

Substrata

Archaeological Geophysical Surveyors

An archaeological magnetometer survey

**Land north-west of Berkeley
Gloucestershire**

Centred on NGR 368218,200023

Report: 1803BER-R-1

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1 Introduction

This report presents the results of an archaeological geophysical survey at the site listed below, hereafter referred to as the Site. It was commissioned by Cotswold Archaeology on behalf of Redrow Homes as part of a programme of archaeological work covering a proposed residential development.

The survey and report were completed in compliance with a Survey Method Statement (Dean, 2018). The Site location is shown in Figure 1.

2 Survey description

2.1 Survey

Method: shallow depth magnetometer survey
Instrument: twin-sensor fluxgate gradiometer
Date: 16 and 17 April 2018
Area: 6.2ha

2.2 Location

Site name: Land north-west of Berkeley
Town & Civil Parish: Berkeley
District: Stroud
County: Gloucestershire
Nearest Postcode: GL13 9AU
NGR: SO 68218 00023 (point)
NGR (E/N): 368218,200023 (point)
Historic environment designation: none

2.3 Client

Cotswold Archaeology, Building 11, Kemble Enterprise Park, Cirencester, Gloucestershire GL7 6BQ

3 Summary

A magnetometer survey was selected to provide a relatively fast and cost-effective evaluation of any buried archaeology across the Site (see Section 12). The magnetic anomaly groups pertaining to potential buried archaeology were georeferenced to the Ordnance Survey National Grid, mapped, characterised and assigned with an appropriate degree of certainty in conformance with the survey aims and objectives set out in Section 4.

The differences in magnetic responses across the Site were sufficient to be able to differentiate between anomalies representing possible buried archaeology and background magnetic responses.

Fourteen magnetic anomaly groups were mapped as representing potential buried archaeology. Of these, three groups coincide with, and likely represent, field boundaries recorded on historic maps with one group possibly representing the enclosure of a strip from an open field system. Two groups may represent ridge-and-furrow ploughing disturbance. The remaining nine groups have characteristics typical of anomalies representing linear archaeological deposits such as fragments of enclosure and/or field boundaries. Four of these may also possibly represent enclosure of open field strips.

The western side of the Site has been subjected to the deposition of rubble containing ferrous material.

4 Aims and objectives

4.1 Aims

Within the framework set out in Chartered Institute for Archaeologists (2014a), complete an archaeological geophysical survey and report to:

1. As far as possible inform on the presence of absence, character, extent and in some cases, apparent relative phasing of buried archaeology, in order to make an assessment of its merit

in the appropriate context, which may lead to one or more of the following:

- a. The formulation of a strategy to ensure further recording, preservation or management of the resource
- b. The formulation of a strategy to mitigate a threat to the archaeological resource
- c. The formulation of a proposal for further archaeological investigation within a programme of research (ibid, 2014a: 4).

4.2 Survey objectives

1. Complete a magnetometer survey across agreed parts of the survey area.
2. Identify any magnetic anomalies that may be related to archaeological deposits, structures or artefacts.
3. Within the limits of the technique and dataset, archaeologically characterise any such anomalies or patterns of anomalies.
4. Accurately record the location of the identified anomalies.
5. Produce a report based on the survey that is sufficiently detailed to inform any subsequent development on the survey area about the location and possible archaeological character of the recorded anomalies.

5 Standards

The standards used to complete this survey are defined by the Chartered Institute for Archaeologists (2014a) and Historic England (2008). The codes of approved practice that were followed are those of the Chartered Institute for Archaeologists (2014b) and Archaeology Data Service (undated).

6 Methodology

The magnetometer survey was undertaken in accordance with a Survey Method Statement (Dean, 2018) to achieve the aims and objectives set out in Section 4 using the standards and guidance specified in Section 5. The survey method was selected to provide a relatively fast and cost-effective evaluation of any buried archaeology across the Site (see Section 12).

Data processing was undertaken using appropriate software (Table 2), with all anomalies being digitised and geo-referenced. The final report (this document) includes a graphical and textual account of the techniques undertaken, the data obtained and an archaeological interpretation of that data and conclusions about any likely archaeology. The survey and report conformed to the Chartered Institute for Archaeologists standard for geophysical survey (CIfA, 2014a).

7 Site

7.1 Location

The Site comprises a single arable field lying to the northwest of Berkeley. The field location is provided in Figure 1.

The field is bounded to the west by a channelled stream, to the north by a small wood, to the northeast by the B4066, to the east by Station Road and to the south by a housing estate. The field boundaries comprise hedges and wire fencing. The housing estate is separated from the field by a lane and fencing with hedging on the field side. The stream represents the modern and historic parish boundary.

7.2 Land use

At the time of the survey, the field was under maize stubble.

7.3 Topology

The Site is on a slope descending southeast to northwest from approximately 20m AOD at the south-eastern corner to approximately 10m AOD at on the western side.

7.4 Geology

The bedrock across the site is the Silurian Raglan Mudstone Formation which generically comprises red mudstones and silty mudstones with calcretes and sandstones. The Townsend Tuff Bed lies 100m from top of the Formation with the Bishop's Frome Limestone at top. A

band of the Formation sandstone runs northwards through the eastern side of the Site and is faulted out approximately half way across the field. Quaternary alluvium is present along the stream valley on the western edge of the Site. Alluvium is normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present (British Geological Survey, undated).

8 Archaeological background

8.1 Historic Environment Status

None.

8.2 Historic landscape characterisation

Regular, organised enclosure ignoring former unenclosed cultivation patterns with an absence of a parliamentary enclosure award for the parish (Archaeology Data Service, undated b).

8.3 Potential buried archaeology

A Heritage Assessment of the Site was produced by Cotswold Archaeology in March 2018 in which the composition and development of the historic landscape within the Site and wider landscape was presented and the likely affect on known and potential heritage assets of the proposed residential development was assessed (Arkley, 2018).

