Substrata
Archaeological Geophysical Surveyors

An archaeological gradiometer and earth resistance survey

Land at Blundell's School
Blundell's Road, Tiverton, Devon

Centred on NGR (E/N): 297610,113210 (point)

Report: 1601BLU-R-1

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15 September 2016

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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 twin-probe earth resistance
Dates:	gradiometer survey: 17 February2016 resistance survey: 30 and 31 March 2016, 4 April 2016
Area:	gradiometer survey 1.44ha earth resistance survey 3.15 ha
Lead surveyor:	Mark Edwards BA
Author:	Ross Dean BSc MSc MA MIfA with contributions from Mark Edwards

1.2 Client

Devon County Council Environment Group, Lucombe House, County Hall, Exeter, Devon EX2 4QD

1.3 Site information

Site:	Land at Blundell's School, Blundell's Road
Civil Parish and Town:	Tiverton
District:	Mid Devon
County:	Devon
NGR:	SS 9761 1321 (point)
NGR E/N:	297610,113210 (point)
Post code:	EX16 4NA
Planning Authority and/or Curator:	Devon County Council
Site HER entries:	MDV108465

1.4 Archive

OASIS number:	substrat1-262640
Archive:	At the time of writing, the archive of this survey will be held by Substrata. Depending on local authority practice, an archive of the unprocessed data may be deposited with the Archaeological Data Service

1.5 Introduction

This report was commissioned by the Devon County Council Environment Group to investigate earthworks located within the playing fields of Blundell's School and recorded in Devon County Council Historic Environment Record entry MDV108465. The earthworks are visible as a banked feature on aerial photographs taken during and after 1946 and on digital images derived from LiDAR data captured between 2005 and 2012. A site visit carried out during December 2014 confirmed their presence and extent. The survey was designed to prospect the earthworks to contribute to the understanding of the monument and to inform its future management.

1.6 Summary

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

Six magnetic anomaly groups and eight earth resistance anomaly groups were identified as possibly representing archaeological deposits or features. Four of these are disrupted curvilinear groups which coincide with the inner edge of the visible bank recorded as a potential monument in the Devon Historical Environment Record (entry MDV108465). It is likely that these anomalies represent a former inner ditch and an outer stony bank. A further curvilinear resistance anomaly group may also reflect deposits or a structure associated with the earthwork bank. Each of these anomaly groups is relatively narrow when compared to the earthworks and a reason for the width of the mapped bank could not be found in either of the survey data sets. Neither could the earthworks be seen as a pattern of anomaly groups

although this is not unusual in magnetometer and resistance surveys when the material comprising the earthworks is similar to the natural sub-soils and/or near-surface bedrock. Two, and possibly four, anomaly groups may represent a curvilinear archaeological feature, possibly a ditch, on the southern edge of the mapped earthworks but not conforming to their extant shape. One resistance anomaly coincides with a visible ditch associated with an extant field boundary of possible Mediaeval origins. The remaining anomalies may represent archaeological deposits but may well reflect recent ground disturbance.

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 Objectives

1. Complete a gradiometer and earth 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 survey area lies within Blundell's School playing fields to the north of Blundell's Road on the eastern edge of Tiverton as shown in Figure 1. The survey area was situated at approximately 85m AOD on relatively flat ground except around the monument itself where earthworks were visible as shown in Figure 2.

During the gradiometer survey the playing fields had steel, rugby goal posts at various points which limited the data collection possible as shown in Figures 5 and 6. By the time the resistance survey took place these had been removed although their impact on the resistance survey data would have been negligible.

4.2 Geology

The geology across the survey area and surrounds comprises a solid geology of sandstone of the Permian Tidcombe Sand Member. The superficial geology was not recorded in the source used (British Geological Society undated).

5 Archaeological background

5.1 Historic landscape characterisation

Medieval enclosures based on strip fields.

This area was probably first enclosed with hedge-banks during the later middle ages. The curving form of the hedge-banks suggests that earlier it may have been farmed as open strip-fields (Devon County Council, undated)

5.2 Archaeological background

The following is a short summary of information obtained from the Devon HER within approximately 500m of the survey area and relevant to the understanding of the geophysical survey. 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

Earthworks of uncertain date and function are visible as a banked feature on aerial photographs from 1946 onwards and are visible on digital images derived from LiDAR data captured between 2005 and 2012. They were confirmed as extant during a site visit in December 2014. The oval shaped earthwork bank measures approximately 83m in length by 79m in width and up to 20m broad. It encompasses an internal and possibly levelled area of approximately 0.16 hectares. The earthworks are bisected by, and so predate, a northwest to southeast aligned possible Medieval field boundary first depicted on the Tiverton parish tithe map of approximately 1838-48. The earthworks on the eastern side of this field boundary have been subject to a greater degree of plough damage and are barely perceptible. The earthwork bank on the western side is visible as a low curvilinear earthwork which peters out to form a slight gap or entrance. The field boundary is significantly more pronounced where it intersects with the northern edge of the earthwork bank. The nature of the earthwork is largely unclear, although given the presence of extensive Prehistoric remains within the vicinity it is conceivable they are of contemporary date. The earthworks may also be of more recent date, perhaps formed for example from the up-cast material of a possible Medieval quarry site largely levelled by the time of the parish tithe map[1].

5.2.2 Heritage assets within 500m of the survey area

Two possible Prehistoric enclosures are recorded 210m on bearing N25 from the survey area as cropmarks on aerial photographs and also showed as anomalies in a geophysical survey. No archaeological features or finds were found in a subsequent evaluation excavation[2]. Cropmark ditches of potential Prehistoric date, visible on oblique aerial photographs of 1989, are recorded 400m on bearing N77 at Lower Moor. The cropmarks appear to form part of a possible rectilinear enclosure or field system[3]. A linear cropmark ditch, 304m on bearing N73 from the survey area is recorded on the same aerial photograph[4]. A geophysical survey anomaly 443m on bearing N118 from the survey area may be indicative of a former cut feature and is probably related to a Prehistoric enclosure[5]. Possible Prehistoric enclosures or field boundaries are recorded as geophysical anomalies 502m on bearing N145 from the survey area[6]. A ring ditch of Prehistoric date on Lower Moor, 400m on bearing N77 from the survey area, is visible as a cropmark ditch on aerial photographs of 1985 onwards and also showed as a clear anomaly during a geophysical survey[7]. A series of curvilinear features were recorded during a geophysical survey 283m on bearing N312 from the survey area, indicating possible Prehistoric activity and field ditches[8].

