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# Flodden 500 Project
# Flodden Hill: Geophysical Survey
# Data Structure Report
# Project 3669

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# Flodden 500 Project

## Flodden Hill: Geophysical Survey

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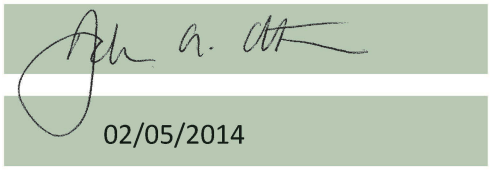
| **On behalf of:** | Flodden 1513 Ecomuseum |
| **NGR:** | NT 91067 35507 |
| **Project Number:** | 3669 |
| **Report by:** | Christine Rennie |
| **Illustrations:** | Fiona Jackson |
| **Project Manager:** | John Atkinson |
| **Approved by:** |  |
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*This document has been prepared in accordance with GUARD Archaeology Limited standard operating procedures.*

**GUARD Archaeology Limited**
**52 Elderpark Workspace**
**100 Elderpark Street**
**Glasgow**
**G51 3TR**

**Tel: 0141 445 8800**
**Fax: 0141 445 3222**
**email: info@guard-archaeology.co.uk**

**www.guard-archaeology.co.uk**

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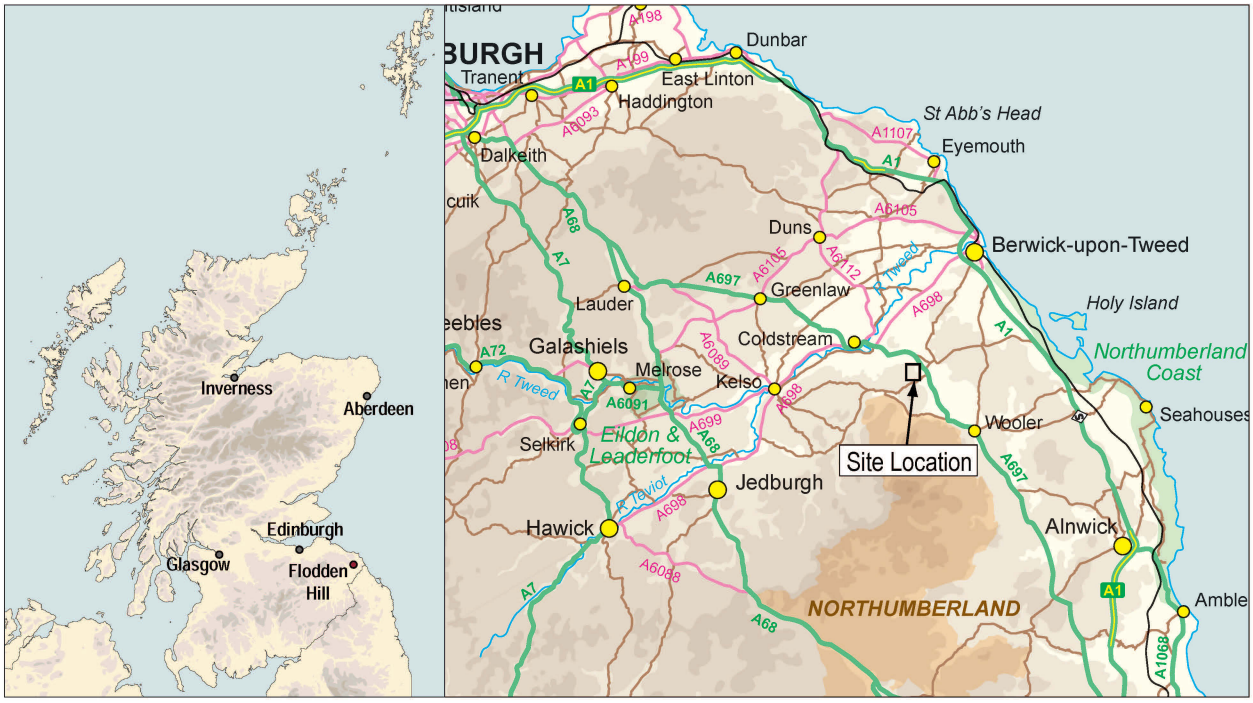


