GEOPHYSICAL SURVEY REPORT

Land to the east of the A228, Snodland, Kent

Client

RPS Consulting Ltd

Survey Report

04595

OASIS Ref. No.

sumogeop1-504097

Date

25 January 2022

Survey Report 04595: Land to the east of the A228, Snodland, Kent

Survey dates	6 January 2022
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Report Date	25 January 2022
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TABLE OF CONTENTS

1 LIST OF FIGURES

2 LIST OF APPENDICES

3 SURVEY TECHNIQUE

3.1 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 Grad 601-2 Traverse Interval 1.0m Sample Interval 0.25m

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.

4 SUMMARY OF RESULTS

4.1 A magnetometer survey of 2 ha of land on the north-eastern outskirts of Snodland, Kent, has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest. Two uncertain linear trends have been detected but they are likely to be due to modern agricultural processes. A former trackway is visible in the dataset and the routes of two service pipes have been marked.

5 INTRODUCTION

5.1 **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 **RPS Consulting Ltd**.

5.2 Site Details

NGR / Postcode	TQ 70543 62315 / ME6 5PD
Location	The site is located 3.5km northwest of Aylesford and 2km south of Halling, on the outskirts of Snodland The survey area is bounded to the west by the A228 and to the east by a railway line.
HER	Kent HER
OASIS Ref. No.	sumogeop1-504097
District	Tonbridge and Malling
Parish	Snodland Civil Parish
Topography	Flat
Current Land Use	Horse paddocks
Geology (BGS 2022)	Bedrock: Gault Formation - Mudstone Superficial: Alluvium - Clay, Silt, Sand and Peat Head - Clay, Silt, Sand and Gravel
Soils (CU 2022)	Soilscape 18: Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.
Archaeology (RPS 2021)	Several designated heritage assets are present within proximity to the study area. The Snodland Roman Villa Scheduled Monument is located approximately 140m to the southeast of the site (10074660). The villa is believed to have its origins in the Late Iron Age and was occupied until the 4th century AD. In 2008, an archaeological excavation was undertaken immediately to the south of the study site at High Street, Snodland. The earliest evidence for human activity encountered during the excavation was a small assemblage of residual Mesolithic and Neolithic worked flint, in addition to a northwest-southeast orientated Later Prehistoric trackway. The main concentration of archaeological features encountered primarily consisted of a bathhouse and field system dating to the 1st to 4th century AD related to the Scheduled remains of Snodland Villa. A small inhumation cemetery immediately post-dated the field system and bathhouse. Two Late Roman coin hoards have also been recovered at different points during the investigations at High Street, Snodland (EKE9306). An evaluation and subsequent excavation were undertaken c250m west of the study site encountered roundhouses, ditches, pits, human remains, all consistent with settlement activity dating to the Bronze Age and Iron Age periods (EKE10047). A programme of

	trial trenching at Churchfields, c.50m to the east of the study site boundary, recorded the presence of a Roman pit, several fragments of Roman tile, and two undated ditches (EKE10046). Within the study site there is considered to be a moderate potential for Palaeolithic deposits of local to regional significance at depth within the study site; a moderate potential for Mesolithic and Neolithic localised remains of local significance; a high potential for localised Bronze Age and Iron Age remains of local significance; and a high potential for Roman remains of local to regional significance. There is considered to be a low potential for all other periods.
Survey Methods	Magnetometer survey (fluxgate gradiometer)
Study Area	2 ha

5.3 *Aims and Objectives*

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

6 RESULTS

6.1 *The survey has been divided into two survey areas (Areas 1-2).*

6.2 *Probable / Possible Archaeology*

6.2.1 No magnetic responses have been recorded that could be interpreted as being of definite archaeological interest.

6.3 *Uncertain*

6.3.1 Two linear responses have been detected in Area 2; these anomalies are very weak which has resulted in them being categorised as *Uncertain*. However, they do roughly correspond with linear depressions visible in the LiDAR data plot (see Figure 05).

6.4 *Former Trackway – Corroborated*

6.4.1 A band of increased magnetic response visible in Area 1 marks the route of a former trackway which is recorded on historic mapping; it is also visible as a raised linear on the LiDAR data plot (see Figure 05).

6.5 *Service*

6.5.1 Two strong dipolar linear ferrous responses are visible in Area 2 which mark the route of service pipes.

6.6 *Ferrous / Magnetic Disturbance*

6.6.1 Increased magnetic background ‘noise’ is visible in both survey areas but is particular prominent in Area 1. This is likely to have been caused by modern processes, possibly a spread of debris from the current farm or in connection with the construction of the A228 which lies immediately to the west. It is possible that this may have obscured any weaker anomalies of archaeological interest, if present.

6.6.2 Ferrous responses close to boundaries are due to adjacent buildings, railway line, road, 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.

7 DATA APPRAISAL & CONFIDENCE ASSESSMENT

7.1 Historic England guidelines (EH 2008) Table 4 states that the typical magnetic response on the local soils / geology is variable. The results from this survey indicate the presence of uncertain linear trends which correspond with anomalies visible in the LiDAR data plot; as a consequence, there is no a priori reason why archaeological features would not have been detected. However, the strong ferrous responses, area of magnetic disturbance and the generally high levels of background 'noise' within the survey areas may have obscured any weaker anomalies of archaeological interest, if present.

8 CONCLUSION

8.1 The magnetometer survey has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest. Two linear trends have been categorised as uncertain; they are likely to be due to agricultural processes. A former trackway is visible in the dataset and the routes of two service pipes have been marked.

