Substrata

Archaeological Geophysical Surveyors

An archaeological magnetometer and resistance survey

Berry Castle, Huntshaw
Torridge, Devon

Centred on NGR (E/N): 249488,122283(point)

Report: 1611BER-R-1

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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 (magnetometer) twin-probe earth resistance
Dates:	gradiometer survey: between 27 June and 1 July 2016 resistance survey: between 14 and 18 November 2016
Area:	gradiometer survey 1.6ha earth resistance survey 0.53ha
Lead surveyor:	Mark Edwards BA
Author:	Ross Dean BSc MSc MA MIfA with contributions from Mark Edwards

1.2 Client

Friends of Berry Castle, c/o Knockworthy Farm, Huntshaw, Torrington, Devon EX38 7HJ

1.3 Site information

Site:	Berry Castle
Civil Parish:	Huntshaw
District:	Torridge
County:	Devon
Nearest Postcode:	EX38 7HB
NGR:	SS 495 223 (point)
Ordnance Survey NGR (E/N):	249488,122283 (point)
Scheduled monument:	1016225
Devon Historical Environment:	MDV5627
National Monuments Record:	33126
Section 42 licence:	Case number SL00127777 Monument number: 1016225 Magnetometer Licence period: 12 April to 12 July 2016 Resistance Licence period: 3 to 18 November 2016

1.4 Archive

OASIS number:	substrat1-2578409
Archive:	At the time of writing, the archive of this survey will be held by Substrata.

1.5 Associated project documentation

Initial assessment:	Alimo (2012)
Gradiometer survey:	Dean (2016b)
Earthwork Survey:	Newman (2016)

1.6 Introduction

This report updates and replaces the original magnetometer survey report (Dean, 2016b)

Berry Castle is classified as a slight, univallate, hillfort. These are defined as enclosures of various shapes, generally between 1ha and 10ha in size, situated on or close to hilltops and defined by a single line of earthworks, the scale of which is relatively small. They date to between the Late Bronze Age and Early Iron Age (eighth - fifth centuries BC), the majority being used for 150 to 200 years prior to their abandonment or reconstruction. Slight univallate hillforts have generally been interpreted as stock enclosures, redistribution centres, places of refuge and permanent settlements (Historic England, undated b).

This report presents the results of an archaeological gradiometer (a type of magnetometer) survey and subsequently commissioned resistance survey at the above site, hereafter referred to as the survey area. It has been prepared for the Friends of Berry Castle as part of an ongoing programme of research and conservation. The survey area location is shown in Figure 1. The survey area includes a Scheduled Monument comprising the bulk of Berry Castle and the

relevant licence to carry out a geophysical survey was obtained by The Friends of Bury Castle as summarised above.

This report includes data and analysis from an earlier report of the magnetometer survey carried out between 27 June and 1 July 2016 (Dean, 2016b). The magnetometer data analysis and conclusions are updated in this report in the light of evidence obtained from the resistance survey.

1.7 Summary

Both the magnetic and earth resistance responses were sufficient to be able to differentiate anomalies representing possible archaeological features.

The magnetometer (gradiometer) and resistance analyses suggest that the structure of the main earthworks at Berry Castle comprises an outer ditch with an small ramp on the outer edge surrounding an earthen bank with a stone-revetted outer face which has partially collapsed into the upper deposits within the ditch. On the southern side of the monument the pattern of anomaly groups may be explained by the partial destruction of the bank and the filling of the ditch to create a track.

The northern-most of two previously identified locations for potential entrances on the western side of the monument is most likely to be a true entrance and not a decoy as originally described in 1906. The magnetic and resistance anomaly groups representing an earthen element of the ramparts on the inner side at the second proposed western entrance is continuous which implies that this is not an entrance and that the bank at this location was breached and repaired at some point subsequent to initial construction and possibly fairly recently. A third previously identified potential entrance on the eastern side was discounted as the anomaly groups representing an earthen element of the rampart is continuous at this location.

Within the main body of the monument a potential charcoal production platform was tentatively identified with associated resistance anomalies implying the presence of pits although these may be tree boles. The potential charcoal production does not rule out an earlier origin for this platform. Two linear magnetic anomalies representing potential archaeological deposits were identified in to the west of the scheduled area but not characterised further. Anomalies representing possible agricultural terraces were identified outside of the scheduled area near the southwestern corner. No conclusions were reached about a previously mapped surface deposit of stones at this location. Evidence for possible agricultural terraces were identified and on the southern side the monument. Linear anomaly groups representing stony and earthen deposits were identified northeast of the scheduled area that represent previously recorded earthworks external to the main monument and which may not have a direct association.

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. Specifically (refer to Figure 2):

1. Within Area 1, understand the constituents and construction of the monument;
2. Within Area 2, examine the apparent slight earthworks running across the current track;
3. Within Area 3, examine the surface deposit of stones;
4. Within Area 4, examine a section of the banks external to the main monument within current tree cover;
5. Within Area 5, examine a possible entrance, a possible track and internal features highlighted in the gradiometer survey, and further examining the idea of a decoy entrance;
6. Within Area 6, examine a possible platform (possibly a charcoal burning area, perhaps with earlier uses), the structure of the denuded ramparts and possible internal features highlighted in the gradiometer survey, and examine an area provisionally identified as the site for a planned information plaque;

7. Within Area 7, look for evidence of tracks and entrances.

2.2 Objectives

1. Complete a gradiometer and resistance survey across the agreed survey area.
2. Identify any magnetic and resistance 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/Digital Antiquity Guides (undated).

4 Site description

4.1 Landscape and land use

The hillfort lies on a relatively flat area towards the western end of an east to west trending spur between approximately 85m to 107m AOD (Figure 1). Steep, wooded valley sides lie to the north, west and south. To the east, the spur rises towards an upland area cut by steep-sided valleys. Referring to Figure 2, the gradiometer survey area comprises Berry Castle hill fort and three adjacent parcels of land (Areas 1 to 4). The resistance survey area comprises three parcels of land within the Berry Castle scheduled area (Areas 5 to 7). At the time of the survey the formally extant forest plantation had been cleared over the scheduled area leaving only tree stumps. The brush and long vegetation had also been cleared in preparation for the survey. Area 2, had been cleared of long vegetation to the limits shown in Figure 2. Area 3 had been partially cleared over the area of stones with knee-deep vegetation surrounding. Area 4 is in an area of woodland with the undergrowth cleared back into small piles. Area 7 lies between the eastern end of the hillfort and the woodland. Preparatory clearance of high vegetation had also been undertaken in this area.

4.2 Geology

The survey area has a solid geology of sandstone of the Carboniferous Bude Formation. These rocks are grey thick-bedded, somewhat argillaceous and silty sandstones, in laterally discontinuous internally massive beds 1-5m thick and commonly amalgamated into units up to 10m thick. When weathered the sandstones become buff and friable. Very thick beds of slumped and destratified strata are also present. Grey mudstones occur as interbeds up to 1m thick but locally packets of darker mudstone up to 20m thick with thin ironstone beds and bundles of thin sandstones, especially in the upper part of the Formation (British Geological Survey, undated).

The superficial geology was not recorded in the source used (ibid).

5 Archaeological background

5.1 Historic landscape characterisation

'Other woodland'

Broad-leaved plantations, re-planted ancient woodland or secondary woodland that has grown up from scrub (Devon County Council, undated).

5.2 Archaeological background

The following is a short summary of information obtained from Alimo (2012) and from the

Devon HER records within approximately 1000m of the survey area and relevant to the understanding of the geophysical survey were. Except where specifically cited, this information was obtained using the Heritage Gateway portal (Historic England, undated a).

5.2.1 Heritage assets within the survey area

Berry Castle Camp is the remains of an Iron Age hillfort in Huntshaw Wood[1]. The hillfort has been under cultivated woodland for perhaps many hundreds of years, over which, the banks have been broken down due to either re-seeding, planting or felling, and the ditches have become filled with tree debris and undergrowth generally. The site has now been cleared of trees and undergrowth in Areas 1 and 3 (Figure 2). The shape of the fort is a fairly regular parallelogram with a well-defined bank and ditch to the north and well defined banks to the east and west. The bank to the south however, is considerable less defined and has been possibly flattened. Evidence of quarrying in the ditch at the north west corner of the site is recorded from 1922, which also states that stones were used from the site for road mending.

Two banks, external to the scheduled area of Berry Castle are located to the north-east corner of the site. It is speculated that they may have been unfinished eastern defences, as this would have been the most vulnerable side of the fort during any attack. Similar outer defences are seen on other hillforts[2].

A possible stone circle or cairn lies 20 metres to the south-west of Berry Castle, it has been exposed due to logging of the area and appears to have been disturbed[3].

Alimo (2012) has summarised the possible entrances to the monument:

The earliest written records of Berry Castle are found in the Victoria County History for Devonshire (Wall, 1906) where reference was made to two entry points with a simple opening in the east (point C in Figure 2 of this report) and a entrance in the west (point B) and a decoy entrance (point A). Alimo (2012: Section 4.7.4 and Figure 21) describes the site of the original eastern entrance is a gap of around two metres in the rampart adjacent to a quarry scoop with an apparent causeway leading up to the gap.

Field Investigators comments from 1953 note an earthwork straddling an east to west ridge that slopes to the west. A glacis-type bank 1.0 metre high was found on the south side with no ditch. Remaining defences consisted of a stony bank with an outer ditch. The strongly defended north-west corner is mentioned along with a counter-scarp bank beyond the ditch. A single entrance at the north-west corner of the hillfort is described and this was associated with an oval depression lying immediately inside. It is claimed that the entrances indicated by Wall were modern gaps in the bank made for tracks through the wood.

Field Investigators comments from 1980 refer to a defended settlement with only the eastern and western sides being relatively complete. A modern track was found to cross east/west through the settlement and this was clear of the original in turned entrance. It was claimed that the "hollow" through the entrance was dug to create the in turning banks (sourced from Alimo, 2012).

5.2.2 Heritage assets within 1000m of the survey area

Several undated enclosures are recorded in the wider area. An enclosure is recorded at Castle Field, a simple defensive enclosure that occupies a ridge 600m N180 from site. The enclosure has been destroyed by cultivation, although some remains are still traceable through crop marks[4]. An enclosure east of Southcott Barton is recorded 906m N264 from the survey area,

Historic Environment Notes

Record entries listed below in order: Devon Historical Environment Record, National Grid Reference, Scheduled monument number (if present), National Monuments Record (if present)

1. MDV5627, SS 495 222, 1016225, 33126
2. MDV107285, SS 495 223
3. MDV107284, SS 494 222
4. MDV11842, SS495 216

formed of a double ditched rectangular enclosure visible on RAF photography. The outer enclosure is approximately 64m by 44m, and the inner enclosure is approximately 30m by 20m[5]. A near circular enclosure visible as cropmarks from aerial photography is recorded 1300m N180 from the survey area, north of Southcott Barton. The enclosure is roughly 45m diameter with no visible entrance[6]

A 1947 aerial photograph suggests the presence of pits 990m N315 from the site, although the 1842 Tithe Apportionment records the field as 'Lower Moor' which is not suggestive of any particular activity[7]

Evidence of modern quarrying is recorded 728m N16 from site, east of Fairoak[8], 860m N54 from site[9] and 922m N13 from the site to north of Fairoak[10].

Historic Environment Notes
Record entries listed below in order: Devon Historical Environment Record, National Grid Reference, Scheduled monument number (if present), National Monuments Record (if present)

5. MDV73888, SS 486 221
6. MDV16675, SS 482 222
7. MDV65515, SS 488 229
8. MDV34103, SS497 229
9. MDV67699, SS 502 277
10. MDV34104, SS 497 231

6 Results, discussion and conclusions

6.1 Scope and definitions

This survey was designed to record magnetic and resistance anomalies.

A magnetic anomaly is a local variation in the Earth's magnetic field. Such variations can result from differences in the chemistry or 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.

A resistance anomaly is a local variation in the electrical resistance of a soil and is related to its porosity, permeability, saturation, and chemical nature of entrapped fluids (Heimmer and De Vore, 1995:30), all of which can be altered by past human activities. Higher concentrations of ions allow electrical current to pass more easily through the soil, creating a lower electrical resistance.

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

Magnetic and resistance 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. They can be, however, indicative of archaeological deposits, structures, features or past human activity.

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

The reader is referred to section 7.

6.2 Results

Figure 2 shows the magnetometer (gradiometer) and resistance survey areas along with their designations. Figure 3 shows the interpretation of the gradiometer and resistance survey data sets and displays the anomalies relating to potential archaeological deposits only.

