

RISO/02



# BORDON GARRISON REDEVELOPMENT, HAMPSHIRE

AREA 3, PHASE A (BUDDS LANE PLAYING FIELD)  
AND AREA 3, SUB-PRIORITY 3 (DALY GROUND)  
GEOPHYSICAL SURVEY

commissioned by Amec Foster Wheeler

55587/001

September 2016



# BORDON GARRISON REDEVELOPMENT, HAMPSHIRE

## AREA 3, PHASE A (BUDDS LANE PLAYING FIELD) AND AREA 3, SUB-PRIORITY 3 (DALY GROUND) GEOPHYSICAL SURVEY

commissioned by Amec Foster Wheeler55587/001

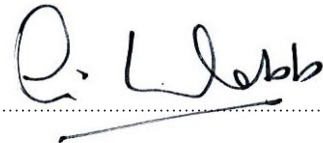
September 2016

project info

HA JOB NO. RISO/02  
NGR SU 79400 36000  
PARISH Whitehill  
LOCAL AUTHORITY East Hampshire  
OASIS REF. headland5-262116

project team

PROJECT MANAGER Alistair Webb  
AUTHOR David Harrison  
FIELDWORK Charlotte Palmer-Craggs, Ross Bishop  
GRAPHICS Caroline Norrman, Mano Kapazoglou, Ross Bishop  
APPROVED BY Alistair Webb – Project Manager



 **HEADLAND  
ARCHAEOLOGY**  
© 2016 by Headland Archaeology (UK) Ltd



**NORTH**  
Headland Archaeology  
Unit 16, Hillside, Beeston Road, Leeds, LS11 8ND

0113 387 6430

[north@headlandarchaeology.com](mailto:north@headlandarchaeology.com)

[www.headlandarchaeology.com](http://www.headlandarchaeology.com)



## PROJECT SUMMARY

Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey covering 6.8 hectares in advance of the proposed redevelopment of Area 3, Phase A and Area 3, Sub-Priority 3, part of the former Bordon Garrison site in Hampshire. A segmented sub-oval anomaly is clearly identified in the south of the Area 3, Phase A site. An archaeological origin for this anomaly should not be dismissed although a more recent cause, perhaps associated with military or recreational activity, is considered equally plausible. Elsewhere the survey has identified a multitude of ferrous spike anomalies and broader areas of magnetic disturbance which are consistent with the modern use of the site. The effect of modern activity on the archaeological resource (if present) is unknown. Based on the results of the geophysical survey, the archaeological potential of the site is assessed as very low and moderate in the vicinity of the oval 'feature'.

# CONTENTS

<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
1.1	SITE LOCATION, TOPOGRAPHY AND LAND-USE	1
1.2	GEOLOGY AND SOILS	1
<b>2</b>	<b>ARCHAEOLOGICAL BACKGROUND</b>	<b>1</b>
<b>3</b>	<b>AIMS, METHODOLOGY AND PRESENTATION</b>	<b>2</b>
3.1	MAGNETOMETER SURVEY	2
3.2	REPORTING	3
<b>4</b>	<b>RESULTS AND DISCUSSION</b>	<b>3</b>
	Magnetic background	3
4.1	FERROUS AND MODERN ANOMALIES	3
	Budds Lane Playing Field (Illus 7-9)	3
4.2	AGRICULTURAL ANOMALIES	3
4.3	GEOLOGICAL ANOMALIES	3
4.4	POSSIBLE ARCHAEOLOGICAL ANOMALIES	3
<b>5</b>	<b>CONCLUSION</b>	<b>4</b>
<b>6</b>	<b>REFERENCES</b>	<b>4</b>
<b>7</b>	<b>APPENDICES</b>	<b>18</b>
	APPENDIX 1 MAGNETOMETER SURVEY	18
	Magnetic susceptibility and soil magnetism	18
	Types of magnetic anomaly	18
	APPENDIX 2 SURVEY LOCATION INFORMATION	19
	APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE	19
	APPENDIX 4 OASIS DATA COLLECTION FORM: ENGLAND	20
	OASIS ID: headland5-262116	20

