



An archaeological gradiometer and earth-resistance survey

**Land at Middle Taphouse  
Liskeard, Cornwall**

Centred on NGR (E/N): 217400,63340 (point)

Report: 1503TAP-R-1

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## Contents

1. Survey description and summary.....	1
2. Survey aims and objectives.....	2
3. Standards.....	2
4. Site description .....	2
5. Archaeological background .....	3
6. Results, discussion and conclusions.....	6
7. Disclaimer and copyright .....	10
8. Acknowledgements.....	10
9. Bibliography .....	10
Appendix 1 Analysis table and supporting plots .....	11
Appendix 2 Methodology .....	37
Appendix 3 Data processing .....	38
Appendix 4 Unprocessed or minimally processed data plots .....	40

## Figures

Figure 1: location map.....	12
Figure 2: location of survey areas with Ordnance Survey mapped heritage assets.....	13
Figure 3: survey interpretation, all areas; OS mapped assets & anomaly labels not shown .....	14
Figure 4: survey interpretation, all areas; OS mapped assets shown, anomaly labels not shown ..	15
Figure 5: survey interpretation, area 1.....	17
Figure 5a: survey interpretation, area 1, barrow HER PRN 6620.09 .....	18
Figure 6: survey interpretation, area 2.....	19
Figure 7: survey interpretation, area 3.....	20
Figure 8: survey interpretation, area 4.....	21
Figure 9: survey interpretation, area 5.....	22
Figure 10: shade plot of processed gradiometer data, all areas .....	23
Figure 11: shade plot of processed gradiometer data, Area 1 .....	24
Figure 12: contour plot of processed gradiometer data, Area 1 .....	25
Figure 13: shade plot of processed gradiometer data, Area 2 .....	26
Figure 14: contour plot of processed gradiometer data, Area 2 .....	27
Figure 15: shade plot of processed gradiometer data, Area 3 .....	28
Figure 16: contour plot of processed gradiometer data, Area 3 .....	29
Figure 17: shade plot of processed gradiometer data, Area 4 .....	30
Figure 18: contour plot of processed gradiometer data, Area 4 .....	31
Figure 19: shade plot of processed gradiometer data, Area 5 .....	32
Figure 20: contour plot of processed gradiometer data, Area 5 .....	33
Figure 21: coloured plot of processed resistance data, Area 5 .....	34
Figure 22: shade plot of processed resistance data, Area 5 .....	35
Figure 23: contour plot of processed resistance data, Area 5 .....	36
Figure 24: shade plot of minimally processed gradiometer data, Area 1 .....	41
Figure 25: shade plot of unprocessed gradiometer data, Area 2.....	42
Figure 26: shade plot of unprocessed gradiometer data, Area 3.....	43
Figure 27: shade plot of unprocessed gradiometer data, Area 4.....	44
Figure 28: shade plot of unprocessed gradiometer data, Area 5.....	45
Figure 29: shade plot of unprocessed resistance data, Area 5 .....	46

## Tables

Table 1: survey Areas and known historical assets .....	1
Table 2: data analysis .....	16
Table 3: methodology summary .....	37
Table 4: gradiometer survey - processed data metadata .....	38
Table 5: earth-resistance survey - processed data metadata .....	39

## Accompanying CD-ROM

Report.....	Adobe PDF format
Copies of report figures.....	Adobe PDF format
Raw and processed grid & composite files .....	DW Consulting TerraSurveyor 3 formats
Minimal processing data plots and metadata .....	DW Consulting TerraSurveyor 3 formats
Final data processing data plots and metadata .....	DW Consulting TerraSurveyor 3 formats
GIS project, shape files and classification schema	
GIS project .....	Manifold 8 '.map' file
GIS shape files .....	ESRI standard
GIS classification schema .....	Adobe PDF format
AutoCAD version of the survey interpretation .....	AutoCAD DXF

*Website: [substrata.co.uk](http://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 and twin probe earth-resistance  
Date: 2 to 4 March 2015 and 13 October 2015  
Area: gradiometer survey 4.89ha, earth-resistance survey 0.25ha  
Author: Ross Dean BSc MSc MA MifA  
Lead surveyor: Mark Edwards BA

### 1.2 Client

Historic England

### 1.3 Location

Site: Land at Middle Taphouse  
Civil Parish: Broadoak and St Pinnock  
Postal Town: Liskeard  
County: Cornwall  
Post code: PL14 4NE  
NGR: SX 174 633 (point)  
NGR E/N: 217400,63340 (point)

### 1.4 Archive

OASIS entry: substrat1-233936

At the time of writing, the archive of this survey will be held by Substrata and will be deposited with the ADS in due course.

### 1.5 Introduction

This report was commissioned by the Historic England and was designed to inform the future heritage management of five Scheduled Bronze Age barrows and a linear Iron Age or Civil War earthwork at the above site.

A magnetometer (gradiometer) survey was completed across five areas corresponding to the five barrows and one earthwork as shown in Figure 1 and listed in Table 1. An earth-resistance survey was completed across Area 5 to mitigate for the presence of a service pipe with a high magnetic response. No resistance anomalies recorded in the dataset related to potential archaeological deposits.

Area	C&S HER(*) PRN	C&S HER (*)reference	Scheduled Monument	Monument
1	6620.09	MCO3110	CO421	barrow
1	6625.04			linear earthwork
2	6620.07	MCO3108	CO421	barrow
3	6620.06	MCO3107	CO443	barrow
4	6620.04	MCO3106	CO441	barrow
5	6620.01	MCO3104	CO441	barrow

Table 1: survey areas and known historical assets

\* Cornwall and Scilly Historic Environment Record

### 1.6 Summary

*Both the magnetic and earth-resistance responses were sufficient to be able to distinguish anomalies representing possible archaeological features from those representing geological and other natural deposits. Forty-five magnetic anomaly groups were characterised as representing archaeological deposits or features with thirty of these ascribed to the five known*

barrows targeted by this survey. Two groups represent the known linear earthwork also targeted by the survey. The majority of the remaining groups are most likely to represent fragments of linear deposits such as ditches from at least one phase of former field boundaries and/or enclosures. One curvilinear sequence of anomaly groups may represent a linear alignment of pits or a recent service trench. An area of enhanced response may also relate to archaeological deposits of an unclear nature.

Four of the targeted barrows (Historic Environment Records (HER) PRN 6620.09, 6620.07, 6620.03 and 6620.04) proved to have sufficient magnetic signatures to confirm that they retain associated archaeological deposits. The anomalies associated with barrows 6620.06 and 6620.07 were relatively well defined and appear to show internal depositional sequencing and/or structures. Barrow 6620.03 could not be surveyed because of vegetation cover. The site of barrow 6620.01 was surveyed using both magnetic and earth-resistance techniques but no anomalies pertaining to archaeological deposits or structures were recorded. It is likely that this monument has been ploughed out.

The linear earthwork (HER entry 6625.04) targeted by the survey was defined by two anomaly groups; a linear anomaly group which is most likely to represent the northern side of the earthworks and a group of anomalies to the immediate south of the earthworks. Some of the latter relate to pits mentioned in the HER entry and some to springs or wet areas possibly formed by water collecting on the up-slope side of the earthwork. From the magnetic response, these pits are most likely to be quarries and, speculatively, may be associated with the construction of the earthwork.

## 2 Survey aims and objectives

### 2.1 Aims

1. Define and characterise any detectable archaeological remains on the site.
2. Inform any future heritage management and archaeological investigation of the area.

### 2.2 Objectives

1. A gradiometer survey and, if necessary, a follow-up earth resistance survey will be completed across the agreed survey areas.
2. Any magnetic and earth-resistance anomalies that may be related to archaeological deposits, structures or artefacts will be identified and accurately mapped.
3. Within the limits of the techniques and dataset, any such anomalies or patterns of anomalies will be archaeologically characterised.
4. The location of the identified anomalies will be accurately recorded.
5. A report based on the survey will be produced that is sufficiently detailed to inform any subsequent archaeological investigation and/or asset management process

## 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

Area 1 is situated on the northern side of a hill to the west of the hamlet of Middle Taphouse. The hill descends into a combe to the north. The area lies between 175m and 180m AOD. At the time of the survey the northern field within the survey area was under immature crops and the southern field had been recently ploughed with deep furrows. The survey area is approximately 2.5ha.

Area 2 is situated within a garden lying at approximately 176m to 177m AOD. The surveyable

area amounted to 0.06ha.

Area 3 lies on the eastern slope of the same hill as Area 1 at approximately 175m AOD. At the time of the survey the area was under pasture.

Areas 4 and 5 are situated on the top of a hill to the east of Middle Taphouse at between 185m and 188m AOD. A farm building lies on the north-eastern corner of Area 4. Area 4 was under pasture at the time of the survey whilst Area 5 had been recently ploughed and harrowed.

#### 4.2 Geology

The geology across the survey areas and surrounds comprises a solid geology of slate and sandstone of the Carboniferous and Devonian Saltash Formation. The rocks are dark grey and grey silty mudstone with variable but very subordinate amounts of laminae and thin beds of siltstone and sandstone. There are scattered units of thin- to thick-bedded limestone, thin- to thick-bedded sandstone, basaltic lava (spilite), massive and bedded hyaloclastite, and bedded tuff. The superficial geology is not recorded in the source used (British Geological Society undated).

### 5 Archaeological background

#### 5.1 Historic landscape characterisation

##### Farmland: Medieval

This landscape is the agricultural heartland of Cornwall with farming settlements documented before the seventeenth century and whose field patterns are morphologically distinct from the generally straight-sided fields of later enclosure. The fields may have either Medieval or Prehistoric origins (Cornwall Council, undated).

#### 5.2 Known Heritage Assets

The following is a short summary of information obtained from the Cornwall and Scilly Historic Environment Record (C&S HER) within approximately 1000m 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 (Historic England, undated).

##### 5.2.1 General

The settlement of Middle Taphouse is first recorded in 1532 AD. 'Taphouse' is English rather than Cornish and means "house at the top or summit" (HER 6608 at NGR SX 1735 6332). Nearby, at Braddock Down (SX 1761 6299), Cornish Royalists, under Sir Ralph Hopton, defeated Parliamentarians on 19th January 1643 (6631). The traditional but no longer thought to be correct site of the battle is at SX 1600 6180 (6631.01). Barrows in the area are reputed to have held guns (6620.01, 6620.03, 6620.04, 6620.06). *6620.01 was surveyed (Area 5 in Figure 2) but no anomalies with archaeological origins were recorded.*

On a high plateau overlooking Middle Taphouse, there is a group of seven Bronze Age (2500 BC to 801 BC) barrows, in varying states of preservation, forming a barrow cemetery (6620 at general locale NGR SX 17 63). Three of the barrows (6620.01, .03, .04) have been repeatedly ploughed; two others (6620.06, .07) are better preserved; and two (6620.08, .09) have been virtually destroyed. Flints have been recovered from the surface of two of the ploughed barrows (6620.02 and 6620.05). *6620.01, 6620.04, 6620.06, 6620.07 and 6620.09 were the subjects of this survey.*

To the northwest and west of the survey areas lie a series of earthworks associated with Largin Castle Iron Age hillfort. Largin Castle hillfort itself (6619 at NGR SX 1691 6452) is well preserved and lies under trees on the spur of a steep sided hill approximately 1.3km to the northwest of Middle Taphouse (Figure 1). It has dependent inner enclosures and two outer cross bank enclosures.

West and northwest of Area 1 there are five sets of linear earthworks (6625 with sub-entries and 6625.01 to .05 centred on SX 1650 6360) associated with the Largin Castle Iron Age

hillfort (6619). These defences were probably built to protect the southern flank of the hill fort; it has been suggested that they may also or alternatively have been associated with a possible Civil War battle at Braddock Down (6229 above). *Of these earthworks, 6625.04 at SX 1650 6364 and eastwards, was targeted for survey.*

### 5.2.2 Heritage Assets within the survey areas (Figure 2)

One Bronze Age bowl barrow is situated in the north-eastern corner of survey Area 1 (6620.09, Scheduled Monument CO421, at NGR SX 1716 6351). It was recorded as being 18m in diameter by 0.6m high with a flattened top. In recent years, the vicinity of the barrow has been used as a vehicle turning area and the barrow is now barely visible as a faint earthwork (Substrata surveyors notes). *Evidence for this barrow was recorded in the survey data.*

A linear earthwork crosses Area 1 running approximately east to west (6625.04, SX 1650 6364 to SX 1718 6349) across the head of the stream which to the east of Largin Castle (Figure 1). It is traceable partly as a field bank and, across Area 1 where it is best preserved, as a 0.7m high bank with shallow pits (*possibly the remains of the ditch but see the analysis in Section 6.2.2*) on the south side. This earthwork is either of Iron Age date (800 BC to 42 AD), and associated with Largin Castle hillfort (6619, below), or it is a Civil War defence. At its western end, it terminates at the square earthwork (6624, below). *Evidence for these earthworks was recorded in the survey data.*

Area 2 contains a single, well preserved bowl barrow 31m in diameter by approximately 3.5m high (6620.07, Scheduled Monument CO421, at SX 1722 6341). *Evidence for the barrow was recorded in the survey data.*

The barrow in Area 3 is in good condition despite plough and cattle damage. It is 45m in diameter and 3.5m high (6620.06, Scheduled Monument CO443, NGR SX 1722 6314). *Evidence for this barrow was recorded in the survey data.*

The bowl barrow in the south west of Area 4 has been reduced through ploughing but is still visible as a low earthwork 25m in diameter and 1.5m high (6620.04, Scheduled Monument CO441 at SX 1760 6320). Flints, including a tranchet derivative arrowhead, have been recovered from the ploughed surface of the mound (6620.05, Scheduled Monument CO441 at SX 1760 6320). A second bowl barrow, on the eastern side of survey Area 4, is approximately 2.5m high by 19m to 22m in diameter. It is covered in scrub and brambles. The barrow has been dug into on the east side and has been reduced by ploughing and rabbit burrowing (6620.03, Scheduled Monument CO441 at NGR SX 1767 6322). *Evidence for barrow 6620.04 was recorded in the survey data. Barrow 6620.03 could not be surveyed because of vegetation cover.*

The bowl barrow in Area 5 has been reduced by ploughing and could not be seen as an earthwork by the Substrata surveyors. The historical environment entry records it as being 17m in diameter and 0.5m high (6620.01, Scheduled Monument CO441, NGR SX 1785 6313). A scatter of ten Prehistoric (before 43 AD) flint flakes were recovered from the west of the field. A further flake was exposed on the surface of the ploughed barrow and another flake was found in the plough soil nearby (6620.02) at SX 1787 6314). This barrow may have been used to site a gun during the Civil War battle of Braddock Down (6631) and after. *No evidence for this barrow was recorded in the survey data.*

### 5.2.3 Heritage Assets within 1000m of the Application Area

To the south of Area 2 is a barrow in a poor state of preservation with only a 3.0m wide and 1.0m high section of its western side surviving. The eastern part has been removed and overlaid by a garage (6620.08, NGR SX 1719 6336)

HER entry 6625.05 at SX 1640 6354 lies to the west of Middle Taphouse and comprises undefinable lengths of ploughed-down bank and ditch which may be further outworks associated with Largin Castle but the Ordnance Survey suggests that they may in fact be

holloways. They run roughly parallel with the modern road and could represent an earlier, pre-enclosure, hatchway across the downland.

To the southwest of Area 1, and apparently connected with two of the Largin Castle associated outworks (6625.03 & .05), is a small rectilinear, univallate enclosure (6624 at SX 1651 6359). In the north is a causeway entrance with a broad obliquely set ditch beyond which may have been a covering work or may be the remnant of a holloway. The alignment and the considerably greater strength of the western side of the work suggests that it utilised a now detached part of the presumed Iron Age bank and ditch which extended northward (6625.03, see Figure 1). The enclosure is probably Medieval (1066 AD to 1539 AD) or later, and possibly a Civil War gun emplacement presumably guarding the Liskeard to Lostwithiel road. It is more likely to be associated with the events after the battle of Braddock Down (19 January 1643) and leading up to the battle of Lostwithiel (1 October 1644).

To the west of the earthworks of 6624 lies a ploughed down Bronze Age barrow which can no longer be seen on the ground. When recorded, the feature had the appearance of a negative barrow or dew pond, showing as a pronounced circular depression in the ground (6618 at SX 1645 6362).

To the west of the Middle Taphouse are two parallel ditches, visible on air photos, running northeast to southwest for approximately 300m. It is possible that these are the remains of a trackway of unknown date (71526 at SX 1666 6317, 71528 at SX 1666 6330 and 71527 at SX 1682 6339). A similar set of parallel ditches is recorded to the northeast of the hamlet (71539 at SX 1818 6396).

A number of Early Medieval to Modern (410 AD to 2050 AD) field boundaries surround the survey areas. To the north a potential historic field boundary was plotted from air photographs (71540 at SX 1730 6370). Two parallel field boundaries are visible on air photos taken to the east. These linear features are each approximately 150m long and are 40m apart (71542 at SX 1778 6324). Linear features representing field boundaries of similar dates were recorded to the northeast (71538 at SX 1807 6390), east (71544 at SX 1813 6316) and south (71524 at SX 1708 6274).

A linear feature interpreted as a field boundary is visible in air photographs to the east of Middle Taphouse. Alternatively this could be the remains of a prehistoric ridge way which extended across this area of former rough ground. The feature follows the contours of the hill slope and has a ditch with a bank either side (71541 at SX 1768 6342).

A number of Post-medieval (1540 AD to 1900 AD) quarries have been recorded from air photographs and historic Ordnance Survey maps. These include 71529 (at SX 1657 6349) and 71530 (at SX 1673 6347) to the west of the survey areas, and 71543 (at SX 1785 6331) to the east.

A number of possible Bronze Age barrows are recorded to the south of the survey areas. A sub-circular ditched enclosure with a diameter of approximately 20m is visible on aerial photographs. Although the original function of this feature is not clear, it is possible that it is the ploughed-out remains of a barrow (71546 at NGR SX 1745 6267). A bowl barrow 30m in diameter and 1.6m high is recorded on Ordnance Survey maps (6627 at SX 1759 6242). It is one in a small group of two, the other being the Scheduled barrow to the south-west (6628); and both may be outliers of the large group at Middle Taphouse (6620). The site is visible on aerial photographs. A sub-circular hollow, approximately 15m in diameter, is visible on air photographs. It is possible that this is the ploughed-out remains of a barrow (71525 at SX 1729 6260). A circular feature, likely to be a barrow, is visible as a slight earthwork on air photographs at SX 1737 6269 (168012).



## 6 Results, discussion and conclusions

This survey was designed to record magnetic and earth-resistance anomalies. The anomalies themselves cannot be regarded as actual archaeological features and the dimensions of the anomalies shown do not represent the dimensions of any associated archaeological features. The analysis presented below identifies and characterises anomalies and anomaly groups that may relate to archaeological deposits and structures.

The terms ‘archaeological features’ and ‘archaeological deposits’ refer to any artefacts, material deposits or disturbance of natural deposits thought to be the result of human activity and not undertaken as recent land development, maintenance or farming.

The reader is referred to section 7.

### 6.1 Results

Results Figures 3 and 4 show the interpretation of the gradiometer survey data for all the survey Areas 1 to 5. Figures 5 to 9 provide the same information at a detailed scale for each survey area and show the anomaly groups identified as relating to archaeological deposits along with their numbers.

The earth-resistance survey was completed across Area 5 to mitigate the influence on the magnetic data of a steel service pipe or cable. No resistance anomalies recorded in the dataset related to potential archaeological deposits.

Table 1 is an extract of the detailed analysis of the survey data which is provided in the attribute tables of the GIS project on the accompanying CD-ROM and in the project archive.

Figures 5 to 9 and Table 1 comprise the analysis of the survey data.

Various plots of the processed gradiometer data are provided in Figures 10 to 20. Plots of the processed resistance data are provided in Figures 21 to 23.

Plots of the minimally processed or unprocessed data are provided in Appendix 2.

### 6.2 Discussion

#### 6.2.1 General points

##### Discussion scope

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

##### Data collection

Data collection along the site edges was restricted as shown in the figures due to the presence of magnetic materials adjacent to the site. Strong magnetic responses mapped close to survey boundaries are likely to relate to these materials except where otherwise indicated in the analysis.

##### 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 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 except where they may have been confused with anomalies relating to potential archaeological deposits or features.

#### General data trends

A west-north-west to east-south-east trend in the data in Area 1, an approximately north-south trend in Area 3, an east-west trend in the northern field of Area 4, a north-south trend in the southern field of Area 4 and an east-west trend in Area 5 are likely to represent recent ploughing (Figures 10 to 12 and 15 to 20).