The report states that there are no known heritage assets recorded within the Site and there is a low potential for the presence of any features of high significance within the Site.

8.4 Statement of research

The Gloucestershire Council Historic Environment Record Archive was examined via the Heritage Gateway (Historic England, undated) to gain an appreciation of historic assets pertinent to the geophysical survey data within approximately 500m of the survey area perimeter. Whilst providing a useful context for the data analysis, this source is not comprehensive and publication of the information in commercial reports is not permitted.

9 Results

9.1 Scope and definitions

This survey was designed to record magnetic anomalies. A magnetic anomaly is a local variation in the Earth's magnetic field. Such variations can result from changes in the magnetism of the underlying solid geology, superficial geology and other near-surface deposits including those altered and created by past human activities. Near-surface artefacts can also create magnetic anomalies.

Magnetic anomalies cannot be regarded as physical archaeological deposits, structures or features and the dimensions of the anomalies shown do not represent the dimensions of any associated archaeology.

The analysis presented below identifies and characterises anomalies and anomaly groups that may relate to buried archaeology.

9.2 Analysis

Figure 2 shows the interpretation of the survey data and include the anomaly groups identified as possibly relating to archaeological deposits along with their identifying numbers. Table 1 is an extract of the detailed analysis of the survey data sourced from the attribute tables of the GIS project provided in the project archive.

Figures 2 along with Table 1 comprises the analysis of the survey data.

Figures 3 and 4 are plots of processed data as specified in Table 3. Figure 5 is a plot of minimally processed data as specified in Table 4. Figure 6 shows the location of the survey grid and grid data files.

10 Discussion

10.1 General points

10.1.1 Discussion scope

Not all anomalies or anomaly groups identified in Table 1 are necessarily discussed below. All identified anomaly groups are recorded in the GIS project held in the survey archive.

10.1.2 Data collection

Data collection along the survey area edges was restricted as shown in the figures due to the presence of magnetic materials within and adjacent to boundaries. Strong magnetic responses mapped close to the boundaries are likely to relate to these materials except where otherwise indicated in Figure 2 and Table 1.

10.1.3 Anomaly characterisation

There are a number of anomaly groups that could be interpreted as relating to large postholes or pits although most will have natural origins. Anomalies of this sort were mapped as potential archaeology when they were associated with other significant anomaly groups or otherwise formed recognisable patterns as listed in Table 1.

Anomalies thought to relate to natural features and recent man-made objects such as manholes, water management equipment, drains, cables and other services were only mapped where they comprised significant magnetic responses across the dataset that needed clarification.

Numerous dipole magnetic anomalies are present within the dataset. These are likely to represent recent ferrous objects. They are only mapped if they could influence the analysis of anomaly groups thought to have an archaeological origin.

10.1.4 Data trends

A set of parallel, linear anomalies trending west-north-west to east-south-east across most of the data set are likely to represent recent ploughing.

10.2 Data relating to historic maps and other records

Magnetic anomaly groups **2**, **4** and **5** coincide with, and likely represent, field boundaries recorded on historic maps as shown in Table 1. Group 2 coincides with a boundary of one of two narrow fields recorded in the Berkeley Tithe apportionment as arable when the surrounding fields were pasture at that time. Arkley (2018, 20) suggests that they may represent enclosed strips from an earlier open field system.

10.3 Data with no previous archaeological provenance

Groups **6**, **9**, **10** and **13** may have similar origins to group 2 (Section 10.2) although it is possible that groups 9 and 10 could represent either ditches or robbed out wall footings defining a former lane or track.

Anomaly group **1** runs parallel with group 2 and may, following on from the discussion in Section 10.2, represent a field boundary associated with earlier strips of an open field system or remnants of ridge-and-furrow ploughing disturbance. Group **8** may have similar origins.

The remaining magnetic anomaly groups (**3**, **7**, **11**, **12** and **14**) are typical of anomalies representing linear deposits such as remnants of enclosure or field boundaries.

10.4 Distinct anomaly patterns

Figures 3 and 4 show a distinct change in anomaly patterns and strength on the western site of the Site. Contained within the line of a former field boundary mapped between 1839 and at least 1978 (represented by anomaly group 4 discussed in Section 10.2), anomalies representing natural deposits (not mapped) suggest a relatively wet environment close to the stream which has been subject to the introduction of rubble mixed with ferrous materials as

shown in Figure 2 (groups **302, 310, 315, 323** and **332**). This area also has a relatively high concentration of dipole anomalies indicating buried ferrous material and a large magnetic response (group **301**) which may indicate the presence of a service such as a steel cable or iron pipe. It is likely that all these anomalies represent relatively recent activity.

Also clear in Figures 3 and 4 is a reduction in response on the northern side of the Site beyond anomaly group 2 (Figure 2). This is in part due to a wetter surface and sub-soil environment at the very north of the site but is also likely to reflect a change in one or more of local soil composition, underlying geology and a reflection in past agrarian practices in this area as discussed in Section 10.2.

11 Conclusions

The differences in magnetic responses across the Site were sufficient to be able to differentiate between anomalies representing possible buried archaeology and background magnetic responses.

Fourteen magnetic anomaly groups were mapped as representing potential buried archaeology. Of these, three groups (2, 4 and 5) coincide with, and likely represent, field boundaries recorded on historic maps with group 2 possibly representing the enclosure of a strip from an earlier open field system. Two groups (1 and 8) may represent ridge-and-furrow ploughing disturbance. The remaining groups have characteristics typical of anomalies representing linear archaeological deposits such as fragments of enclosure and/or field boundaries. Because of their similar orientation to group 2, four of these groups (6, 9, 10 and 13) may represent enclosure of open field strips.

The western side of the Site has been subjected to the deposition of rubble containing ferrous material.