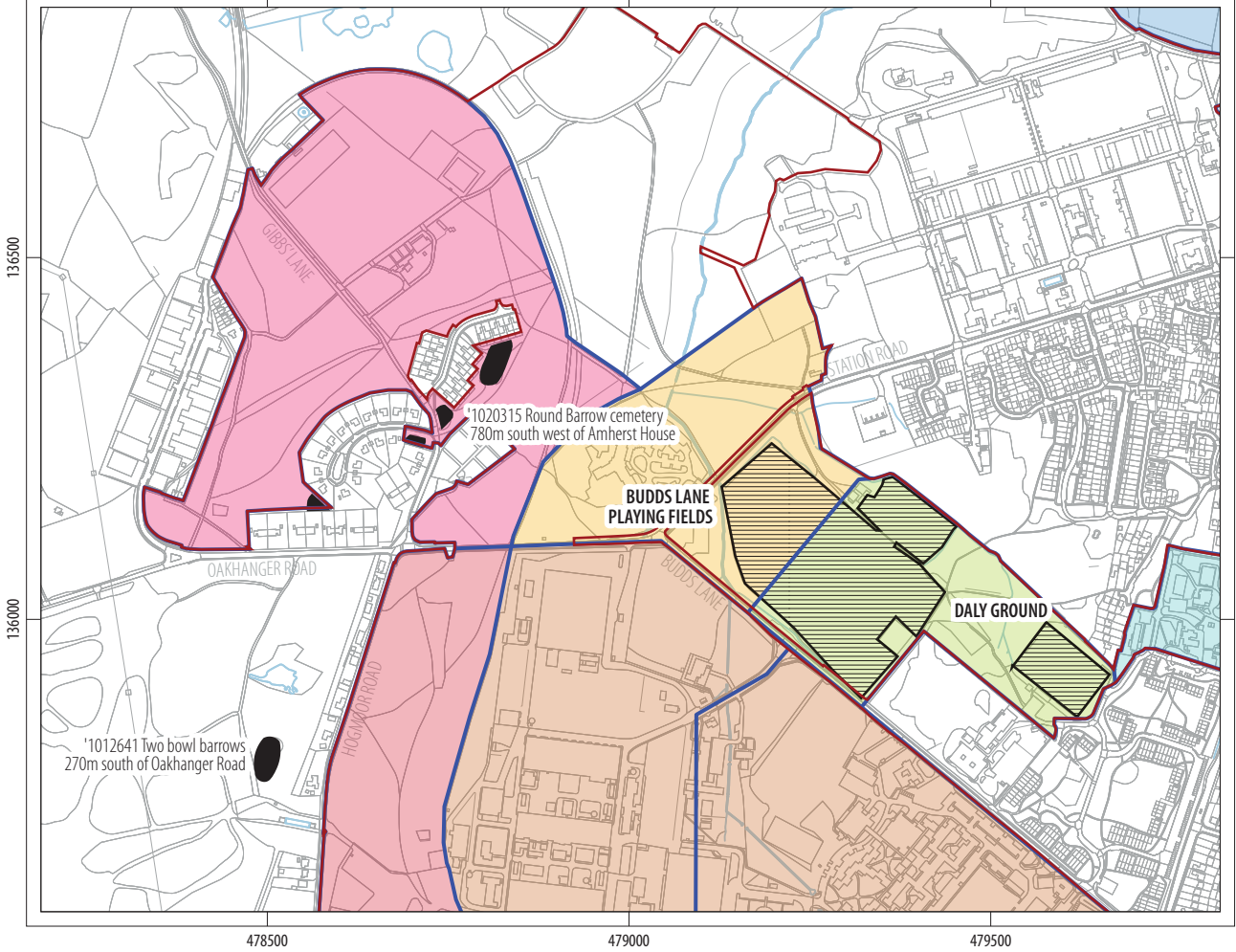
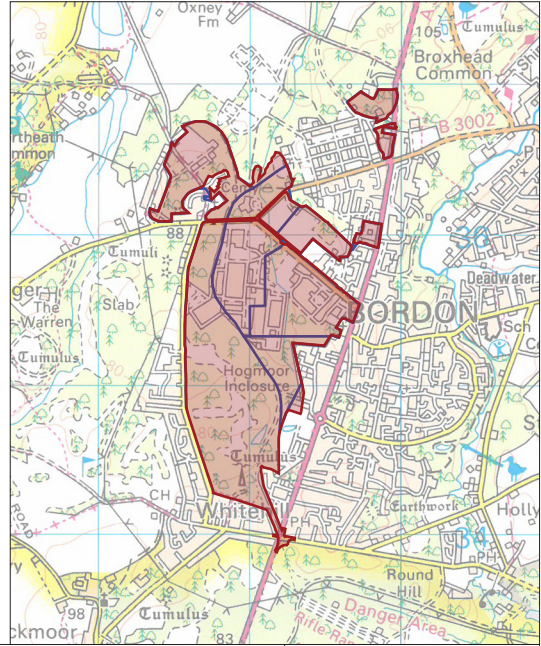
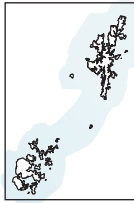
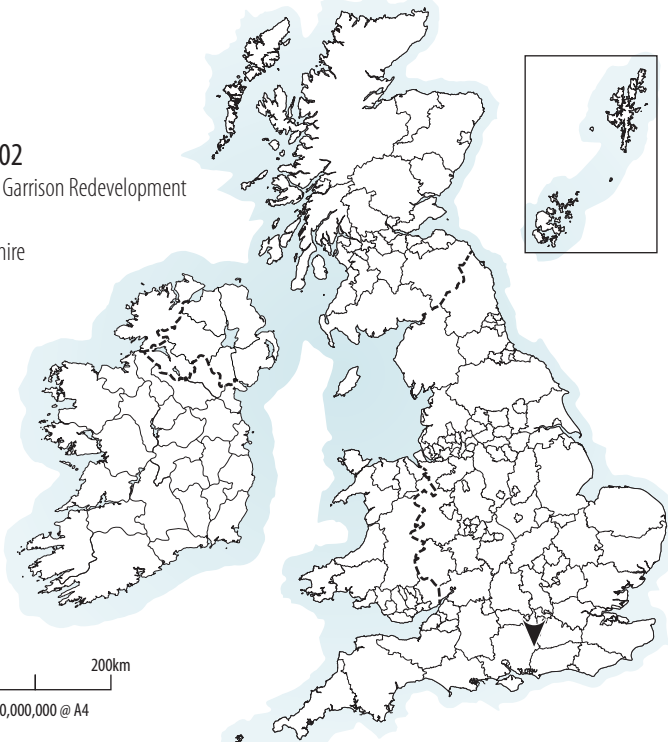
# LIST OF ILLUSTRATIONS

<b>ILLUS 1</b> SITE LOCATION	VIII
<b>ILLUS 2</b> GENERAL VIEW OF AREA 3, PHASE A (BUDDS LANE PLAYING FIELDS - WEST), LOOKING NORTH	2
<b>ILLUS 3</b> GENERAL VIEW OF AREA 3, PHASE A (BUDDS LANE PLAYING FIELDS - EAST), LOOKING NORTH	2
<b>ILLUS 4</b> GENERAL VIEW OF AREA 3, SUB-PRIORITY 3 (DALY GROUND), LOOKING EAST	2
<b>ILLUS 5</b> SURVEY LOCATION SHOWING PROCESSED GREYSCALE MAGNETOMETER DATA AND AREA OF PREVIOUS SURVEY (1:4,000)	5
<b>ILLUS 6</b> OVERALL INTERPRETATION OF MAGNETOMETER DATA (1:4,000)	7
<b>ILLUS 7</b> PROCESSED GREYSCALE MAGNETOMETER DATA; AREA 3, PHASE A (BUDDS LANE PLAYING FIELDS) (1:1,250)	9
<b>ILLUS 8</b> XY TRACE PLOT OF MAGNETOMETER DATA; AREA 3, PHASE A (BUDDS LANE PLAYING FIELDS) (1:1,250)	11
<b>ILLUS 9</b> INTERPRETATION OF MAGNETOMETER DATA; AREA 3, PHASE A (BUDDS LANE PLAYING FIELDS) (1:1,250)	13
<b>ILLUS 10</b> PROCESSED GREYSCALE MAGNETOMETER DATA; AREA 3, SUB-PRIORITY 3 (DALY GROUND) (1:1,250)	15
<b>ILLUS 11</b> XY TRACE PLOT OF MAGNETOMETER DATA; AREA 3, SUB-PRIORITY 3 (DALY GROUND) (1:1,250)	16
<b>ILLUS 12</b> INTERPRETATION OF MAGNETOMETER DATA; AREA 3, SUB-PRIORITY 3 (DALY GROUND) (1:1,250)	17

**RISO/02**  
 Bordon Garrison Redevelopment  
 Bordon  
 Hampshire

0 200km  
 1:10,000,000 @ A4

Ordnance Survey © Crown copyright 2013. All rights reserved. Licence no. AL 100013329