The 'wavy' nature of the linear trend in Area 1 was the result of imprecise survey pacing imposed by extremely difficult wet and muddy conditions in the recently ploughed field.

#### 6.2.2 Data relating to historical maps and other records

See Section 5 for a description of the known historic assets discussed below.

##### Area 1 (Figures 5, 5a, 11 and 12)

Magnetic anomaly group **5** represents a now removed section of a Cornish bank field wall that was mapped by the Ordnance Survey until at least 1987.

Group **10** represents part of an extant bank thought to date from either the Iron Age or from the English Civil War; the battle of Braddock Down took place around the Taphouse hamlets and nearby land on 19th January 1643 (PRN 6625.04). Group **11** appears associated with this earthwork and may represent quarry pits, perhaps to gain material for the earthwork, rather than the remains of a ditch as suggested in the HER entry. Whether or not this earthwork and associated pits are Iron Age, Civil War or Iron Age with Civil War augmentation is impossible to tell from the survey data.

Groups **15**, **18**, **19** and **21** are likely to represent archaeological deposits from a known and recently extant barrow that has been all but flattened (PRN 6620.09, Scheduled Monument CO421). Groups **14**, **16**, **17** and **20** may also be associated with the barrow (Figure 5a). Group 16 is discussed further below.

##### Area 2 (Figures 6, 13 and 14)

The barrow targeted in Area 2 is situated in a garden (PRN 6620.07, Scheduled Monument CO421). As is typical of such environments, the magnetic survey area was limited due to the presence of magnetic materials and physical obstructions. Nevertheless, sufficient data was collected to identify a number of anomalies that are probably related to the barrow. Groups **22** and **24** are likely to represent the outer ditch and inner deposits of the barrow while groups **23**, **25**, **26** and **27** may also be associated with the barrow and hint at some internal depositional sequencing and/or structures. Group 26 is discussed further below.

##### Area 3 (Figures 7, 15 and 16)

Area 3 was placed to target a barrow with well preserved, extant earthworks (PRN 6620.06, Scheduled Monument CO443). The magnetic response was excellent with what appear to be internal depositional sequencing and/or structures clearly visible in the data set. Groups **28**, **29** and **30** are likely to relate to curvilinear deposits possibly associated with the barrows construction. Group **31** may also relate to such deposits although it may be a 'shadow anomaly' created from surrounding anomaly groups. Group **32** may also relate to the structure of the barrow and group **35** may represent internal deposits such as burnt material. Groups 33 and 36 are discussed further below.

#### Area 4 (Figures 8, 17 and 18)

Area 4 was defined to include two barrows (PRN 6620.04 and PRN 6620.03, both Scheduled Monument number CO441). The latter was covered in scrub and brambles and lay close to a farm building, both of which prevented surveying. The barrow has been subjected to frequent ploughing and has reduced earthworks as a consequence. The magnetic response reflects this damage with only one magnetic anomaly group, **44**, being likely to relate to the monument although the other groups mapped (**42** to **45**) are probably also associated with the barrow.

#### Barrow anomalies - a common trend

Groups **16** (Area 1, barrow 6620.09), **26** (Area 2, barrow 6620.07), **33** and **36** (Area 3, barrow 6620.06), and **43** (Area 4, barrow 6620.04) are approximately northeast - southwest trending linear anomaly groups associated with the barrows and best seen in the contour plots (Figures 12, 14, 16 and 18). It is unclear what these anomalies represent but their presence in all four of the barrows recorded in the data requires explanation. Figure 16 and, to a lesser extent, Figure 18 show faint similarly orientated linear trends within the general data for Areas 3 and 4 respectively. The anomalies may represent field drains or former ploughing disturbance emphasised by the enhanced magnetic response in deposits around the barrows but only excavation will answer the question as to what these anomalies actually represent.

#### 6.2.3 Data with no previous archaeological provenance

##### Area 1 (Figures 5, 5a, 11 and 12)

Group **1** represents past ploughing and possibly ridge-and-furrow cultivation.

Groups **2**, **4**, **7** and **8** are most likely to represent fragments of linear deposits such as ditches from at least one phase of former field boundaries and/or other enclosures.

Group **3** may represent a ditch-sided routeway or a combination of ditch-sided routeway and ploughing headland.

Group **6** represents a group of deposits with an enhanced magnetic response. While this group has no clear pattern, the tight distribution and nature of the magnetic response implies a possible archaeological origin.

Groups **12** and **13** appear to represent linear archaeological deposits, possibly ditches, of unknown provenance although a more recent origin such as service trenches or field drains cannot be ruled out.

##### Area 4 (Figures 8, 17 and 18)

Group **40** may represent a curvilinear series of pits although its approximate alignment with the farm buildings suggest that the anomaly group could reflect a service trench with a weak magnetic response.

#### 6.2.4 Area 5 (Figures 9 and 19 to 23)

As can be seen in Figures 19 and 20, the magnetic response across the site of barrow PRN 6620.01 (Scheduled Monument CO441, NGR SX 1785 6313) is compromised by the presence of a service pipe running across the area. An earth-resistance survey was completed across the site to provide an alternative view of the site which would be less compromised by the presence of this pipe. As is clear from Figures 24 to 27, none of the resistance anomalies recorded can be characterised as pertaining to archaeological deposits. While the HER describes the barrow as extant (see Section 5.2.2), no earthworks were visible to the surveying team and no magnetic or resistance anomalies could be ascribed to the monument.

### 6.3 Conclusions

Both the magnetic and earth-resistance responses were sufficient to be able to distinguish anomalies representing possible archaeological features from those representing geological and other natural deposits. Forty-five magnetic anomaly groups were characterised as representing archaeological deposits or features with thirty of these ascribed to the five known barrows targeted by this survey. Two groups represent the known linear earthwork also targeted by the survey. The majority of the remaining groups are most likely to represent fragments of linear deposits such as ditches from at least one phase of former field boundaries and/or enclosures. One curvilinear sequence of anomaly groups may represent a linear alignment of pits or a recent service trench. An area of enhanced magnetic response may also relate to archaeological deposits of an unclear nature.

Four of the targeted barrows (6620.09, 6620.07, 6620.03 and 6620.04) proved to have sufficient magnetic responses to confirm that they retain associated archaeological deposits. The anomalies associated with barrows 6620.06 and 6620.07 were relatively well defined and appear to show internal depositional sequencing and/or structures. Barrow 6620.03 could not be surveyed because of vegetation cover. The site of barrow 6620.01 was surveyed using both magnetic and earth-resistance techniques but no anomalies pertaining to archaeological deposits or structures were recorded. It is likely that this monument has been ploughed out.

The linear earthwork (HER entry 6625.04) targeted by the survey was defined by two anomaly groups; a linear anomaly group which is most likely to represent the northern side of the earthworks and a group of anomalies to the immediate south of the earthworks. Some of the latter relate to pits mentioned in the HER entry and some to springs or wet areas possibly formed by water collecting on the up-slope side of the earthwork. From the magnetic response, these pits are most likely to be quarries and, speculatively, may be associated with the construction of the earthwork.

## 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 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 present than those specified in this report.

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## 8 Acknowledgements

Substrata would like to thank Caroline Vulliamy, Historic England Heritage at Risk Projects Officer, for commissioning us to complete this survey.

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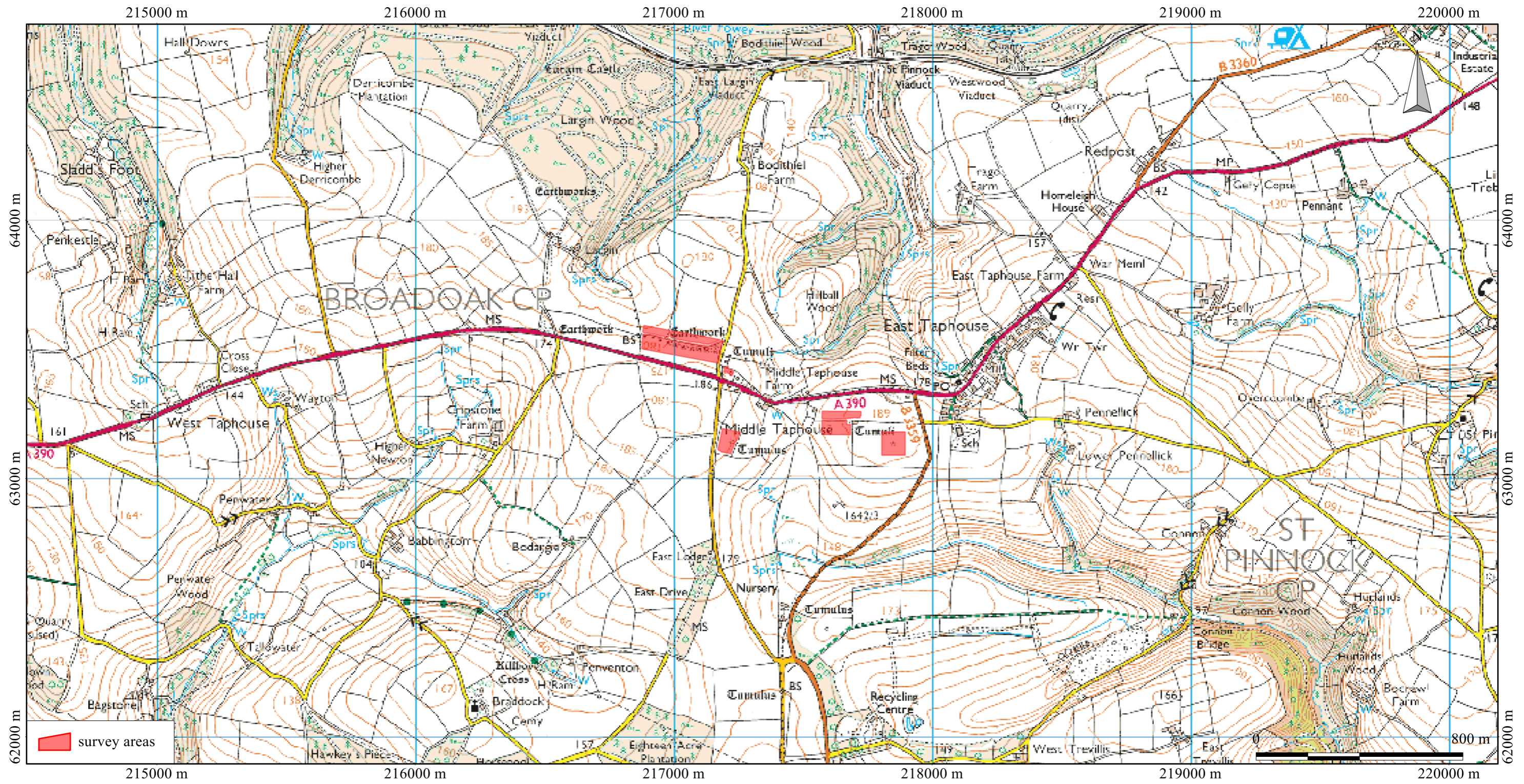
## Appendix 1 Analysis table and supporting plots

### General Guidance

The anomalies represented in the survey plots provided in this appendix are magnetic anomalies and earth-resistance 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  
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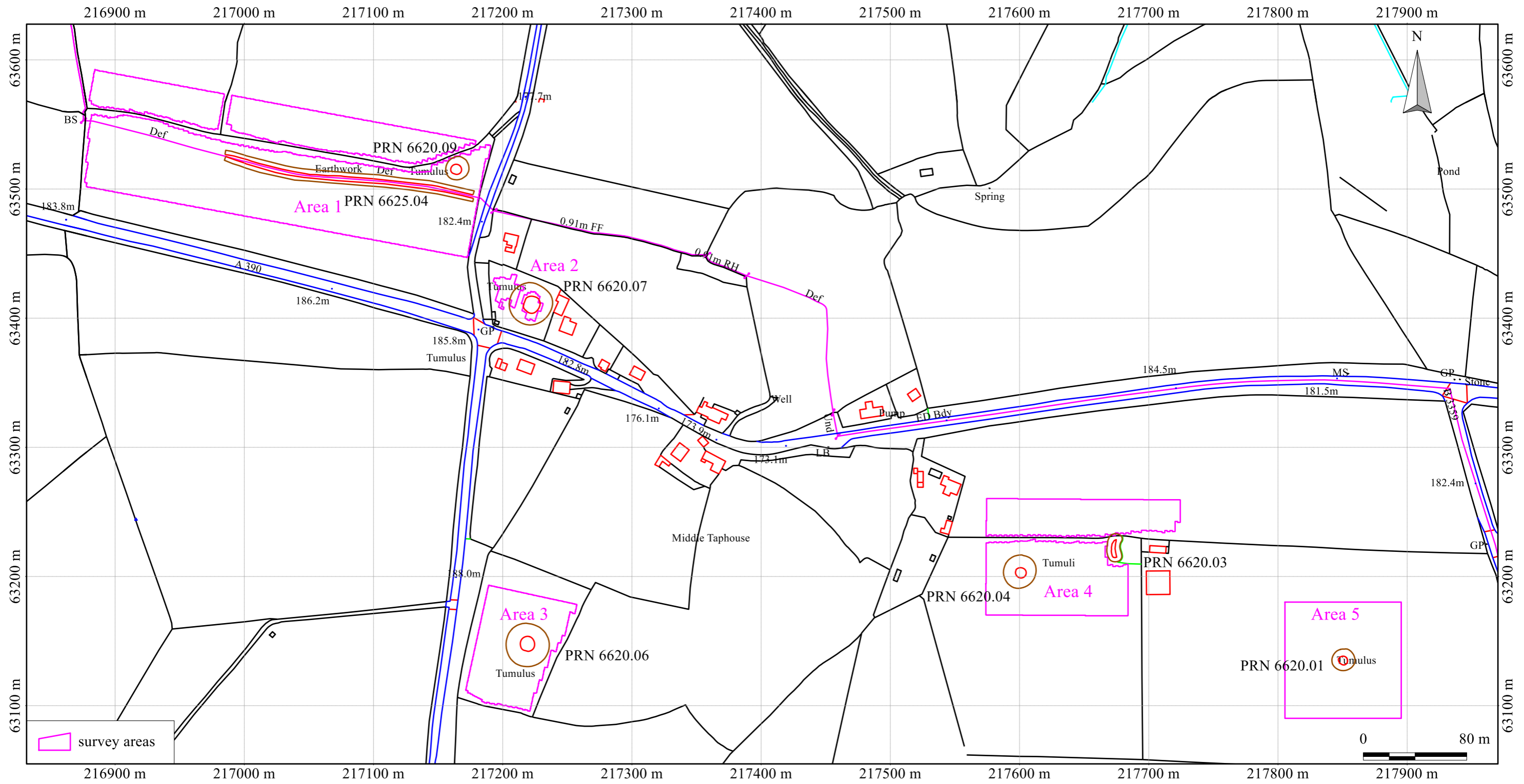
Scale: 1:15000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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 Report: 1503TAP-R-1

Figure 1: location map

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British Grid  
 centre X: 217400.87 m, centre Y: 63341.28 m

Scale: 1:3000 @ A3. Spatial Units: Meter. Do not scale off this drawing

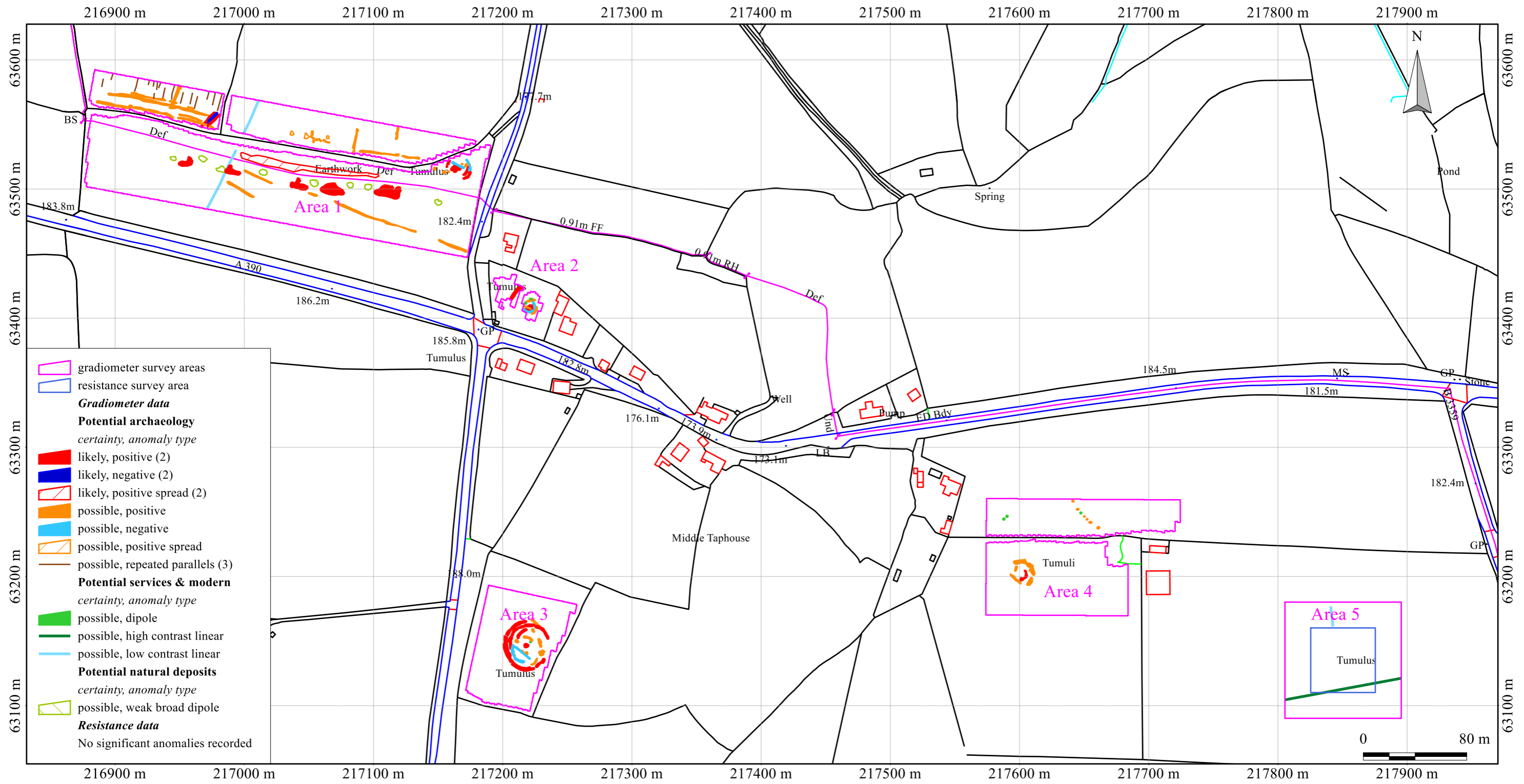
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Figure 2: location of survey areas with Ordnance Survey mapped heritage assets

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  2. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.
  3. Representative; not all instances are mapped.
  4. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

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Figure 3: survey interpretation, all areas;  
 Ordnance Survey mapped heritage assets not shown  
 anomaly labels not shown

