




Largs Bowling Club: Geophysical Survey
Data Structure Report
Project 4255

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Largs Bowling Club: Geophysical Survey

Data Structure Report

On behalf of: Largs Bowling Club

NGR: NS 20572 60309

Project Number: 4255

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09/02/16	[signature]		

This document has been prepared in accordance with GUARD Archaeology Limited standard operating procedures.

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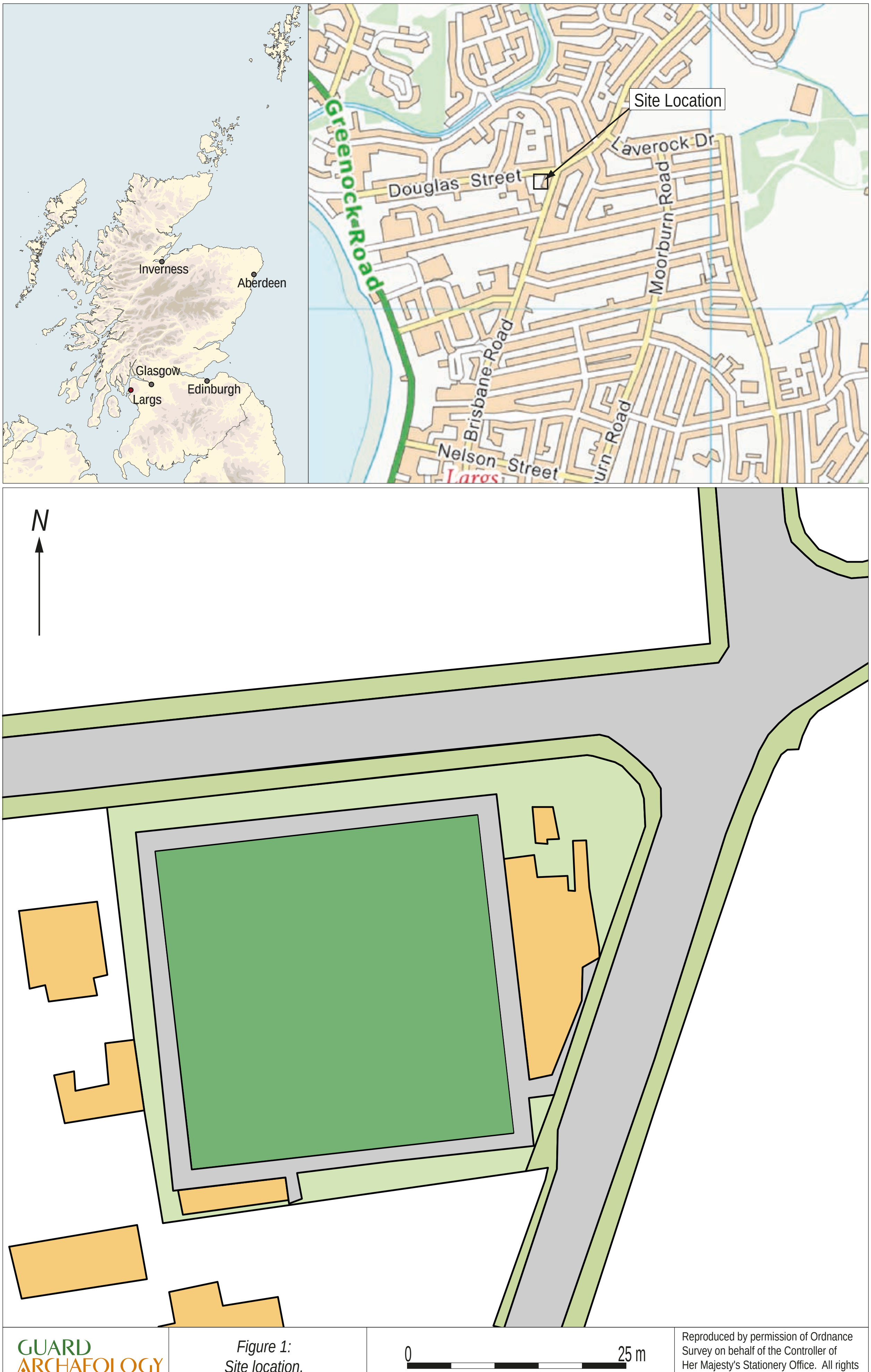

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Figure 1:
Site location.

Executive Summary

1.1 GUARD Archaeology Limited was commissioned by Largs Bowling Club to undertake a geophysical survey over the club bowling green in order to investigate and locate the drainage systems. Resistivity, gradiometry and metal detecting surveys were undertaken on 11th January 2016, and revealed some anomalies that could represent sub-surface drainage.