136500  
 136000

478500 479000 479500

0 200m  
 1:10,000 @ A4

- KEY**
- application area
  - proposed development area
  - geophysical survey area
  - scheduled monuments
  - Area 1
  - Area 2
  - Area 3 – Phase A
  - Area 3 – Sub-priority 3
  - Area 3 – Phase D
  - Area 4 – Employment zone
  - Area 4 – Phase B



**NORTH**  
 Unit 16, Hillside, Beeston Road  
 Leeds LS11 8ND  
 0113 387 6430  
 www.headlandarchaeology.com



# BORDON GARRISON REDEVELOPMENT, HAMPSHIRE

## AREA 3, PHASE A (BUDDS LANE PLAYING FIELD) AND AREA 3, SUB-PRIORITY 3 (DALY GROUND) GEOPHYSICAL SURVEY

### 1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Amec Foster Wheeler (the Client) on behalf 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 Area 3, Phase A and Area 3, Sub-Priority 3, the Budds Lane Playing Fields (hereafter BLPF) and Daly Ground (hereafter DG) sites, part of the overall proposed development area (PDA), and is the second of a series of surveys being undertaken on the former military site (see also Headland Archaeology 2016a).

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 June 15th and June 16th 2016 in order to provide information on the archaeological potential of the two Area 3 PDA's.

#### 1.1 SITE LOCATION, TOPOGRAPHY AND LAND-USE

The overall 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 the BLPF and DG areas only.

The BLPF site is centred at NGR SU 792 360. The survey area is bound to the south-west by Budds Lane, to the north-west by Station Road, to the north and north-east by mature woodland and by playing fields associated with Bordon Junior School to the south-east. It comprised of several sports pitches which were disused and under long grass at the time of survey (see Illus 2 and Illus 3). The topography slopes gently upwards from 76m aOD at Station Road to 78m aOD at the south-eastern edge of the playing fields.

The DG site is centred at NGR SU 795 359 and comprised an extant football pitch which was under short grass at the time of survey (see Illus 4). The pitch is bound by School Lane to the south and east, by woodland to the north and west and by residential properties on Haweswater Close to the north-east. The survey area is flat, being at 80m aOD.

#### 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's.

### 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:



**ILLUS 2** General view of Area 3, Phase A (Budds Lane Playing Fields - west), looking north **ILLUS 3** General view of Area 3, Phase A (Budds Lane Playing Fields - east), looking north **ILLUS 4** General view of Area 3, Sub-Priority 3 (Daly Ground), looking east

'...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 Budds Lane Playing Fields 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 sub-surface 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 - Illus 4 are general site condition photographs. Illus 5 shows the processed greyscale magnetometer data at a scale of 1:4,000, and Illus 6 shows an overall interpretation at the same scale.

Detailed data plots (greyscale and XY trace) and interpretative illustrations are presented at a scale of 1:1,250 in Illus 7 to Illus 12 inclusive.

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 (© Crown copyright).

The illustrations in this report have been produced following analysis of the data in 'raw' and 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 datasets are dominated by high magnitude ferrous anomalies throughout making a confident assessment of the background magnetic contrast difficult. However, discrete areas of magnetic enhancement, as well as clearer ditch-type anomalies, have been identified against this background. These anomalies are discussed below, and cross-referenced to specific anomalies on the interpretive illustrations, where appropriate.

#### 4.1 FERROUS AND MODERN 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. Across this site there is a large number of ferrous spikes throughout, often coalescing into broader areas of

magnetic disturbance. This frequency of ferrous contamination is suggestive of infilling and landscaping. Other areas of disturbance around the perimeter of the survey areas is due to ferrous material within the boundaries and by the proximity of buildings, goal posts and recreational equipment. These type of anomalies are common to both the BLPF and DG sites.

#### Budds Lane Playing Field (Illus 7-9)

Three large ferrous spikes (BH1-BH3) are due to capped boreholes.

Five high magnitude dipolar linear anomalies (SP1 to SP5 inclusive) recorded on various alignments across the playing fields locate buried service pipes.

Other ferrous linear anomalies are identified at the south-eastern edge of the playing (FF1 to FF5 inclusive) are thought to locate the footings of former fences.

One linear anomaly (FD1) on an east-west alignment within the southern corner of the playing fields is lower in magnitude and does not fit this pattern. This anomaly is interpreted as a drain or culvert, perhaps linking to the culverted drain recorded on the map base.

#### 4.2 AGRICULTURAL ANOMALIES

No anomalies of agricultural origin have been identified by the geophysical survey. Analysis of historical Ordnance Survey (OS) maps indicates that the layout and division of land remained largely unchanged between the publication of the first edition OS map in 1871 and the development of Bordon Camp which is first depicted on the 1910 edition. A single small field which is first depicted within the southern corner of Budds Lane Playing Fields on the 1896 edition OS map but is removed by the 1937 edition, does not manifest as a magnetic anomaly within the data. The reason for this is not clear but it is likely that any magnetic trace of the former boundary has been completely removed by subsequent landscaping, or that the deposits within the soil-filled ditch are masked by the higher magnitude magnetic disturbance within this area.

#### 4.3 GEOLOGICAL ANOMALIES

Discrete areas of magnetic enhancement are identified throughout the two survey 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, probably exacerbated by recent ground disturbance.

#### 4.4 POSSIBLE ARCHAEOLOGICAL ANOMALIES

A clear oval anomaly (A see Illus 11-13) of uncertain origin has been identified to the south-east of BLPF, centred at NGR SU 793 360. The anomaly describes a sub-oval shape measuring 40m x 30m and is aligned north-west/south-east, oblique to the current and historical pattern of land division. Internally, the 'feature' is sub-divided into six regular cells. It is possible that the anomaly is due to an unmapped military structure or is associated with the later recreational use of the site. However, an archaeological origin, such as an enclosure, should not be dismissed.

## 5 CONCLUSION

The geophysical survey has successfully evaluated the survey areas and has identified an anomaly of possible archaeological potential at the Budds Lane Playing Fields site. However, a more recent cause, perhaps associated with military or recreational activity, is considered equally plausible.

Elsewhere, the survey has detected numerous ferrous anomalies and broader areas of magnetic disturbance which are consistent with the modern use of the PDA's for recreational purposes. Broader areas of magnetic disturbance may mask or obscure weaker anomalies of archaeological potential within the affected areas. Recent activity may also have led to the truncation of archaeological deposits, if present.

If the areas have not been truncated the survey has demonstrated that there is likely to be sufficient magnetic contrast within the soils in these two areas for buried archaeological deposits to manifest as magnetic anomalies, despite the ferrous contamination of the upper soil horizons. Overall, based solely on the results and interpretation of the geophysical data, the archaeological potential of the site is assessed as low, but moderate in the vicinity of the oval 'feature'.

