Report on a Geophysical Survey of the Barham Downs Anglo-Saxon Barrow Field and Prehistoric Linear Earthwork

Undertaken by Classical and Archaeological Studies for Canterbury Archaeological Trust

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Barham Downs Anglo-Saxon Barrow Field

and Prehistoric Linear Earthwork

Geophysical survey Report

Contents

1. Summary

1.1 This report presents the results from magnetic and earth resistance geophysical surveys at Barham Downs Anglo-Saxon Barrow Field and Prehistoric Linear Earthwork. The purpose of these surveys was to determine the presence of burials and other buried archaeological features along the line of a proposed rabbit fence and advise on where archaeology may be disturbed by the construction of the fence.

1.2 While evidence of burials can only be inferred from the magnetic survey due to the nature of the anomalies being sought (see 2.3), it has been possible to pinpoint areas of the proposed rabbit fence where graves may be located and care should be taken during construction work.

1.3 In contrast, and disappointingly, the earth resistance survey has failed to produce any anomalies that can be positively identified as grave cuts, although a possible ring ditch may have been identified. An anomalous linear feature, possibly relating to earlier land use, has also been identified.

1.4 Areas most heavily disturbed by rabbit burrowing, (i.e., where grave cuts were clearly visible from the surface), were recorded with a total station to help identify possible graves in the geophysical data. However, no pattern could be discerned that identified a correlation between recorded disturbance and anomalies in the magnetic or electrical resistance data.

2. Introduction

2.1 The objective of this geophysical survey was to identify archaeological features for excavation ahead of the construction of rabbit proof fencing. The work was undertaken on behalf of Canterbury Archaeological Trust (CAT) by staff and students of Classical & Archaeological Studies at the University of Kent (UKC).

2.2 The survey site is bounded to the southwest by Dover Road (A2), to the southwest, by Ileden Lane and by open fields to the north and northeast and is to the north-east of the village of Kingston. The field is the location of Barham Downs Anglo-Saxon Barrow Field and Prehistoric Linear Earthwork scheduled area (SM 1013377), with NGR TR 20298 51921 (centred).

2.3 Due to backfilling taking place only a short time after being cut, graves very rarely produce anomalous readings that geophysical equipment can detect (Cheetham 2005, cited in Aspinall *et al*, 2009). However, grave goods that are predominantly ferrous in nature can produce anomalous readings that a magnetometer, sensitive to fluctuations in the earth's magnetic field, can detect. While predicting the location of graves with geophysical equipment is fraught with risk, it is this type of anomaly with this cause that is believed to be present in the results from this survey.

Landuse and topography

2.4 The survey area has an elevation of c. 79-86m, gently rising to the north, north-west and north-east. The land is currently uncultivated and noticeably soft underfoot in places, presumably due to the extensive rabbit burrowing on the site.

Dates

2.5 Fieldwork was undertaken on the 4th and 5th of February 2013, with an interim report being prepared during the weeks following the survey completion, and this full report in August 2013.

Personnel

2.6 Fieldwork was supervised by Lloyd Bosworth (UKC Archaeology Technician), Matt Charlwood (UKC postgraduate student) and Adam Webber (UKC graduate). This report and illustrations were prepared by Lloyd Bosworth.

3. Field Methods

3.1 Three survey grids where established on the first day of survey to match the course of the proposed rabbit proof fence as closely as possible: two aligned with the A2 fence line (grids 01 and 02), and the third aligned to the Ileden Road hedge line (grid 03). The three survey grids comprised 26 20m x 20m grid squares, giving a total survey area of 10,400m^2 (1.04 hectare; 2.57 acres).

3.2 A Bartington Grad601-2 dual fluxgate gradiometer was used to measure the geomagnetic field gradient. Sensor separation is fixed at 1.0m and the geomagnetic field gradient is measured in nanoTesla (nT). A zig-zag survey pattern was employed and data were automatically logged in 20m grid units. Instrument sensitivity was set at 0.1nT, with a sample interval of 0.25m and a traverse interval of 1.0m.

3.3 A Geoscan RM85 resistance meter was used to measure earth resistance. A twin probe array with multiplexer was used, with a probe separation of 50cm, a sample interval of 50cm and a traverse interval of 1.0m. Data were automatically logged to an internal data logger in 20m grid units.

3.4 Data were downloaded in the field to a laptop computer for initial processing and then copied to an office based desktop PC for final processing and interpretation.

4. Data processing

4.1 Raw data from both magnetic and earth resistance were processed using TerraSurveyor 3.0 (formally called ArchaeoSurveyor) to produce greyscale plots on a continuous scale from black to white.

4.1 For magnetic data, positive magnetic anomalies are displayed as black and negative magnetic anomalies are displayed as white.

4.2 For earth resistance data, low resistance is displayed as white, and high resistance is displayed as black.

4.3 The following processing functions were applied to the raw magnetometer survey data to aid interpretation:

- Destripe: when data from a magnetometer survey conducted in a zig-zag pattern are plotted, they can exhibit alternating bands of light and dark traverses caused by the directional sensitivity of the machine. The destripe function assumes that the directional error is constant and sets the mean of all traverses to either zero or a value common to all traverses.
- Despike - ferrous objects on or under the ground surface cause anomalously strong spikes in the plotted data. The despike function detects and replaces these readings with a mean filter.
- Clip - the clip function removes extreme data values by replacing the min and max readings with either absolute values or by +/- standard deviations.
- Interpolate - the interpolate function increases the resolution of plotted data by generating extra datapoints between every existing datapoint in both X and Y directions.

4.4 The following processing functions were applied to the raw resistivity survey data to aid interpretation:

- High pass filter: a filter applied to resistivity data to balance out the minimum and maximum readings to produce a more even gradient.
- Clip - the clip function removes extreme data values by replacing the min and max readings with either absolute values or by +/- standard deviations.
- Interpolate - the interpolate function increases the resolution of plotted data by generating extra datapoints between every existing datapoint in both X and Y directions.

4.5 Graphics showing the interpretation of the greyscale plots were produced using ESRI's ArcMap 10.1, AutoCAD 2011, Adobe Illustrator CS6 and Adobe Photoshop CS6.

4.6 All maps were produced using ESRI's ArcMap 10.1 GIS package. Base map data were obtained under license from the EDINA Digimap/JtSC service and are © Crown Copyright Ordnance Survey 2013.

5. Anomaly types: magnetic

5.1 Three types of magnetic anomaly have been identified in the geophysical data:

- Positive magnetic - the plotted data shows as dark grey to black where the geomagnetic field gradient is higher than the mean zero. Usually associated with soil-filled, cut features, such as ditches and pits.
- Negative magnetic - the plotted data shows as light grey to white where the geomagnetic field gradient is lower than the mean zero. Usually associated with soil-filled, cut features, such as ditches and pits.
- Dipole magnetic - the plotted data shows paired positive-negative (black- white) anomalies that are typically ferrous (service pipes, metallic litter, etc.).

6. Anomaly types: resistivity

6.1 Soil water content and temperature can affect the recorded electrical resistance of the ground. Generally, high resistance anomalies have low water content and can typically be interpreted as structures (walls), or compacted ground (paving, rubble filled pits, etc.). Low resistance anomalies have higher moisture content and can typically be interpreted as buried ditches, pits, etc.

7. Processed results: magnetic survey - Grids 01, 02 and 03

7.1 The spread of dipole anomalies appears even across much of grids 01 and 02, though perhaps less dense in concentration in grid 02.

7.2 There are three distinct clusters of anomalies: squares 2 and 3; 13 and 14; 21 and 22.

7.3 Positive magnetic anomalies appear less dense than dipole, but show a clustering around grid squares 4 and 5.

7.4 Negative magnetic anomalies are the least frequent and are thinly spread across the whole survey area.

7.5 The clustering of anomalies in square 2 and 3 has the appearance of very disturbed ground, perhaps the site of burning or containing a quantity of ferrous debris.

7.6 Grid squares 2, 23, 24, 25 and 26 show strong magnetic interference due to the unavoidable proximity of metal fencing, the effect of which processing has been unable to remove.

8. Processed results: resistivity survey - Grids 01, 02 and 03

8.1 As with the magnetic survey, the electrical resistance data does not show any clear anomalies that could be interpreted as burials. However, there is a weak circular negative anomaly that has the visual characteristics of a soil filled ring ditch.

8.2 Grid square 1 has a poorly defined, roughly circular in area, negative anomaly that is consistent with the location of interpreted disturbed ground from the magnetic survey (7.5).

8.3 Grid 03 contains a clearly defined negative linear anomaly running roughly east / west across all three grid squares. This is mirrored by a much weaker and less clearly defined positive linear anomaly c. 10m south in the same grid.

