GEOPHYSICAL SURVEY REPORT

STRATASCAN™

SUMO Survey Services
SUMO Group Member

Project name:
Peels Farm, Whitings Lane, Rocklands, Norfolk

Client:
Witham Archaeology

Job ref:
J9838

HER event number:
ENF140690

May 2016

GEOPHYSICAL SURVEY REPORT

Project name: **Peels Farm, Whitings Lane, Rocklands, Norfolk** Client: **Witham Archaeology**	Job ref: **J9838**
Survey date: **14th April 2016**	Report date: **May 2016**
Field team: **Alistair Galt** BA BSc PCIfA **Tiago do Pereiro** MSc	Project Manager: **Simon Haddrell** BEng(Hons) AMBCS PCIfA
Report written By: **Thomas Richardson** MSc ACIfA	Report approved by: **David Elks** MSc ACIfA
CAD illustrations by: **Thomas Richardson** MSc ACIfA	Site Director: **Peter Barker** C.Eng MICE MCIWEM MCIfA MCIfA FCInistCES
Version number and issue date:	Amendments:
V1 05/05/2016	

STRATASCAN LTD
Vineyard House Upper Hook Road Upton upon Severn
Worcestershire WR8 0SA United Kingdom

T: 01684 592266 F: 01684 594142
info@stratascansumo.com www.stratascan.co.uk

SUMO Survey Services
SUMO Group Member

TABLE OF CONTENTS

LIST OF FIGURES

1 SUMMARY OF RESULTS

A detailed gradiometry survey was conducted over approximately 1.2 hectares of grassland. The survey has not identified any anomalies of archaeological origin. Several field boundaries detected across the site, as well as an area of modern ploughing, suggesting that the site has a recent agricultural past. The remaining anomalies are all natural or modern, relating to a former area of woodland and a structure, ferrous objects, and fencing.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned to undertake a geophysical survey of an area outlined for development of agricultural buildings. This survey forms part of an archaeological investigation being undertaken by Witham Archaeology.

2.2 Site Details

NGR / Postcode	TL 978 952 NR17 1BU
Location	The site lies to the east of Whiting's Lane, Rocklands, Norfolk.
HER Event Number	ENF140690
HER	Norfolk
District	Breckland
Parish	Rocklands CP
Topography	The site lies on a gentle south facing slope, dropping from c.40m AOD in the north-east to c.35m AOD in the south-west.
Current Land Use	Grassland – pasture
Weather Conditions	Overcast, dry
Soils	The overlying soils are known as Isleham 2, which are typical humic-sandy gley soils. These consist of sandy and peaty soils (Soil Survey of England and Wales, Sheet 4 Eastern England)
Geology	The underlying geology is Seaford Chalk Formation and Newhaven Chalk Formation (undifferentiated) – chalk. The drift geology is Cover Sand – sand (British Geological Survey website).
Archaeology	Extract from 'Peels Farm, Whitings Lane, Rocklands, Norfolk – Archaeological Desk Based Assessment' (Witham Archaeology 2016):

	There is single record in the Norfolk County Council Historic Environment Record (HER) of archaeological finds from within the boundaries of the proposed development site. This relates to finds recovered during metal detecting by private individuals on land located at the extreme southeast corner of the area. Among the finds were recovered were Neolithic struck flints a Late Bronze Age spearhead, a Roman ring, brooches and pottery and Iron Age, Roman, Medieval and post-medieval coins and other metalwork. *There are also a total of 26 other records held by the Norfolk County Council Historic Environment Record (HER) which relate to past occupation within the wider assessment area. These include 17 records which relate to the retrieval of artefacts, either through casual recovery, metal detector surveys or formal programmes of fieldwalking or excavation. A further eight of the records relate to HER entries defined as monuments, represented by physical remains in the landscape or buried archaeological remains. One record relates to a former historic building which was recorded before demolition.* *Significant archaeological deposits within the wider Assessment Area include those revealed by several programmes of archaeological work in advance of quarrying at Honeypots Plantation, Shropham, located approximately 550m south of the proposed development site. Here, deposits indicating settlement from the Neolithic through the Bronze Age and Iron Age were recovered. Neolithic and Bronze Age features have also been recorded in the fields north and west of the Honeypots Plantation site.* *Metal detecting activities undertaken in the surrounding areas, particularly to the east and northeast of the proposed development site, have recovered many artefacts from the prehistoric to the post-medieval periods. Fields to the west and southwest of the proposed development site have also produced a broadly similar range of finds from metal detecting.* *Overall, the evidence derived from the distribution of known archaeological sites and monuments in the vicinity of the proposed development site, indicates that site has moderate potential to contain subsurface archaeological features or deposits.*
Survey Methods	Gradiometry
Study Area	1.2ha

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 (2008) and the Chartered Institute for Archaeologists (2002 & 2014).