9 REFERENCES

BGS 2022 British Geological Survey, Geology of Britain viewer [accessed 25/01/2022] *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

CU 2022 The Soils Guide. Available: www.landis.org.uk. Cranfield University, UK. [accessed 25/01/2022] *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.

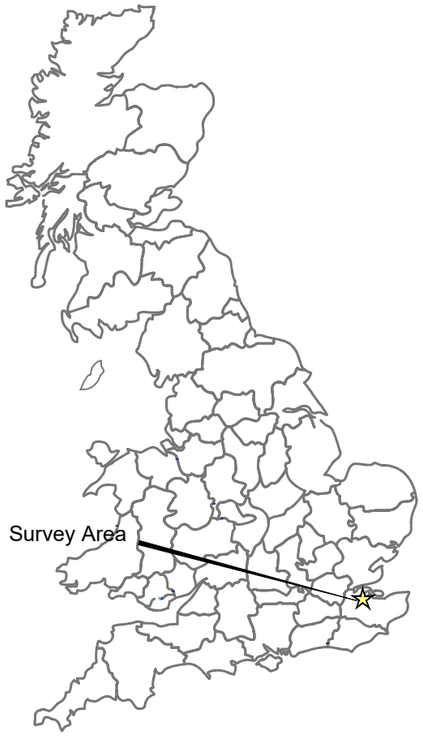
EH 2008 *Geophysical Survey in Archaeological Field Evaluation.* English Heritage, Swindon https://content.historicengland.org.uk/images-books/publications/geophysical-survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf/

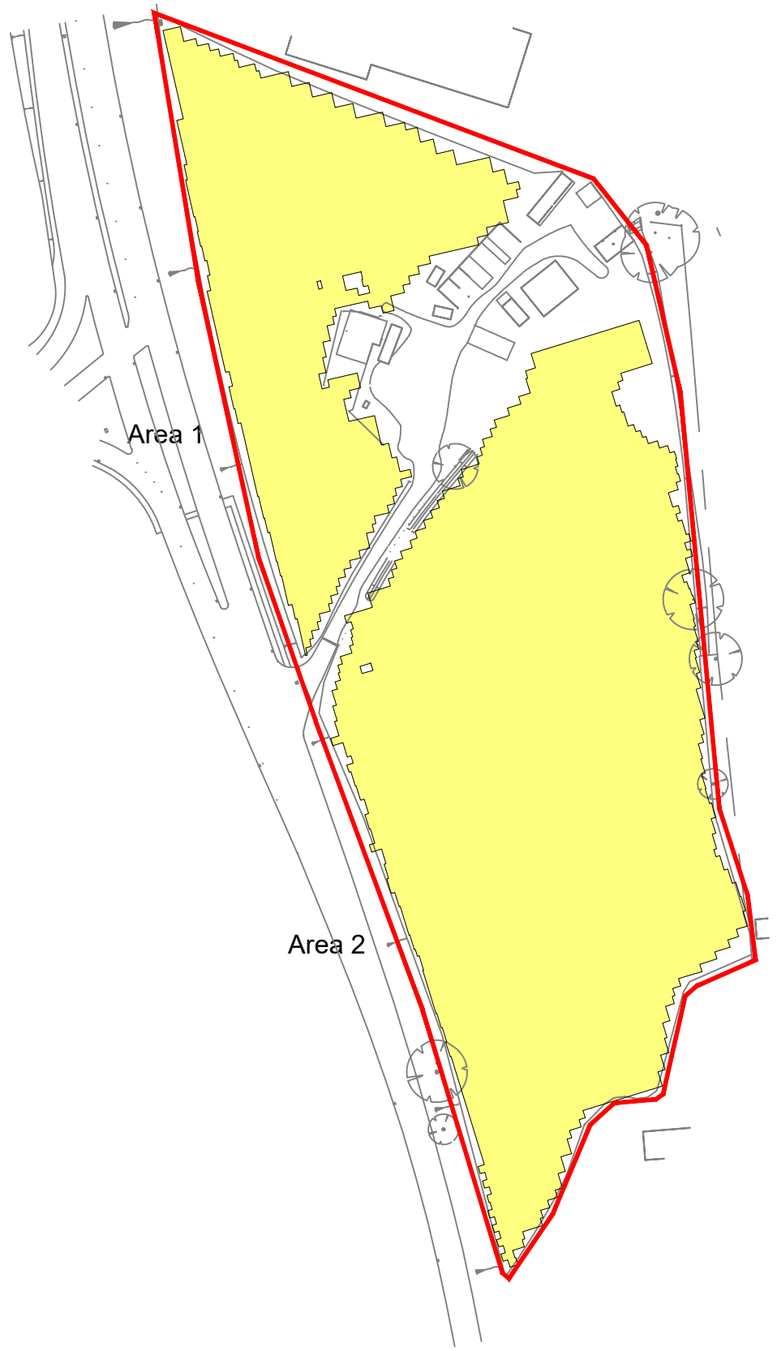
RPS 2021 *Land to the East of the A228, Snodland, Kent Hertiage Desk-Based Assessment. RPS Consulting Ltd, Gloucester*

10 ARCHIVE

10.1 The minimally processed data, data images, XY traces and a copy of this report are stored in **SUMO Geophysics Ltd.'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**.**