12 Disclaimer

The description and discussion of the results presented in this report are the authors', based on their interpretation of the survey data. Every effort has been made to provide accurate descriptions and interpretations of the geophysical data set. The nature of archaeological geophysical surveying is such that interpretations based on geophysical data, while informative, can only be provisional. Geophysical surveys are a cost-effective early step in the multi-phase process that is archaeology. The programme of archaeological work of which this survey is part may also be informed by other archaeological work and analysis. It must be presumed that more archaeological features will be found than those specified in this report.

13 Copyright

Substrata Ltd will assign copyright to the client upon written request but retains the right to be identified as the author of all project documentation and reports as defined in the Copyright, Designs and Patents Act 1988 (Chapter IV, s.79). This report contains material that is non-Substrata Limited copyright or the intellectual property of third parties. Such material is labelled with the appropriate copyright and is non-transferrable by Substrata Ltd.

14 Archive

14.1 Online Access to the Index of archaeological investigationS (OASIS)

OASIS ID: substrat1-315383

The OASIS entry has been completed and the boundary file and report uploaded with six months delay in publication.

14.2 Substrata Limited archive

A full archive of this survey will be held by Substrata Limited on cloud and local hard drive storage as specified in Appendix 3.

14.3 Archaeological Data Service (ADS)

Depending on local authority policy, an archive may be deposited with the ADS as specified in Appendix 3.

14.4 Historic Environment Record (HER)

Subject to any contractual requirements on confidentiality, a PDF or printed copy of the report will be submitted to the appropriate HER within six months of completion.

15 Acknowledgements

Substrata would like to thank Andrew Burn, Principal Heritage Consultant, Cotswold Archaeology, for commissioning us to complete this survey.

16 Bibliography

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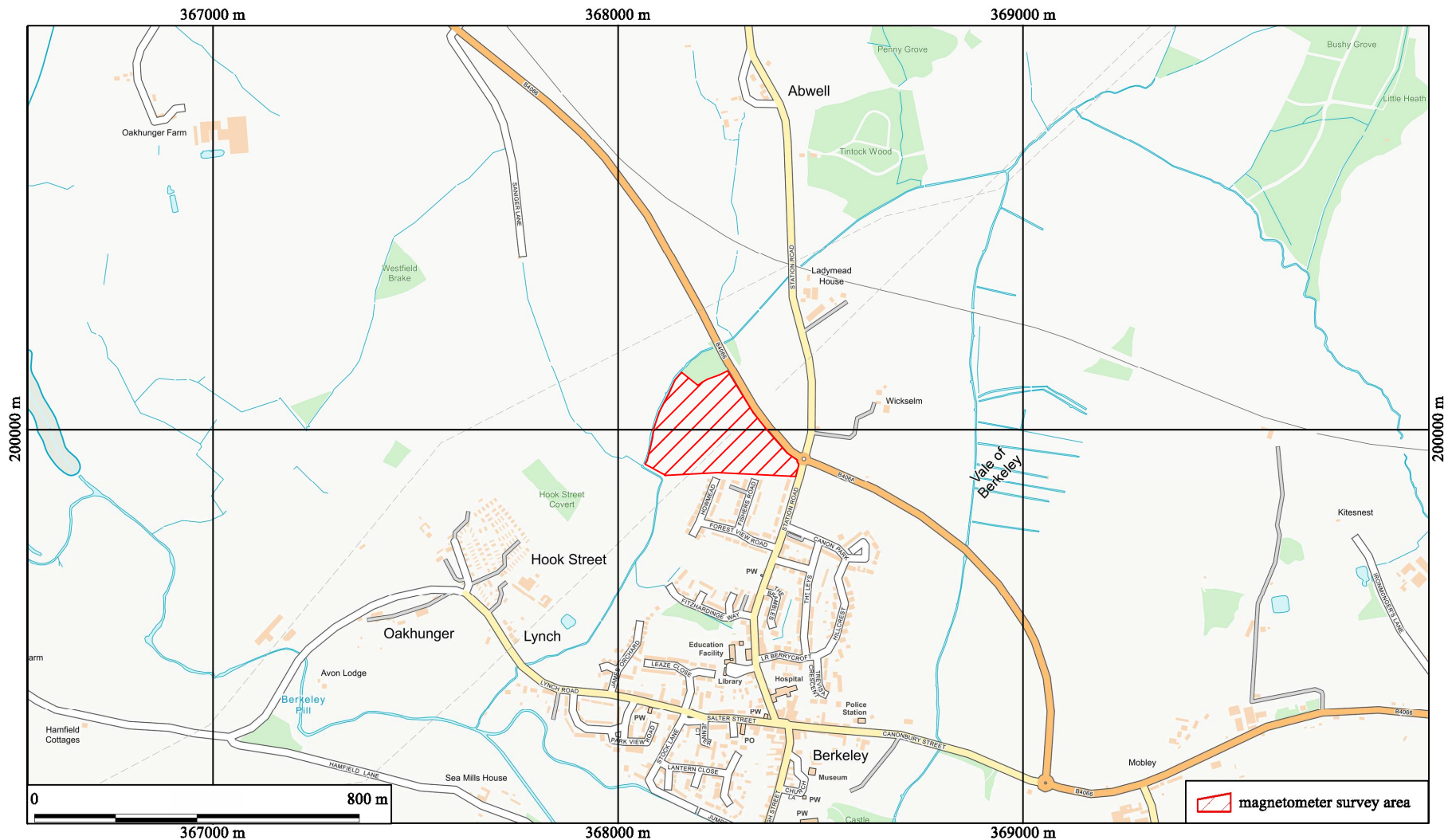
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Appendix 1 Figures

General Guidance

The anomalies represented in the survey plots provided in this appendix are magnetic anomalies. The apparent size of such anomalies and anomaly patterns are unlikely to correspond exactly with the dimensions of any associated archaeological features .

A rough rule for interpreting magnetic anomalies is that the width of an anomaly at half its maximum reading is equal to the width of the buried feature, or its depth if this is greater (Clark, 2000: 83). Caution must be applied when using this rule as it depends on the anomalies being clearly identifiable and distinct from adjacent anomalies. In northern latitudes the position of the maximum of a magnetic anomaly will be displaced slightly to the south of any associated physical feature.