## 6 REFERENCES

AMEC Environment & Infrastructure 2014 *Bordon Garrison Redevelopment, Heritage Statement* Unpublished AMEC document Ref DIO/HPA/DOC/20

Chartered Institute for Archaeologists (CIfA) 2014 *Standard and guidance for archaeological geophysical survey* [online document] Accessed 20 July 2016 from [http://www.archaeologists.net/sites/default/files/CIfAS&GGeophysics\\_1.pdf](http://www.archaeologists.net/sites/default/files/CIfAS&GGeophysics_1.pdf)

Cranfield University 2016 *Cranfield Soil and Agrifood Institute Soilscales* [online] Accessed 20 July 2016 from [www.landis.org.uk/soilscales/](http://www.landis.org.uk/soilscales/)

Department of Communities and Local Government (DCLG) 2012 *National Planning Policy Framework* [online document] Accessed 20 July 2016 from [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/6077/2116950.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf)

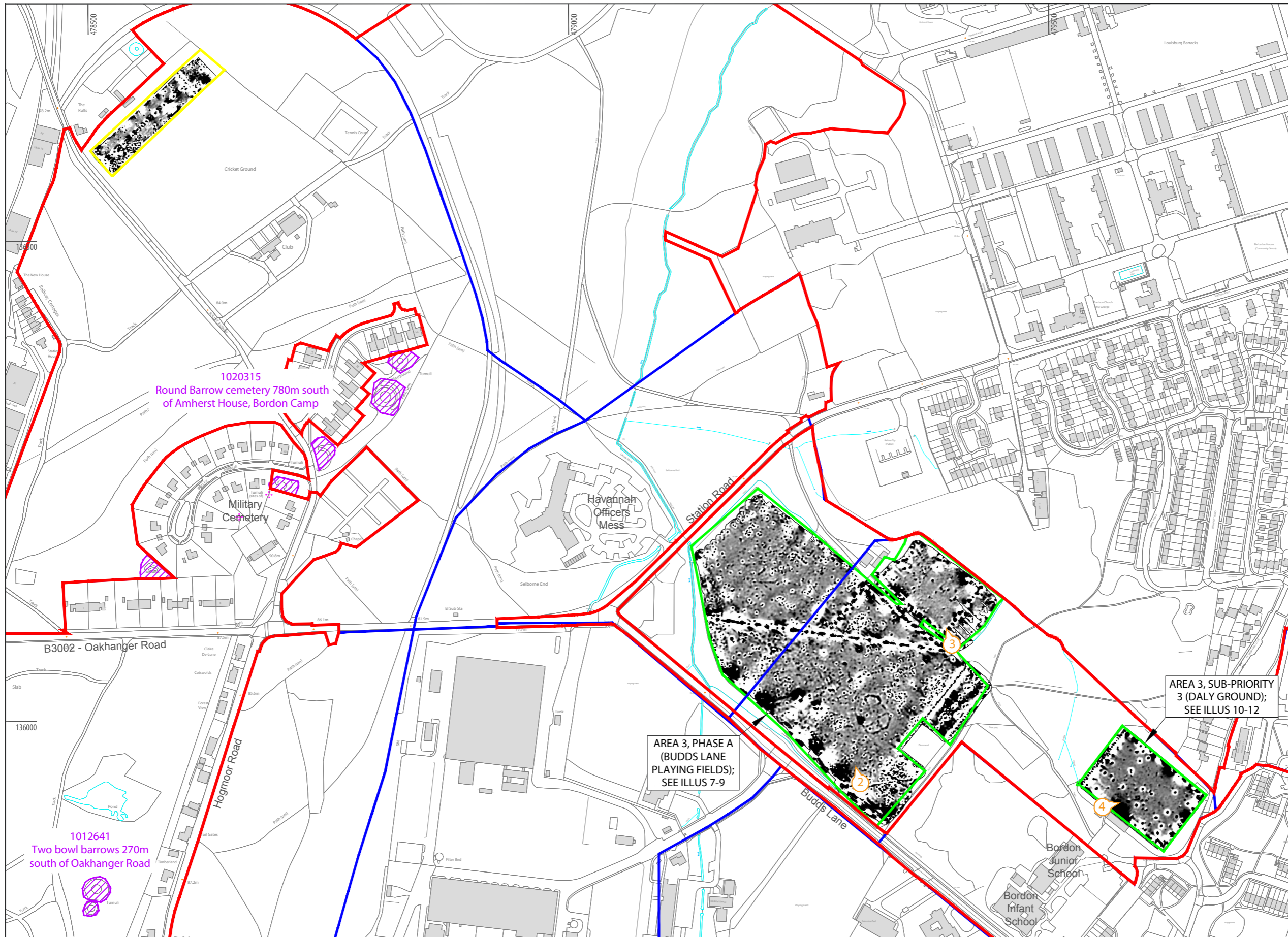
English Heritage 2008 *Geophysical Survey in Archaeological Field Evaluation: Research and Professional Services Guidelines* (2nd edition) [online document] Accessed 13 July 2016 from <http://content.historicengland.org.uk/images-books/publications/geophysical-survey-in-archaeological-field-evaluation/geophysics-guidelines.pdf>

Gaffney, C & Gater, J 2003 *Revealing the Buried Past: Geophysics for Archaeologists* The History Press: Stroud

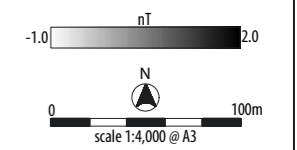
Headland Archaeology 2016 *Trial Trench Evaluation and Geophysical Survey, Bordon Garrison, Hampshire; Written Scheme of Investigation* Unpublished Headland document Ref RISO/01

Headland Archaeology 2016a *Bordon Garrison Redevelopment: Area A, Phase B (Bordon and Oakhanger Sports Club), Hampshire: Geophysical Survey* Unpublished Headland document Ref RISO/02

Natural Environment Research Council (NERC) 2016 *British Geological Survey* [online] Accessed 20 July 2016 from <http://www.bgs.ac.uk/>



- ▬ Application Boundary
- ▬ Proposed development area
- ▬ Geophysical survey area
- ▬ Previous geophysical survey area
- ▭ Scheduled Monument
- Location and direction of ILLUS 2-4



AREA 3, SUB-PRIORITY  
3 (DALY GROUND);  
SEE ILLUS 10-12

AREA 3, PHASE A  
(BUDDS LANE  
PLAYING FIELDS);  
SEE ILLUS 7-9

1012641  
Two bowl barrows 270m  
south of Oakhanger Road

1020315  
Round Barrow cemetery 780m south  
of Amherst House, Bordon Camp

PROJECT Bordon Garrison Redevelopment  
Hampshire  
(RISO/02)

