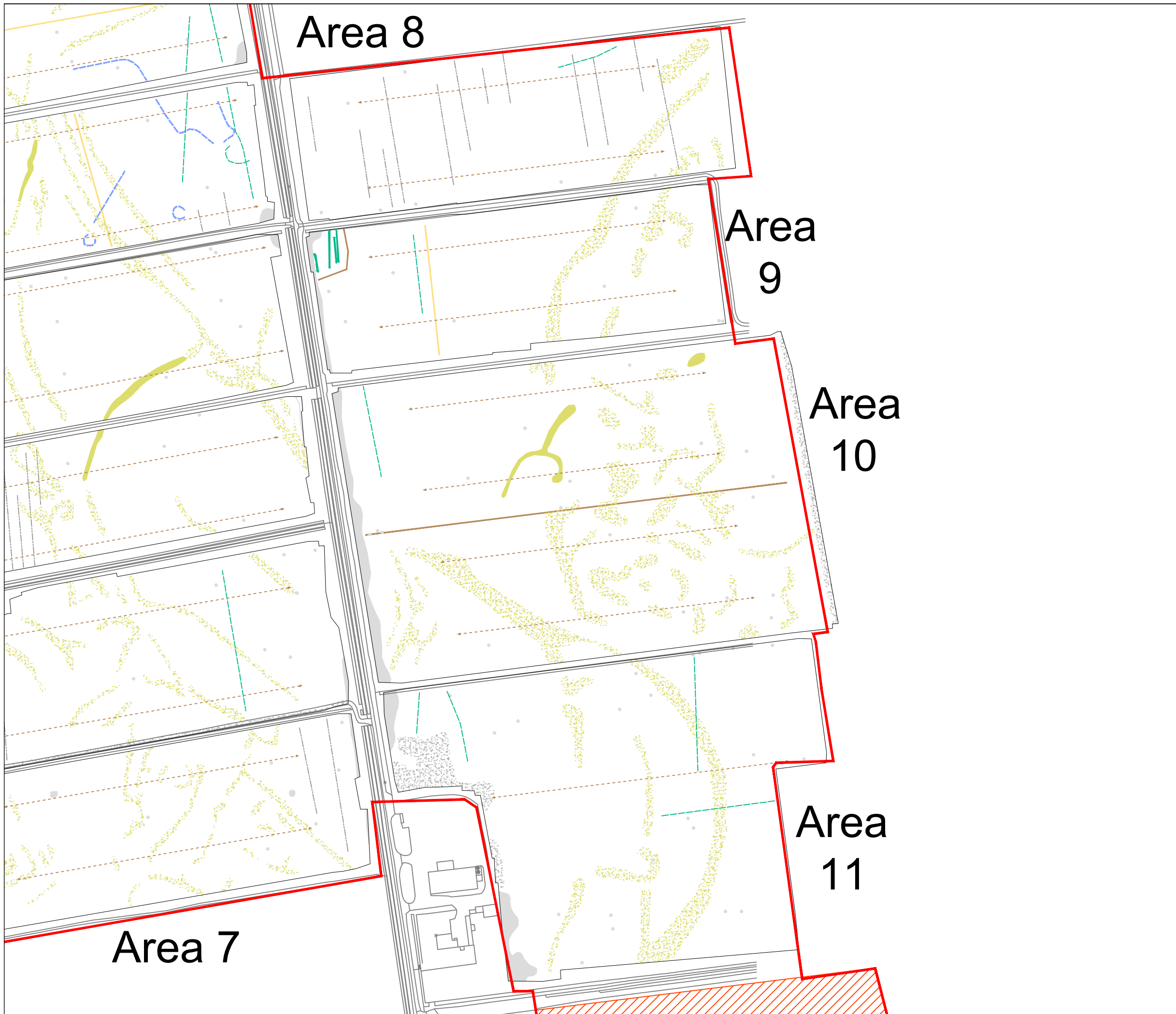









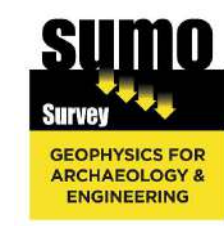


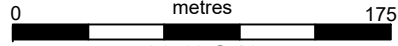
Fig No: 12

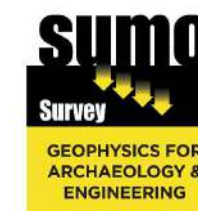


KEY

	Possible archaeology (trend)
	Uncertain Origin (discrete anomaly / trend)
	Former field boundary (corroborated)
	Former field boundary (conjectural)
	Agriculture (plough)
	Land drain
