

GEOPHYSICAL SURVEY REPORT

# STRATASCAN™



Project name:  
**Land East of Saxon Drive, Biggleswade**

Client:  
**Albion Archaeology**

Job ref:  
**J10458**

**November 2016**

## GEOPHYSICAL SURVEY REPORT

Project name: <b>Land East of Saxon Drive, Biggleswade</b> Client: <b>Albion Archaeology</b>	Job ref: <b>J10458</b>
Survey date: <b>19-20 October 2016</b>	Report date: <b>November 2016</b>
Field team: <b>Robert Knight</b> BA (Hons) <b>Edward Cox</b> MSc	Project Manager: <b>Simon Haddrell</b> BEng(Hons) AMBCS PCIfA
Report written by: <b>Rebecca Davies</b> BSc (Hons)	Report approved by: <b>David Elks</b> MSc ACIfA
CAD illustrations by: <b>Rebecca Davies</b> BSc (Hons)	Site Director: <b>Dr John Gater</b> MCIfA FSA
Version number and issue date: <b>V1</b> 10/11/2016	Amendments:



**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](http://www.stratascan.co.uk)

## TABLE OF CONTENTS

<b>1</b>	<b>SUMMARY OF RESULTS.....</b>	<b>1</b>
<b>2</b>	<b>INTRODUCTION .....</b>	<b>1</b>
<b>3</b>	<b>METHODS, PROCESSING &amp; PRESENTATION.....</b>	<b>2</b>
<b>4</b>	<b>RESULTS .....</b>	<b>3</b>
<b>5</b>	<b>DATA APPRAISAL &amp; CONFIDENCE ASSESSMENT .....</b>	<b>4</b>
<b>6</b>	<b>CONCLUSION .....</b>	<b>4</b>
<b>7</b>	<b>REFERENCES .....</b>	<b>5</b>
	<b>Appendix A - Technical Information: Magnetometer Survey Method.....</b>	<b>6</b>
	<b>Appendix B - Technical Information: Magnetic Theory .....</b>	<b>8</b>

## LIST OF FIGURES

Figure 01	1:25 000	Location plan of survey area
Figure 02	1:1250	Location of survey grids and referencing
Figure 03	1:1250	Colour plot of gradiometer data showing extreme values
Figure 04	1:1250	Plot of minimally processed gradiometer data
Figure 05	1:1250	Interpretation of gradiometer anomalies

## 1 SUMMARY OF RESULTS

A detailed gradiometry survey was conducted over approximately 6.3 hectares of arable land. A number of linear anomalies of possible archaeological origin have been detected that may relate to the deserted medieval settlement recorded on site. Evidence of ridge and furrow, ploughing, land drains and a trackway indicate that the site has a recent agricultural past. A number of linear anomalies are of uncertain origin, though are likely to be a result of agricultural activity. Magnetic spikes across the site are likely to be modern rubbish.

## 2 INTRODUCTION

### 2.1 Background synopsis

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

### 2.2 Site Details

<b>NGR / Postcode</b>	TL 206 439 / SG18 8ST
<b>Location</b>	The site is located to the south-east of Biggleswade, Bedfordshire. Saxon Drive lies to the west of the site, with Stratton Park to the east, a farm track to the north and park homes to the south.
<b>HER/SMR</b>	Bedfordshire and Luton
<b>Unitary Authority</b>	Central Bedfordshire
<b>Parish</b>	Biggleswade CP
<b>Topography</b>	Flat
<b>Current Land Use</b>	Arable
<b>Weather Conditions</b>	Dry, overcast
<b>Soils</b>	The overlying soils are known as Elmtun 1 which are typical brown rendzina soils. These consist of calcareous fine loamy soils (Soil Survey of England and Wales, Sheet 4 Eastern England).
<b>Geology</b>	The underlying geology comprises sandstone of Woburn Sands Formation. Glaciofluvial deposits of sand and gravel are recorded across the site (British Geological Survey website).

