GEOPHYSICAL SURVEY REPORT G14112

Willow Farm
Evesham
Worcestershire

Client:

RPS

On Behalf Of:

AR Partners ltd

GSB PROSPECTION Ltd

Celebrating over 25 years
at the forefront of
Archaeological Geophysics

sumo Survey Services

GSB Survey Report No. G14112

Willow Farm, Evesham

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Survey Personnel

Field Co-ordinator:	Graeme Attwood MSc
Report Author:	Jimmy Adcock BSc MSc MIfA
Project Assistants:	Sam Dollman, Jon Tanner BSc MSc PIfA

Dates

Fieldwork:	8 - 10 December 2014
Report:	11 December 2014

Report Approved: Dr John Gater MIfA FSA

Background Project Details

NGR	SP 030 473
Location	Fields west and north of Willow Farm which lies on the north side of Chadbury Road, immediately west of Lenchwick approximately 4km north of Evesham.
HER/SMR	Worcestershire
District	Wychavon
Parish	Norton and Lenchwick CP
Topography	Gentle slopes down to the east, south and southeast in the western half of the site and down to the south and west in the eastern part of the application area.
Current Land Use	Stock-grazed pasture.
Soils	Evesham 2 (411b) association: calcareous clayey soils and some non-calcareous clayey and fine loamy or fine silty over clayey soils (SSEW 1983).
Geology	Bedrock comprises mudstone of the Blue Lias and Charmouth Mudstone formations (undifferentiated); no superficial deposits are recorded (BGS 2014).
Archaeology	None recorded within the application area and although once part of the Wood Norton Hall estate, there is no evidence that the proposed development area ever contained formal elements of landscaped parkland. The field layout has not changed significantly since first edition Ordnance Survey mapping (Slatcher 2014).
Survey Methods	Detailed magnetometer survey (fluxgate gradiometer).
Study Area	~11ha
HER ref	WSM66548

Aims

To locate and characterise any anomalies of possible archaeological interest within the study area. The work forms part of a wider archaeological assessment being carried out by **RPS Group Plc** on behalf of **AR Partners Ltd**.

Summary of Results

No anomalies with a clear archaeological character have been detected anywhere across the application area. Evidence of former agricultural practices comprises anomalies relating to ridge and furrow, more recent ploughing striations, possible land drains and magnetic disturbance near field edges (possibly indicating the dumping of material to consolidate the ground).

There are a few anomalies characterised as having an uncertain origin but in the context of the survey, they are unlikely to be of archaeological interest.

A low-slung power line has introduced a band of interference across areas 1, 2 and 3, but this is of limited breadth and unlikely to be masking anything of archaeological significance.

Method

All survey data points had their position recorded using Trimble R10 Real Time Kinematic (RTK) VRS Now GNSS equipment. The geophysical survey area is georeferenced relative to the Ordnance Survey National Grid.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	CARTEASY^{N} cart system (Bartington Grad 601 sensors)	0.75m	0.125m

All survey work is carried out in accordance with the current English Heritage guidelines (EH 2008).

Data Processing

Data processing was performed as appropriate using in-house software packages (CARTEASY^{N}) as outlined below.

Magnetic Data - CART

Zero Mean Traverse, Gridding

Interpretation

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: *Archaeology – ?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 *?Archaeology*. Details of the data plot formats and interpretation categories used are given in the Appendix: Technical Information at the end of the report.

General Considerations

Conditions for survey were generally good with the fields being under short pasture and relatively free of obstructions.

1.0 Survey Results - Magnetometer Survey

1.1 No anomalies of obvious archaeological origin have been detected within the application area. A series of parallel linear responses in Areas 1, 2 and 3 almost certainly originate from former ridge and furrow cultivation practices.

1.2 A few linear trends and poorly defined anomalies do not fall into an obvious interpretation category, so they have been classified as having an uncertain origin. They are most likely to be agricultural or natural rather than archaeological.

1.3 Very faint parallel linear anomalies can be seen running through Areas 3 and 4 on a roughly east-west alignment. These do not share an orientation with any of the existing field boundaries and therefore may be some form of drainage.

