

BORDON GARRISON REDEVELOPMENT, HAMPSHIRE

AREA 2 (TTA) GEOPHYSICAL SURVEY

commissioned by Amec Foster Wheeler

55587/001

September 2016





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project info

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ab



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PROJECT SUMMARY

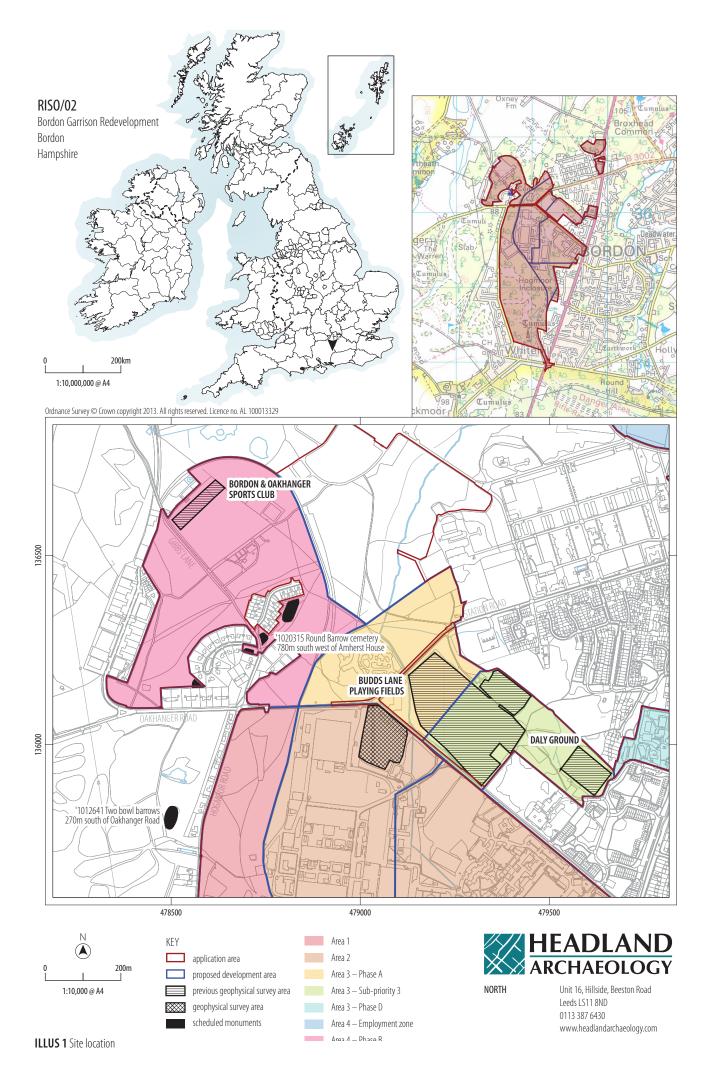
Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey, covering 1.5 hectares, in advance of the proposed redevelopment of Area 2 (TTA), part of the former Bordon Garrison site in Hampshire. The survey has identified areas of magnetic disturbance which could mask the much weaker responses from archaeological deposits, if present. Linear anomalies caused by a comprehensive system of land drains are consistent with the recent use of the site as a cricket ground. No anomalies of possible archaeological potential have been identified. The archaeological potential of this area is assessed as very low based on the results of the survey.

CONTENTS

| 1 | INTRODUCTION | 1 | |
|--------------------------------------|------------------------------------------------|----|--|
| | 1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE | 1 | |
| | 1.2 GEOLOGY AND SOILS | 1 | |
| 2 | ARCHAEOLOGICAL BACKGROUND | | |
| 3 AIMS, METHODOLOGY AND PRESENTATION | | 2 | |
| | 3.1 MAGNETOMETER SURVEY | 2 | |
| | 3.2 REPORTING | 2 | |
| 4 RESULTS AND DISCUSSION | | 2 | |
| | Magnetic background | 2 | |
| | 4.1 FERROUS ANOMALIES | 2 | |
| | 4.2 GEOLOGICAL ANOMALIES | 3 | |
| 5 | CONCLUSION | | |
| 6 | REFERENCES | | |
| 7 | APPENDICES | 8 | |
| | APPENDIX 1 MAGNETOMETER SURVEY | 8 | |
| | Magnetic susceptibility and soil magnetism | 8 | |
| Types of magnetic anomaly | | 8 | |
| | APPENDIX 2 SURVEY LOCATION INFORMATION | 9 | |
| | APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE | 9 | |
| | APPENDIX 4 OASIS DATA COLLECTION FORM: ENGLAND | 10 | |
| | OASIS ID: headland5-262132 | 10 | |