<b>Archaeology</b>	A search of Bedfordshire HER identifies a number of archaeological remains within close proximity of the site. Extending across the west of the site is the deserted medieval village of Stratton (HER518). This site was first revealed as cropmarks and earthworks and has undergone excavation work between 1991 and 2007. The settlement was established in the Saxon period and developed into a village including several homesteads. The excavations also recorded evidence of prehistoric and Roman activity. In the area immediately south of the site, a moated site (HER520) is recorded, along with additional enclosure earthworks.
<b>Survey Methods</b>	Detailed magnetic survey (gradiometry)
<b>Study Area</b>	c. 6.3 hectares

### 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 ClfA and are committed to upholding its policies and standards.

### 3.2 Survey methods

Due to the close proximity of recorded medieval remains, 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. *De-stripe*
2. *De-stagger*

### 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 Biggleswade has identified a number of anomalies that have been characterised as being of *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*

A number of positive linear anomalies and weak linear trends [1] in the south-west of the survey area are indicative of former cut features, such as ditches. Given the close proximity of the deserted medieval village of Stratton, it is possible that these represent ditches and gullies associated with settlement; however, they align with land drains, ridge and furrow and a trackway which suggests they may be agricultural.

### 4.3 *Medieval/Post-Medieval Agriculture*

A small number of parallel linear anomalies [2] in the north of the area are likely to be associated with ridge and furrow cultivation, while closely spaced parallel linear anomalies [3] are likely associated with more recent ploughing. A relatively high amplitude linear anomaly [4] running approximately north-south through the site is related to a trackway, visible on mapping and aerial photographs.

### 4.4 *Other Anomalies*

A number of positive linear anomalies [5] are of uncertain origin. It is possible that they are a result of agricultural activity, though their origin cannot be determined with confidence. Two linear anomalies [6], running approximately east-west across the site, correspond with the locations of land drains recorded on available OS mapping from 1925 to 1970. Small magnetic anomalies around the site are likely to be modern rubbish.

## 5 DATA APPRAISAL & CONFIDENCE ASSESSMENT

Sandstone geologies, such as those present across the site, combined with superficial deposits of sand and gravel, can provide variable results for magnetic survey. The detection of a number of possible archaeological anomalies, along with ridge and furrow, suggests that the survey has been effective and that the data collected are a good indicator of buried features.

## 6 CONCLUSION

The survey at Biggleswade has not identified any anomalies of probable archaeological origin, however a series of possible cut features have been detected. It is possible that these are associated with the deserted medieval village recorded to the west of the area. Evidence of ridge and furrow, modern agriculture, land drains and a trackway all suggest that the site has a largely agricultural past. The only other feature detected are small magnetic 'spikes' which are likely to be modern rubbish.

## 7 REFERENCES

Bedfordshire and Luton HER (2016) [online] Available through: [www.heritagegateway.org.uk](http://www.heritagegateway.org.uk) [Accessed 10/11/2016]

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](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*



## Appendix A - Technical Information: Magnetometer Survey Method

### Cart collection

Every point that is recorded is referenced using a Trimble R8 RTK GNSS 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.

### Survey equipment and gradiometer configuration

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 using an appropriate instrument.

The magnetic survey was carried out using a Bartington magnetometer cart system utilizing Bartington 1000L Gradiometer sensors. The instrument consists of two fluxgates 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.

### Sampling interval

For cart collected data readings were taken at intervals of 0.125m along traverses 0.75m apart.

### Depth of scan and resolution

The Bartington magnetometer cart system collects data at 10Hz which approximates 0.125m.

### Data capture

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

### Display

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

## Interpretation Categories

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

<i>Archaeology/Probable Archaeology</i>	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.
<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 &amp; 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 &amp; 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 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.
<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. They are presumed to be modern.
<i>Service</i>	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.
<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</i> and <i>Possible Natural</i> or (in the case of linear responses) <i>Possible Archaeology</i> and <i>Possible 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 0.2 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.