British Grid
 centre X: 368270.13 m, centre Y: 200011.51 m

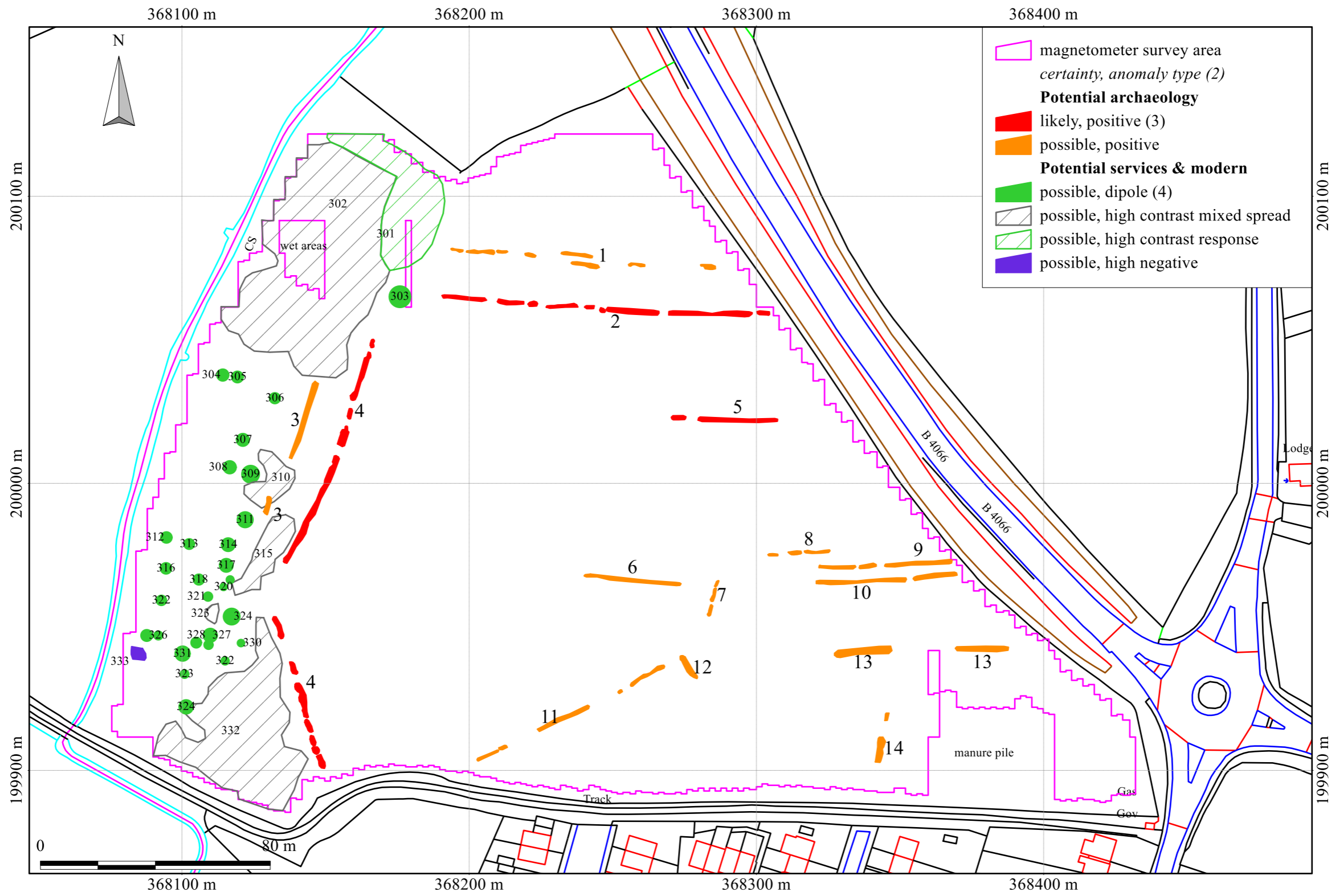
Scale: 1:10000 @ A3. Spatial Units: Meter. Do not scale off this drawing

Geophysical survey: Copyright Substrata Limited.
 Base map: Ordnance Survey (c) Crown Copyright 2018.
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An archaeological magnetometer survey
 Land north-west of Berkeley, Gloucestershire
 Centred on NGR 368218,200023
 Report: 1803BER-R-1

Figure 1: location map

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 Tel: 01271 342721
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British Grid
centre X: 368270.13 m, centre Y: 200011.51 m