Introduction

2.1 This report sets out the results of a geophysical and metal detecting survey undertaken by GUARD Archaeology Ltd, on behalf of Largs Bowling Club over the club's bowling green. The aim of the fieldwork was to locate the drainage system below the green to enable remedial work to be carried out. During the course of the survey, several linear anomalies that could represent drainage systems were identified.

2.2 All elements of the fieldwork and any subsequent post-excavation work were undertaken in line with the following policies and guidelines of the Chartered Institute for Archaeologists (CIfA) of which GUARD Archaeology Ltd is a Registered Organisation:

- *By-laws: Code of Conduct* (2014); and
- *Standard and guidance for geophysical survey* (2014).

Site Location and Geology

3.1 Largs Bowling Club is located on the junction of Douglas Street and Brisbane Road, Largs, North Ayrshire (NS 20572 60309; Figure 1). The bowling green measures about 1521 m² (approximately 39 m by 39 m) and sits about 15 m AOD.

3.2 The green is surrounded by a drainage ditch which is edged with concrete slabs. Concrete slabs are located at each corner of the green to allow access onto the playing surface via portable steps. Outside the clubhouse, at the east end of the green are a series of metal props that support a plastic chain, preventing access to the green. At the time of the survey, the playing surface was already very wet, and heavy showers caused it to become more saturated.

3.3 The underlying bedrock is Kelly Burn Sandstone Formation, sedimentary Bedrock formed approximately 359 to 385 million years ago when the local environment was dominated by rivers. The superficial deposits are Raised Marine Deposits of mud, silt, sand and gravel (British Geological Survey, Geology of Britain Viewer). Neither of these geological units would be expected to have an adverse effect on the results of geophysical survey.

Aims and Objectives

4.1 The general aim of the survey was to use non-invasive techniques in order to identify any anomalies that could represent the existing or older drainage system present beneath the bowling green.

4.2 The objectives were therefore to;

- Carry out resistivity and gradiometry surveys across the extent of the bowling green in order to produce a detailed survey image.
- Accurately locate the grids using sub-centimetre GPS equipment so that results could be tied into the National Grid.
- Carry out a metal detecting survey of the area and locate any anomalies within the Ordnance Survey National Grid.

Historical Background

5.1 Although Largs Bowling Club was established in 1856, it did not move to its present location at the corner of Douglas Street and Brisbane Road until 1880. All of the plans and records dating back to the formation of the club were destroyed in the 1960s.

5.2 A river or watercourse is said to lie below the bowling green, running approximately NE to SW. A search of on-line maps available from the National Library of Scotland (NLS) was undertaken in an attempt to discover the whereabouts of this watercourse. Despite studying all available maps from the eighteenth to the early twentieth century, no evidence for this watercourse was found (Figures 2 and 3).

Figure 3: Excerpt from Ordnance Survey 1857 6" map Ayrshire Sheet III. Reproduced with permission of the Trustees of the National Library of Scotland.

Figure 2: Excerpt from Roy's 1747-55 Military Map of Scotland. Reproduced with permission of the Trustees of the National Library of Scotland.

Methodology

6.1 A series of four 20 m by 20 m grids (or part thereof) were established over the bowling green, and each grid was surveyed using gradiometry and resistivity. The metal detecting survey was carried out using transects spaced around 2 m apart.

6.2 Measurements of earth electrical resistance (resistivity) were recorded using a Geoscan RM15 Resistivity meter with an attached multiplex unit. A multiple probe array was utilised, with probe separations of 0.5 m and 1 m. The resistance sensitivity was set to 1.0 ohm, and a zig-zag traverse scheme was used. The traverse and sample intervals were 0.5 m, giving 1600 survey points for each grid.

6.3 Measurements of vertical geomagnetic field gradient (gradiometry) were recorded using a Geoscan FM256 Fluxgate Gradiometer, with a sensitivity setting of 1.0 nT (nanoTesla). A parallel traverse scheme was used, with data logged in 20 m by 20 m grids. The sample interval was 0.5 m and the traverse interval was 1 m, giving 800 survey points for each grid.

6.4 These survey frequencies allowed a good resolution of detail with the minimum impact in terms of the time required to complete the survey.

6.5 The data was downloaded into Geoplot v3 for processing, 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.

Limitations of geophysical survey

6.6 Gradiometers are very sensitive to the presence of metal, and will produce anomalous readings if used in their proximity. Some such obstacles were found at Largs Bowling Club, with the result that no readings could be taken within about 1 m of the chain fence located between the club house and the green.

6.7 Resistivity works on the basis of conductivity of an electrical current, and measures the resistance to that current at each point recoded. This resistance varies depending on several factors, including the composition of the soil. The regular sanding of the bowling green may have resulted in a build-up of this silica-rich material, which is a poor conductor of an electric current, and is known to result in artificially high resistance.

6.8 The layers that form the foundation platform for the bowling green could affect the readings and the data from the surveys, for example if burnt material had been used (ash, blaes or clinker).