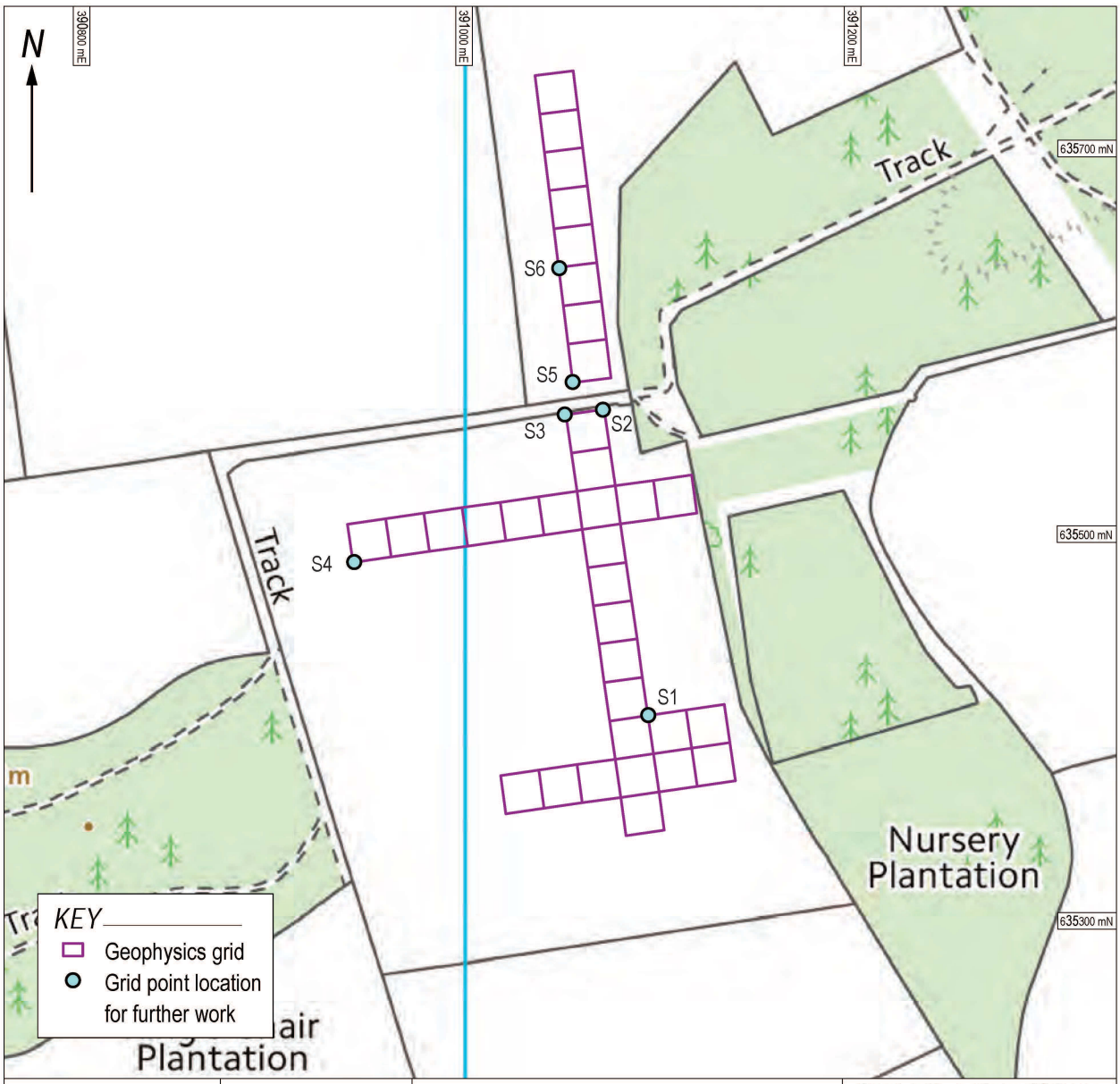


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*Figure 1: Site location.*

0 100 m

## Executive Summary

1.1 In April 2014, GUARD Archaeology Limited undertook a geophysical survey of part of Flodden Hill, Northumberland on behalf of the Flodden 1513 Ecomuseum. The survey, which was carried out as part of the Flodden 500 project, aimed to assess evidence for the past human use of the site, gauge its archaeological sensitivity and locate targets for future intrusive fieldwork.

1.2 The survey recorded a possible enclosure with internal features, two possible redoubts and what appear to be track-ways leading from the flat central area onto and beyond the ridge at the south of the site. The possible remains of cultivation rigs were also located.

## Introduction

2.1 This report sets out the results of a geophysical survey undertaken by GUARD Archaeology Limited on behalf of Flodden 1513 Ecomuseum Limited. The survey was carried out as part of the Flodden 500 project, and took place in the general vicinity of the Scottish army camp on Flodden Hill, Northumberland. The work was carried out between 14th and 18th April 2014, and was funded by the Heritage Lottery Fund.