10.2 The Grey Literature will be archived with OASIS and the relevant HER within a period of 12 months





Survey Areas

N

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

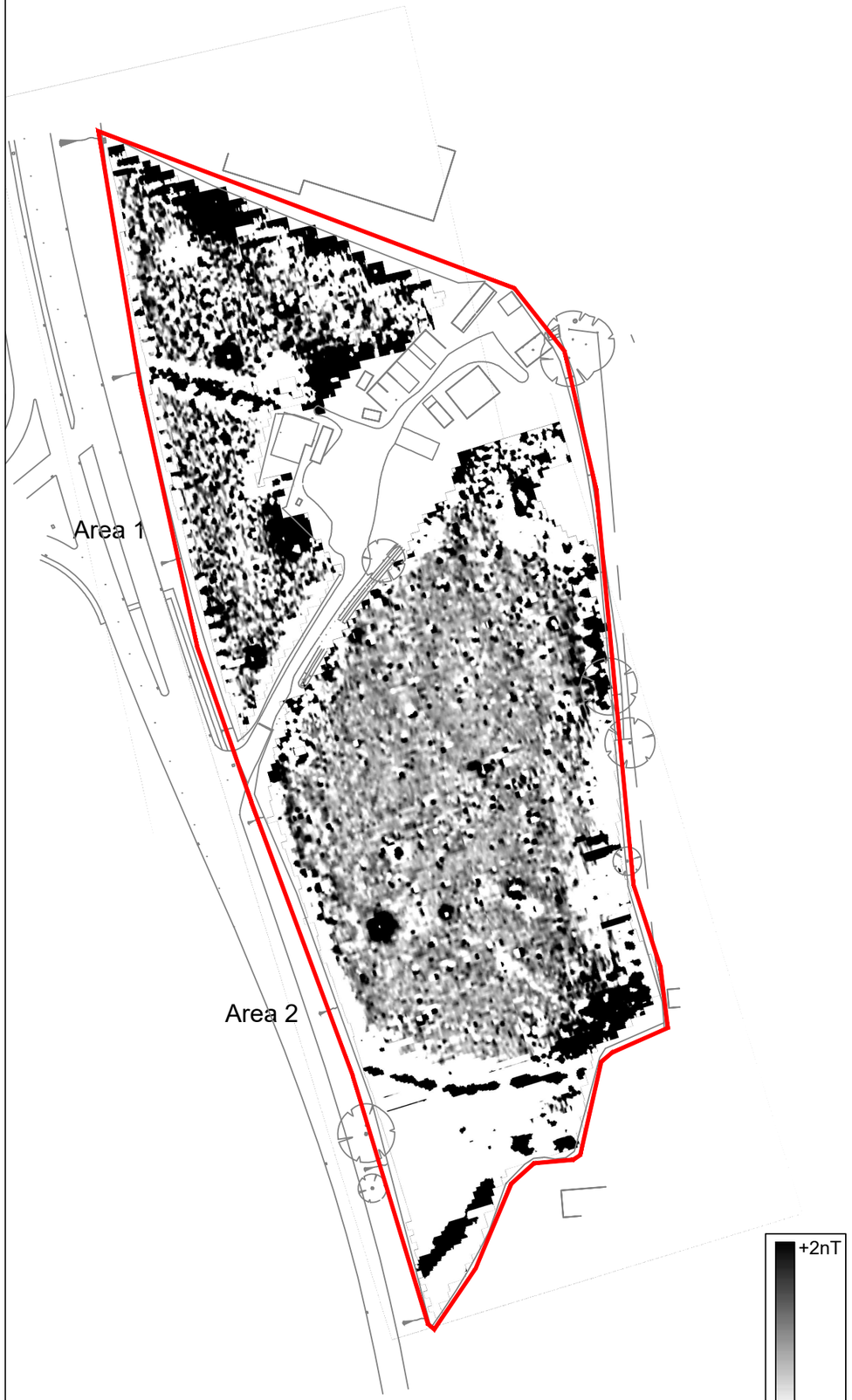
Title:
Site Location

Client:
RPS Consulting Ltd

Project:
04595 - Land to the east of the A228, Snodland, Kent

Scale:
NOT TO SCALE

Fig No:
01



N

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

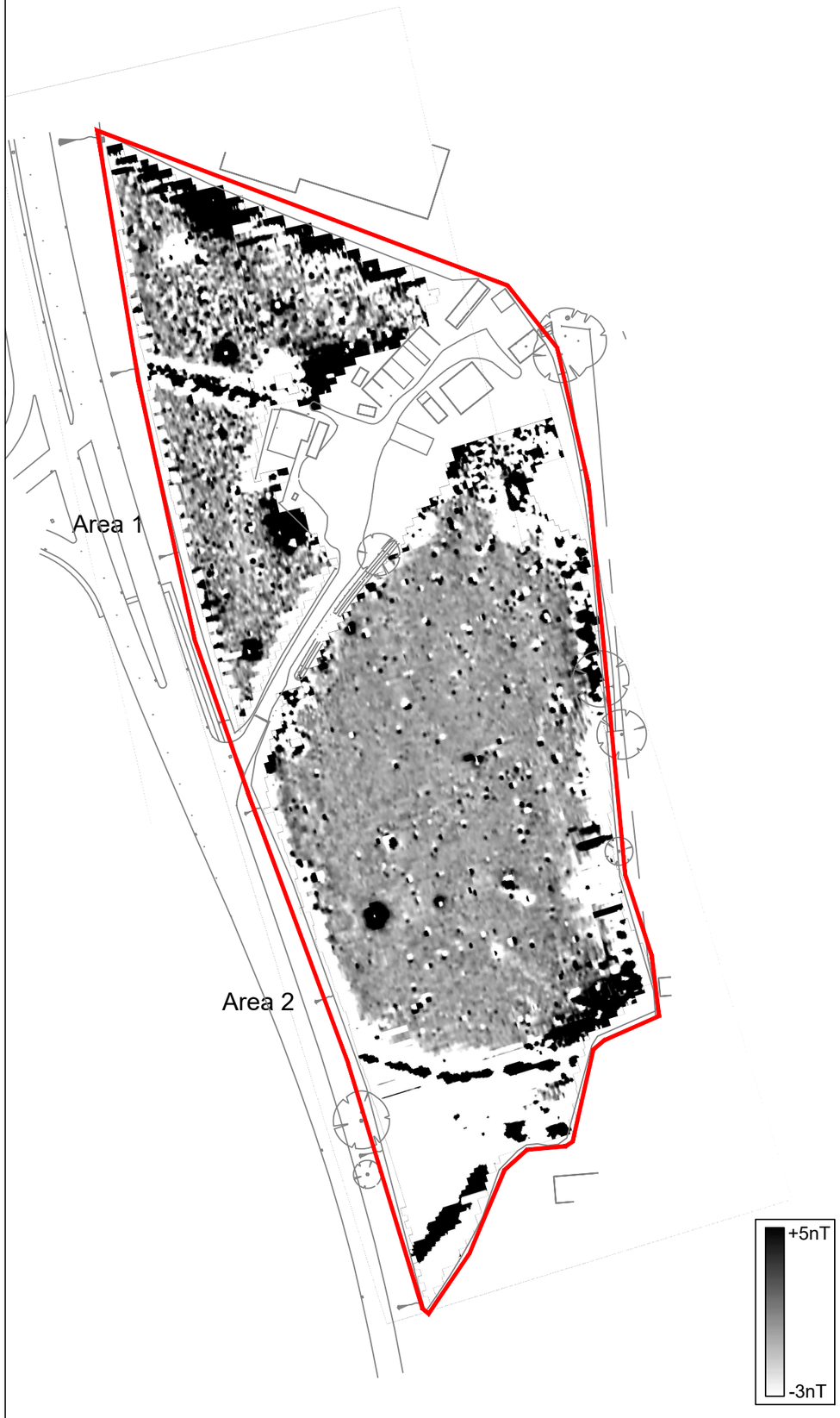
Title:
Magnetometer Survey - Greyscale Plots