There are two recorded Post-medieval water meadows in close proximity to the survey area. A water meadow of probable 19th Century date lies 390m on bearing N359 from the survey area between Cowleymoor and Craze Lowman. It is visible as a series of earthwork ditches and banks on aerial photographs from 1946 onwards[9]. Another water meadow of probable 19th Century date lies 461m on bearing N207 from the survey area, to the west of Pool Anthony. It

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. MDV108465, SS 976 132
2. MDV54066, SS 977 134
3. MDV108469, SS 980 133
4. MDV108468, SS 979 133
5. MDV113656, SS 980 130
6. MDV113657, SS 979 120
7. MDV56027, SS 980 133
8. MDV78811, SS 974 134
9. MDV108639, SS 976 136

is visible as a series of earthwork ditches on aerial photographs of 1947 and 1966[10].

A number of linear anomalies of unknown date were recorded during a geophysical survey 533m on bearing N113 from the survey area. These anomalies are indicative of former cut features and may be of archaeological origin[11]. Evidence from the same geophysical survey recorded a number of linear anomalies 490m on bearing N91 from the survey area. These are probably related to former field boundaries and are undated[12].

5.2.3 Designated heritage assets in the wider landscape

'Long Barrow' is a Neolithic long barrow lying 972m on bearing N66 from the survey area. The monument survives as an elongated oval mound aligned east-west, which is widest at the eastern end. It measures approximately 92m long, 18m wide at the east tapering to 11m wide at the west and is up to 0.9m high. The flanking quarry ditch is partially visible on the northern side, extends around the eastern end and to the south, and is elsewhere preserved as a buried feature which measures up to 10m wide. Partial excavation has shown that this ditch measures up to 3.2m deep. [13].

'Craze Lowman Barrow' is an Early Neolithic to Late Bronze Age bowl barrow lying 1207m on bearing N55 from the survey area approximately 260m northwest of Putson Cross in the valley of the River Lowman. It is 120m south east of a natural ford now crossed by a bridge. The monument survives as a circular mound which measures 21.5m in diameter and is up to 0.9m high. The surrounding quarry ditch from which material to construct the mound was derived is preserved as a buried feature, which measures approximately 3m wide. The monument is crossed by a road and ditched field boundary on its eastern side[14].

10. MDV78742, SS 974, 128
11. MDV113665, SS 981 133
12. MDV113659, SS 981 132
13. MDV1364, SS 985 136, 1019058
14. MDV12370, SS 986 139, 1017132

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. Resistance surveys can often be used to identify compacted areas (walkways, floors), buried foundations, and areas that have been previously excavated and filled such as ditches and pit features.

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 actual 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 interpretation of the magnetometer (gradiometer) and resistance survey data sets. It includes 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.

Figure 2 and Table 1 comprise the analysis of the survey data. Figures 3 and 4 show the interpretations of the magnetometer

Plots of the gradiometer and earth resistance interpretations are provided separately in Figures 3 and 4 respectively.

Various plots of the processed data as specified in Table 3 are provided in Figures 5 to 9.

Figures 10 and 11 are plots of the minimally processed gradiometer data and the unprocessed resistance data respectively.

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 during the gradiometer survey was restricted as shown in the figures due to the presence of magnetic materials in goal posts, steel cabins and buildings. Strong magnetic responses mapped close to survey boundaries are likely to relate to these materials except where otherwise indicated in Figure 2.

Data collection during the resistance survey was restricted as shown in the figures by the presence of hard-standing and concrete close to buildings and cabins.

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.

Recent man-made objects such as manholes, water management equipment, drains, cables and other services were only mapped where they comprised significant magnetic or resistance responses across the dataset that needed clarification. If mapped, they are listed in Table 1 but are not discussed below.

Anomalies thought to relate to natural features were not mapped.

Numerous dipole magnetic anomalies are scattered across the gradiometer data set. These are likely to represent recent ferrous objects.

6.3.2 Data relating to historical maps and other records

Magnetic anomaly group **g1** and **g2**, along with resistance anomaly groups **r1** and **r2**, are disrupted, curvilinear groups that lie along the boundary between the oval shaped earthwork bank and the internal and possibly levelled area that comprise the monument under investigation and described in Section 5.2.1. It is likely that g1 and r1 represent a former ditch and that g2 and r2 represent a relatively stony bank external to the ditch. Resistance anomaly group **r3** may also be associated with the bank.

Resistance anomaly group **r8** coincides with a visible ditch which is part of the current field wall passing through the monument and which may have Medieval origins (Section 5.2.1).

6.3.3 Data with no previous archaeological provenance

Magnetic anomaly group **g3** and resistance anomaly group **r7** define a sub-circular feature, possibly a former ditch, which does not appear to relate to the extant earthworks.

Magnetic groups **g5** and **g6** may be associated with the deposits represented by g3 and r7 but may equally represent relatively recent disturbance which is the most likely explanation for group **g4**.

Resistance groups **r4**, **r5** and **r6** may be associated with the earthworks but equally well may represent recent disturbance associated with the adjacent steel cabin.

6.4 Conclusions

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

Six magnetic anomaly groups and eight earth resistance anomaly groups were identified as possibly representing archaeological deposits or features. Referring to Figure 2, four of these are disrupted curvilinear groups (g1, g2, r1 and r2) which coincide with the inner edge of the visible bank recorded as a potential monument in the Devon Historical Environment Record (entry MDV108465). It is likely that these anomalies represent a former inner ditch (g1 and r1) and an outer stony bank (g2 and r2). A further curvilinear resistance anomaly group, r3, may also reflect deposits or a structure associated with the earthwork bank. Each of these

anomaly groups is relatively narrow when compared to the earthworks and a reason for the width of the mapped bank could not be found in either of the survey data sets. Neither could the earthworks be seen as a pattern of anomaly groups although this is not unusual in magnetometer and resistance surveys when the material comprising the earthworks is similar to the natural sub-soils and/or near-surface bedrock.

Two, and possibly four, anomaly groups (g3, r7 and possibly g5 and g6) may represent a curvilinear archaeological feature, possibly a ditch, on the southern edge of the mapped earthworks but not conforming to their extant shape.