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: AL 50125A  
Licencee:  
Stratascan Ltd.  
Vineyard House  
Upper Hook Road  
Upton Upon Severn  
WR8 0SA

OS 100km square = TL



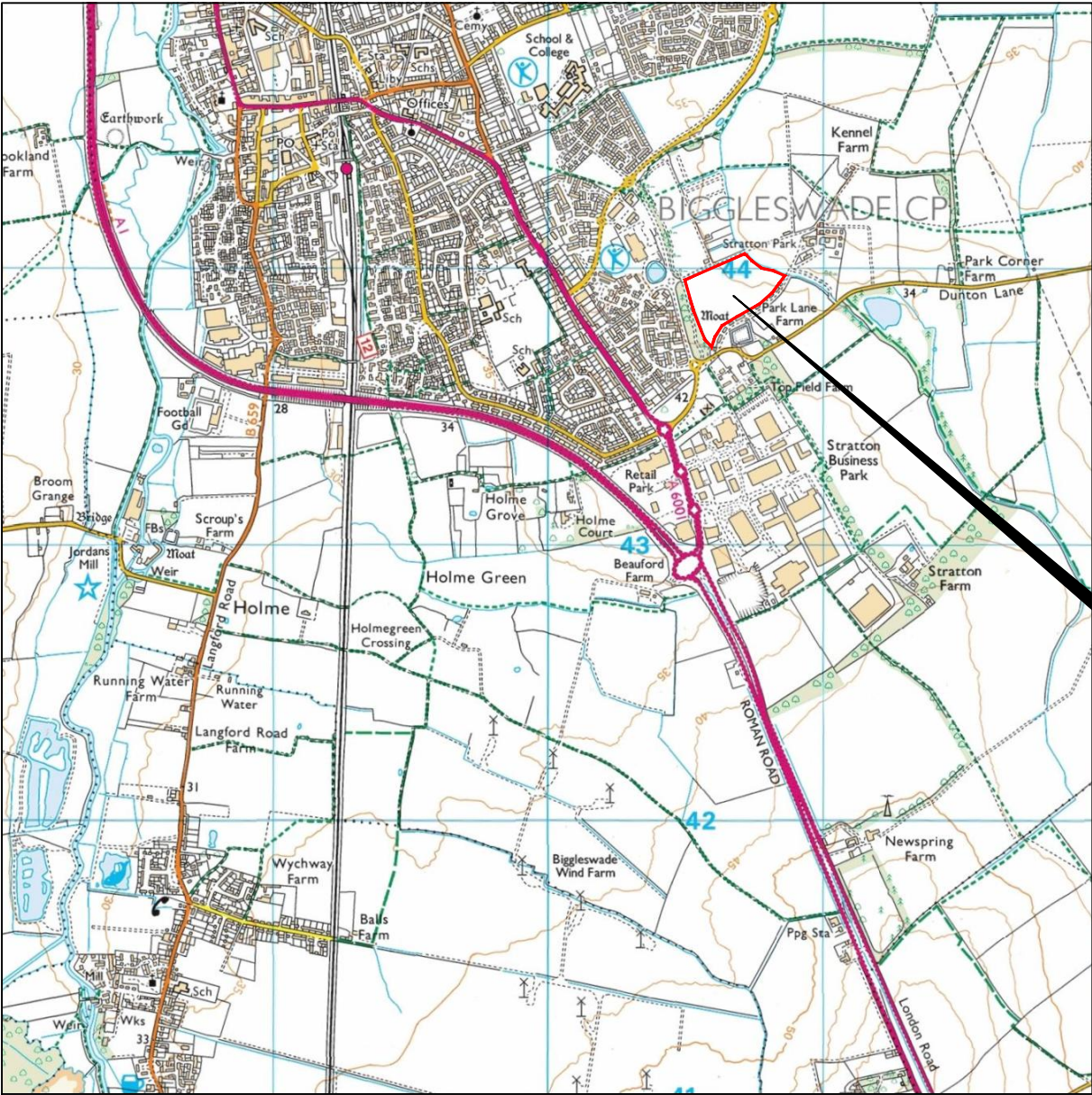
45

44

43

42

41



Survey Area

18

19

20

21

22

**STRATASCAN™**  
GEOPHYSICS FOR ARCHAEOLOGY  
AND ENGINEERING



Stratascan Ltd  
VINEYARD HOUSE  
UPPER HOOK ROAD  
UPTON UPON SEVERN  
WORCESTERSHIRE  
WR8 0SA  
TEL: 01684 59 22 66  
FAX: 0845 408 0653  
[www.stratascanSUMO.com](http://www.stratascanSUMO.com)