8.4 All three grids show variable high/low readings that are consistent with background geology. However, several discreet areas of high resistance have been highlighted as potential points of interest, although unfortunately the total survey area is too narrow to identify definite patterns in their distribution.

9. Interpretation and conclusions

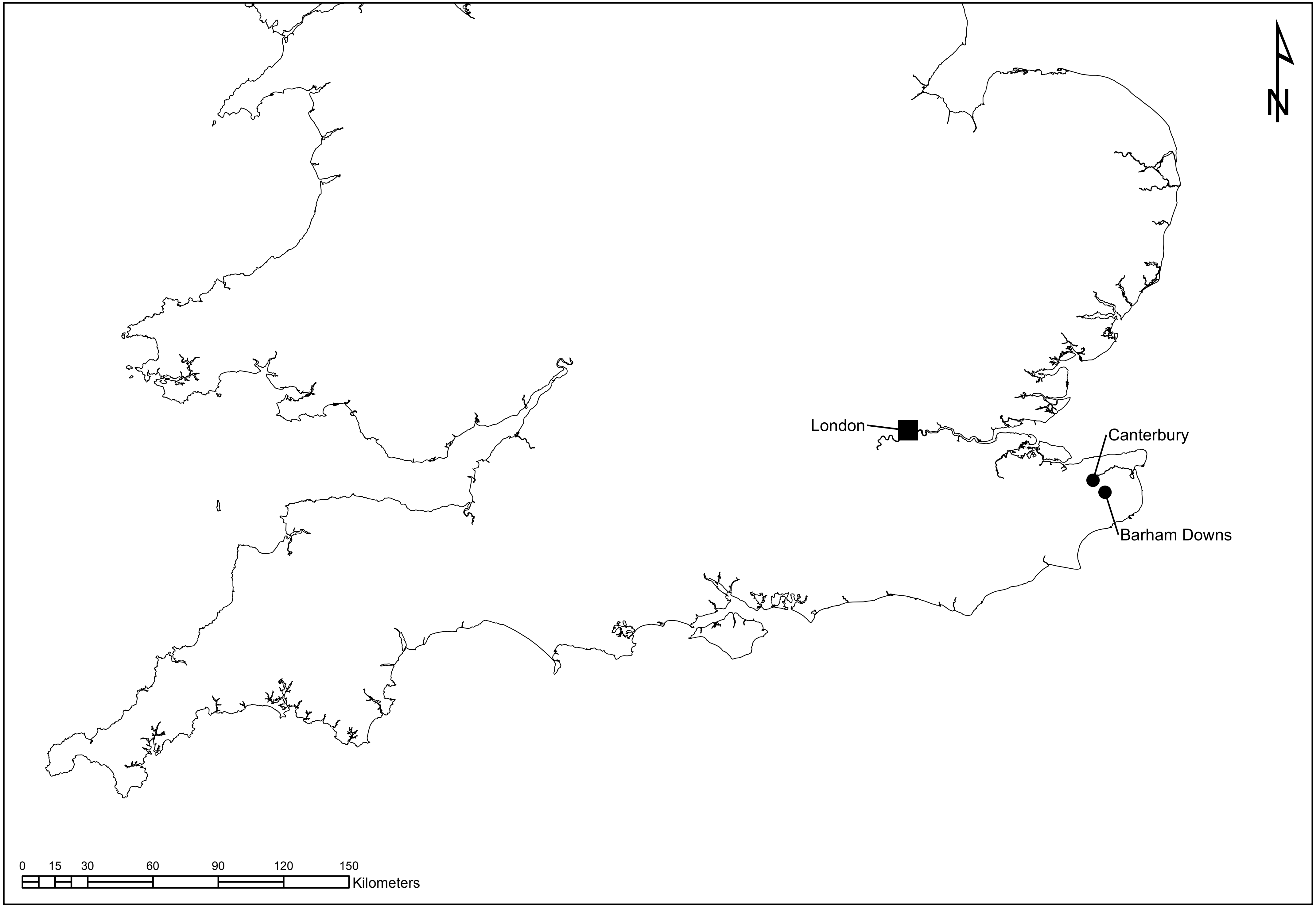
9.1 The anomalies identified as a ring ditch and linear feature in the resistivity data are the exceptions to an otherwise disappointing set of results from both survey techniques. The resistivity data has obvious and clear variations in the electrical resistance of the ground, but lack the defined breaks expected of buried archaeological features.

9.2 As previously noted, grave cuts are very difficult to locate based solely on their magnetic properties, but grave goods of a ferrous composition can indicate burials otherwise invisible to the gradiometer. However, a note of caution must be aired concerning the reliability of this method in determining the presence or absence of graves, as the scattering of ferrous litter across the ground surface could equally produce the same or similar results.

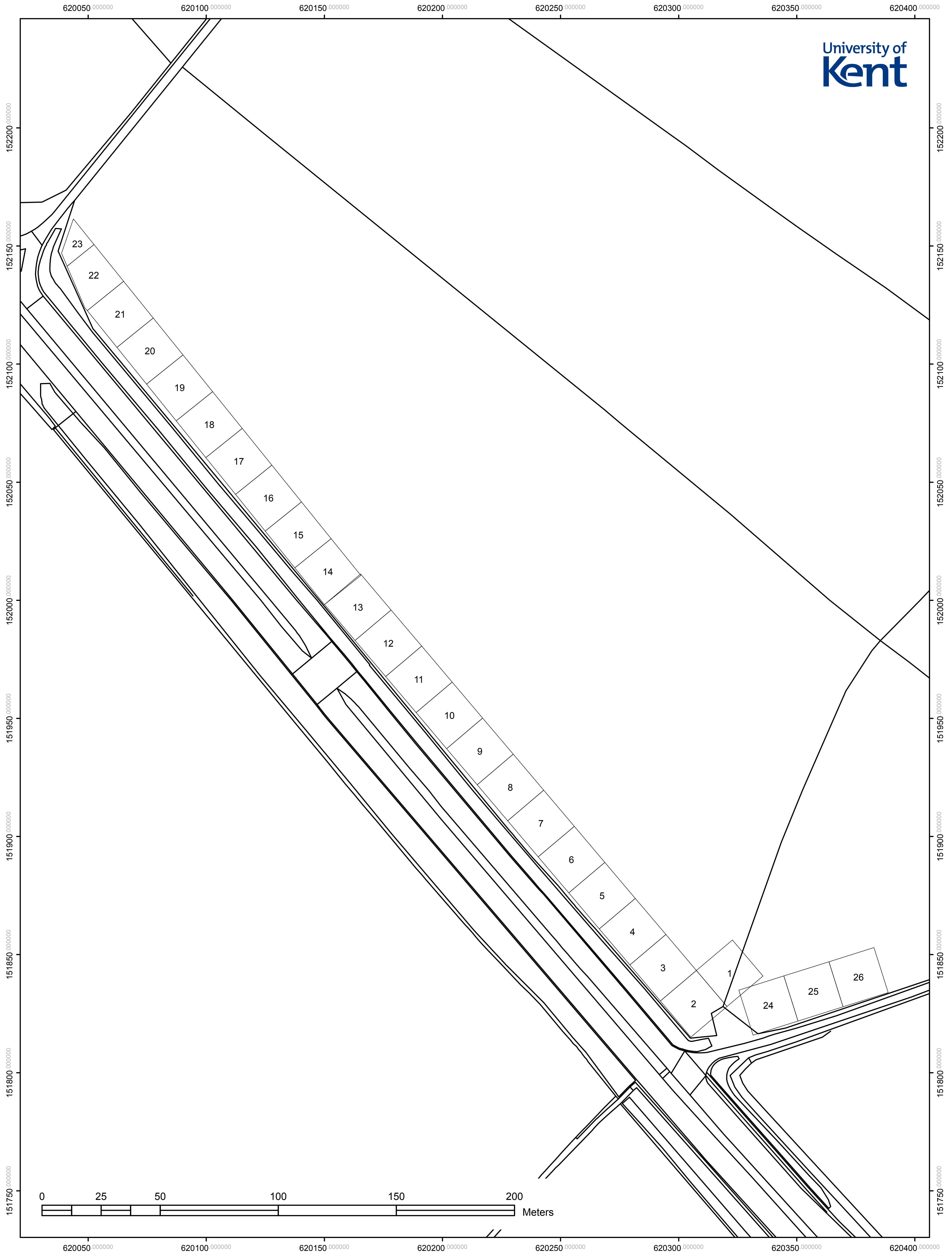
10. Bibliography

Aspinall, A., Gaffney, C. and Schmidt, A., 2009. Magnetometry for Archaeologists. Plymouth (UK): AltaMira Press

Cheetham, P. 2005. Forensic geophysical survey. In *Forensic archaeology: Advances in theory and practice*. J. R. Hunter and M. Cox (eds.). London: Routledge Press.