2.2 The survey transects were carried out over two ridges and a relatively flat plateau within two fields located on Flodden Hill (NGR: centred at NT 91067 35507). In the northern field (Field 3), the terrain rose sharply from north to south, the difference in height over the eight grid transect being about 20 m. In the southern field (Field 2), the terrain rose more gently from north to south, and from east to west, the difference in height here being about 10 m.

2.3 The site is bounded to the west by King's Chair Plantation and to the east by forestry on Flodden Hill. Open fields lie to the north and south of the area. At the time of the fieldwork, the land was used for pastoral farming.

2.4 The bedrock over the site is Cheviot Volcanic Formation Andesite, an igneous rock type that formed in the Devonian Period (398 to 416 million years ago). The superficial geology is Devensian Till, deposited about 2 million years ago in glacial conditions. While the superficial geology would not adversely affect the geophysical survey, the presence of an igneous bedrock may be detected by the gradiometer, particularly in circumstances where the bedrock has intruded close to or above ground surface (BGS 1979).

## Aims and Objectives

3.1 The aims of this study were to identify geophysical evidence of any previously unrecorded archaeological or historical features within that part of Flodden Hill occupied by the Scottish army prior to the 1513 Battle of Flodden, and to recommend potential targets for future intrusive investigation.

3.2 In order to facilitate the location of excavation trenches, six inter-visible markers were left in the field. The locations of these stations are annotated on Figure 1 and their NGR co-ordinates are listed below.

| Station Number | Easting | Northing |
|---|---|---|
| S1 | 391094.0280 | 635406.6720 |
| S2 | 391071.3440 | 635565.0560 |
| S3 | 391051.5460 | 635562.2210 |
| S4 | 390941.2640 | 635485.8140 |
| S5 | 391055.1430 | 635578.9910 |
| S6 | 391047.7520 | 635638.5340 |

3.3 The specific objectives of the assessment were:

- to survey 1.3 hectares using gradiometry and resistivity;

- to report on the results of the investigations; and
- to utilise the information from these surveys to define areas that would benefit from further archaeological investigation.

## Methodology

4.1 The survey comprised a gradiometry survey and a resistivity survey. The gradiometry survey was carried out using a Geoscan FM256 Fluxgate Gradiometer and the resistivity survey was carried out using a Geoscan RM15 Resistivity meter with a twin-probe array and a fixed probe separation of 0.5 m.

4.2 For both geophysical techniques, readings were taken at a 0.5 m sample interval and a 1 m traverse interval, giving 800 survey points per 20 m by 20 m grid. This survey frequency allowed a good resolution of detail with the minimum impact in terms of the time required to complete the survey.

4.3 The data was downloaded into Geoplot v3 for analysis and plot production. The resulting plots were overlaid onto the existing plan of the site, showing where any anomalies lay in relation to the surface features. The location of the geophysical survey was recorded using a Leica Smart Rover sub-centimetre DGPS. This creates fully geo-referenced information for each grid point for the accurate placement of the geophysics results within the Ordnance Survey national grid, allowing for the ease of relocating areas identified for further assessment.

4.4 Gradiometers are very sensitive to the presence of metals and will produce erroneous readings if used in their proximity. In order to avoid collecting such anomalous data, no readings were taken within 4 m of the wire fences at the north and east of Field 2.

## Historical and Archaeological Background

5.1 Flodden Hill was one of the locations of the large Scottish army's encampment in the days leading up to the Battle of Flodden on 9th September 1513. Along with Flodden Edge and the King's Chair, Flodden Hill was heavily fortified by the Scots who occupied this elevated ground between 1st and 8th September. At least one of these fortifications, a redoubt, remains visible as a cropmark (English Heritage Monument Number 3682; NMR NT92NW 19), while a second redoubt within the woodland on Flodden Hill was investigated as part of the BBC2 television series 'Two Men in a Trench'.

5.2 The events leading up to the battle are well-known, and are summarised below.

5.3 Following the invasion of France by Henry VIII in 1513, King Louis XII requested assistance from his ally, King James IV of Scotland, in the form of a diversionary invasion of England. Despite having signed the Treaty of Perpetual Peace with England, King James IV led the Scottish muster south during late August, besieging and taking the castles at Norham, Etal and Ford en route.