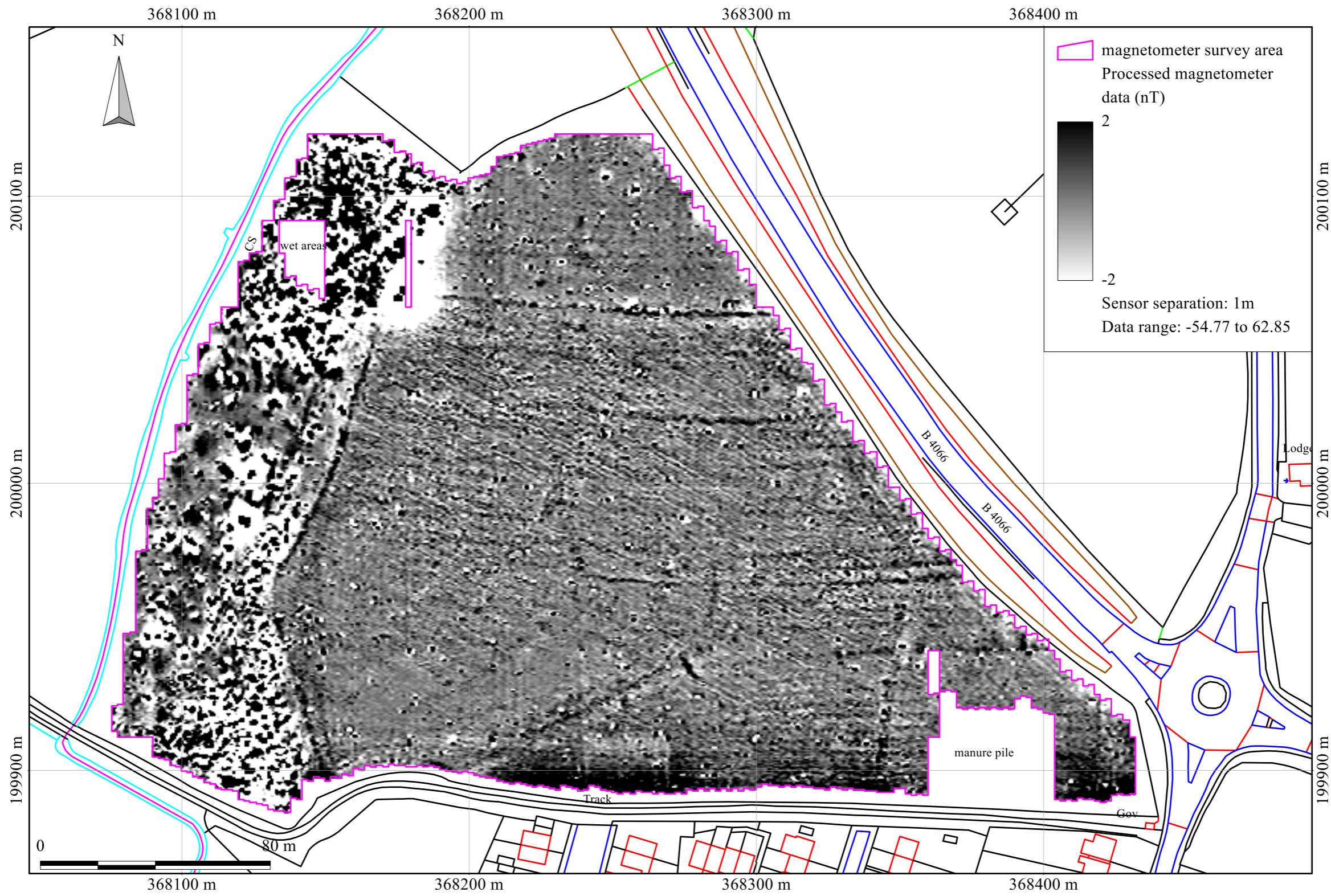
Scale: 1:1500 @ A3. Spatial Units: Meter. Do not scale off this drawing

Geophysical survey: Copyright Substrata Limited.
Base map: Ordnance Survey (c) Crown Copyright 2018.
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Report: 1803BER-R-1

Figure 2: survey interpretation

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Web: substrata.co.uk



British Grid
 centre X: 368270.13 m, centre Y: 200011.51 m

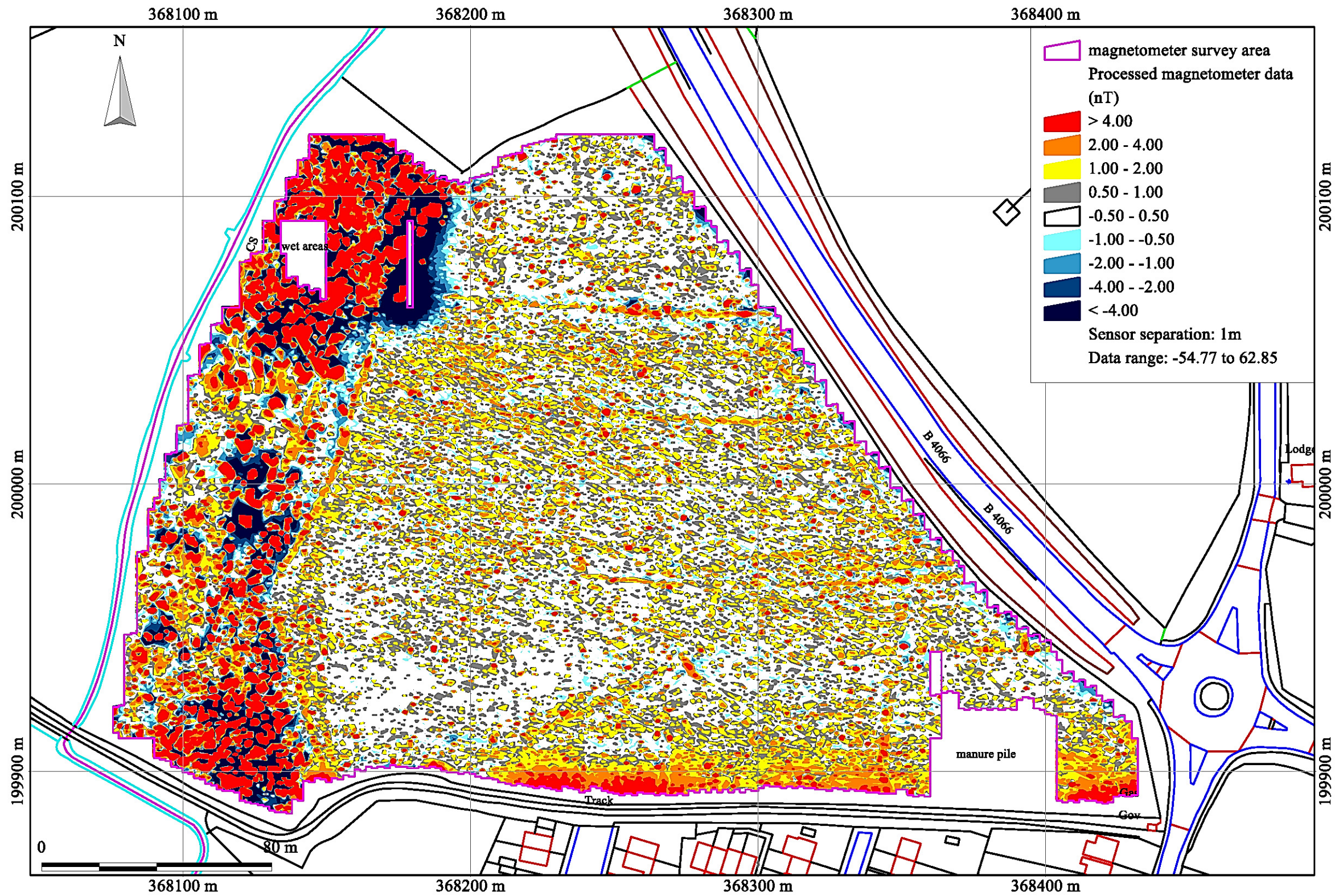
Scale: 1:1500 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Figure 3: shade plot of processed data