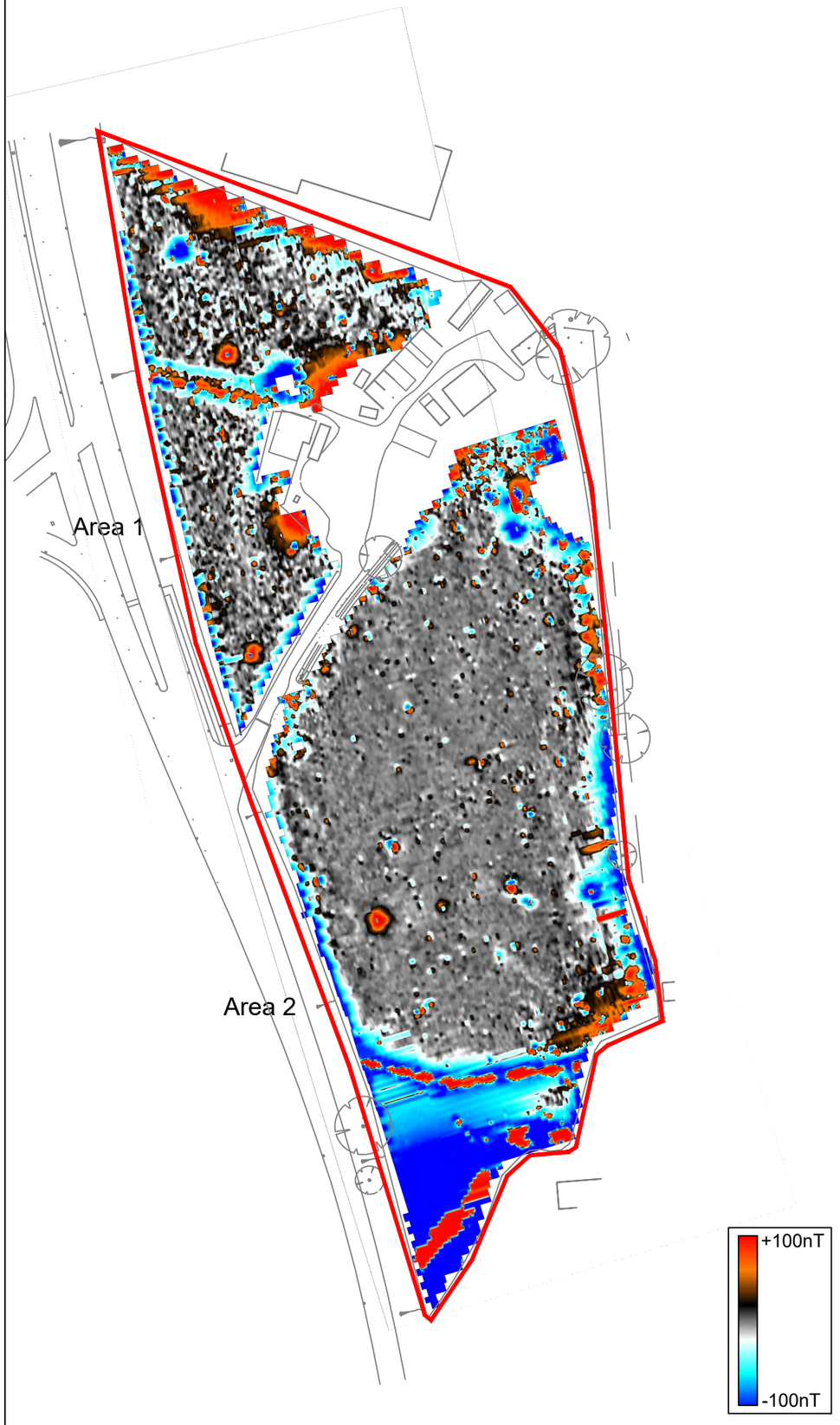
Client:
RPS Consulting Ltd

Project:
04595 - Land to the east of the A228, Snodland, Kent

Scale:
0 metres 75
1:1500 @ A3

Fig No:
02





N

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

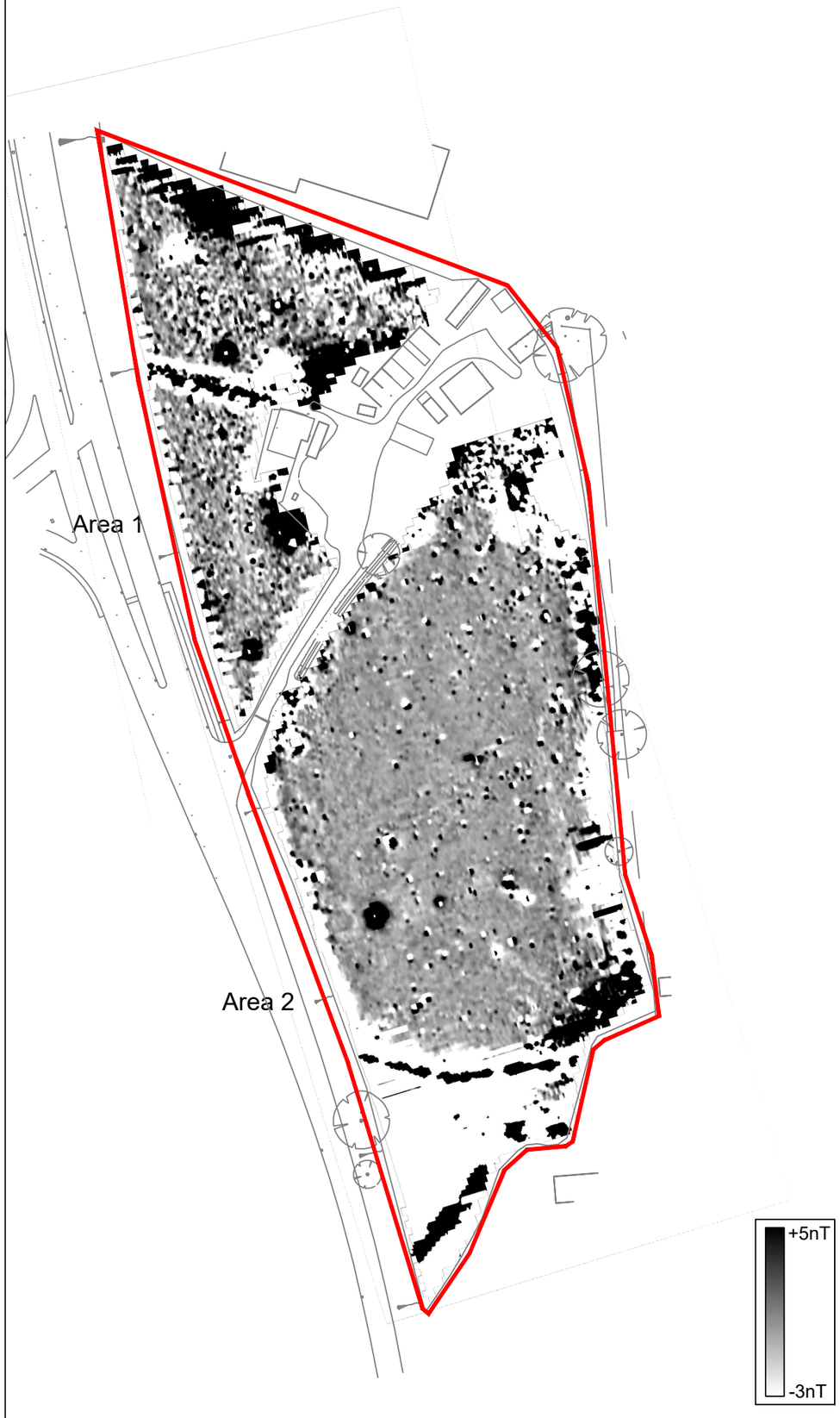
Title:
Magnetometer Survey - Greyscale and Colour Plots

