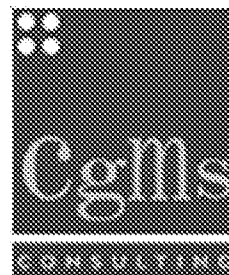


GEOPHYSICAL SURVEY REPORT G1613

**Land at Water Lane
Angmering
West Sussex**

Client:



On Behalf Of:

**Rydon Homes
and
Gleeson Strategic Land**

GSB
PROSPECTION Ltd

*Celebrating over 25 years
at the forefront of
Archaeological Geophysics*



GSB Survey Report No. G1613

Water Lane, Angmering, West Sussex

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Digital Content (CD)

- Minimally Processed Greyscale Images and XY Trace Plots in DWG format
- DWG Viewer
- Digital Copies of Report Text and Figures (both PDF and native formats)

Survey Personnel

Field Co-ordinator:	Alexis Thouki MA
Report Author:	Jon Tanner BSc MSc PlfA
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Dates

Fieldwork:	18-19 February 2016
Report:	25 February 2016

Report Approved: Dr John Gater MCifA FSA

Background Project Details

NGR	TQ 0755 0450
Location	The site is located approximately 2km north of the eastern extremity of Littlehampton, and is bounded to the north by Water Lane and to the east by the A280.
HER/SMR	West Sussex
District	Arun DC
Parish	Angmering CP
Topography	Flat
Current Land Use	Pasture and paddocks
Soils	Soils are unclassified (SSEW 1983).
Geology	Bedrock: Lambeth group – clay, silt and sand in the north and Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation and Culver Chalk Formation in the south. Superficial deposits: Head deposits – clay, silt, sand and gravel – in the north and undifferentiated river terrace deposits – sand, silt and clay in the south (BGS 2016).
Archaeology	Late Bronze Age, Iron Age and Romano-British occupation has been identified in the vicinity through findspots and evaluation excavations. There is also evidence of Saxon and Medieval activity (CgMs 2016).
Survey Methods	Detailed magnetometer survey (fluxgate gradiometer).
Study Area	c.10.5ha

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 **CgMs Consulting** on behalf of **Rydon Homes** and **Gleeson Strategic Land**.

Written Scheme of Investigation (WSI)

This project was carried out in accordance with a WSI submitted to the West Sussex CC.

Summary of Results

A number of anomalies of archaeological interest were detected; a group of ditches form a complex of enclosures and possible trackways. Adjacent pit-like anomalies may also have archaeological potential. Former trackways recorded on historic mapping and visible on satellite imagery were identified and past cultivation was recorded. Modern activity and natural effects are the source of numerous other anomalies.

Method

All survey grid positioning was carried out using Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS equipment. The geophysical survey areas are georeferenced relative to the Ordnance Survey National Grid by tying in to local detail and corrected to the mapping provided by the client; these are presented in Figure 2. Please refer to this diagram when re-establishing the grid or positioning trenches.

Technique	Instrument	Traverse Interval	Sample Interval
Magnetometer	Bartington Grad 601-2	1m	0.25m

All survey work is carried out in accordance with the current Historic England (then English Heritage) and Chartered Institute for Archaeologists guidelines (IfA 2002, EH 2008, ClfA 2014).

Data Processing

Data processing was performed as appropriate using an in-house software package (GeoSuB) as outlined below.

Magnetic Data

Zero Mean Traverse, Step Correction (De-stagger) and Interpolation (on the Y axis).

Limitations

Magnetic survey is an effective technique for site evaluation, providing fast data acquisition and responding, to some degree, to the majority of archaeological site-types. The technique relies upon enhancement of naturally occurring iron-bearing compounds in the soil through anthropogenic activity. Detection rates can be poor where archaeological sites have only seen temporary and/or sporadic occupation or where there is insufficient activity to drive the enhancement; this is often true of Lithic-era sites. Success may also be limited over soils which are naturally deficient in iron compounds. Conversely, soils overlying (or derived of) naturally magnetic geological units, for example igneous formations, will produce strong responses which may mask subtler archaeological enhancement within.

The presence of ferrous structures above or below ground (buildings, pylons, fences, pipes etc.) will produce very strong magnetic fields extending far beyond their physical footprint. The strength of these magnetic 'shadows' is such that it will mask practically any archaeological anomalies. Similarly, later features and demolition spreads or imported consolidation material can produce areas of magnetic disturbance that will mask underlying features.

As a general rule, the Bartington Grad 601 sensors allow for a depth of investigation of approximately 1.0m, depending on the strength of the field produced by the buried feature; below this depth only particularly enhanced material will be detected with any kind of confidence.

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

Site conditions were generally acceptable for survey. The narrow field north of Area 7 and some small areas in the north were waterlogged and muddy, which accounts for small gaps in the data.