Results

Resistivity Survey

7.1 The resistivity data was collected at two depths, 0.5 m and 1.0 m below ground surface, and the results are contained in Figures 4 and 5 respectively.

7.2 0.5 m depth

7.2.1 The greyscale plot shows five area of light grey/white (Anomaly A), and a rectangular banded dark grey/black area (Anomaly B) to the north-east of the centre of the green.

7.2.2 Anomaly A represents areas of lower earth electrical resistance than is found in the surrounding soil.

7.2.3 Anomaly B is a rectangular area aligned approximately south-east to north-west and measuring about 22 m by 15 m. This is an area where earth electrical resistance is higher than the resistance within the surrounding area.

7.2.4 No other potential features were recorded at this depth.

7.3 1 m depth

7.3.1 This greyscale plot also shows Anomaly A on the northern edge of the green and in the north-west and south-east quadrants.

7.3.2 Anomaly B appears to be slightly less well defined at 1 m depth, but still appears to be rectangular in shape.

7.3.3 No other potential features were recorded at this depth.

Gradiometry Survey

7.4 The gradiometry survey (Figure 6) identified three linear anomalies, all of which are aligned south-east to north-west across the bowling green (Anomalies C, D and E). The most distinct of these is Anomaly C, which is at least 34 m long and up to 1 m wide.

7.5 Anomaly D is a more subtle feature lying to the north-east of Anomaly C. It is visible for about 15 m and, like Anomaly C, is about 1 m wide.

7.6 Anomaly E is also a more subtle feature, and is located to the south-west of Anomaly C. This linear feature is about 17 m long and about 0.5 m wide.

7.7 A possible fourth linear anomaly (Anomaly F) may lie at the north-east corner of the bowling green, but is masked by magnetic disturbance in that area. This disturbance, which is also found on the west, south and east sides of the area surveyed, is indicative of the presence of metal, and is almost certainly caused by modern infrastructure associated with lighting around the green.

7.8 No other potential features were recorded by gradiometry.

Metal Detecting Survey

7.9 The metal detecting survey did not record any linear anomalies, or other points of interest.

Discussion

8.1 The areas of relatively lower resistance noted as Anomaly A are almost certainly caused by moisture retained within the soil, which allows a current to easily pass through. The localised nature of these areas of lower resistance may indicate slight variations in the composition of the soil, making it less free-draining.

8.2 Resistivity Anomaly B represents higher resistance which is most often recorded over areas of sub-surface stone, or where soils are heavily compacted. Such higher resistance could also be the result of the silica component of sand which, although free-draining, does not easily conduct an electric current.

8.3 Anomaly C and, to a lesser extent, Anomalies D and E have the appearance of negative-cut features. The combination of slightly negative and slightly positive readings along the course of Anomaly C indicates some disturbance of the soil, with the in-fill material having marginally different magnetic properties to the surrounding soil. The geophysical signature of ditches can consist of one or more linear bands where the readings recorded over the ditch cut are noticeably different to those recorded on either side of the ditch. Depending on the nature of the ditch fill, the readings over the ditch cut can be more strongly positive or negative than the readings over the surrounding soil.