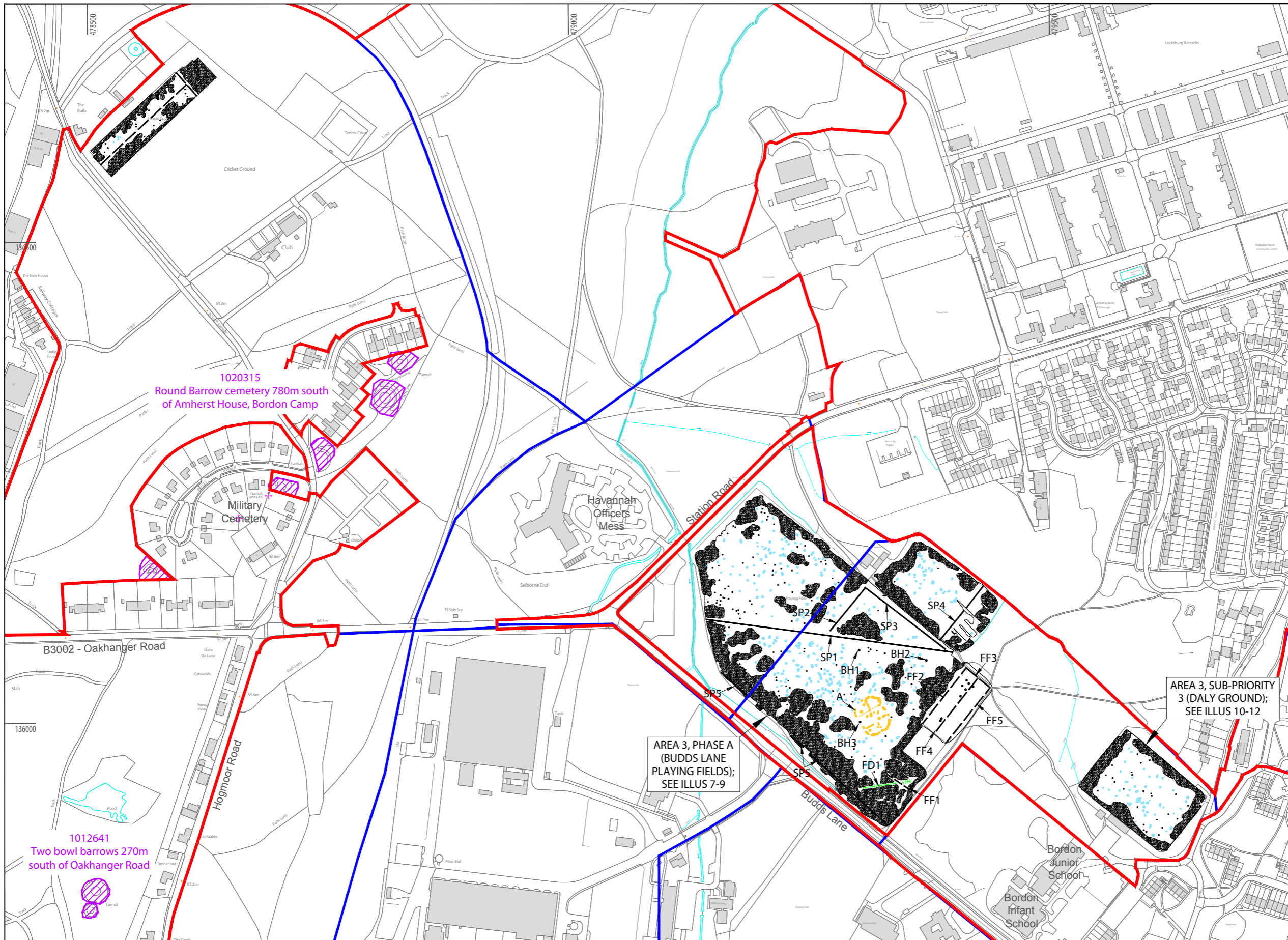
CLIENT Amec Foster Wheeler  
Environment and Infrastructure

Reproduced using digital data supplied by Amec Foster Wheeler.  
Ordnance Survey © Crown copyright. All rights reserved.

**HEADLAND  
ARCHAEOLOGY**

NORTH Unit 16, Hillside  
Beeston Road  
Leeds LS11 8ND  
0113 387 6430  
www.headlandarchaeology.com





Application Boundary	Proposed development area		
TYPE OF ANOMALY		INTERPRETATION	
	Dipolar Isolated		Ferrous Material
	Magnetic Disturbance		Ferrous Material
	Dipolar Linear		Service Pipe
	Dipolar Linear		Former Fence?
	Linear Trend		Field Drain
	Magnetic Enhancement		Geology
	Linear		Archaeology?
	Magnetic Enhancement		Archaeology?
ABBREVIATIONS			
BH borehole			
FF former fence			
FD field drain			
SP service pipe			