Stratascan Ltd are a Registered Organisation with the CIfA and are committed to upholding its policies and standards.

3.2 Survey methods

Given the potential for archaeological activity from several periods, detailed magnetic survey was used as an efficient and effective method of locating archaeological anomalies.

More information regarding this technique is included in Appendix A.

3.3 Processing

The following schedule shows the basic processing carried out on the data used in this report:

1. *Destripe*
2. *Destagger*

3.4 Presentation of results and interpretation

The presentation of the data for each site involves a plot of the minimally processed data as a greyscale plot and a colour plot showing extreme magnetic values. Magnetic anomalies have been identified and plotted onto the 'Interpretation of Anomalies' drawing.

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 very specific known features documented in other sources, this is done (for example: Abbey Wall, Roman Road). For the generic categories levels of confidence are indicated, 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 detailed magnetic gradiometer survey conducted at Peels Farm has not identified any anomalies that have been characterised as being either of a *probable* or *possible* archaeological origin. The following list of numbered anomalies refers to numerical labels on the interpretation plots.

4.1 Probable Archaeology

No probable archaeology has been identified within the survey area.

4.2 *Possible Archaeology*

No possible archaeology has been identified within the survey area.

4.3 *Medieval/Post-Medieval Agriculture*

1 A positive linear anomaly in the west of the site. Given its apparent relation to Anomaly 2 this is likely to be a post-medieval field boundary not present on available mapping.

2-6 Positive linear anomalies across the site. These are related to former field boundaries present on available mapping. Anomaly 2 is present in 1846, Anomaly 3 1846-1891, Anomalies 4-5 1846-1958, and Anomaly 6 1883-1958.

7 An area of magnetic disturbance in the north-west of the site. This is likely related to a former enclosed area of woodland and a structure present on available mapping 1883-1886 and 1846-1906 respectively.

8 Areas of closely spaced parallel linear anomalies across the site. These are indicative of modern agricultural activity, such as ploughing.

4.4 *Other Anomalies*

9 A small discrete area of magnetic variation in the north of the site. This is likely related to natural pitting in the chalk bedrock.

10 Areas of magnetic disturbance are the result of substantial nearby ferrous metal objects such as fences and underground services. These effects can mask weaker archaeological anomalies, but on this site have not affected a significant proportion of the area.

11 A number of magnetic ‘spikes’ (strong focussed values with associated antipolar response) indicate ferrous metal objects. These are likely to be modern rubbish.

5 DATA APPRAISAL & CONFIDENCE ASSESSMENT

Chalk geologies, such as those at Peels Farm, generally provide good responses to magnetic survey; however, overlying cover sands do have the potential to mask archaeological features. A strong contrast is seen between the field boundaries detected and the background responses. This suggests that the survey has been effective and that any effect the cover sands may be having is not enough to mask any substantial archaeological features.

6 CONCLUSION

The survey at Peels Farm has not identified any anomalies of archaeological origin. There is no evidence for prehistoric or Roman activity, which is recorded in the surrounding area. The survey has detected several field boundaries, as well as an area of modern ploughing, suggesting that the site has a recent agricultural past. The remaining anomalies are all modern or natural. The modern anomalies relate to a former area of woodland and a structure, ferrous objects, and fencing.

7 REFERENCES

British Geological Survey, n.d., *website*: (http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps) Geology of Britain viewer. [Accessed 11/01/2015]

Chartered Institute For Archaeologists. *Standard and Guidance for Archaeological Geophysical Survey. (*http://www.archaeologists.net/sites/default/files/CIfAS&GGeophysics_1.pdf)

English Heritage, 2008. *Geophysical Survey in Archaeological Field Evaluation.*

IfA 2002. The Use of Geophysical Techniques in Archaeological Evaluations, IFA Paper No 6, C. Gaffney, J. Gater and S. Ovenden. Institute for Archaeology, Reading

Soil Survey of England and Wales, 1983. *Soils of England and Wales, Sheet 4 Eastern England*

Witham Archaeology, 2016. *Peels Farm, Whitings Lane, Rocklands, Norfolk – Archaeological Desk Based Assessment*

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.