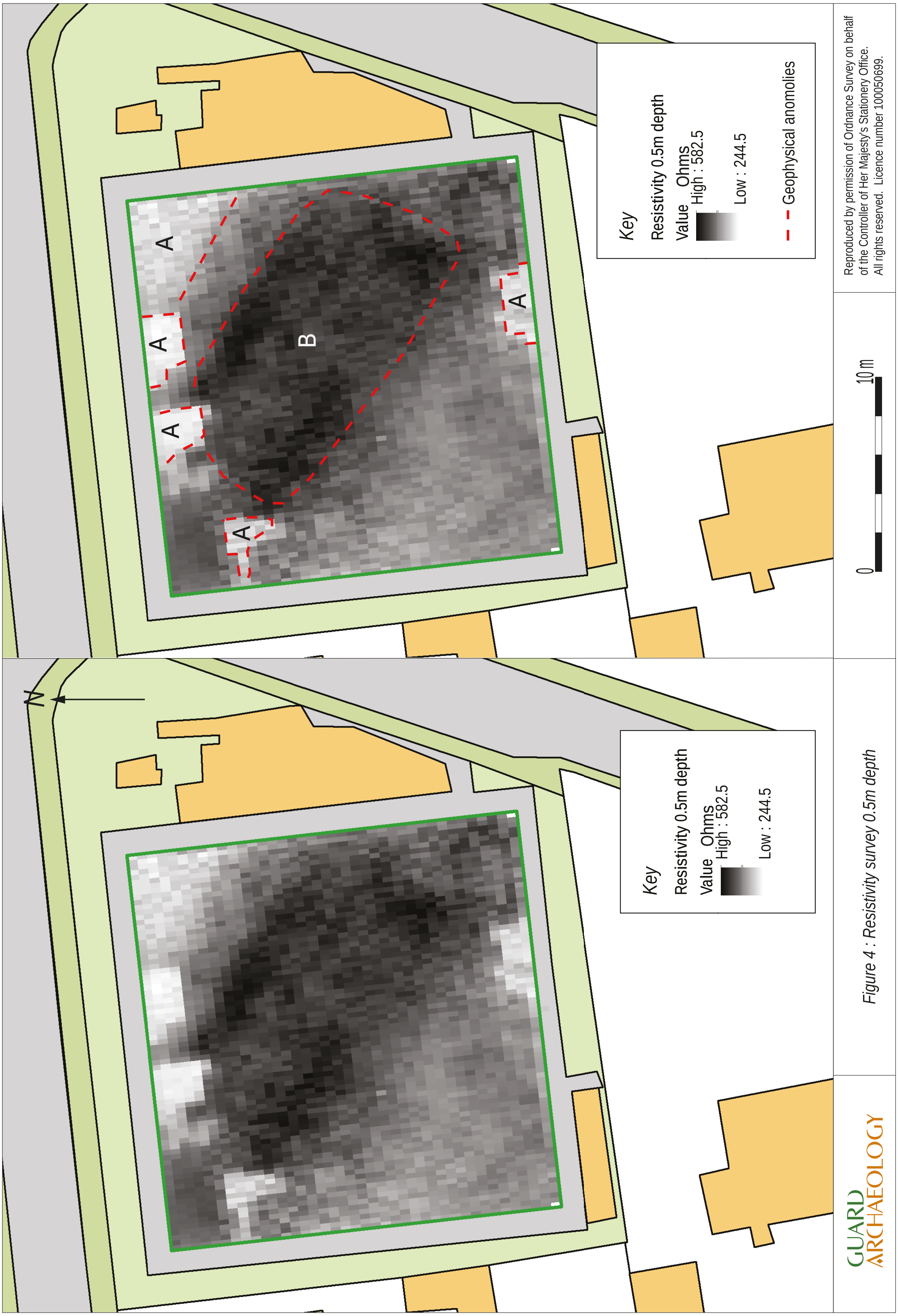
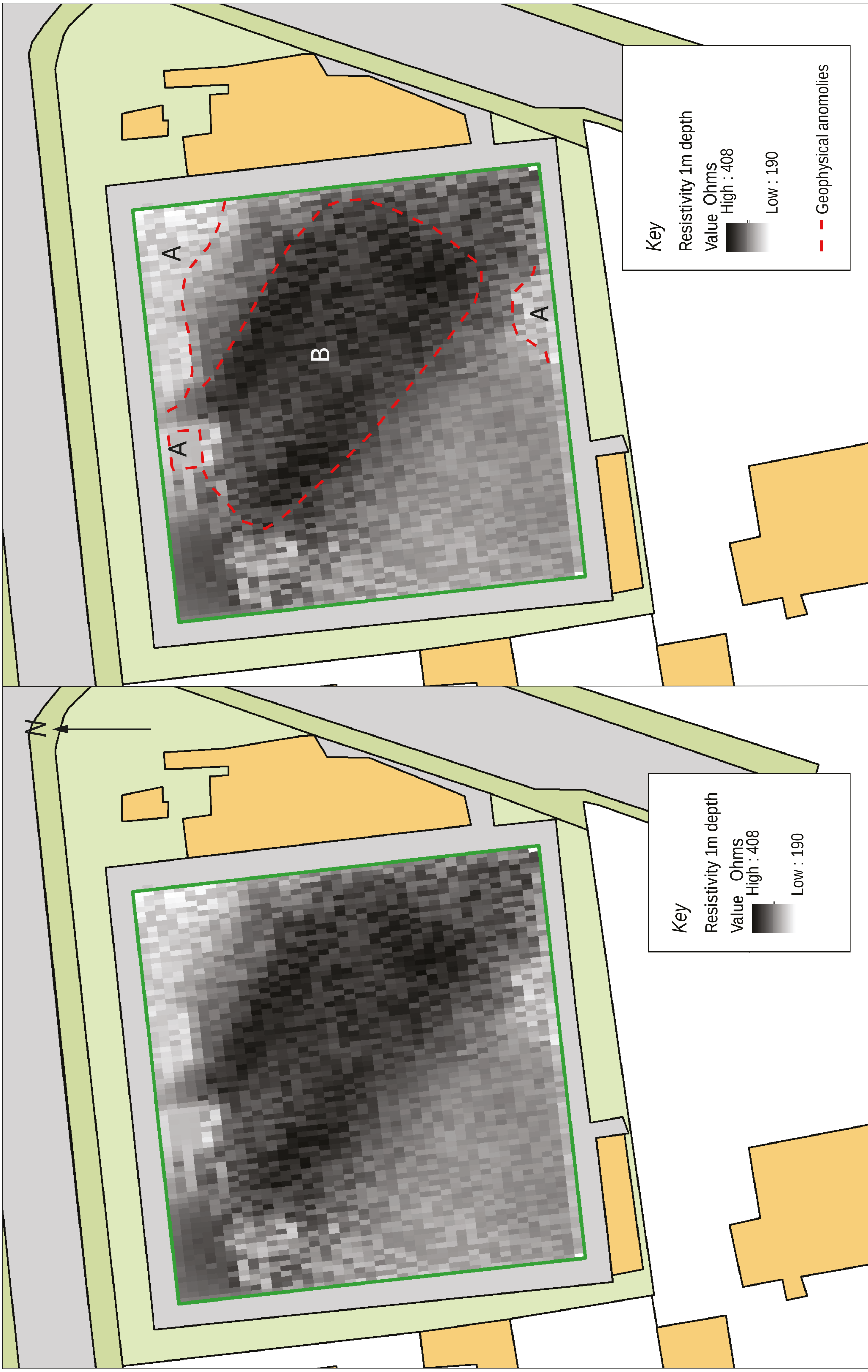