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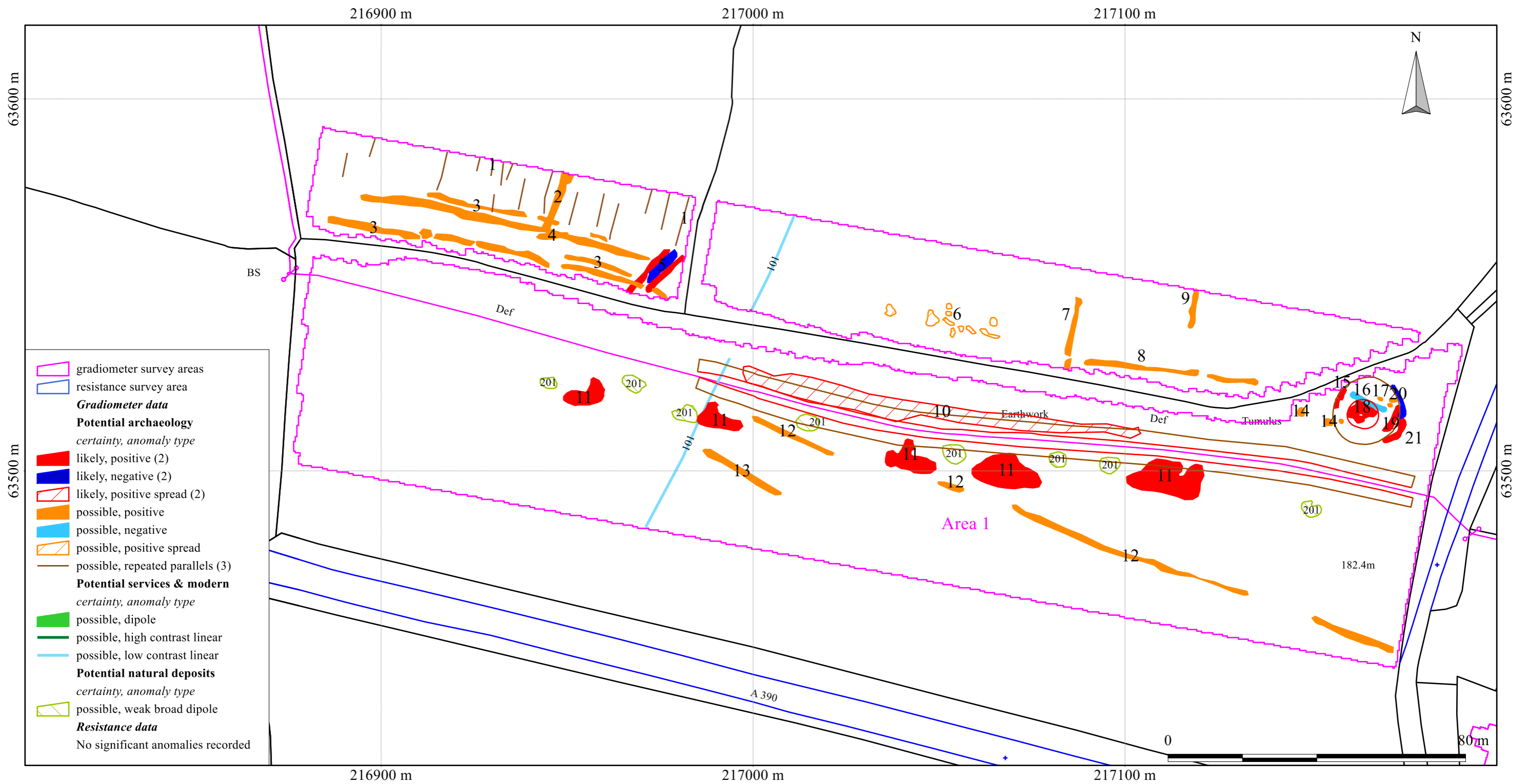


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 Report: 1503TAP-R-1

area number	anomaly group	associated anomalies	anomaly characterisation certainty & class	anomaly form	additional archaeological characterisation	comments	supporting evidence
1	1		possible, repeated parallels		ploughing disturbance	some of the anomalies may represent ridge-and-furrow ploughing or, given the lack of reversed-S curving, steam ploughing or possibly spade dug ridge cultivation	
	2		possible, positive	linear			
	3		possible, positive	disrupted curvilinears	ditched routeway possibly with headland	one of a series of parallel linear anomalies that may form a ditched track with a stony surface or a combination of track and ploughing headland - a similar structure, thought to be a holloway, is recorded to the southwest and south of the modern road	HER PRN 6625.05
	4		possible, positive	linear			
	5		likely, positive-negative-positive	linear	field boundary - Cornish bank	anomaly group coincides with a section of an extant field boundary altered after 1987	Ordnance Survey map 1987 1:10,000
	6		possible, positive spread	irregular	area of enhanced magnetic response	anomalies appear to lie within an area of enhanced magnetic response which can be indicative of archaeological deposits	
	7		possible, positive	disrupted linear			
	8		possible, positive	disrupted linear			
	9		possible, positive	linear		anomaly group may represent archaeological deposits or ploughing	
	10		likely, positive spread	linear	spread of archaeological material	anomaly group lies along the northern side of an earthworks mapped by the Ordnance Survey and recorded in the C&S HER; thought to be either Iron Age or English Civil War	HER PRN 6625.04
	11		likely, positive	irregular	filled hollows or pits - possible quarry	anomaly group is likely to represent a pit which is part of a linear earthwork with shallow pits on the southern side mapped by the Ordnance Survey and recorded in the C&S HER; thought to be either Iron Age or English Civil War	HER PRN 6625.04
	12		possible, positive	disrupted linear			
	13		possible, positive	linear			
	14		possible, positive	ovals	pits	anomaly group close to a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.09, Scheduled Monument CO421
	15		likely, positive	curvilinear	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.09, Scheduled Monument CO421
	16	26 33 34 36 43	possible, negative	linear	deposits associated with a known barrow	anomaly group may represent relatively recent ground disturbance but similar anomalies are found in association with other barrows in the survey and so group needs recording as possible archaeology	HER PRN 6620.09, Scheduled Monument CO421
	17		possible, positive	ovals	deposits associated with a known barrow - pits		HER PRN 6620.09, Scheduled Monument CO421
	18		likely, positive	irregular	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.09, Scheduled Monument CO421
	19		likely, positive	curvilinear	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.09, Scheduled Monument CO421
	20		likely, negative	curvilinear	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.09, Scheduled Monument CO421
	21		likely, positive	curvilinear	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.09, Scheduled Monument CO421
	101		possible, low contrast linear		service trench		
2	22		likely, positive	curvilinear	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.07, Scheduled Monument CO421
	23		possible, positive	disrupted curvilinear	deposits associated with a known barrow	anomaly group coincides with and may represent deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.07, Scheduled Monument CO421
	24		likely, positive	irregular oval	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.07, Scheduled Monument CO421
	25		possible, negative	disrupted curvilinear	deposits associated with a known barrow	anomaly group coincides with and may represent deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.07, Scheduled Monument CO421
	26	16 33 34 36 43	possible, positive	linear	deposits associated with a known barrow	anomaly group may represent relatively recent ground disturbance but similar anomalies are found in association with other barrows in the survey and so group needs recording as possible archaeology	HER PRN 6620.07, Scheduled Monument CO421
	27		possible, positive	curvilinear	deposits associated with a known barrow	anomaly group coincides with and may represent deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.07, Scheduled Monument CO421
	102		possible, dipole		ferrous material		
	103		possible, dipole		ferrous material		
	201		possible, weak broad dipole	irregular	spring or wet area		
3	28		likely, positive	curvilinear	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.06, Scheduled Monument CO443
	29		likely, positive	curvilinear	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.06, Scheduled Monument CO443
	30		likely, positive	curvilinear	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.06, Scheduled Monument CO443
	31		possible, negative	curvilinear	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.06, Scheduled Monument CO443
	32		possible, positive	curvilinear	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.06, Scheduled Monument CO443
	33		possible, positive	ovals	deposits associated with a known barrow - pits	anomaly group coincides with and may represent deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.06, Scheduled Monument CO443
	34	16 26 33 36 43	possible, negative	linear	deposits associated with a known barrow	anomaly group may represent relatively recent ground disturbance but similar anomalies are found in association with other barrows in the survey and so group needs recording as possible archaeology	HER PRN 6620.06, Scheduled Monument CO443
	35		likely, positive	oval	deposits associated with a known barrow - pit or burnt deposit	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.06, Scheduled Monument CO443
	36	16 26 33 34 43	possible, positive	linear	deposits associated with a known barrow	anomaly group may represent relatively recent ground disturbance but similar anomalies are found in association with other barrows in the survey and so group needs recording as possible archaeology	HER PRN 6620.06, Scheduled Monument CO443
	37		possible, positive	linear	deposits associated with a known barrow	anomaly group coincides with and may represent deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.06, Scheduled Monument CO443
	38		possible, positive	irregular	deposits associated with a known barrow	anomaly group coincides with and may represent deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.06, Scheduled Monument CO443
	39		possible, positive	curvilinear	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.06, Scheduled Monument CO443
	104		possible, dipole		ferrous material		
4	40		possible, positive	curvilinear group	a curvilinear line of pits	there is a possibility that this group represents recent ground disturbance such as a deep or disrupted service trench	
	41		possible, positive	curvilinear	deposits associated with a known barrow	anomaly group coincides with and may represent deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.04, Scheduled Monument CO441
	42		possible, positive	curvilinear	deposits associated with a known barrow	anomaly group coincides with and may represent deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.04, Scheduled Monument CO441
	43	16 26 33 34 36	possible, positive	linear	deposits associated with a known barrow	anomaly group may represent relatively recent ground disturbance but similar anomalies are found in association with other barrows in the survey and so group needs recording as possible archaeology	HER PRN 6620.04, Scheduled Monument CO441
	44		likely, positive	curvilinear	deposits associated with a known barrow	anomaly group coincides with and likely represents deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.04, Scheduled Monument CO441
	45		possible, positive	broad linear	deposits associated with a known barrow	anomaly group coincides with and may represent deposits from a barrow mapped by the Ordnance Survey and recorded in C&S HER	HER PRN 6620.04, Scheduled Monument CO441
	105		possible, dipole		ferrous material	anomaly most likely represents relatively recent ferrous material and are included here to discount what appears to be a return	
	106		possible, dipole		ferrous material		

Table 2: data analysis

Notes:  
 C&S HER : Cornwall and Scilly Historic Environment Record



British Grid  
 centre X: 217002.10 m, centre Y: 63520.32 m

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

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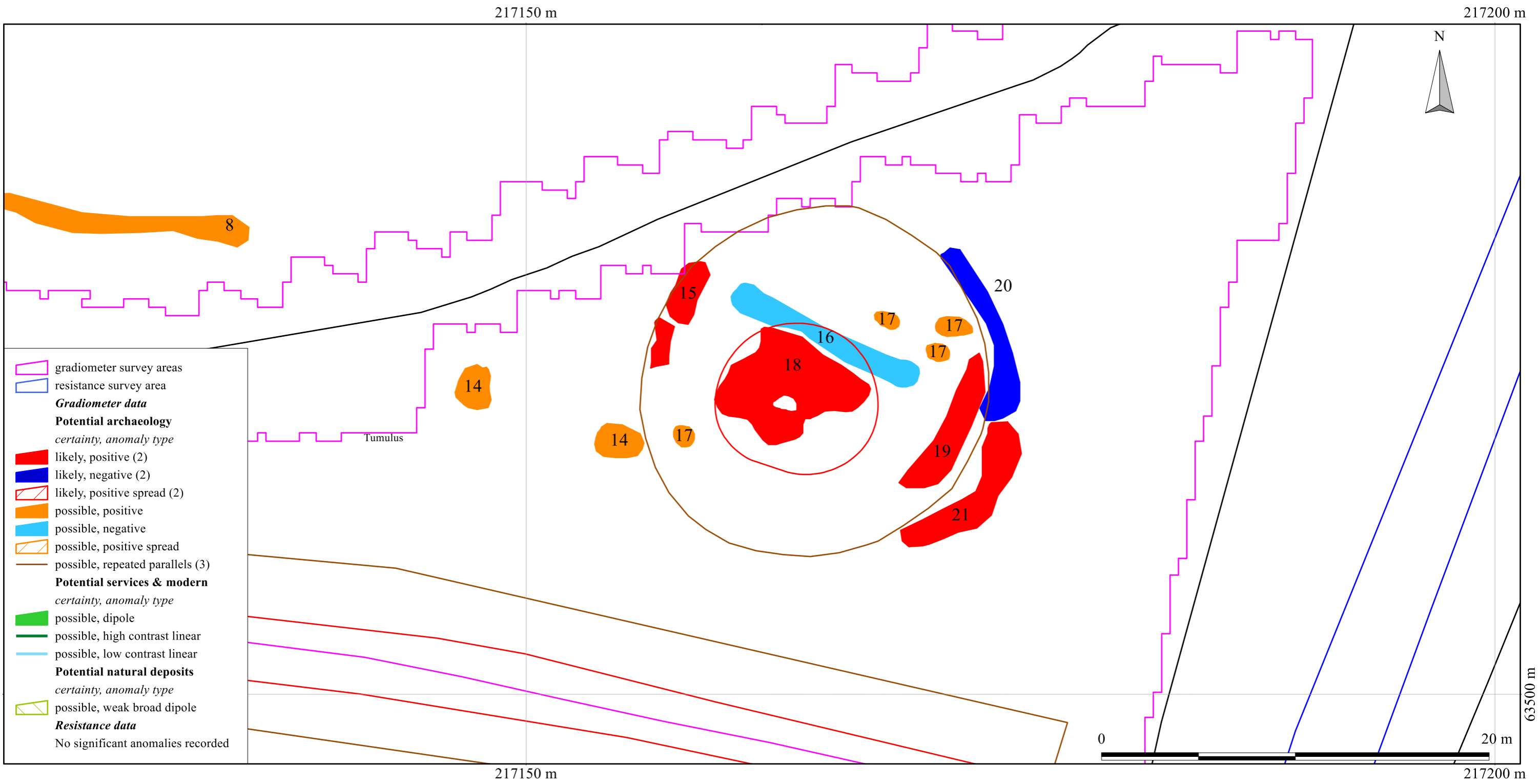
Notes:

1. All interpretations are provisional and represent potential archaeological deposits.
2. Anomalies designated "likely archaeology" have supporting evidence e.g. historical maps and or visible earthworks.
3. Representative; not all instances are mapped.
4. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

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Figure 5: survey interpretation, area 1;  
 Ordnance Survey mapped heritage assets shown

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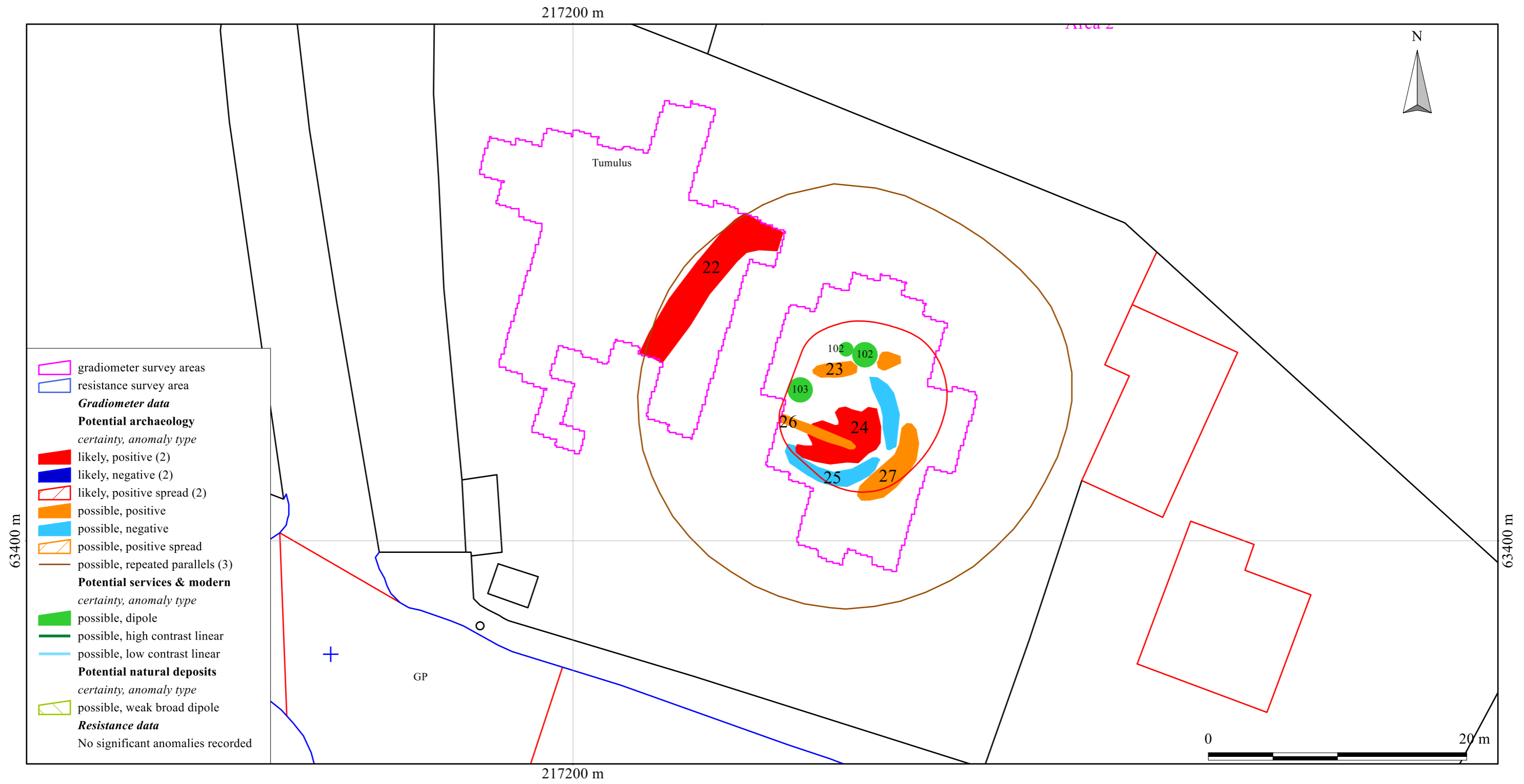
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  3. Representative; not all instances are mapped.
  4. Anomalies likely to represent geological or other natural deposits are not mapped unless relevant to potential archaeological events or deposits.