	Natural
	Magnetic disturbance
	Ferrous



Title:	Magnetometer Survey - Interpretation [Areas 8 - 11]	
Client:	Pigeon Investment Management Ltd	
Project:	04444 - Thorney, Peterborough	
Scale:	 1:3500 @ A3	Fig No: 13



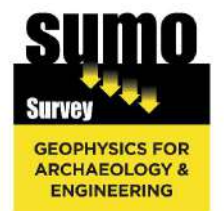
Title: 1959 National Grid Mapping

Client: Pigeon Investment Management Ltd

Project: 04444 - Thorney, Peterborough

Scale: 0 metres 225
1:4500 @ A3

Fig No: 14



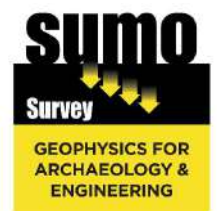
Title:
2020 Aerial Imagery

Client:
Pigeon Investment Management Ltd

Project:
04444 - Thorney, Peterborough

Scale:
0 metres 225
1:4500 @ A3

Fig No:
15



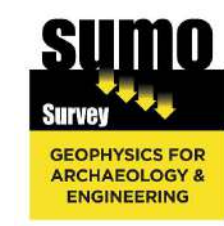
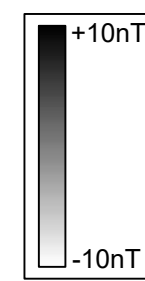
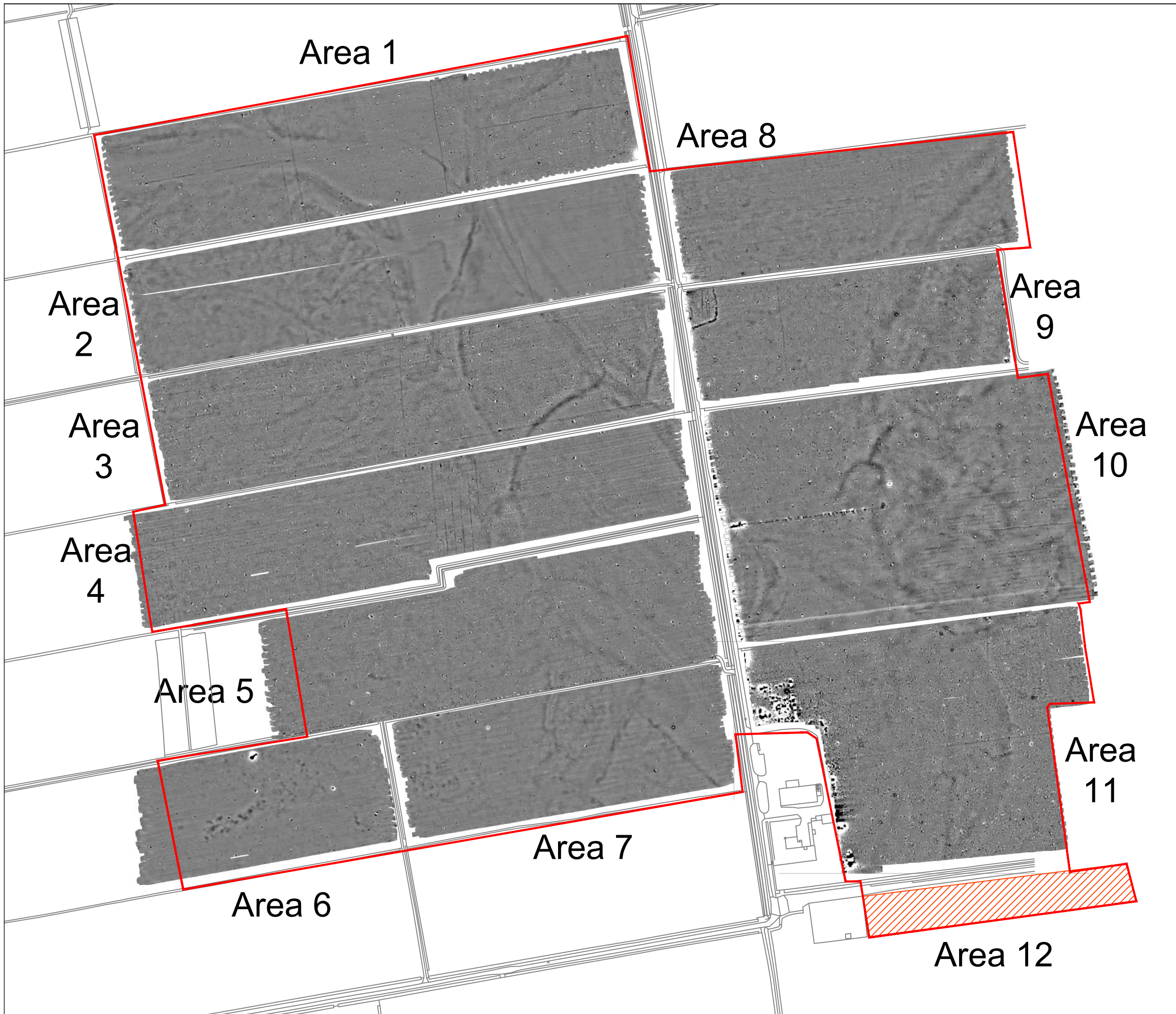
Title: LiDAR Data Plot

