# Meridian Solar Farm

EN010169

**Volume 6**

**Environmental Statement**

**6.3 ES Appendix 8-2: Historic Environment Desk Based Assessment - Appendix D.1 - Part 10**

APFP Regulation 5(2)(a)

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

**March 2026**

534000

534200

314400

314200

D-3-05

D-3-06

D-4



Minimally Processed Gradiometer Data – XY Trace

Figure 7.101

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.101 | |
| Created by: AC | Date: 18/06/2025 |
| Checked by: SO | Date: 18/06/2025 |
| Approved by: SO | Date: 18/06/2025 |

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Minimally Processed Gradiometer Data – XY Trace

Figure 7.102

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.102 | |
| Created by: AC | Date: 18/06/2025 |
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Minimally Processed Gradiometer Data – XY Trace

Figure 7.103

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.103 | |
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Holbeach Drove Gate



Minimally Processed Gradiometer Data – XY Trace

Figure 7.104

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.104 | |
| Created by: AC | Date: 18/06/2025 |
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Minimally Processed Gradiometer Data – XY Trace

Figure 7.105

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.105 | |
| Created by: AC | Date: 18/06/2025 |
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Waltons Farm

D-6

Langary Gate Rd

D-5-02



Minimally Processed Gradiometer Data – XY Trace

Figure 7.106

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.106 | |
| Created by: AC | Date: 18/06/2025 |
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D-3-06

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Langary Gate Rd



Minimally Processed Gradiometer Data – XY Trace

Figure 7.107

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.107 | |
| Created by: AC | Date: 18/06/2025 |
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D-3-06

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Minimally Processed Gradiometer Data – XY Trace

Figure 7.108

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.108 | |
| Created by: AC | Date: 18/06/2025 |
| Checked by: SO | Date: 18/06/2025 |
| Approved by: SO | Date: 18/06/2025 |

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D-6

D-7

D-4

Langany Gate Rd



Minimally Processed Gradiometer Data – XY Trace

Figure 7.109

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.109 | |
| Created by: AC | Date: 18/06/2025 |
| Checked by: SO | Date: 18/06/2025 |
| Approved by: SO | Date: 18/06/2025 |

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534400

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D-4





Minimally Processed Gradiometer Data – XY Trace

Figure 7.110

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.110 | |
| Created by: AC | Date: 18/06/2025 |
| Checked by: SO | Date: 18/06/2025 |
| Approved by: SO | Date: 18/06/2025 |

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533800

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534200

313600

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D-4

D-6

D-5

Langany Gate Rd

Langany Gate Rd





Minimally Processed Gradiometer Data – XY Trace

Figure 7.111

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.111 | |
| Created by: AC | Date: 18/06/2025 |
| Checked by: SO | Date: 18/06/2025 |
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534200

313400

313200

D-6

D-5

Cheviot House

Fleet Drain



Minimally Processed Gradiometer Data – XY Trace

Figure 7.112

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.112 | |
| Created by: AC | Date: 18/06/2025 |
| Checked by: SO | Date: 18/06/2025 |
| Approved by: SO | Date: 18/06/2025 |

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534200 534400 534600

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D-5

Fleet Drain



Minimally Processed Gradiometer Data – XY Trace

Figure 7.113

50 nT
-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.113 | |
| Created by: AC | Date: 18/06/2025 |
| Checked by: SO | Date: 18/06/2025 |
| Approved by: SO | Date: 18/06/2025 |

AOC Archaeology Group

533800

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D-5-02



Minimally Processed Gradiometer Data – XY Trace

Figure 7.114

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: 05/40648/GEO/7.114 | |
| Created by: AC | Date: 18/06/2025 |
| Checked by: SO | Date: 18/06/2025 |
| Approved by: SO | Date: 18/06/2025 |