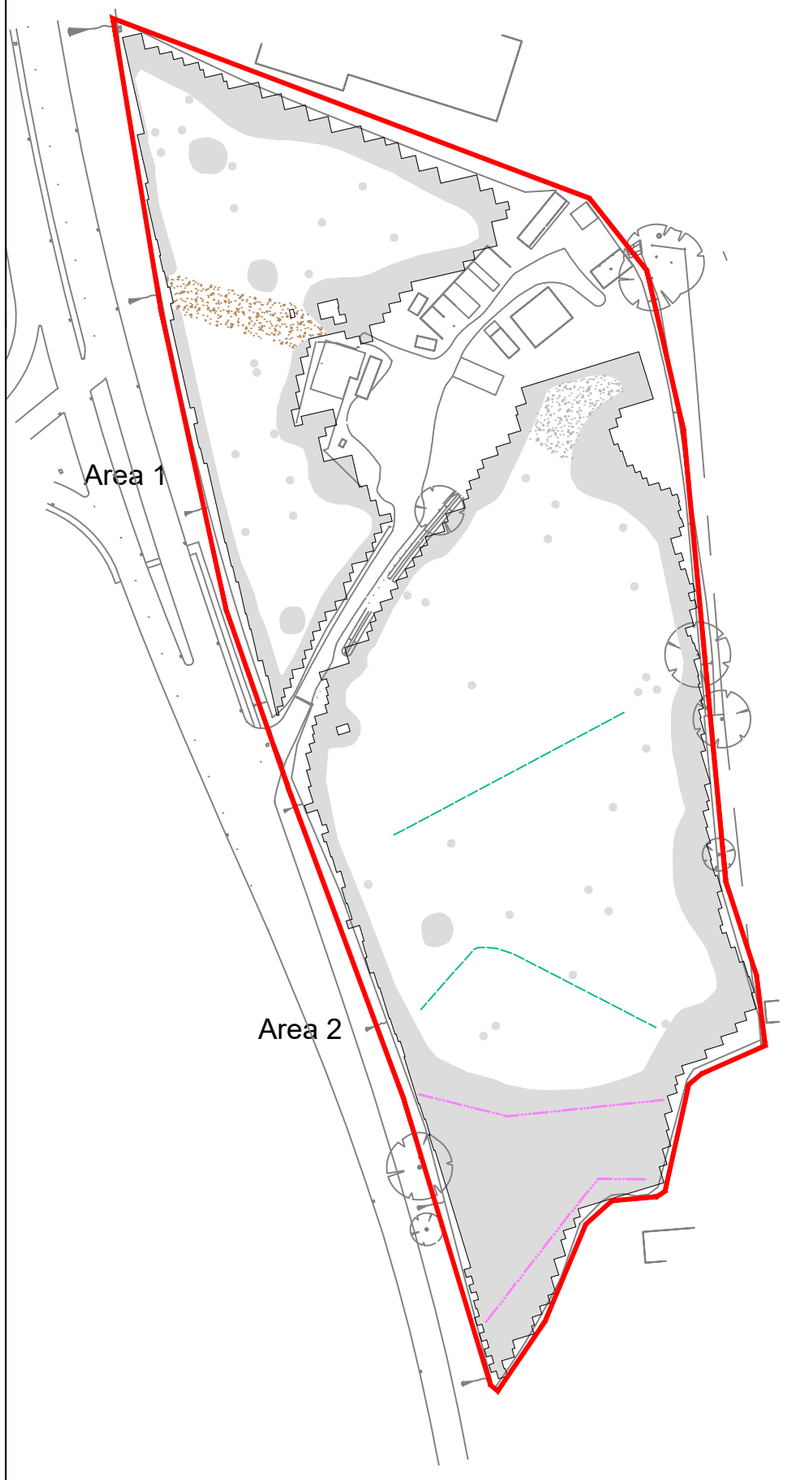
Client:
RPS Consulting Ltd

Project:
04595 - Land to the east of the A228, Snodland, Kent

Scale:
0 metres 75
1:1500 @ A3

Fig No:
03





N

KEY

	Uncertain Origin (trend)
	Former track (corroborated)
	Magnetic disturbance
	Service
	Ferrous

sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

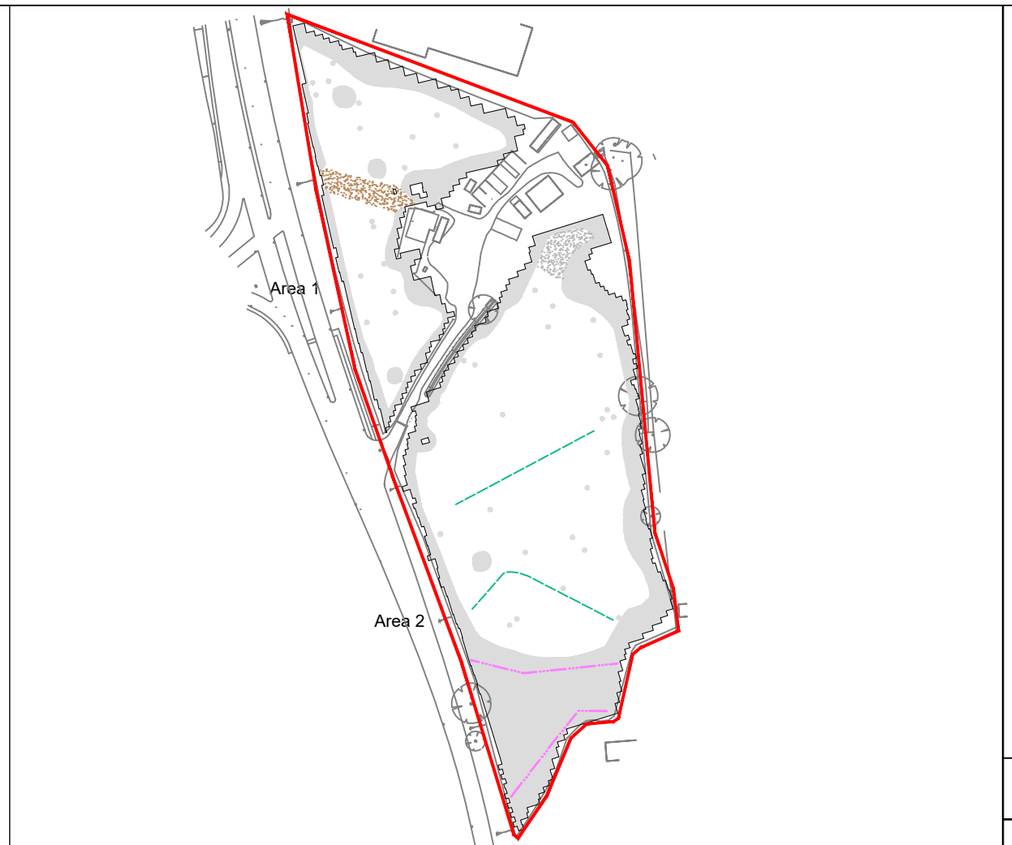
Title:
Magnetometer Survey - Greyscale Plots / Interpretation