5.4 With King Henry VIII in France, the Earl of Surrey led the English army into Northumberland to meet the Scottish army, by then occupying the ridge at Flodden Hill. Noting the strategic advantage the Scots had in holding the high ground and their formidable fortifications, Surrey requested that the battle take place on ground where neither side had such an obvious advantage. Following refusal of this request, Surrey out-manoeuvred James IV by moving the English army east and north to out-flank the Scots and cut off their retreat. This tactic forced James to move his army north to a small ridge above the village of Branxton, from where the Scots had to cross boggy ground in order to meet the English army.

5.5 In the ensuing battle, Scots casualties were high. James IV and a large number of the Scottish nobles were killed. King James's death was a catastrophe for Scotland, resulting in decades of political instability.

# Results

## Gradiometry survey

6.1 Thirty-four grids were surveyed using gradiometry, and 11 potential features were recorded over the site. The processed results are illustrated on Figure 2.

6.2 The most obvious features of the gradiometry survey are the rather dramatic looking black and white striped areas at the western ends of two east/west transects. Unfortunately, these have been caused by the underlying igneous bedrock, where the magnetic properties of the rocks has been enhanced by the intense and prolonged heat involved in their formation

6.3 Anomaly A lies at the extreme south of the site, and appears to be an oval-shaped feature with dimensions of about 18 m by over 20 m. This anomaly, which extends beyond the limit of the survey, seems to comprise either a ditch or bank that is about 2.5 m wide and has an apparent gap at the north-east. The feature may have interior elements, as shown by Anomaly R, a dark area measuring about 3 m by 3 m.

6.4 Anomaly B is a curvilinear area of higher positive readings that is ca. 15 m wide and, like Anomaly A, extends beyond the southern limit of the survey.

6.5 Anomaly C is an oval-shaped area measuring about 12 m by 8 m. This magnetic anomaly lies in close proximity to B, and may be the same type of feature.

6.6 On the flatter ground are four linear anomalies (D to G), three of which are aligned approximately east/west with the fourth being on a north-east/south-west alignment. Each of these is about 0.5 m wide, and all extend beyond the limit of the survey.

6.7 Anomaly H is a small area of magnetic disturbance at the northern end of Field 2. It is about 8 m long and 5 m wide.

6.8 Anomaly I is a small di-pole that is probably caused by the burial or casual loss of a small metal object.

6.9 Curvilinear Anomaly J has a similar morphology to E, F and G, and may even be a continuation of Anomaly G. Its recorded length is about 34 m and, like the aforementioned linear anomalies, is 0.5 m wide.

6.10 Anomaly K is a fairly large di-pole and, like Anomaly I, is probably caused by the burial or casual loss of a metal object.

## Resistivity survey

6.11 Thirty-four grids were surveyed using resistivity, and seven potential features were recorded over the Site. The processed results are illustrated on Figure 3. The raw data was de-spiked to remove erroneous data and was filtered to reduce the geological effects (darker areas) most visible at the south and north of the site.

6.12 As was the case with the gradiometry survey, the resistivity survey also recorded geological features, most notably on the ridges at the extreme north and south-west of the Site, while more discrete geological effects were recorded towards the south-east of the area. All of these areas are noted on Figure 3.

6.13 A small patch of higher resistance at the south of the site is at the same location of Anomaly A, and is probably related to that oval-shaped feature.

6.14 The resistivity survey also recorded an anomaly that may represent gradiometry Anomaly B. This irregularly-shaped area of slightly lower resistance corresponds in part to the location of B, but also extends into the presumed interior of Anomaly A. The relatively lower resistance recorded over this possible feature suggests that it may be negative-cut.

6.15 Anomaly C is a small area of higher resistance measuring about 3 m by 2 m located on the ridge at the south of the site.

6.16 Several linear and curvilinear anomalies were recorded in the central portion of the main north/south axis of the survey (between the transverse lines of grids). The geophysical picture is quite confused and although some of the features correspond to those detected by gradiometry (i.e. Anomalies D, E and G), the overall impression is of geological rather than archaeological features. The three identifiable archaeological anomalies appear as bands of slightly higher resistance. These are not so evident on the resistivity plot as they appear with gradiometry, which may reflect the sub-surface depth of these features.

6.17 Anomalies L and M are located at the south-east of the site, where they were recorded as parallel bands of lower resistance. Anomaly L is at least 20 m long, about 5 m wide and appears to flare out at its southern end. Anomaly M is slightly narrower, being 2 to 3 m wide and Anomaly N is a linear feature that is perpendicular to M, appearing to intersect with it at a right angle.