London
Canterbury
Barham Downs
N
0
15
30
60
90
120
150
Kilometers



Survey Grids 01, 02 and 03
Grid square numbering
Barham Down

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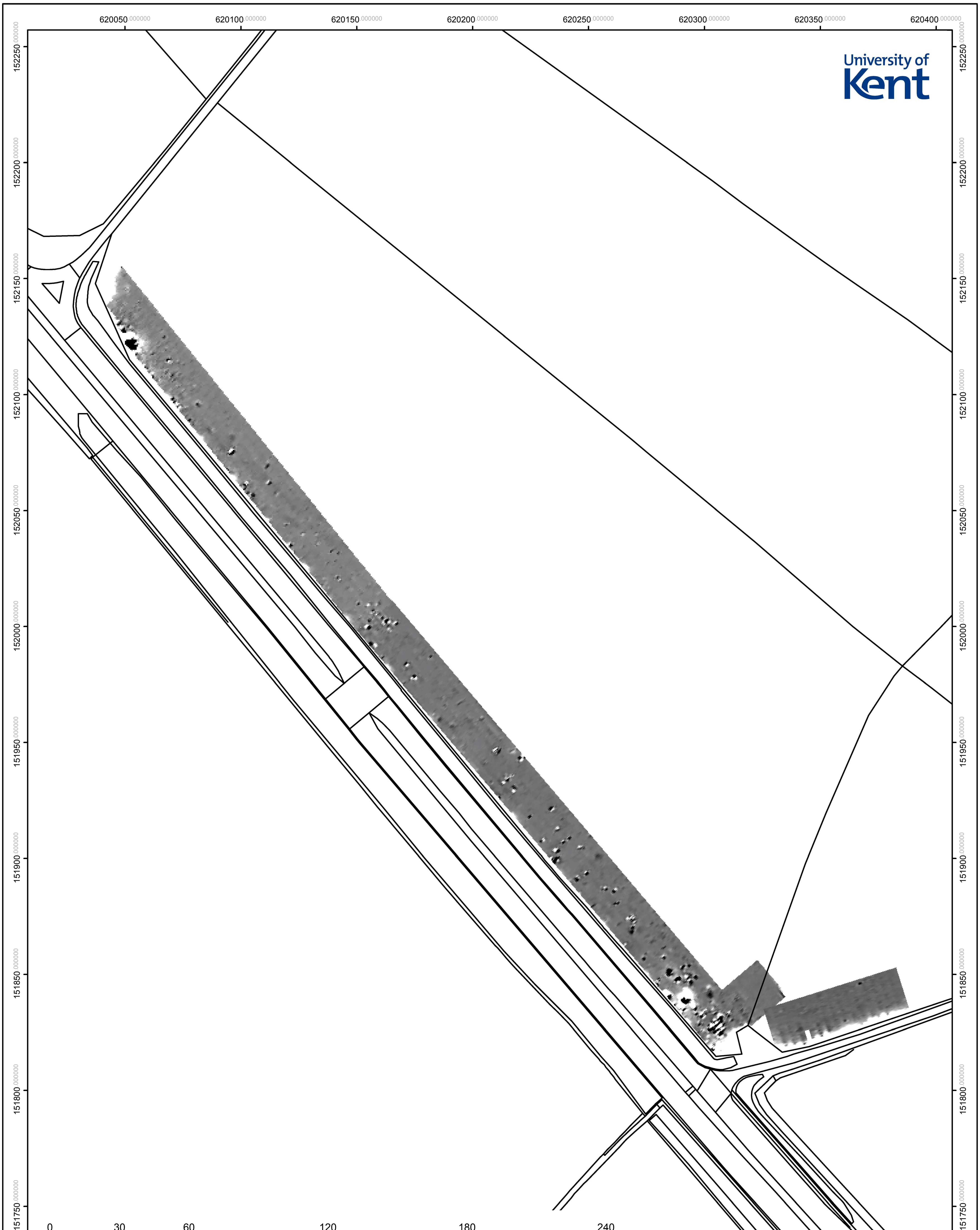

Survey Grids 01, 02 and 03
Greyscale gradiometer plot
Barham Down

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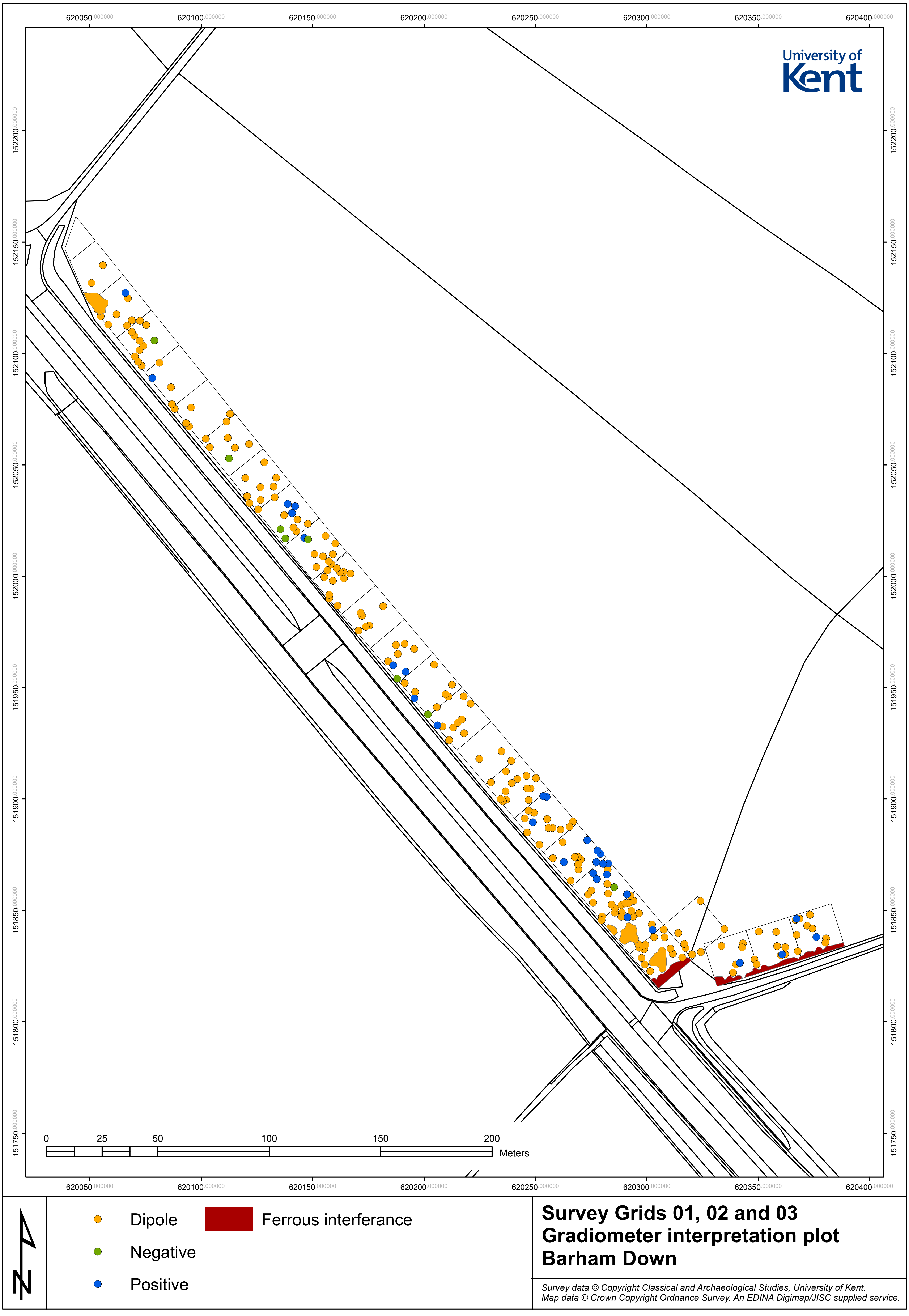