Client:
RPS Consulting Ltd

Project:
04595 - Land to the east of the A228, Snodland, Kent

Scale:
0 metres 75
1:1500 @ A3

Fig No:
04



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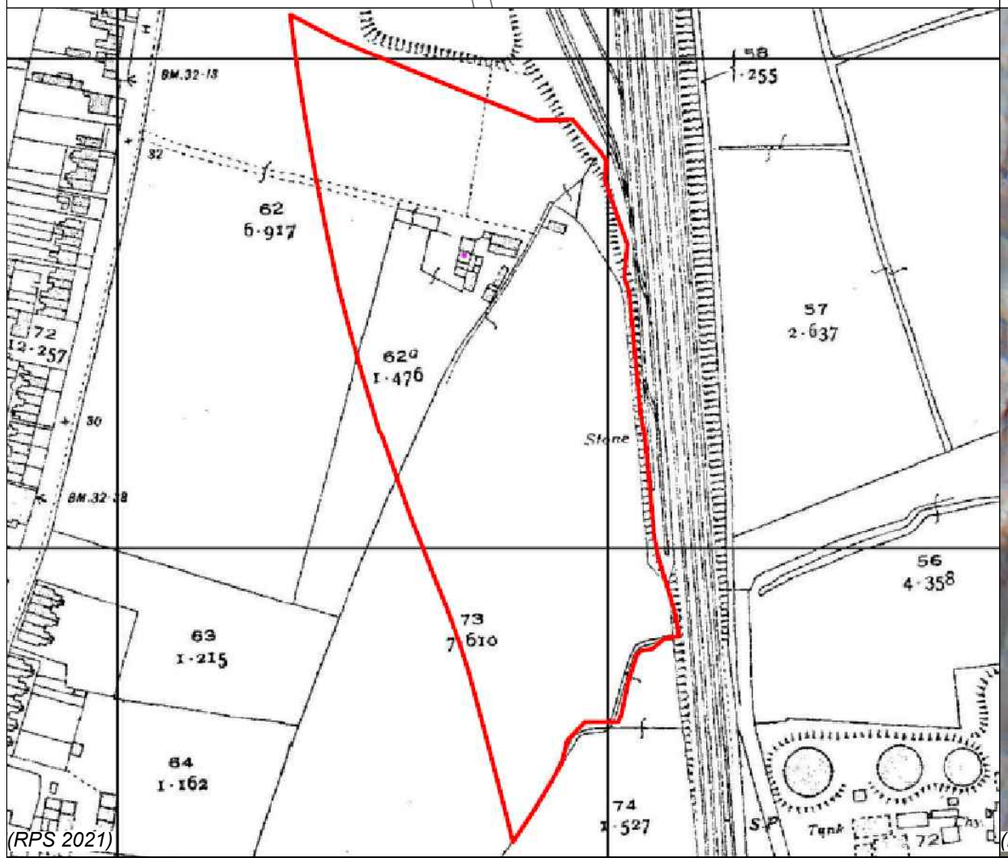
KEY

	Uncertain Origin (trend)
	Former track (corroborated)
	Magnetic disturbance
	Service
	Ferrous



sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title: Magnetometer Survey - Greyscale Plots / Interpretation / 1939 Ordnance Survey Mapping / LiDAR Data Plot