Figures 4 and 5 provide the complete interpretation of the gradiometer and resistance data sets respectively. The anomaly groups identified as possibly relating to archaeological deposits, structures or features along with their identifying labels. Anomalies identified as possibly relating to modern services and relatively recent (‘modern’) ground disturbance are also shown. Tables 1 and 2 (gradiometer and resistance surveys respectively) are extracts of the detailed analysis of the survey data sourced from the attribute tables of the GIS project provided in the project archive.

All the interpretations are displayed over a recently completed earthworks survey of the hillfort to provide essential context (Newman, 2016).

Figures 4 and 5 along with Tables 1 and 2 comprise the analysis of the survey data.

Various plots of the processed data as specified in Tables 4 and 5 are provided in Figures 5 to 9.

Figures 10 to 16 are plots of the unprocessed gradiometer and resistance data along with the relevant metadata.

6.3 Discussion

6.3.1 General points

Discussion scope

The following discussion links the results of the geophysical survey with the extant earthworks of Berry Castle. The earthworks map, produced by Southwest Landscape Investigations (Newman, 2016) is reproduced in Figures 3 to 5.

Anomalies groups identified in Tables 1 and 2 as possibly representing archaeological deposits or features but which cannot be further characterised are not discussed below. All identified anomaly groups are recorded in the GIS project held the survey archive.

Data collection

Data collection within the survey area was restricted as shown in Figure 2 and elsewhere due to the presence of steep ground (Areas 1, 5 and 7), vegetation (Areas 1 and 3 to 7) and standing trees (Areas 1, 4 and 6). The southern boundary of Areas 1 and 6 were defined by the start of relatively dense woodland.

Anomaly characterisation and mapping

Referring to Figures 6 to 9, there are a number of anomaly groups that could be interpreted as relating to large postholes or pits although most will relate to tree boles or have other natural origins. Anomalies of this sort are only mapped as potential archaeology if they are clustered in groups or otherwise form recognisable patterns.

Numerous dipole magnetic anomalies are scattered across the gradiometer data set (Figures 6 and 7). 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.

Anomalies thought to relate to natural features and recent man-made objects were only mapped where they comprised significant magnetic responses across the dataset that needed clarification.

6.3.2 Magnetometer (gradiometer) survey

6.3.2.1 Area 1

The survey of Area 1 was designed to contribute to the understanding of the constituents and construction of the monument.

On the west, north and east sides of the monument the same pattern of magnetic anomaly groups are present. Group g1 represents a low mound on the outer edge of the monument ditch. Group g3 may be a continuation of g1 but may instead represent ditch deposits. Group g2 may represent ditch deposits or tree boles within the visible ditch.

Group g4 represents deposits that lie on the outside face of the main monument bank on the western and eastern sides of the monument, on the outside face of the bank and within the ditch on the northern side of the monument and almost completely in what is assumed to be the ditch on the southern side of the monument. It is most likely that g4 represents relatively stony deposits and possibly the remains of a stone revetment on the outer face of the bank.

Group g5 consistently lies along the crest of the bank all around the monument and has magnetic characteristics normally associated with relatively earthen deposits. The inner face of the main bank, in contrast, has no strong magnetic response which implies that its constitution is similar to that of the background, natural deposits across the site.

On the southern side of the monument, the material represented by g4 coincides with the former ditch, assuming that a ditch once existed at this location. Group g6 is in the same relative position to the ditch deposits as g1 is on the other sides of the monument. Group g6, however, corresponds with a sloping earthwork (or lynchet) and not the bank of g1. The

combination of g5, g4 and g6 along with the earthwork survey suggests that the original southern bank has been toppled into the ditch at some point in the past. One possible explanation is that a track was created along the line of the former ditch on the southern edge of the monument with a revetment on the down-slope side of the track being represented by g6. Groups g17 and g18 may represent linear deposits such as agricultural terracing. Their relationship to the monument is unknown.

Excluding the three relatively recent quarry pits (Figure 2 and other figures), and other sections of the earthworks too steep to survey safely, groups g4 and g5 show only one distinct gap in their collective pattern which is situated to the northern end of the western side and corresponds to the proposed decoy entrance described by Wall (1906) (location A in Figure 2). The fact that all three anomaly groups break here suggests that this is the site of an original entrance (see Section 5.3.1 for a discussion of this entrance). The earthworks represented by groups g201 and g202 were recorded by Wall (1906) as earthworks associated with a false or decoy entrance. The magnetic response in conjunction with the earthwork survey suggests that these groups represent relatively recent ground disturbance, possibly the quarrying recorded in this vicinity from 1922 onwards (Section 5.3.1). These conclusions are supported by the earthwork survey (Newman, 2016: 7).

Two other entrances have been proposed by Wall at points B and C in Figure 2) although these were not identified as entrances in two later studies (see Section 5.3.1).

Group g13 on the western side of the monument has characteristics typical of a former routeway or track. Indeed the magnetic anomalies at the point of intersection with g13 and the extant bank ramparts show a gap in group g4 and a break in the pattern of g5. The position of the break in the anomalies coincides with an entrance mapped by Allcroft (1908) at point B in Figure 2. The three anomalies are here interpreted as representing former routeway which passed through a break in the bank earthworks that has been later filled in. The resistance anomalies at the same point show the same gap (Section 6.3.3). The anomaly pattern points towards a relatively recent origin for the routeway rather than it being an original entrance and this is supported by the earthwork survey (Newman, 2016: 7).

Point C is the third entrance proposed by Wall. The analysis of the anomalies is complicated by the presence of a quarry pit but here group g5 appears continuous so making this proposed entrance far less likely than the other two. Newman (2016: 7) points out that, although there is a hollow across it at this location, the bank has not been breached.

Groups g7 and g8 on the northern bank, and group g16 on the southern bank may represent drains or other small breaches of the bank structure of unknown date.

Group g12 within the monument lies close to a platform recorded in the earthwork survey. It has some characteristics that are typical of anomalies representing a former charcoal burning platform. Given the context of the site and the form of coinciding resistance anomalies r6 and r7 discussed in Section 6.3.3, this does mean that the platform may have had a use before charcoal production.

Anomaly groups g203, g204 and g205 approximately coincide with the current track (g204) and previous expression of that track recorded by Wall in 1906 (g203 and g205).

6.3.2.2 Area 2

The survey across Area 2 was designed examine the apparent slight earthworks running across the current track. Groups g21 and g22 may represent linear archaeological deposits but could not be characterised further.

6.3.2.3 Area 3

The survey across Area 3 was designed to test for the presence of a cairn implied by a small surface deposit of stones. No evidence for a cairn was recorded in the data. Groups g23, g24 and g25 may represent agricultural terracing or natural deposits.

6.3.2.4 Area 4

The survey across Area 4 was designed to provide a preliminary assessment of the banks external to the main monument within current tree cover and which have been identified as possible unfinished eastern defences associated with the main monument. Anomaly groups g25 to g28 and perhaps groups g29 to g31 do appear to represent linear structures although no further archaeological characterisation is possible from the gradiometer data. The earthwork survey undertaken by Southwest Landscape Investigations (Newman, 2016,:7,8) suggests that these features are not associated with the monument and are likely to be relatively recent.

6.3.3 Resistance survey

6.3.3.1 Area 5

The survey across Area 5 was designed to examine a possible entrance, a possible track and internal features highlighted in the gradiometer survey, and further examining the idea of a decoy entrance.

On the west side of the monument the relatively low resistance anomaly group r1 represents deposits lying within the ditch, the higher resistance anomaly r2 representing deposits along the outer face of the bank and r3 representing low resistance anomalies on the inner face of the bank. Whilst this pattern does not coincide exactly with the gradiometer anomalies so far as the ditch and the top of the bank are concerned, both sets of anomalies represent a clear structure for the bank of an external stone revetted face and a main bank comprising relatively earthen deposits. The external ditch is well defined in the resistance data and no stony deposits were recorded which implies that the gradiometer data may be recording relatively shallow collapse deposits from the outer bank while the resistance data is recording responses from deeper archaeological deposits.

The break in the bank at A (Figure 2) is clear and supports the gradiometer data and earthwork survey in suggesting that this is the main entrance. The response and pattern of group r202 suggests that the structure here is superficial compared to the main ditch and bank and probably later which supports the gradiometer analysis of this location (Section 6.3.2.1).

Evidence for a gap in the bank discussed in Section 6.3.2.1 is supported by the pattern of anomaly groups r1 to r5 in the southern half of Area 5 at point B (Figure 2). Group r4 in particular is most likely to represent a later low resistance in-fill deposit between the higher resistance groups r2 and r5. Group r3 either represents inner bank deposits or, less likely, a later build up of earthen material.

6.3.3.2 Area 6

The survey across Area 6 was designed to examine a possible platform (possibly a charcoal burning area, perhaps with earlier uses), the structure of the denuded ramparts and possible internal features highlighted in the gradiometer survey, and examine an area provisionally identified as the site for a planned information plaque.

Resistance anomaly groups r6 and r7 coincide with a slight platform recorded in the earthwork survey and with magnetic anomaly group g12. The magnetic data suggests the presence of a charcoal burning platform. The resistance data implies the presence of three pits and a curvilinear deposit although the ’pits’ may be tree boles. Whilst the anomaly patterns are enigmatic they, along with the gradiometer data, do support the idea of possible archaeology near the mapped earthwork platform.

At the southern edge of Area 6, the linear resistance anomalies again provide a different view of the bank deposits and again are likely to represent deposits and features at a different depth to those behind the magnetic responses. The relatively low earthworks in the area are not consistently represented in the data. The low-resistance anomaly groups r10 and r12 lie to the north and south of a high resistance anomaly group r11. In this case the resistance anomaly pattern straddles a small mound within the lower bank and the surface deposits here may have influenced the average resistance values. Group r9 may indicate the presence of a large tree bole or other more recent ground disturbance.

6.3.3.3 Area 7

The survey across Area 7 was designed to look for evidence of tracks and entrances.

The linear resistance anomalies r13 to r15 reflect the general structure of the bank but imply a relatively earthen bank with patches of stony deposits inconsistent with the pattern of resistance anomalies seen in Area 5. The gradiometer data, in contrast, suggested a structure generally in keeping with the western and northern bank. Again it is clear the resistance data reflects deposits at different depths to those represented by the magnetic data and it also seems to be the case that, once again, the resistance data reflects slightly deeper deposits. If this is so then the resistance data implies disturbance of the stony deposits of the bank in this area which would be consistent with the evidence for quarrying recorded in the earthwork survey.

6.4 Conclusions

Both the magnetic and earth resistance responses were sufficient to be able to differentiate anomalies representing possible archaeological features.

The magnetometer (gradiometer) and resistance analyses suggest that the structure of the main earthworks at Berry Castle comprises an outer ditch with an small ramp on the outer edge surrounding an earthen bank with a stone-revetted outer face which has partially collapsed into the upper deposits within the ditch. On the southern side of the monument the pattern of anomaly groups may be explained by the partial destruction of the bank and the filling of the ditch to create a track.

The northern-most of two previously identified locations for potential entrances on the western side of the monument is most likely to be a true entrance and not a decoy as originally described in 1906. The magnetic and resistance anomaly groups representing an earthen element of the ramparts on the inner side at the second proposed western entrance is continuous which implies that this is not an entrance and that the bank at this location was breached and repaired at some point subsequent to initial construction and possibly fairly recently. A third previously identified potential entrance on the eastern side was discounted as the anomaly groups representing an earthen element of the rampart was continuous at this location.

Within the main body of the monument a potential charcoal production platform was tentatively identified with associated resistance anomalies implying the presence of pits although these may be tree boles. The potential charcoal production does not rule out an earlier origin for this platform. Two linear magnetic anomalies representing potential archaeological deposits were identified in to the west of the scheduled area but not characterised further. Anomalies representing possible agricultural terraces were identified outside of the scheduled area near the southwestern corner. No conclusions were reached about a previously mapped surface deposit of stones at this location. Evidence for possible agricultural terraces were identified and on the southern side the monument. Linear anomaly groups representing stony and earthen deposits were identified northeast of the scheduled area that represent previously recorded earthworks external to the main monument and which may not have a direct association.

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.

8 Acknowledgements

Substrata and would like to thank The Friends of Berry Castle for commissioning us to complete the surveys.

The Friends of Bury Castle would like to thank Clinton Devon Estates, Historic England, the Coastal Recycling Community Fund, Alverdiscott and Huntshaw Parish Council, Weare Giffard Parish Council, the Great Torrington Cavaliers, the North Devon Archaeological Society, and the Torrington, Holsworthy and Bideford Cadets for their assistance in making this survey possible.