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533600 533800 534000

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Langaly Gate Rd

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D-5-02

Gedney Hill Golf Cl



Minimally Processed Gradiometer Data – XY Trace

Figure 7.115

50 nT

-50 nT

N

0 30m

Scale: 1:1,250 @ A3

| | |
|---|---|
| Drawing Number: | 05/40648/GEO/7.115 |
| Created by: AC | Date: 18/06/2025 |
| Checked by: SO | Date: 18/06/2025 |
| Approved by: SO | Date: 18/06/2025 |

AOC Archaeology Group

# Appendix 1: Survey Metadata

**Oasis ID: aocarcha1-523165**

| Field | Description |
|---|---|
| Surveying Company | AOC Archaeology Group |
| Data collection staff | K.Wade, R.Haywood, V.Huggett, A.Galt, G.Bruce, R.Legg |
| Client | Downing Renewable Developments LLP |
| Site name | Meridian |
| County | Lincolnshire |
| NGR | NGR TF 29061 13240 (centre) |
| Land use/ field condition | Agricultural land |
| Duration | December 2023 – February 2025 |
| Weather | Various |
| Survey type | Gradiometer Survey |
| Instrumentation | Bartington cart survey: Bartington Non-Magnetic Cart, six Bartington Grad 601-2, Trimble R10 GNSS System<br>Sensys cart survey: Sensys MXPDA cart, sixteen FGM650/3 sensors, Carlson GNSS System |
| Area covered | 985ha |
| Download software | MLGrad601 |
| Processing software | Geomar, MultiGrad601 and TerraSurveyor |
| Visualisation software | ArcGIS Pro |
| Geology | Various, see paragraph 2.3 (BGS, 2025) |
| Soils | Various, see paragraph 2.3 (Soilscapes 2025) |
| Scheduled Ancient Monument | YES |
| Known archaeology on site | Yes |
| Historical documentation/ mapping on site | Yes |
| Report title | Meridian Solar Farm, Lincolnshire: Archaeological Geophysical Survey: Interim Report |
| Project number | 40648 |
| Report Author | Anna Chmielowska BA MA PhD MCIfA |
| Quality Checked by | Susan Ovenden BSc (Hons) PhD MCIfA FSA Scot |

# Appendix 2: Archaeological Prospection Techniques, Instrumentation and Software Utilised

## Gradiometer Survey

Gradiometer surveys measure small changes in the earth's magnetic field. Archaeological materials and activity can be detected by identifying changes to the magnetic values caused by the presence of weakly magnetised iron oxides in the soil (Aspinall et al., 2008, 23; Sharma, 1997, 105). Human habitation often causes alterations to the magnetic properties of the soils and sediments present in the area (Aspinall et al, 2008, 21). There are two physical transformations that produce a significant contrast between the magnetic properties of archaeological features and the surrounding soil: the enhancement of magnetic susceptibility and thermoremnant magnetization (Aspinall et al., 2008, 21; Heron and Gaffney 1987, 72).

Ditches and pits can be easily detected through gradiometer survey as the topsoil within and around settlements generally has a greater magnetisation than the subsoil; caused by human activity. This enhanced material accumulates in cut features such as ditches and pits. Areas of burning or materials which have been subjected to heat commonly also have high magnetic signatures, such as hearths, kilns, fired clay and mudbricks (Clark 1996, 65; Lowe and Fogel 2010, 24).

It should be noted that negative anomalies can also be useful for characterising archaeological features. If the buried remains are composed of a material with a lower magnetisation compared to the surrounding soil, the feature in question displaying a negative signature. For example, stone- built structures that are composed of sedimentary rocks are frequently non-magnetic and so will appear as negative features within the dataset if the local soils and sediments are at all magnetised.

Ferrous objects – i.e. iron and its alloys - are strongly magnetic and are typically detected as high-value peaks in gradiometer survey data; small (in spatial terms) spikes are generally assumed to derive from ferrous material of recent origin (e.g. stray bits of farm equipment) in the topsoil, though archaeological sources cannot be ruled out. Broader dipolar anomalies and those with diagnostic characteristics of form will be assigned to other classifications based on their character, which might include archaeology, burning, modern ferrous or uncertain.