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Figure 5a: survey interpretation, area 1, barrow HER PRN 6620.09;  
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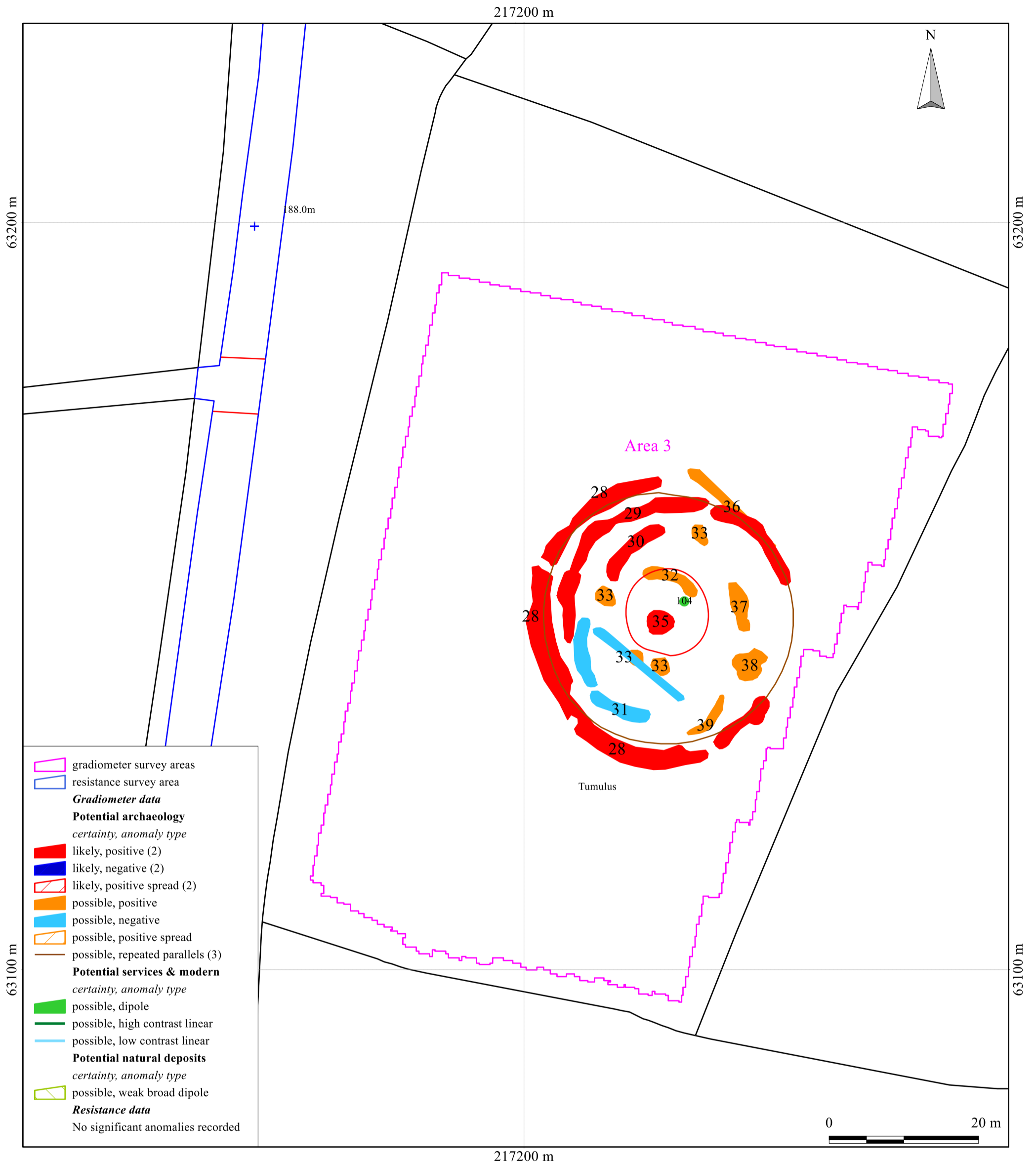
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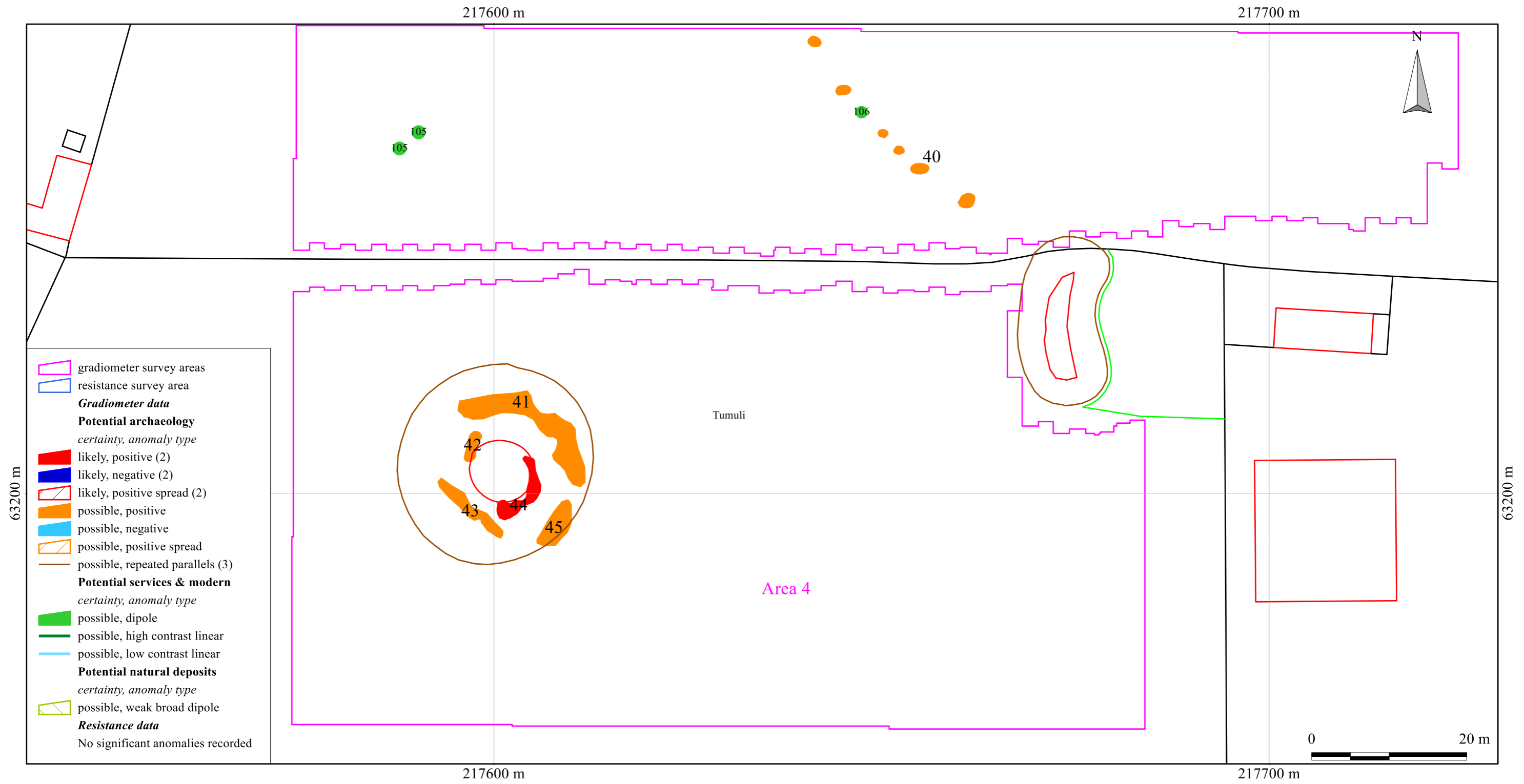
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Figure 6: survey interpretation, area 2;  
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British Grid  
 centre X: 217634.62 m, centre Y: 63212.80 m

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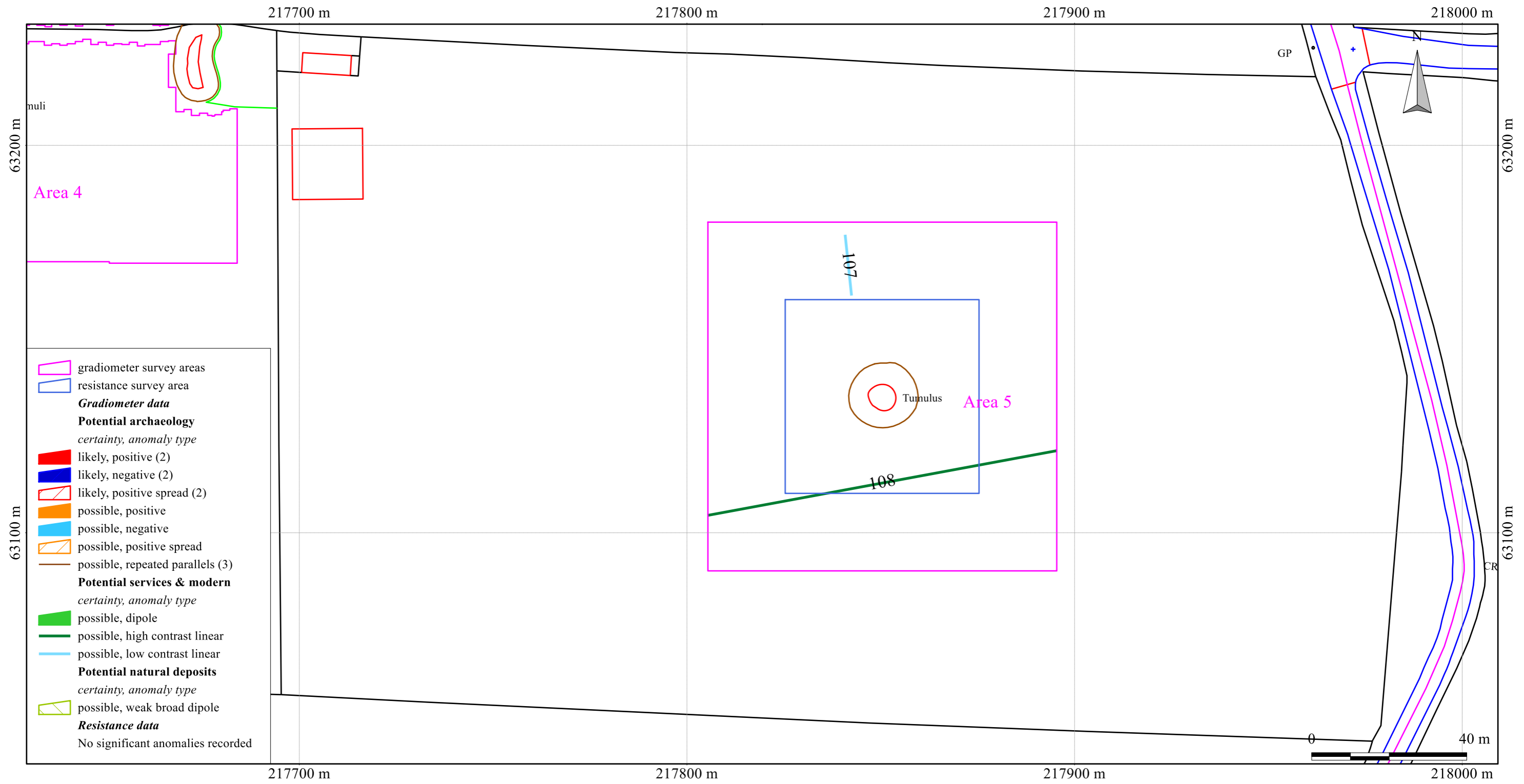
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Figure 8: survey interpretation, area 4;  
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British Grid  
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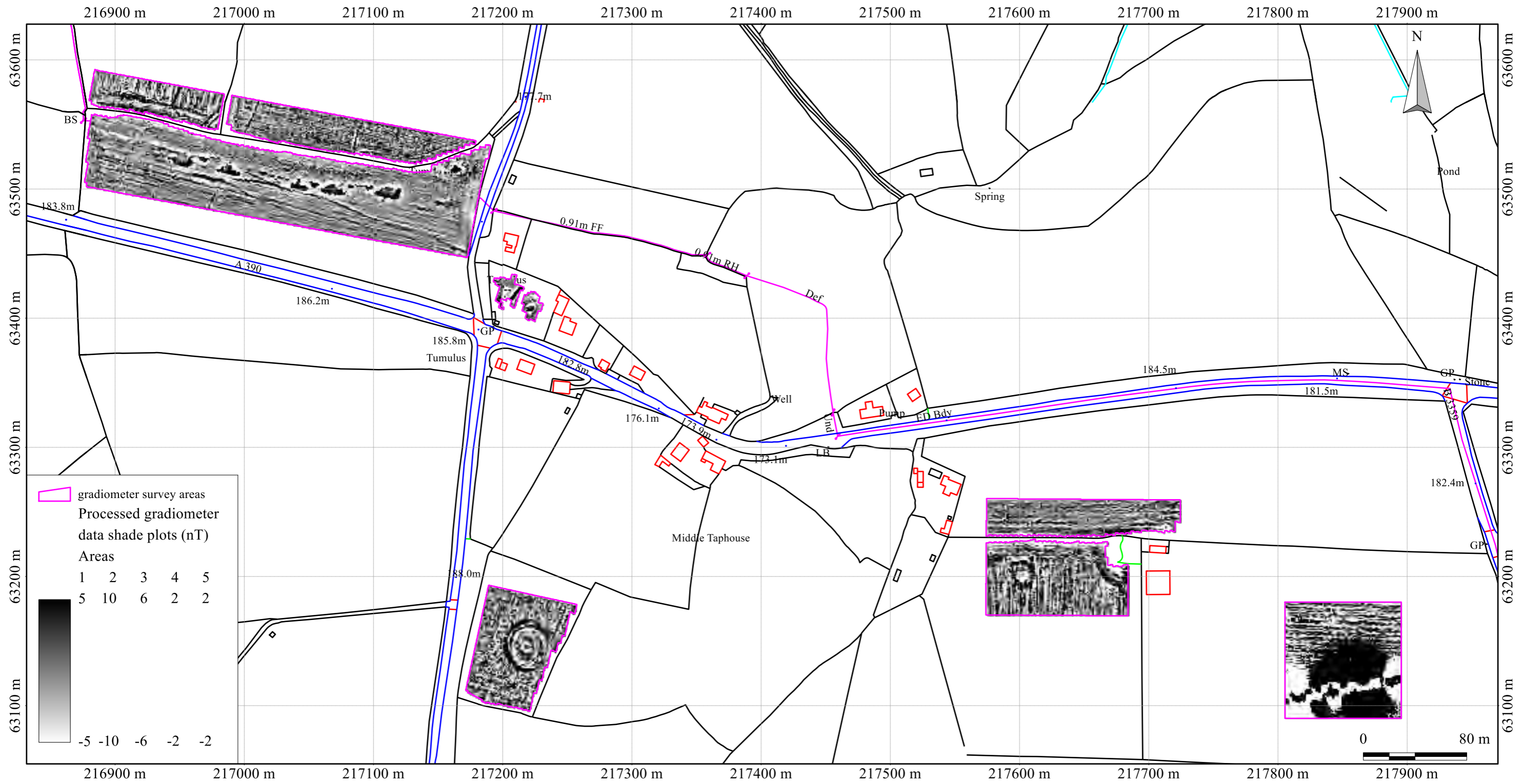
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Figure 9: survey interpretation, area 5;  
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British Grid  
 centre X: 217400.87 m, centre Y: 63341.28 m

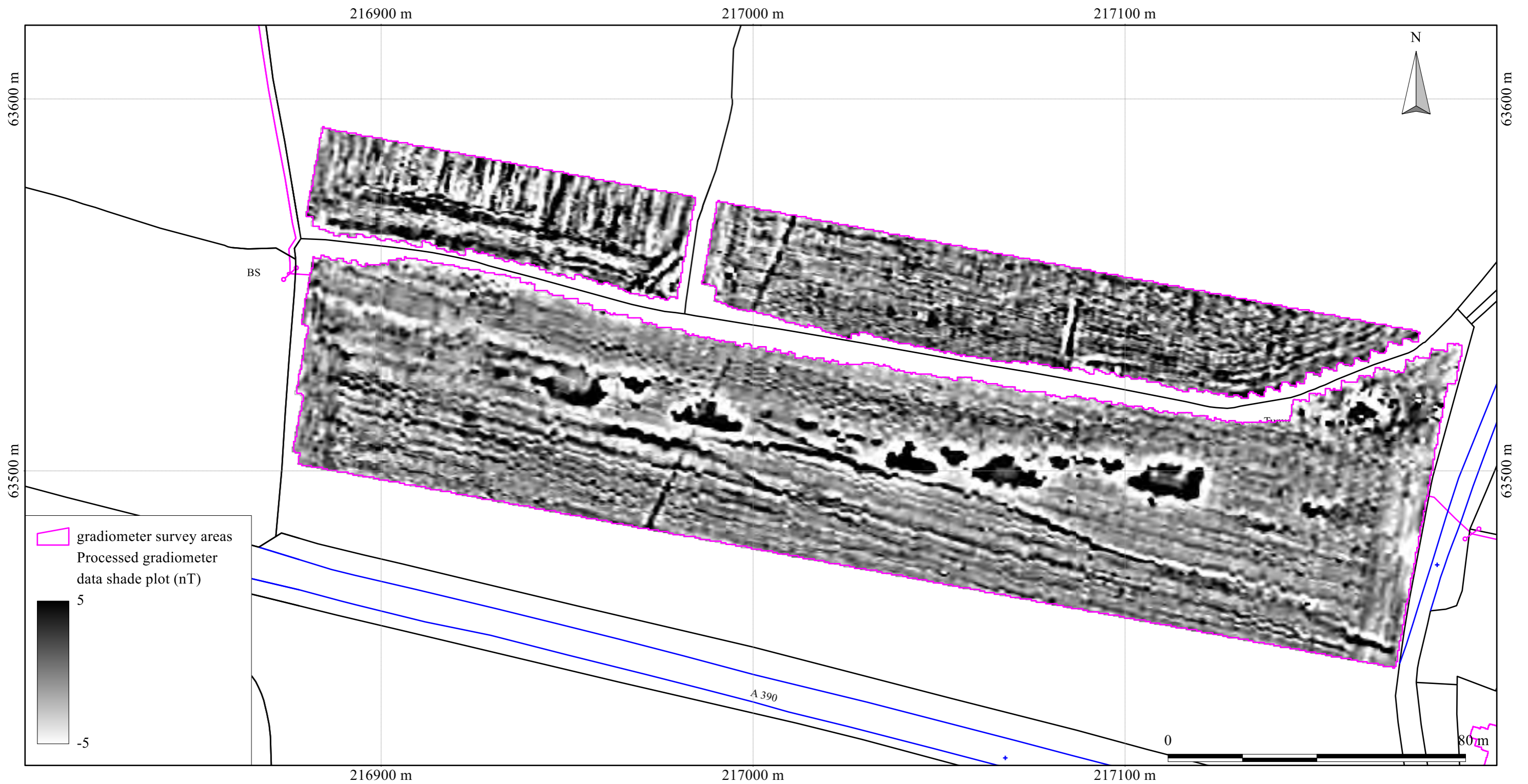
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Figure 10: shade plot of processed gradiometer data, all areas

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British Grid  
 centre X: 217002.10 m, centre Y: 63520.32 m

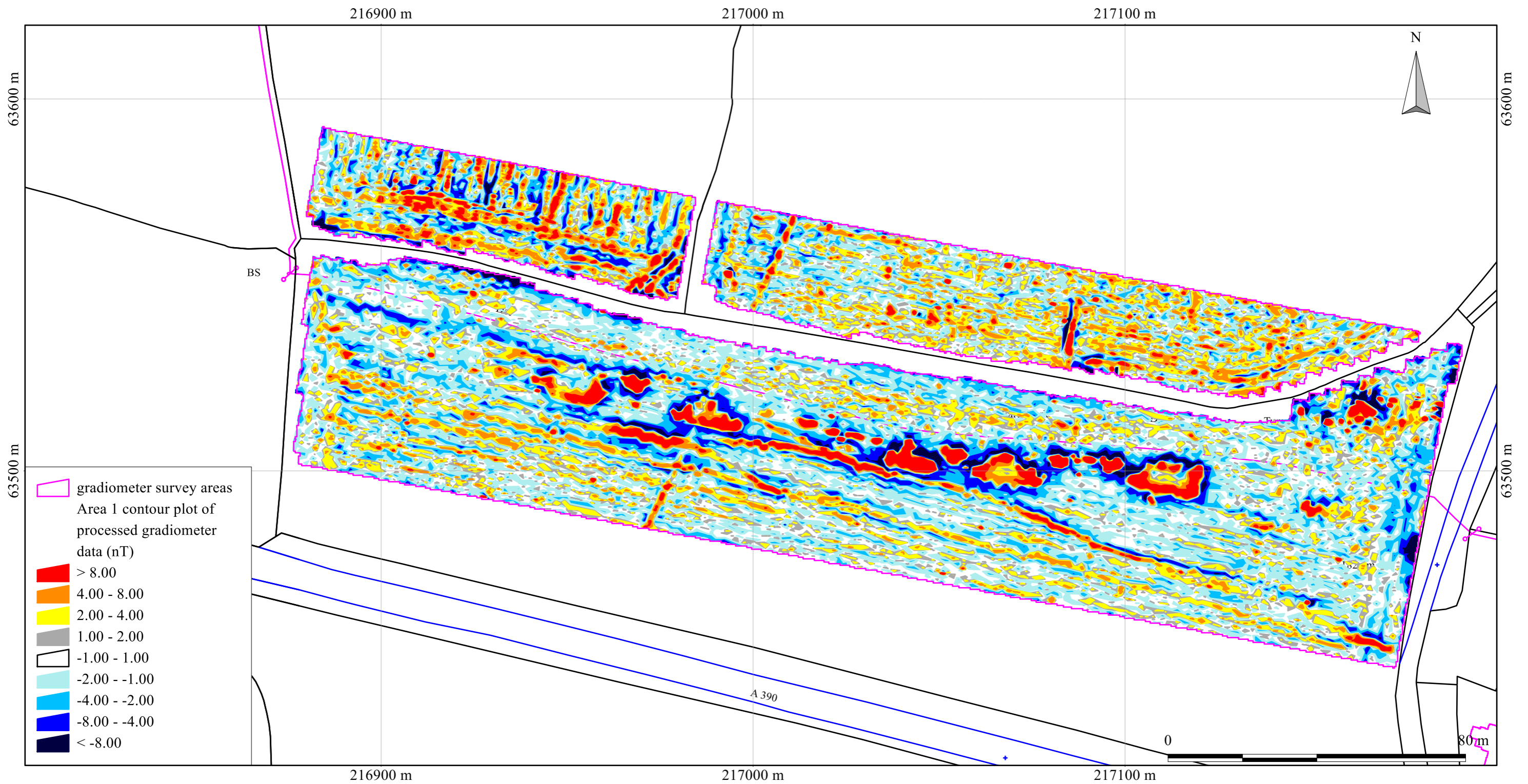
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Figure 11: shade plot of processed gradiometer data, area 1

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British Grid  
centre X: 217002.10 m, centre Y: 63520.32 m