One resistance anomaly (r8) coincides with a visible ditch associated with an extant field boundary of possible Mediaeval origins.

The remaining anomalies may represent archaeological deposits but may well reflect recent ground disturbance.

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 would like to thank Bill Horner, Devon County Council Archaeologist, for commissioning us to complete this survey. Our thanks are also due to Mr James Halton, Assistant Bursar (Estates and Buildings), Blundell's School for arranging access to the school playing fields and to the Blundell's School ground staff for their assistance, cooperation and advice regarding the patterns of playing field lines recorded in the data.

9 Bibliography

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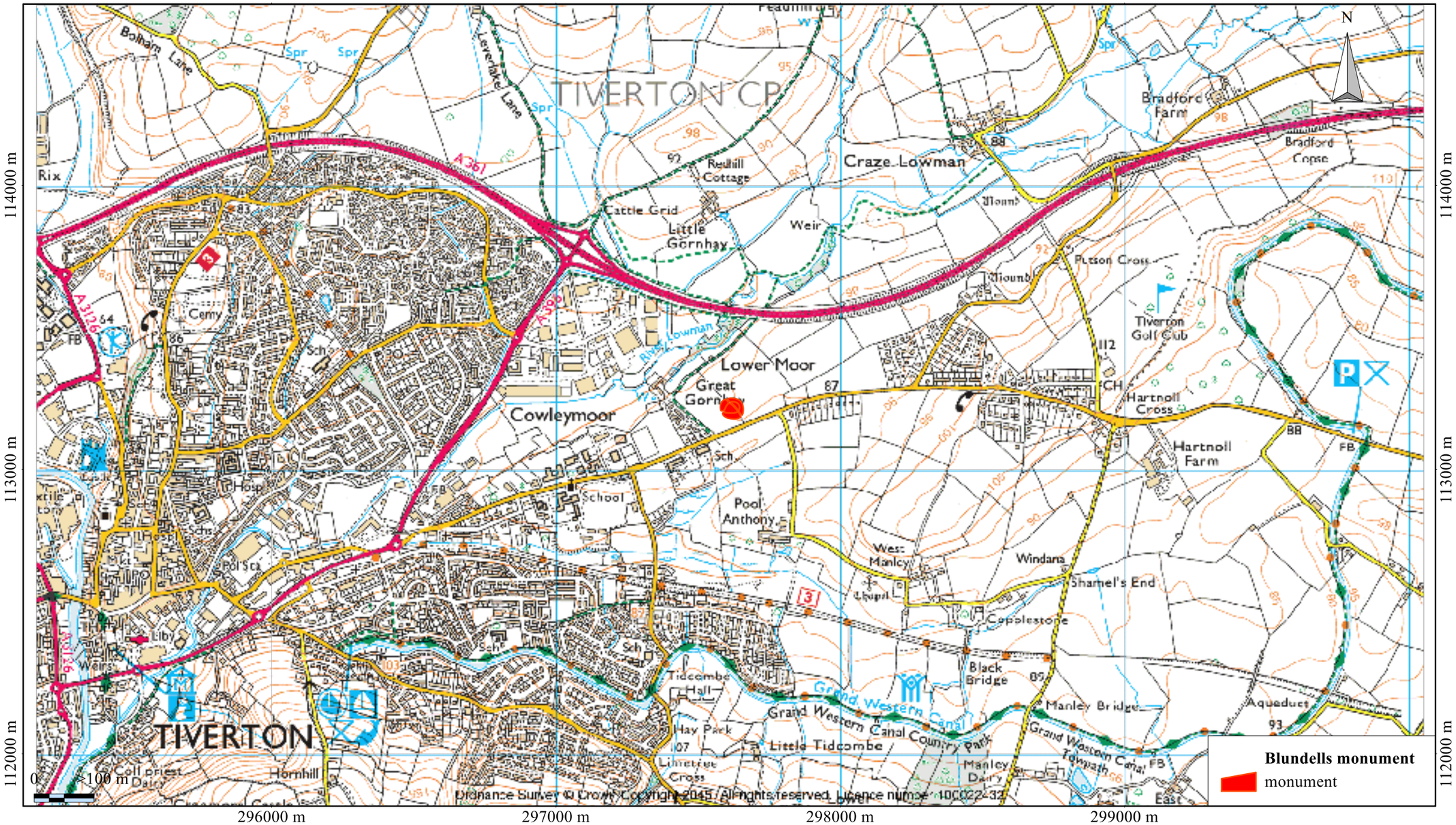
Appendix 1 Supporting plots and analysis table

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: 297610.00 m, centre Y: 113227.35 m

Scale: 1:15000 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer survey
Land at Blundells School, Blundells Road, Tiverton, Devon
Centred on NGR (E/N): 297610,113210 (point)
Report: 1601BLU-R-1

Figure 1: location map

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297600 m

297700 m

113200 m

N

r8
g1
r1
r1
g1
r1
g2
r1
g1
r2
g2
r2
r4
r5
r6
r3
101
g3
g4
g5
g6
r7

Gradiometer survey
gradiometer survey area
certainty, anomaly type (2)
Potential archaeology
likely, positive (3)
likely negative (3)
possible, positive
possible, negative
Potential natural (4)
possible, weak broad dipole
Resistance survey
resistance survey area
certainty, anomaly type (2)
Potential archaeology
likely, high (3)
likely, low (3)
possible, high
possible, low
Earthworks survey
DHER MDV108465
visible bank
internal, possibly levelled area

0
40 m

297600 m

297700 m

British Grid
centre X: 297624.64 m, centre Y: 113209.92 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 description.
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 gradiometer survey
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Figure 2: gradiometer and resistance survey interpretation
excluding anomalies representing services and modern activities

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297500 m 297600 m 297700 m

113300 m

113200 m

N

Playing Field

g1 g1 g2 g2 g1 101 g102 g3 g4 g103 g5 g6

BLUNDELL'S ROAD

Mistletoe

0 40 m

Gradiometer survey
gradiometer survey area
certainty, anomaly type (2)
Potential archaeology
likely, positive (3)
likely negative (3)
possible, positive
possible, negative
Potential services & modern
possible, dipole (4)
likely, narrow linears (4)
Potential natural (5)
possible, weak broad dipole
Earthworks survey
DHER MDV108465
visible bank
internal, possibly levelled area

British Grid
centre X: 297613.99 m, centre Y: 113223.89 m

Scale: 1:900 @ 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 description.
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.