The Friends of Berry Castle are grateful for the permissive rights granted by Clinton Devon Estates.

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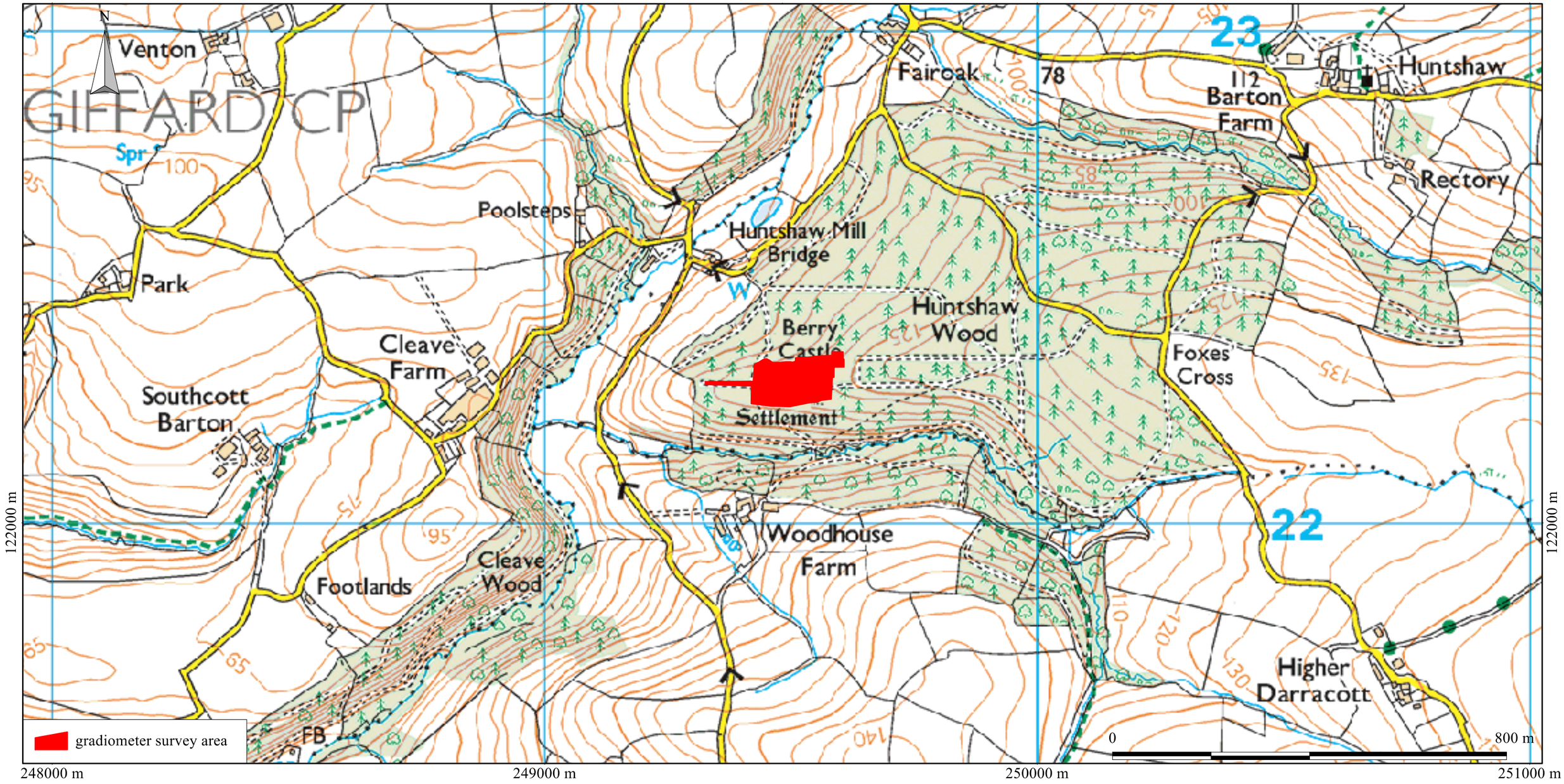
Appendix 1 Supporting plots and analysis table

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.

A rough rule for interpreting resistance anomalies is that if an x-y trace is drawn of the resistance over an anomaly, then the width of an anomaly at half its maximum height is equal to the width of the buried feature. Caution must be applied when using this rule as it depends on the anomalies being clearly identifiable and distinct from adjacent anomalies and it should be noted that the relationship between change in resistance response and depth is not linear (Gaffney and Gater, 2003: 112).



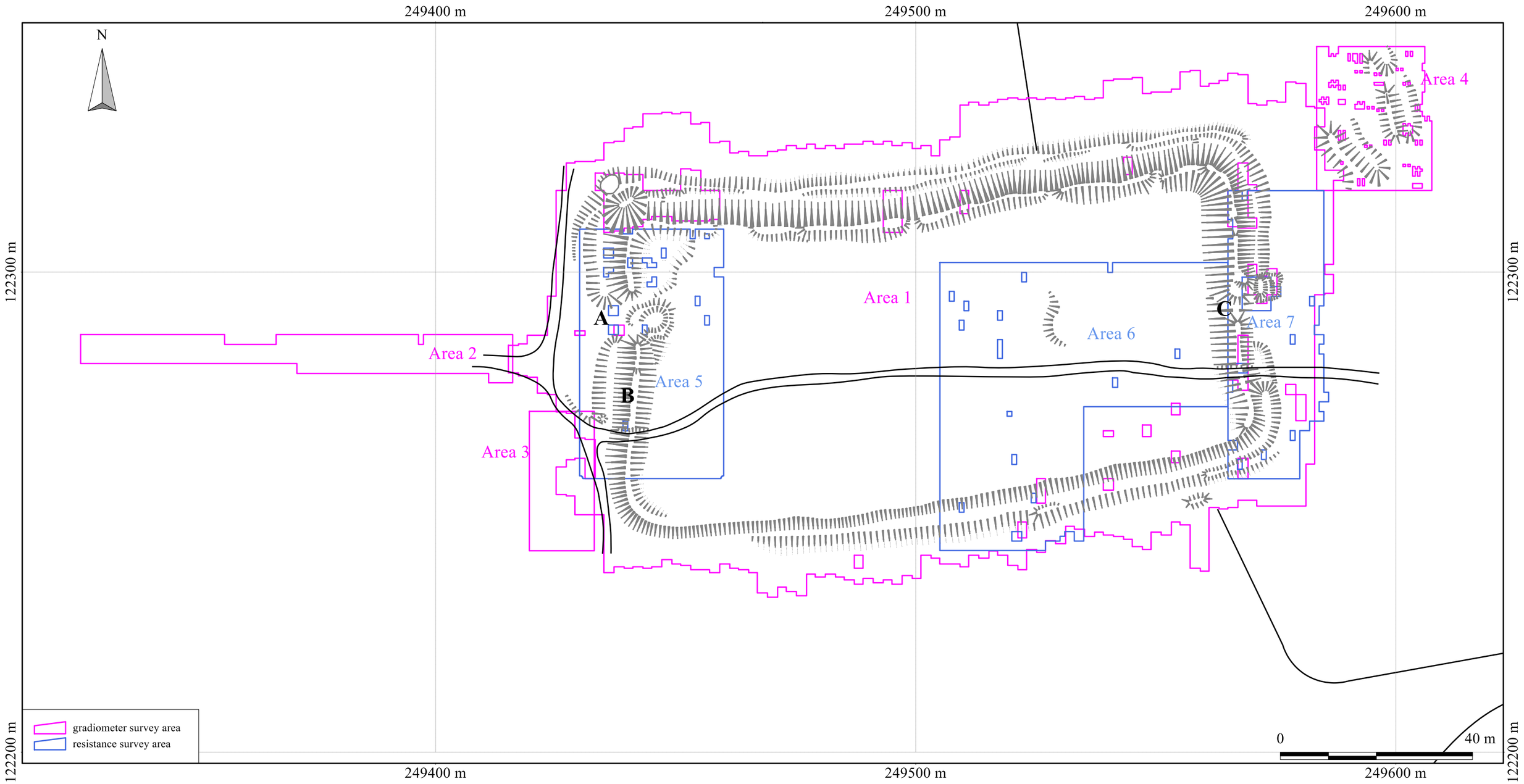
British Grid
centre X: 249482.76 m, centre Y: 122282.67 m

Scale: 1:8000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer and resistance survey
Berry Castle, Huntshaw, Torridge, Devon
Centred on NGR (E/N): 249488,122283 (point)
Report: 1611BER-R-1

Figure 1: location map

Substrata Limited
Langstrath, Goodleigh
Barnstaple, Devon EX32 7LZ
Tel: 01271 342721
Email: geophysics@substrata.co.uk
Web: substrata.co.uk



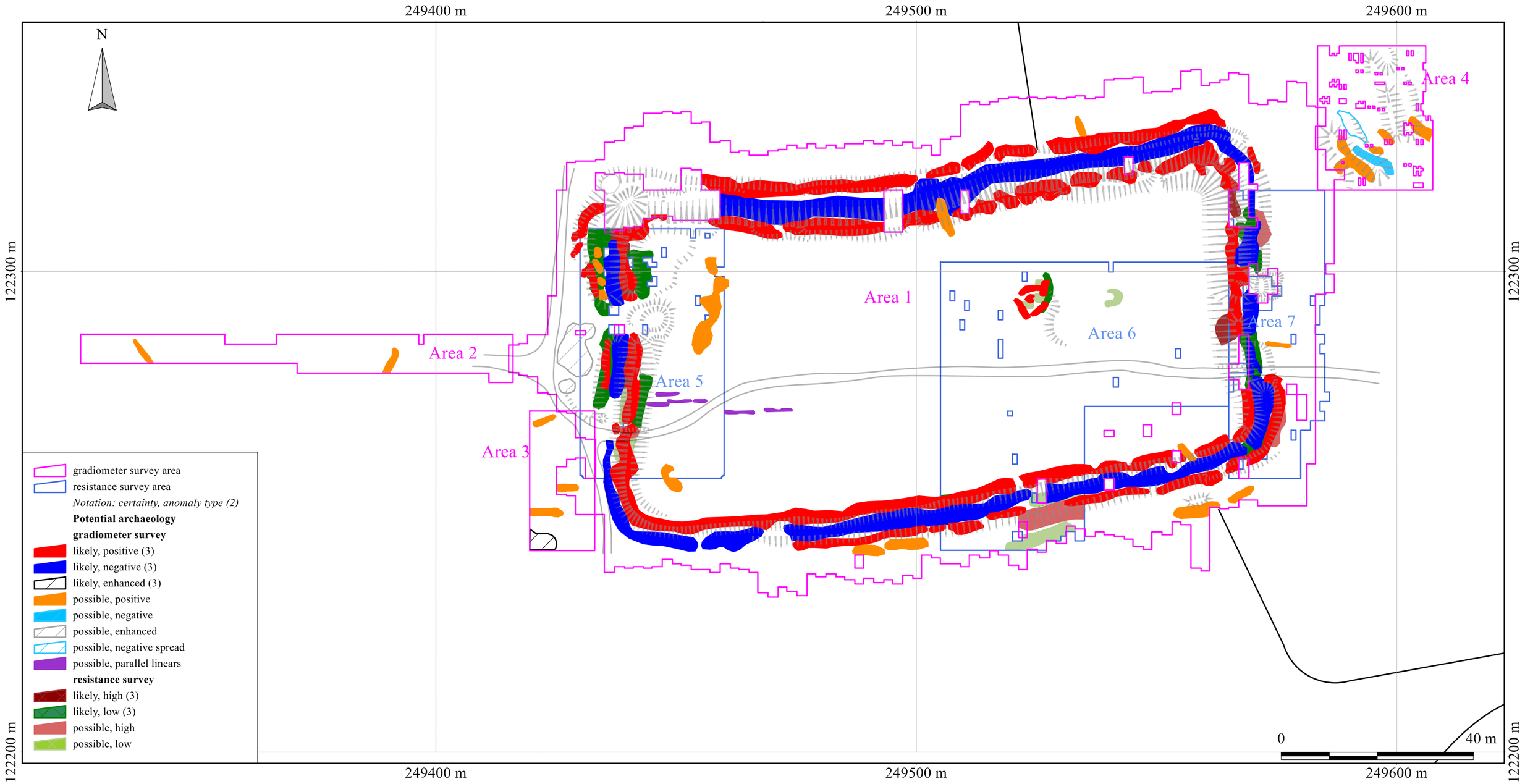
British Grid
centre X: 249468.15 m, centre Y: 122274.80 m