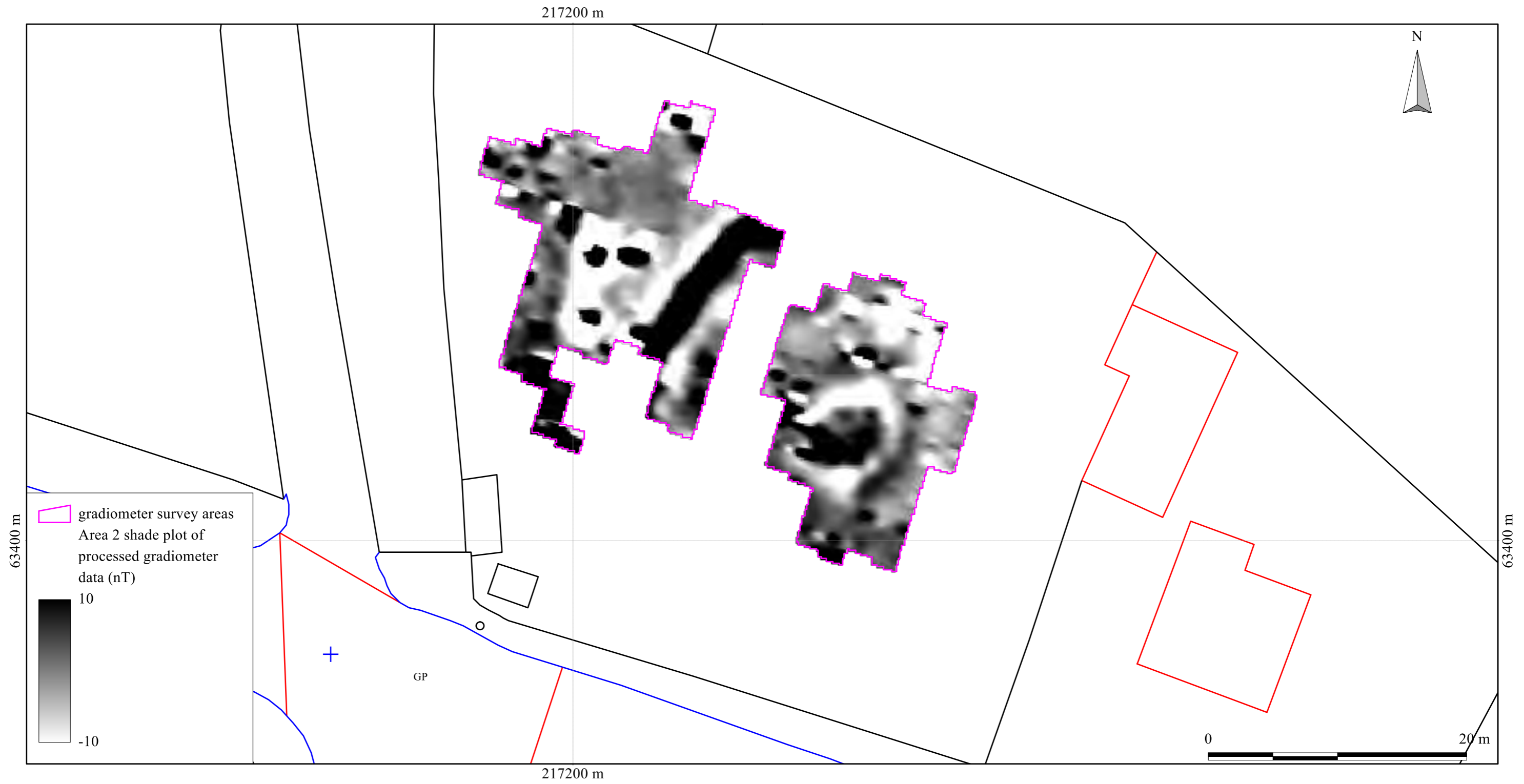
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An archaeological magnetometer and earth resistance sur  
Land at Middle Taphouse, Liskeard, Cornwall  
Centred on NGR (E/N): 3217495,63286 (point)  
Report: 1503TAP-R-1

Figure 12: contour plot of processed gradiometer data, area 1

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Bideford, Devon EX39 2JT  
Tel: 01273 273599  
Email: geophysics@substrata.co.uk  
Web: substrata.co.uk



British Grid  
 centre X: 217214.65 m, centre Y: 63411.37 m

Scale: 1:300 @ A3. Spatial Units: Meter. Do not scale off this drawing

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An archaeological magnetometer and earth resistance sur  
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 Centred on NGR (E/N): 3217495,63286 (point)  
 Report: 1503TAP-R-1

Figure 13: shade plot of processed gradiometer data, area 2

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 Web: substrata.co.uk

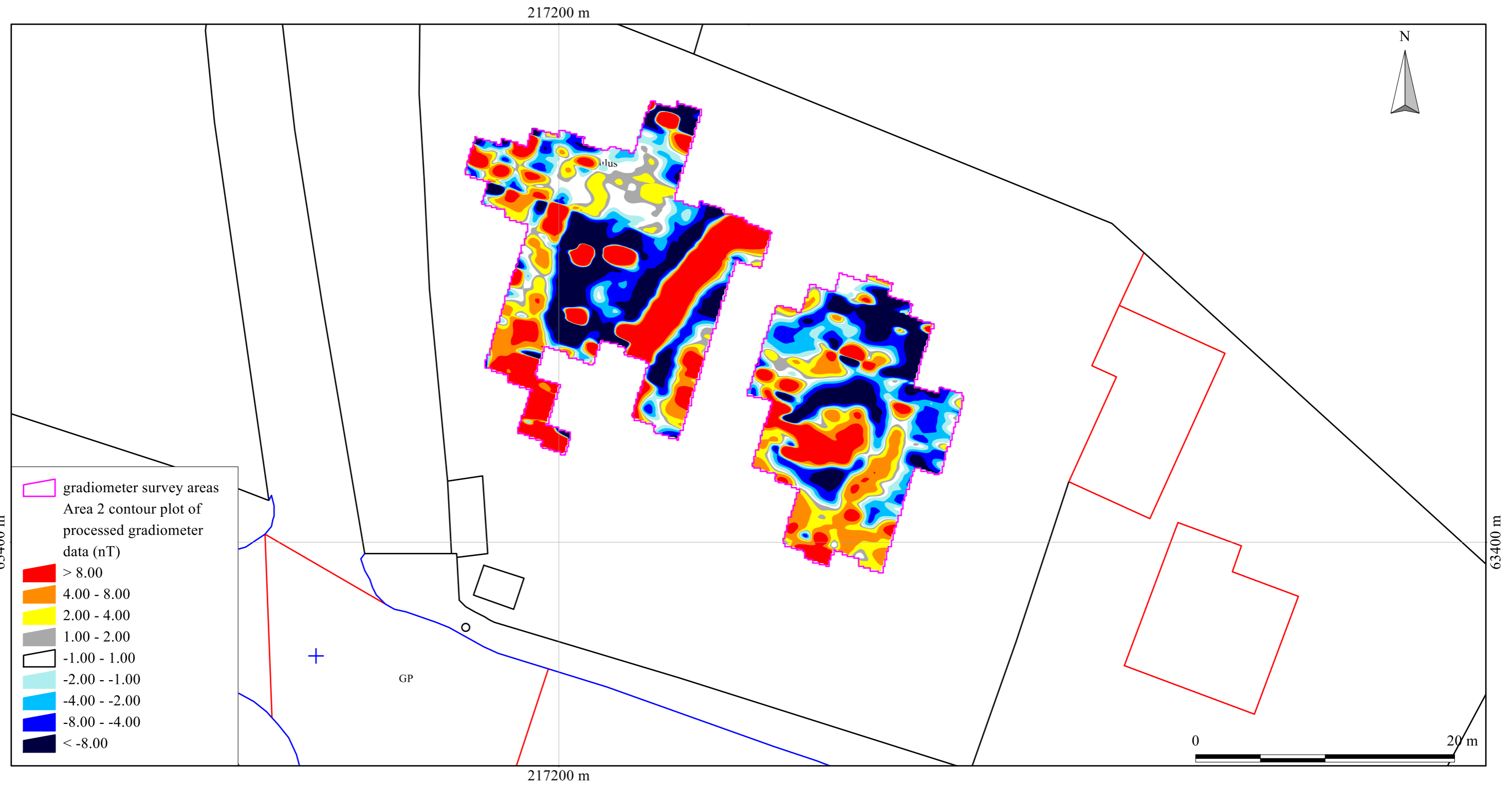
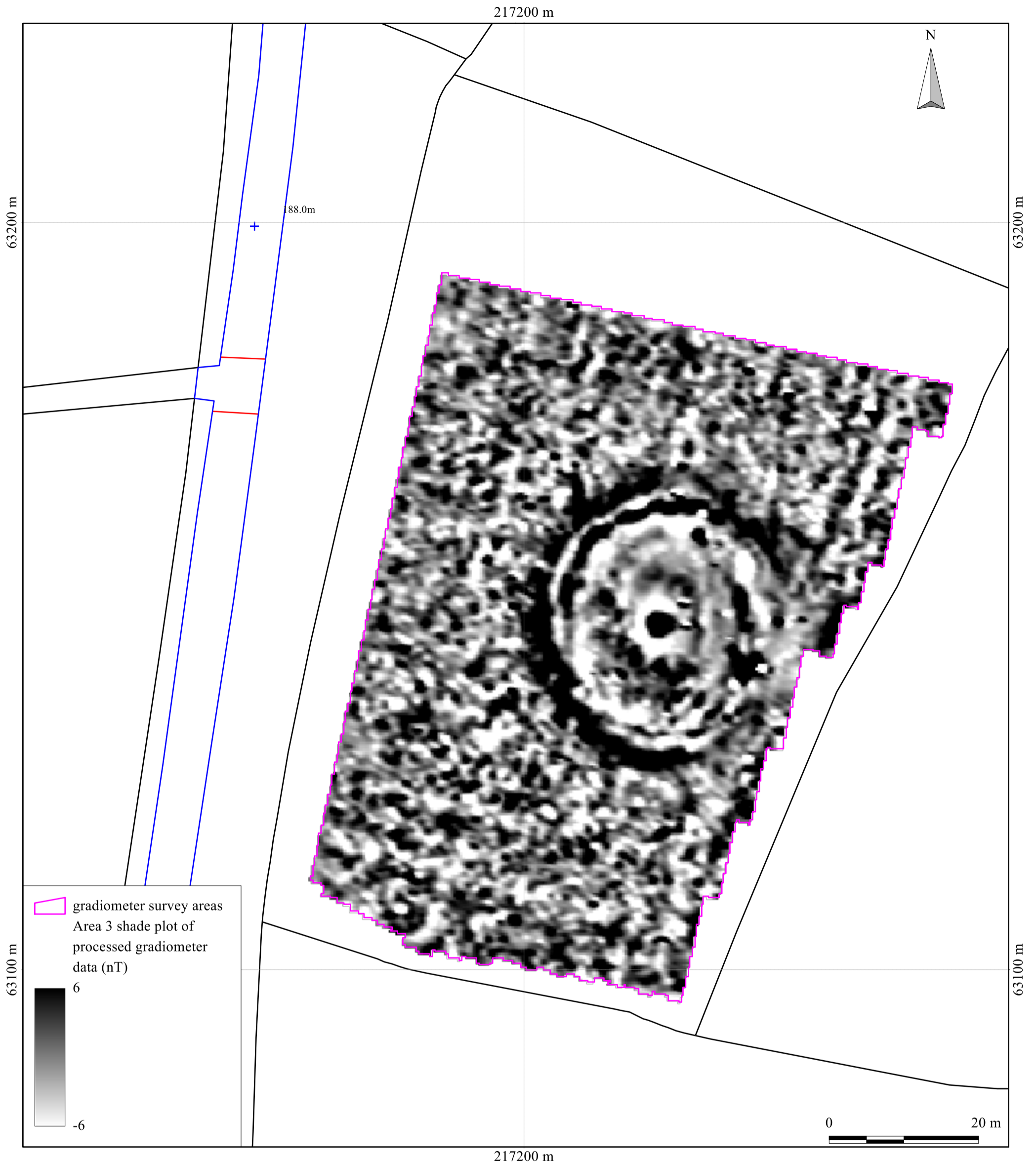


Figure 14: contour plot of processed gradiometer data, area 2



British Grid  
 centre X: 217198.90 m, centre Y: 63151.46 m

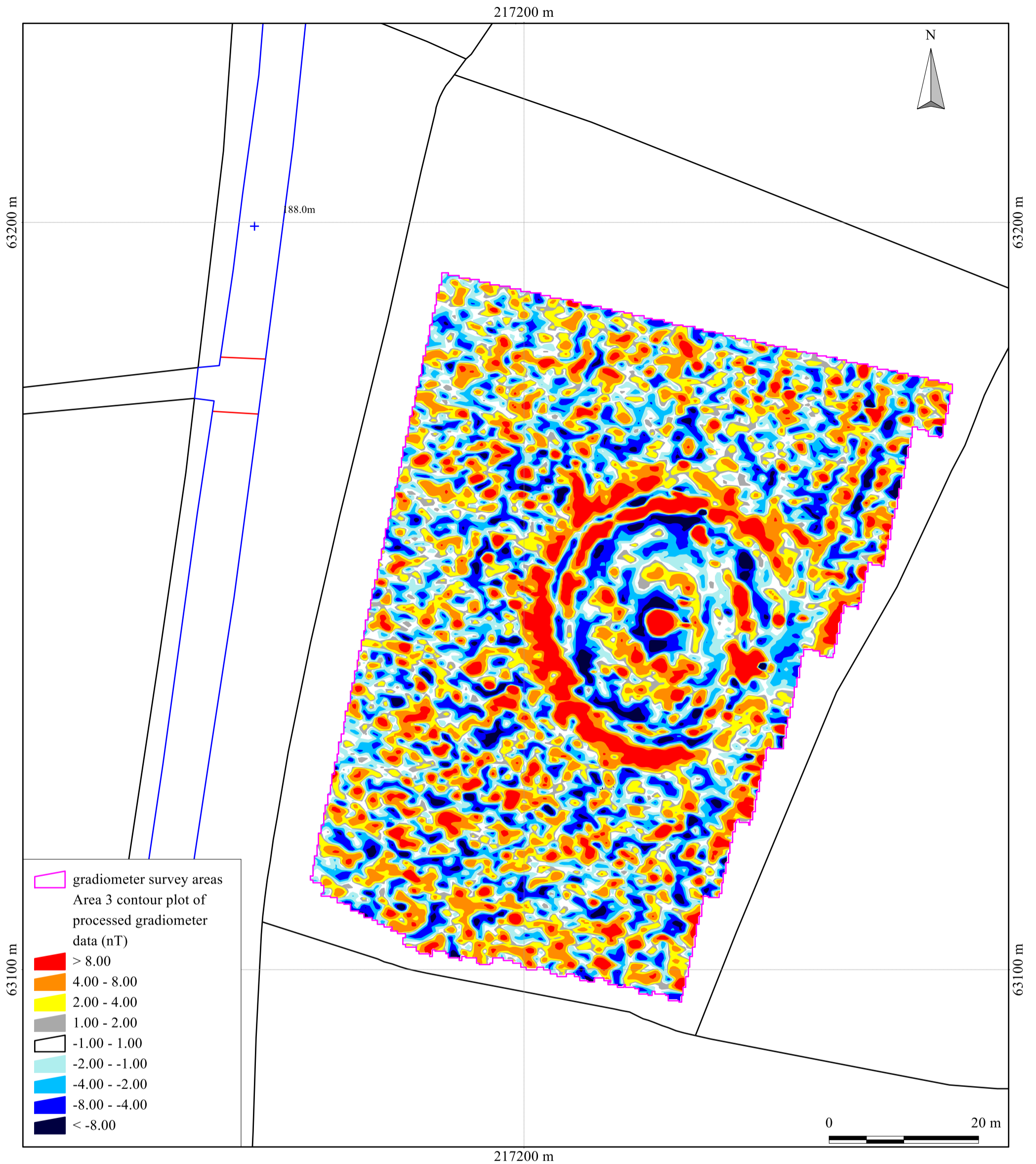
Geophysical survey: Copyright Substrata 2015.  
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Scale: 1:500 @ A3. Spatial Units: Meter. Do not scale off this drawing

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 Centred on NGR (E/N): 3217495,63286 (point)  
 Report: 1503TAP-R-1

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 Email: [geophysics@substrata.co.uk](mailto:geophysics@substrata.co.uk)  
 Web: [substrata.co.uk](http://substrata.co.uk)

Figure 15: shade plot of processed gradiometer data, area 3

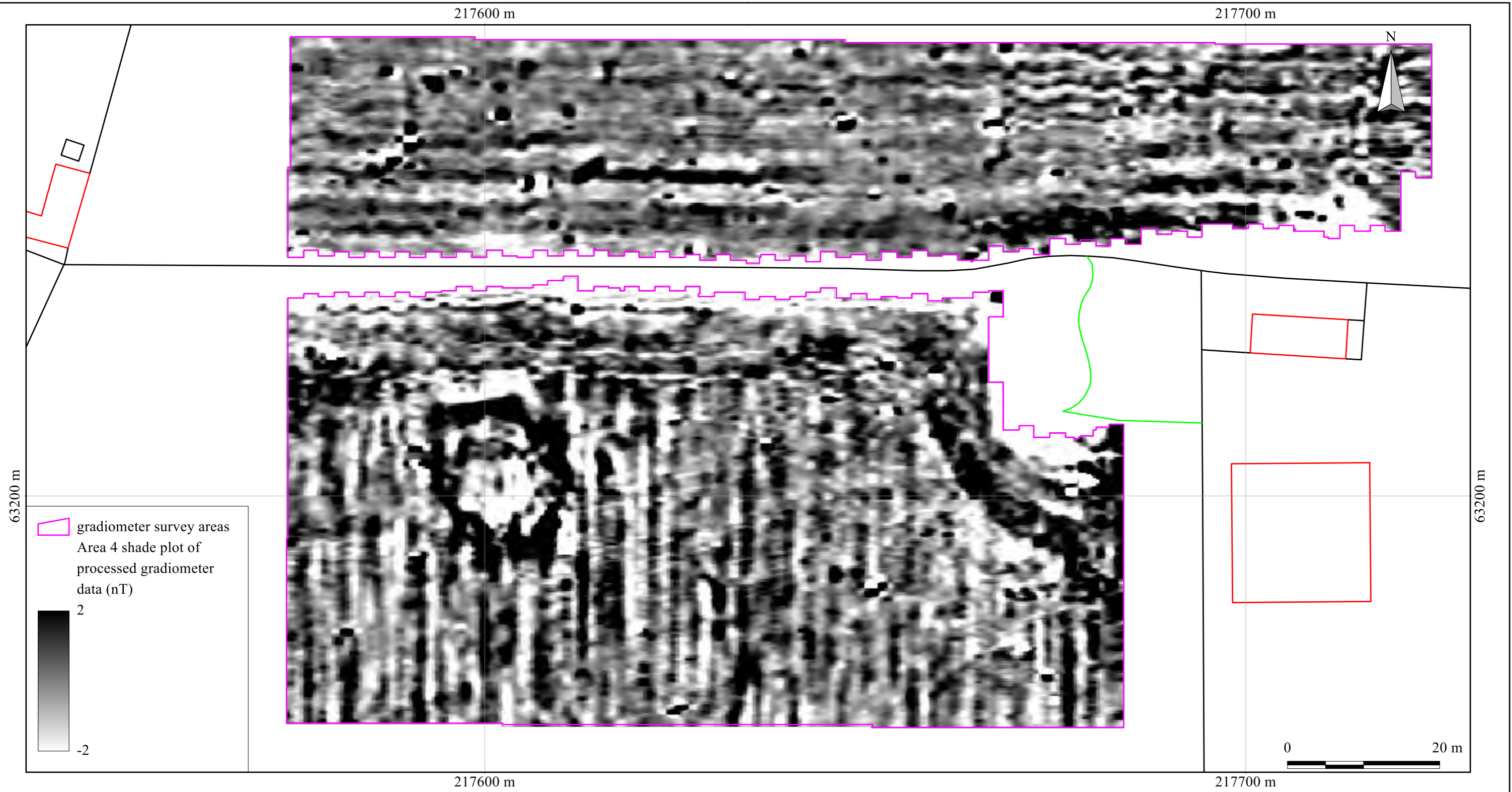


An archaeological magnetometer and earth resistance survey  
Land at Middle Taphouse, Liskeard, Cornwall  
Centred on NGR (E/N): 3217495,63286 (point)  
Report: 1503TAP-R-1

Figure 16: contour plot of processed gradiometer data, area 3

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Email: [geophysics@substrata.co.uk](mailto:geophysics@substrata.co.uk)  
Web: [substrata.co.uk](http://substrata.co.uk)