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Figure 3: gradiometer survey interpretation

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297500 m 297600 m 297700 m

113200 m

N

Playing Field

r8 r1 r1 r1 r1 r2 r2 r3 r4 r5 r6 r7

r101 r102 r103

0 40 m

Resistance survey

certainty, anomaly type (2)

Potential archaeology

likely, high (3)

likely, low (3)

possible, high

possible, low

Potential services & modern

possible, strong spike(4)

likely, narrow regular linears (4)

possible, linear (4)

Earthworks survey

DHER MDV108465

visible bank

internal, possibly levelled area

297500 m 297600 m 297700 m

British Grid
centre X: 297613.63 m, centre Y: 113215.93 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 description.
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.

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Figure 4: resistance survey interpretation

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anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
g1	r1	likely, positive	disrupted curvilinear	ditch	anomaly group coincides with the boundary of mapped bank and ditch earthworks	DHER MDV108465
g2	r2	possible, negative	disrupted curvilinear	stony deposit	anomaly group lies within mapped bank earthworks	DHER MDV108465
g3	r7	possible, positive	linear		anomaly group may be related to resistance anomaly r7 although no clear archaeological relationship can be demonstrated	
g4		possible, positive	linear		it is not clear whether these anomalies represent archaeological deposits or recent ground disturbance	
g5		possible, negative	disrupted linear		it is not clear whether these anomalies represent archaeological deposits or recent ground disturbance	
g6		possible, positive	disrupted linear		it is not clear whether these anomalies represent archaeological deposits or recent ground disturbance	
r1	g1	likely, low	disrupted curvilinear	ditch	anomaly group coincides with the boundary between mapped bank and ditch earthworks	DHER MDV108465
r2	g2	likely, high	disrupted curvilinear	stony bank	anomaly group coincides with the boundary between mapped bank and ditch earthworks	DHER MDV108465
r3		possible, high	curvilinear			
r4		possible, low	linear	linear deposit - may be archaeological or modern	anomaly group may have modern origins associated with adjacent huts but an archaeological origin cannot be ruled out	
r5		possible, low	linear	linear deposit - may be archaeological or modern	anomaly group may have modern origins associated with adjacent huts but an archaeological origin cannot be ruled out	
r6		possible, high	linear	linear deposit - may be archaeological or modern	anomaly group may have modern origins associated with adjacent huts but an archaeological origin cannot be ruled out	
r7	g3	possible, low	curvilinear			
r8		likely, low	linear	ditch	anomaly group represents a visible ditch associated with an extant field boundary	surveyor observation
g101		likely, narrow linears		games pitch painted lines		confirmation with school ground staff
g102		possible, dipole		recent ferrous material		
g103		possible, dipole		recent ferrous material		
g104		possible, dipole		recent ferrous material		
g105		possible, positive linear	disrupted linear	modern track	anomaly group is most likely to represent a modern track or service trench although an archaeological origin cannot be entirely ruled out	
r101		likely, narrow regular linears		games pitch painted lines		
r102		possible, linear		service trench		
r103		possible, strong spike		service		
r103		possible, strong spike		service		
g201		possible, weak broad dipole		possible spring or wet area		

Table 1: data analysis

297500 m 297600 m 297700 m

113300 m

113200 m

N

Processed gradiometer data shade plot (nT)
0.8
-0.8

BLUNDELL'S ROAD

0 40 m

British Grid
centre X: 297613.99 m, centre Y: 113223.89 m

Scale: 1:900 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer survey
Land at Blundells School, Blundells Road, Tiverton, Devon
Centred on NGR (E/N): 297610,113210 (point)
Report: 1601BLU-R-1

Figure 5: shade plot of processed gradiometer data

Substrata
Office 1, 5 Mill Street
Bideford, Devon EX39 2JT
Tel: 01273 273599
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

297500 m 297600 m 297700 m

113300 m

113200 m

N

Playing Field

BLUNDELL'S ROAD

Mistletoe

0 40 m

gradiometer survey area

Processed gradiometer data contour plot (nT)

