Substrata

Archaeological Geophysical Surveyors

An archaeological magnetometer survey

Land at Redwood Drive and Poplar Close Chaddlewood, Plympton, Devon

Centred on NGR (E/N): 255836,056486 (point)

Report: 1607CHD-R-1

Ross Dean BSc MSc MA MCIfA

19 October 2016

Contents

Figures

Tables

Project archive

Website: substrata.co.uk

For an overview of Substrata, our archaeological geophysical surveying techniques and the results we obtain.

1 Survey description and summary

1.1 Survey

Type:	twin-sensor fluxgate gradiometer
Date:	between 28 September and 3 October 2016
Area:	6.3ha
Lead surveyor:	Mark Edwards BA
Author:	Ross Dean BSc MSc MA MIfA
	with contributions from Mark Edwards

1.2 Clients

AC Archaeology Ltd, 4 Halthaies Workshops, Bradninch Nr Exeter, Devon EX5 4QL

1.3 Location

Site:	Land at Redwood Drive and Poplar Close, Chaddlewood
Unitary Authority:	Plymouth
County:	Devon
Nearest Postcode:	PL7 2GD
NGR:	SX 559 564 (point)
NGR (E/N):	255836,056486 (point)

1.4 Archive

OASIS number:	substrat1-265882
Archive:	At the time of writing, the archive of this survey will be held by Substrata. Depending on local authority policy, an archive of the unprocessed data may be deposited with the Archaeological Data Service.

1.5 Introduction

This report presents the results of an archaeological magnetometer survey at the above site, hereafter referred to as the survey area. It has been prepared for AC Archaeology Ltd on behalf of clients. The survey area location is shown in Figure 1.

1.6 Summary

The magnetic responses across the survey area were sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses.

Fifty-three magnetic anomaly groups were mapped as representing possible archaeological deposits or features. Their distribution and characteristics are strongly suggestive of anomaly groups representing multiple phases of archaeological deposits, such as ditches or banks comprising sections of former field and enclosure boundaries, of unknown periods and predating the 1841 Plympton and St Mary Tithe map.

2 Survey aims and objectives

2.1 Aims

To establish the presence or absence, extent and character of any archaeological features and deposits within the survey area.

2.2 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 techniques 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.

3 Standards

The standards used to complete this survey are defined by the Chartered Institute for Archaeologists (2014a) and Historic England (2010). The codes of approved practice that were followed are those of the Chartered Institute for Archaeologists (2014b) and Archaeology Data Service (undated).

4 Site description

4.1 Landscape and land use
The survey area is divided into Plots 1 and 2 for ease of description. These designations are those provided in an Historic Environment Assessment completed by AC Archaeology Ltd for the same programme of work as this report (Pink, 2016).

The survey area comprises two fields located in Chaddlewood, on the northeast edge of Plympton. The fields comprise an area of approximately 6.3ha of land, which slopes down in a westerly and southerly direction from 105m to 83m AOD. The application area is bounded by modern housing on all sides (Pink, 2016: 1).

At the time of the survey both plots were open to the public and under recently cleared rough grassland. Piles of cleared scrub were present across the plots. The plots were both surrounded and sub-divided by reptile barriers erected for on-going environmental work, best indicated by the survey area depicted in Figures 2 and 5.

4.2 Geology
The survey area has a solid geology of Middle Devonian Slates. On the northern boundary of the area the solid geology changes to Upper Devonian Slates. The superficial geology is not recorded in the source used. A number of geotechnical test pits were opened as part of a housing development just south of Plot 2. An example of these at NGR 255990,56210 shows a profile of topsoil (0 to 0.5m), soft clay subsoil with root growth (0.5 to 0.9m), weak weathered fragmented slate with a firm to stiff brown clay binder (0.9 to 1.5m) and thinly laminated weak blue grey slate (1.5 to 2.4m) (British Geological Survey, undated).

5 Archaeological background

5.1 Historic landscape characterisation
Modern enclosures adapting Post-medieval fields.
These fields have been created by adapting earlier fields of probable post-medieval date.

The areas of housing surrounding the application area are classified as *modern settlement,* while Chaddle Wood is recorded as *other woodland.* Areas of *industrial complex* are recorded within the wider landscape to the northwest and southeast of the application area, and there are areas of *post-medieval enclosures* and *medieval enclosures based on strip fields* within the wider landscape to the north of the application area (Pink, 2016:13 after Devon County Council, undated).

5.2 Historical and archaeological background
The following is taken from an Historic Environment Assessment completed by AC Archaeology Ltd for the same programme of work as this report (Pink, 2016: 1).

The assessment identified a total of 12 designated heritage assets within a 1km study area surrounding the application area including the Plympton St Maurice Conservation Area, a single Grade I Listed Building and ten Grade II Listed Buildings. There are an additional 22

non-designated heritage assets within the study area. No assets are recorded within the application area on the Plymouth HER, although the location of a former building has been identified within the application area from a 1940s aerial photographic. This could potentially relate to a military presence during World War 2, but this is by no means certain.

The potential for the presence and/or survival of below-ground deposits is generally considered to be good, with the possibility of encountering hitherto unknown remains of prehistoric and Romano-British date based on evidence from the wider landscape surrounding the site. There is also considered to be potential for remains of Medieval date to be present, in particular agricultural features associated with the former Domesday manors.

6   Results, discussion and conclusions

6.1   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 variations in the magnetism of 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.