Survey Grids 01, 02 and 03
Gradiometer interpretation plot
Barham Down

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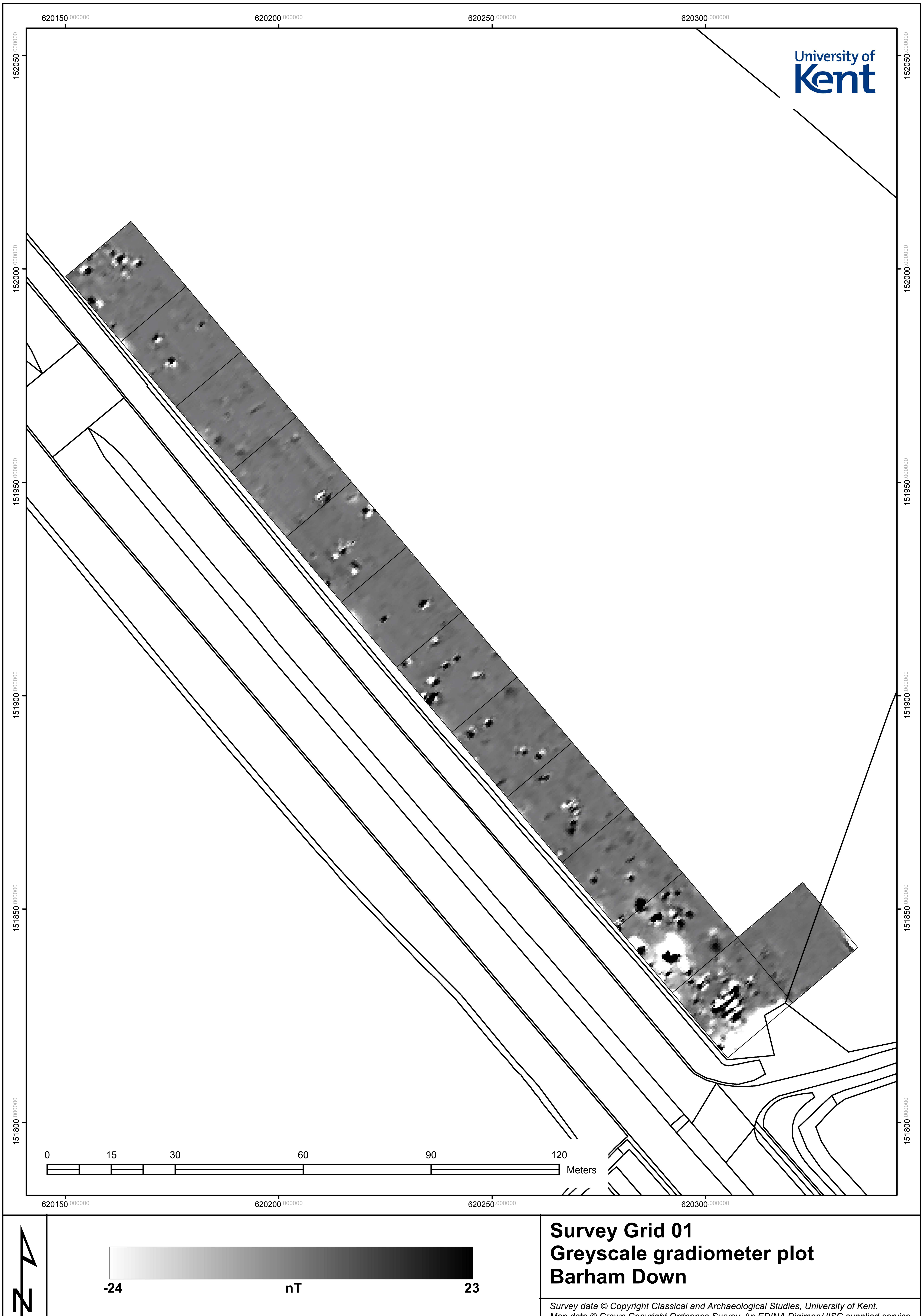

Survey Grid 01
Greyscale gradiometer plot
Barham Down

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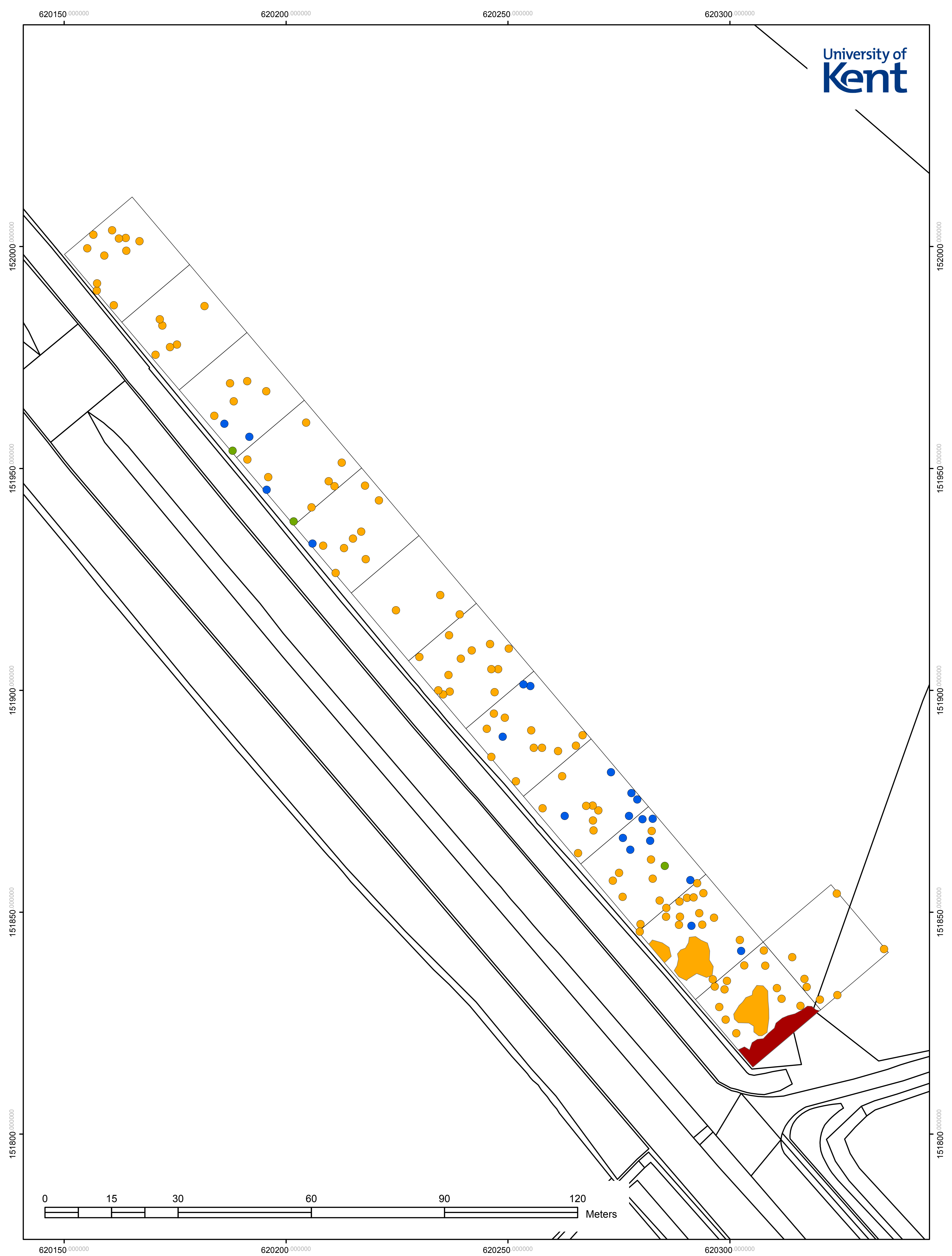