British Grid  
 centre X: 217634.62 m, centre Y: 63212.80 m

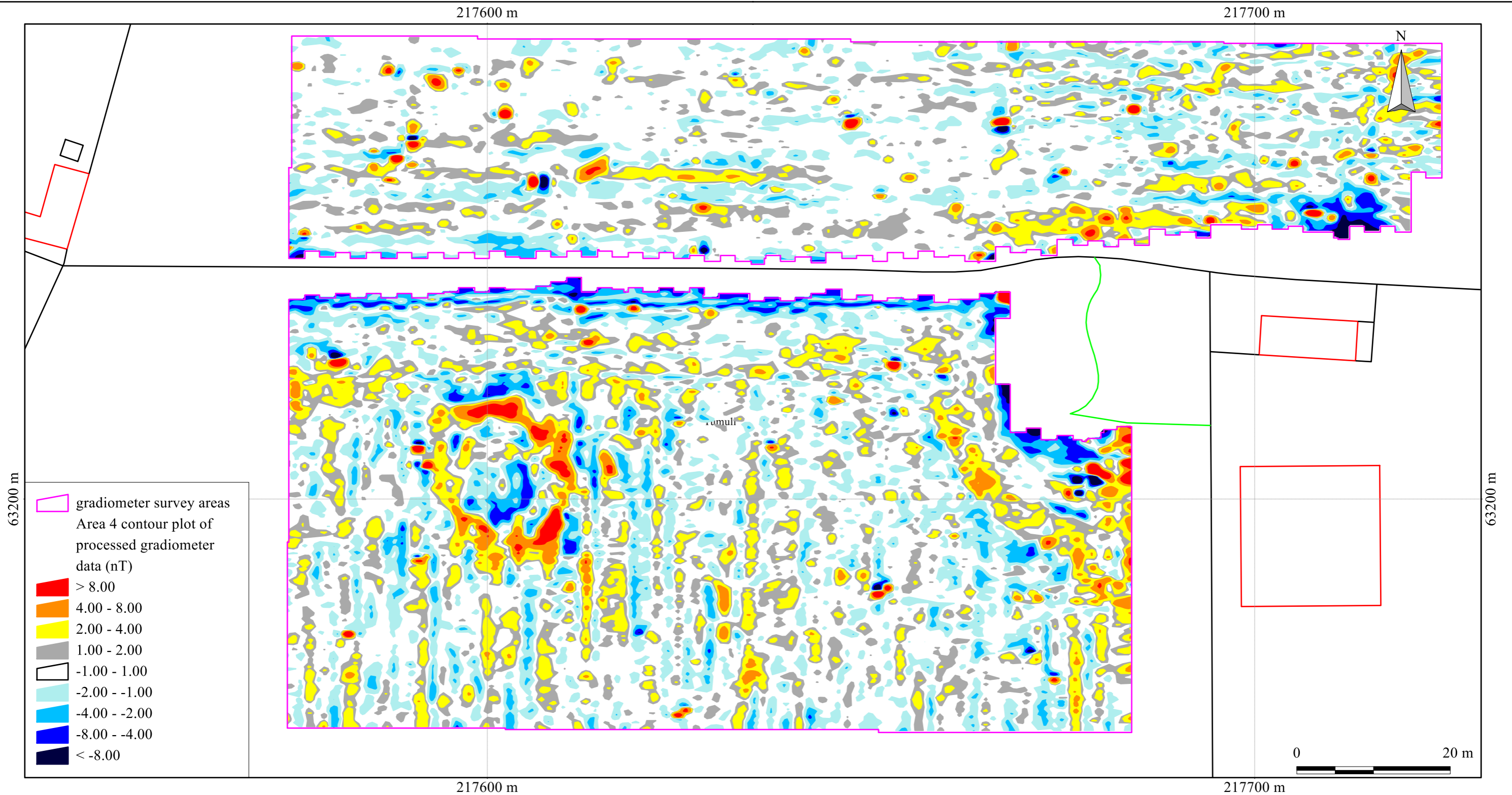
Scale: 1:500 @ A3. Spatial Units: Meter. Do not scale off this drawing

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 Report: 1503TAP-R-1

Figure 17: shade plot of processed gradiometer data, area 4

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



British Grid  
centre X: 217634.62 m, centre Y: 63212.80 m

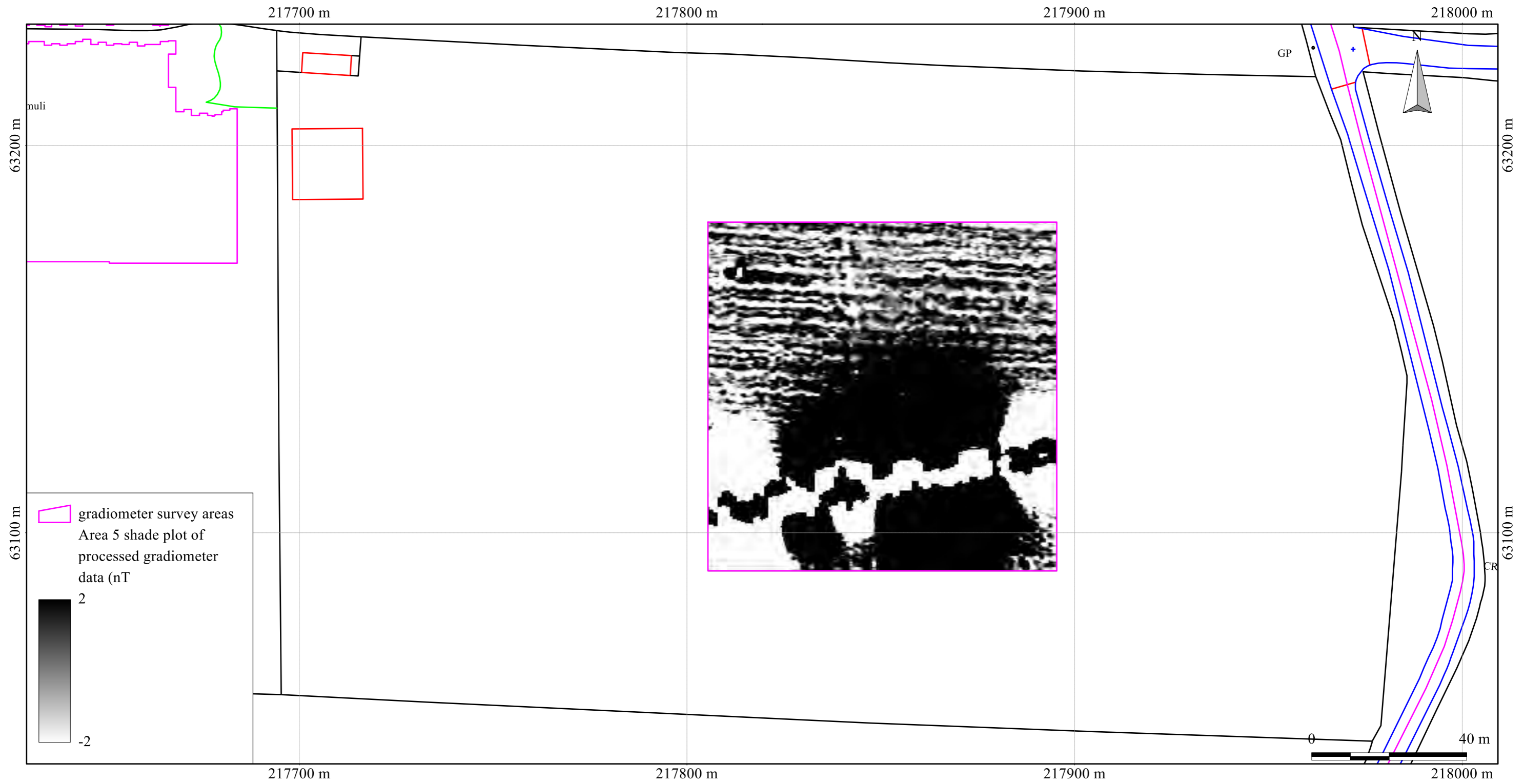
Scale: 1:500 @ A3. Spatial Units: Meter. Do not scale off this drawing

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Centred on NGR (E/N): 3217495,63286 (point)  
Report: 1503TAP-R-1

Figure 18: contour plot of processed gradiometer data, area 4

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



British Grid  
 centre X: 217819.43 m, centre Y: 63135.81 m

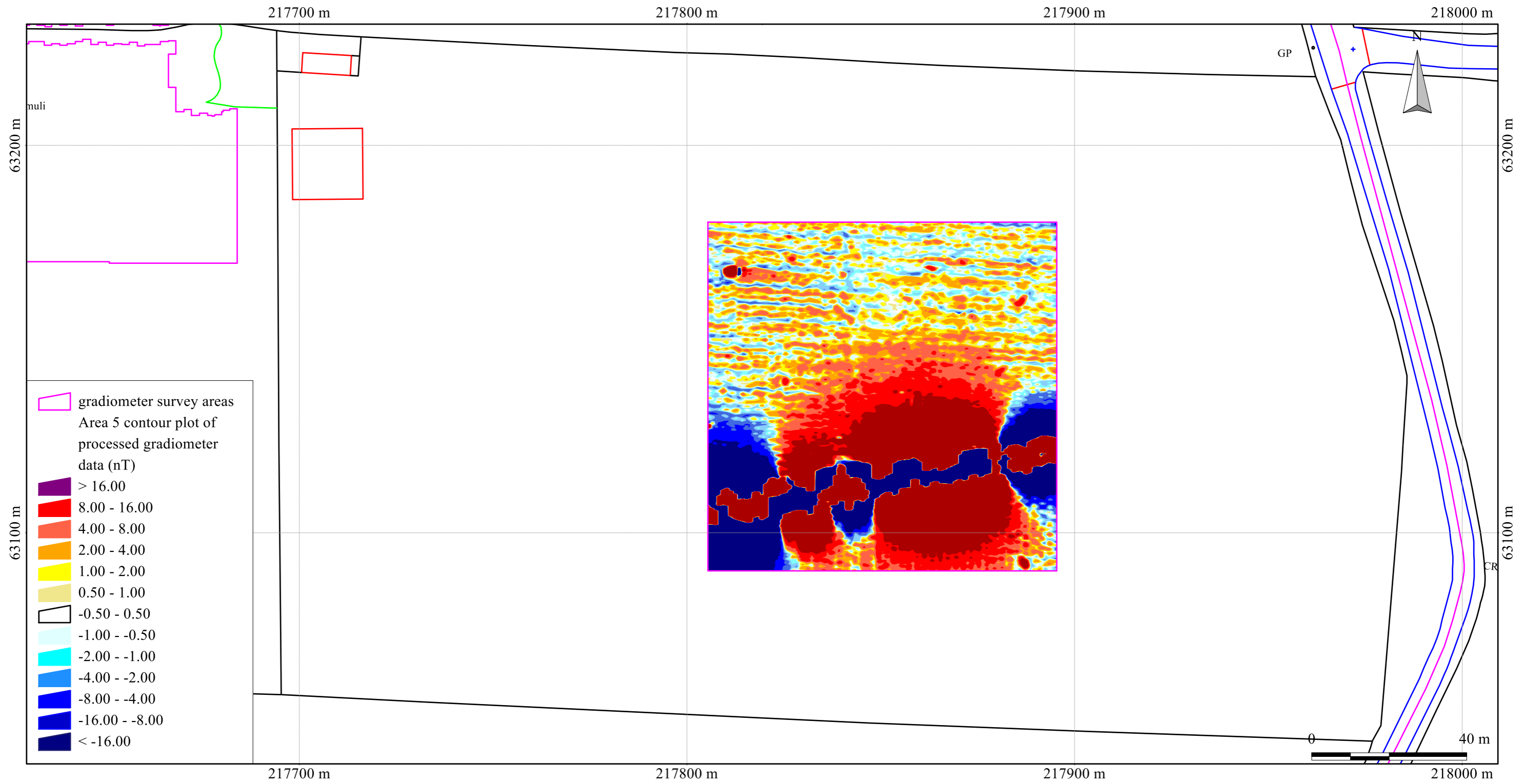
Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

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 Centred on NGR (E/N): 3217495,63286 (point)  
 Report: 1503TAP-R-1

Figure 19: shade plot of processed gradiometer data, area 5

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



British Grid  
 centre X: 217819.43 m, centre Y: 63135.81 m

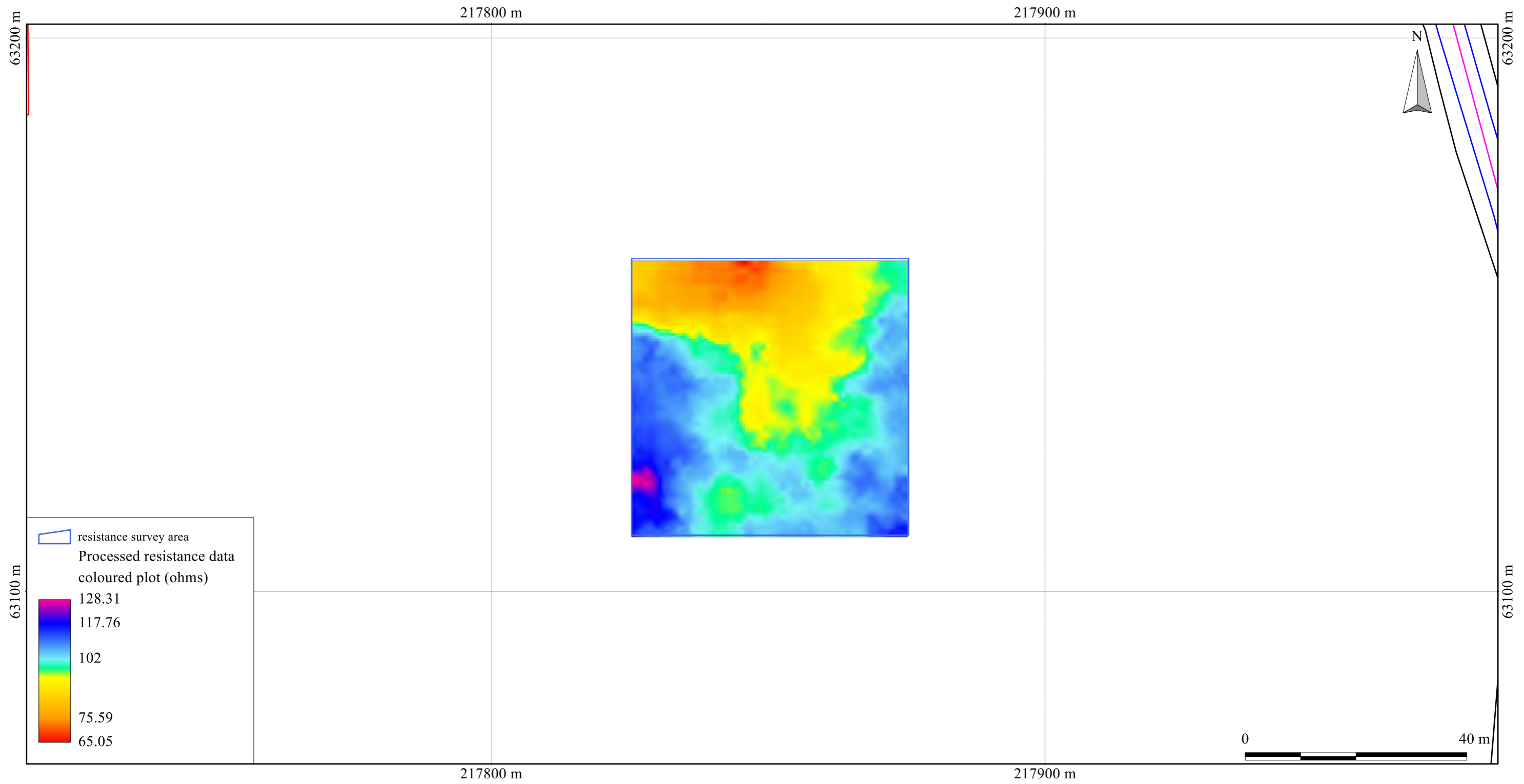
Scale: 1:1000 @ A3. Spatial Units: Meter. Do not scale off this drawing

Geophysical survey: Copyright Substrata 2015.  
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 Report: 1503TAP-R-1

Figure 20: contour plot of processed gradiometer data, area 5

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 Bideford, Devon EX39 2JT  
 Tel: 01273 273599  
 Email: geophysics@substrata.co.uk  
 Web: substrata.co.uk



British Grid  
 centre X: 217848.93 m, centre Y: 63135.68 m

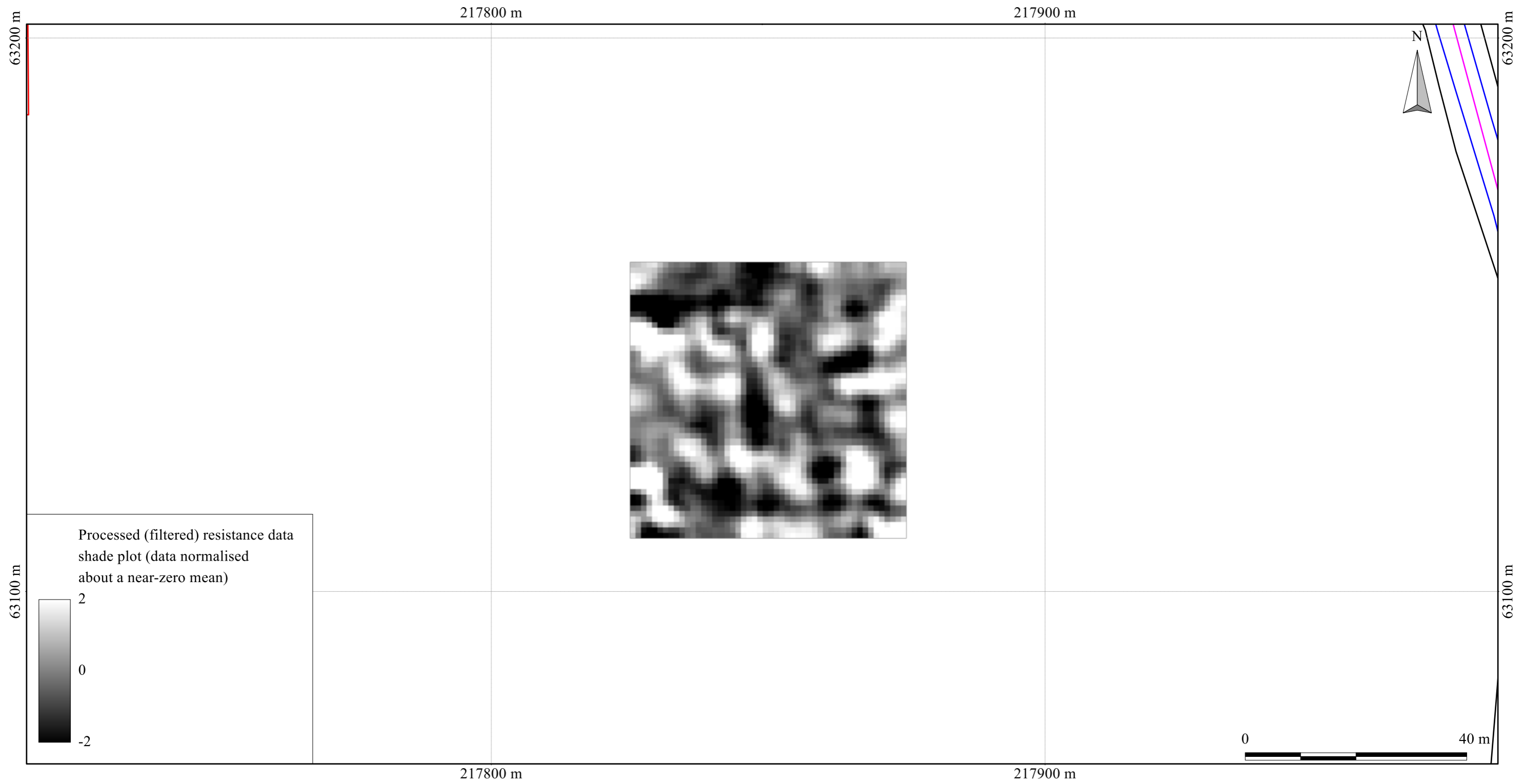
Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