The terms 'archaeological deposit', 'structure' and 'feature' refer to any material deposits, artefacts or disturbance of natural deposits thought to be the result of human activity, excluding recent land maintenance and farming.

Magnetic anomalies may reflect physical archaeological deposits, structures or features but the dimensions of the anomalies do not represent the dimensions of any associated archaeology.

The analysis presented below identifies and characterises anomalies and anomaly groups that may relate to archaeological deposits, structures and features.

The reader is referred to section 7.

6.2   Results

Figures 2, 3 and 4 show the interpretation of the survey data at various scales. They 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 to 4 and Table 1 comprise the analysis of the survey data.

Figure 5 shown the survey interpretation over a 25cm resolution aerial photograph of the site with the intention of distinguishing modern tracks and footpaths from mapped magnetic anomalies potentially representing archaeological deposits and features.

Figures 6 to 8 are plots of processed data as specified in Table 3. Figure 9 is a plot of the minimally processed gradiometer data.

6.3   Discussion
6.3.1   General points

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 the survey archive.

Data collection

Data collection along the survey area edges and within the area was restricted as shown in the figures due to the presence of reptile barriers in place as part of an on going programme of environmental work. Magnetic materials within these barriers precluded surveying closer than 2m. Strong magnetic responses mapped close to the barriers are likely to relate to these materials except where otherwise indicated in Figures 2 to 4. One area in Plot 1 was being worked on by an environmental surveyor during the gradiometer survey and so could not be surveyed (Figures 2 and 3).

Anomaly characterisation and mapping

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 are only mapped as potential archaeology if they are clustered in groups or otherwise form recognisable patterns.

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 scattered across the data set. 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.

<u>Data trends</u>
There is a distinct east-west trend in the data in Plot 1 (Figure 7) and a similar trend running north-south in Plot 2 (Figure 8). These are likely to represent relatively recent ground disturbance resulting from ploughing.

6.3.2 Data relating to historic maps and other records
No magnetic anomaly groups pertaining to known heritage assets were recorded.

6.3.3 Data with no previous archaeological provenance
All of the magnetic anomaly groups mapped as representing possible archaeological deposits and features have patterns that are typical of anomalies representing archaeological deposits, such as former ditches or banks, of unknown period. Their distribution is suggestive of more than one phase of past land management. While some of these anomalies may represent relatively recent ground disturbance, it should be noted that the modern footpaths and tracks that cross the area do not have a significant impact on the survey data (Figures 5 and 6).

6.4 Conclusions
Fifty-three magnetic anomaly groups were mapped as representing possible archaeological deposits or features. Their distribution and characteristics are strongly suggestive of anomaly groups representing multiple phases of archaeological deposits, such as ditches or banks comprising sections of former field and enclosure boundaries, of unknown periods and predating the 1841 Plympton and St Mary Tithe map.

7 Disclaimer and copyright

The description and discussion of the results presented in this report are the authors, based on his 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 evaluation programme of which this survey is part may also be informed by other archaeological assessment work and analysis. It must be presumed that more archaeological features will be evaluated than those specified in this report.

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8 Acknowledgements

Substrata would like to thank John Valentin of AC Archaeology Ltd for commissioning us to complete this survey.

9 Bibliography

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Pink, F. (2016) *Land at Redwood Drive and Poplar Close, Chaddlewood, Plympton, Devon (Centred on SX 55836 56486) Historic Environment Assessment,* AC Archaeology Ltd unpublished report ACD1362/1/1
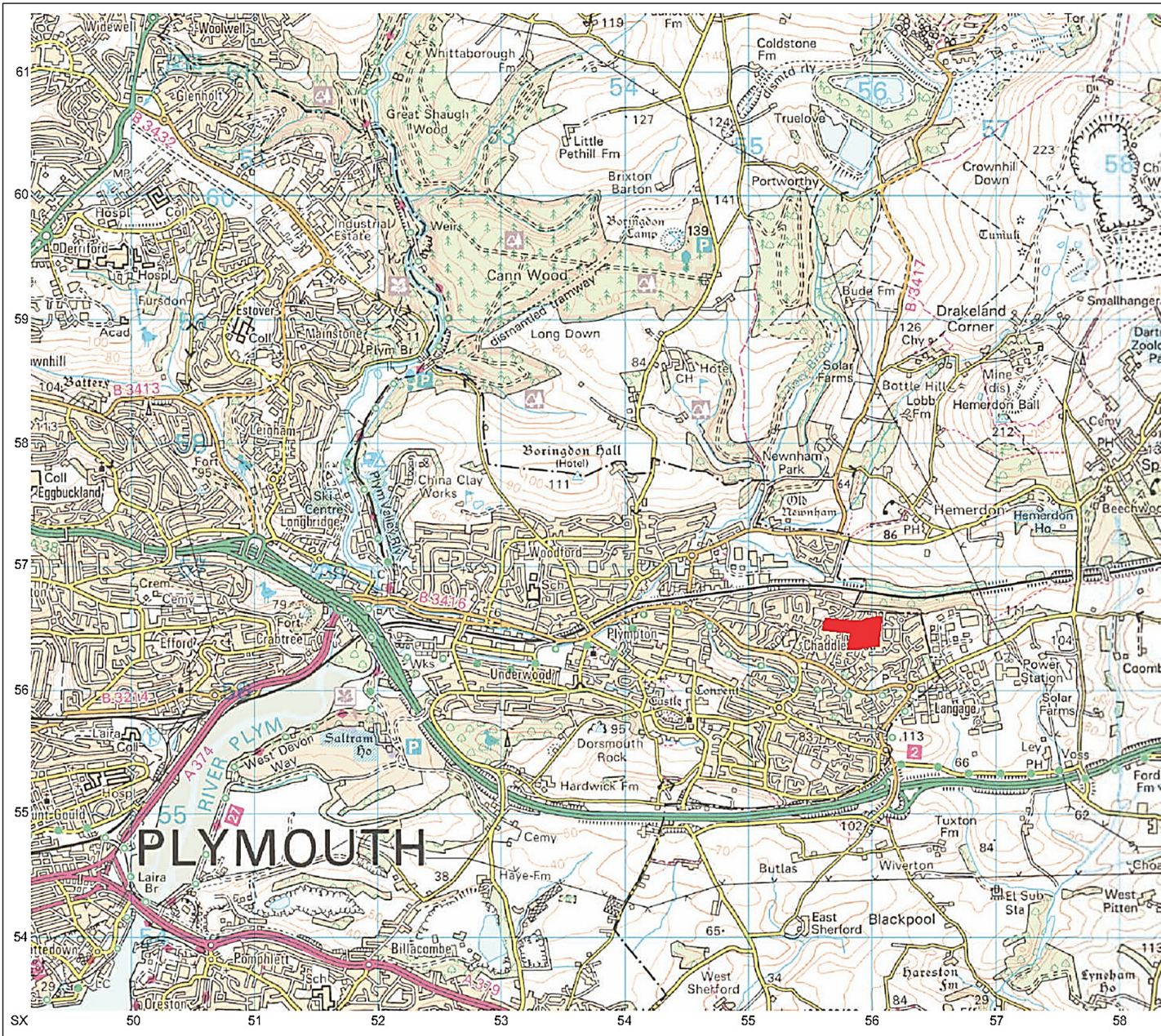
Appendix 1   Supporting plots