> 2.00

1.00 - 2.00

0.50 - 1.00

-0.50 - 0.50

-1.00 - -0.50

-2.00 - -1.00

< -2.00

British Grid

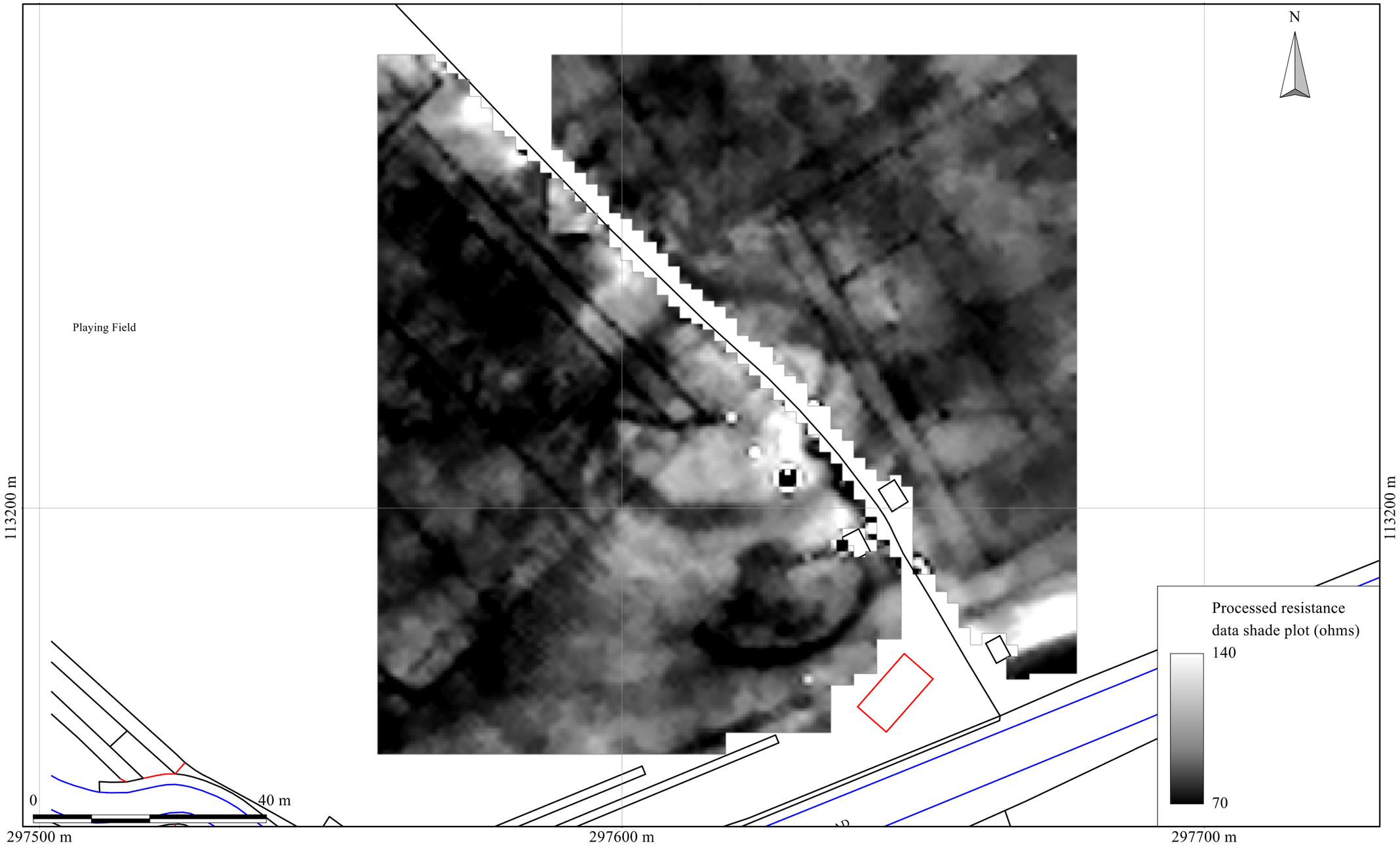
centre X: 297613.99 m, centre Y: 113223.89 m

Scale: 1:900 @ A3. Spatial Units: Meter. Do not scale off this drawing

An archaeological gradiometer survey
Land at Blundells School, Blundells Road, Tiverton, Devon
Centred on NGR (E/N): 297610,113210 (point)
Report: 1601BLU-R-1

Figure 6: contour plot of processed gradiometer data

Substrata
Office 1, 5 Mill Street
Bideford, Devon EX39 2JT
Tel: 01273 273599
Email: geophysics@substrata.co.uk
Web: substrata.co.uk



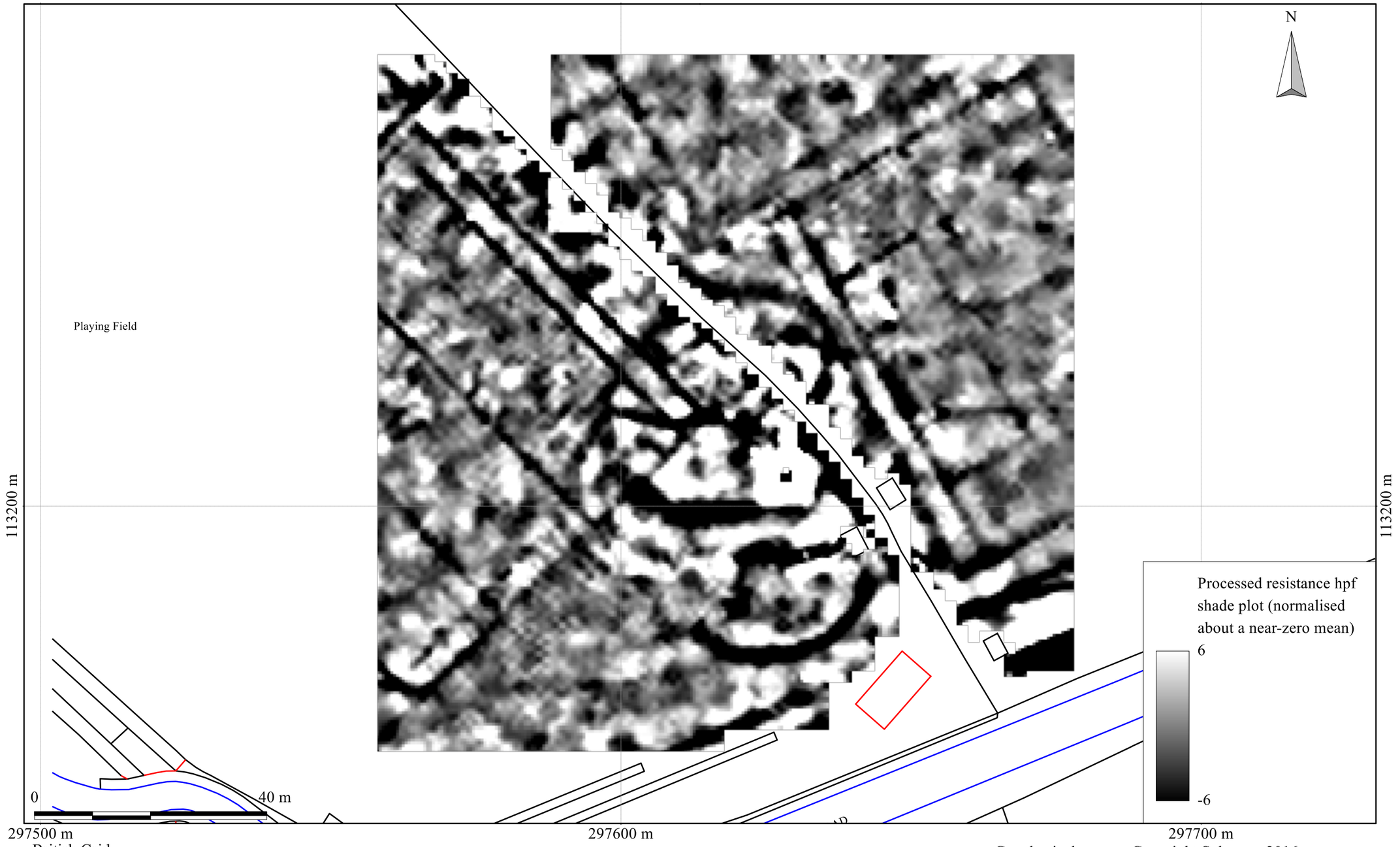
British Grid
centre X: 297613.63 m, centre Y: 113215.93 m