6.18 Adjoining N at its western extreme is a further linear anomaly (O) that was recorded for about 15m and is about 4 m wide. This feature was recorded as a negative-cut with stone or compacted soil forming its outer edges. Anomaly O may truncate sub-circular Anomaly P; the latter is about 10 m long and about 7 m wide.

6.19 Anomaly Q comprises two linear areas of markedly lower resistance among the geological interference at the south-westernmost part of the site. This potential feature is visible for ca. 7 m on its south-west/north-east 'leg' and about 2.5 m on its north/south 'leg'. Both legs extend beyond the limit of the survey.

## Discussion

7.1 Discounting the obvious geological interference noted on Figure 3, it appears that the resistivity survey has recorded further geological effects within the central section of the north/south axis. In this area, the data set shows many small and very irregular patches of relatively higher resistance and, while some of these appear to form lines, circles and ovals, this is unlikely to reflect sub-surface archaeological remains.

7.2 The fairly substantial oval-shaped gradiometry anomaly at the south of the site (Anomaly A) is located on elevated ground that has commanding views to the south and south-east. The morphology of this anomaly is consistent with an enclosure, the walls or defining ditches of which may contain a stone component. The resistivity survey recorded a small area of the higher resistance normally associated with heavily compacted subsoil or with sub-surface stone. The relatively limited extent of this resistivity anomaly in comparison with that recorded by gradiometry may indicate that the majority of this potential feature lies beyond the recording depth of the resistivity meter. A possible interior feature (Anomaly R) was recorded by gradiometry.

7.3 Anomaly B, recorded both by gradiometry and by resistivity, is located immediately north-west of A. These two anomalies may have a stratigraphic association as, following their projected outlines, the two should intersect at a point just out-with the limit of the survey. The relatively lower resistance recorded over Anomaly B suggests that this may be a negative-cut feature.

7.4 Anomaly C was also recorded by both survey techniques and, on the gradiometry plot, appears to have a similar shape and geophysical profile to Anomaly B. However, the higher resistance recorded here suggests that, unlike Anomaly B, this potential feature contains a stone element.

7.5 Anomaly D is aligned approximately east/west, runs downslope and may be the remains of a field drain. The magnetic disturbance at Anomaly H is relatively small-scale and may reflect ground disturbance associated with agricultural activity. Other possible agricultural remains may be represented by Anomalies E, F, G and J, all of which are aligned approximately north-east/south-west. Of these, F, G and, to a lesser extent, E are almost perfectly parallel and, while J has a more sinuous appearance, it may link up with Anomaly G. The width of these features is