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British Grid
centre X: 368270.13 m, centre Y: 200011.51 m

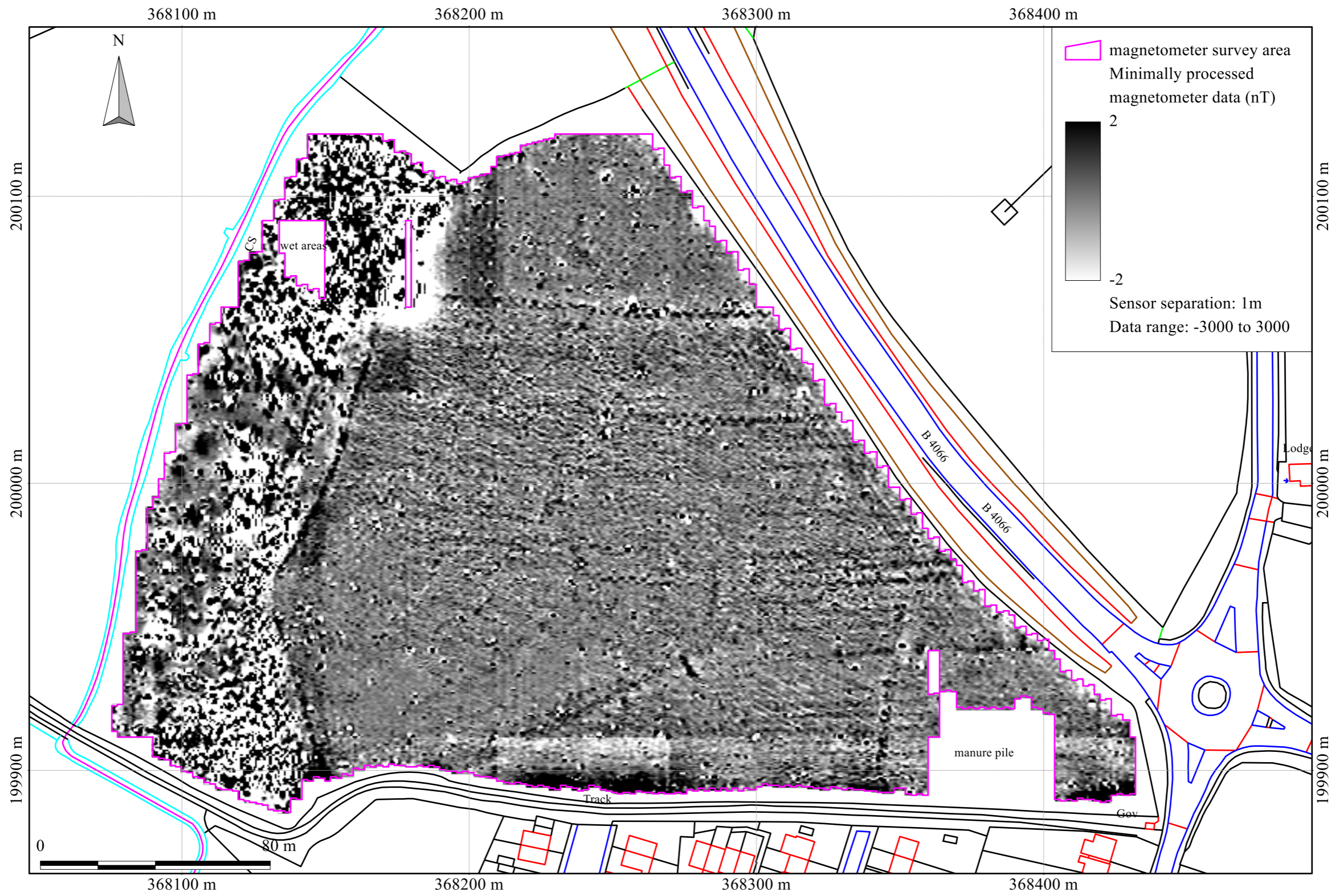
Scale: 1:1500 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Centred on NGR 368218,200023
Report: 1803BER-R-1