LIST OF ILLUSTRATIONS

| ILLUS 1 SITE LOCATION | VIII |
|----------------------------------------------------------------------------------------------------|------|
| ILLUS 2 SURVEY LOCATION SHOWING GREYSCALE MAGNETOMETER DATA AND AREAS OF PREVIOUS SURVEY (1:2,000) | 4 |
| ILLUS 3 PROCESSED GREYSCALE MAGNETOMETER DATA (1:1,250) | 5 |
| ILLUS 4 XY TRACE PLOT OF MINIMALLY PROCESSED MAGNETOMETER DATA (1:1,250) | 6 |
| ILLUS 5 INTERPRETATION OF MAGNETOMETER DATA (1:1,250) | 7 |



BORDON GARRISON REDEVELOPMENT, HAMPSHIRE

AREA 2 (TTA) GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Amec Foster Wheeler (the Client) on behalf of The Whitehill and Bordon Regeneration Company Limited (the Developer) to undertake a geophysical (magnetometer) survey at Bordon Garrison, Hampshire (see Illus 1). The survey will inform forthcoming archaeological strategy in advance of the proposed redevelopment of the site and the adjoining land into residential and commercial units, transport links and open space (East Hampshire District Council Planning Ref. 55587/001). This report covers the survey of Area 2 (TTA) of the overall proposed development area (PDA) and is the third of a series of surveys being undertaken on the former military site (see also Headland Archaeology 2016a and 2016b).

The work was undertaken in accordance with a Written Scheme of Investigation (Headland Archaeology 2016) which was submitted to Hampshire County Council's Historic Environment Team, with guidance contained within the National Planning Policy Framework (DCLG 2012) and in line with current best practice (English Heritage 2008).

The survey was carried out on September 6th 2016 in order to provide information on the archaeological potential of the Area 2 (TTA) PDA.

1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The Application Boundary comprises former Ministry of Defence land on the western side of the A325 between Bordon and Whitehall, Hampshire, centred on NGR SU 790 352. It is subdivided into several PDA's (see Illus 1). This report is concerned with Area 2 (TTA) only.

The survey area is centred at NGR SU 791 360 and comprised an area of short grass most recently in use as a cricket ground, part of the Budds Lane sports facility. It is bounded by Budds Lane to the north-

east with former garrison facilities to the south and west. The site was flat at approximately 76m above Ordnance Datum.

1.2 GEOLOGY AND SOILS

The underlying bedrock comprises sandstone of the Folkestone Formation. No superficial deposits are recorded (NERC 2016).

The soils are classified in the Soilscape 14 association, characterised as freely draining very acid sandy and loamy soils (Cranfield University 2016). However, it is worth considering that, owing to recent land use (both military and sports/recreational) there is likely to be some disparity between this classification and the actual condition of the soils across the PDA.

2 ARCHAEOLOGICAL BACKGROUND

No known archaeological remains are recorded within the geophysical survey areas. However, a Heritage Statement (AMEC 2014) for the wider PDA concluded that:

'...there is a strong likelihood that sub-surface archaeological remains will be present within some of the application areas but not in all. Heritage assets potentially affected include Mesolithic artefact scatters and working floors, Bronze Age ritual and funerary remains and 20th century military remains, including extant structures.'