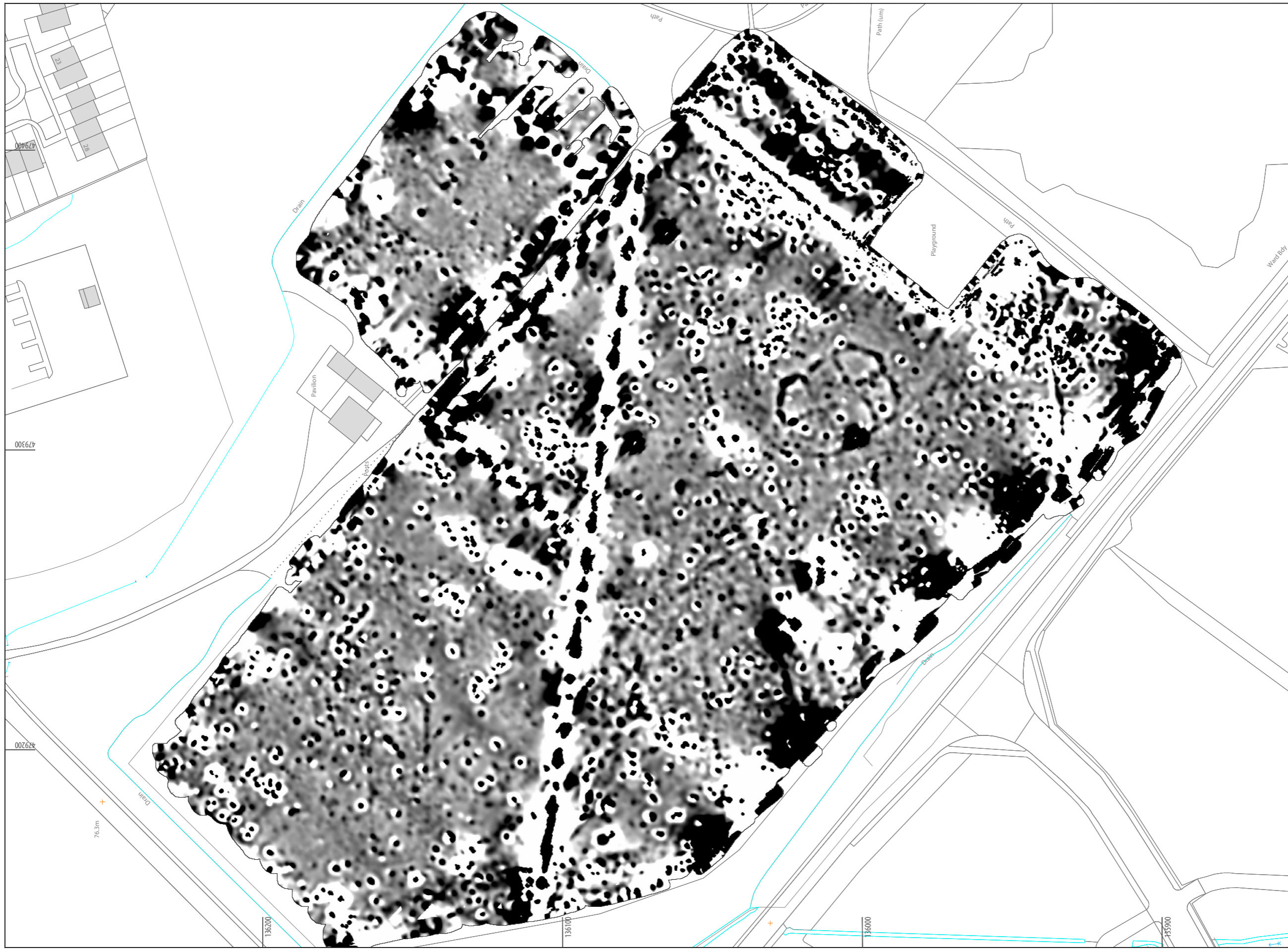
  

0 100m  
scale 1:4,000 @ A3

PROJECT	Bordon Garrison Redevelopment Hampshire (RISO/02)
CLIENT	Amec Foster Wheeler Environment and Infrastructure
<small>Reproduced using digital data supplied by Amec Foster Wheeler. Ordnance Survey © Crown copyright. All rights reserved.</small>	
NORTH	Unit 16, Hillside Beeston Road Leeds LS11 8ND 0113 387 6430 www.headlandarchaeology.com







**HEADLAND**  
**ARCHAEOLOGY**

NORTH

Unit 16, Hillside  
Beeston Road  
Leeds LS11 8ND  
0113 387 6430  
www.headlandarchaeology.com

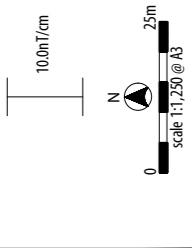
**PROJECT** Bordon Garrison Redevelopment  
Hampshire  
(RISO/02)

**CLIENT** Amec Foster Wheeler  
Environment and Infrastructure

Reproduced using digital data supplied by Amec Foster Wheeler.  
Ordnance Survey © Crown copyright. All rights reserved.

ILLUS 7 Processed greyscale magnetometer data: Area 3, Phase A (Budds Lane Playing Fields) (1:1,250)





PROJECT Bordon Garrison Redevelopment  
Hampshire  
(RISO/02)

CLIENT Amec Foster Wheeler  
Environment and Infrastructure

Reproduced using digital data supplied by Amec Foster Wheeler.  
Ordnance Survey © Crown copyright. All rights reserved.

**HEADLAND**  
**ARCHAEOLOGY**


NORTH

Unit 16, Hillside  
Beeston Road  
Leeds LS11 8ND  
0113 387 6430  
www.headlandarchaeology.com

ILLUS 8 XY trace plot of magnetometer data; Area 3, Phase A (Budds Lane Playing Fields) (1:1,250)