1.4 Zones of magnetic disturbance have been recorded, most notably across the northern edge of Area 2. This looks like modern disturbance, perhaps due to rubble or similar material having been introduced to consolidate the ground.

1.5 Small scale ferrous anomalies, best represented in the XY trace plots (see Archive CD) as small spikes, have been recorded in all areas. These are assumed to be a result of modern debris within the topsoil or on the ground surface unless *a priori* knowledge suggests otherwise. Only a representative sample are included on the interpretation diagram. Strong anomalies around the field edges are the result of agricultural implements and metal fencing whilst a band of interference across Areas 1 and 2 is the result of a low-slung power line; the limited breadth of the effect means it is unlikely to have masked anything significant.

2.0 Conclusions

2.1 The survey has not identified any anomalies which would readily be interpreted as having an archaeological origin. Given that ridge and furrow cultivation has been recorded, if archaeological features were present then any associated magnetic enhancement should have been detected.

References

BGS 2014	British Geological Survey, Geology of Britain Viewer http://mapapps.bgs.ac.uk/geologyofbritain/home.html 1:50,000 scale geology, centred on 404430,249482. Accessed 10/12/2014
EH 2008	*Geophysical Survey in Archaeological Field Evaluation.* English Heritage, Portsmouth, UK.
Slatcher, D 2014	*Historic Landscape Assessment in Connection with a Proposed Ground Mounted Solar Scheme at Willow Farm, Lenchwick, Worcestershire.* Unpublished report, October 2014, Ref: OXF8600. RPS, Leeds, UK.
SSEW 1983	*Soils of England and Wales. Sheet 5, South West England.* Soil Survey of England and Wales, Harpenden, UK.

GSB Prospection Ltd
Cowburn Farm, 21 Market Street
Thornton
Bradford
BD13 3HW
+44 (0)1274 835016

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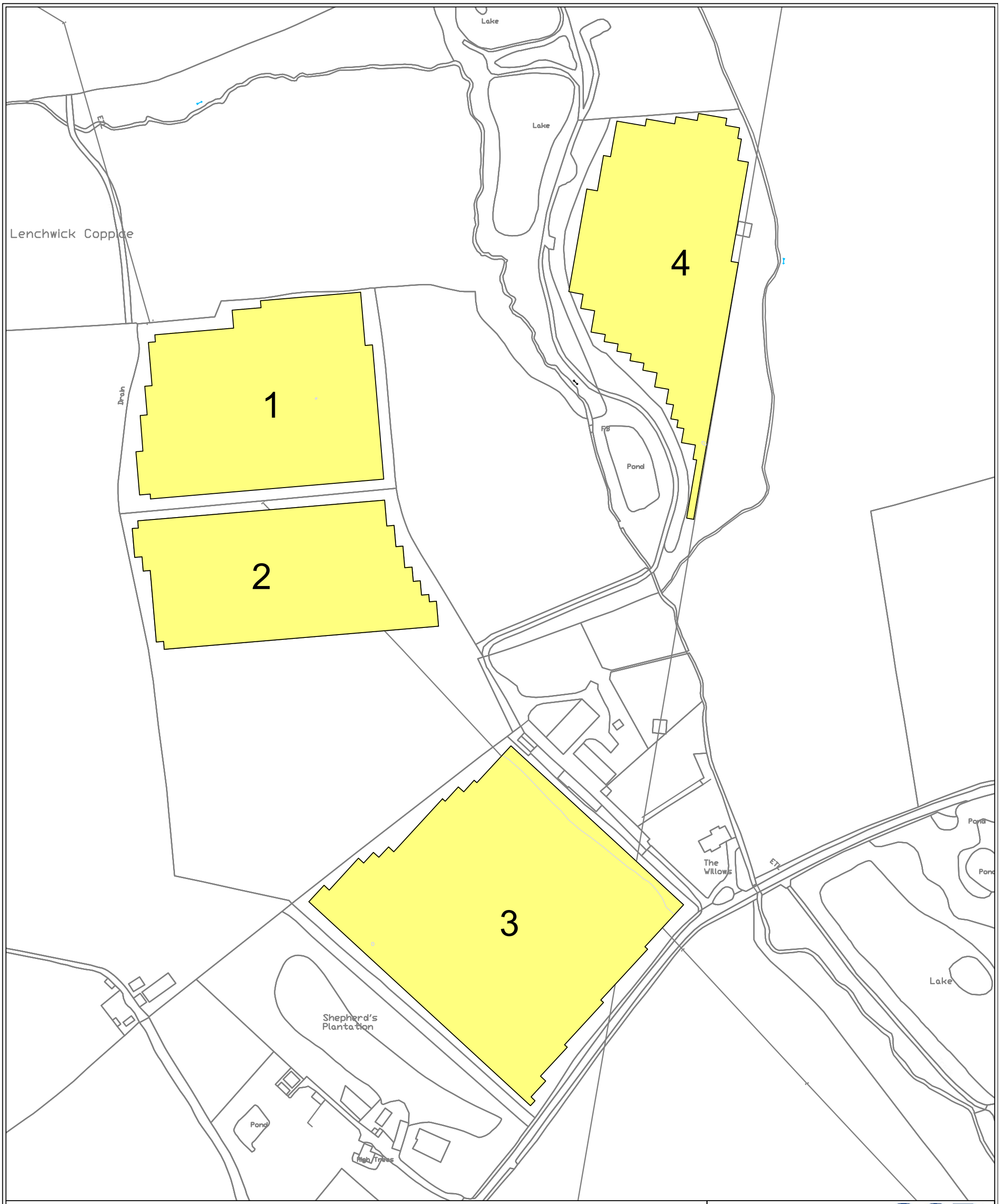
Title: Site Location Diagram