N

Dipole

Negative

Positive

Ferrous interferance

Survey Grid 01
Gradiometer interpretation plot
Barham Down

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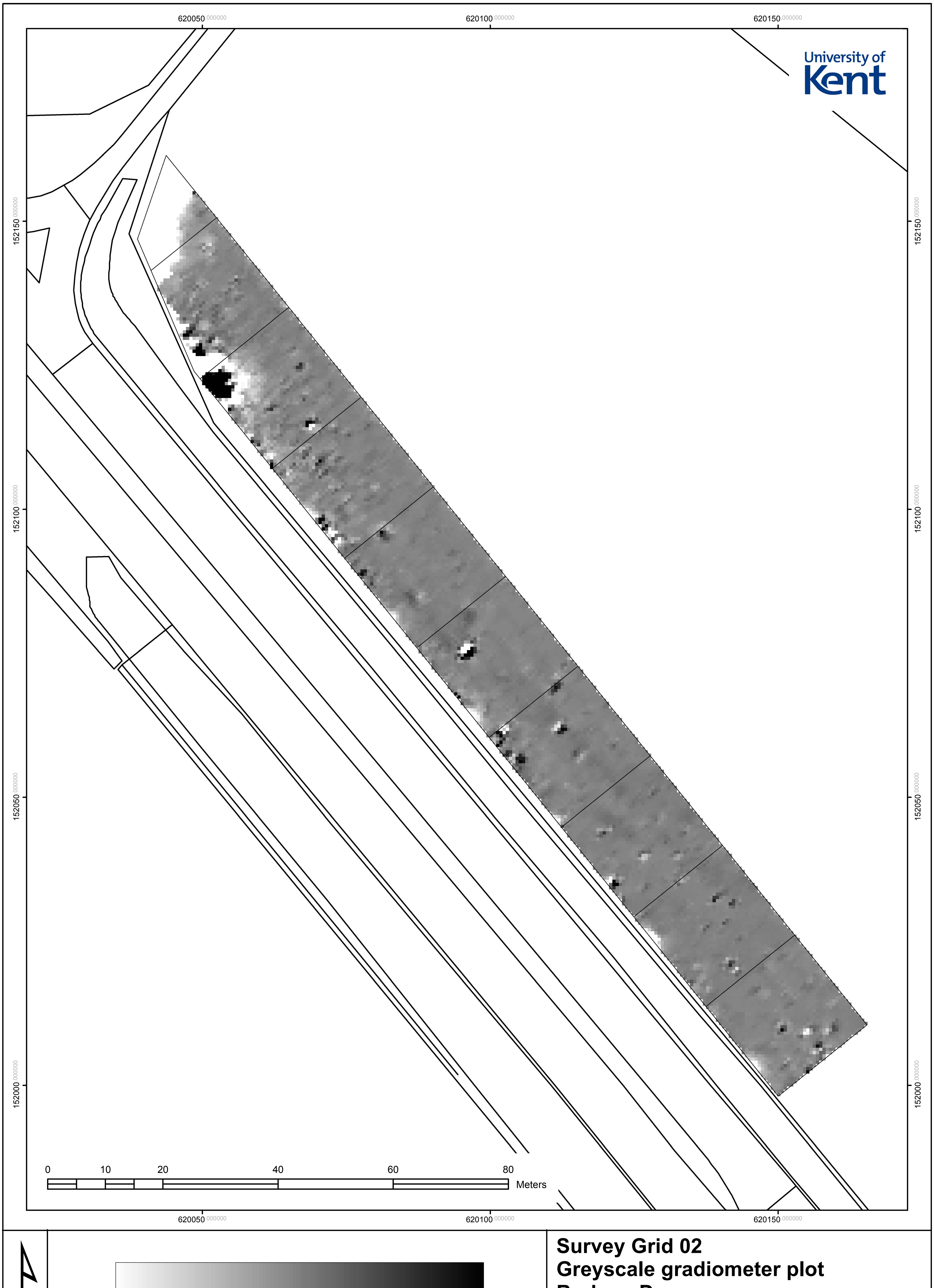

Survey Grid 02
Greyscale gradiometer plot
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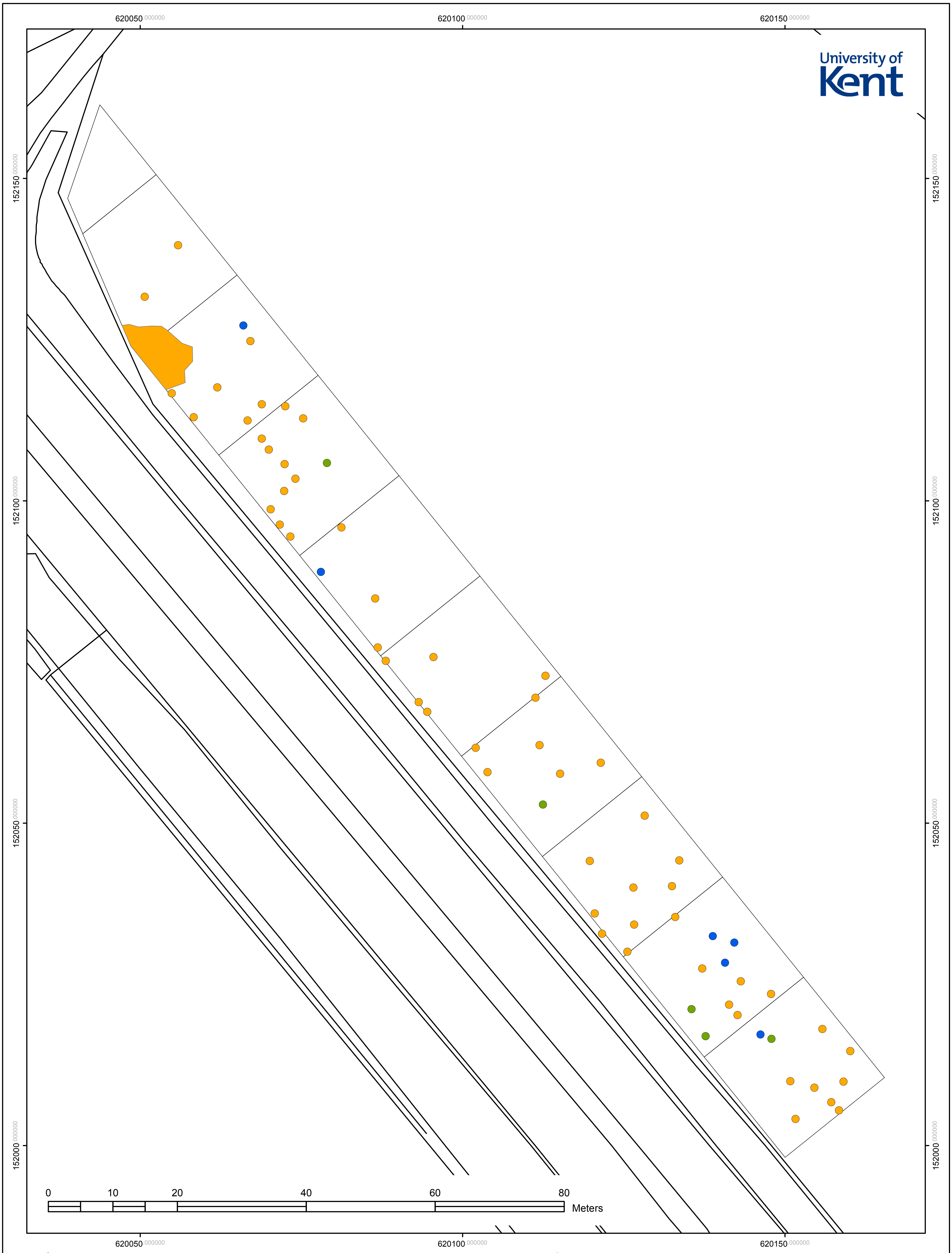

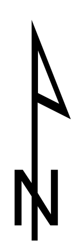

Dipole

Negative

Positive

Survey Grid 02
Gradiometer interpretation plot
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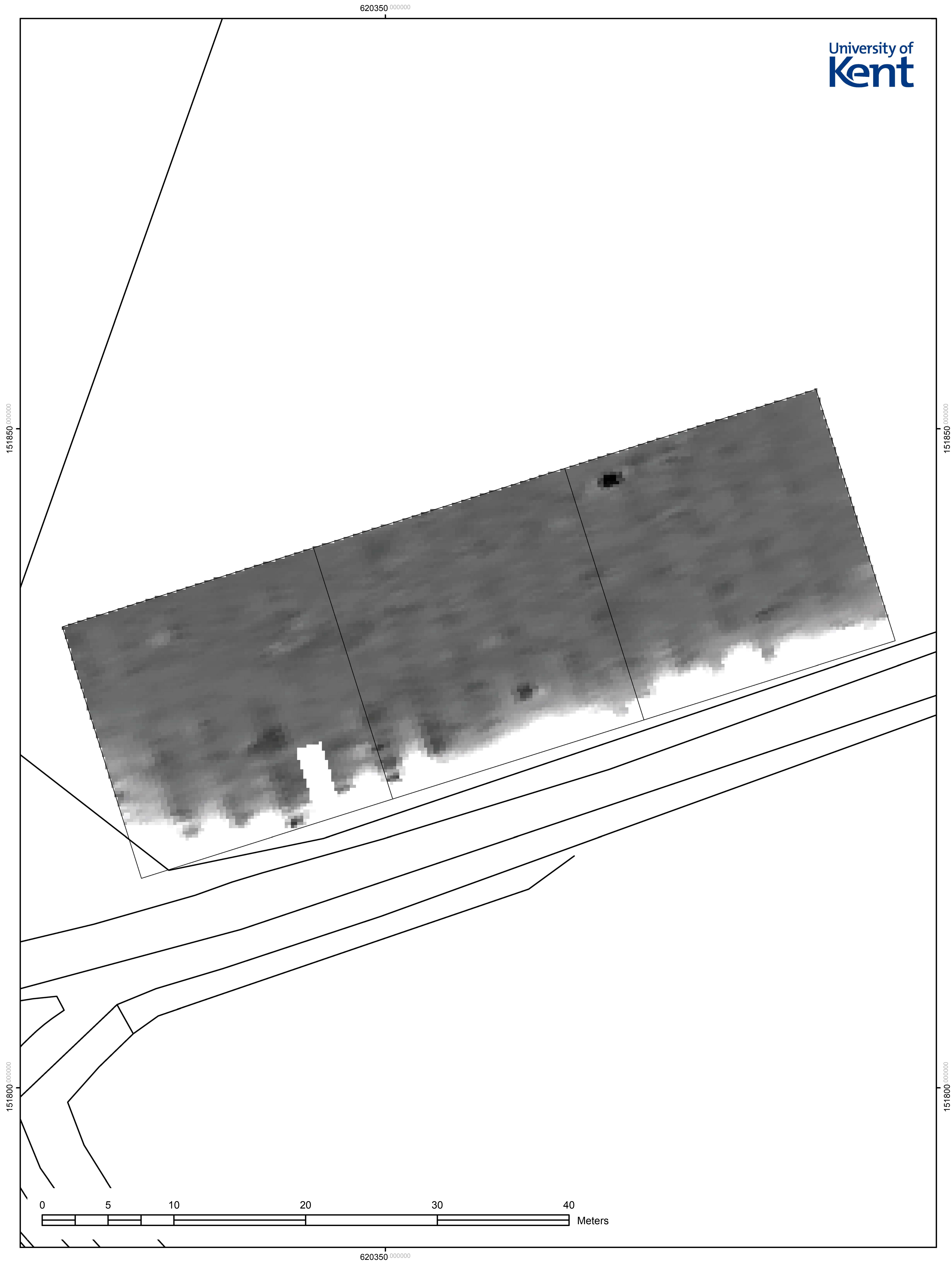