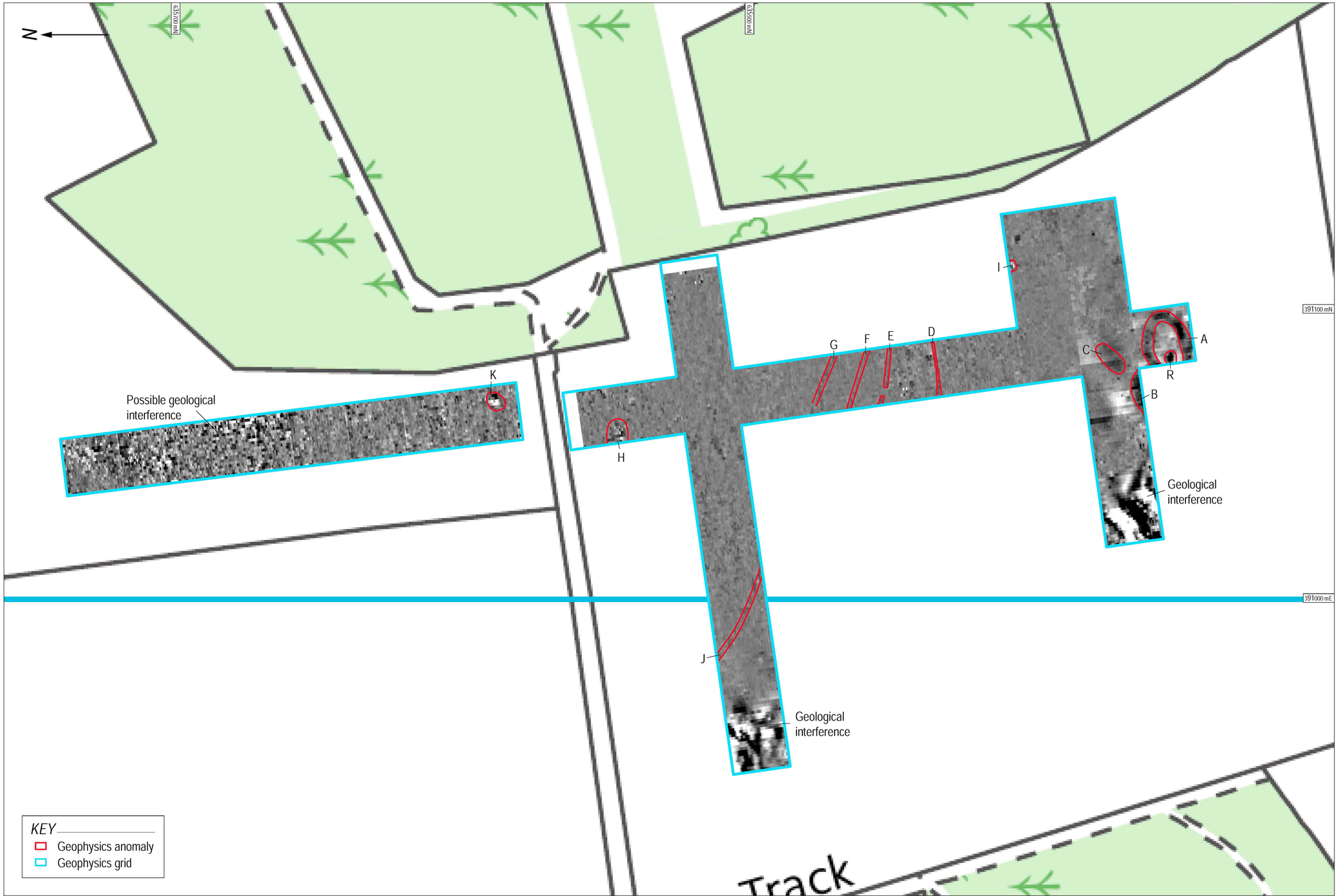


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*Figure 2:*
*Gradiometry survey results.*