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 Report: 1503TAP-R-1

Figure 21: coloured plot of processed resistance data, area 5

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 Web: substrata.co.uk



British Grid  
 centre X: 217848.93 m, centre Y: 63135.68 m

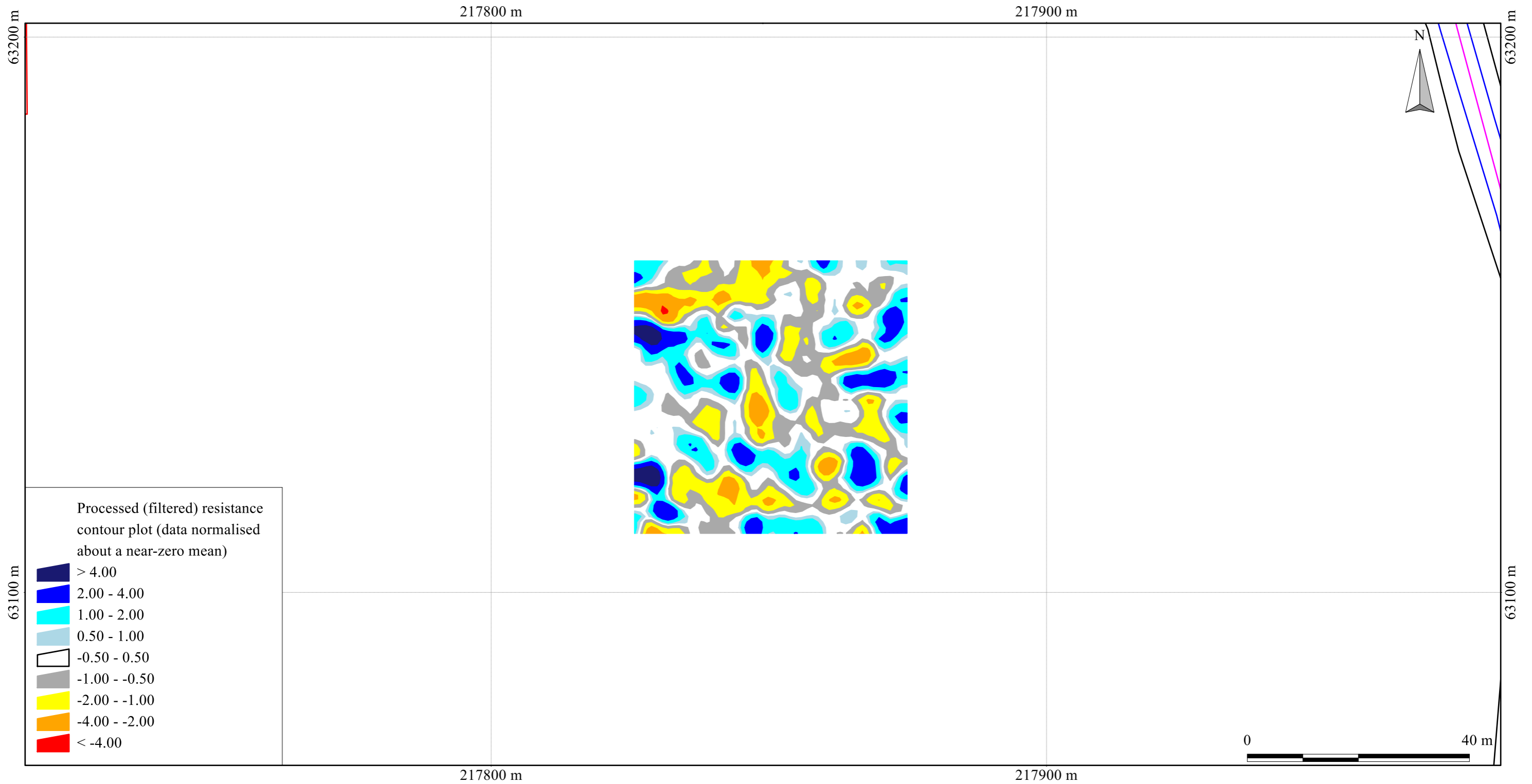
Scale: 1:700 @ A3. Spatial Units: Meter. Do not scale off this drawing

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 Report: 1503TAP-R-1

Figure 22: shade plot of processed resistance data, area 5

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



British Grid  
centre X: 217848.93 m, centre Y: 63135.68 m

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

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Base map: Ordnance Survey (c) Crown Copyright 2015,  
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## Appendix 2 Methodology Summary

Table 3: methodology summary	
<p><b>Documents</b> Survey method statement: Dean (2015a and b)</p>	
<p><b>Methodology</b></p> <ol style="list-style-type: none"> <li>1. The work was undertaken in accordance with the survey methodology statement.</li> <li>2. The geophysical survey was undertaken with reference to standard guidance provided by the Chartered Institute for Archaeologists (2014a), Historic England (2010) and Archaeology Data Service/Digital Antiquity Guides (undated).</li> <li>3. The survey grid location information and grid plan was recorded as part of the project in a suitable GIS system.</li> <li>4. Data processing was undertaken using appropriate software, with all anomalies assessed as relevant being digitised and geo-referenced.</li> <li>5. 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.</li> </ol>	
<p><b>Grid</b> <i>Method of Fixing:</i> DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates. <i>Composition:</i> 30m by 30m grids <i>Recording:</i> Geo-referenced and recorded using digital map tiles. <i>DGPS used:</i> Spectra Precision PM5V2 GPS with external antenna and survey pole and DigiTerra Explorer 7 as the survey control program.</p>	
<p><b>Magnetometer Equipment</b> <i>Instrument:</i> Bartington Instruments grad601-2 <i>Firmware:</i> version 6.1</p>	<p><b>Magnetometer Data Capture</b> <i>Sample Interval:</i> 0.25-metres <i>Traverse Interval:</i> 1 metre <i>Data capture:</i> automatic data logger <i>Traverse Method:</i> zigzag <i>Traverse Orientation:</i> GN</p>
<p><b>Earth-resistance Equipment</b> <i>Instrument:</i> Geoscan Research RM15 multi-probe resistance meter <i>Configuration:</i> twin probe <i>Mobile probe spacing:</i> 0.5-metres</p>	<p><b>Earth-resistance Data Capture</b> <i>Sample Interval:</i> 1 metre <i>Traverse Interval:</i> 1 metre <i>Data capture:</i> automatic data logger <i>Traverse Method:</i> zigzag <i>Traverse Orientation:</i> GN</p>
<p><b>Data Processing, Analysis and Presentation Software</b> 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</p>	

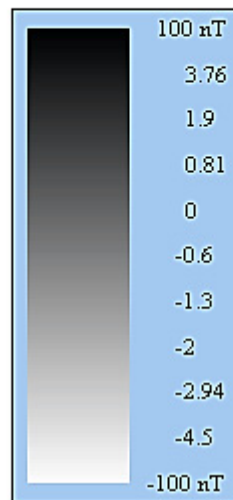
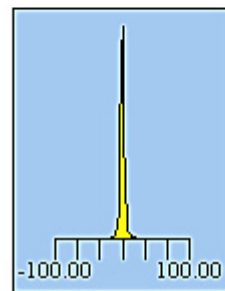
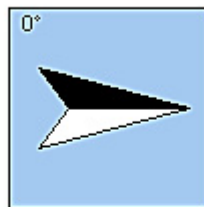
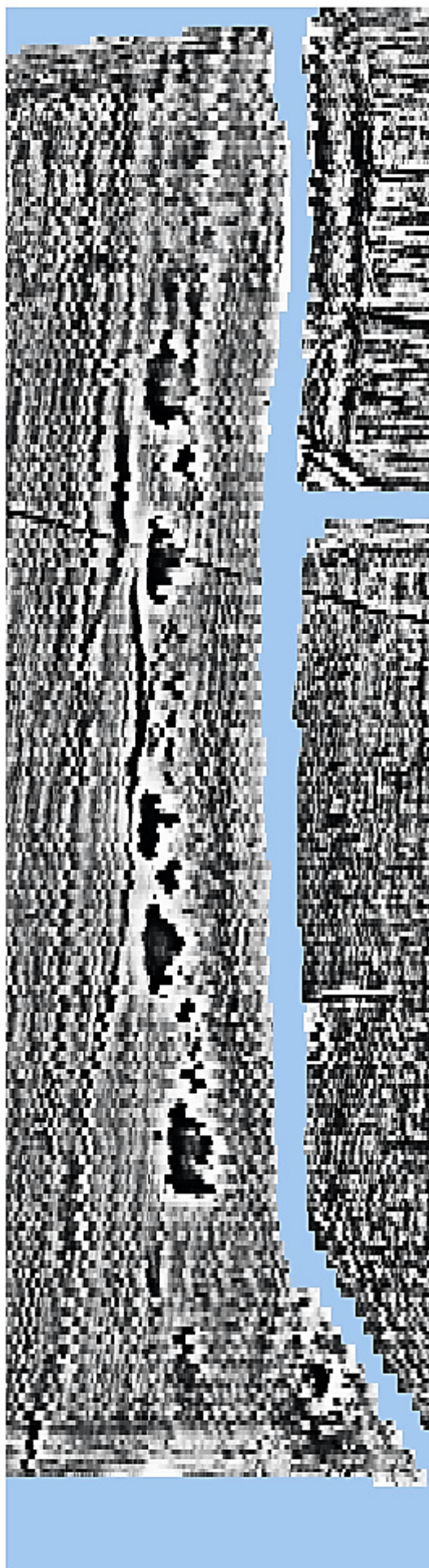


## Appendix 3 Data processing

Table 3: gradiometer survey - processed data metadata	
<p><b>SITE</b>  Instrument Type: Bartington Grad 610  Units: nT  Direction of 1st Traverse: see below  Collection Method: ZigZag  Sensors: 2 @ 1.00 m spacing.  Dummy Value: 32702</p> <p><b>PROGRAM</b>  Name: TerraSurveyor  Version: 3.0.28.1</p>	
<p><u>Area 1</u>  Stats  Max: 49.26  Min: -52.68  Std Dev: 4.26  Mean: -0.41  Median: -0.60  Surveyed Area: 2.5277 ha</p>	<p>Processes: 11  1 Base Layer  2 Clip from -100.00 to 100.00 nT  3 Clip at 5.00 SD  4 De Stagger: Grids: All Mode: Both By: -1 intervals  5 De Stagger: Grids: tc1.xgd tc4.xgd tc2.xgd tc3.xgd Mode: Both By: -2 intervals  6 De Stagger: Grids: tc10.xgd Mode: Both By: -2 intervals  7 De Stagger: Grids: tc13.xgd Mode: Both By: -1 intervals  8 De Stagger: Grids: tc16.xgd tc17.xgd tc20.xgd tc21.xgd tc18.xgd tc19.xgd tc22.xgd Mode: Both By: -1 intervals  9 De Stagger: Grids: td1.xgd td2.xgd td3.xgd Mode: Both By: -1 intervals  10 De Stagger: Grids: td9.xgd td10.xgd td11.xgd Mode: Both By: -1 intervals  11 Interpolate: Match X &amp; Y Doubled.</p>
<p><u>Area 2</u>  Stats  Max: 89.38  Min: -116.24  Std Dev: 14.11  Mean: 0.74  Median: -0.08  Surveyed Area: 0.0578 ha</p>	<p>Processes: 5  1 Base Layer  2 Clip at 4.00 SD  3 De Stagger: Grids: All Mode: Both By: -2 intervals  4 DeStripe Median Sensors: All  5 Interpolate: X &amp; Y Doubled.</p>
<p><u>Area 3</u>  Stats  Max: 37.34  Min: -27.58  Std Dev: 5.36  Mean: 0.40  Median: 0.07  Surveyed Area: 0.5242 ha</p>	<p>Processes: 5  1 Base Layer  2 Clip at 5.00 SD  3 De Stagger: Grids: All Mode: Both By: -2 intervals  4 DeStripe Median Sensors: All  5 Interpolate: Match X &amp; Y Doubled.</p>
<p><u>Area 4</u>  Stats  Max: 51.64  Min: -23.38  Std Dev: 2.16  Mean: 0.06  Median: 0.01  Surveyed Area: 0.99875 ha</p>	<p>Processes: 6  1 Base Layer  2 Clip at 1.00 SD  3 De Stagger: Grids: All Mode: Both By: -2 intervals  4 De Stagger: Grids: ta9.xgd ta10.xgd ta11.xgd ta12.xgd ta13.xgd Mode: Both By: -1 intervals  5 DeStripe Median Sensors: All  6 Interpolate: Match X &amp; Y Doubled.</p>
<p><u>Area 5</u>  Stats  Max: 26.61  Min: -19.67  Std Dev: 13.72  Mean: 3.41  Median: 1.35  Surveyed Area: 0.81 ha</p>	<p>Processes: 11  1 Base Layer  2 Clip at 1.00 SD  3 De Stagger: Grids: All Mode: Both By: -1 intervals  4 DeStripe Median Sensors: tb2.xgd tb5.xgd tb3.xgd tb4.xgd  5 DeStripe Median Sensors: tb9.xgd  6 Edge Match (Area: Top 30, Left 120, Bottom 59, Right 239) to Right edge  7 DeStripe Median Sensors: tb8.xgd  8 Edge Match (Area: Top 60, Left 120, Bottom 89, Right 239) to Right edge  9 De Stagger: Grids: tb9.xgd Mode: Both By: -1 intervals  10 De Stagger: Grids: tb2.xgd Mode: Both By: -1 intervals  11 Clip at 1.00 SD</p> <p>Note: the process of exporting the data as an ESRI grid file from TerraSurveyor3 imposes a 'Match X &amp; Y Doubled' interpolation on the data if not already applied</p>

Table 4: earth-resistance survey - processed data metadata	
<p><b>SITE</b>  Instrument Type: Geoscan Research (Resistance)  Units: Ohm  Direction of 1st Traverse: north  Collection Method: ZigZag  Probes: 2 @ 1.00 m spacing.  Dummy Value: 32702</p> <p><b>PROGRAM</b>  Name: TerraSurveyor  Version: 3.0.28.1</p>	
<p><u>Area 5 (Figure 21)</u>  Stats  Max: 128.31  Min: 65.05  Std Dev: 10.53  Mean: 98.41  Median: 99.86  Surveyed Area: 0.25 ha</p>	<p>Processes: 5  1 Base Layer  2 Despiking Threshold: 1 Window size: 3x3  3 Despiking Threshold: 1 Window size: 3x3  4 Despiking Threshold: 1 Window size: 3x3  5 Interpolate: X &amp; Y Doubled.</p>
<p><u>Area 2 (Figures 22 and 23)</u>  Stats  Max: 6.66  Min: -4.53  Std Dev: 1.46  Mean: 0.05  Median: -0.08  Surveyed Area: 0.25 ha</p>	<p>Processes: 6  1 Base Layer  2 Despiking Threshold: 1 Window size: 3x3  3 Despiking Threshold: 1 Window size: 3x3  4 Despiking Threshold: 1 Window size: 3x3  5 High pass Uniform (mean) filter: Window: 10 x 10  6 Low pass Uniform (mean) filter: Window: 3 x 3</p>

## Appendix 4 Unprocessed or minimally processed data plots



Description:  
 Instrument Type: Bartington Grad 610  
 Units: nT  
 Direction of 1st Traverse: 0 deg  
 Collection Method: ZigZag  
 Sensors: 2 @ 0.00 m spacing.  
 Dummy Value: 32702

Dimensions  
 Composite Size (readings): 360 x 330  
 Survey Size (meters): 90 m x 330 m  
 Grid Size: 30 m x 30 m  
 X Interval: 0.25 m  
 Y Interval: 1 m

Stats  
 Max: 100.00  
 Min: -100.00  
 Std Dev: 4.89  
 Mean: -0.40  
 Median: -0.60  
 Composite Area: 2.97 ha  
 Surveyed Area: 2.5389 ha

PROGRAM  
 Name: TerraSurveyor  
 Version: 3.0.28.1

Processes: 2  
 1 Base Layer  
 2 Clip from -100.00 to 100.00 nT

Survey conditions  
 Northern area: pasture  
 Southern area: recently ploughed, wet, slope

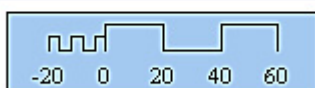
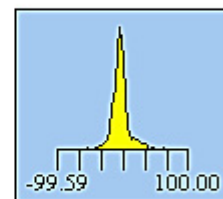
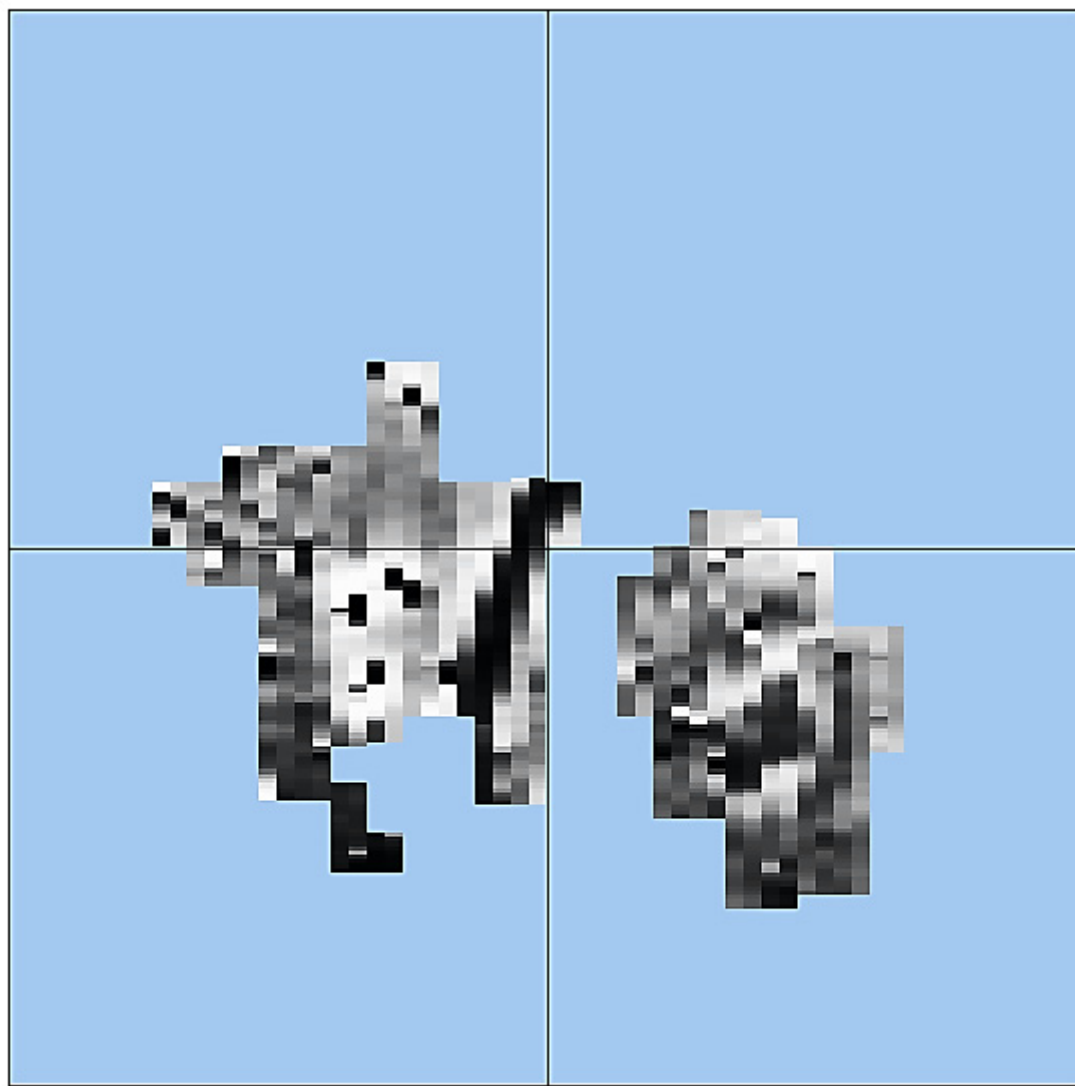