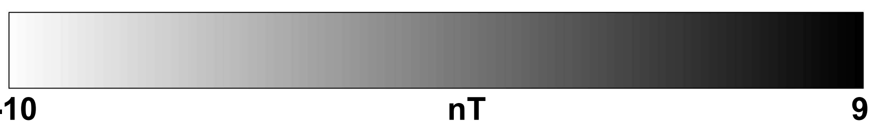

Survey Grid 03
Greyscale gradiometer plot
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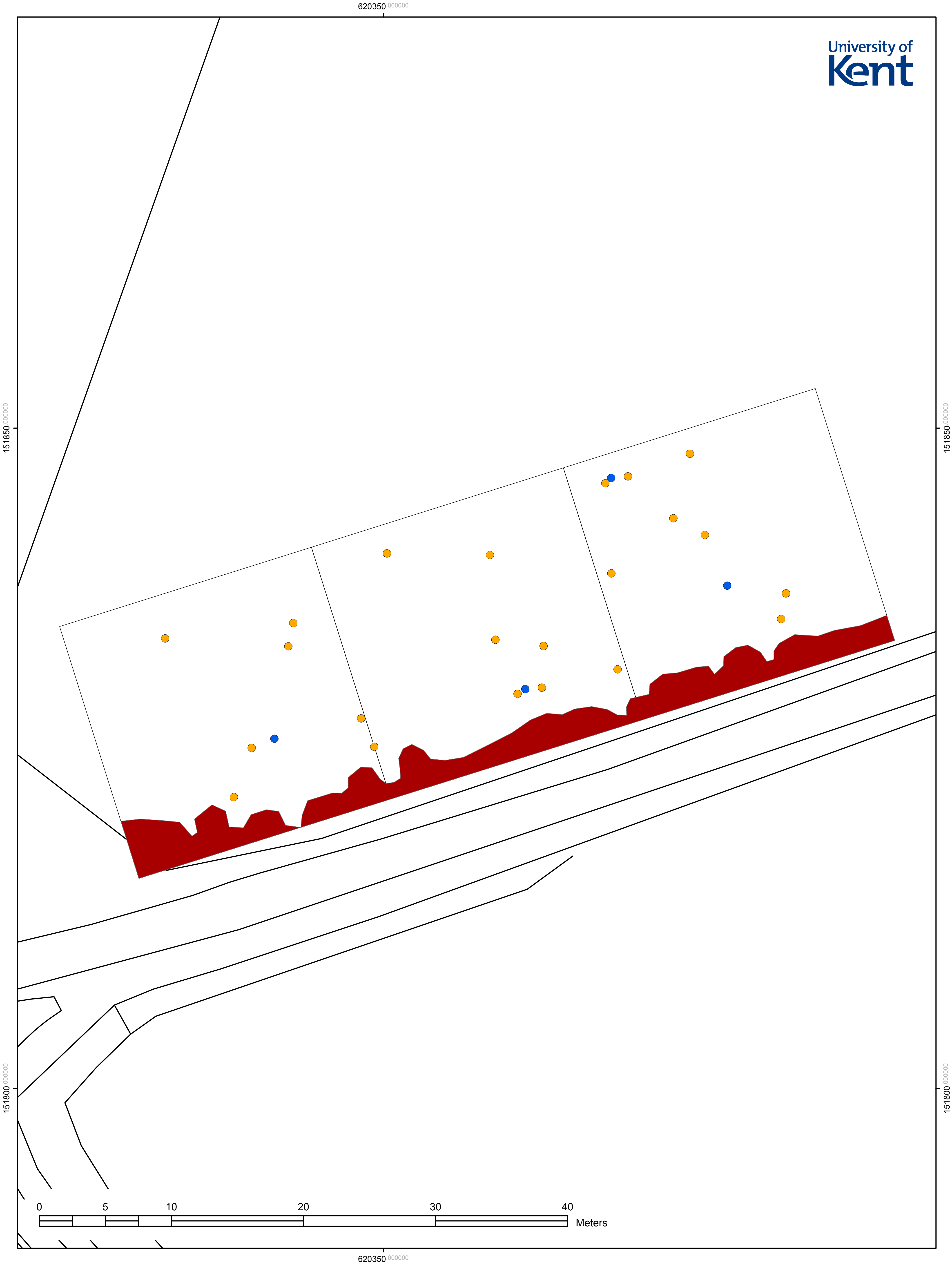

Dipole

Positive

Ferrous interferance

Survey Grid 03
Gradiometer interpretation plot
Barham Down

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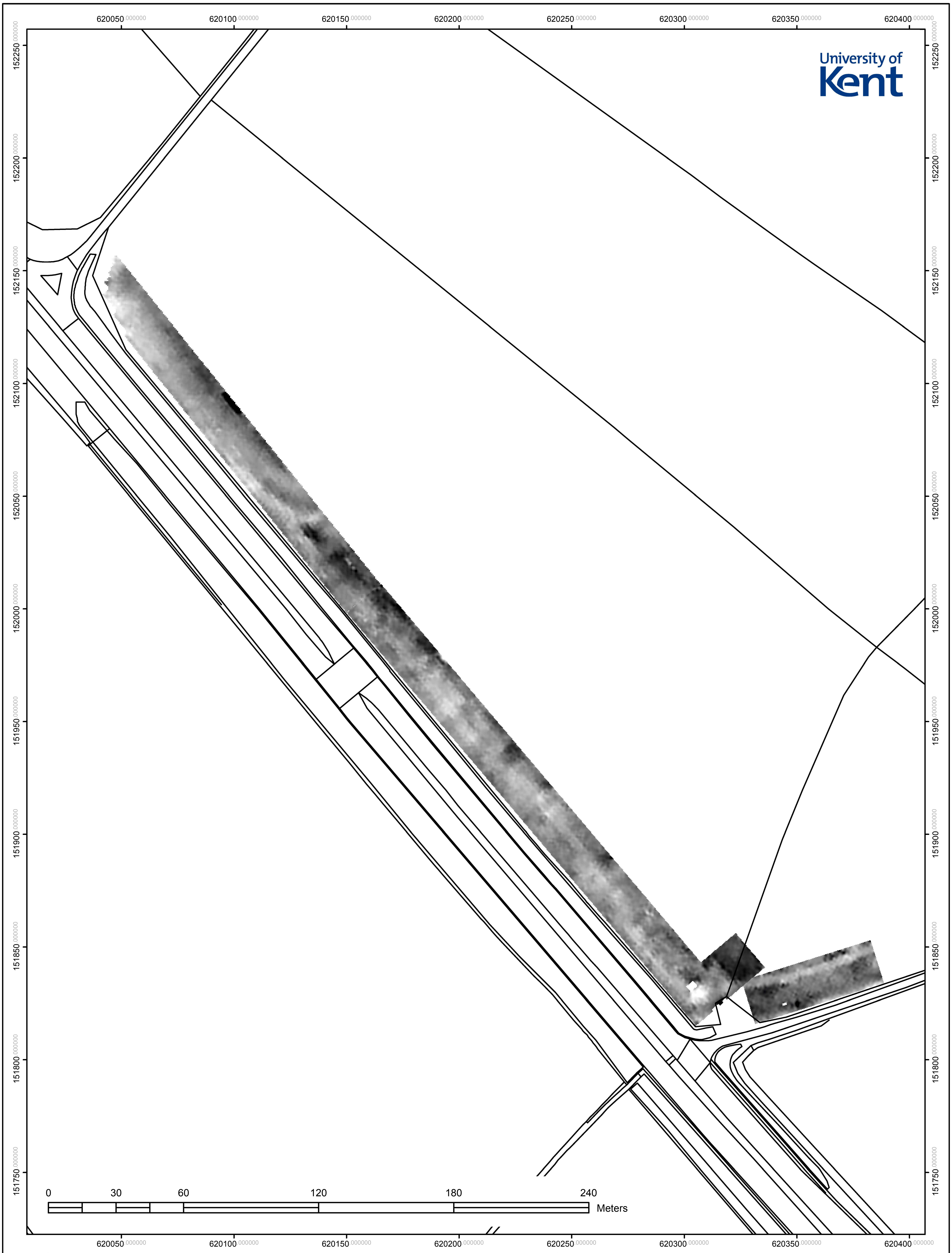