<u>General Guidance</u>

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 (see Section 6.1).

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.

PROJECT

Land at Redwood Drive and Poplar Close, Chaddlewood , Plympton, Devon
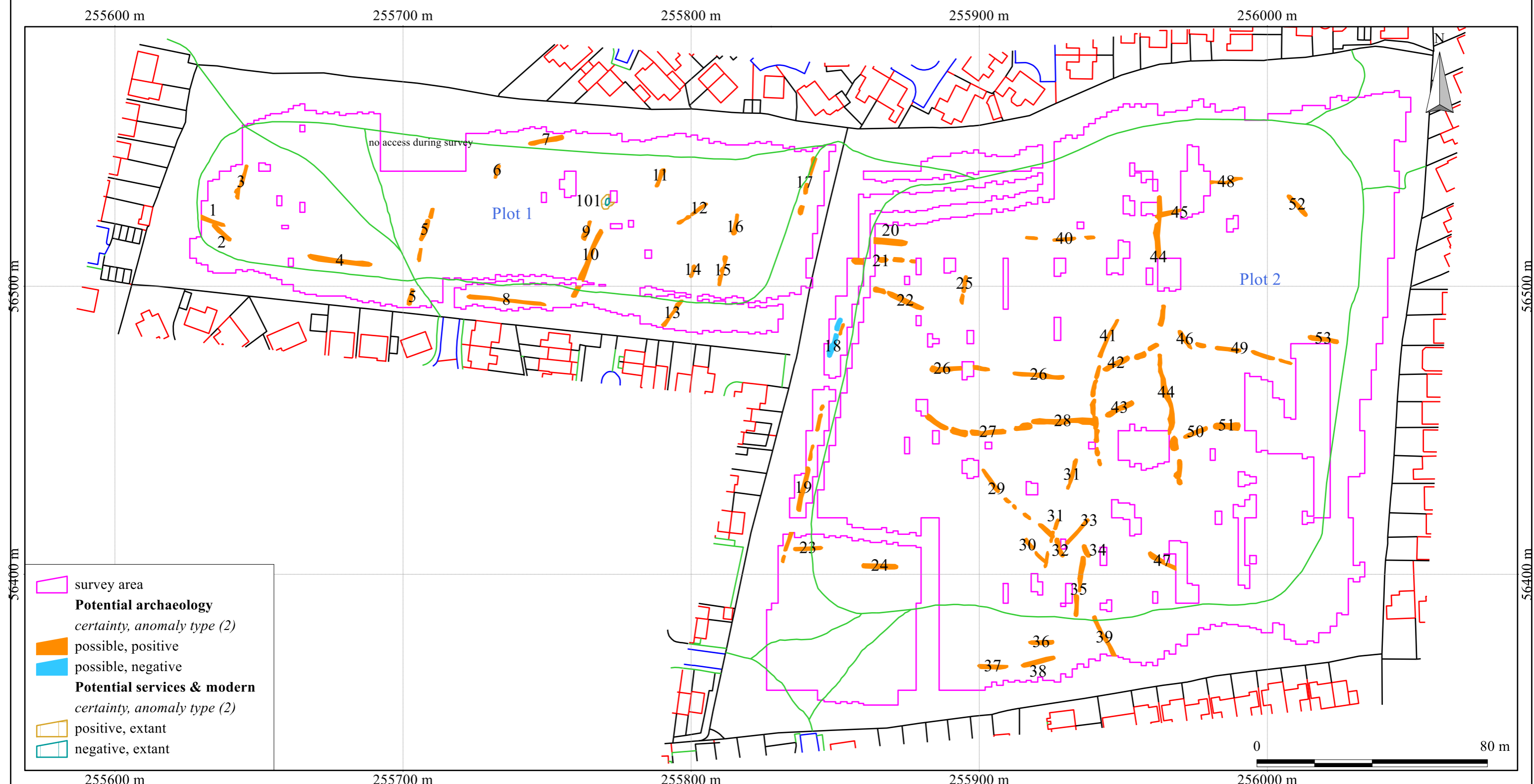
TITLE