Figure 4: contour plot of processed data

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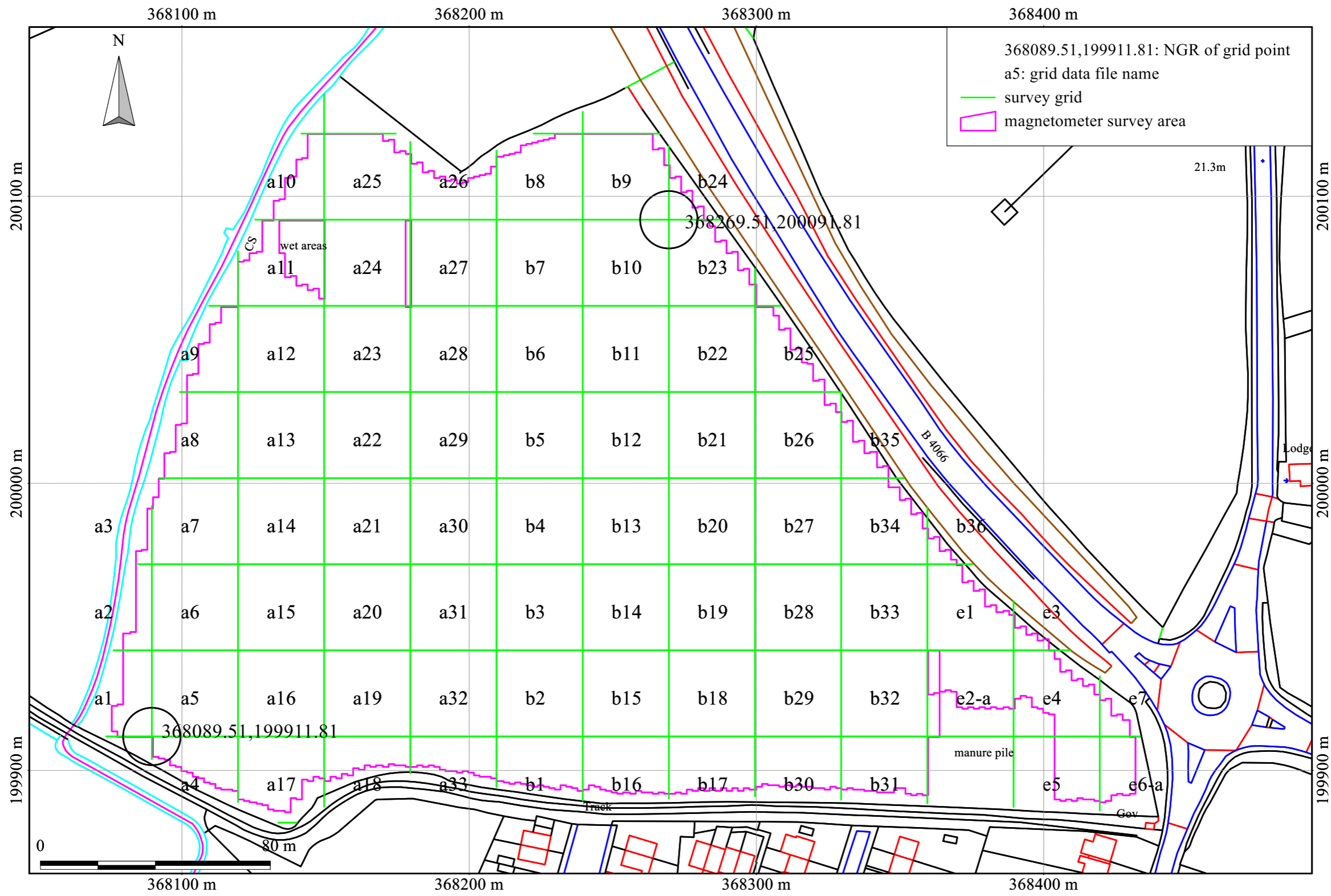


British Grid
centre X: 368270.13 m, centre Y: 200011.51 m

Scale: 1:1500 @ A3. Spatial Units: Meter. Do not scale off this drawing

Geophysical survey: Copyright Substrata Limited.
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Figure 5: shade plot of minimally processed data



British Grid
centre X: 368270.13 m, centre Y: 200011.51 m

Scale: 1:1500 @ A3. Spatial Units: Meter. Do not scale off this drawing

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An archaeological magnetometer survey
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Figure 6: survey grid plan and location

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Appendix 2 Tables

Site: An archaeological magnetometer survey
Land north-west of Berkley, Gloucestershire
Centred on NGR 368218,200023
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| anomaly group | associated anomalies | anomaly characterisation certainty & class | anomaly form | additional archaeological characterisation | comments | supporting evidence |
|---------------|----------------------|--|----------------------------|---|--|--|
| 1 | | possible, positive | disrupted parallel linears | traces of former ridge-and-furrow-ploughing or field boundary | | |
| 2 | | likely, positive | disrupted linear | field boundary | anomaly group coincides with, and likely represents a former field boundary recorded on historic maps between 1839 and 1978 | 1839 Berkeley Tithe map, OS maps 1880-85 1:2500 to 1974-78 1:10000 |
| 3 | | possible, positive | disrupted linear | | | |
| 4 | | likely, positive | disrupted curvilinear | field boundary | anomaly group coincides with, and likely represents a former field boundary recorded on historic maps between 1839 and at least 1978 | 1839 Berkeley Tithe map, OS maps 1880-85 1:2500 to 1974-95 1:10000 |
| 5 | | likely, positive | disrupted linear | field boundary | anomaly group coincides with, and likely represents a former field boundary recorded on the 1839 tithe map but not on later maps | 1839 Berkeley Tithe map |
| 6 | 10? | possible, positive | linear | | | |
| 7 | | possible, positive | disrupted linear | | | |
| 8 | | possible, positive | disrupted linear | traces of former ridge-and-furrow-ploughing? | | |
| 9 | 10? | possible, positive | disrupted linear | | | |
| 10 | 6? 9? | possible, positive | disrupted linear | | | |
| 11 | | possible, positive | disrupted linear | | | |
| 12 | | possible, positive | linear | | | |
| 13 | | possible, positive | disrupted linear | | | |
| 14 | | possible, positive | disrupted linear | | | |
| 301 | | possible, high contrast response | | ferrous material, possible service pipe or cable | | |
| 302 | | possible, high contrast mixed spread | | rubble with ferrous material | | |
| 303 to 309 | | possible, dipole | | ferrous material | | |
| 310 | | possible, high contrast mixed spread | | rubble with ferrous material | | |
| 311 to 314 | | possible, dipole | | ferrous material | | |
| 315 | | possible, high contrast mixed spread | | rubble with ferrous material | | |
| 316 to 323 | | possible, dipole | | ferrous material | | |
| 323 | | possible, high contrast mixed spread | | rubble with ferrous material | | |
| 324 to 331 | | possible, dipole | | ferrous material | | |
| 332 | | possible, high contrast mixed spread | | rubble with ferrous material | | |
| 333 | | possible, high negative | | re-inforced concrete? | | |