For CARTEASY^{N} collected data each data point had its position recorded using a Trimble R10 Real Time Kinematic (RTK) VRS Now GNSS GPS system. The geophysical survey area is georeferenced relative to the Ordnance Survey National Grid.

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	CartEasy^{N} cart system (Bartington Grad 601 sensors)	0.75m	0.125m

Instrumentation: Bartington *Grad*601-2 / GSB CARTEASY^{N} Cart system

Both the Bartington and CARTEASY^{N} 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 CARTEASY^{N} system has four gradiometer units mounted at 0.75m intervals across its frame – rather than working in grids, the cart uses an on-board survey grade GNSS for positioning. The cart system allows for the collection of topographic data in addition to the magnetic field measurements.

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.
Interpolation	When geophysical data are presented as a greyscale, each data point is represented as a small square. The resulting plot can sometimes have a 'blocky' appearance. The interpolation process calculates and inserts additional values between existing data points. The process can be carried out with points along a traverse (the x axis) and/or between traverses (the y axis) and results in a smoother greyscale image.

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 response 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 will often lead and empty into larger diameter pipes and 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. They are presumed to be modern.
Service	Magnetically strong anomalies usually forming linear features indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) cause weaker magnetic responses and can be identified from their uniform linearity crossing large expanses.
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* and *Possible Natural* or (in the case of linear responses) *Possible Archaeology* and *Possible 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 0.2 nanoTeslas (nT) in an overall field strength of 48,000nT, 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.

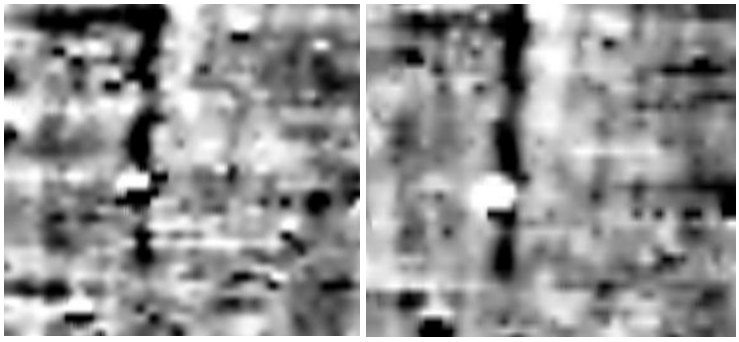
Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and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