Survey Grids 01, 02 and 03
Greyscale resistivity plot
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N

Possible ring ditch

High resistance

Low resistance

Survey Grids 01, 02 and 03
Resistivity interpretation plot
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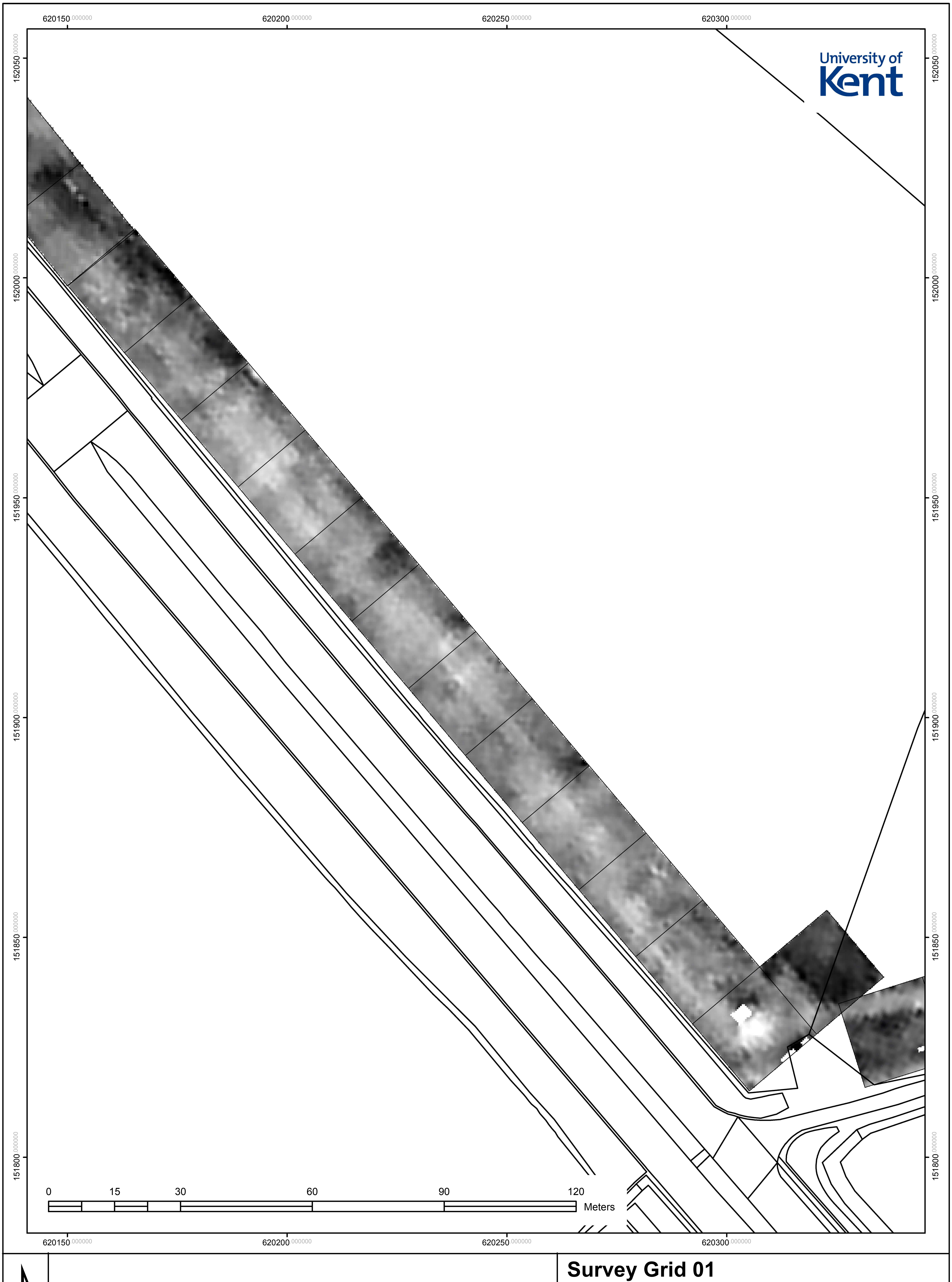

Survey Grid 01
Greyscale resistivity plot
Barham Down

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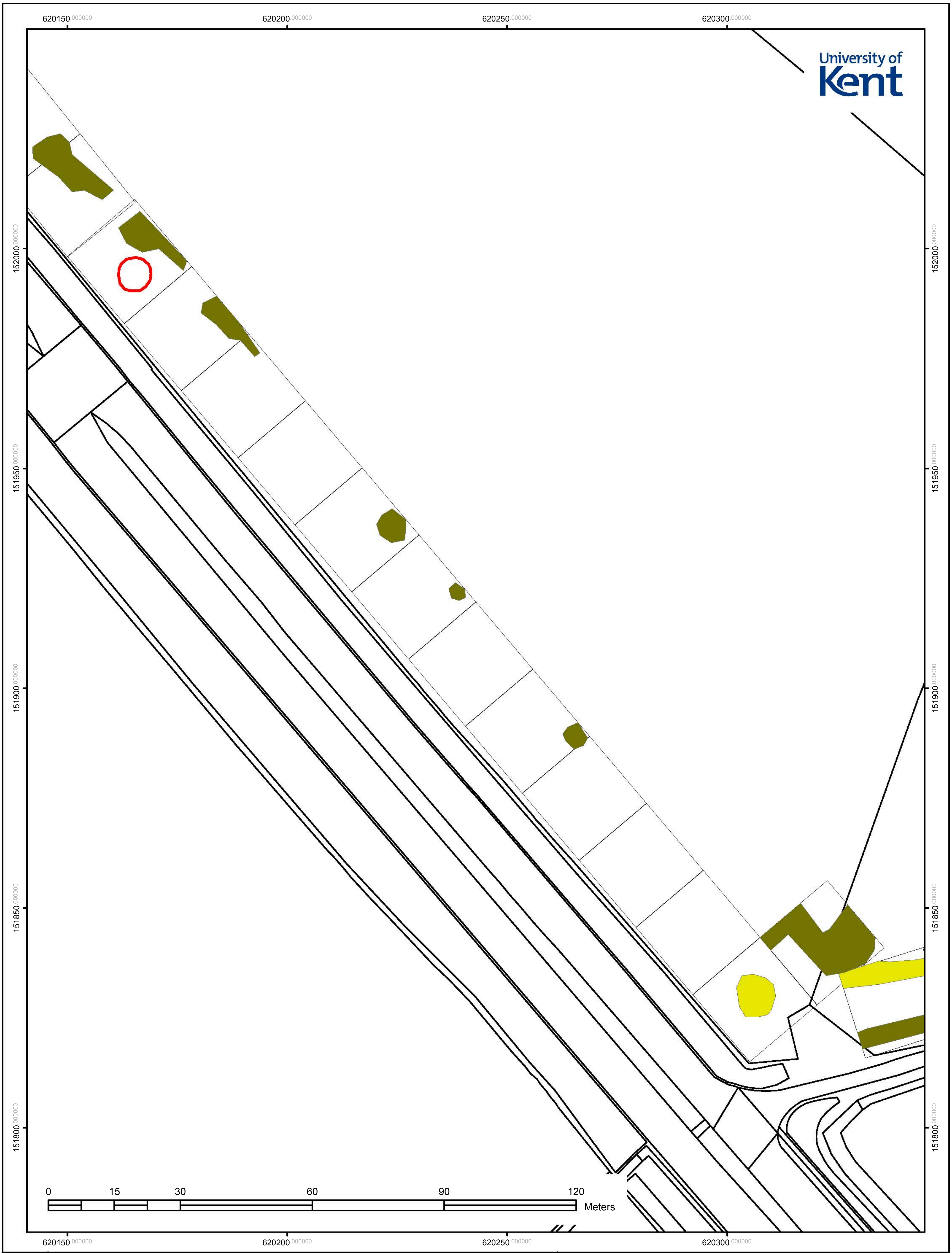