Fig. 1: Site location (Pink, 2016)

Application area

AC archaeology

Scale 1:5000@A4

0 — 2.5km

Figure 2: survey interpretation, entire area

no access during survey

Plot 1

Plot 2

101

survey area

Potential archaeology
certainty, anomaly type (2)
possible, positive
possible, negative

Potential services & modern
certainty, anomaly type (2)
positive, extant
negative, extant

0   80 m

British Grid
centre X: 255827.79 m, centre Y: 56461.01 m

Scale: 1:1300 @ A3. Spatial Units: Meter. Do not scale off this drawing

Notes:

1. All interpretations are provisional and represent potential archaeological deposits.

2. 'Anomaly type' is a description of the magnetic anomaly. See the report text or GIS for an archaeological characterisation.

3. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.

4. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

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Land at Redwood Drive and Poplar Close
Chaddlewood, Plympton, Devon
Centred on NGR (E/N): 255836,056486 (point)
Report: 1607CHD-R-1

Figure 2: survey interpretation, entire area

255600 m   255700 m   255800 m

N

no access during survey

Plot 1

101

Legend

- survey area
- **Potential archaeology**
- *certainty, anomaly type (2)*
- possible, positive
- possible, negative
- **Potential services & modern**
- *certainty, anomaly type (2)*
- positive, extant
- negative, extant

0   80 m

British Grid
centre X: 255729.69 m, centre Y: 56522.20 m

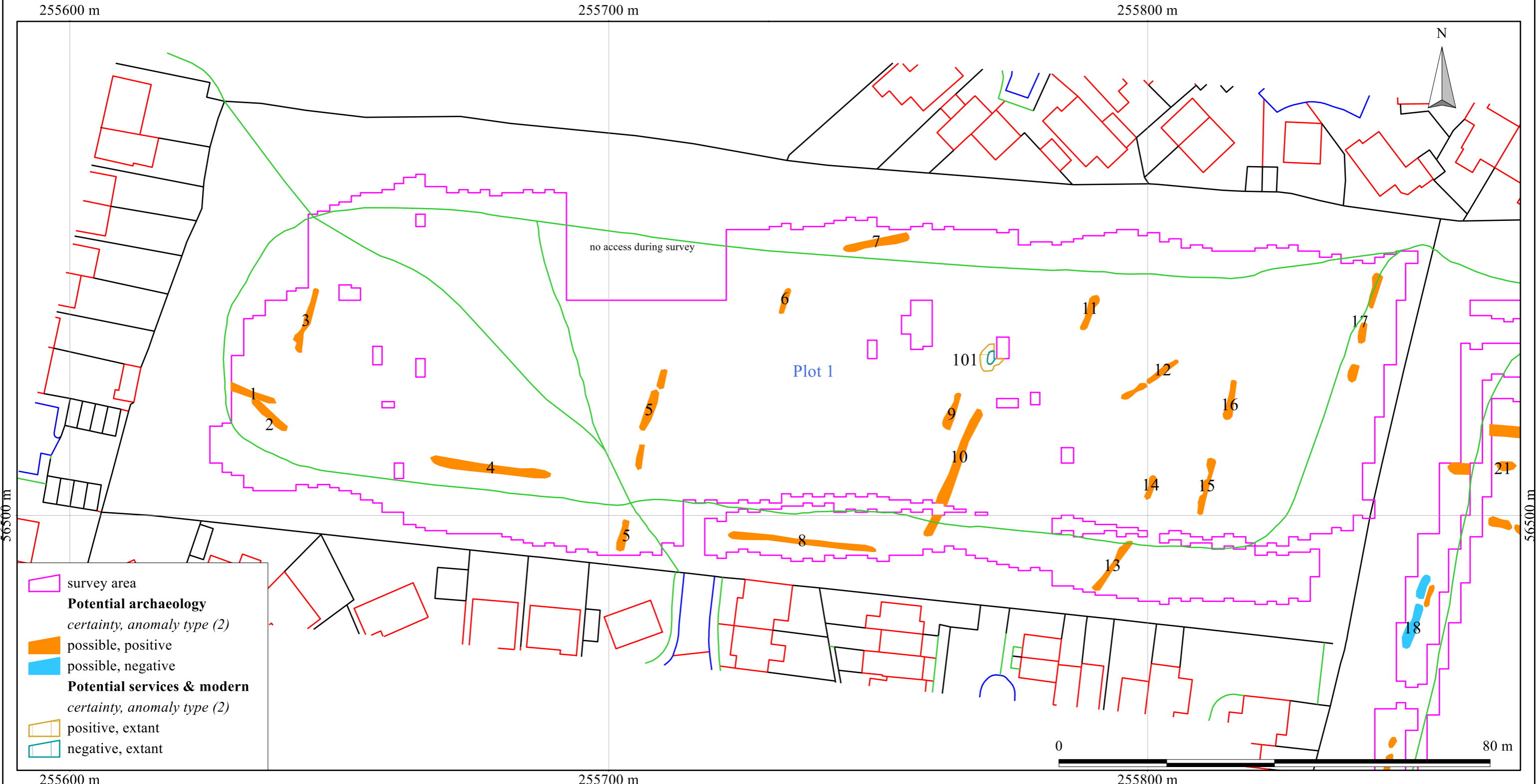Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

Notes:

1. All interpretations are provisional and represent potential archaeological deposits.

2. 'Anomaly type' is a description of the magnetic anomaly. See the report text or GIS for an archaeological characterisation.

3. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.

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Figure 3: survey interpretation, Plot 1

Plot 1

Plot 2

Legend:

survey area

Potential archaeology
certainty, anomaly type (2)
possible, positive
possible, negative

Potential services & modern
certainty, anomaly type (2)
positive, extant
negative, extant

Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

British Grid
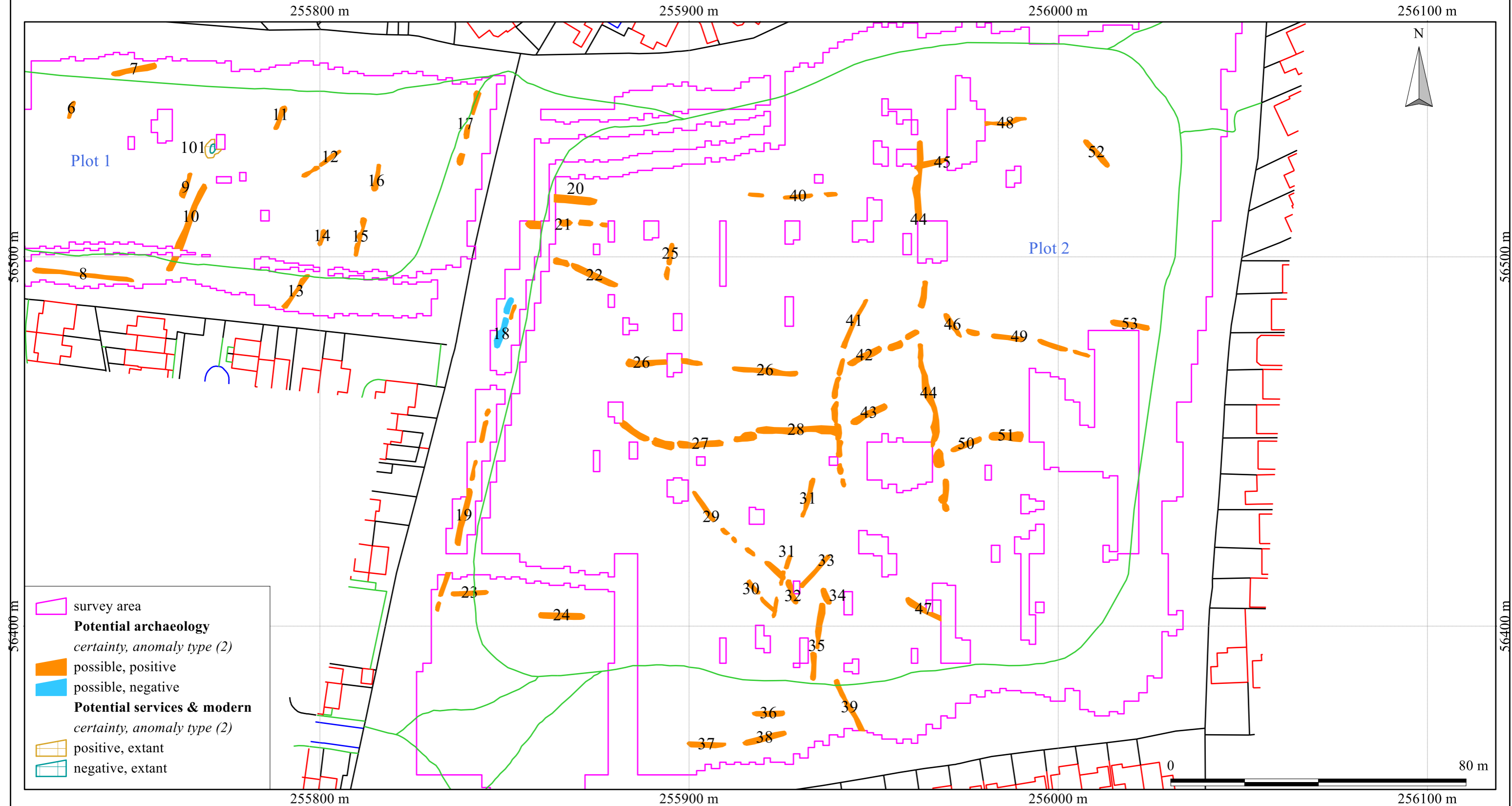centre X: 255919.25 m, centre Y: 56459.70 m

Notes:
1. All interpretations are provisional and represent potential archaeological deposits.
2. 'Anomaly type' is a description of the magnetic anomaly. See the report text or GIS for an archaeological characterisation.
3. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.
4. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