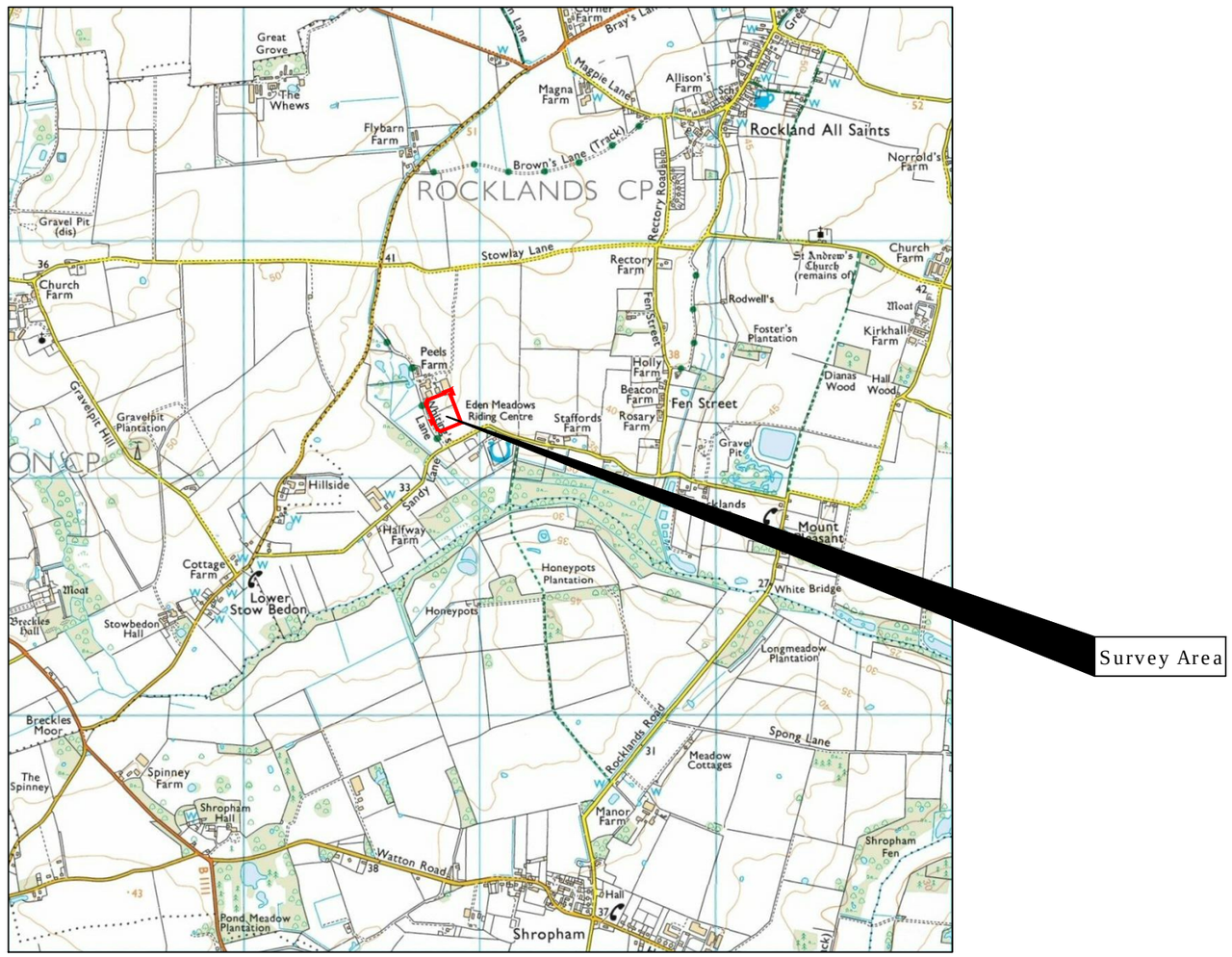
Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried 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, disturbance from modern services etc.

Appendix C – Repeat Data



Repeat cart data collected 14/04/16



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Site centred on NGR TL 978 952