Scale: 1:800 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer and resistance survey
Berry Castle, Huntshaw, Torridge, Devon
Centred on NGR (E/N): 249488,122283 (point)
Report: 1611BER-R-1

Figure 2: survey areas over earthworks survey
and proposed entrances A, B and C (Wall, 1906)

Substrata Limited
Langstrath, Goodleigh
Barnstaple, Devon EX32 7LZ
Email: geophysics@substrata.co.uk
Web: substrata.co.uk



British Grid
centre X: 249468.15 m, centre Y: 122274.80 m

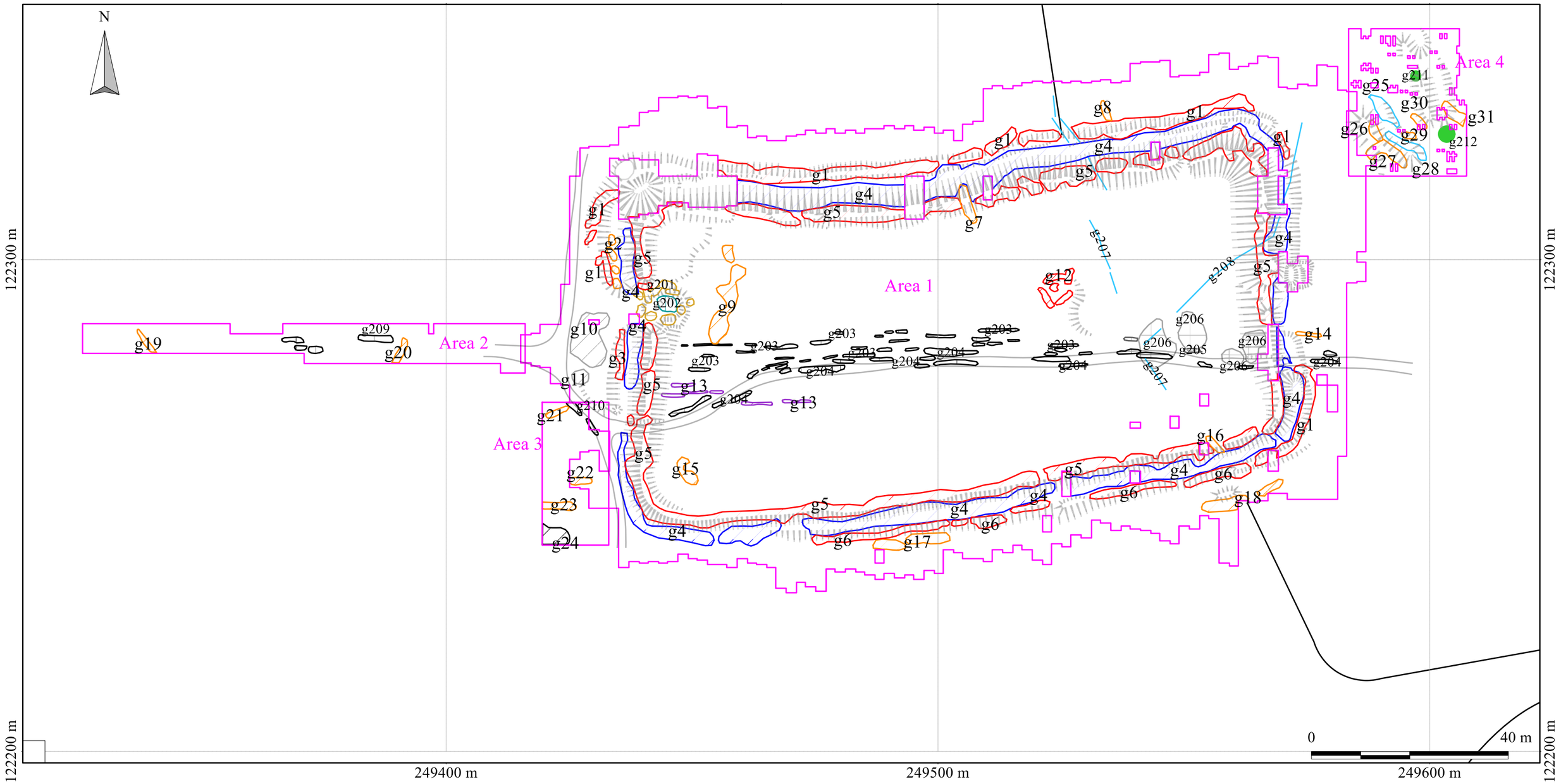
Scale: 1:800 @ A3. Spatial Units: Meter. Do not scale off this drawing

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. Representative; not all instances are mapped.
5. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

An archaeological magnetometer and resistance survey
Berry Castle, Huntshaw, Torridge, Devon
Centred on NGR (E/N): 249488,122283 (point)
Report: 1611BER-R-1

Figure 3: gradiometer and resistance survey interpretation, anomalies relating to potential archaeology only

Substrata Limited
Langstrath, Goodleigh
Barnstaple, Devon EX32 7LZ
Tel: 01271 342721
Email: geophysics@substrata.co.uk
Web: substrata.co.uk



British Grid
centre X: 249468.15 m, centre Y: 122274.80 m

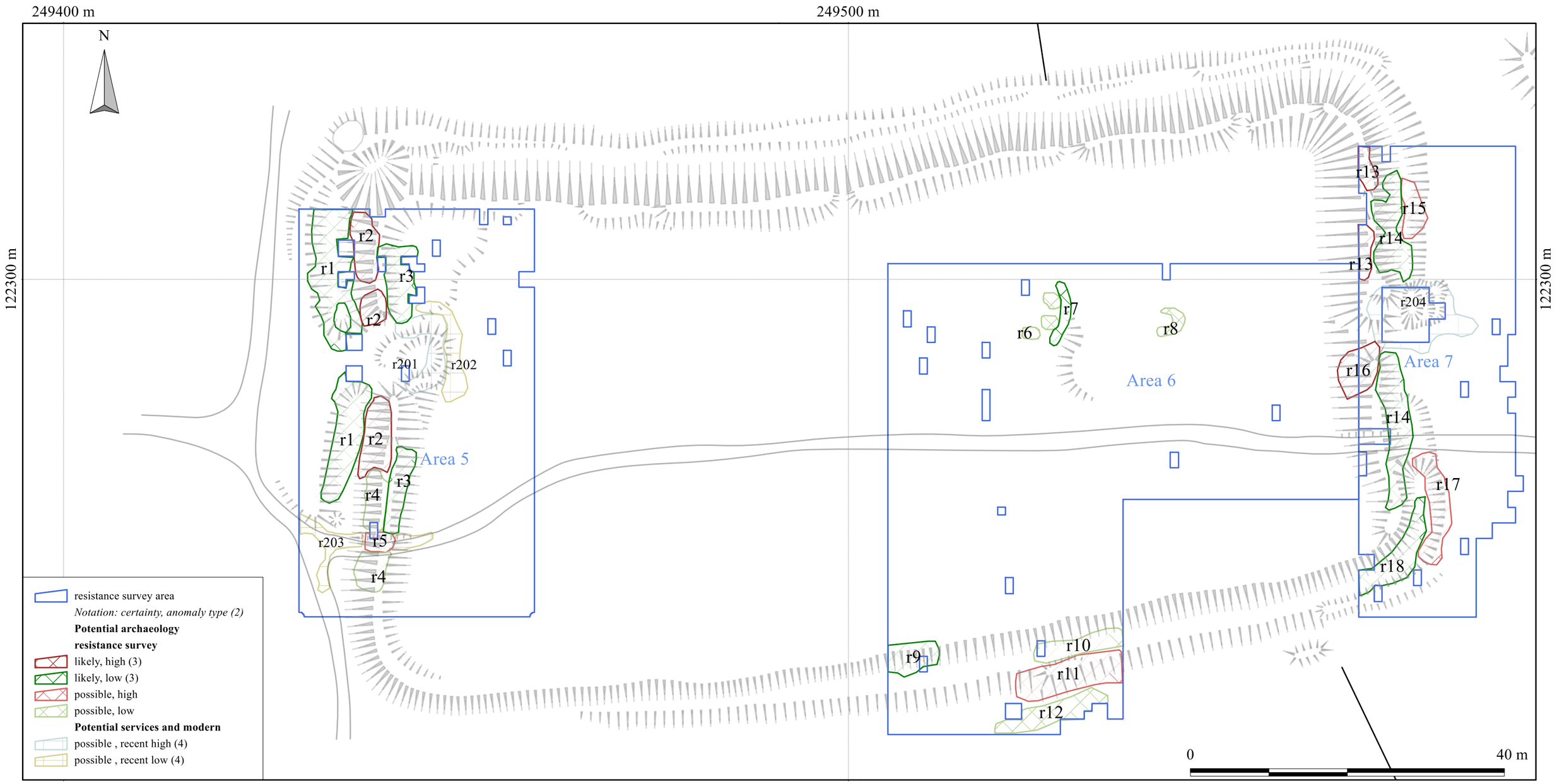
Scale: 1:800 @ A3. Spatial Units: Meter. Do not scale off this drawing

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. Representative; not all instances are mapped.
5. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

An archaeological magnetometer and resistance survey
Berry Castle, Huntshaw, Torridge, Devon
Centred on NGR (E/N): 249488,122283 (point)
Report: 1611BER-R-1

Figure 4: gradiometer survey interpretation

Substrata Limited
Langstrath, Goodleigh
Barnstaple, Devon EX32 7LZ
Tel: 01271 342721
Email: geophysics@substrata.co.uk
Web: substrata.co.uk



British Grid
centre X: 249491.20 m, centre Y: 122284.42 m

Scale: 1:500 @ 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. Representative; not all instances are mapped.
5. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

An archaeological magnetometer and resistance survey
Berry Castle, Huntshaw, Torridge, Devon
Centred on NGR (E/N): 249488,122283 (point)
Report: 1611BER-R-1

Figure 5: resistance survey interpretation

Substrata Limited
Langstrath, Goodleigh
Barnstaple, Devon EX32 7LZ
Tel: 01271 342721
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

249400 m

249500 m

249600 m

N

122300 m

122300 m

Processed gradiometer
data shade plot (nT)
2
-2

0

40 m

122200 m

122200 m

249400 m

249500 m

249600 m

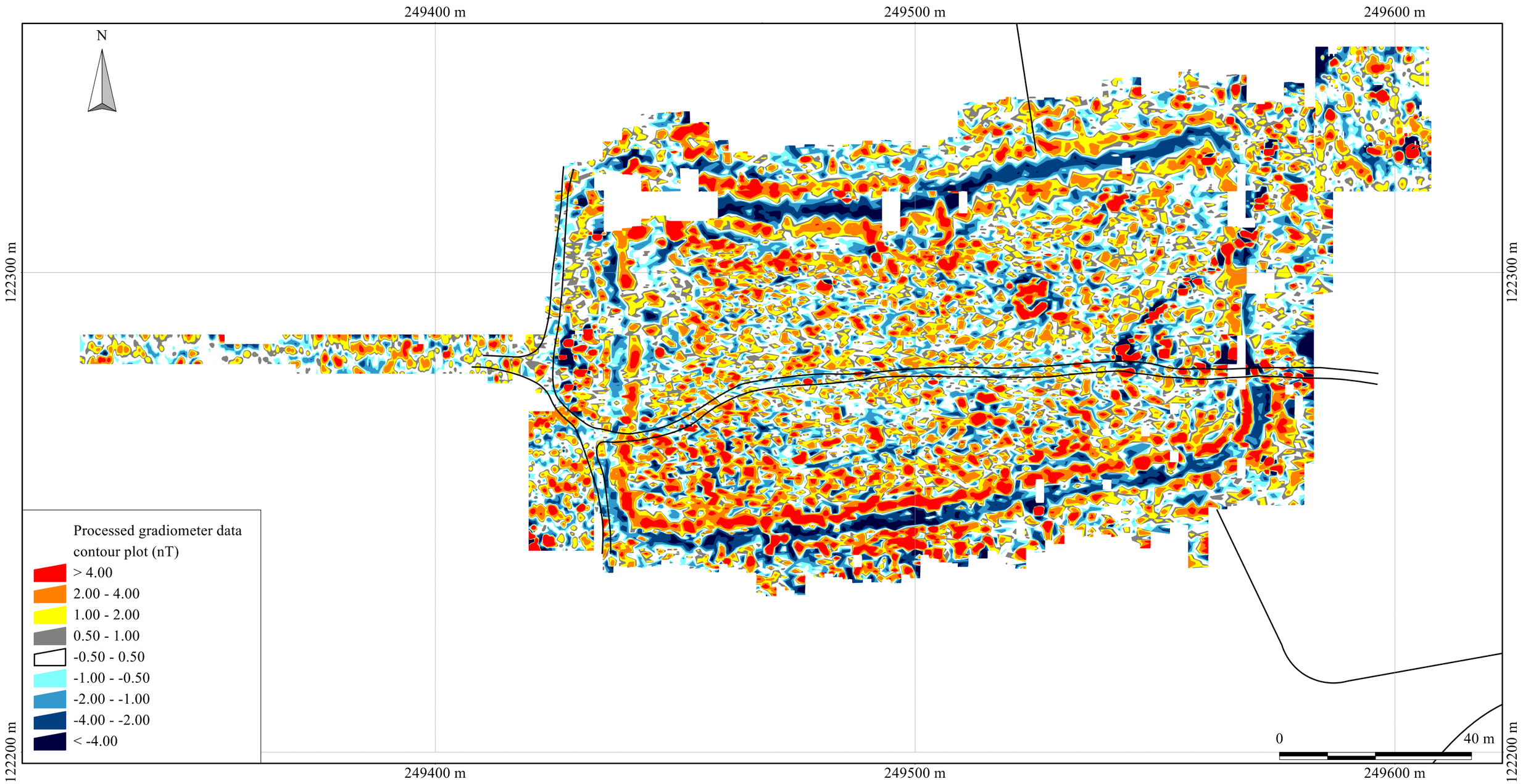
British Grid
centre X: 249468.15 m, centre Y: 122274.80 m