There is significant evidence for Bronze Age funerary remains 350m north-west of the survey area where a round barrow cemetery (Scheduled Monument 1020315; see Illus 1) comprising five prehistoric burial mounds is recorded. In addition a further twenty burial mounds (including another five scheduled monuments) are recorded within 2km of the application area.

3 AIMS, METHODOLOGY AND PRESENTATION

The main aim of the geophysical survey was to identify and assess the nature and extent of any anomalies which may relate to subsurface features or deposits of archaeological interest within the footprint of the PDA. The survey also aimed to identify any areas of disturbance or activity which may have affected the archaeological evaluation and establish the suitability of site conditions (geology, soils etc.) and any variability within the site as evidence from the responses encountered during the survey.

The general archaeological objective of the geophysical survey was to produce a full report to include the analysis and interpretation of the survey, and to include commentary on the perceived effectiveness of the survey in response to ground conditions. This will inform decisions regarding the nature and scope of any further scheme of archaeological works that may be required.

3.1 MAGNETOMETER SURVEY

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. A feature such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney & Gater 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.

The survey was undertaken using four Bartington Grad601 sensors mounted at 1m intervals (1m traverse interval) onto a rigid carrying frame. The system is programmed to take readings at a frequency of 10Hz (allowing for a 10-15cm sample interval) on roaming traverses 4m apart. These readings are stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system is linked to a Trimble R8s Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point.

MLGrad601 and MultiGrad601 (Geomar Software Inc.) software has been used to collect and export the data. Terrasurveyor V3.0.28.4 (DWConsulting) software has been used to process and present the data.

Marker canes were laid out using a Trimble VRS differential Global Positioning System (Trimble GeoXR model).

3.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:10,000. Illus 2 shows the greyscale data in relation to the data from the adjacent Area 3 site at scale 1:2000. The processed data in greyscale and XY trace format, together with an interpretation graphic, are presented at a scale of 1:1,250 in Illus 3, 4 and 5.

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2

details the survey location information and Appendix 3 describes the composition and location of the site archive. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 4.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (Headland Archaeology 2016) and guidelines outlined by English Heritage (English Heritage 2008) and by the Chartered Institute for Archaeologists (CIfA 2014). All illustrations reproduced from Ordnance Survey mapping are with the permission of the controller of Her Majesty's Stationery Office (Ó Crown copyright).

The illustrations in this report have been produced following analysis of the data in unprocessed, minimally processed and fully processed formats and over a range of different display levels. All illustrations are presented to most suitably display and interpret the data from this site based on the experience and knowledge of management and reporting staff.

4 RESULTS AND DISCUSSION

Magnetic background

The magnetic dataset is dominated by high magnitude linear anomalies and areas of magnetic disturbance making a confident assessment of the background magnetic contrast difficult.

4.1 FERROUS ANOMALIES

Ferrous anomalies, characterised as individual 'spikes', are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an archaeological interpretation, as modern ferrous debris or material is common on most sites, often being present as a consequence of manuring or tipping/infilling. On this site there are relatively few ferrous spikes compared to the number on the site on the other side of Budds Lane (see Illus 2).

A single high magnitude dipolar linear (SP – see Illus 5) is caused by a sub-surface ferrous pipe.

The remainder of the linear anomalies are due to a system of land drains to improve the drainage of the cricket ground. The cricket wicket, CW, is clearly identifiable as a rectangular high magnitude anomaly in the centre of the survey area.

Within the north-west of the survey area a broad area of magnetic disturbance corresponds to an area of ground disturbance, GD, with is shown on Google earth imagery (Infoterra & Bluesky 2016). The disturbance is due to ferrous material (e.g. concrete, brick, gravels) spread within the topsoil.

Other areas of disturbance around the perimeter of the survey areas is due to ferrous material within the boundaries and to the proximity of buildings.

4.2 GEOLOGICAL ANOMALIES

Discrete areas of magnetic enhancement are identified throughout the surveyed areas. The low magnitude and even distribution of these anomalies suggests a geological or pedological origin. The anomalies are thought to be due to localised variations in the depth and composition of the soils.