Client: RPS Consulting Ltd

Project: 04595 - Land to the east of the A228, Snodland, Kent

Scale: 0 metres 125
1:2500 @ A3

Fig No: 05

N

+10nT

-10nT

sumo Survey

GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

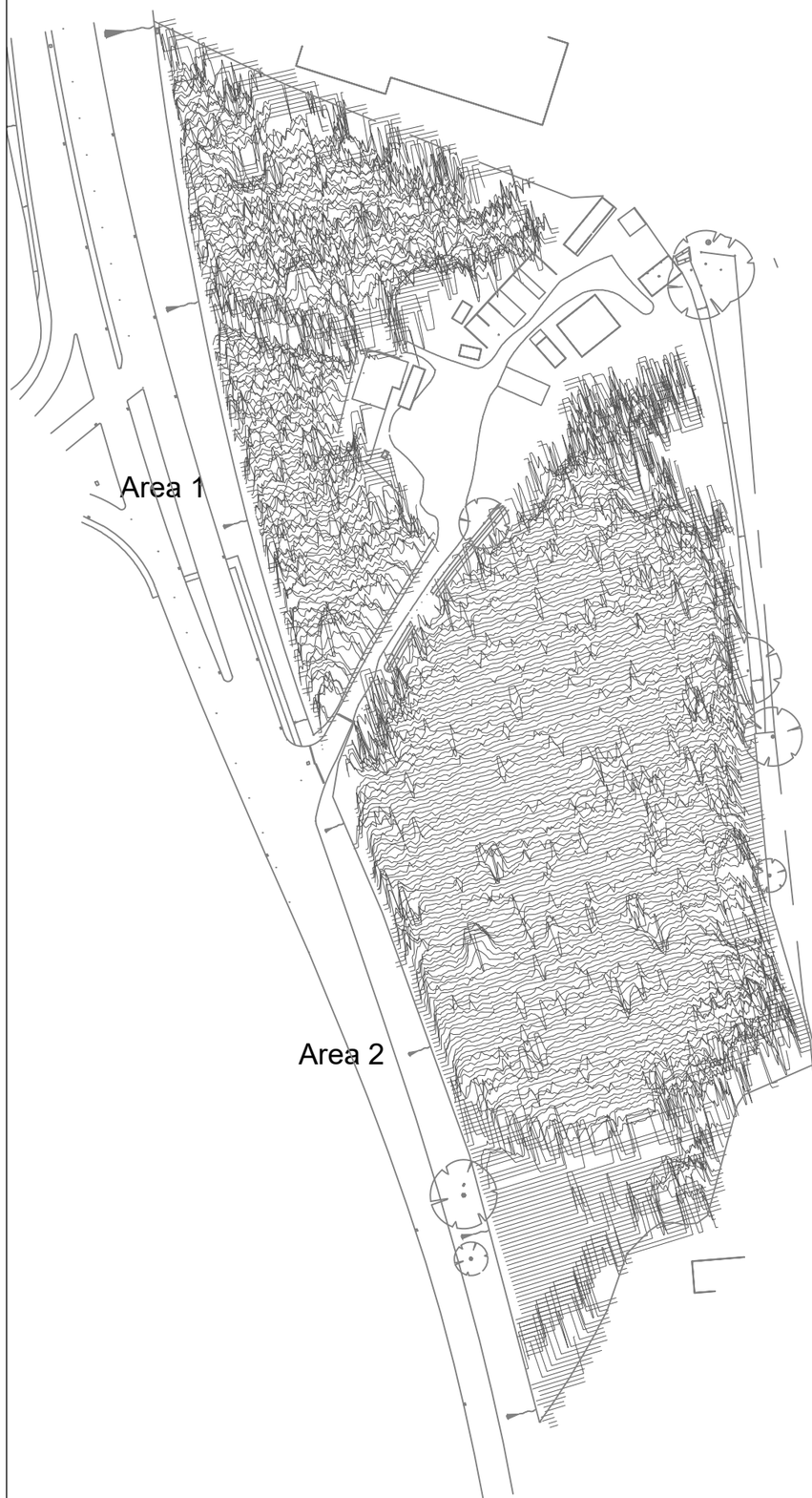
Title:
Minimally Processed Data - Greyscale Plots

Client:
RPS Consulting Ltd

Project:
04595 - Land to the east of the A228, Snodland, Kent

Scale:
0 metres 50
1:1000 @ A3

Fig No:
06



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sumo Survey
GEOPHYSICS FOR ARCHAEOLOGY & ENGINEERING

Title:
XY Trace Plots (clipped at +/-15nT and +/-100nT)

Client:
RPS Consulting Ltd

Project:
04595 - Land to the east of the A228, Snodland, Kent

Scale:
0 metres 70
1:1400 @ A3

Fig No:
07

Appendix A - Technical Information: Magnetometer Survey Method, Processing and Presentation

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 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.

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.

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.

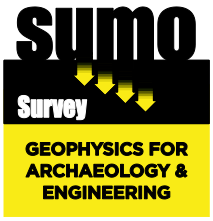
Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement 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.

Summary for sumogeop1-504097

OASIS ID (UID)	sumogeop1-504097
Project Name	Geophysical Survey at Land to the east of the A228, Snodland, Kent
Activity type	Geophysical Survey, MAGNETOMETRY SURVEY
Project Identifier(s)	04595
Planning Id	
Reason For Investigation	Planning requirement
Organisation Responsible for work	SUMO Geophysics Ltd.
Project Dates	06-Jan-2022 - 06-Jan-2022
Location	Land to the east of the A228, Snodland, Kent NGR : TQ 70554 62265 LL : 51.3338986694288, 0.446910559305679 12 Fig : 570554,162265
Administrative Areas	Country : England County : Kent District : Tonbridge and Malling Parish : Snodland
Project Methodology	A temporary grid system was 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. Hand Held: Data will be collected using a Bartington Grad 601-2. The instrument consists of two paired sensors (see below) and readings are logged at 0.25m centres along traverses 1.0m apart across 30m grids. The collection of data at 0.25m centres provides an appropriate methodology balancing cost and time with resolution as per Historic England guidelines. Two 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.
Project Results	The magnetometer survey has not recorded any magnetic responses that could be interpreted as being of definite archaeological interest. Two linear trends have been categorised as uncertain; they are likely to be due to agricultural processes. A former trackway is visible in the dataset and the routes of two service pipes have been marked.
Keywords	Trackway - POST MEDIEVAL - FISH Thesaurus of Monument Types Pipeline - 20TH CENTURY - FISH Thesaurus of Monument Types
HER	Kent HER - unRev - STANDARD
HER Identifiers	
Archives	



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

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