Scale: 1:800 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer and resistance survey
Berry Castle, Huntshaw, Torridge, Devon
Centred on NGR (E/N): 249488,122283 (point)
Report: 1611BER-R-1

Figure 6: shade plot of processed gradiometer data

Substrata Limited
Langstrath, Goodleigh
Barnstaple, Devon EX32 7LZ
Tel: 01271 342721
Email: geophysics@substrata.co.uk
Web: substrata.co.uk



British Grid
centre X: 249468.15 m, centre Y: 122274.80 m

Scale: 1:800 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer and resistance survey
Berry Castle, Huntshaw, Torridge, Devon
Centred on NGR (E/N): 249488,122283 (point)
Report: 1611BER-R-1

Figure 7: contour plot of processed gradiometer data

Substrata Limited
Langstrath, Goodleigh
Barnstaple, Devon EX32 7LZ
Tel: 01271 342721
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

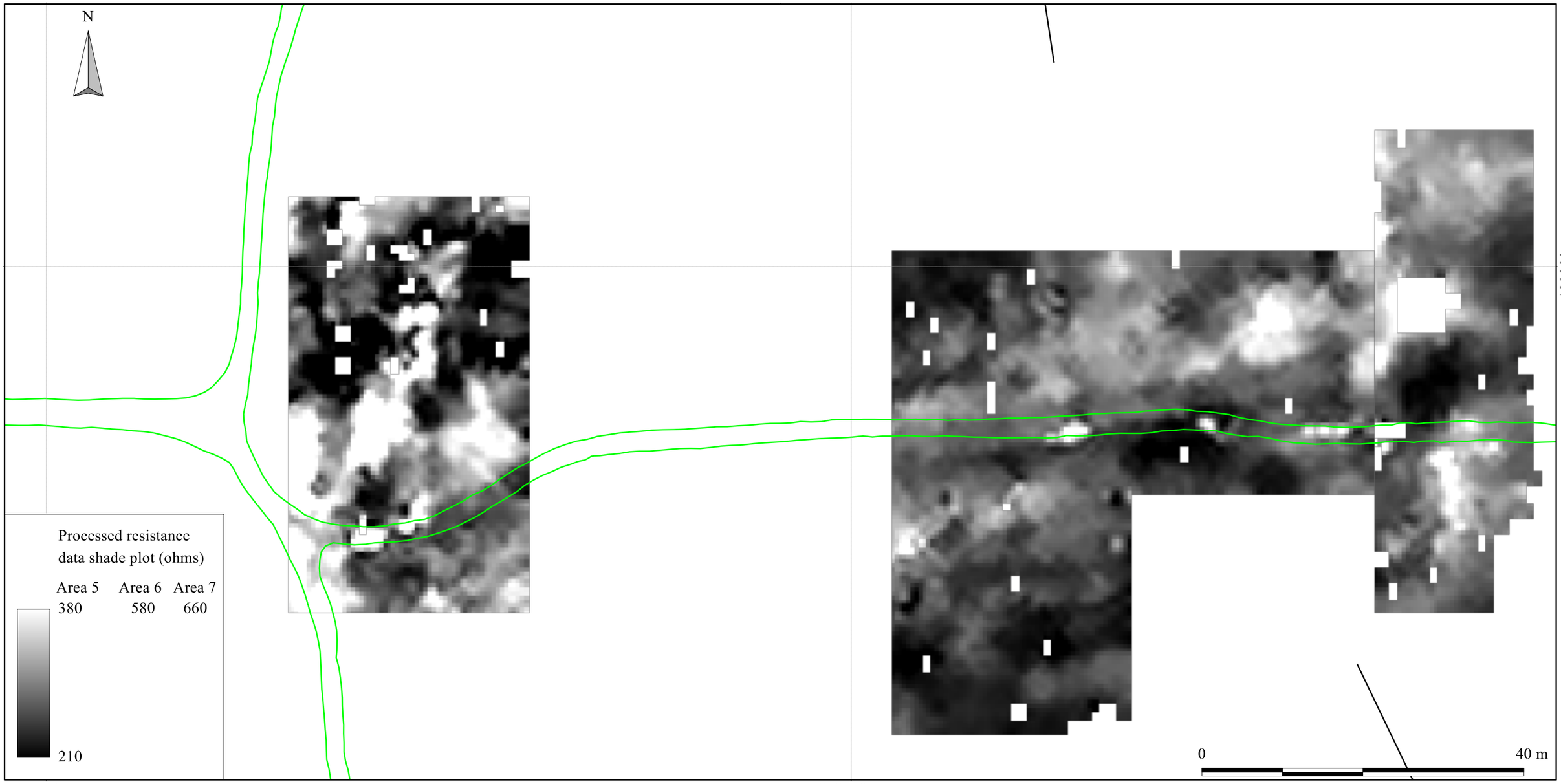
249400 m

249500 m

N

122300 m

122300 m



249400 m

249500 m

British Grid
centre X: 249491.20 m, centre Y: 122284.42 m

Scale: 1:500 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer and resistance survey
Berry Castle, Huntshaw, Torridge, Devon
Centred on NGR (E/N): 249488,122283 (point)
Report: 1611BER-R-1

Figure 8: shade plot of processed resistance data

Substrata Limited
Langstrath, Goodleigh
Barnstaple, Devon EX32 7LZ
Tel: 01271 342721
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

249400 m

249500 m

N

122300 m

122300 m

Processed resistance data
(high pass filter: data normalised about a near-zero mean)

- > 80.00
- 40.00 - 80.00
- 20.00 - 40.00
- 10.00 - 20.00
- -10.00 - 10.00
- -20.00 - -10.00
- -40.00 - -20.00
- -80.00 - -40.00
- < -80.00

0 40 m

249400 m

249500 m

British Grid
centre X: 249491.20 m, centre Y: 122284.42 m

Scale: 1:500 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological magnetometer and resistance survey
Berry Castle, Huntshaw, Torridge, Devon
Centred on NGR (E/N): 249488,122283 (point)
Report: 1611BER-R-1

Figure 9: contour plot of processed resistance data

Substrata Limited
Langstrath, Goodleigh
Barnstaple, Devon EX32 7LZ
Tel: 01271 342721
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

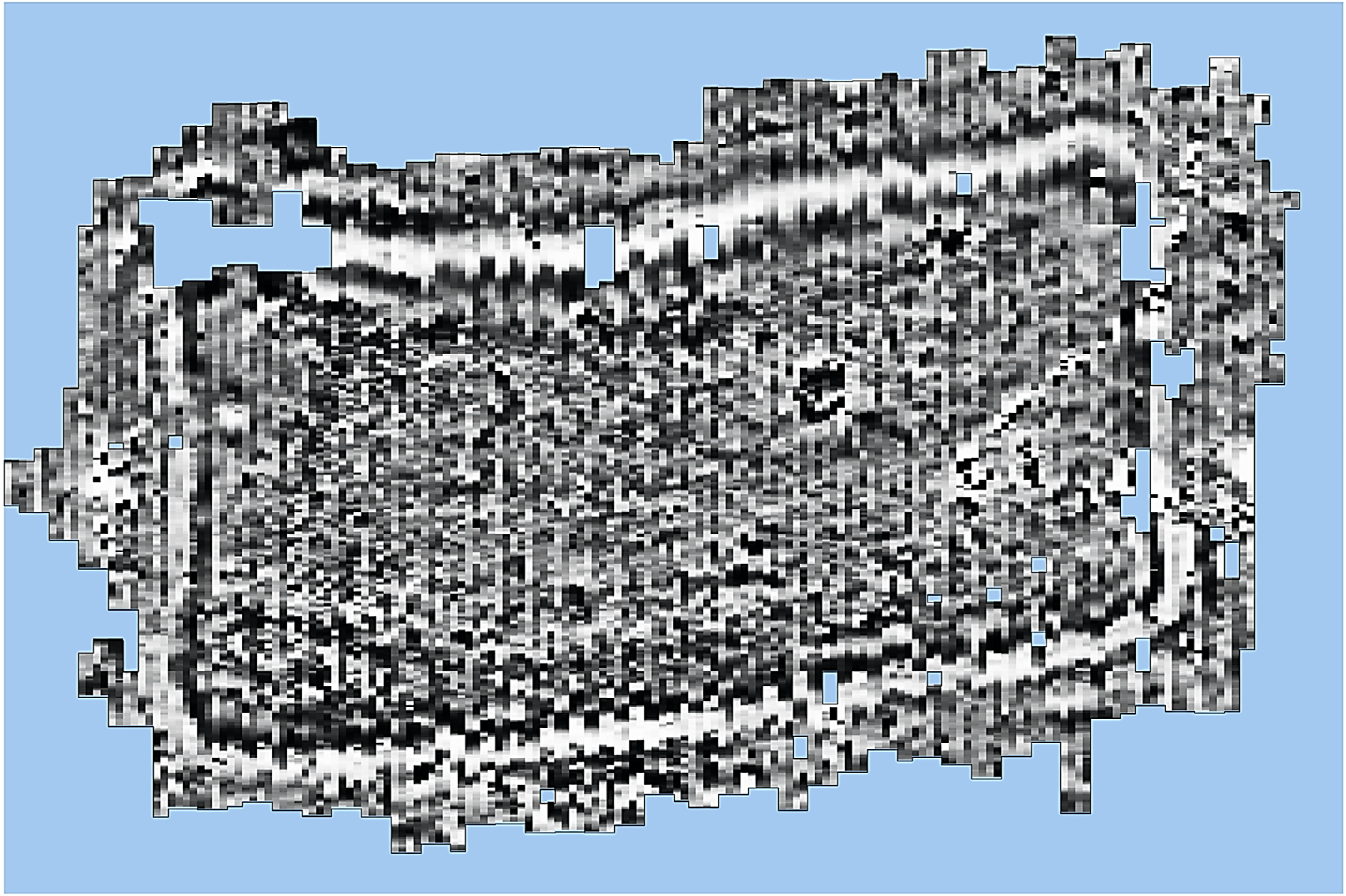
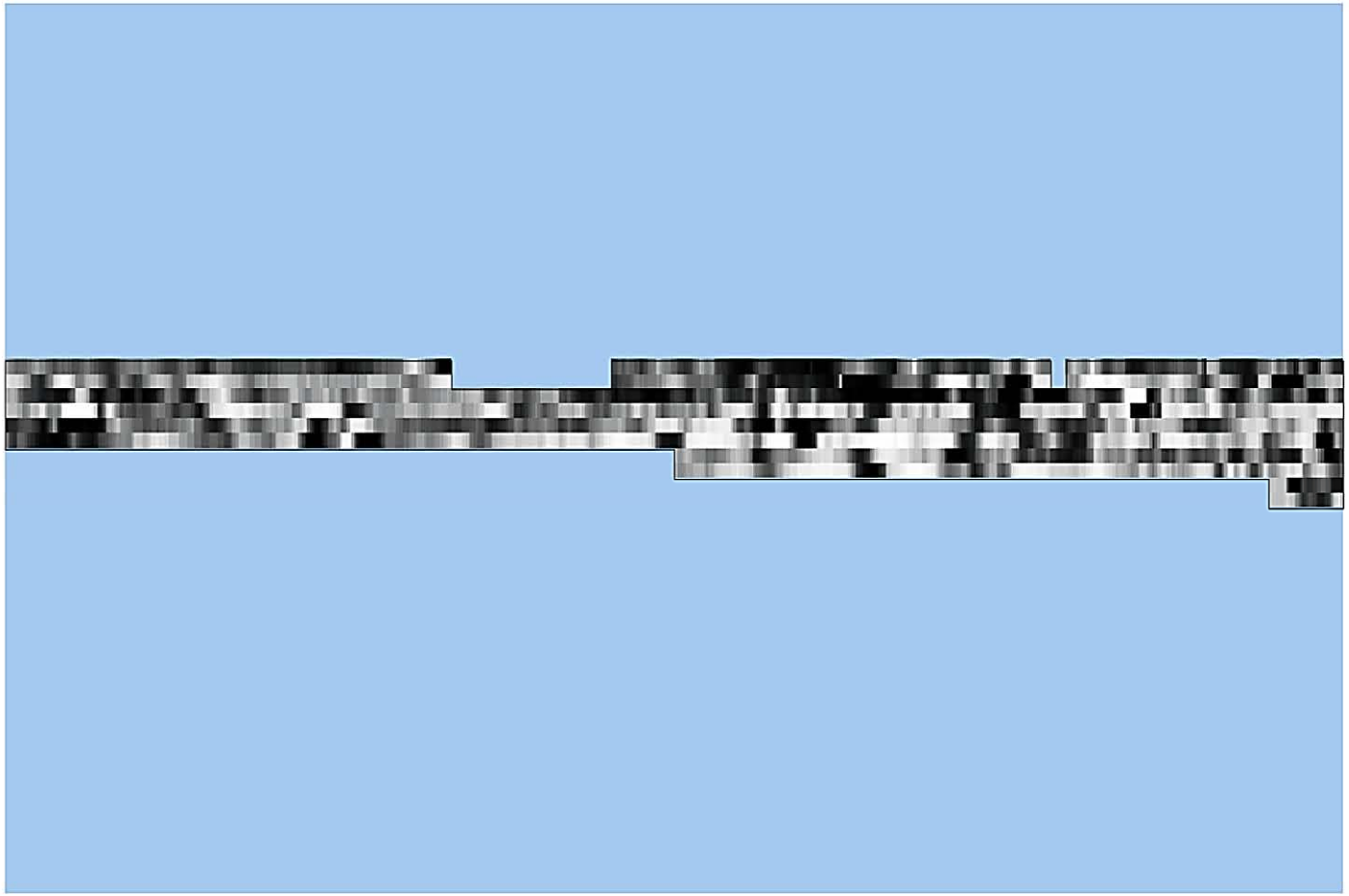
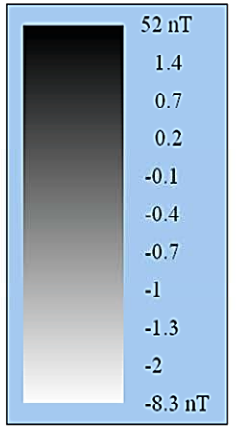