Although gradiometer surveys have been successfully carried out in all areas of the United Kingdom, the effectiveness of the technique is lessened in areas with complex geology, particularly where igneous and metamorphic bedrock is present or there are layers of alluvium or till between the surface and the layers of interest. All magnetic geophysical surveys must therefore take the effects of background geological and geomorphological conditions into account.

### Bartington Non-Magnetic Cart Instrumentation and Software

AOC Archaeology's cart-based surveys are carried out using a Bartington Non-Magnetic Cart. The cart enables multiple traverses of data to be collected at the same time, increasing the speed at which surveys may be carried out and offers the benefits of reduced random measurement noise and rapid area coverage (Schmidt et al 2015, 60-62, David et al. 2008, 21).

The cart uses a configuration of six Grad-01-1000L sensors mounted upon a carbon fibre frame along with two DL601 dataloggers and one BC601 battery cassette. The sensors are normally positioned at 1m intervals on a horizontal bar, with the datalogger taking readings every 12.5cm along each traverse, though this can be altered to increase / reduce resolution if required. The data is georeferenced via a Trimble R10 Real Time Kinematic (RTK) VRS Now GNSS GPS which streams data throughout survey and allows the data to be recorded relative to a WGS1984 UTM coordinate system.

The gradiometer data is collected through Geomar MLGrad601 software on a laptop in real-time during the survey. The data is downloaded and converted into a .xyz file in Geomar MultiGrad601 before being processed along with the GPS data in TerraSurveyor v3.0.34.10 (see Appendix 3 for a summary of the processes used in Geoplot to create final data plots).

## Sensys MAGNETO® MXPDA Non-Magnetic Cart Instrumentation and Software

AOC Archaeology's cart-based surveys are carried out using a Sensys MAGNETO® MXPDA tow-cart magnetometer system. The cart enables multiple traverses of data to be collected at the same time, increasing the speed at which surveys may be carried out and offers the benefits of reduced random measurement noise and rapid area coverage (Schmidt et al 2015, 60-62, David et al. 2008, 21).

The cart uses a configuration of sixteen FGM650/3 fluxgate gradiometer sensors mounted upon a frame along with data logging equipment. The sensors are normally positioned at 0.5m intervals along the cart frame, with the data being collected in a constant stream through the data acquisition unit MXPDA. The data is georeferenced via a Carlson Real Time Kinematic (RTK) VRS Now GNSS GPS which streams data throughout survey and allows the data to be recorded relative to a WGS1984 UTM coordinate system. Whilst the cart is surveying, the data acquisition is visualised through a tablet PC which is connected in the ATV.

The data is downloaded via USB and converted using DLMGPS and Geoserver, before being processed (compensated) using MAGNETO® 3.0 software (see Appendix 3 for a summary of the processes used in MAGNETO® to create final data plots).

# Appendix 3: Summary of Data Processing

| Process | Effect |
|---|---|
| Clip | Limits data values to within a specified range |
| De-spike | Removes small spatial scale exceptionally high readings in the data. In resistivity survey, these can be caused by poor contact of the mobile probes with the ground. In gradiometer survey, these can be caused by highly magnetic items such as buried modern ferrous objects. |
| De-stagger | Corrects a misalignment of data when the survey is conducted in a zig-zag traverse pattern. |
| Discard Overlap (TerraSurveyor) | Removes datapoints which occur too closely together and can cause digital artefacts in the data which are caused by the overlapping of parallel traverses. |
| Edge Match | Counteracts edge effects in grid composites by subtracting the difference between mean values in the two lines either side of the grid edge from one of the grids. |
| Filter (MAGNETO) | Much like a zero mean traverse, it resets the median value of each point to zero, in order to address the effect of striping in the data and counteract edge effects. In MAGNETO the individual values take into account the value of all uncorrected points within a certain distance to create its own median. |
| GPS Filter (MAGNETO) | Used to either remove or reduce the appearance of constant and reoccurring features that are not consistent with the GPS signal in use by the cart system. |
| High pass filter | Removes low-frequency, large spatial scale variance in order to remove background trends in the data, such as variations in geology. |
| Interpolate | Increases the resolution of a survey by interpolating new values between surveyed data points, creating a smoother overall effect. |
| Low Pass filter | Uses a Gaussian filter to remove high-frequency, small spatial scale variance, typically for smoothing the data. |
| Periodic Filter | Used to either remove or reduce the appearance of constant and reoccurring features that distort other anomalies, such as recent plough lines. |
| Remove Turns (TerraSurveyor) | Uses analysis of the direction of travel derived from the GNSS data to break continuous streams of data into individual traverses. |
| Zero Mean Grid | Resets the mean value of each grid to zero, in order to counteract grid edge discontinuities in composite assemblies. |
| Zero Mean Traverse | Resets the mean value of each traverse to zero, in order to address the effect of striping in the data and counteract edge effects. |