Client: Pigeon Investment Management Ltd

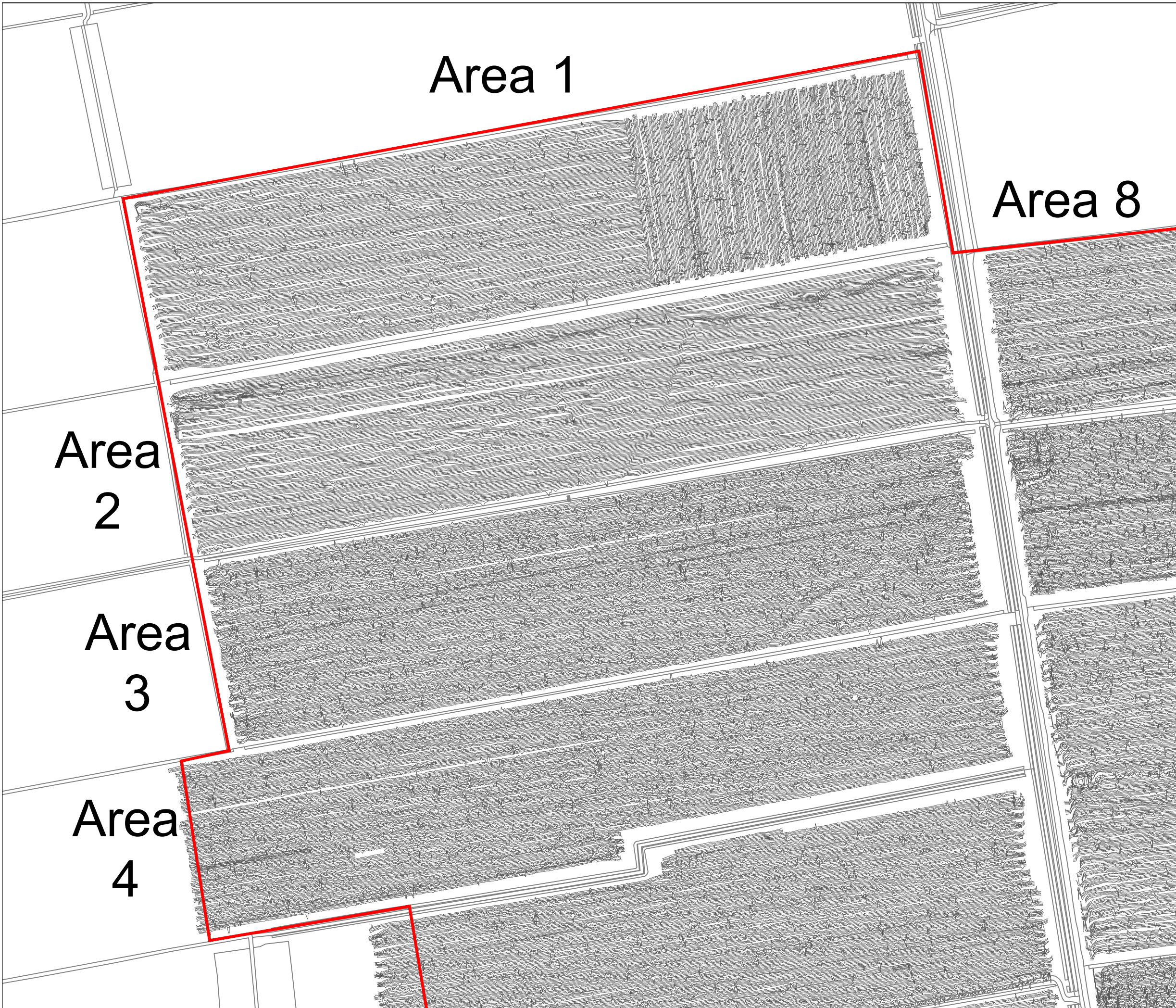
Project: 04444 - Thorney, Peterborough

Scale: 0 metres 225
1:4500 @ A3

Fig No: 16



Title: Minimally Processed Data - Greyscale Plots	
Client: Pigeon Investment Management Ltd	
Project: 04444 - Thorney, Peterborough	
Scale: 0 metres 225 1:4500 @ A3	Fig No: 17



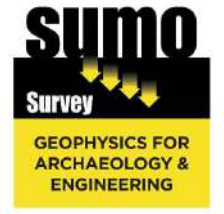
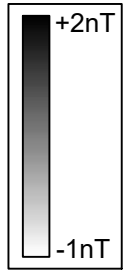
Area 1

Area 8

Area 2

Area 3

Area 4



Title: XY Trace Plots (clipped at +/-15nT)
[Areas 1 - 4]

Client: Pigeon Investment Management Ltd

Project: 04444 - Thorney, Peterborough

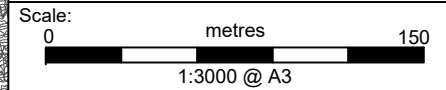
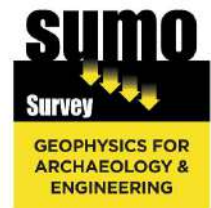