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

An archaeological gradiometer survey
Land at Blundells School, Blundells Road, Tiverton, Devon
Centred on NGR (E/N): 297610,113210 (point)
Report: 1601BLU-R-1

Figure 7: shade plot of processed resistance data

Substrata
Office 1, 5 Mill Street
Bideford, Devon EX39 2JT
Tel: 01273 273599
Email: geophysics@substrata.co.uk
Web: substrata.co.uk



British Grid
centre X: 297613.63 m, centre Y: 113215.93 m

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

An archaeological gradiometer survey
Land at Blundells School, Blundells Road, Tiverton, Devon
Centred on NGR (E/N): 297610,113210 (point)
Report: 1601BLU-R-1

Figure 8: shade plot of processed resistance data
(processing includes high pass filter)

Substrata
Office 1, 5 Mill Street
Bideford, Devon EX39 2JT
Tel: 01273 273599
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

297500 m

297600 m

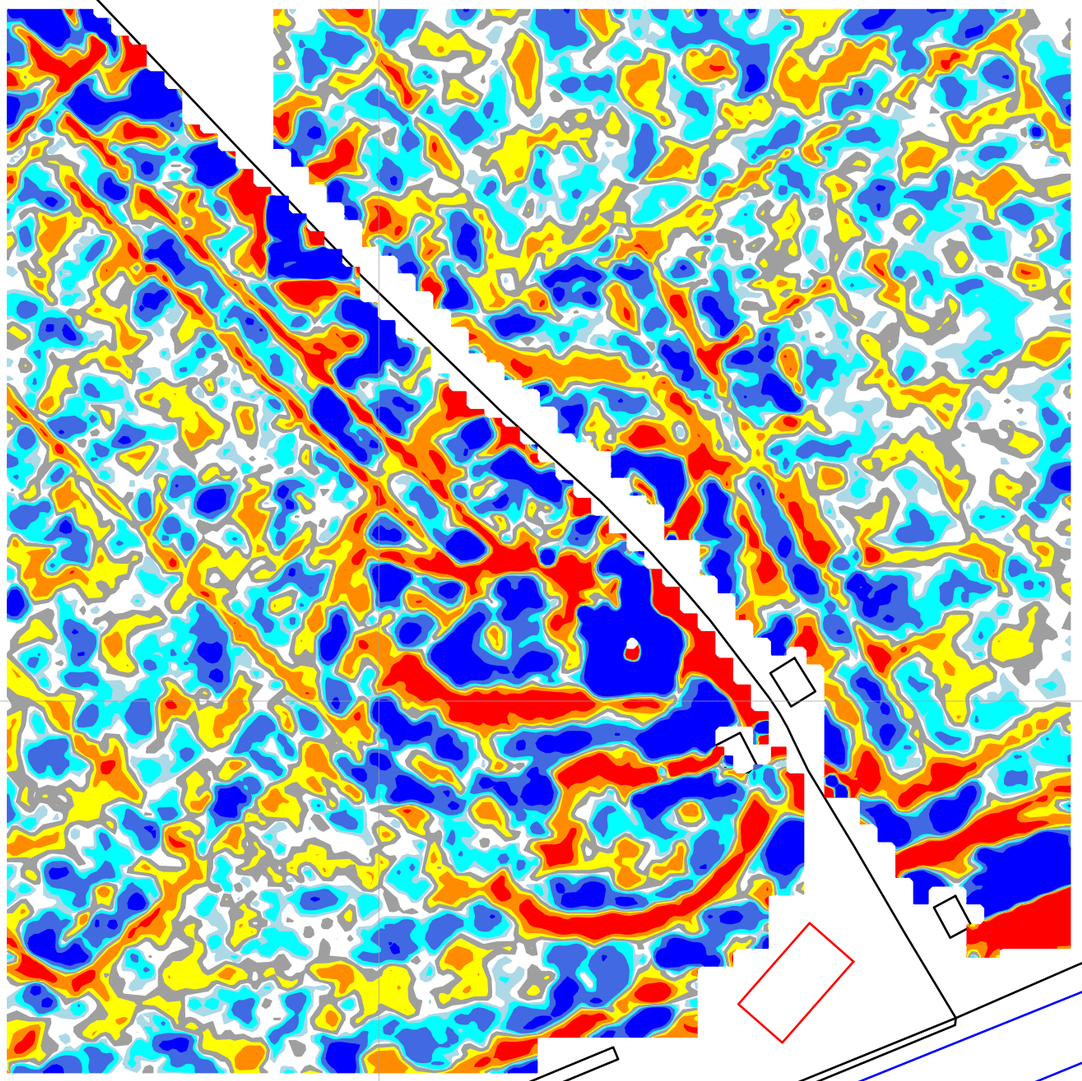
297700 m

N

Playing Field

113200 m

113200 m



Processed resistance hpf data contour plot (normalised about a near-zero mean)

- > 8.00
- 4.00 - 8.00
- 2.00 - 4.00
- 1.00 - 2.00
- -1.00 - 1.00
- -2.00 - -1.00
- -4.00 - -2.00
- -8.00 - -4.00
- < -8.00

0

40 m

297500 m

297600 m

297700 m

British Grid
centre X: 297613.63 m, centre Y: 113215.93 m

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

An archaeological gradiometer survey
Land at Blundells School, Blundells Road, Tiverton, Devon
Centred on NGR (E/N): 297610,113210 (point)
Report: 1601BLU-R-1

Figure 9: contour plot of processed resistance data (processing includes high pass filter)

Substrata
Office 1, 5 Mill Street
Bideford, Devon EX39 2JT
Tel: 01273 273599
Email: geophysics@substrata.co.uk
Web: substrata.co.uk

Appendix 2 Methodology summary

Table 2: methodology summary

Documents
Survey method statement: Dean (2016)