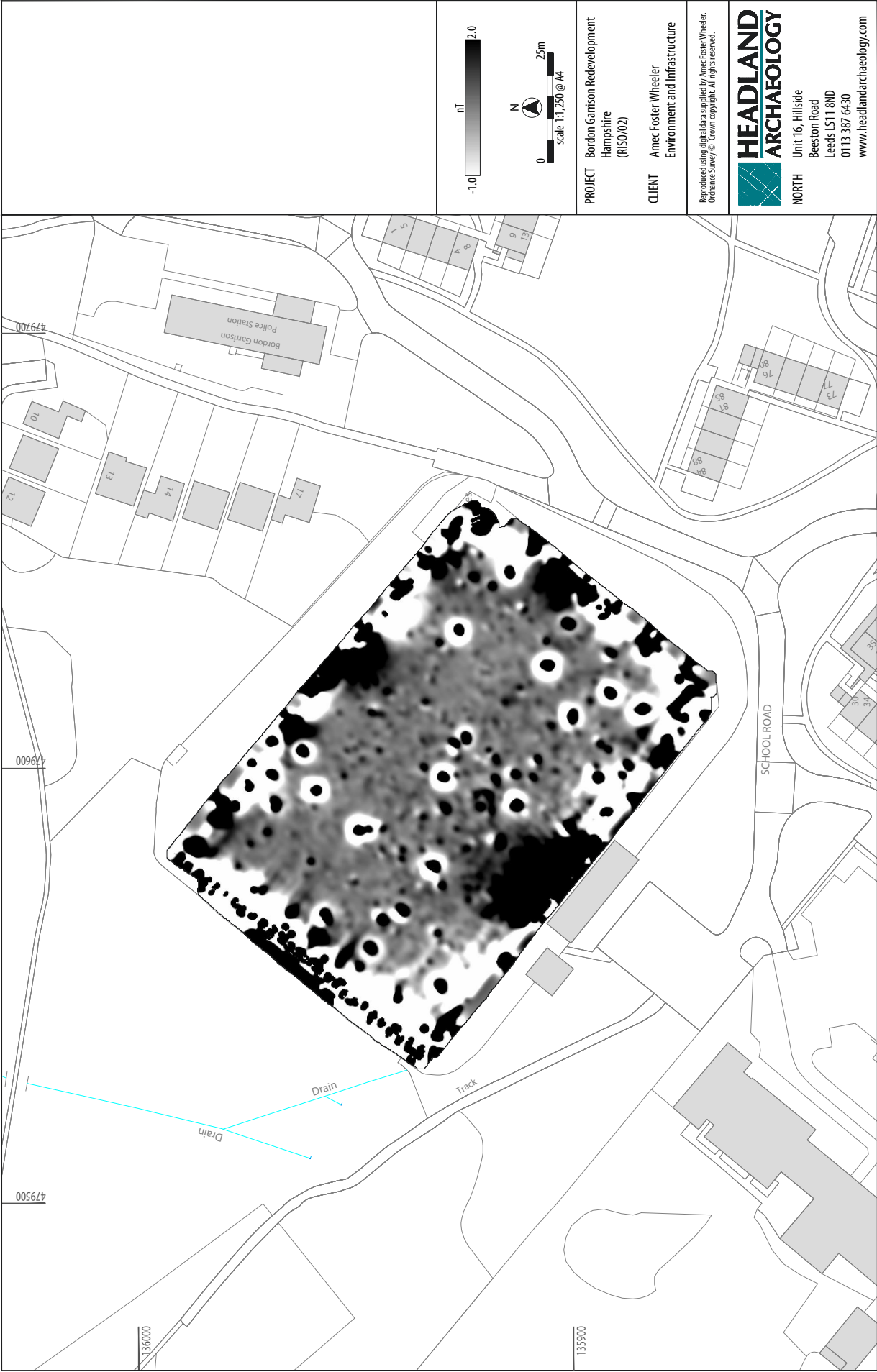




 <p><b>HEADLAND ARCHAEOLOGY</b></p> <p>NORTH Unit 16, Hillside Beeston Road Leeds LS11 8ND 0113 387 6430 www.headlandarchaeology.com</p>	<p><b>PROJECT</b> Bordon Garrison Redevelopment Hampshire (RISO/02)</p> <p><b>CLIENT</b> Amec Foster Wheeler Environment and Infrastructure</p> <p><small>Reproduced using digital data supplied by Amec Foster Wheeler. Ordnance Survey © Crown copyright. All rights reserved.</small></p>	<p>0 2.5m Scale 1:1,250 @ A3</p> <p>N</p>	<table border="1"> <thead> <tr> <th>TYPE OF ANOMALY</th> <th>INTERPRETATION</th> <th>TYPE OF ANOMALY</th> <th>INTERPRETATION</th> <th>ABBREVIATIONS</th> </tr> </thead> <tbody> <tr> <td>● Dipolar Isolated</td> <td>Ferrous Material</td> <td>— Linear</td> <td>Archaeology?</td> <td>BH borehole</td> </tr> <tr> <td>⊕ Magnetic Disturbance</td> <td>Ferrous Material</td> <td>⊗ Magnetic Enhancement</td> <td>Archaeology?</td> <td>FF former fence</td> </tr> <tr> <td>— Dipolar Linear</td> <td>Service Pipe</td> <td></td> <td></td> <td>FD field drain</td> </tr> <tr> <td>— Dipolar Linear</td> <td>Former Fence?</td> <td></td> <td></td> <td>SP service pipe</td> </tr> <tr> <td>— Linear Trend</td> <td>Field Drain</td> <td></td> <td></td> <td></td> </tr> <tr> <td>⊕ Magnetic Enhancement</td> <td>Geology</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	TYPE OF ANOMALY	INTERPRETATION	TYPE OF ANOMALY	INTERPRETATION	ABBREVIATIONS	● Dipolar Isolated	Ferrous Material	— Linear	Archaeology?	BH borehole	⊕ Magnetic Disturbance	Ferrous Material	⊗ Magnetic Enhancement	Archaeology?	FF former fence	— Dipolar Linear	Service Pipe			FD field drain	— Dipolar Linear	Former Fence?			SP service pipe	— Linear Trend	Field Drain				⊕ Magnetic Enhancement	Geology			
TYPE OF ANOMALY	INTERPRETATION	TYPE OF ANOMALY	INTERPRETATION	ABBREVIATIONS																																		
● Dipolar Isolated	Ferrous Material	— Linear	Archaeology?	BH borehole																																		
⊕ Magnetic Disturbance	Ferrous Material	⊗ Magnetic Enhancement	Archaeology?	FF former fence																																		
— Dipolar Linear	Service Pipe			FD field drain																																		
— Dipolar Linear	Former Fence?			SP service pipe																																		
— Linear Trend	Field Drain																																					
⊕ Magnetic Enhancement	Geology																																					

ILLUS 9 Interpretation of magnetometer data, Area 3, Phase A (Budds Lane Playing Fields) (1:1,250)