## Processing Steps

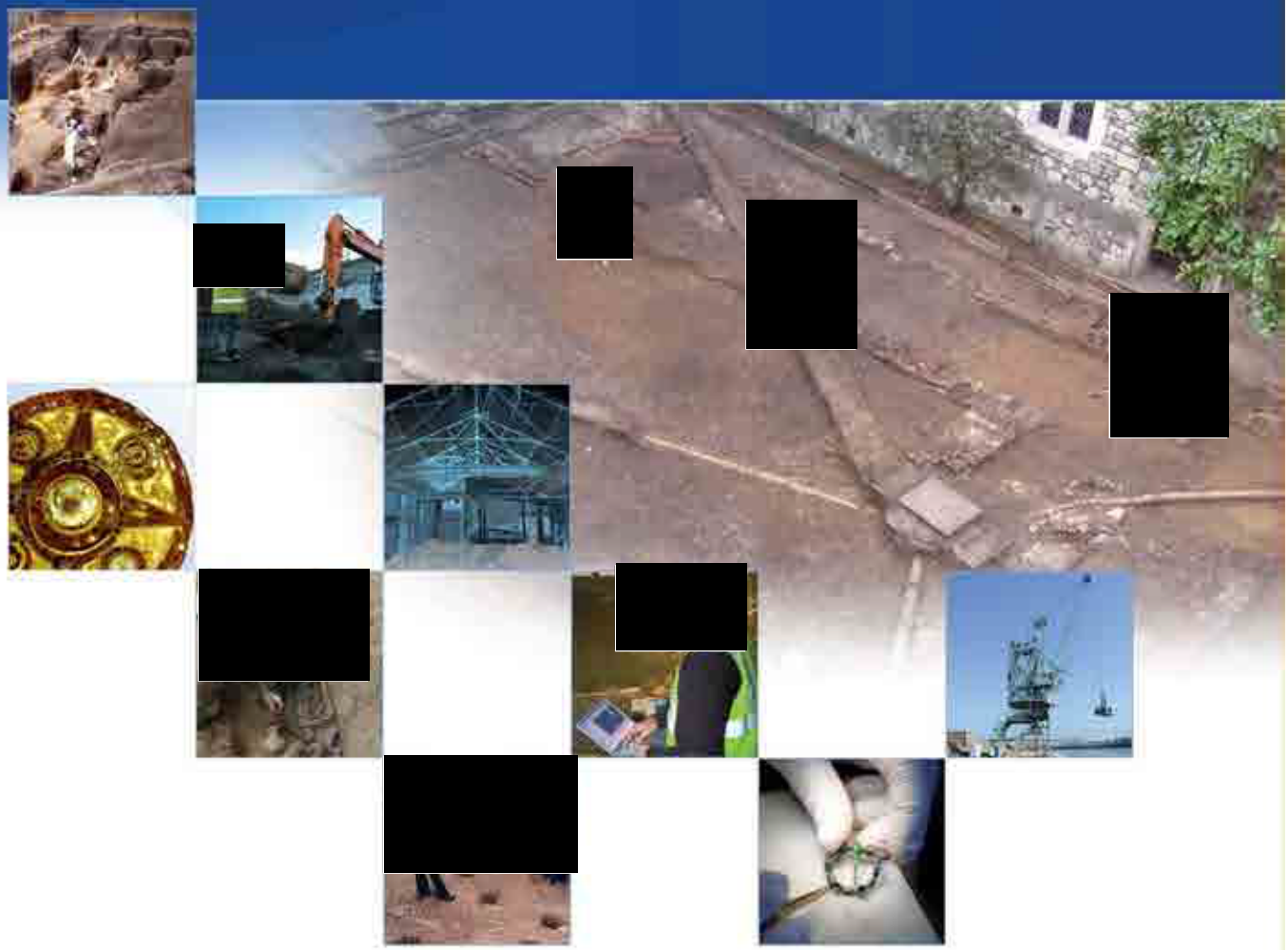
| **Bartington Cart survey** | |
|---|---|
| **Process** | **Extent** |
| Base Settings | Interval 0.121m, Track Radius 1.06m |
| Remove Turns | Threshold Angle 90°, Cut Length 5m |
| Discard Overlap | Threshold Distance 0.4m, Minimum Track 5, Newest |
| Despike | Mean Diameter 3 Threshold 12 |
| Destripe | Mean Traverse SD 1.5 |
| High Pass Filter | Uniform (Median) 12 |
| Clip | -30/30 |