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Report: 1607CHD-R-1

Figure 4: survey interpretation, Plot 2

Site: An archaeological magnetometer survey
        Land at Redwood Drive and Poplar Close
        Chaddlewood, Plympton, Devon
        Centred on NGR (E/N): 255836,056486 (point)

area number	anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments
1	1		possible, positive	linear		
	2		possible, positive	linear		
	3		possible, positive	linear		
	4		possible, positive	linear		
	5		possible, positive	disrupted linear		
	6		possible, positive	linear		
	7		possible, positive	linear		
	8		possible, positive	linear		
	9		possible, positive	linear		
	10		possible, positive	disrupted linear		
	11		possible, positive	linear		
	12		possible, positive	disrupted linear		
	13		possible, positive	linear		
	14		possible, positive	linear		
	15		possible, positive	linear		
	16		possible, positive	linear		
	17		possible, positive	disrupted linear	linear deposit or current footpath	anomaly group partially coincides with a current public footpath but may represent an archaeological deposit such as a filled ditch
	101		positive, extant/negative, extant		visible, recent excavation	anomaly group is most likely to represent a relatively recent excavation, possibly a geotechnical test pit
2	18	19	possible, negative	disrupted linear	linear deposit or relatively recent ploughing disturbance	
	19	18	possible, positive	disrupted linear	linear deposit or relatively recent ploughing disturbance	
	20		possible, positive	linear		
	21		possible, positive	disrupted linear		
	22		possible, positive	disrupted linear		
	23		possible, positive	linear		
	24		possible, positive	linear		
	25		possible, positive	disrupted linear		
	26		possible, positive	disrupted linear		
	27		possible, positive	disrupted curvilinear		
	28		possible, positive	linear		
	29		possible, positive	disrupted curvilinear		
	30		possible, positive	disrupted linear		
	31		possible, positive	disrupted linear		
	32		possible, positive	linear		
	33		possible, positive	linear		
	34		possible, positive	linear		
	35		possible, positive	disrupted linear		
	36		possible, positive	linear		
	37		possible, positive	linear		
	38		possible, positive	linear		
	39		possible, positive	linear		
	40		possible, positive	disrupted linear		
	41		possible, positive	disrupted curvilinear		
	42		possible, positive	disrupted linear		
	43		possible, positive	linear		
	44		possible, positive	disrupted linear		
	45		possible, positive	linear		
	46		possible, positive	linear		
	47		possible, positive	linear		
	48		possible, positive	linear		
	49		possible, positive	disrupted linear		
	50		possible, positive	linear		
	51		possible, positive	linear		
	52		possible, positive	linear		
	53		possible, positive	linear		

Table 1: data analysis

Figure 5: survey interpretation, entire area
over 25cm aerial photography image

Legend:

- survey area
- **Potential archaeology**
  certainty, anomaly type (2)
  - possible, positive
  - possible, negative
- **Potential services & modern**
  certainty, anomaly type (2)
  - positive, extant
  - negative, extant

no access during survey

Plot 1

Plot 2

0   80 m

British Grid
centre X: 255827.79 m, centre Y: 56461.01 m

Scale: 1:1300 @ A3. Spatial Units: Meter. Do not scale off this drawing

Geophysical survey: Copyright Substrata
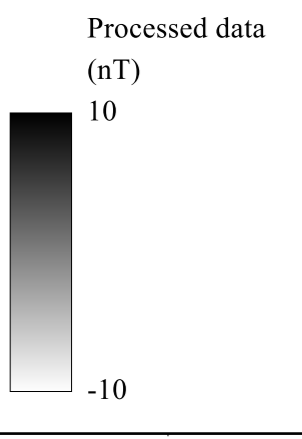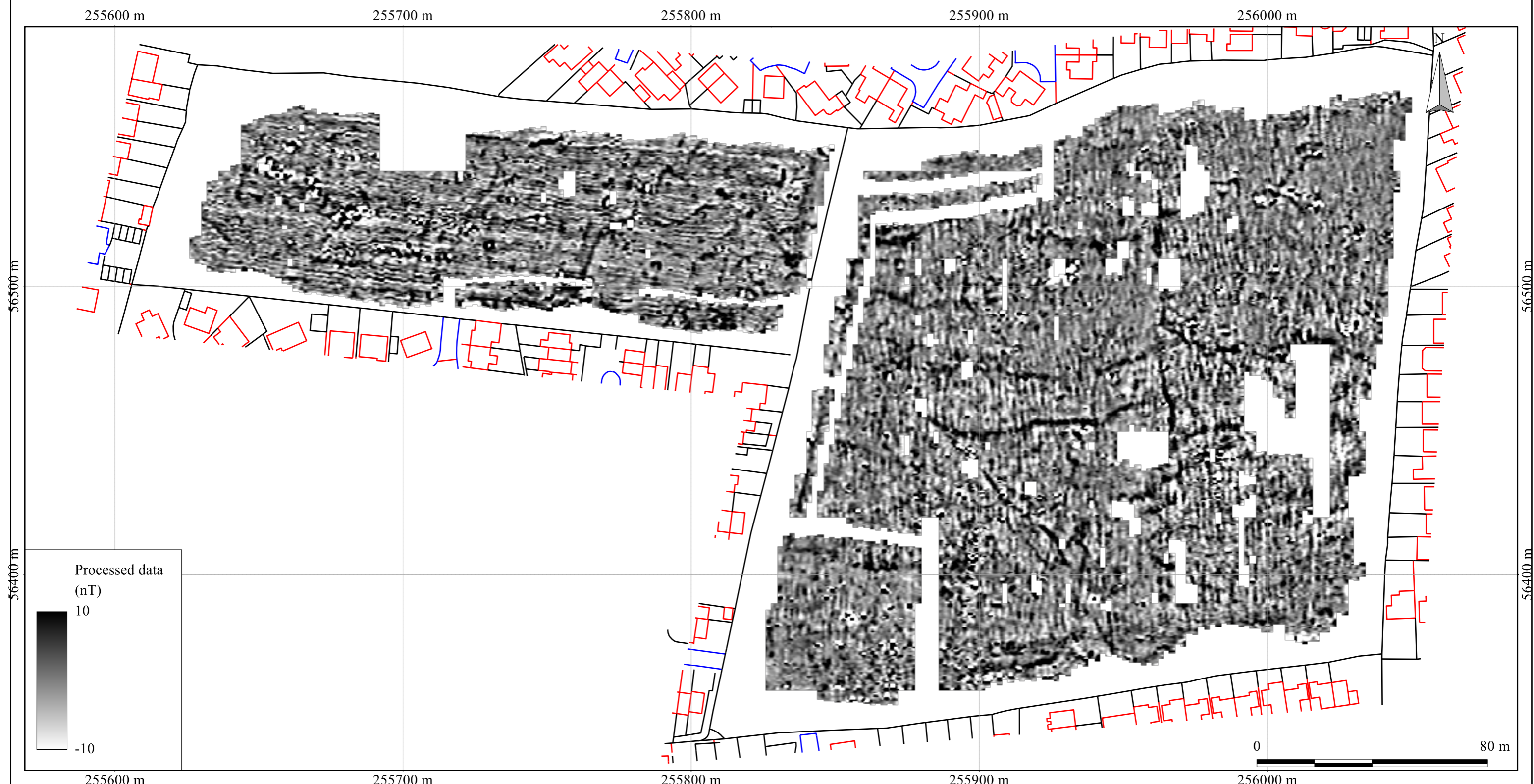Base map: (c) Getmapping plc 2016