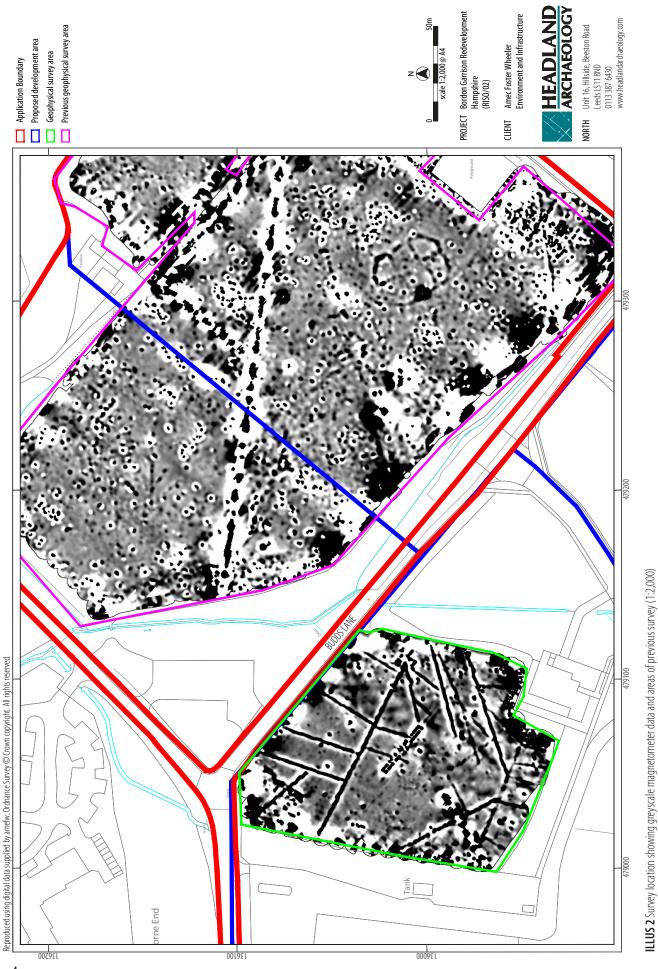
5 CONCLUSION

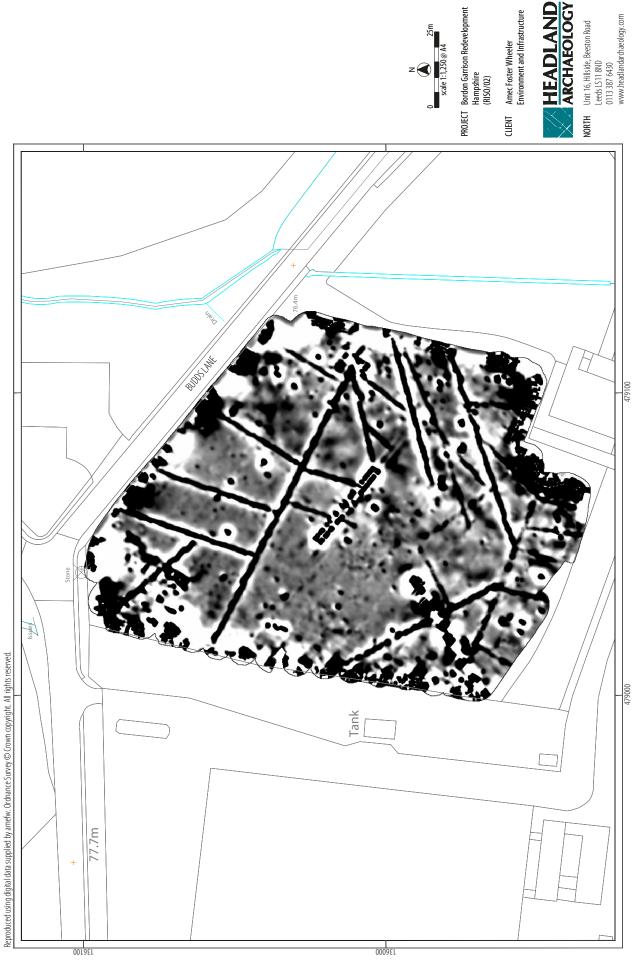
The geophysical survey has identified anomalies consistent with the most recent usage of the site as a cricket pitch. All other anomalies reflect modern activity. No anomalies of possible archaeological origin have been identified and therefore the archaeological potential of this site is assessed as very low.