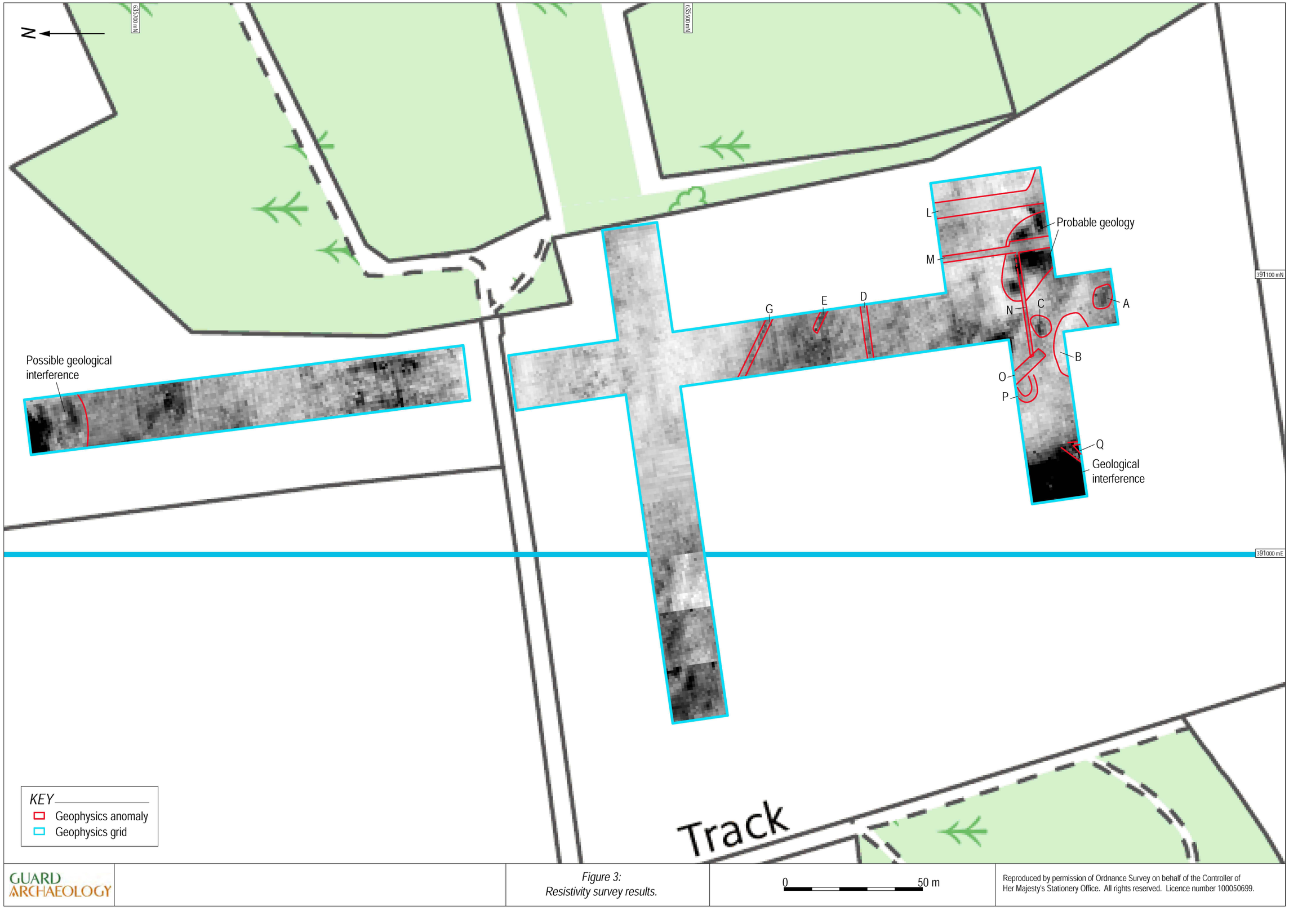


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*Figure 3:*
*Resistivity survey results.*

consistent with rig & furrow cultivation, and the curvilinear appearance of J may indicate that these are the type of 'broad, sinuous, high-backed rigs' that are found 'around the fringes of the Improved Landscape throughout the Tweed Basin' (Halliday 2001).

7.6 As previously mentioned, Anomalies I and K are di-poles. These types of geophysical anomaly are associated with the presence of metal or with areas of burning, where the magnetic properties of the soil have been altered by the intensity of the fire. The small size of Anomaly I is consistent with the loss or burial of a small metal object, while the stronger signal from Anomaly K may indicate burning or the burial of a larger metal object.

7.7 Linear Anomalies L and M were recorded as parallel areas of relatively lower resistance, suggesting that these are negative-cut features. From their location on the slope and plateau of the ridge, it is possible that these features represent the sub-surface remains of tracks or roads, possibly created to facilitate the movement of heavy artillery onto the summit of the ridge and beyond.

7.8 Anomaly N, which appears to link Anomalies M and O, may also have been a track for the movement of people and artillery uphill towards the highest point of the area surveyed. Factors that strengthen this interpretation are the possible stone component in the feature, which may have assisted with traction problems, and the possible redoubts represented by Anomalies P and Q.

## Conclusions and recommendations

8.1 The geophysical survey on Flodden Hill has revealed a number of anomalies that potentially indicate the survival of archaeological or historical remains that pre-date the current pastoral use of the site

8.2 Anomalies A, B, C, P, Q and R may be the remains of defence-works situated along the ridge that overlooks the presumed direction of the English attack. We would suggest that these potential features could be investigated via trial trenches, with the aim of establishing their nature, function and possible date-range.

8.3 The four possible tracks at the south of the Site (Anomalies L to O) may have been associated with the movement of people and/or artillery onto the southern ridge. We would suggest that these features could also be investigated via trial trenches, with the aim of establishing their nature and possible function.

8.4 While most of the remaining possible features are likely to be agricultural, investigation of the potential cultivation rigs (Anomalies E, F, G and J) may uncover datable evidence for this type of cultivation that was in use from the Medieval period until the late nineteenth century.

8.5 We would further suggest that additional geophysical survey, concentrating on the southern ridge, may be a useful method of determining the full extent of the possible tracks represented by Anomalies L and M, and in establishing the dimensions of the possible enclosure represented by Anomaly A.

## Acknowledgements

9.1 GUARD Archaeology would like to thank Chris Burgess of Flodden 1513 Ecomuseum Ltd for his input into the fieldwork. Technical and administrative support was provided by Jen Cochrane, Aileen Maule and John Kiely. The illustrations were produced by Fiona Jackson, who also carried out the GPS survey of the geophysics grids, and the report was desk top published by Gillian McSwan. The project was managed for GUARD Archaeology Limited by John Atkinson.

9.2 OASIS reference number: guardarc1-178014

# Flodden 500 Project
# Flodden Hill: Geophysical Survey

## Section 2: Appendices

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# Appendices

## Appendix A: Sources Consulted

British Geological Survey 1979 *Ford (S&D)* 1:50,000.

English Heritage website http://www.english-heritage.org.uk [Accessed 17 March 2014].