Table 1: data analysis

| | |
|---|--|
| Grid <i>Method of Fixing:</i> DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates. <i>Composition:</i> 30m by 30m grids <i>Recording:</i> Geo-referenced and recorded using digital map tiles. <i>DGPS used:</i> Spectra Precision PM5V2 GPS with external antenna and survey pole and DigiTerra Explorer 7 as the survey control program. | |
| Equipment <i>Instrument:</i> Bartington Instruments grad601-2 <i>Firmware:</i> version 6.1 | Data Capture <i>Sample Interval:</i> 0.25m <i>Traverse Interval:</i> 1 metre <i>Traverse Method:</i> zigzag <i>Traverse Orientation:</i> GN |
| Data Processing, Analysis and Presentation Software IntelliCAD 8.4 DW Consulting TerraSurveyor3 Manifold System 8 GIS Microsoft Corp. Office 365: Excel, Publisher, Word Adobe Systems Inc Adobe Acrobat 9 Pro Extended | |

Table 2: methodology information

| | |
|--|--|
| Instrument Type: Bartington Grad-601 gradiometer Units: nT Direction of 1st Traverse: see below Collection Method: ZigZag Sensors: 2 @ 1.00 m spacing, each with 1m separation Dummy Value: 32702 | |
| Program Name: TerraSurveyor Version: 3.0.33.6 | |
| Statistics Max: 37.06 Min: -38.58 Std Dev: 6.50 Mean: -0.02 Median: 0.00 | Processing 1 Base Layer 2 Clip at 1.00 SD 3 Clip at 1.00 SD 4 DeStripe Median Sensors: Grids: All 5 Edge Match (Area: Top 60, Left 0, Bottom 89, Right 119) to Bottom edge 6 Edge Match (Area: Top 60, Left 360, Bottom 89, Right 479) to Bottom edge 7 Edge Match (Area: Top 90, Left 600, Bottom 119, Right 719) to Bottom edge 8 Edge Match (Area: Top 120, Left 720, Bottom 149, Right 839) to Bottom edge 9 Edge Match (Area: Top 120, Left 840, Bottom 149, Right 959) to Bottom edge 10 Edge Match (Area: Top 150, Left 0, Bottom 179, Right 119) to Top edge 11 Edge Match (Area: Top 180, Left 0, Bottom 209, Right 119) to Bottom edge 12 Edge Match (Area: Top 330, Left 0, Bottom 359, Right 119) to Right edge 13 Edge Match (Area: Top 360, Left 0, Bottom 389, Right 119) to Right edge 14 De Stagger: Grids: All By: 0 intervals, 25.00cm 15 De Stagger: Grids: All By: 0 intervals, 25.00cm 16 De Stagger: Grids: b14.xgd b13.xgd b12.xgd b11.xgd b10.xgd By: 0 intervals, 25.00cm 17 De Stagger: Grids: b7.xgd By: 0 intervals, 25.00cm 18 De Stagger: Grids: b21.xgd By: 0 intervals, 25.00cm 19 De Stagger: Grids: b31.xgd b32.xgd b33.xgd b34.xgd b35.xgd By: 0 intervals, -25.00cm 20 Edge Match (Area: Top 210, Left 0, Bottom 299, Right 119) to Right edge |

Table 3: processed data metadata

| | |
|----------------------------|--|
| Instrument | |
| Type: | Bartington Grad-601 gradiometer |
| Units: | nT |
| Direction of 1st Traverse: | see below |
| Collection Method: | ZigZag |
| Sensors: | 2 @ 1.00 m spacing, each with 1m separation |
| Dummy Value: | 32702 |
| Program | |
| Name: | TerraSurveyor |
| Version: | 3.0.33.6 |
| Statistics | Processing |
| Max: | 3000.00 |
| Min: | -3000.00 |
| Std Dev: | 259.62 |
| Mean: | 0.01 |
| Median: | 0.00 |
| | 1 Base Layer |
| | 2 DeStripe Median Sensors: Grids: All |
| | 3 Clip from -3000.00 to 3000.00 nT |
| | x=y double interpolation imposed on input to GIS |

Table 4: minimally processed data metadata

Appendix 3 Project archive contents

A3.1 Substrata Limited archive

A full archive of this survey will be held by Substrata Limited on cloud and local hard drive storage as follows:

| | |
|---|--|
| Report: | Adobe PDF format |
| Raw grid & composite files: | DW Consulting TerraSurveyor 3 format xyz files |
| Final data processing composite files: (excluding interpolation processes) | DW Consulting TerraSurveyor 3 format xyz files |
| GIS project: | GIS project Manifold 8 .map format ESRI shape files |
| AutoCAD version of the survey interpretation: (if generated) | AutoCAD DXF |
| All project working files: | various (Table 2) |

A3.2 Online Access to the Index of archaeological investigationS (OASIS)

| | |
|-------------------------------------|------------------|
| Metadata: | online form |
| Georeferenced survey boundary file: | ESRI shape file |
| Report: | Adobe PDF format |

A3.3 Archaeological Data Service

Depending on local authority policy, an archive may be deposited with the ADS as follows:

| | |
|-----------------------------|--------------------------------|
| Raw data composite file: | xyz file |
| Processed data plot: | rendered images in TIFF format |
| Survey grid plot: | image in TIFF format |
| Details of data processing: | image in TIFF format |
| Interpretation plot: | rendered images in TIFF format |
| Metadata: | Microsoft Excel format |

A3.4 Historic Environment Record (HER)

Subject to any contractual requirements on confidentiality, a PDF copy of the report will be submitted to the appropriate HER within 6 months of the completion of this report via the OASIS process or by other means, depending on the relevant HER process.