| **Sensys Cart survey** | |
|---|---|
| **Process** | **Extent** |
| Filter | Moving median with 15 metre rolling median (import with a minimum of 5 GPS points) |
| GPS filter | 1Hz with angle correction |
| Clip | No compensation |
| Interpolate | X = 0.2 metres, Y = 0.2 metres<br>Interpolation output = Bi-linear triangle |
| Raw Palette Scale | User colour palette (256 colours)<br>Min= -5nT Max= 5nT |
| Palette Scale | User colour palette (256 colours)<br>Min= -5nT Max= 5nT |

# Appendix 4: Technical Terminology

| Type of Anomaly | Description of Type/Class and rationale for interpretation |
|---|---|
| Anomaly | Usually linear / curvilinear / rectilinear / discrete anomalies characterised by a sharp-edged increase or decrease in values compared to the magnetic background. Some interpretation classes may have more gradual transitions in magnetic character- this is used as part of the classification process. |
| Spread | Spreads of enhanced material refer to diffuse areas of altered magnetic character, which suggest a localised spread of material with a magnetic contrast within the topsoil or ploughzone or a generalised enhancement of the magnetic properties over a specific area. These anomalies do not have the high dipolar response characteristic of ferrous material anomaly unless specifically classified as a spread of ferrous debris. |
| Linear Trend | Linear trends are less distinct and are typically visible as linear patterning in the overall texture of the data. A common example of these is the striping effect caused by recent ploughing. |