Methodology
1. The work was undertaken in accordance with the survey methodology statement. The geophysical (gradiometer) survey was 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 *Instrument:* Bartington Instruments grad601-2 *Firmware:* version 6.1	**Magnetometer Data Capture** *Sample Interval:* 0.125-metres *Traverse Interval:* 1 metre *Data capture:* automatic data logger *Traverse Method:* zigzag *Traverse Orientation:* GN
Magnetometer Equipment *Instrument:* Geoscan Research RM15 multi-probe resistance meter *Configuration*: twin probe *Mobile probe spacing*: 0.5-metres	**Magnetometer Data Capture** *Sample Interval:* 1 metre *Traverse Interval:* 1 metre *Data capture:* automatic data logger *Traverse Method:* zigzag *Traverse Orientation:* GN

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

Appendix 3 Data processing

Table 3: gradiometer survey - processed data metadata
SITE Instrument Type: Bartington Grad 601 Units: nT 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
Stats Max: 11.11 Min: -10.24 Std Dev: 1.11 Mean: 0.02 Median: 0.00 Composite Area: 3.15 ha Processes: 21 1 Base Layer 2 Clip at 1.00 SD 3 Clip at 4.00 SD 4 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 38, Left 2, Bottom 43, Right 237) 5 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 29, Left 237, Bottom 44, Right 264) 6 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 30, Left 1056, Bottom 33, Right 1173) 7 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 49, Left 1048, Bottom 57, Right 1176) 8 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 53, Left 1000, Bottom 56, Right 1048) 9 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 75, Left 720, Bottom 90, Right 760) 10 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 75, Left 554, Bottom 84, Right 714) 11 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 73, Left 1024, Bottom 84, Right 1199) 12 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 134, Left 565, Bottom 156, Right 618) 13 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 73, Left 552, Bottom 80, Right 754) 14 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 162, Left 234, Bottom 180, Right 280) 15 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 135, Left 528, Bottom 139, Right 576) 16 Search & Replace From: -3000 To: 3000 With: Dummy (Area: Top 30, Left 978, Bottom 59, Right 1128) 17 De Stagger: Grids: d1.xgd b1.xgd b14.xgd d2.xgd b2.xgd b13.xgd d3.xgd b3.xgd b12.xgd d4.xgd b4.xgd b10+b11.xgd d5.xgd b5+b7.xgd b8+b9.xgd Mode: Both By: -2 intervals 18 De Stagger: Grids: a6.xgd a5.xgd a13.xgd c6.xgd a12+a4.xgd a14.xgd c5.xgd a11.xgd c1.xgd c4.xgd a10.xgd c2.xgd c3.xgd Mode: Both By: -1 intervals 19 De Stagger: Grids: a8.xgd a9.xgd Mode: Both By: -1 intervals 20 DeStripe Median Traverse: Grids: All 21 Edge Match (Area: Top 30, Left 960, Bottom 59, Right 1199) to Left edge

Table 4: earth resistance survey - processed data metadata

SITE
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

Figure 7
Stats
Max: 170.00
Min: 60.00
Std Dev: 14.21
Mean: 85.02
Median: 82.30
Composite Area: 1.44 ha

Processes: 8
1 Base Layer
2 Despike Threshold: 1 Window size: 3x3
3 Despike Threshold: 1 Window size: 3x3 (Area: Top 90, Left 0, Bottom 119, Right 119)
4 Edge Match (Area: Top 60, Left 90, Bottom 89, Right 119) to Left edge
5 Edge Match (Area: Top 90, Left 60, Bottom 119, Right 89) to Right edge
6 Edge Match (Area: Top 60, Left 60, Bottom 89, Right 89) to Bottom edge
7 Interpolate: X & Y Doubled.
8 Clip from 60.00 to 170.00

Figures 8 and 9
Stats
Max: 49.60
Min: -114.44
Std Dev: 6.72
Mean: 0.10
Median: -0.09

Processes: 9
1 Base Layer
2 Despike Threshold: 1 Window size: 3x3
3 Despike Threshold: 1 Window size: 3x3 (Area: Top 90, Left 0, Bottom 119, Right 119)
4 Edge Match (Area: Top 60, Left 90, Bottom 89, Right 119) to Left edge
5 Edge Match (Area: Top 90, Left 60, Bottom 119, Right 89) to Right edge
6 Edge Match (Area: Top 60, Left 60, Bottom 89, Right 89) to Bottom edge
7 High pass Uniform (mean) filter: Window: 10 x 10
8 Clip at 2.00 SD
9 Interpolate: X & Y Doubled.