Title:  
LOCATION PLAN OF SURVEY AREA

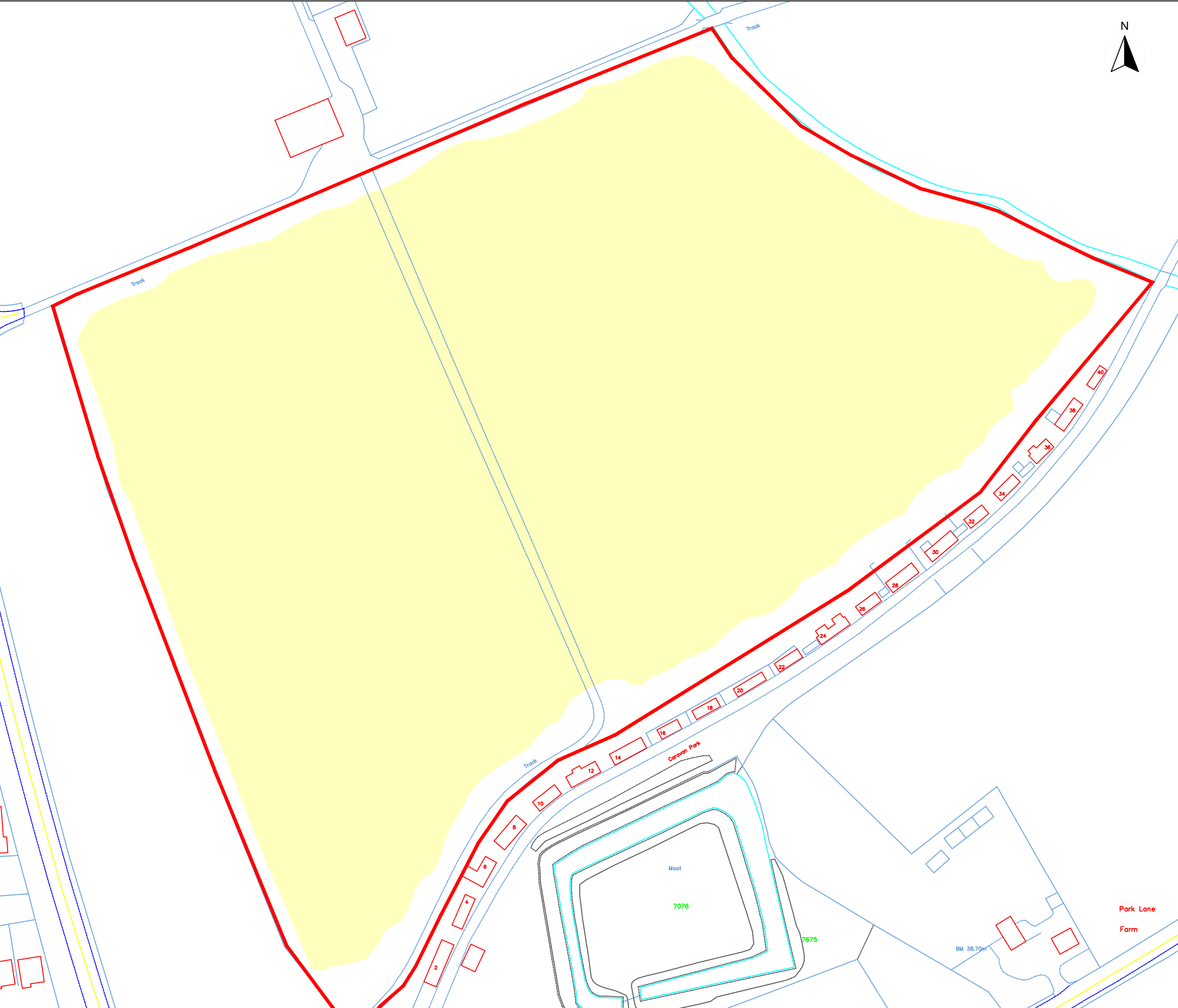
Client:  
ALBION ARCHAEOLOGY

Project:  
J10458 - LAND EAST OF SAXON DRIVE,  
BIGGLESWADE

Scale: 1:25000 @ A3  
0m 500 1000m

Fig No:  
01







Area surveyed by cart



STRATASCAN™  
GEOPHYSICS FOR ARCHAEOLOGY  
AND ENGINEERING



**Sumo**  
Survey  
Services