6 **REFERENCES**

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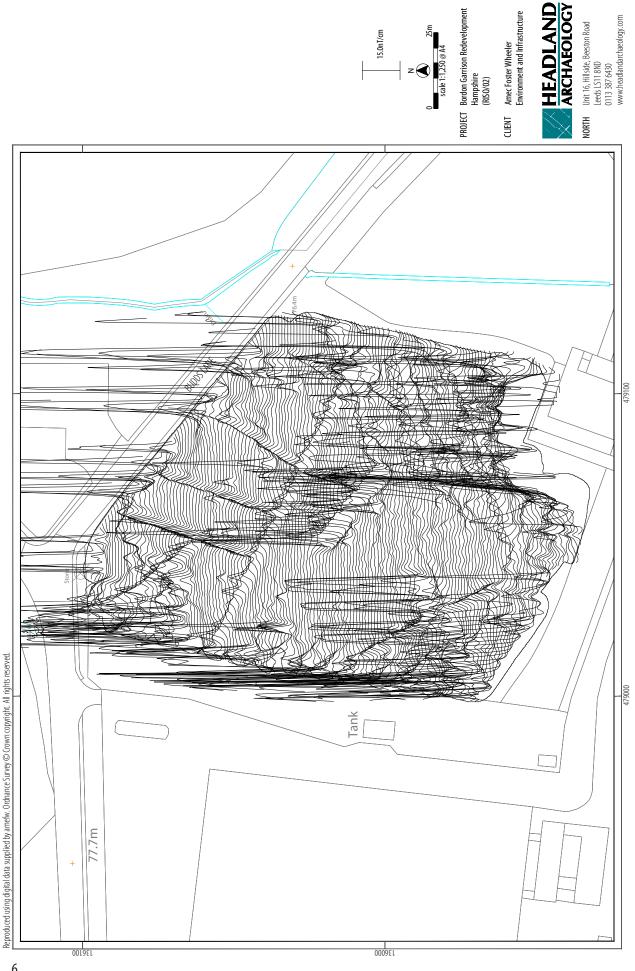




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ILLUS 3 Processed greyscale magnetometer data (1:1,250)



ILLUS 4 XY trace plot of minimally processed magnetometer data (1:1,250)

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7

ILLUS 5 Interpretation of magnetometer data (1:1,250)

7 APPENDICES

APPENDIX 1 MAGNETOMETER SURVEY

Magnetic susceptibility and soil magnetism

Iron makes up about 6% of the earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haematite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms so that by measuring the magnetic susceptibility of the topsoil, areas where human occupation or settlement has occurred can be identified by virtue of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected.

The magnetic susceptibility of a soil can also be enhanced by the application of heat. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

Types of magnetic anomaly

In the majority of instances anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can therefore remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes)

These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance

These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend

This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies

Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an XY trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often therefore be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies

Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

APPENDIX 2 SURVEY LOCATION INFORMATION

GPS-based survey

An initial survey base station was established using a Trimble VRS differential Global Positioning System (dGPS). The magnetometer data was georeferenced using a Trimble RTK differential Global Positioning System (Trimble R8s model).

Temporary sight markers were laid out using a Trimble VRS differential Global Positioning System (Trimble R8s model) to guide the operator and ensure full coverage. The accuracy of this dGPS equipment is better than 0.01m.

The survey data were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if coordinates are measured off hard copies of the mapping rather than using the digital coordinates.