Figure 4 : Resistivity survey 0.5m depth



0 10 m

Figure 5 : Resistivity survey 1m depth

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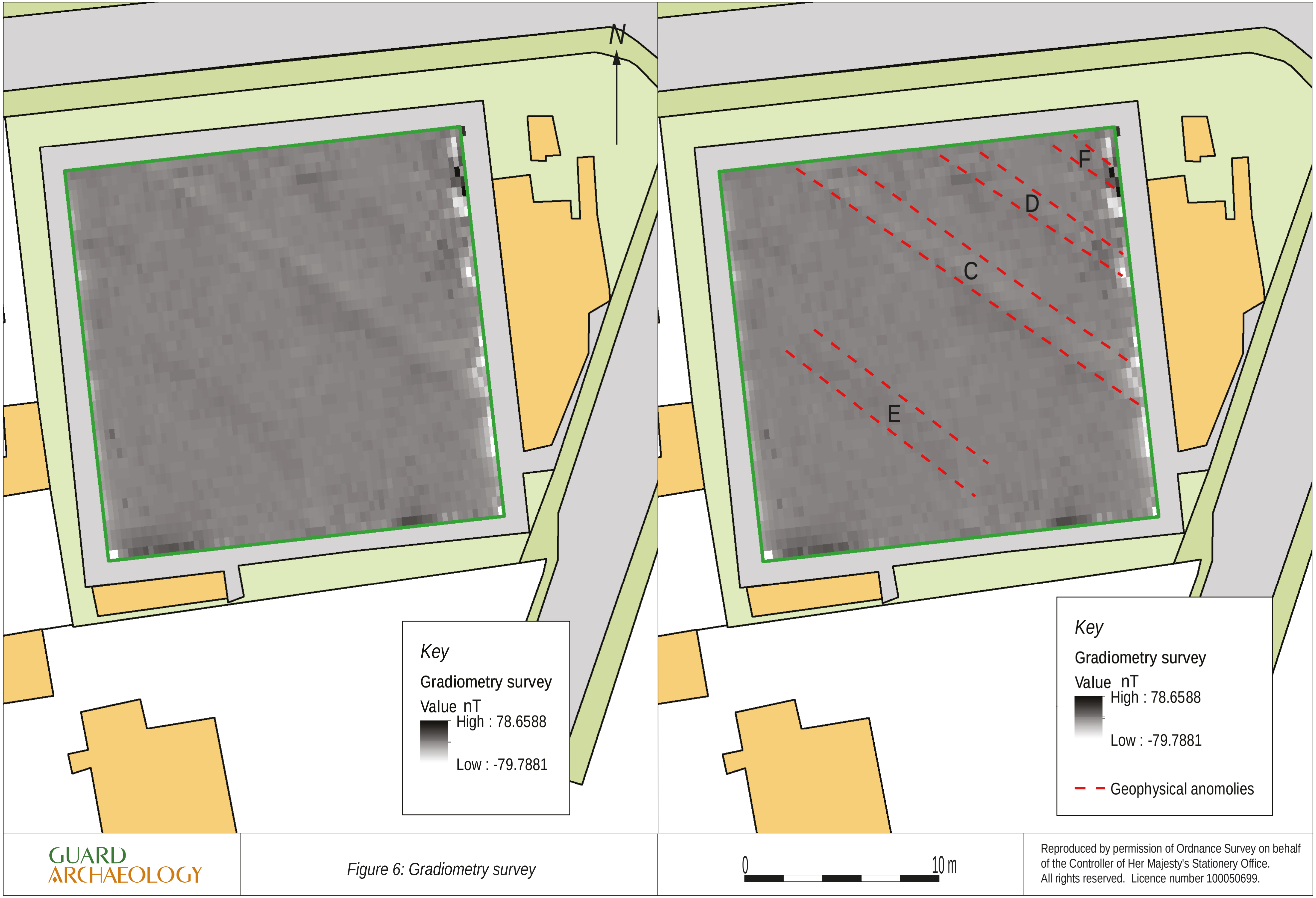