| Class of Anomaly | Description |
|---|---|
| ***Probable Archaeology*** | Interpretation is supported by the presence of known archaeological remains or by other forms of evidence such as HER records, LiDAR data or cropmarks identified through aerial photography. OR the data contains diagnostic anomalies in terms of character or morphology which allow a secure interpretation. Anomalies typically have well defined edges with abrupt transitions indicative of cut features with magnetically enhanced fills, such as ditches. Discrete anomalies will be checked on XY traces for their magnetic character; discrete anomalies in this class likely to be cut features such as pits; anomalies indicating high temperature processes will alternatively classified as 'burned area' - see below. Ferrous material creates distinct 'spikes' and is classified as such. |
| ***Possible Archaeology*** | Anomalies are interpreted as likely to have an archaeological origin, though other explanations are also possible, but less likely. Anomalies typically have well defined edges with abrupt transitions indicative of cut features with magnetically enhanced fills, such as ditches. Discrete anomalies checked on XY traces; discrete anomalies in this class likely to be cut features such as pits; anomalies indicating high temperature processes classified as 'burned area' - see below. |
| ***Burned Area*** | An anomaly with a form on the XY trace plot that is characteristic of high temperature activity such as a kiln or hearth. Should be considered as possible archaeology and should be assigned an anomaly number if a more specific interpretation is possible based on the anomaly characteristics (for example, a clear kiln) so that this can be discussed in text. |
| **Historical Features** | Features observed on historical mapping that correspond with anomalies in the data. Linear anomalies caused by removed field boundaries often exhibit distinct characteristics related to the removal process. Areas of enhanced magnetism in this class could relate to former buildings, trackways, quarries or ponds and their nature should be clarified with the use of anomaly numbers and discussion in the results section. |
| **Unclear Origin** | These anomalies are (often) magnetically weak and discontinuous or isolated making their context difficult to ascertain. OR they are indistinct for other reasons such as magnetic disturbance in their vicinity. Anomalies in this category have no more likely explanation than another, so whilst an archaeological origin is possible, an agricultural, geological, or modern origin is also equally likely. |
| **Agricultural** | Anomalies associated with agricultural activity, either historical (unless shown on a map, then classed as a historical feature) or modern. Usually, this interpretation is arrived at due to on the ground observations of (for example) ploughing, access tracks and the like, or from observation of recent aerial images of the survey area. Recent ploughing is shown as a dashed line and Ridge and Furrow ploughing is shown as a solid line. |
| **Ridge and Furrow / Rig and Furrow** | A series of regular linear or slightly curvilinear anomalies which are broad and usually have diffuse edges, either composed of an increased or decreased magnetic response compared to background values. Wide regular spacing between the anomalies is consistent with that of a ridge and furrow / rig and furrow ploughing regime, and the regime may also have a degree of sinuosity characteristic of certain types of ridge and furrow cultivation. Often, multiple directions will be present, with distinct headlands in between. The pattern might follow the general landscape organisation, or it may radically differ from it, depending on the local sequence of inclosure. The anomalies often present as a positive 'ridge' anomaly adjacent to a negative 'furrow' anomaly. |
| **Ploughing Trends** | A series of regular linear anomalies or changes in the texture of the survey data, either composed of an increased or decreased magnetic response compared to background values. Anomalies seen parallel to field edges are representative of headlands caused by ploughing. |
| **Drains** | A series of magnetic linear anomalies (often with a characteristic alternating positive-negative pattern, which indicates a ceramic drain) of an indeterminate date, usually with a regular dendritic or herringbone patterning which reflects the topography of the survey area. |
| **Geology / Natural** | An area of enhanced magnetism that is composed of irregular (usually) weak increases or decreases in magnetic values, frequently with gradual transitions in character, compared with background readings. These are likely to indicate natural variations in soil composition or reflect variations in the bedrock or superficial geology. In areas where former water courses were present, paleochannels may present as distinct curving and banded or braided linear anomalies. |
| **Service** | Strong linear anomalies often composed of contrasting high positive and negative dipolar values, with a halo of magnetic disturbance extending from the causative body. Such anomalies are characteristic of below-ground services. |
| **Magnetic Disturbance** | A zone of strong magnetic response (usually alternating between positive and negative with abrupt transitions) that has been caused by modern infrastructure or ferrous material within or adjacent to the survey area, such as metallic boundary fencing, gateways. The magnetic haloes around services and changes in the background texture of the data resulting from overhead power lines also fall into this class. These haloes are strong enough to obscure other anomalies (including those of possible archaeological interest) in the area they affect. |
| **Ferrous Anomalies / Ferrous (iron spikes) and ferrous or debris spreads** | A response caused by ferrous materials on the ground surface or within the subsoil, which causes a strong but localised dipolar response in the data. These generally represent modern material often re-deposited during manuring, rubbish at field edges and spreads of debris or building material used to surface tracks or left behind following demolition. Distinct from magnetic disturbance, these anomalies relate to material at their spatial location, rather than an effect occurring at a distance from the material responsible. |
| **Free Category for custom use** | A category which may be employed to denote specifically identified anomalies related to known past activity within the area, for example those definitely associated with a former airfield, or mapped former mineral extraction. |



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