Notes:
1. All interpretations are provisional and represent potential archaeological deposits.
2. 'Anomaly type' is a description of the magnetic anomaly. See the report text or GIS for an archaeological characterisation.
3. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.
4. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

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Substrata Limited
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Tel: 01273 273599
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

Processed data (nT)

10

-10

255600 m   255700 m   255800 m   255900 m   256000 m

56500 m   56400 m

0   80 m

British Grid
centre X: 255827.79 m, centre Y: 56461.01 m

Scale: 1:1300 @ A3. Spatial Units: Meter. Do not scale off this drawing

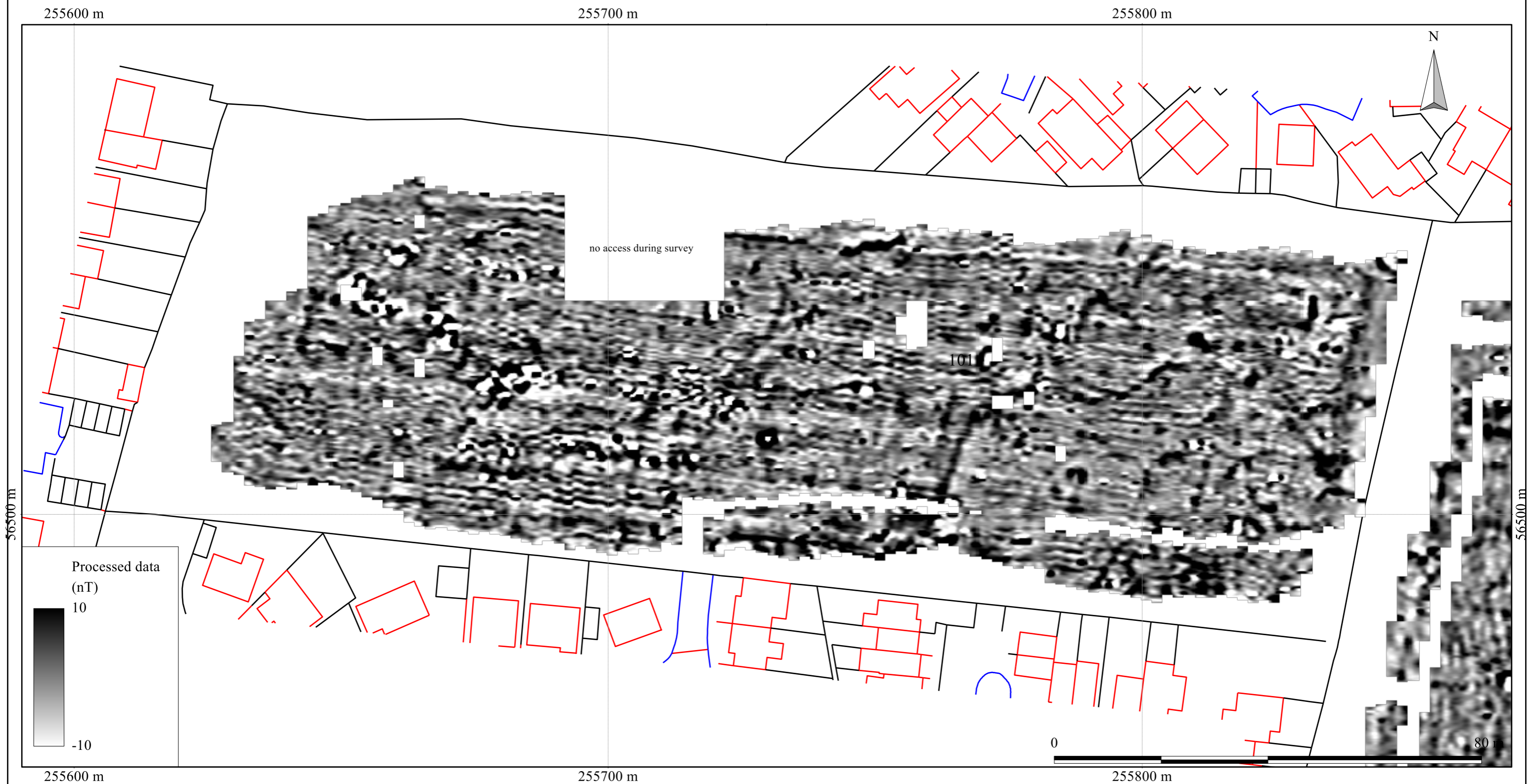An archaeological magnetometer survey
Land at Redwood Drive and Poplar Close
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Centred on NGR (E/N): 255836,056486 (point)
Report: 1607CHD-R-1