Halliday, S. 2001. 'Appendix 1: Rig and furrow in Scotland' in Barber, J. *Guidelines for the Preservation of Areas of Rig and Furrow in Scotland*. Scottish Trust for Archaeological Research. http://www.startrust.org.uk/RIG%20AND%20FURROW-AF.PDF [Accessed 1 May 2014].

## Appendix B: Geophysical Raw Data


*Figure 4:*
*Gradiometry raw data.*

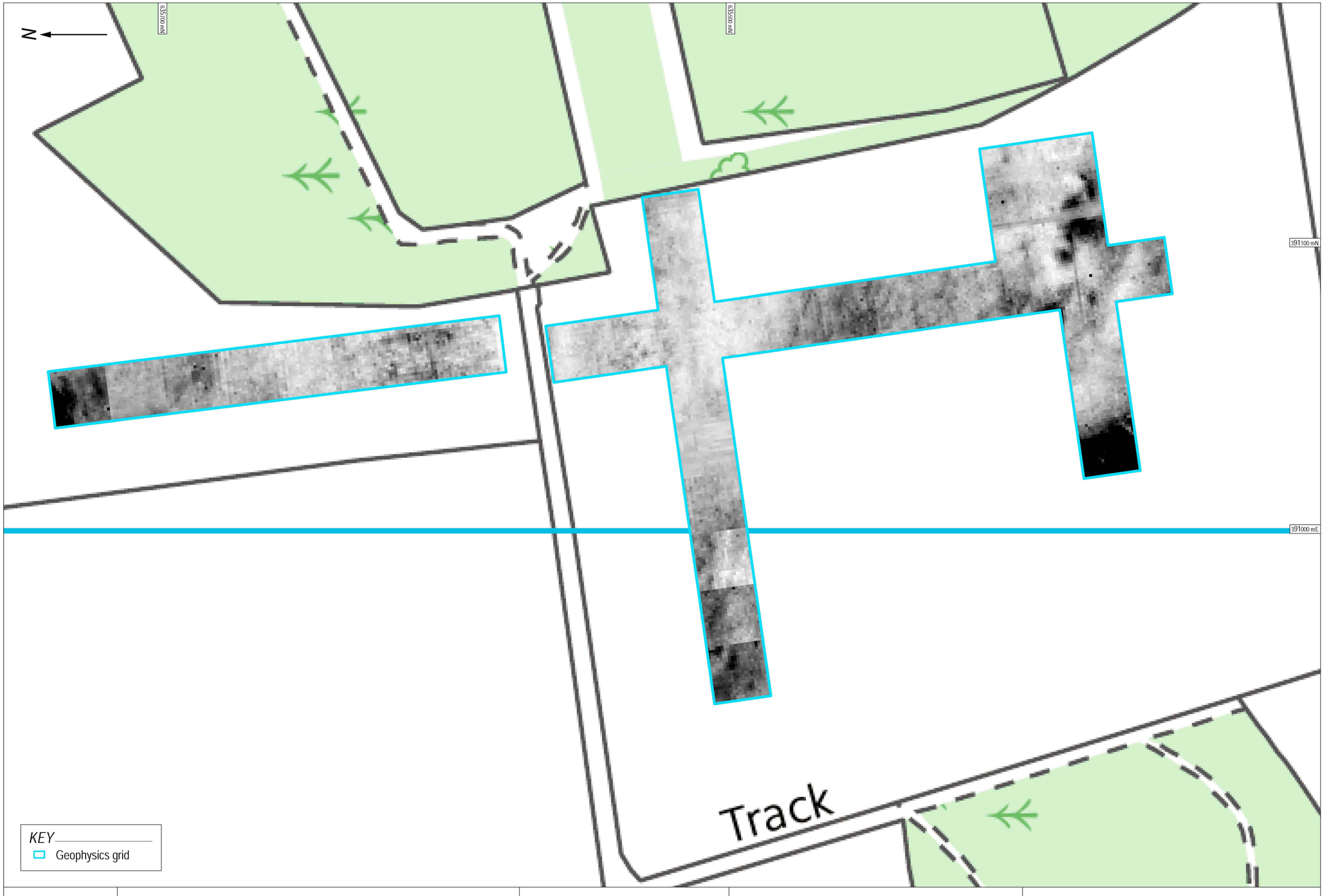


*Figure 5:*
*Resistivity raw data.*

GUARD Archaeology Limited
52 Elderpark Workspace
100 Elderpark Street
Glasgow
G51 3TR

Tel: 0141 445 8800
Fax: 0141 445 3222
email: info@guard-archaeology.co.uk

www.guard-archaeology.co.uk