Headland Archaeology cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE

The geophysical archive comprises:

 an archive disk containing the raw data in XYZ format, a raster image of each greyscale plot with associate world file, and a PDF of the report

The project will be archived in-house in accordance with recent good practice guidelines (http://guides.archaeologydataservice. ac.uk/g2gp/Geophysics_3). The data will be stored in an indexed archive and migrated to new formats when necessary.

APPENDIX 4 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: headland5-262132

| PROJECT DETAILS | |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PROJECT NAME | Bordon Garrison Redevelopment: Area 2 (TTA): Geophysical Survey |
| SHORT DESCRIPTION OF THE PROJECT | Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey, covering 1.5 hectares, in advance of the proposed redevelopment of Area 2 (TTA), part of the former Bordon Garrison site in Hampshire. The survey has identified areas of magnetic disturbance which could mask the much weaker responses from archaeological deposits, if present. Linear anomalies caused by a comprehensive system of land drains are consistent with the recent use of the site as a cricket ground. No anomalies of possible archaeological potential have been identified. The archaeological potential of this area is assessed as very low based on the results of the survey. |
| PROJECT DATES | Start: 06-09-2016 End: 06-09-2016 |
| PREVIOUS/FUTURE WORK | Not known / Not known |
| ANY ASSOCIATED PROJECT REFERENCE CODES | RISO-02 - Contracting Unit No. |
| TYPE OF PROJECT | Field evaluation |
| SITE STATUS | None |
| CURRENT LAND USE | Other 14 - Recreational usage |
| MONUMENTTYPE | N/A None |
| MONUMENTTYPE | N/A None |
| SIGNIFICANT FINDS | N/A None |
| SIGNIFICANT FINDS | N/A None |
| METHODS & TECHNIQUES | "Geophysical Survey" |
| DEVELOPMENTTYPE | Not recorded |
| PROMPT | National Planning Policy Framework – NPPF |
| POSITION IN THE PLANNING PROCESS | After outline determination (eg. As a reserved matter) |
| SOLID GEOLOGY (OTHER) | Folkstone Formation – sandstone |
| DRIFT GEOLOGY (OTHER) | None |
| TECHNIQUES | Magnetometry |
| PROJECT LOCATION | |
| COUNTRY | England |
| SITE LOCATION | HAMPSHIRE EAST HAMPSHIRE WHITEHILL Bordon Garrison Redevelopment: Area 2 (TTA) |
| POSTCODE | GU35 9HQ |
| STUDY AREA | 1.5 Hectares |
| SITE COORDINATES | SU 7905 3606 51.117839000398 -0.870456555983 51 07 04 N 000 52 13 W Point |
| PROJECT CREATORS | |
| NAME OF ORGANISATION | Headland Archaeology |
| PROJECT BRIEF ORIGINATOR | AMECFW |
| PROJECT DESIGN ORIGINATOR | Headland Archaeology |
| PROJECT DIRECTOR/MANAGER | Webb, A. |

| PROJECT SUPERVISOR | Bishop, R |
|-------------------------------|-----------------------------------------------------------------|
| TYPE OF SPONSOR/FUNDING BODY | Developer |
| | |
| PROJECT ARCHIVES | |
| PHYSICAL ARCHIVE EXISTS? | No |
| DIGITAL ARCHIVE EXISTS? | No |
| DIGITAL MEDIA AVAILABLE | "Geophysics" |
| PAPER ARCHIVE EXISTS? | No |
| PAPER MEDIA AVAILABLE | "Report" |
| | |
| PROJECT BIBLIOGRAPHY 1 | |
| PUBLICATION TYPE | Grey literature (unpublished document/manuscript) |
| TITLE | Bordon Garrison Redevelopment: Area 2 (TTA): Geophysical Survey |
| AUTHOR(S)/EDITOR(S) | Webb, A. |
| DATE | 2016 |
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| PLACE OF ISSUE OR PUBLICATION | Leeds |
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| ENTERED BY | David Harrison (david.harrison@headlandarchaeology.com) |
| ENTERED ON | 9 September 2016 |





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