1.0 Survey Results - Magnetometer Survey

- 1.1 A number of relatively magnetically strong and well-defined linear responses in Areas 2 and 3 are ditch-like in form and appear to form a complex of enclosures. The absence of anomalies or enhanced magnetic response within the enclosures suggest a field system, as opposed to settlement; parallel ditches [1, 2, 3] may represent trackways or droveways. They are all therefore classified as *?Archaeology*.
- 1.2 A positive anomaly or group of anomalies [4] in Area 3 is almost rectilinear in shape, and is on a different orientation to the enclosures, with an abutting linear response (possibly two) that is parallel to the adjacent ditches. A very strong magnetic response at the north-east angle of anomaly [4] could be coincidental or part of the anomaly; it could be due to a ferrous object or a past burning event. No structures or features are depicted on historic mapping (OS 2016) in this position and the responses are therefore placed in the category *?Archaeology*.
- 1.3 Several pit-like anomalies in Area 3 have been categorised as *?Archaeology* due to their proximity to the enclosure ditches described above. However, they form no obvious pattern, and it is difficult to make a confident interpretation as natural features produce very similar responses, as does more modern human activity (e.g. more deeply buried ferrous debris).
- 1.4 Responses interpreted as of an uncertain origin have been identified across the survey areas. These responses include pit-like anomalies and trends within the data. They lack the defined morphology of anomalies that might be interpreted as of an archaeological origin and may reflect natural soil or geological variations and/or agricultural features. However, an archaeological origin should not be entirely ruled out for some of these anomalies.
- 1.5 A linear anomaly traversing Area 2 (south) resembles the response from that of a pipe, but correlates with a former field division visible on online satellite imagery.
- 1.6 A band of magnetic disturbance [5] in Area 2 (south) corresponds with a track depicted on historic mapping and still shown on the 1938-73 edition (OS 2016). Similar strips of magnetic disturbance [6] in Area 4 represent former, but relatively recent, trackways visible on online satellite imagery. The track may continue across Area 3 as a trend, shown on Figure 4 as a trend of uncertain origin.
- 1.7 A general spread of magnetic disturbance in Area 4 is probably of relatively recent origin, possibly due to consolidation material; however, such responses are frequently recorded in areas used for equestrian purposes. This is also likely to account for the magnetic disturbance in Area 2 (west).
- 1.8 Evidence of past agriculture was detected as relatively weak parallel linear responses in Area 1. Whilst these are probably due to relatively recent ploughing, past and ridge and furrow cultivation should not be discounted.
- 1.9 The datasets for Areas 5, 6 and 7 are dominated by magnetic disturbance, with a few magnetically weak and somewhat amorphous responses. These anomalies can be attributed to a combination of the waterlogged conditions adjacent to the stream, the equestrian land use and the scattered debris observed in these fields.
- 1.10 An area of positive response in the north of Area 3 is relatively weak and indistinct, and is likely to have a natural origin.
- 1.11 A small pipe was detected in the south of Area 3, probably serving a water trough or similar.
- 1.12 A large ferrous response in the south of Area 3 is due to an animal feeder. Ferrous responses adjacent to the edges of survey areas are due to fences, gates and adjacent buildings. Smaller scale ferrous anomalies ("iron spikes") are present throughout the data, and their form is best illustrated in the XY trace plots. These responses are characteristic of small pieces of ferrous debris in the topsoil and are commonly assigned a modern origin. The most prominent of these are highlighted on the interpretation diagram

2.0 Conclusions

- 2.1 The survey detected a number of ditches forming a complex of enclosures and possible trackways. An adjacent rectilinear anomaly and a number of pit-like responses may also be of archaeological interest.
- 2.2 Numerous discrete anomalies and trends are of uncertain origin, although natural or agricultural causes are the most likely.
- 2.3 Former trackways, some relatively recent, and a field division were detected.
- 2.4 Areas of magnetic disturbance are due to a combination of natural causes and modern activity.

References

- BGS 2016 British Geological Survey, Geology of Britain Viewer
<http://mapapps.bgs.ac.uk/geologyofbritain/home.html>
1:50 000 scale geology, centred on 507554, 104500. Accessed 24/02/2016.
- CgMs 2016 *Archaeological Desk Based Assessment: Water Lane, Angmering, West Sussex*
Unpublished report, CgMs Consulting, London
- ClfA 2014 *Standard and Guidance for Archaeological Geophysical Survey*. ClfA Guidance
note. Chartered Institute for Archaeologists, Reading
[http://www.archaeologists.net/sites/default/files/node-
files/ClfAS&GGeophysics_1.pdf](http://www.archaeologists.net/sites/default/files/node-files/ClfAS&GGeophysics_1.pdf)
- EH 2008 *Geophysical Survey in Archaeological Field Evaluation*. English Heritage,
Portsmouth.
- 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
- OS 2016 <http://www.old-maps.co.uk/maps.html>., centred on 507554, 104500. Accessed
24/02/2016.
- SSEW 1983 *Soils of England and Wales. Sheet 6, South East England*. Soil Survey of England
and Wales, Harpenden.