Figure 6: Gradiometry survey

8.4 The morphology of Anomalies C, D and E strongly suggests that these are cut features lying at a depth of about 0.5 m to 0.75 m below the surface of the bowling green. The linear features are not equidistant, as C lies about 10 m north-east of E, and D is located about 7 m north-east of C. The features do, however, create a fairly regular pattern across the bowling green, and are of similar enough dimensions to suggest that they are all related.

Conclusions

9.1 The surveys identified three linear anomalies (Anomalies C, D and E) at Largs Bowling Green that have the characteristics of cut features. While it is very likely that these are cuts for drainage channels, the fieldwork could not positively establish this. No evidence for ceramic, or other types of pipe, was recorded within these channels, although their presence cannot be ruled out.

9.2 Should the linear anomalies prove to be drain cuts, they may be draining into Douglas Street or Brisbane Road. Intrusive work would be required in order to further investigate any of the geophysical anomalies.

9.3 The remaining anomalies recorded by resistivity (Anomalies A and B) do not represent sub-surface features, but are most probably a reflection of the soil composition over the extent of the bowling green.

Acknowledgements

10.1 GUARD Archaeology would like to thank Largs Bowling Club and, in particular Ron Hempseed, for their assistance during the survey. The fieldwork was carried out by Diarmuid O'Connor and Christine Rennie, with technical support from Aileen Maule. The post-fieldwork data processing was carried out by Christine Rennie. The illustrations were produced by Diarmuid O Connor, and the report was desk top published by Gillian McSwan. The project was managed for GUARD Archaeology Limited by Bob Will.

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Section 2: Appendices

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Appendices

Appendix A: References

Roy, W 1747-55 *Military Map of Scotland*.

Ordnance Survey 1857 *Ayr Sheet III*. First Edition 6" to the mile map series.

British Geological Survey, Geology of Britain Viewer. Available at http://mapapps.bgs.ac.uk/geologyofbritain/home.html. Accessed 12th January 2016.