Figure 10: shade plot of unprocessed gradiometer data, area 1





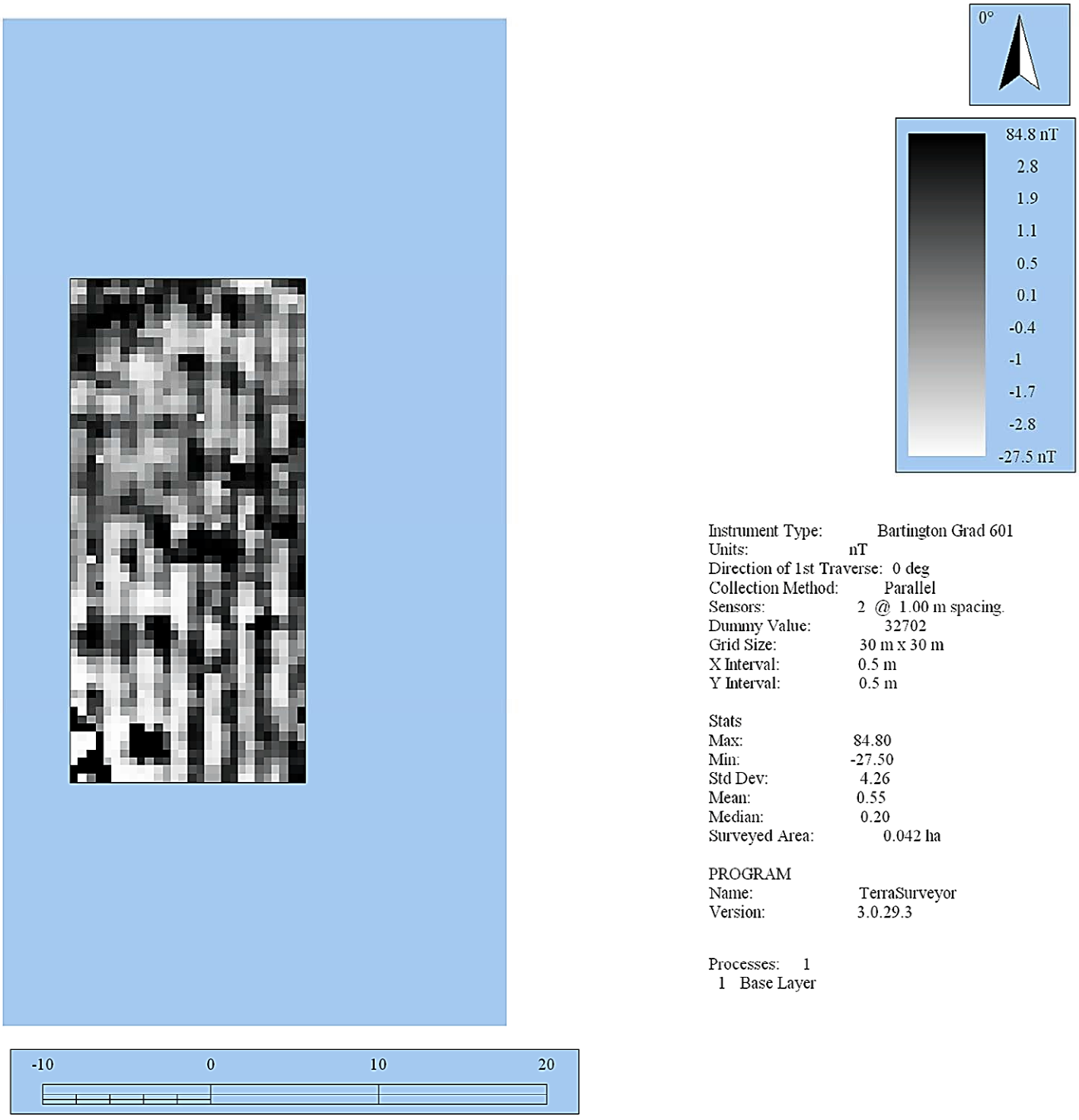
Instrument Type: Bartington Grad 601
Units: nT
Surveyed by: on 30/12/1899
Assembled by: on 30/12/1899
Direction of 1st Traverse: 270 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702
Grid Size: 30 m x 30 m
X Interval: 0.125 m
Y Interval: 1 m

Stats
Max: 52.00
Min: -8.30
Std Dev: 2.08
Mean: -0.13
Median: -0.30
Surveyed Area: 0.06165 ha

PROGRAM
Name: TerraSurveyor
Version: 3.0.29.3

Processes: 1
1 Base Layer

Figure 11: shade plot of unprocessed gradiometer data, area 2



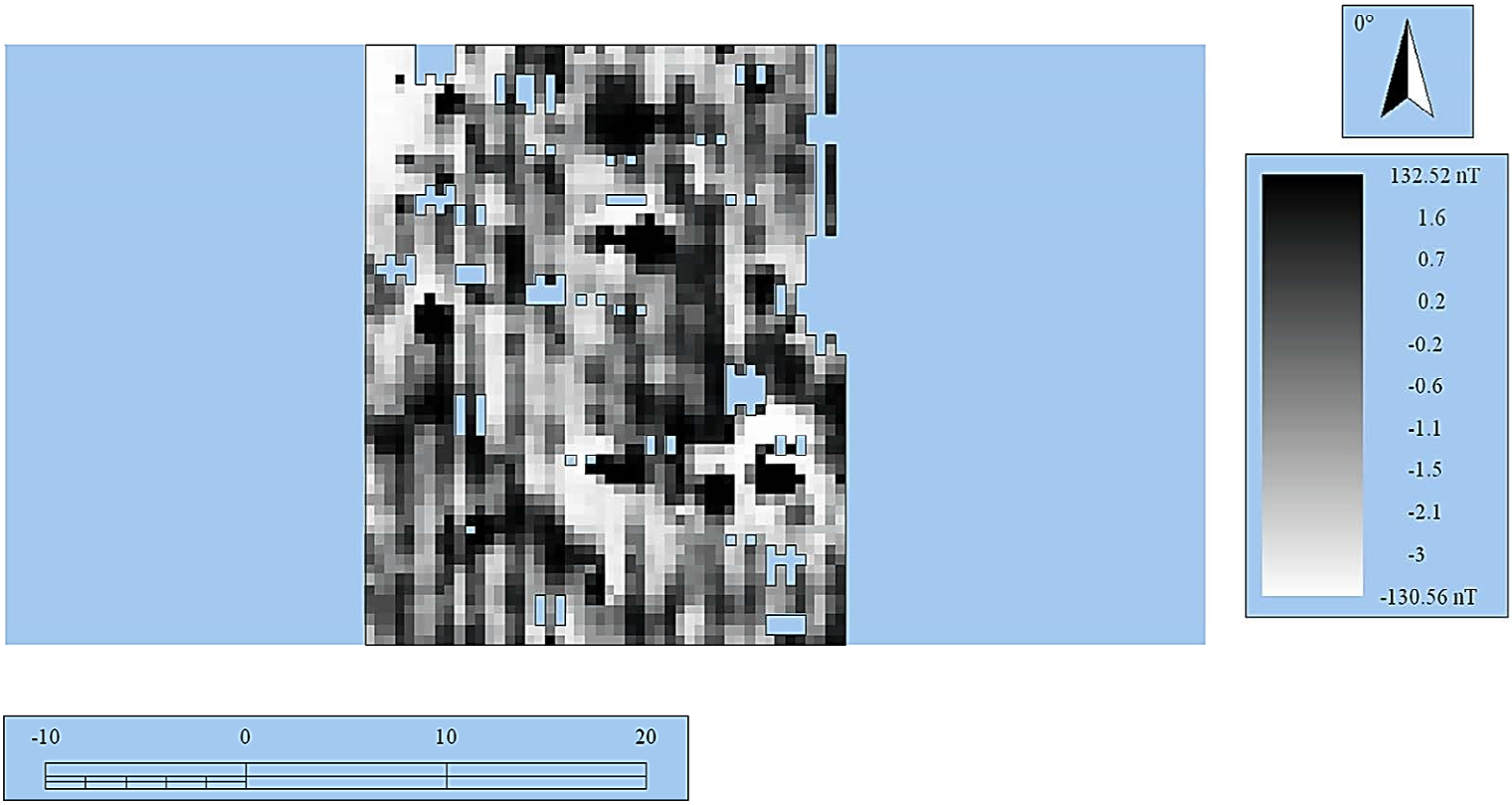
Instrument Type: Bartington Grad 601
Units: nT
Direction of 1st Traverse: 0 deg
Collection Method: Parallel
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702
Grid Size: 30 m x 30 m
X Interval: 0.5 m
Y Interval: 0.5 m

Stats
Max: 84.80
Min: -27.50
Std Dev: 4.26
Mean: 0.55
Median: 0.20
Surveyed Area: 0.042 ha