Fig No: 18



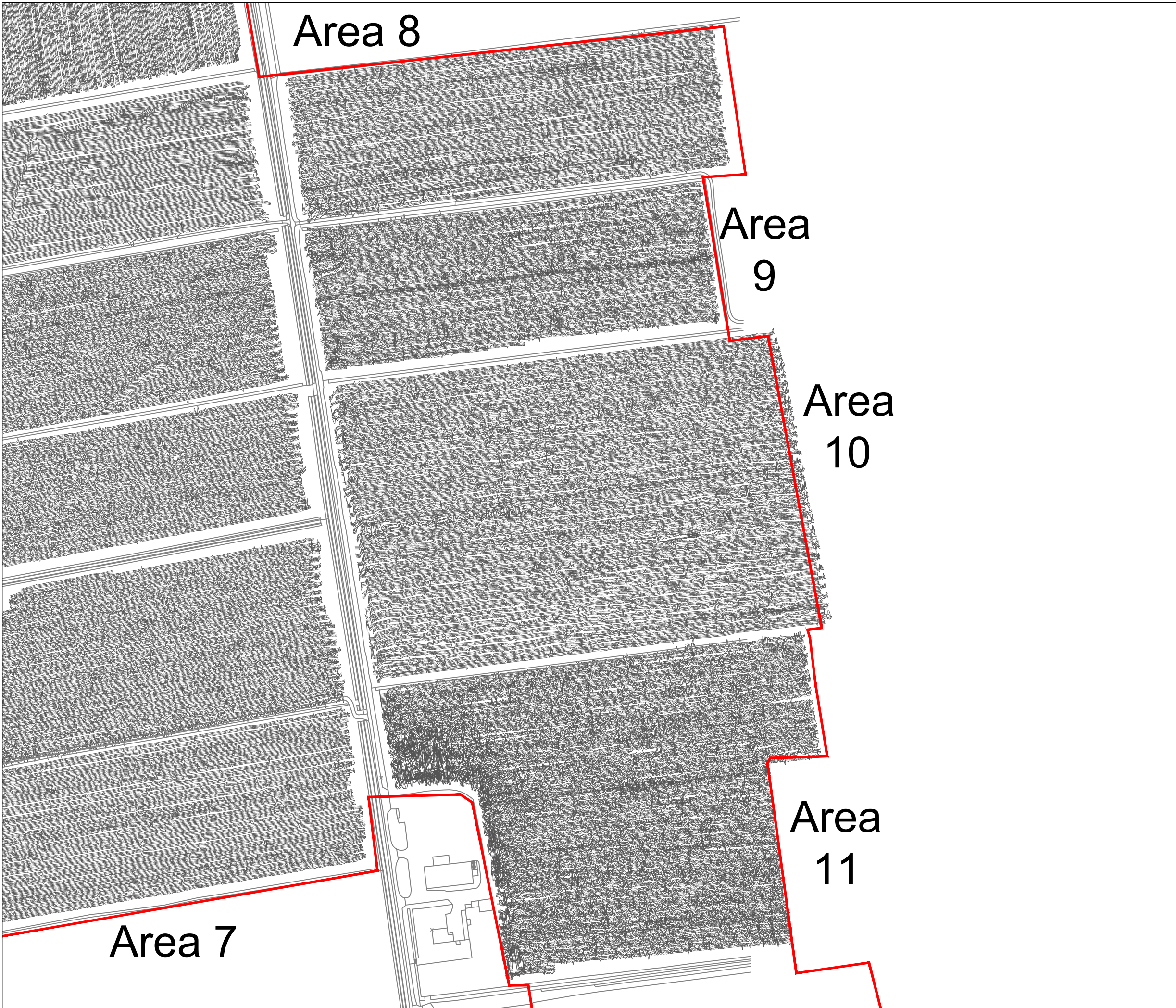
Title: XY Trace Plots (clipped at +/-15nT)
[Areas 2 - 7]

Client: Pigeon Investment Management Ltd

Project: 04444 - Thorney, Peterborough

Scale: 0 metres 150
1:3000 @ A3

Fig No: 19



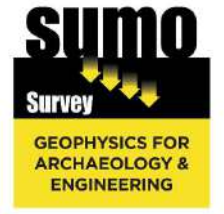
Area 8

Area 9

Area 10

Area 11

Area 7



Title: XY Trace Plots (clipped at +/-15nT)
[Areas 8 - 11]

Client: Pigeon Investment Management Ltd

Project: 04444 - Thorney, Peterborough

Scale: 0 metres 175
1:3500 @ A3

Fig No: 20

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).