Client
WITHAM ARCHAEOLOGY

Project Title Job No. J9838
PEELS FARM, WHITINGS LANE, ROCKLANDS, NORFOLK

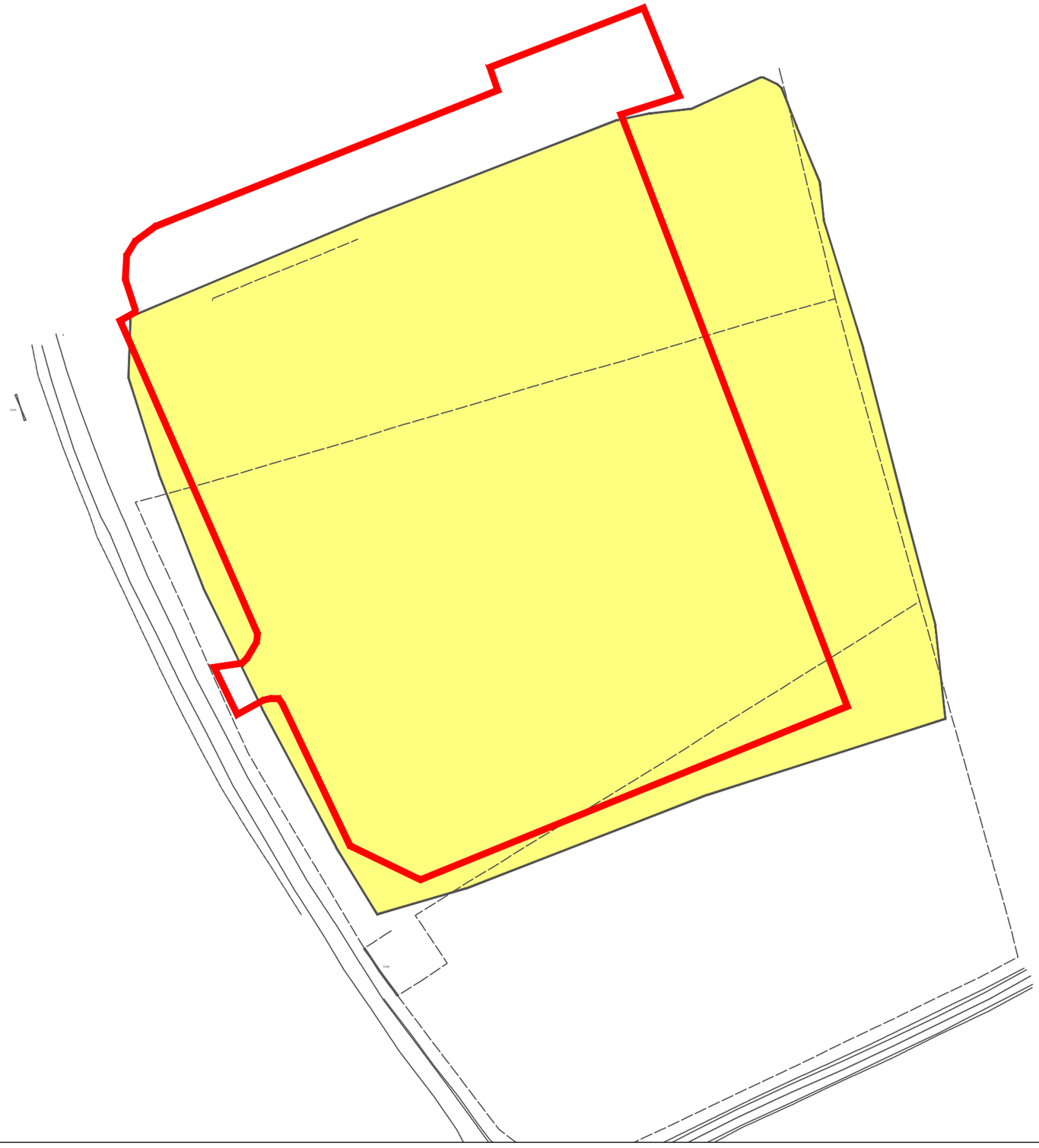
Subject
LOCATION PLAN OF SURVEY AREA

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

SUMO GROUP MEMBER

Scale 1:25000 (0m 500 1000m)