PROGRAM
Name: TerraSurveyor
Version: 3.0.29.3

Processes: 1
1 Base Layer

Figure 12: shade plot of unprocessed gradiometer data, area 3



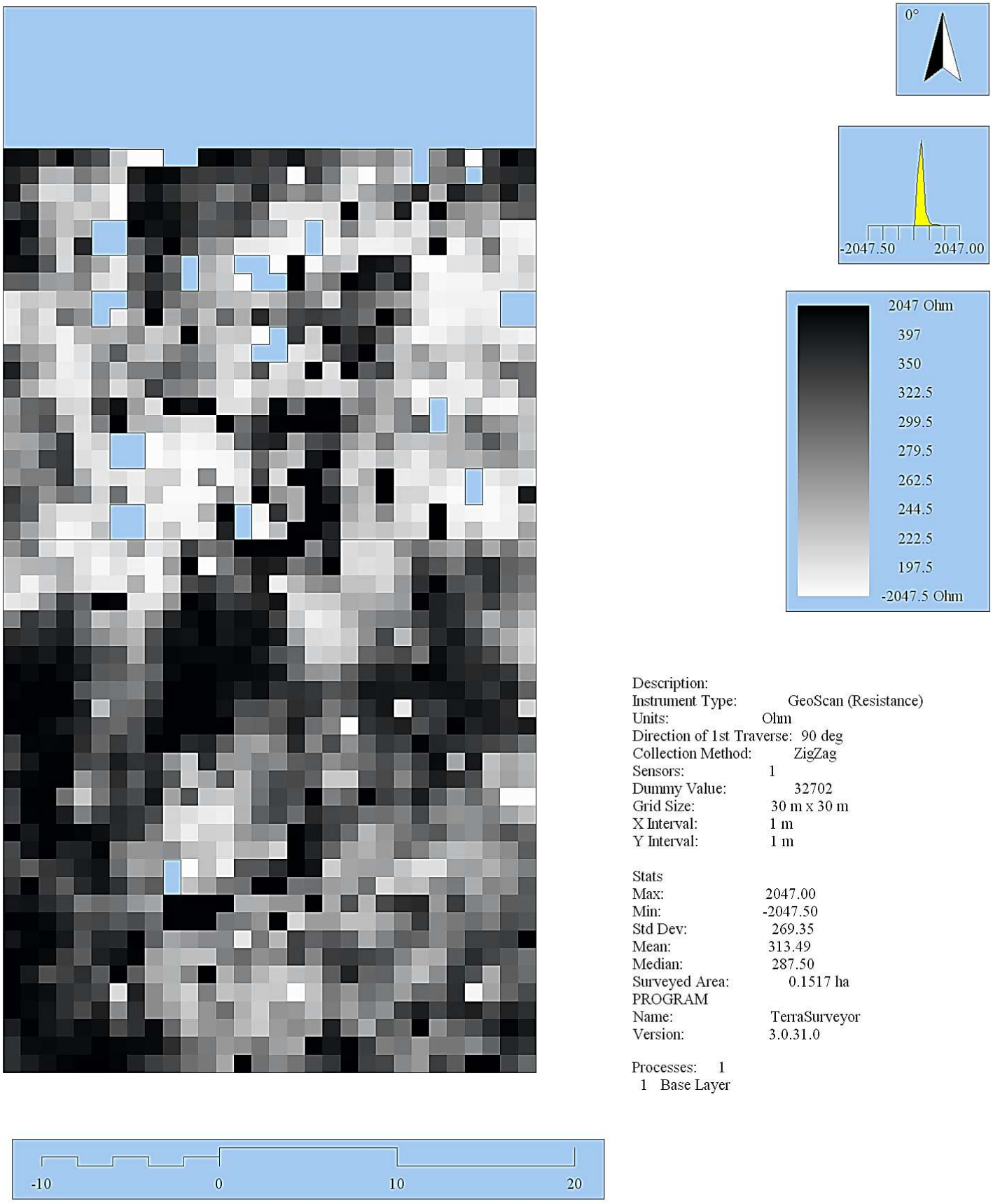
Instrument Type: Bartington Grad 601
Units: nT
Direction of 1st Traverse: 0 deg
Collection Method: Parallel
Sensors: 2
Dummy Value: 32702
Grid Size: 30 m x 30 m
X Interval: 0.5 m
Y Interval: 0.5 m

Stats
Max: 132.52
Min: -130.56
Std Dev: 9.40
Mean: -0.52
Median: -0.60
Surveyed Area: 0.066025 ha

PROGRAM
Name: TerraSurveyor
Version: 3.0.29.3

Processes: 1
1 Base Layer

Figure 13: shade plot of unprocessed gradiometer data, area 4

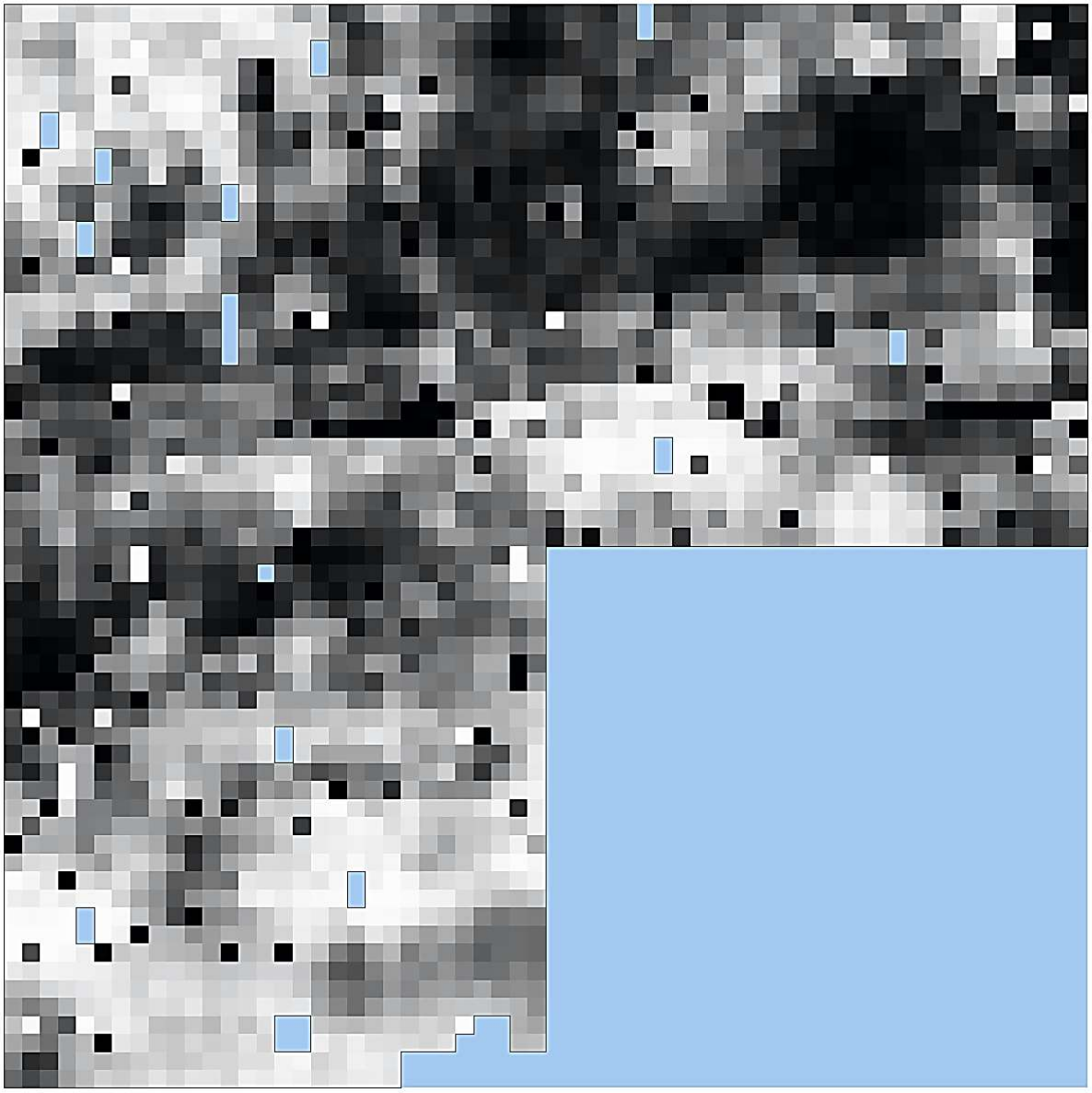


Description:
Instrument Type: GeoScan (Resistance)
Units: Ohm
Direction of 1st Traverse: 90 deg
Collection Method: ZigZag
Sensors: 1
Dummy Value: 32702
Grid Size: 30 m x 30 m
X Interval: 1 m
Y Interval: 1 m

Stats
Max: 2047.00
Min: -2047.50
Std Dev: 269.35
Mean: 313.49
Median: 287.50
Surveyed Area: 0.1517 ha
PROGRAM
Name: TerraSurveyor
Version: 3.0.31.0

Processes: 1
1 Base Layer

Figure 14: shade plot of unprocessed resistance data, area 5

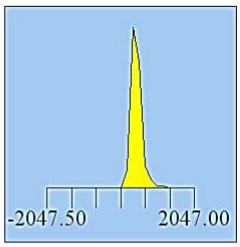


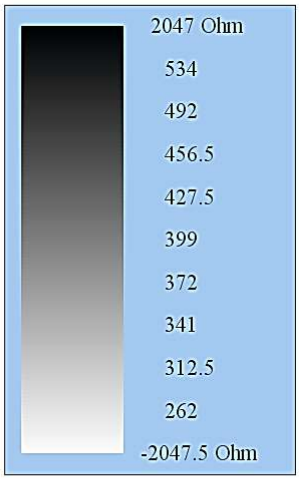
Instrument Type: GeoScan (Resistance)
Units: Ohm
Direction of 1st Traverse: 90 deg
Collection Method: ZigZag
Sensors: 1
Dummy Value: 32702
Grid Size: 30 m x 30 m
X Interval: 1 m
Y Interval: 1 m
Stats
Max: 1836.00
Min: -2047.50
Std Dev: 201.58
Mean: 347.81
Median: 327.50
Surveyed Area: 0.2648 ha

Processes: 1
1 Base Layer

PROGRAM
Name: TerraSurveyor
Version: 3.0.31.0

Figure 15: shade plot of unprocessed resistance data, area 6





Instrument Type: GeoScan (Resistance)
Units: Ohm
Direction of 1st Traverse: 90 deg
Collection Method: ZigZag
Sensors: 1
Dummy Value: 32702
Grid Size: 30 m x 30 m
X Interval: 1 m
Y Interval: 1 m

Stats
Max: 2047.00
Min: -2047.50
Std Dev: 483.17
Mean: 375.62
Median: 415.00
Surveyed Area: 0.1105 ha
PROGRAM
Name: TerraSurveyor
Version: 3.0.31.0

Processes: 1
1 Base Layer

Figure 16: shade plot of unprocessed resistance data, area 7

Appendix 2 Tables

Site: An archaeological magnetometer and resistance survey
Berry Castle, Huntshaw, Torridge, Devon
Centred on NGR (E/N): 249488,122283 (point)
Report: 16011BER-R-1

area number	anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1	g1	g3	likely, positive	disrupted sub-rectangular	earthen deposits	anomaly group coincides with an outer bank of intermittent ditch earthworks	earthwork survey (Newman, 2016)
	g2		possible, positive	linear group of ovals	tree bole disturbance within ditch deposits	anomaly group is most likely to represent tree boles but may contain deposits associated with the monument ditch	earthwork survey (Newman, 2016)
	g3	g1	likely, positive	linear	ditch deposits or outer bank	anomaly group coincides with ditch earthworks and possibly with an outer bank	
	g4		likely, negative	disrupted sub-rectangular	stony deposits filling former ditch	anomaly group overlaps intermittently ditch earthworks and the adjacent outer edge of bank earthworks	earthwork survey (Newman, 2016)
	g5		likely, positive	disrupted sub-rectangular	earthen bank	anomaly group coincides with the tops of bank earthworks	earthwork survey (Newman, 2016)
	g6		likely, positive	disrupted linear		anomaly group approximately coincides with an intermittently extant earthwork along the southern side of the monument	earthwork survey (Newman, 2016)
	g7		possible, positive	linear			
	g8		possible, positive	linear			
	g9		possible, positive	disrupted linear			
	g10		possible, enhanced	irregular	stony deposit	anomaly group is most likely to represent rubble of unknown deposition date	
	g11		possible, enhanced	irregular	stony deposit	anomaly group is most likely to represent rubble of unknown deposition date	
	g12	r6 r7	likely, positive	complex	area of archaeological activity - possible charcoal platform	anomaly group partially coincides with faint earthworks defining a platform	earthwork survey (Newman, 2016)
	g13		possible, parallel linears		routeway	anomaly group coincides with a 'gap' in both gradiometer and resistance anomalies representing stony deposits although extant earthworks are continuous	earthwork survey (Newman, 2016)
	g14		possible, positive	linear			
	g15		possible, positive	curvilinear			
	g16		possible, positive	linear			
	g17		possible, positive	disrupted linear			
	g18		possible, positive	disrupted linear		anomaly group partially corresponds with a faint earthwork	earthwork survey (Newman, 2016)
	g201		likely, positive extant	sub-circular		anomaly group represents an observed earthen bank of uncertain origin but likely to be relatively recent; anomaly group indicates the presence of tree bowls within the deposit	surveyor observation
	g202		likely, negative extant	oval		anomaly group represents an observed stony deposit of uncertain origin but likely to be relatively recent	surveyor observation
	g203	g204 g205 g206	likely, mixed parallel linears		former track	the anomaly group coincides with the route of a track recorded on an earthworks map	Wall, 1906
	g204	g204 g205 g206	likely, mixed parallel linears		current track	the anomaly group coincides with a modern track as recorded by a Substrata GPS survey; the eastern half also corresponds with a track recorded in 1906 (group 203)	surveyor observation
	g205	g204 g205 g206	possible, mixed parallel linears		former track	anomaly group likely to be associated with group 204	
	g206		possible, mixed spread	irregular	relatively recent rubble and iron fragments	anomaly group indicated a mix of rubble with iron or steel fragments from, more than likely, a former fence	
	g207		likely, low contrast linear		recent fence line	anomaly groups match an extant fence to the north and south	surveyor observation and current OS digital tile (2016)
	g208		likely, low contrast linear		recent fence line	anomaly groups are an extension an extant fence to the north	surveyor observation of fence line ground disturbance
2	g19		possible, positive	linear			
	g20		possible, positive	linear			
	g209		likely, mixed parallel linears		current track	the anomaly group coincides with a track recorded in a Substrata GPS survey	surveyor observation
3	g21		possible, positive	linear			
	g22		possible, positive	linear	terracing?		
	g23		possible, positive	linear	terracing?		
	g24		likely, enhanced	irregular	surface and near-surface stony deposit	anomaly group coincides with a deposit of relatively large stones within dense vegetation	surveyor observation
	g210		likely, mixed parallel linears		current track	the anomaly group coincides with a track recorded in a Substrata GPS survey	surveyor observation
4	g25		possible, negative spread	linear	stony deposit		
	g26		possible, positive	linear	ditch?		
	g27		possible, positive	return	ditch?		
	g28		possible, negative	linear	stony bank		
	g29		possible, positive	linear			
	g30		possible, positive	linear	ditch?		
	g31		possible, positive	linear	ditch?		
	g211		likely, dipole		ferrous material: fencing debris		surveyor observation
	g212		likely, dipole		ferrous material: fencing debris		surveyor observation