Figure 24: shade plot of unprocessed data, area 1



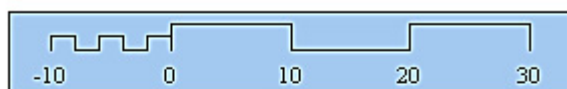
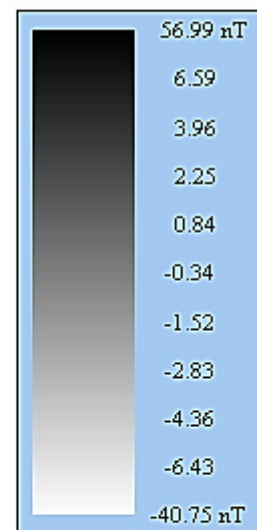
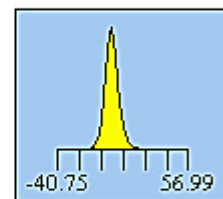
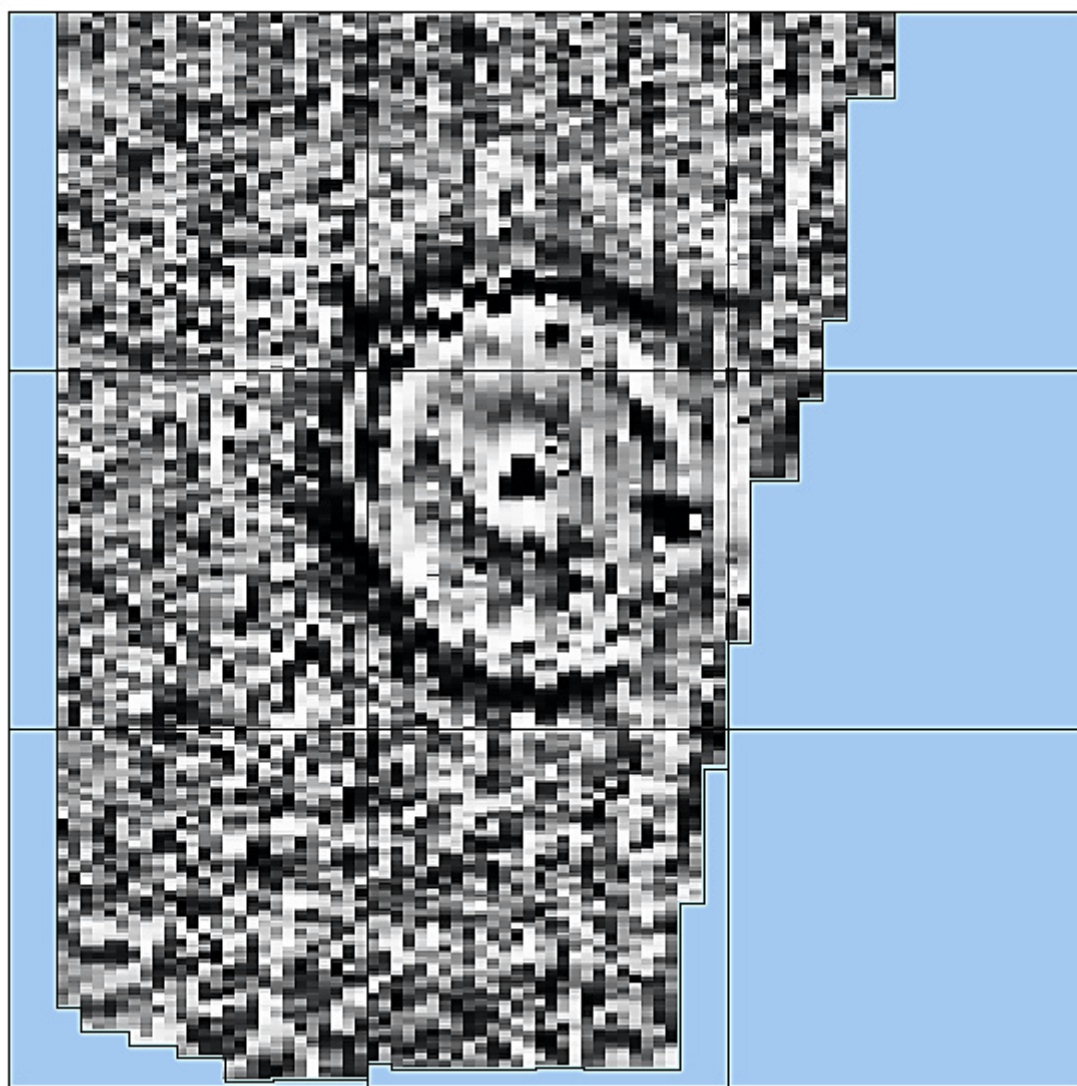
<b>Description:</b>		<b>Processes:</b> 1	<b>Survey conditions</b>
Instrument Type:	Bartington Grad 610	1 Base Layer	Garden environment
Units:	nT		
Direction of 1st Traverse:	0 deg		
Collection Method:	ZigZag		
Sensors:	2 @ 0.00 m spacing.		
Dummy Value:	32702		

**Dimensions**  
 Composite Size (readings): 240 x 60  
 Survey Size (meters): 60 m x 60 m  
 Grid Size: 30 m x 30 m  
 X Interval: 0.25 m  
 Y Interval: 1 m

**Stats**  
 Max: 100.00  
 Min: -99.59  
 Std Dev: 16.29  
 Mean: -2.89  
 Median: -4.34  
 Composite Area: 0.36 ha  
 Surveyed Area: 0.06 ha

**PROGRAM**  
 Name: TerraSurveyor  
 Version: 3.0.28.1

Figure 25: shade plot of unprocessed data, area 2



Description:  
 Instrument Type: Bartington Grad 610  
 Units: nT  
 Direction of 1st Traverse: 0 deg  
 Collection Method: ZigZag  
 Sensors: 2 @ 0.00 m spacing.  
 Dummy Value: 32702

Processes: 1  
 1 Base Layer

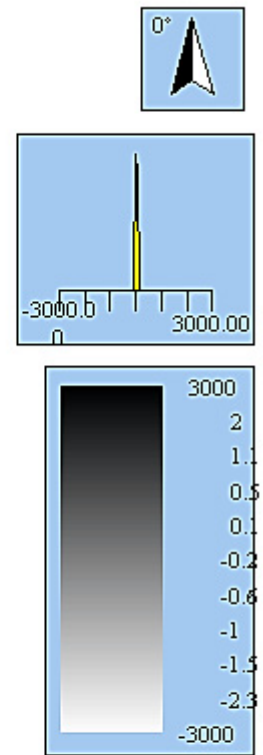
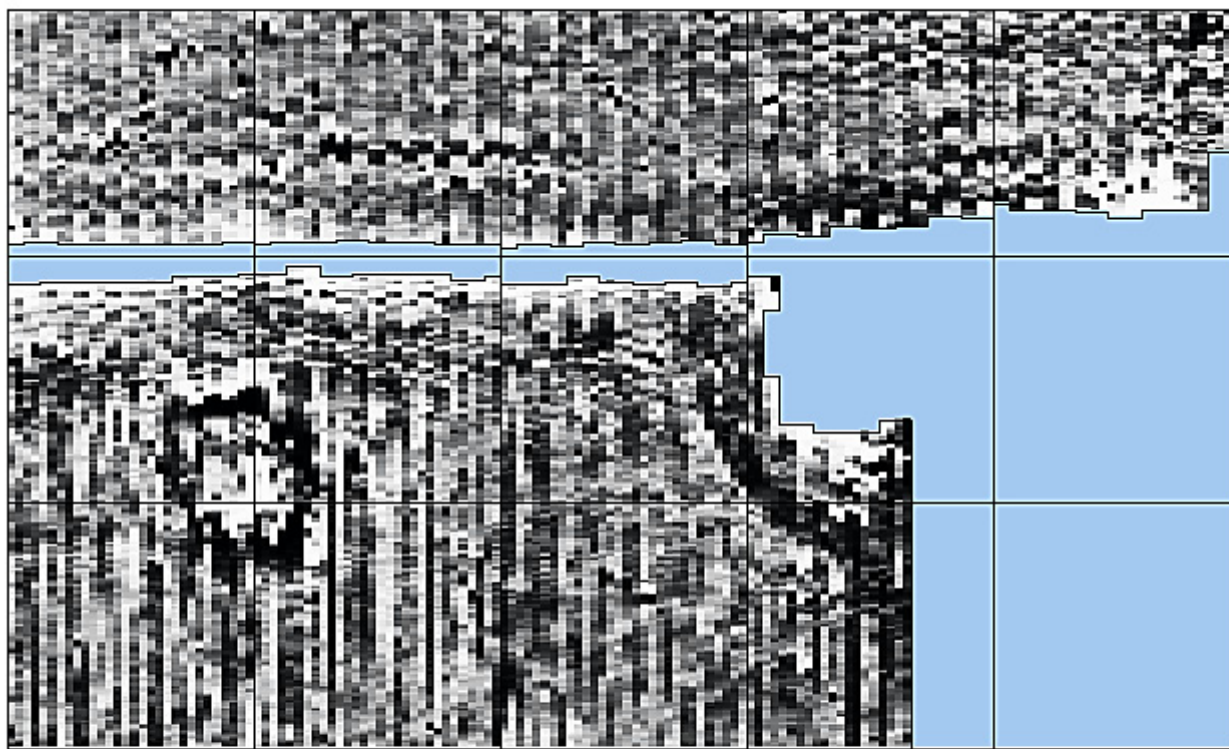
Survey conditions  
 Pasture

Dimensions  
 Composite Size (readings): 360 x 90  
 Survey Size (meters): 90 m x 90 m  
 Grid Size: 30 m x 30 m  
 X Interval: 0.25 m  
 Y Interval: 1 m

Stats  
 Max: 56.99  
 Min: -40.75  
 Std Dev: 5.60  
 Mean: 0.01  
 Median: -0.33  
 Composite Area: 0.81 ha  
 Surveyed Area: 0.5258 ha

PROGRAM  
 Name: TerraSurveyor  
 Version: 3.0.28.1

Figure 26: shade plot of unprocessed data, area 3



Description:  
 Instrument Type:  
 Units:  
 Direction of 1st Traverse: 0 deg  
 Collection Method: ZigZag  
 Sensors: 2 @ 0.00 m spacing.  
 Dummy Value: 32702

Processes: 1  
 1 Base Layer

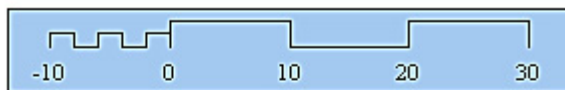
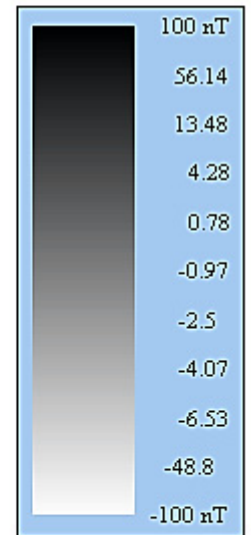
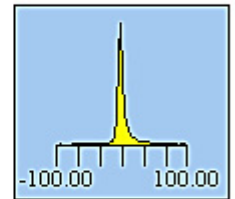
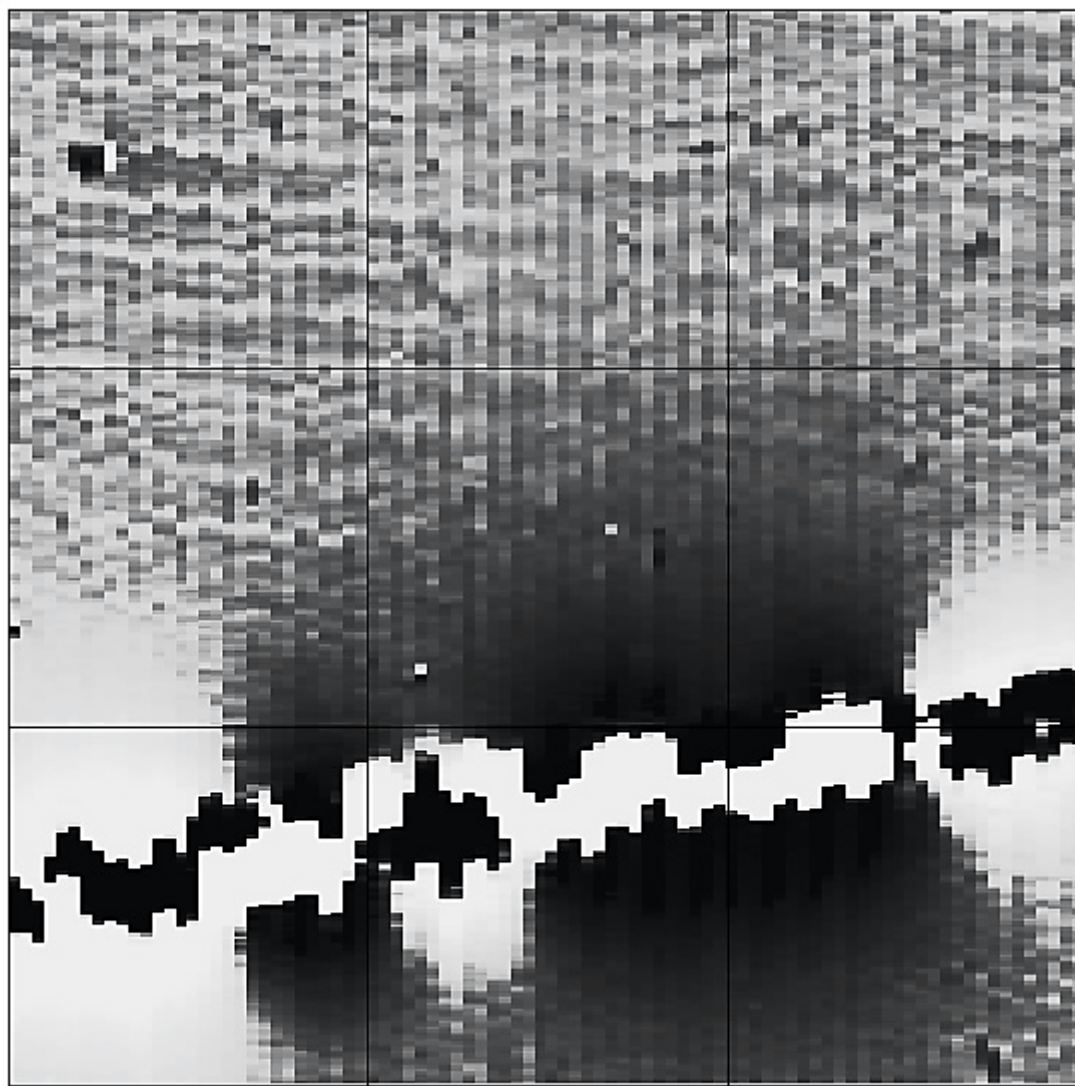
Survey conditions  
 Pasture with buildings in north east corner

Dimensions  
 Composite Size (readings): 360 x 150  
 Survey Size (meters): 90 m x 150 m  
 Grid Size: 30 m x 30 m  
 X Interval: 0.25 m  
 Y Interval: 1 m

Stats  
 Max: 3000.00  
 Min: -3000.00  
 Std Dev: 21.83  
 Mean: -0.13  
 Median: -0.20  
 Composite Area: 1.35 ha  
 Surveyed Area: 1.007 ha

PROGRAM  
 Name: TerraSurveyor  
 Version: 3.0.28.1

Figure 27: shade plot of unprocessed data, area 4



Description:  
 Instrument Type: Bartington Grad 610  
 Units: nT  
 Direction of 1st Traverse: 0 deg  
 Collection Method: ZigZag  
 Sensors: 2 @ 0.00 m spacing.  
 Dummy Value: 32702

Processes: 1  
 1 Base Layer

Survey conditions  
 Cultivated field

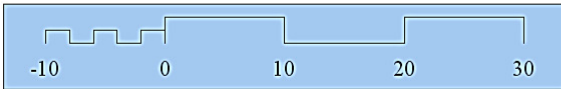
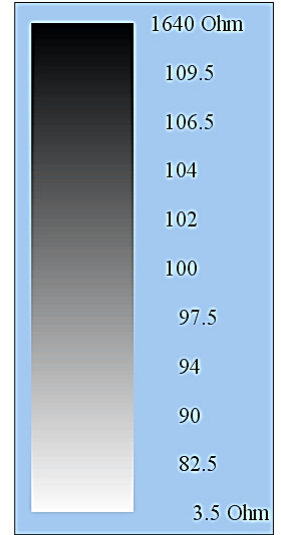
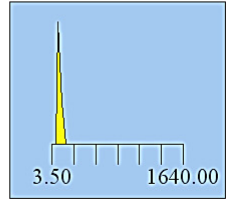
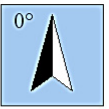
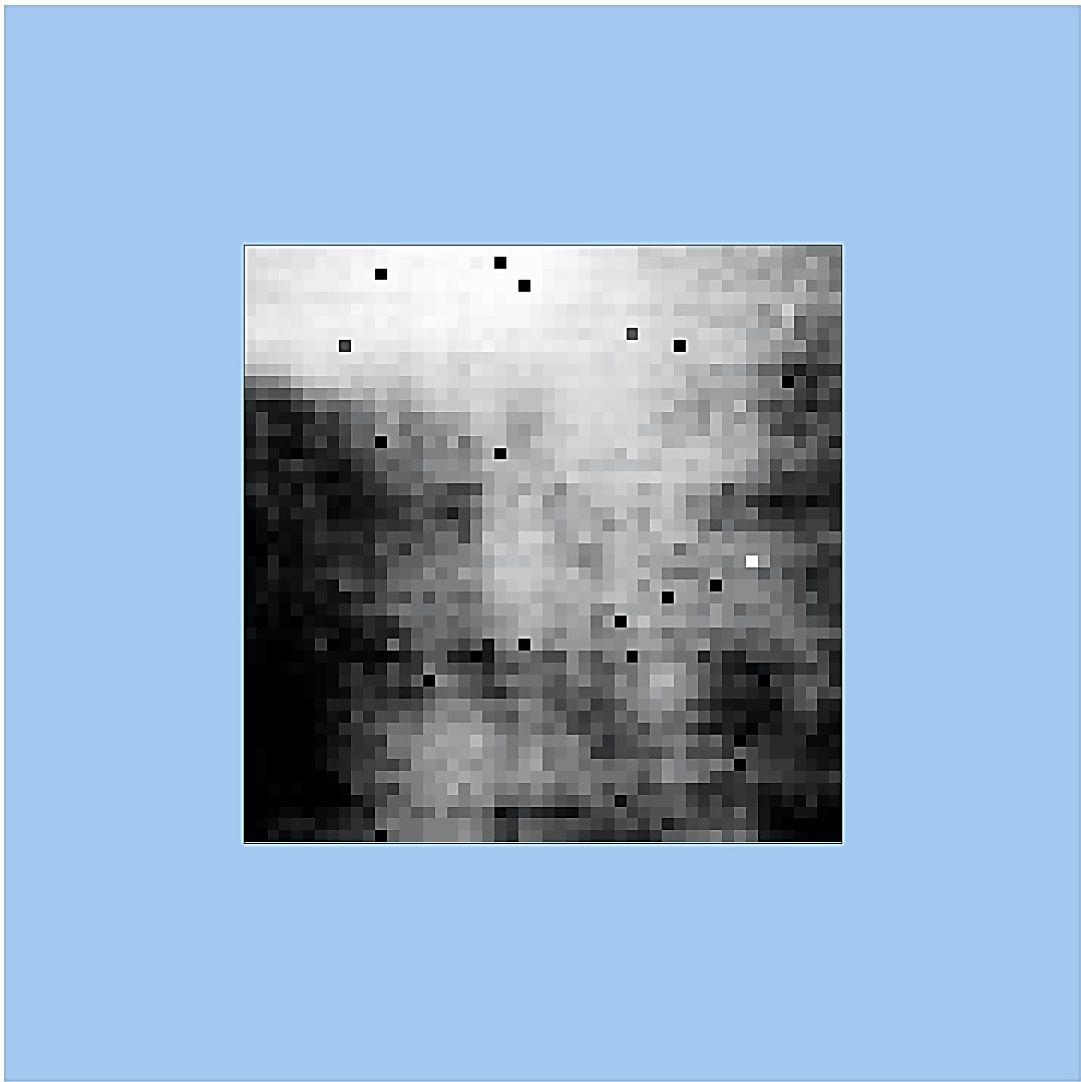
Dimensions  
 Composite Size (readings): 360 x 90  
 Survey Size (meters): 90 m x 90 m  
 Grid Size: 30 m x 30 m  
 X Interval: 0.25 m  
 Y Interval: 1 m

Stats  
 Max: 100.00  
 Min: -100.00  
 Std Dev: 43.73  
 Mean: 1.68  
 Median: -0.97  
 Composite Area: 0.81 ha  
 Surveyed Area: 0.81 ha

PROGRAM  
 Name: TerraSurveyor  
 Version: 3.0.28.

Figure 28: shade plot of unprocessed data, area 5





Description:  
 Instrument Type: GeoScan (Resistance)  
 Units: Ohm  
 Direction of 1st Traverse: 0 deg  
 Collection Method: ZigZag  
 Sensors: 1  
 Dummy Value: 32702

Processes: 1  
 1 Base Layer

Survey conditions  
 Ploughed and harrowed field

Dimensions  
 Composite Size (readings): 90 x 90  
 Survey Size (meters): 90 m x 90 m  
 Grid Size: 30 m x 30 m  
 X Interval: 1 m  
 Y Interval: 1 m

Stats  
 Max: 1640.00  
 Min: 3.50  
 Std Dev: 46.38  
 Mean: 101.33  
 Median: 100.00  
 Composite Area: 0.81 ha  
 Surveyed Area: 0.25 ha

PROGRAM  
 Name: TerraSurveyor  
 Version: 3.0.28.1

Figure 29: shade plot of unprocessed resistance data, area 5