Stratascan Ltd  
VINEYARD HOUSE  
UPPER HOOK ROAD  
UPTON UPON SEVERN  
WORCESTERSHIRE  
WR8 0SA  
TEL: 01684 59 22 66  
FAX: 0845 408 0653  
[www.stratascanSUMO.com](http://www.stratascanSUMO.com)

Title:

REFERENCING

Client:

ALBION ARCHAEOLOGY

Project:

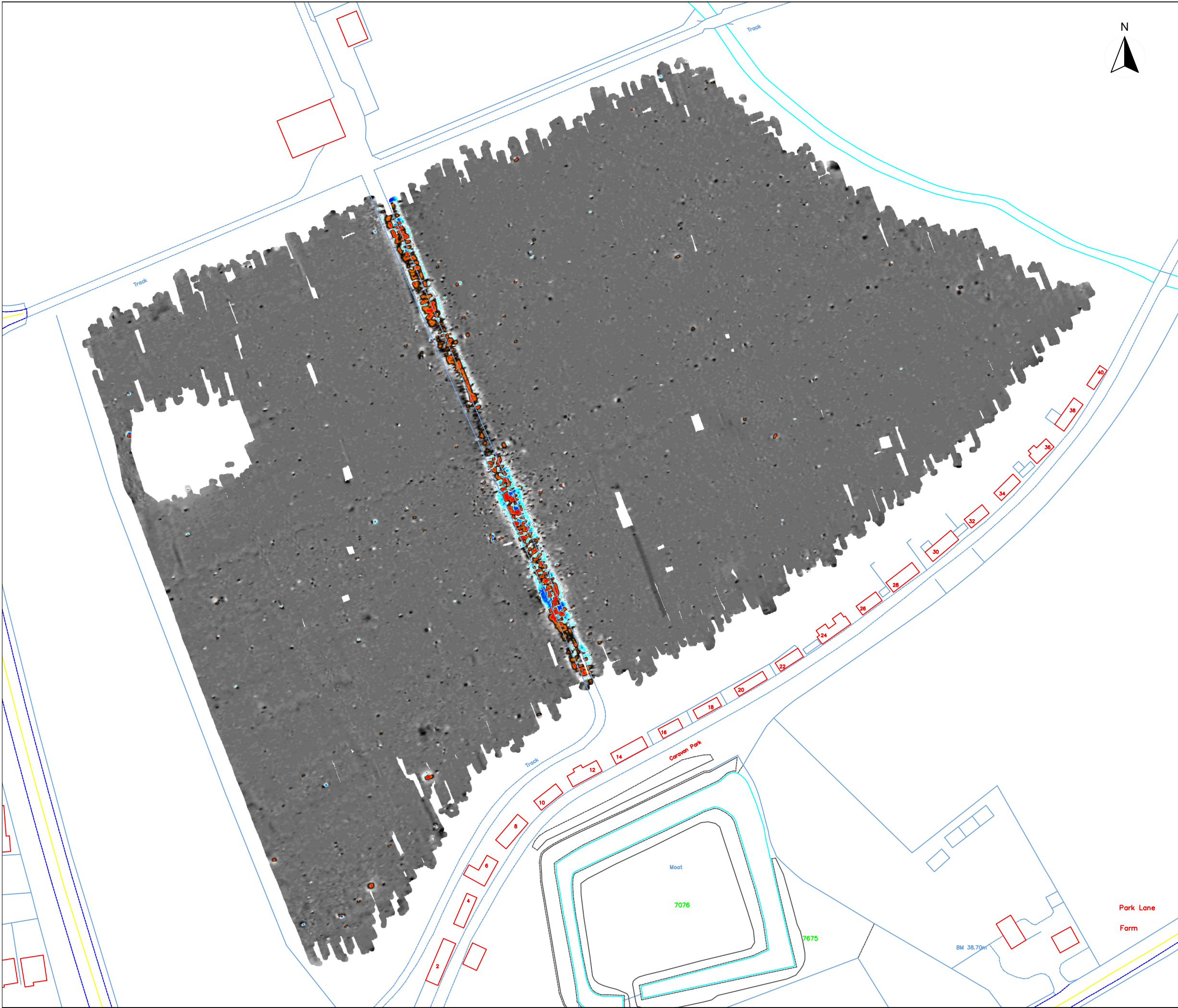
J10458 - LAND EAST OF SAXON DRIVE,  
BIGGLESWADE