Possible ring ditch
High resistance
Low resistance

Survey Grid 01
Resistivity interpretation plot
Barham Down

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Survey Grid 02
Greyscale resistivity plot
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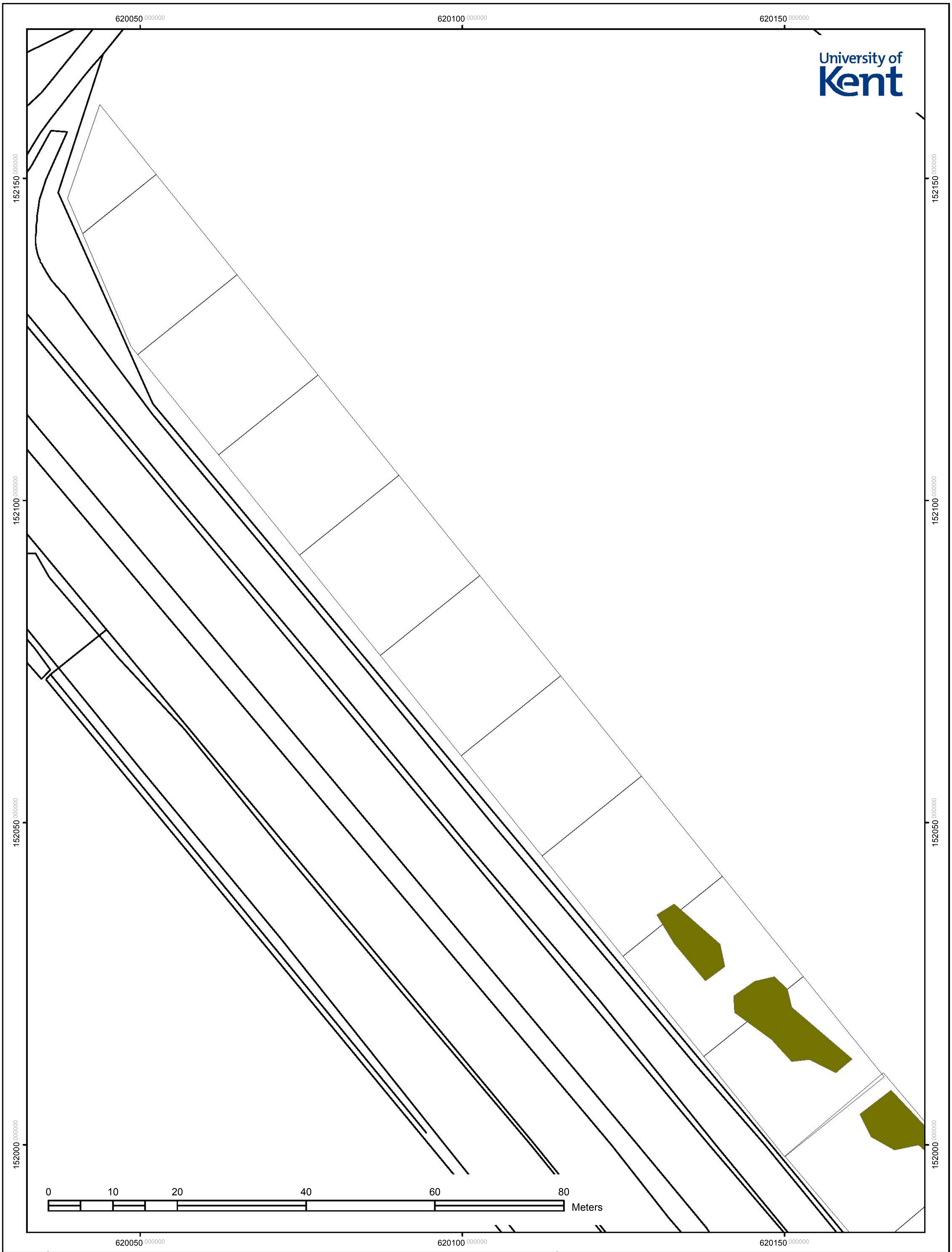

High resistance

Low resistance

Survey Grid 02
Resistivity interpretation plot
Barham Down

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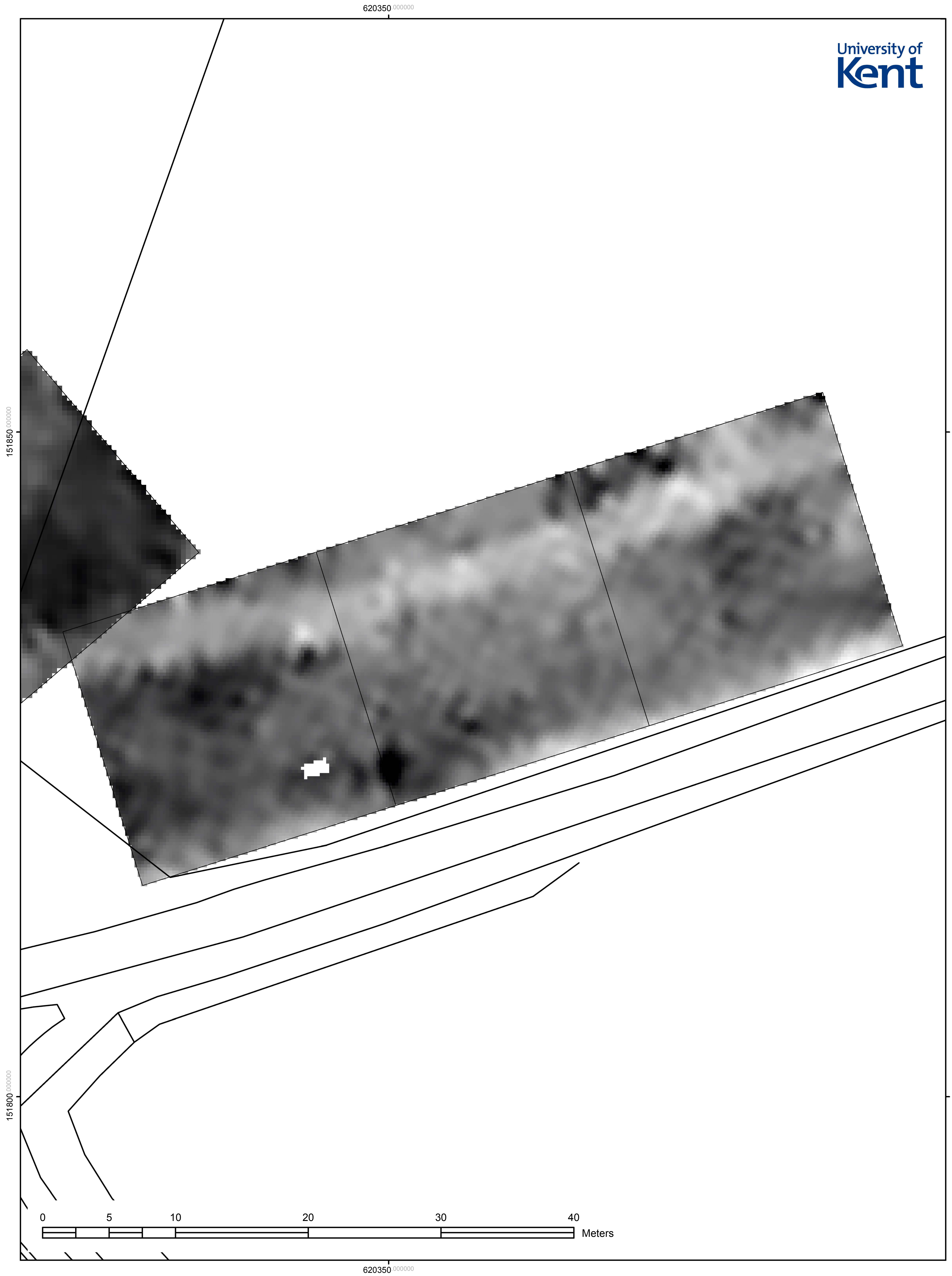

-79 Ohm 111

Survey Grid 03
Greyscale resistivity plot
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High resistance

Low resistance

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