0 metres 2000



1:50,000 @ A4



Site Location

GSB Propection Ltd
Cowburn Farm, 21 Market Street
Thornton
Bradford
BD13 3HW



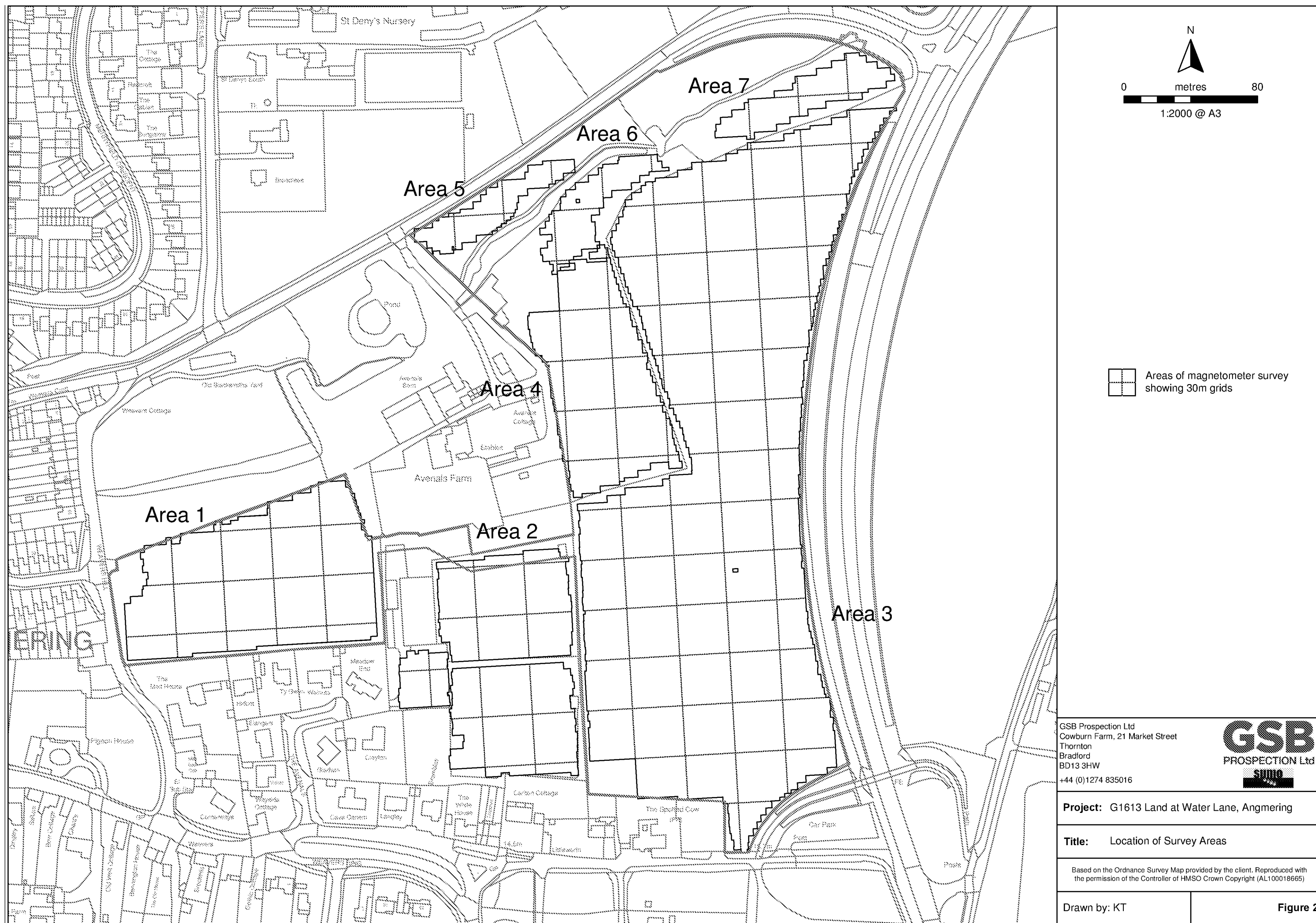
Project: G1613 Water Lane, Angmering,
West Sussex

Title: Site Location Diagram

Reproduced from the Ordnance Survey Map with the permission
of the Controller of HMSO © Crown Copyright (AL100018665)

Drawn by: JMT

Figure 1



Appendix - Technical Information: Magnetometer Survey

Instrumentation: Bartington *Grad601-2* / 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.

<i>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>?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>Increased Magnetic Response</i>	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.
<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>Old Field Boundary</i>	Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions.
<i>Ridge & Furrow</i>	Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases the response may be the result of more recent agricultural activity.
<i>Ploughing</i>	Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.
<i>Natural</i>	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 <i>?Natural</i> .
<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>?Archaeology</i> and <i>?Natural</i> or (in the case of linear responses) <i>?Archaeology</i> and <i>?Ploughing</i> ; occasionally they are simply of an unusual form.
<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>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.

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).