Plot	Checked by	Issue No.
A3	DGE	01
Survey date	Drawn by	Figure No.
APR 16	RD	01



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

OS GRID REFERENCES

Survey area

Area surveyed

Client

WITHAM ARCHAEOLOGY

Project Title — Job No. J9838

PEELS FARM, WHITINGS LANE, ROCKLANDS, NORFOLK

Subject

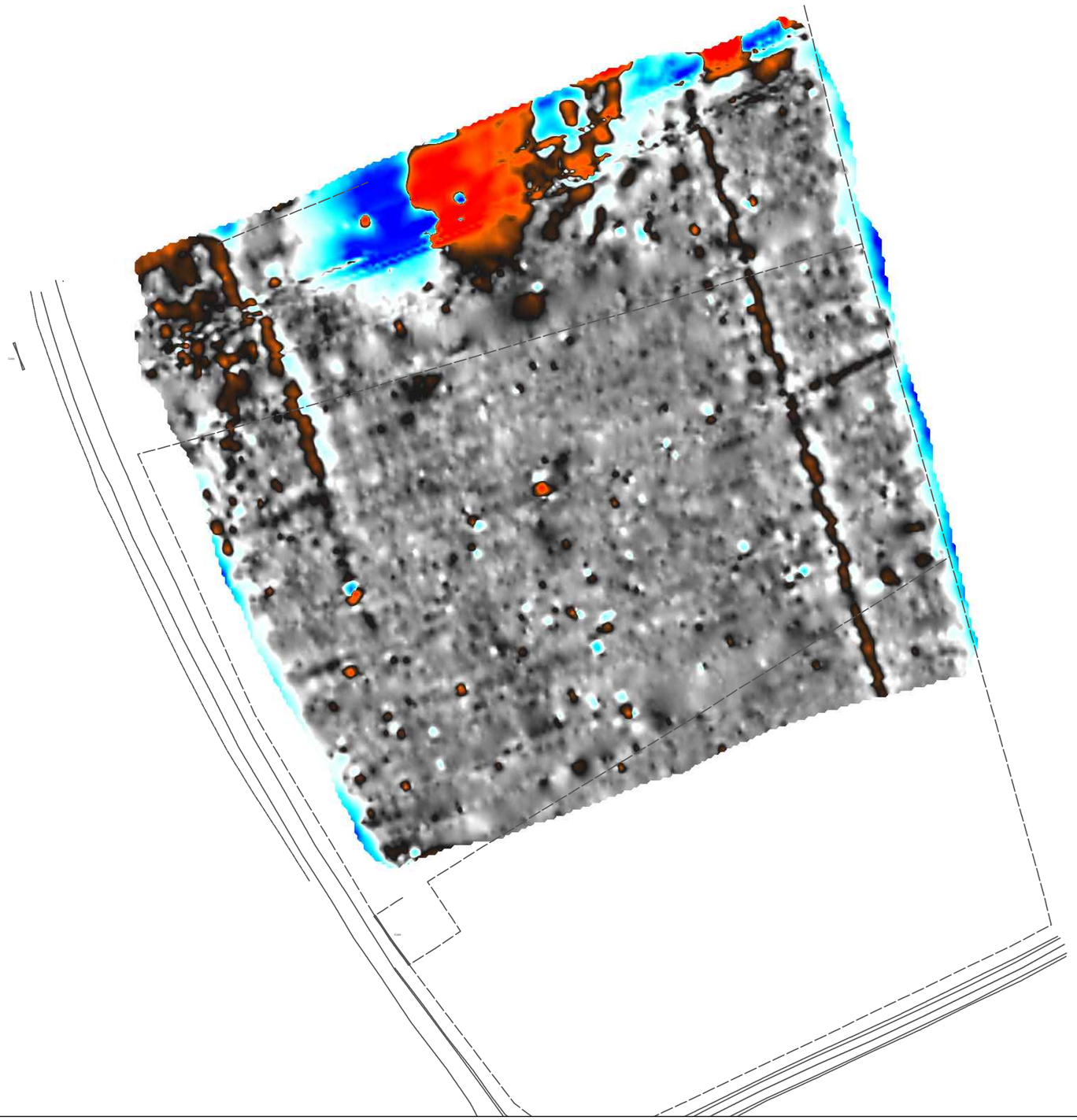
LOCATION OF SURVEY AREA

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

SUMO GROUP MEMBER

Scale 1:750 — 0m 5 15 30m

Plot	Checked by	Issue No.
A3	DGE	01
Survey date	Drawn by	Figure No.
APR 16	RD	02



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters

Maximum +100nT (red)
Minimum -100nT (blue)