Figure 6: shade plot of processed gradiometer data, entire area

Figure 7: shade plot of processed gradiometer data, Plot 1

255600 m
255700 m
255800 m

N

no access during survey

101

Processed data
(nT)

10

-10

56500 m

56500 m

0
80 m

255600 m
255700 m
255800 m

Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer survey
Land at Redwood Drive and Poplar Close
Chaddlewood, Plympton, Devon
Centred on NGR (E/N): 255836,056486 (point)
Report: 1607CHD-R-1

255800 m   255900 m   256000 m   256100 m

Processed data
(nT)

10

−10

56500 m

56400 m

N

0   80 m

255800 m   255900 m   256000 m   256100 m

Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Centred on NGR (E/N): 255836,056486 (point)
Report: 1607CHD-R-1

Figure 8: shade plot of processed gradiometer data, Plot 2

Appendix 2   Methodology Summary

Table 2: methodology summary
Documents Survey methodology statement: Dean (2016)
Methodology 1.   The work was undertaken in accordance with the survey methodology statement. The geophysical (magnetometer) survey was undertaken with reference to standard guidance provided by the Chartered Institute for Archaeologists (2014) and Archaeology Data Service (undated). 2.   The survey grid location information and grid plan was recorded as part of the project in a suitable GIS system. 3.   Data processing was undertaken using appropriate software, with all anomalies being digitised and geo-referenced. The final report included 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.
Grid *Method of Fixing:* DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates. *Composition:* 30m by 30m grids *Recording:* Geo-referenced and recorded using digital map tiles. *DGPS used:* Spectra Precision PM5V2 GPS with external antenna and survey pole and DigiTerra Explorer 7 as the survey control program.

Equipment *Instrument:* Bartington Instruments grad601-2 *Firmware:* version 6.1	**Data Capture** *Sample Interval:* 0.25m *Traverse Interval:* 1 metre *Traverse Method:* zigzag *Traverse Orientation:* GN

Data Processing, Analysis and Presentation Software IntelliCAD Technology Consortium IntelliCAD 8.0 DW Consulting TerraSurveyor3 Manifold System 8 GIS Microsoft Corp. Office Excel 2013 Microsoft Corp. Office Publisher 2013 Adobe Systems Inc Adobe Acrobat 9 Pro Extended

Appendix 3   Data processing

Table 3: magnetometer survey - processed data metadata

SITE
Instrument Type: Bartington Grad-601 gradiometer
Units: nT
Direction of 1st Traverse: see below
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702

PROGRAM
Name: TerraSurveyor
Version: 3.0.29.3

Stats	Processes: 13

Max: 169.57
Min: -140.53
Std Dev: 7.66
Mean: 0.35
Median: 0.03
	1 Base Layer
	2 Clip at 1.00 SD
	3 DeStripe Median Sensors: Grids: All
	4 De Stagger: Grids: All Mode: Both By: -1 intervals
	5 De Stagger: Grids: All Mode: Both By: -1 intervals
	6 De Stagger: Grids: c1.xgd c6.xgd c15.xgd c2.xgd c5.xgd c16.xgd c3.xgd
	    c4.xgd c17.xgd Mode: Both By: -1 intervals
	7 De Stagger: Grids: c10.xgd c11.xgd c9.xgd c12.xgd c8.xgd c13.xgd c7.xgd
	    c14.xgd c6.xgd c15.xgd Mode: Both By: -1 intervals
	8 De Stagger: Grids: d1.xgd d3.xgd d4.xgd d5.xgd d6.xgd d7.xgd d8.xgd
	    Mode: Both By: -1 intervals
	9 De Stagger: Grids: d2.xgd e1.xgd e2.xgd e3.xgd e4.xgd e5.xgd e6.xgd
	    Mode: Both By: 1 intervals
	10 De Stagger: Grids: e8.xgd e7.xgd Mode: Both By: 1 intervals
	11 De Stagger: Grids: d12.xgd d13.xgd Mode: Both By: -1 intervals
	12 De Stagger: Grids: d11.xgd d10.xgd d9.xgd Mode: Both By: -1 intervals
	13 Interpolate: Match X & Y Doubled.

0°

-3002.60   3002.90

	3002.9 nT
	8.2
	4.9
	2.9
	1.35
	0
	-1.3
	-2.7
	-4.5
	-7.1
	-3002.6 nT

-10 0 10 20 30 40 50

Processes: 2
    1   Base Layer
    2   DeStripe Median Sensors: Grids: All

Instrument Type: Bartington Grad 601
Units: nT
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 2 @ 0.00 m spacing.
Dummy Value: 32702
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m
Stats
Max: 3002.90
Min: -3002.60
Std Dev: 62.93
Mean: 0.17
Median: 0.00
PROGRAM
Name: TerraSurveyor
Version: 3.0.29.3

Figure 9: shade plot of minimally processed data