Scale: 1:1250 @ A3



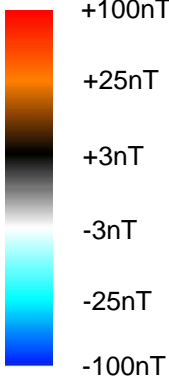
Fig No:

02



Plotting parameters

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



**STRATASCAN™**  
GEOPHYSICS FOR ARCHAEOLOGY  
AND ENGINEERING



**Stratascan Ltd**  
VINEYARD HOUSE  
UPPER HOOK ROAD  
UPTON UPON SEVERN  
WORCESTERSHIRE  
WR8 0SA  
TEL: 01684 59 22 66  
FAX: 0845 408 0653  
[www.stratascanSUMO.com](http://www.stratascanSUMO.com)

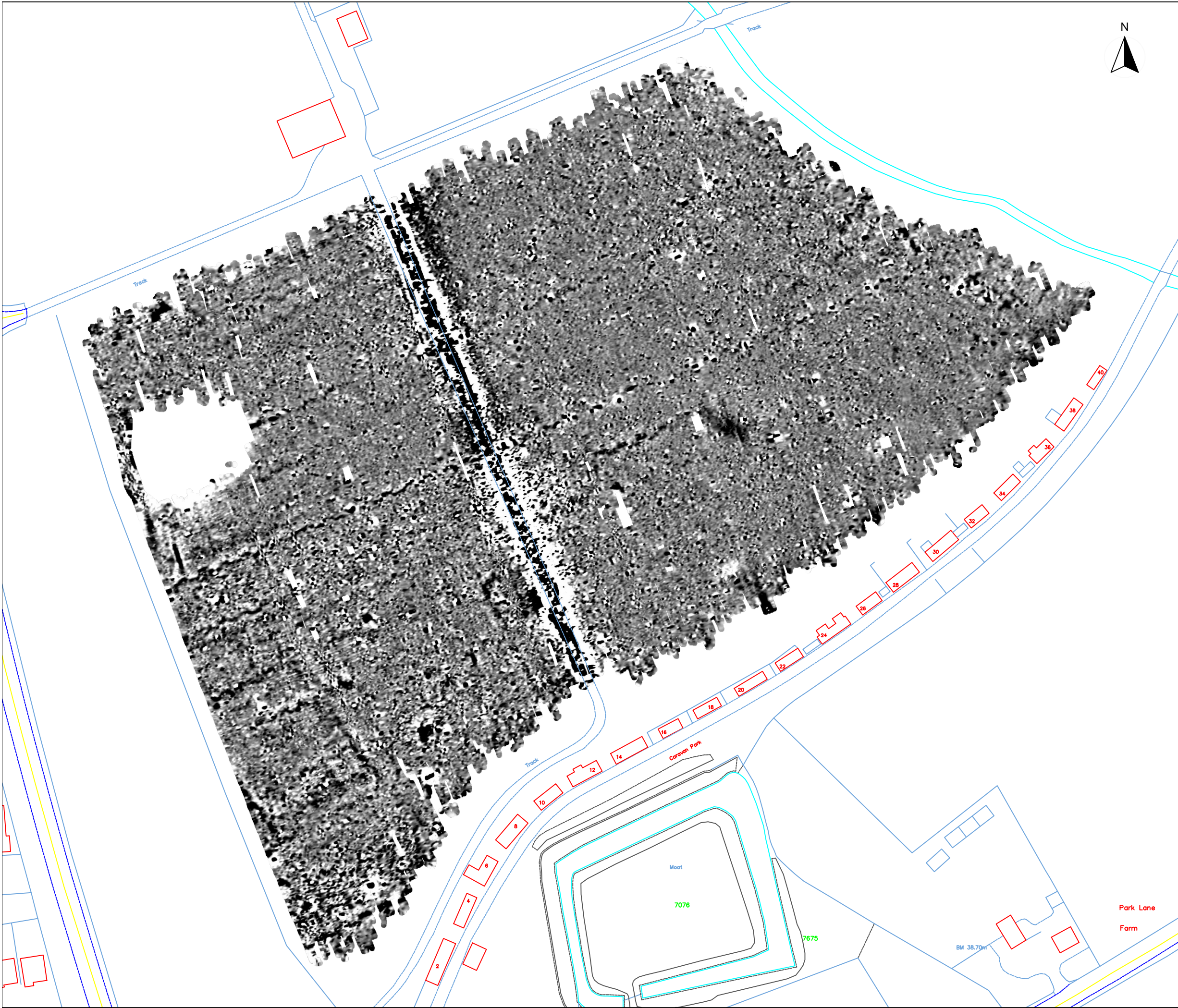
Title:  
**COLOUR PLOT OF GRADIOMETER DATA  
SHOWING EXTREME VALUES**