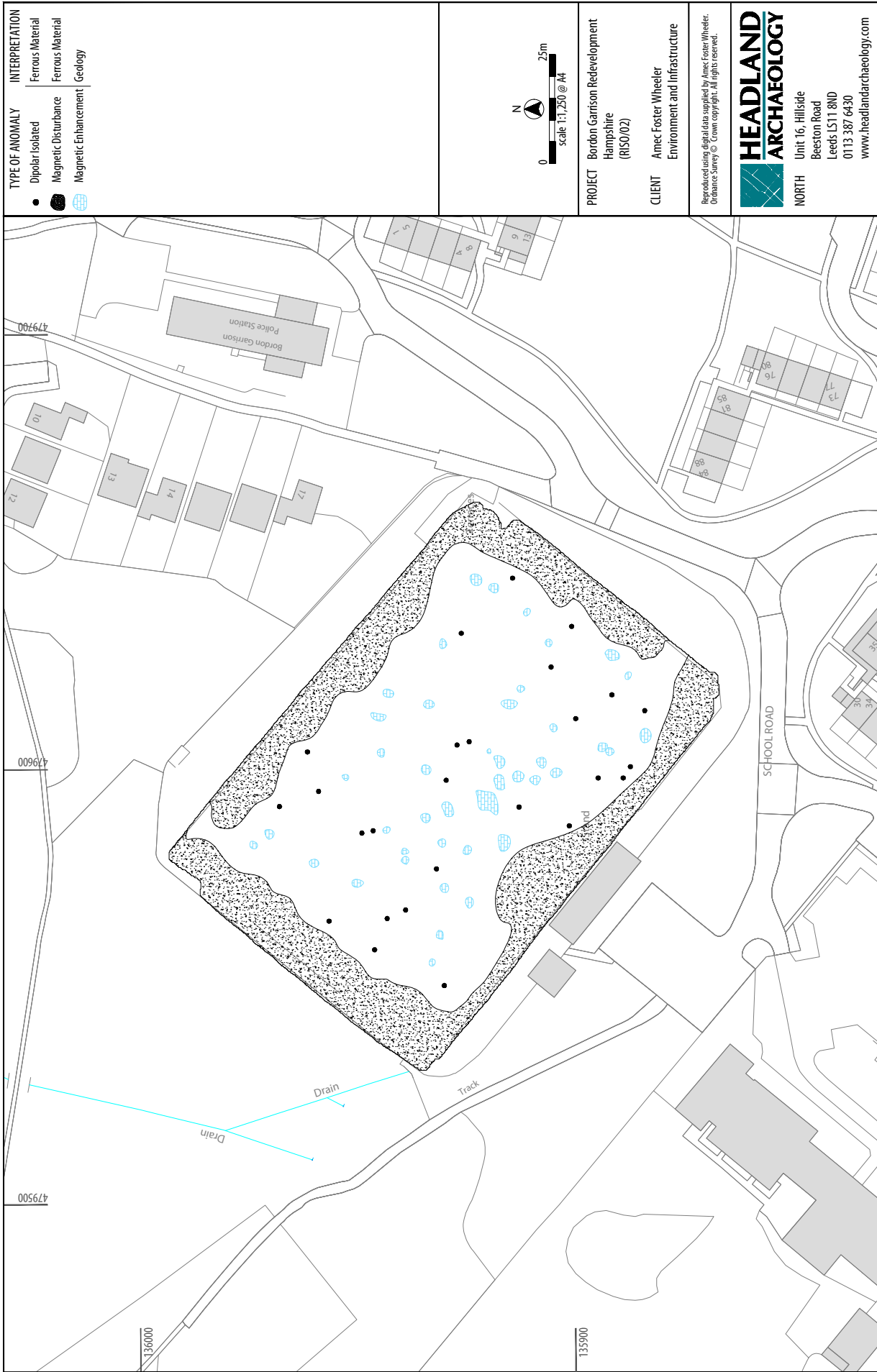


ILLUS 10 Processed greyscale magnetometer data, Area 3, Sub-Priority 3 (Daily Ground) (1:1,250)



**ILLUS 11** XY trace plot of magnetometer data; Area 3, Sub-Priority 3 (Daily Ground) (1:1,250)





ILLUS 12 Interpretation of magnetometer data; Area 3, Sub-Priority 3 (Daily Ground) (1:1,250)

<p><b>TYPE OF ANOMALY</b></p> <ul style="list-style-type: none"> <li>● Dipolar Isolated</li> <li>⊕ Magnetic Disturbance</li> <li>⊕ Magnetic Enhancement</li> </ul>	<p><b>INTERPRETATION</b></p> <ul style="list-style-type: none"> <li>Ferrous Material</li> <li>Ferrous Material</li> <li>Geology</li> </ul>
<p>N</p> <p>scale 1:1,250 @ A4</p>	
<p><b>PROJECT</b> Bordon Garrison Redevelopment Hampshire (RISO/02)</p>	
<p><b>CLIENT</b> Amec Foster Wheeler Environment and Infrastructure</p>	
<p><small>Reproduced using digital data supplied by Amec Foster Wheeler. Ordnance Survey ©. Crown copyright. All rights reserved.</small></p>	
<p><b>HEADLAND ARCHAEOLOGY</b> NORTH Unit 16, Hillside Beeston Road Leeds LS11 8ND 0113 387 6430 www.headlandarchaeology.com</p>	

## 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](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: headland5-262116

PROJECT DETAILS	
PROJECT NAME	Bordon Garrison Redevelopment, Hampshire: Area 3, Phase A and Area 3, Sub-Priority 3: Geophysical Survey
SHORT DESCRIPTION OF THE PROJECT	Headland Archaeology (UK) Ltd undertook a geophysical (magnetometer) survey covering 6.8 hectares in advance of the proposed redevelopment of Area 3, Phase A and Area 3, Sub-Priority 3, part of the former Bordon Garrison site in Hampshire. A segmented sub-oval anomaly is clearly identified in the south of the Area 3, Phase A site. An archaeological origin for this anomaly should not be dismissed although a more recent cause, perhaps associated with military or recreational activity, is considered equally plausible. Elsewhere the survey has identified a multitude of ferrous spike anomalies and broader areas of magnetic disturbance which are consistent with the modern use of the site. The effect of modern activity on the archaeological resource (if present) is unknown. Based on the results of the geophysical survey, the archaeological potential of the site is assessed as very low and moderate in the vicinity of the oval 'feature'.
PROJECT DATES	Start: 15-06-2016 End: 16-06-2016
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
MONUMENT TYPE	N/A None
MONUMENT TYPE	N/A None
SIGNIFICANT FINDS	N/A None
SIGNIFICANT FINDS	N/A None
METHODS & TECHNIQUES	"Geophysical Survey"
DEVELOPMENT TYPE	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, Hampshire: Area 3, Phase A and Area 3, Sub-Priority 3
POSTCODE	GU35 0JB
STUDY AREA	6.8 Hectares
SITE COORDINATES	SU 7926 3591 51.116461260586 -0.867489473849 51 06 59 N 000 52 02 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, Hampshire: Area 3, Phase A (Budds Lane Playgign Field) and Area 3, Sub-Priority 3 (Daly Ground): Geophysical Survey
AUTHOR(S)/EDITOR(S)	Harrison, D.
DATE	2016
ISSUER OR PUBLISHER	Headland Archaeology
PLACE OF ISSUE OR PUBLICATION	Leeds
DESCRIPTION	A4 bound report
ENTERED BY	David Harrison (david.harrison@headlandarchaeology.com)
ENTERED ON	9 September 2016







© 2016 by Headland Archaeology (UK) Ltd

**SOUTH & EAST**

Headland Archaeology  
Building 68C, Wrest Park, Silsoe  
Bedfordshire MK45 4HS

01525 861 578

[southandeast@headlandarchaeology.com](mailto:southandeast@headlandarchaeology.com)

**MIDLANDS & WEST**

Headland Archaeology  
Unit 1, Clearview Court, Twyford Road  
Hereford HR2 6JR

01432 364 901

[midlandsandwest@headlandarchaeology.com](mailto:midlandsandwest@headlandarchaeology.com)

**NORTH**

Headland Archaeology  
Unit 16, Hillside, Beeston Road  
Leeds LS11 8ND

0113 387 6430

[north@headlandarchaeology.com](mailto:north@headlandarchaeology.com)

**SCOTLAND**

Headland Archaeology  
13 Jane Street  
Edinburgh EH6 5HE

0131 467 7705

[scotland@headlandarchaeology.com](mailto:scotland@headlandarchaeology.com)

[www.headlandarchaeology.com](http://www.headlandarchaeology.com)