+100nT
+25nT
+3nT
-3nT
-25nT
-100nT

Client

WITHAM ARCHAEOLOGY

Project Title — Job No. J9838

PEELS FARM, WHITINGS LANE, ROCKLANDS, NORFOLK

Subject

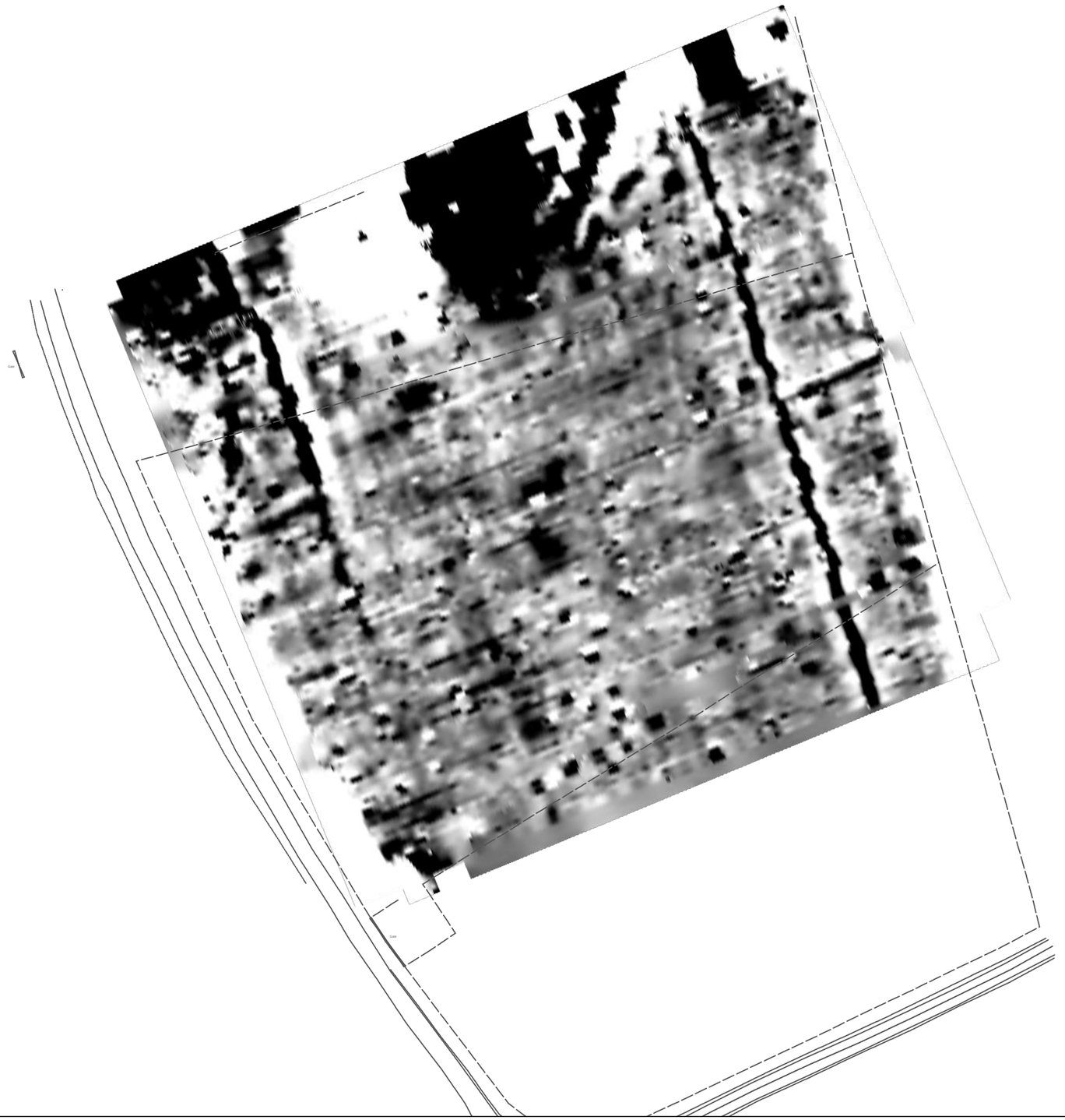
COLOUR PLOT OF GRADIOMETER DATA SHOWING EXTREME VALUES

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

SUMO GROUP MEMBER

Scale 1:750 — 0m 5 15 30m

Plot	Checked by	Issue No.
A3	DGE	01
Survey date	Drawn by	Figure No.
APR 16	RD	03



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters

Maximum +2nT (black)
Minimum -2nT (white)