Drawn by: JMT

Figure 1



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Thornton
Bradford
BD13 3HW
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Title: Location of Survey Areas

Drawn by: GA

Figure 2

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Title: Magnetometer Survey - Greyscale Plots

Drawn by: GA

Figure 3

Lenchwick Coppice

Lake

Lake

Drain

1

2

3

4

Fm

Pond

The Willows

Pond

Pond

Lake

Shepherd's Plantation

Pond

High Trees

N

0 metres 100

1:2500 @ A3

Uncertain Origin (discrete anomaly / trend)

Ridge and furrow

Field drain

Ferrous / area of magnetic disturbance

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Title: Magnetometer Survey - Interpretation

Drawn by: GA

Figure 4

Appendix - Technical Information: Magnetometer Survey

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. 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.

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 (Destagger)	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.
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.

Display

XY Trace Plot	This involves a line representation of the data. Each successive row of data is equally incremented in the Y axis, to produce a stacked profile effect. This display may incorporate a hidden-line removal algorithm, which blocks out lines behind the major peaks and can aid interpretation. The advantages of this type of display are that it allows the full range of the data to be viewed and shows the shape of the individual anomalies. The display may also be changed by altering the horizontal viewing angle and the angle above the plane.
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.
3D Surface Plot	This is similar to the XY trace, but in 3 dimensions. Each data point of a survey is represented in its relative position on the x and y axes and the data value is represented in the z axis. This gives a digital terrain, or topographic effect.

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	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.
?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.
Increased Magnetic Response	An area where increased fluctuations attest to greater magnetic enhancement of the soils, but no specific patterns can be discerned in the data and no visual indications on the ground surface hint at a cause. They may have some archaeological potential, suggesting damaged archaeological deposits.
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.
Old Field Boundary	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions.
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.
Ploughing	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
Natural	These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions. Smaller, isolated responses which do not form such obviously 'natural' patterns but which are, nonetheless, likely to be natural in origin may be classified as *?Natural*.
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 *?Archaeology* and *?Natural* or (in the case of linear responses) *?Archaeology* and *?Ploughing*; occasionally they are simply of an unusual form.
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.
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.

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).

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Tel: +44 (0)1274 835016
Fax: +44 (0)1274 830212
Email: info@gsbsumo.com
Web: www.gsbprospection.com

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