Appendix B: Raw Data

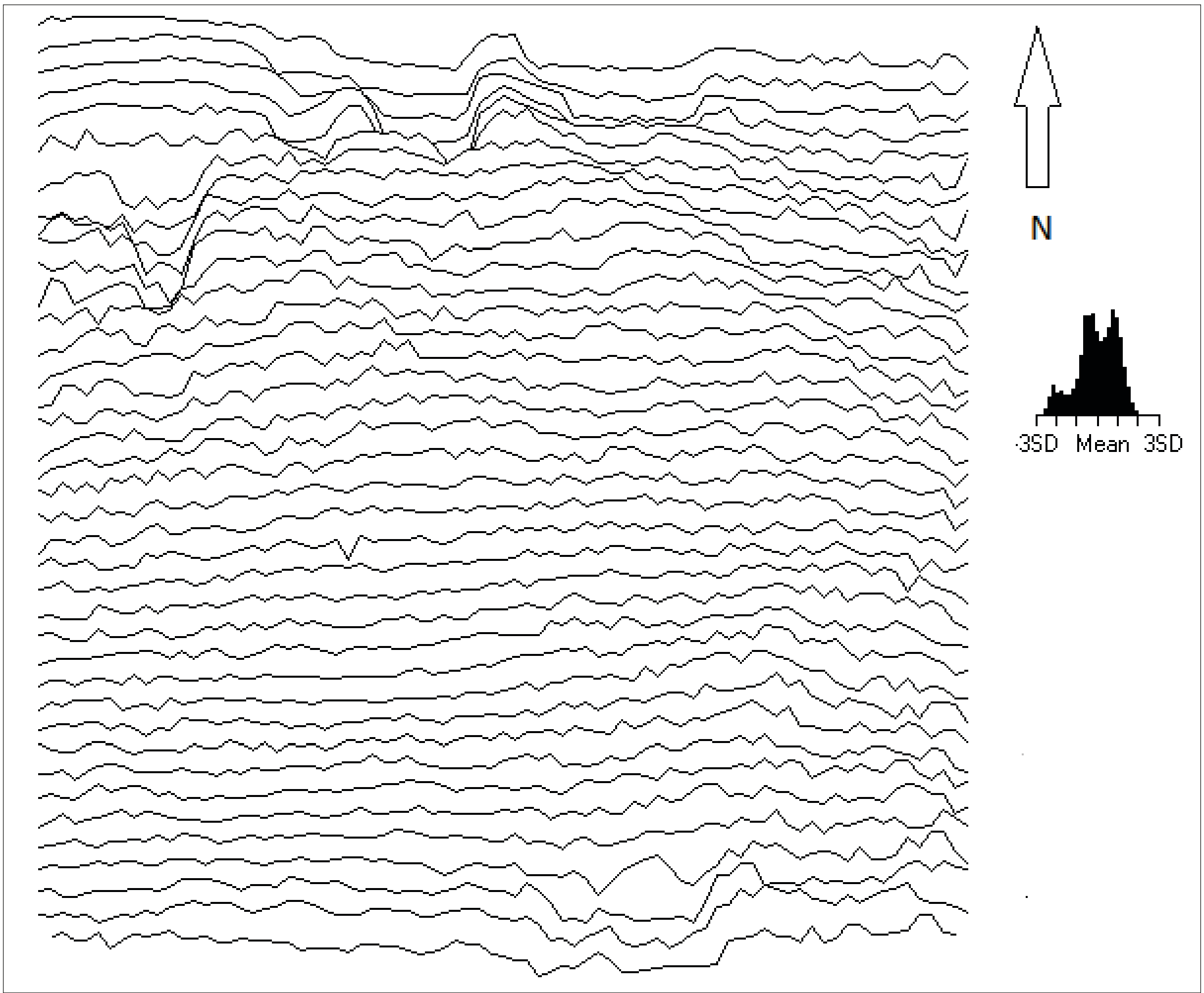

Figure 7. Raw resistivity data trace plot, 0.5 m depth.

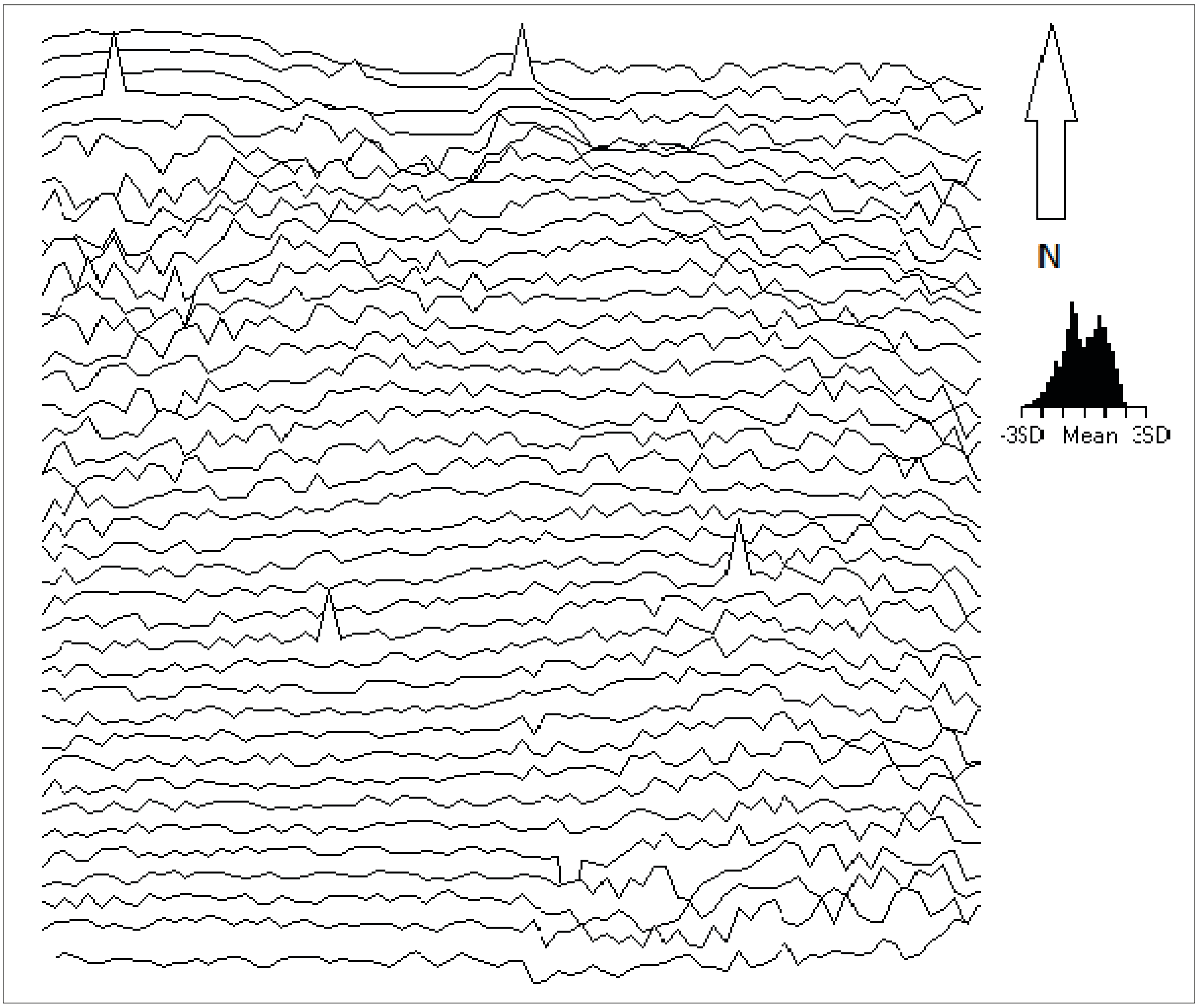

Figure 8. Raw resistivity data trace plot, 1 m depth.