Client:  
**ALBION ARCHAEOLOGY**

Project:  
**J10458 - LAND EAST OF SAXON DRIVE,  
BIGGLESWADE**

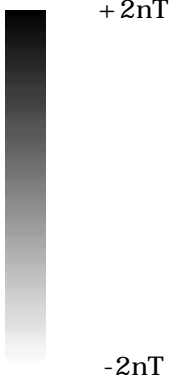
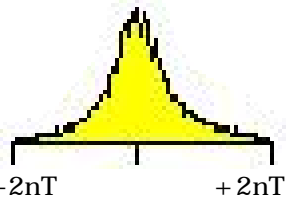
Scale: 1:1250 @ A3  
0m 10 20 30 40 50m  
Fig No:  
**03**





Plotting parameters

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



**STRATASCAN™**  
GEOPHYSICS FOR ARCHAEOLOGY  
AND ENGINEERING



Stratascan Ltd  
VINEYARD HOUSE  
UPPER HOOK ROAD  
UPTON UPON SEVERN  
WORCESTERSHIRE  
WR8 0SA  
TEL: 01684 59 22 66  
FAX: 0845 408 0653  
[www.stratascanSUMO.com](http://www.stratascanSUMO.com)

Title:  
**PLOT OF MINIMALLY PROCESSED  
GRADIOMETER DATA**

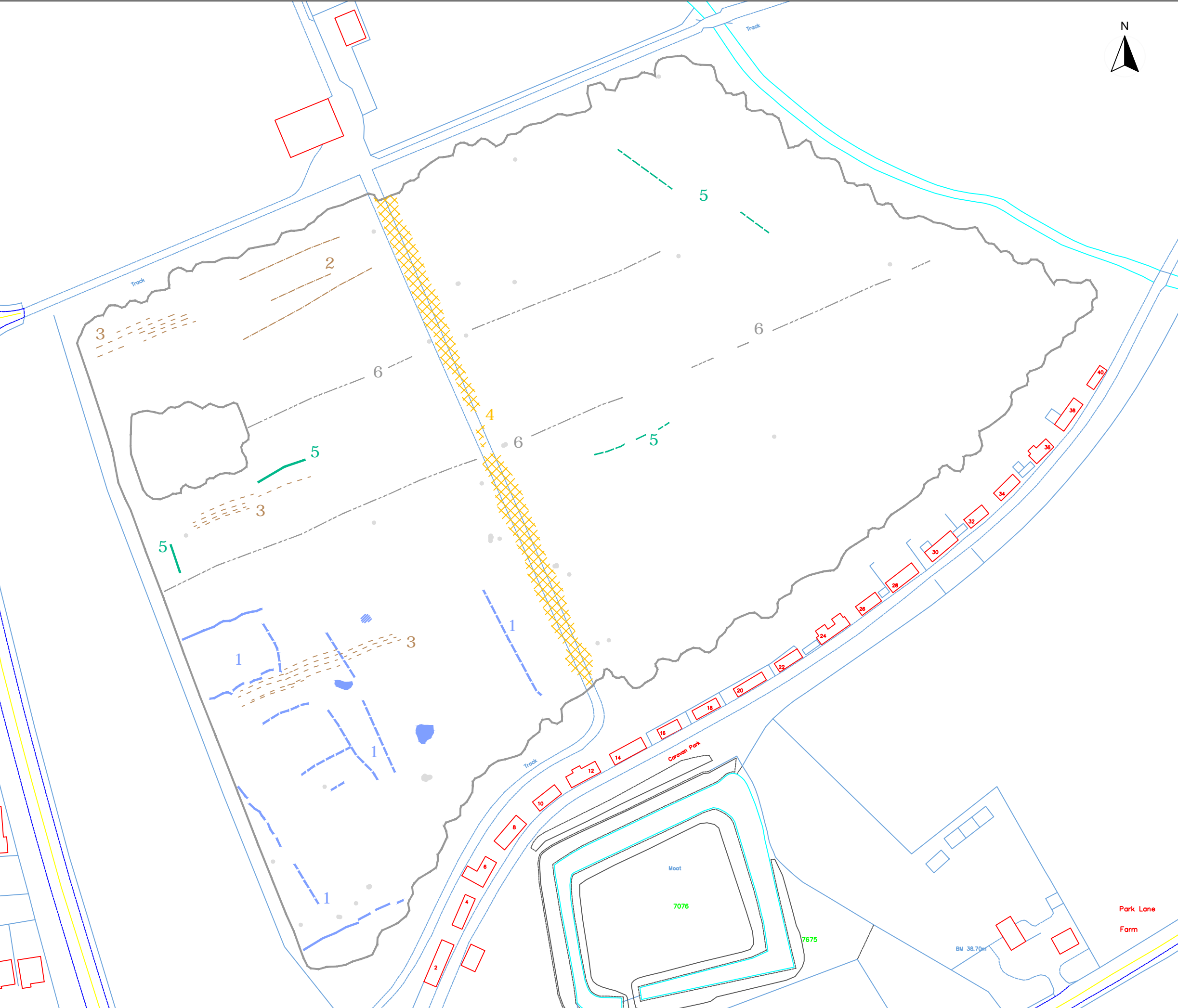
Client:  
**ALBION ARCHAEOLOGY**

Project:  
**J10458 - LAND EAST OF SAXON DRIVE,  
BIGGLESWADE**

Scale: 1:1250 @ A3  
0m 10 20 30 40 50m

Fig No:  
**04**





**KEY**

	Possible archaeology (positive/trend)
	Trackway
	Ridge and furrow
	Agriculture (e.g. ploughing)
	Land drain
	Ferrous
	Uncertain (positive//trend)

**STRATASCAN™**  
GEOPHYSICS FOR ARCHAEOLOGY  
AND ENGINEERING

**sumo**  
Survey  
Services

**Stratascan Ltd**  
VINEYARD HOUSE  
UPPER HOOK ROAD  
UPTON UPON SEVERN  
WORCESTERSHIRE  
WR8 0SA  
TEL: 01684 59 22 66  
FAX: 0845 408 0653  
[www.stratascanSUMO.com](http://www.stratascanSUMO.com)

Title:  
**ABSTRACTION AND INTERPRETATION OF  
GRADIOMETER ANOMALIES**

Client:  
**ALBION ARCHAEOLOGY**

Project:  
**J10458 - LAND EAST OF SAXON DRIVE,  
BIGGLESWADE**

Scale: 1:1250 @ A3

0m 10 20 30 40 50m

Fig No:  
**05**



*Survey services you can rely on*

## 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