+2nT

-2nT

Client

WITHAM ARCHAEOLOGY

Project Title — Job No. J9838

PEELS FARM, WHITINGS LANE, ROCKLANDS, NORFOLK

Subject

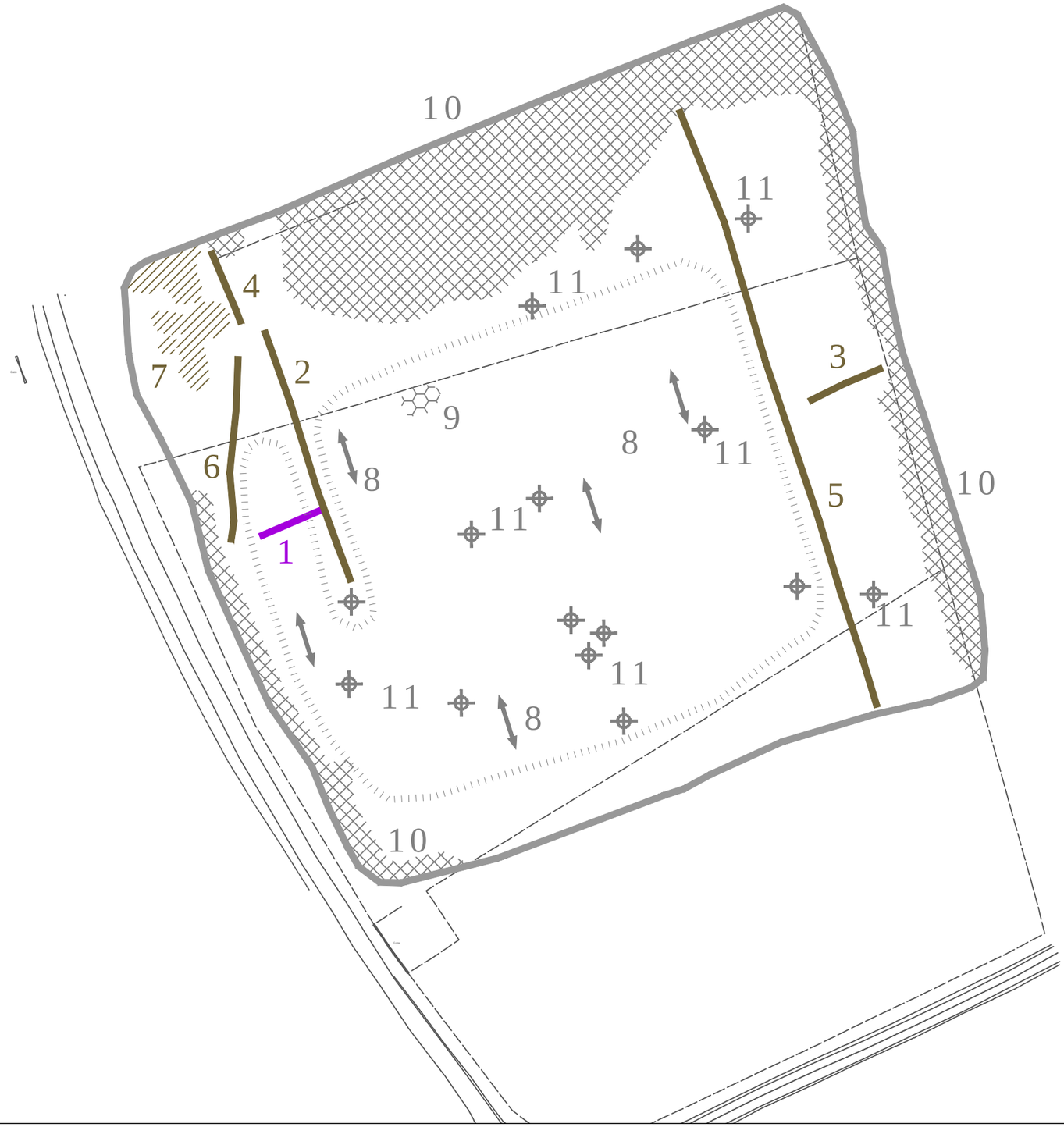
PLOT OF MINIMALLY PROCESSED GRADIOMETER DATA

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

SUMO GROUP MEMBER

Scale 1:750 — 0m 5 15 30m

Plot	Checked by	Issue No.
A3	DGE	01
Survey date	Drawn by	Figure No.
APR 16	RD	04



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

PROBABLE ARCHAEOLOGY

- Positive anomaly / weak positive anomaly - probable cut feature of archaeological origin
- Negative anomaly / weak negative anomaly - probable bank or earthwork of archaeological origin

POSSIBLE ARCHAEOLOGY

- Positive anomaly / weak positive anomaly - possible cut feature of archaeological origin
- Negative anomaly / weak negative anomaly - possible bank or earthwork of archaeological origin

MEDIEVAL/POST-MEDIEVAL AGRICULTURE

- Widely spaced curving parallel linear anomalies - probably related to ridge-and-furrow
- Closely spaced parallel linear anomalies - probably related to agricultural activity such as ploughing
- Linear anomaly - probable former field boundary not present on available mapping
- Linear anomaly - related to a former field boundary present on available mapping
- Magnetic disturbance - likely related to a former area of woodland present on available mapping

OTHER ANOMALIES

- Linear anomaly - probably related to pipe, cable or other modern service
- Magnetic disturbance associated with nearby metal object such as service or field boundary
- Scattered magnetic debris
- Area of amorphous magnetic variation - probable natural (e.g. geological or pedological) origin
- Magnetic spike - probable ferrous object

Client

WITHAM ARCHAEOLOGY

Project Title — Job No. J9838

PEELS FARM, WHITINGS LANE, ROCKLANDS, NORFOLK

Subject

ABSTRACTION AND INTERPRETATION OF GRADIOMETER ANOMALIES

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

Scale 1:750 (0m 5 15 30m)

Plot	Checked by	Issue No.
A3	DGE	01
Survey date	Drawn by	Figure No.
APR 16	RD	05

sumo Survey Services

Your Survey Partner

For a complete and complementary range of survey services.

Survey services you can rely on

- Archaeological
- As Built Records
- Boundary Disputes
- CCTV
- Geophysical
- Laser Scanning
- Measured Building
- Pipeline Routes
- Railway
- Retrofit
- Setting Out
- Statutory Plan Collation
- Topographic
- Utility Mapping
- UXO Detection
- Void Detection