Table 1: data analysis, gradiometer survey

Site: An archaeological magnetometer and resistance survey
Berry Castle, Huntshaw, Torridge, Devon
Centred on NGR (E/N): 249488,122283 (point)
Report: 16011BER-R-1

area number	anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
5	r1		likely, low	linear	ditch deposits	anomaly group coincides with ditch earthworks	earthwork survey (Newman, 2016)
	r2		likely, high	linear	stony bank deposits	anomaly group coincides with the outer slopes of bank earthworks	earthwork survey (Newman, 2016)
	r3		likely, low	linear	ditch deposits	anomaly group coincides with the inner slopes of bank earthworks	earthwork survey (Newman, 2016)
	r4		possible, low	linear	earthen bank	anomaly group coincides with a bank earthwork and appears to have more earthen material than stony material	earthwork survey (Newman, 2016)
	r5		possible, high	oval	stony deposit or a stone		
	r201		possible , recent high	sub-rectangular	relatively recent stony bank	anomaly group is more likely to represent a relatively recent bank than one contemporary with the monument	surveyor field observation
	r202		possible , recent low	sub-rectangular	relatively recent earthen bank	anomaly group is more likely to represent a relatively recent bank than one contemporary with the monument	surveyor field observation
	r203		possible , recent low		modern path material		surveyor field observation
6	r6	g12	possible, low	oval	earthen deposits - possible pits	anomaly group partially coincides with faint earthworks defining a platform; may represent pits or tree boles	earthwork survey (Newman, 2016)
	r7	g12	likely, low	curvilinear	earthen deposits	anomaly group partially coincides with faint earthworks defining a platform	earthwork survey (Newman, 2016)
	r8		possible, low	sub-circular	earthen deposits		
	r9		likely, low	linear	earthen bank	anomaly group coincides with a bank earthwork and appears to have more earthen material than stony material	earthwork survey (Newman, 2016)
	r10		possible, low	linear	ditch deposits	anomaly group coincides with a flat area between part of two bank earthworks	earthwork survey (Newman, 2016)
	r11		possible, high	linear	stony deposits	anomaly group coincides with part of a bank earthwork	earthwork survey (Newman, 2016)
	r12		possible, low	linear			
7	r13		likely, high		stony bank deposits	anomaly group coincides with the top of bank earthworks	earthwork survey (Newman, 2016)
	r14		likely, low	curvilinear	earthen bank	anomaly group coincides with the outer slope of a bank earthwork and appears to have more earthen material than stony material	earthwork survey (Newman, 2016)
	r15	r17	possible, high	linear	stony deposits	anomaly group coincides with the inner slope of an outer bank of a ditch earthwork	earthwork survey (Newman, 2016)
	r16		likely, high	oval	stony bank deposits	anomaly group coincides with a bank earthwork	earthwork survey (Newman, 2016)
	r17	r15	possible, high	curvilinear	stony deposits	anomaly group coincides with the inner slope of an outer bank of a ditch earthwork	earthwork survey (Newman, 2016)
	r18		likely, low	curvilinear	earthen bank	anomaly group coincides with a ditch earthwork	earthwork survey (Newman, 2016)
	r204		possible , recent high		stony deposits flanking a relatively recent quarry		surveyor field observation

Table 2: data analysis, resistance survey

Documents
Survey method statement: Dean (2016a and 2016c)

Methodology
1. The work was undertaken in accordance with the survey methodology statement. The magnetometer (gradiometer) and resistance surveys were undertaken with reference to standard guidance provided by the Chartered Institute for Archaeologists (2014) and Archaeology Data Service/Digital Antiquity Guides (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.

Magnetometer Equipment	**Magnetometer Data Capture**
Instrument: Bartington Instruments grad601-2 *Firmware:* version 6.1	*Sample Interval:* 0.125-metres (Areas 1 & 2) 0.5m (Areas 3 & 4) *Traverse Interval:* 1 metre (Areas 1 & 2) 0.5m (Areas 3 & 4) *Data capture:* automatic data logger (Areas 1 & 2) manual trigger (Areas 3 & 4) *Traverse Method:* zigzag (Areas 1 & 2) parallel ((Areas 3 & 4) *Traverse Orientation:* GN
Resistance Equipment	**Resistance Data Capture**
Instrument: Geoscan Research RM15 multi-probe resistance meter *Configuration*: twin probe *Mobile probe spacing*: 0.5-metres	*Sample Interval:* 1 metre *Traverse Interval:* 1 metre *Data capture:* automatic data logger *Traverse Method:* zigzag *Traverse Orientation:* GE

Data Processing, Analysis and Presentation Software
IntelliCAD Technology Consortium IntelliCAD 7.2
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

Table 3: methodology summary

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:	3.0.31.0

Area 1 (Figures 6 and 7)

Stats	
Max:	101.82
Min:	-93.40
Std Dev:	3.73
Mean:	0.18
Median:	0.02
Surveyed Area:	1.3875 ha

Processes: 16

1 Base Layer
2 Clip at 1.00 SD
3 De Stagger: Grids: a1.xgd a2+a3.xgd a4.xgd a5.xgd Mode: Both By: -2 intervals
4 De Stagger: Grids: a9.xgd a8.xgd Mode: Both By: -6 intervals
5 De Stagger: Grids: a10.xgd Mode: Both By: -6 intervals
6 De Stagger: Grids: a11.xgd Mode: Both By: -4 intervals
7 De Stagger: Grids: a12.xgd a13.xgd Mode: Both By: -6 intervals
8 De Stagger: Grids: a14.xgd Mode: Both By: -4 intervals
9 De Stagger: Grids: a16.xgd Mode: Both By: -2 intervals
10 De Stagger: Grids: a17.xgd Mode: Both By: -6 intervals
11 De Stagger: Grids: b1.xgd b2.xgd Mode: Both By: -4 intervals
12 De Stagger: Grids: b4.xgd Mode: Both By: -4 intervals
13 De Stagger: Grids: b7.xgd b6.xgd b5.xgd Mode: Both By: 2 intervals
14 DeStripe Median Sensors: Grids: All
15 De Stagger: Grids: a6.xgd Mode: Both By: -2 intervals
16 Interpolate: X & Y Doubled.

Area 2 (Figures 6 and 7)

Max:	14.44
Min:	-9.69
Std Dev:	1.52
Mean:	0.19
Median:	0.03
Surveyed Area:	0.0616 ha

Processes: 4

1 Base Layer
2 Clip at 3.00 SD
3 DeStripe Median Traverse: Grids: All
4 Interpolate: Match X & Y Doubled.

Area 3 (Figures 6 and 7)

Max:	78.83
Min:	-31.55
Std Dev:	3.66
Mean:	0.55
Median:	0.03
Surveyed Area:	0.042 ha

Processes: 4

1 Base Layer
2 DeStripe Median Traverse: Grids: All Threshold: 2 SDs
3 Interpolate: X & Y Doubled.
4 Interpolate: X & Y Doubled.

Area 4 (Figures 6 and 7)

Max:	133.14
Min:	-129.96
Std Dev:	9.34
Mean:	0.09
Median:	0.00
Surveyed Area:	0.066 ha

Processes: 3

1 Base Layer
2 Clip at 1.00 SD
3 DeStripe Median Traverse: Grids: All

Table 4: processed data metadata, gradiometer survey

Instrument Type: Geoscan Research RM15
Units: resistance data (ohms) normalised about a near-zero mean
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702

PROGRAM
Name: TerraSurveyor
Version: 3.0.25.0

Area 5 (Figure 8)

Stats	
Max:	380.00
Min:	210.00
Std Dev:	57.18
Mean:	291.02
Median:	283.98
Surveyed Area:	0.152 ha

Processes: 5
1 Base Layer
2 Despike Threshold: 1 Window size: 3x3
3 Despike Threshold: 1 Window size: 3x3
4 Interpolate: X & Y Doubled.
5 Clip from 210.00 to 380.00 Ohm

Area 5 (Figure 9)

Max:	109.00
Min:	-95.00
Std Dev:	42.17
Mean:	-1.33
Median:	-4.51
Surveyed Area:	0.152 ha

Processes: 6
1 Base Layer
2 Despike Threshold: 1 Window size: 3x3
3 Despike Threshold: 1 Window size: 3x3
4 High pass Gaussian filter: Window: 10 x 10
5 Interpolate: X & Y Doubled.
6 Clip from -95.00 to 109.00 Ohm

Area 6 (Figure 8)

Max:	580.00
Min:	200.00
Std Dev:	80.36
Mean:	333.77
Median:	325.46
Surveyed Area:	0.265 ha

Processes: 5
1 Base Layer
2 Despike Threshold: 1 Window size: 3x3
3 Despike Threshold: 1 Window size: 3x3
4 Interpolate: X & Y Doubled.
5 Clip from 200.00 to 580.00 Ohm

Area 6 (Figure 9)

Max:	80.30
Min:	-80.18
Std Dev:	34.46
Mean:	-1.07
Median:	-2.80
Surveyed Area:	0.265 ha

Processes: 6
1 Base Layer
2 Despike Threshold: 1 Window size: 3x3
3 Despike Threshold: 1 Window size: 3x3
4 High pass Gaussian filter: Window: 10 x 10
5 Interpolate: X & Y Doubled.
6 Clip at 2.00 SD

Area 7 (Figure 8)

Max:	660.00
Min:	210.00
Std Dev:	103.41
Mean:	419.69
Median:	412.95
Surveyed Area:	0.106 ha

Processes: 7
1 Base Layer
2 Despike Threshold: 1 Window size: 3x3
3 Despike Threshold: 1 Window size: 3x3
4 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 20, Left 3, Bottom 24, Right 8)
5 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 58, Left 15, Bottom 59, Right 29)
6 Interpolate: X & Y Doubled.
7 Clip from 210.00 to 660.00 Ohm

Area 7 (Figure 9)

Max:	160.00
Min:	-80.00
Std Dev:	48.23
Mean:	-0.98
Median:	-10.78
Surveyed Area:	0.106 ha

Processes: 8
1 Base Layer
2 Despike Threshold: 1 Window size: 3x3
3 Despike Threshold: 1 Window size: 3x3
4 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 20, Left 3, Bottom 24, Right 8)
5 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 58, Left 15, Bottom 59, Right 29)
6 High pass Gaussian filter: Window: 10 x 10
7 Interpolate: X & Y Doubled.
8 Clip from -80.00 to 160.00 Ohm

Table 5: processed data metadata, resistance survey