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 This process sets the background mean of each traverse within each grid to zero.
Traverse 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.

Presentation of results and interpretation

The presentation of the results includes a 'minimally processed data' and a 'processed data' greyscale plot. Magnetic anomalies are identified, interpreted and plotted onto the 'Interpretation' drawings.

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.

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.

<i>Archaeology / Probable Archaeology</i>	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.
<i>Possible Archaeology</i>	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.
<i>Industrial / Burnt-Fired</i>	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.
<i>Former Field Boundary (probable & possible)</i>	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.
<i>Ridge & Furrow</i>	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.
<i>Agriculture (ploughing)</i>	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
<i>Land Drain</i>	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.
<i>Natural</i>	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.
<i>Magnetic Disturbance</i>	Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present.
<i>Service</i>	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.
<i>Ferrous</i>	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.
<i>Uncertain Origin</i>	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 <i>Possible Archaeology / Natural</i> or (in the case of linear responses) <i>Possible Archaeology / Agriculture</i> ; 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.

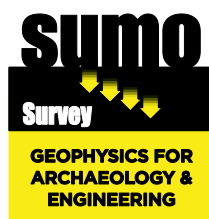
Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same 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.

Summary for sumogeop1-503694

OASIS ID (UID)	sumogeop1-503694
Project Name	Geophysical Survey at Thorney, Peterborough
Activity type	Geophysical Survey, MAGNETOMETRY SURVEY
Project Identifier(s)	04444
Planning Id	
Reason For Investigation	Planning requirement
Organisation Responsible for work	SUMO Geophysics Ltd.
Project Dates	17-Nov-2021 - 03-Dec-2021
Location	Thorney, Peterborough NGR : TF 32593 06169 LL : 52.6370769783277, -0.042033077413698 12 Fig : 532593,306169
Administrative Areas	Country : England County : Cambridgeshire District : Peterborough Parish : Thorney
Project Methodology	A temporary grid system will be established over the site and marked out using canes. The location of the grid will be set out using an RTK GPS system theoretically accurate to some 0.01m and referenced to OS co-ordinates. Data will be collected using a cart carrying four paired Bartington magnetic sensors. Four sensors mounted 1m horizontally apart and very accurately aligned to nullify the effects of the earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background. Each data point is geographically referenced using an on-board Trimble RTK survey grade GPS system. Readings will be taken at 0.125m centres along traverses 1.0m apart. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background.
Project Results	The magnetometer survey has recorded a couple of magnetic responses that have been interpreted as being of possible archaeological interest. Possible ring-ditches and other ditch-like response have been recorded which roughly correspond to the location of a Roman field system that is noted in the HER. The anomalies are magnetically weak but given the context archaeological origins cannot be dismissed. A number of linear responses have been interpreted as being of uncertain origin; they are likely to be due to a combination of underlying natural and modern agricultural processes. Former field boundaries, ploughing and land drains have also been mapped in the survey. The spreading of green waste across the site has caused an increase in the level magnetic background 'noise' with Area 11 being the worst affected.
Keywords	Ring Ditch - UNCERTAIN - FISH Thesaurus of Monument Types Ditch - UNCERTAIN - FISH Thesaurus of Monument Types Field Boundary - POST MEDIEVAL - FISH Thesaurus of Monument Types Plough Marks - POST MEDIEVAL - FISH Thesaurus of Monument Types Drain - 20TH CENTURY - FISH Thesaurus of Monument Types

HER	Peterborough City Council HER - unRev - STANDARD
HER Identifiers	HER Event No - EPB1096
Archives	



- Archaeological
- Geophysical
- Laser Scanning
- Measured Building
- Topographic
- Utility Mapping

SUMO Services Ltd, incorporated under the laws of England and Wales,
Company Registration No.4275993.
Registered Office Unit 8 Hayward Business Centre, New Lane, Havant, Hampshire, PO9 2NL