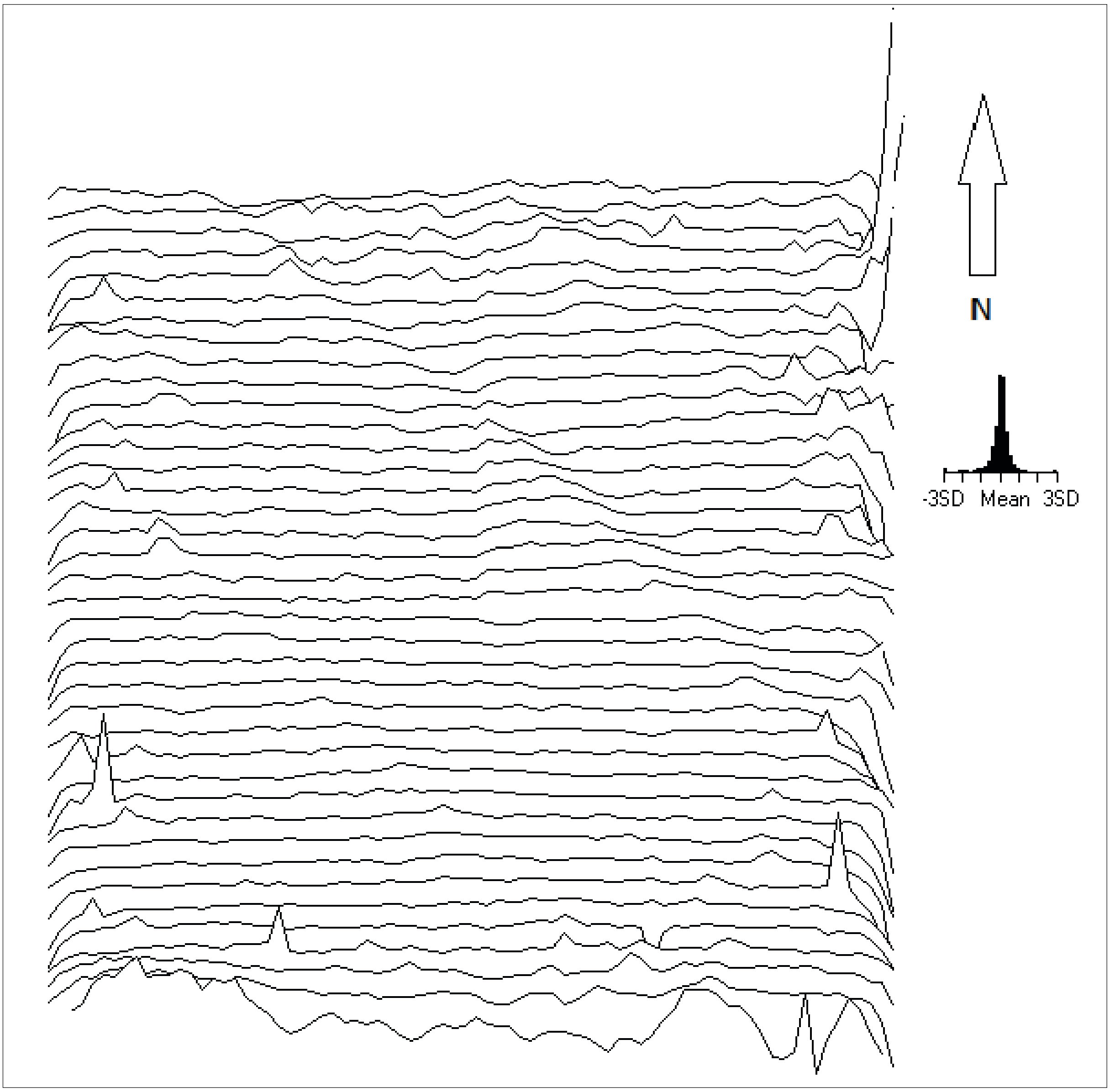

Figure 9. Raw gradiometry data trace plot.

Appendix C: Processing of Geophysical Data

Resistivity

The raw data was de-spiked to remove any artificially high or low readings.

Gradiometry

Zero Mean Traverse was applied in order to even out the data. The data was then de-spiked to reduce artificially high and low readings.

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