Appendix 4 Unprocessed and minimally processed data plots

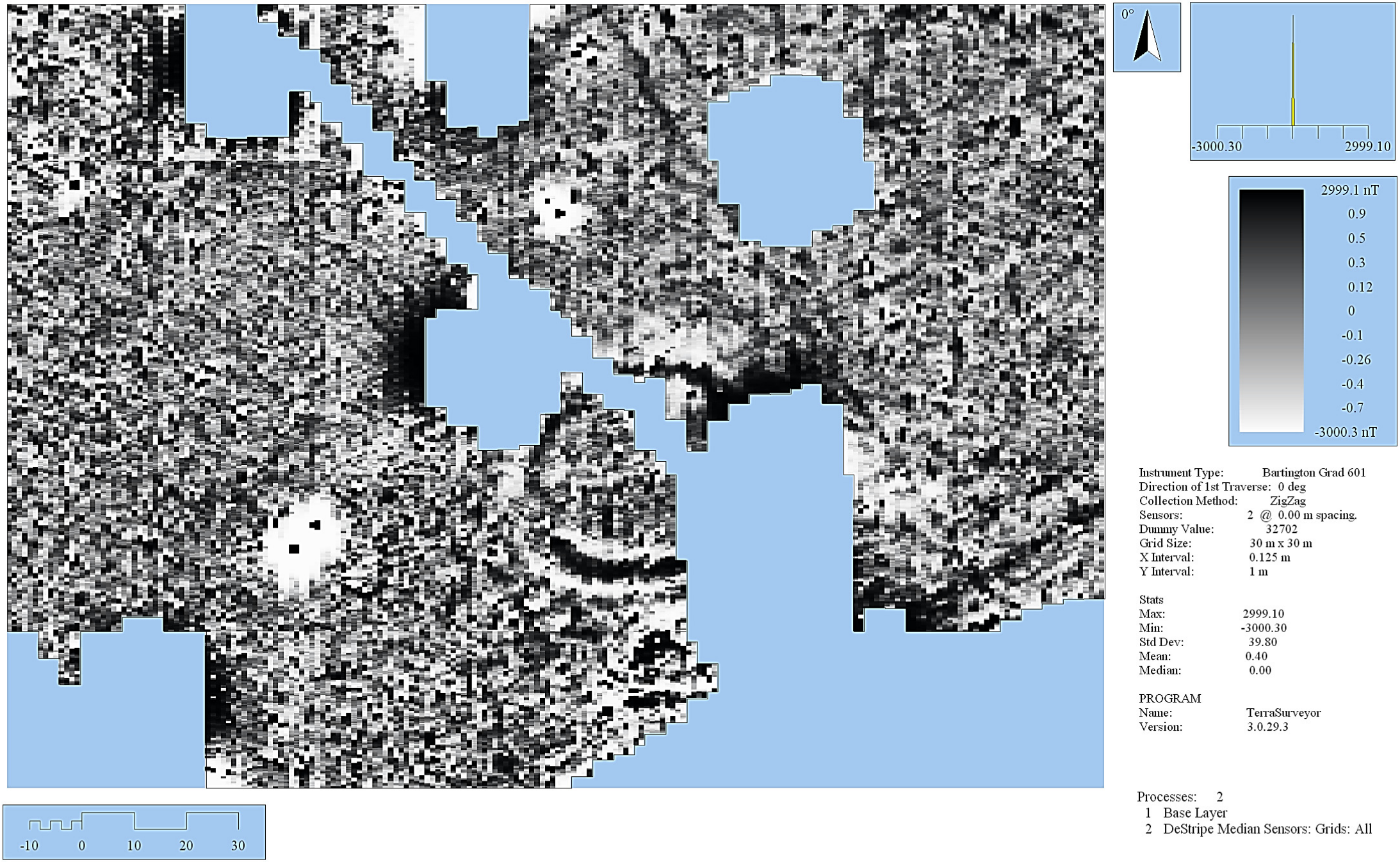
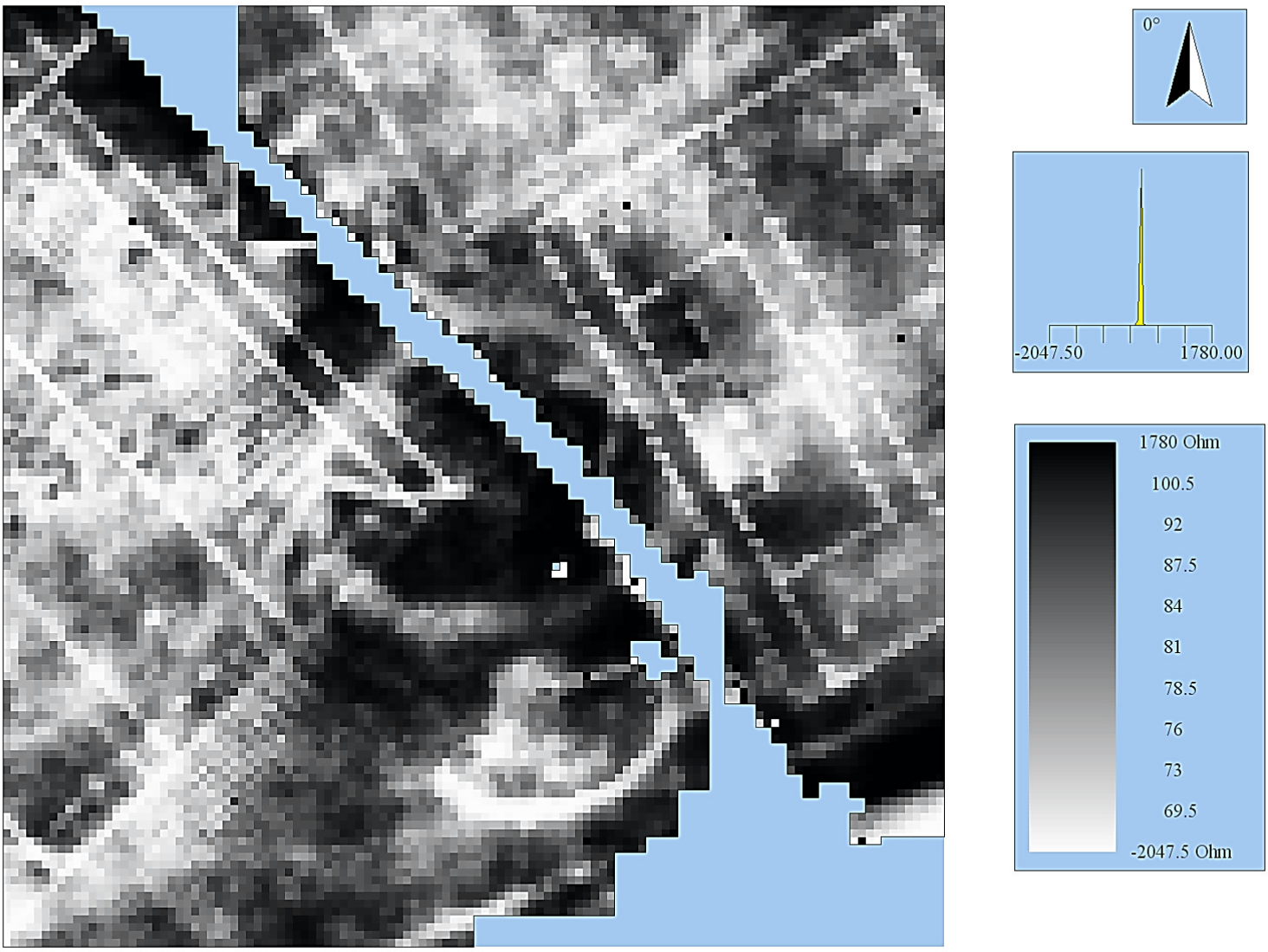


Figure 10: shade plot of minimally processed gradiometer data



Processes: 1
1 Base Layer

Instrument Type:	GeoScan (Resistance)
Units:	Ohm
Direction of 1st Traverse:	0 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:	1780.00
Min:	-2047.50
Std Dev:	49.34
Mean:	84.25
Median:	81.50

PROGRAM

Name:	TerraSurveyor
Version:	3.0.29.3

Figure 11: shade plot of unprocessed resistance data