Archaeological Evaluation

at

RALPH ALLEN SCHOOL, CLAVERTON DOWN ROAD, COMBE DOWN, BATH.

for

Bath and North East Somerset Council

Report No. 2636/2012

By Cai Mason

Bristol and Region Archaeological Services

St. Nicholas Church, St. Nicholas Street, Bristol, BS1 1UE. Tel: (0117) 903 9010

Archaeological Evaluation

at

RALPH ALLEN SCHOOL, CLAVERTON DOWN ROAD, COMBE DOWN, BATH.

Centred on
N.G.R. ST 77142 62680

Client: Bath and North East Somerset Council

Author:	Cai Mason
email:	cai.mason@bristol.gov.uk
Approved by:	John Bryant
Signature:	
Date Issued:	26 April 2012

St.Nicholas Church, St.Nicholas Street, Bristol BS1 1UE. Tel: (0117) 903 9010
E-mail: info@baras.org.uk
www.baras.org.uk

CONTENTS

Abbreviations

AD	Anno Domini	Km	Kilometre
aOD	Above Ordnance Datum	m	Metre
BaRAS	Bristol & Region Archaeological Services	NGR	National Grid Reference
BC	Before Christ	NMR	National Monuments Record
c	Circa	NPPF	National Planning Policy Framework
DCLG	Department for Communities and Local Government	OS	Ordnance Survey
HER	Historic Environment Record		

NOTE
Notwithstanding that Bristol and Region Archaeological Services have taken reasonable care to produce a comprehensive summary of the known and recorded archaeological evidence, no responsibility can be accepted for any omissions of fact or opinion, however caused.

April, 2012.

SUMMARY

A geophysical survey and archaeological evaluation was undertaken in advance of a planning application for the construction of a new school building and an all weather sports pitch at Ralph Allen School, Claverton Down Road, Combe Down, Bath.

The geophysical survey identified a number of features of possible archaeological origin. The subsequent evaluation demonstrated that apart from a modern drain crossing the school hockey pitch, most of the geophysical anomalies appear to be natural features, primarily caused by variations in the local geology. Some of the linear geophysical anomalies in the playing field may represent the lines of former hedged field boundaries, now defined by magnetic differences in the soil and outcrops of bedrock.

A small quantity of early to middle Iron Age and Romano-British pottery, and some worked flint was recovered from the topsoil and topsoil/natural interface layers. Although these finds provide some evidence for prehistoric and Romano-British activity somewhere in the vicinity of the site, they are not thought to be indicative of any significant activity within the proposed development area.

LIST OF ILLUSTRATIONS

Figures

Plates

1. INTRODUCTION

1.1 This report presents the results of archaeological evaluation carried out by Bristol and Region Archaeological Services (BaRAS) at Ralph Allen School, Claverton Down Road, Combe Down, Bath.

1.2 The archaeological work was commissioned by Bath and North East Somerset Council to support a planning application (Application Number 11/05199/REG03) for the construction of a new school building and an all weather sports pitch with associated works and landscaping.

1.3 The archaeological work took place on the 10th and 11th of April 2012.

1.4 The project archive will be deposited with Roman Baths Museum & Pump Room under the Accession Number BATRM 2012.8. A digital copy of the report will be sent to the National Monuments Record maintained by English Heritage. The project has been entered in the OASIS Online Access to the Index of Archaeological Investigations as: bristola1-122245.

2. THE SITE

2.1 The site (centred on NGR ST 77142 62680) is located in playing fields to the south and west of Ralph Allen School. The school is situated *c* 2km to the south-east of Bath City Centre, near the southern edge of Claverton Down (**Fig. 1**). The site boundaries are defined by Claverton Down Road to the north, Sulis Sports Club playing fields to the east, tennis courts and a car park for the Barceló Combe Grove Manor Hotel to the south, and an access road for the hotel and the garden of St Winifred (a house on Claverton Down Road) to the west. At the time the evaluation was undertaken the southern half of the site was a playing field; the northern half was a 'redgra' surfaced hockey pitch.

2.2 The site is situated on the northern edge of Monkton Combe parish; the site's northern and eastern boundaries lie along the Claverton/Monkton Combe parish boundary.

2.3 The solid geology comprises Jurassic oolitic limestone of the Chalfield Oolite Formation (BGS 2012). The site is situated on a gentle south-facing slope that ranges from *c* 166m aOD at Claverton Down Road, down to *c* 156m aOD in the south-west corner of the playing field. About 50m to the south of the site the land drops away sharply into the deep valley of the Midford Brook.

3. ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

3.1 The downs to the south and east of Bath are an area of considerable archaeological interest, with evidence of prehistoric and Roman occupation, field systems, and burials found in a number of locations.

3.2 In 1935 a large quantity of Mesolithic, Neolithic and Bronze Age worked flint, including several barbed and tanged arrowheads and hundreds of scrapers, were recovered in a field to the west of Combe Down Quarry (an area of woodland to the east of the site). The B&NES HER records the find spot (HER No. MBN1824) as ST 7715 6266; an area that now lies in the centre of the school playing fields. The find spot is also recorded as being '*Located in the field immediately east of Combe Down Quarries and south of the house, "St Winifred"*.'

3.3 A stone coffin, probably of Roman date, and spreads of Romano-British pottery have also been found in the fields immediately south of the playing fields (O.S. Archaeology Branch 1949).

3.4 A geophysical survey of the playing fields (**Appendix 2**) was undertaken in February 2012, this identified a number of possible archaeological features, including several linear anomalies that appeared to form a rectilinear pattern. These features were interpreted as a possible ancient field system. A number of discrete pit-like anomalies were also identified.

4. AIMS AND METHODOLOGY

4.1 The fieldwork complied with the methodology outlined in a *Written Scheme of Investigation* (Roper 2011) and followed the *Standard and Guidance for archaeological field evaluation* (IfA 2008). The aim of the evaluation was to characterise the nature of the geophysical anomalies identified during the geophysical survey, and to make a full and accurate record (written, drawn, photographic) of the date, character, degree of survival, extent and location of any archaeological deposits within the proposed development area.

4.2 The evaluation comprised seven 1.6m-wide trial trenches, totalling 150m^2 (**Fig. 2**), which were located in positions designed to investigate the geophysical anomalies identified by the geophysical survey. The trenches were dug with a 7.5 tonne JCB-type mechanical excavator fitted with a toothless grading bucket under the direction of a BaRAS Project Officer. Mechanical excavation proceeded until either *in-situ* archaeological deposits, or undisturbed natural geology was encountered.

4.3 The site was recorded in accordance with the BaRAS Site Recording Manual (BaRAS 2005).

5. RESULTS

5.1 Two areas of the school grounds were investigated. Area 1 is a hockey pitch to the west of the school and Area 2 is a playing field to the south of the school.

Geophysical Survey

5.2 A geophysical (magnetometer) survey of the school grounds was carried out by Stratascan, the results are summarised below; the full report is presented in **Appendix 2**.

Area 1

5.3 Magnetic disturbance from nearby fences and/or buried services was found across about 40% of Area 1. In the areas unaffected by magnetic disturbance a number of possible archaeological features were identified. These comprised a cluster of discrete positive anomalies characteristic of backfilled pits, one of which appeared to form a small annular feature. Three linear anomalies indicative of modern drains and a weak positive linear anomaly possibly indicating the position of a backfilled ditch were also identified.

Area 2

5.4 Magnetic disturbance from nearby fences and/or buried services was found across about 15% of Area 1, mainly at the eastern end of the field and an area in the centre. A linear anomaly indicative of a buried service crossed the centre of the site. In the areas unaffected by magnetic disturbance a number of possible archaeological features were identified. These features comprise a series of NNW-SSE and E-W aligned negative anomalies indicative of buried banks or earthworks. A number of E-W aligned positive anomalies indicative of backfilled ditches, three pit-like positive anomalies, and a weak negative rectangular anomaly were also identified.

Evaluation

5.5 No archaeological features were uncovered in any of the trenches.

5.6 The geology of the site is Jurassic oolitic limestone, the upper surface of which was degraded and fissured. In places the rock was broken into small angular cobble and gravel-sized fragments, in others it was split into large angular boulders. Fissures in the rock were filled

with smaller rock fragments and clay. Natural disturbance caused by tree roots or animal burrows was evident in some of the trenches. The evaluation revealed a broadly similar sequence of horizontal deposits, details of which are presented below.

Trench 1

5.7 Trench 1 (**Plate 1**) was situated in the centre of Area 2. The trench was aligned ENE-WSW and measured 20m x 1.6m.

5.8 The horizontal sequence comprised limestone bedrock with patches of natural yellowish clay (103), overlain by a 0.32m-thick layer of firm yellowish-brown silty clay mixed with limestone fragments (102), which was in turn overlain by a 0.28m-thick layer of dark brown friable silty clay topsoil (101).

Trench 2

5.9 Trench 2 (**Plate 2**) was situated near the western edge of Area 2. The trench was aligned NNW-SSE and measured 20m x 1.6m.

5.10 The horizontal sequence comprised limestone bedrock with patches of natural orangey-brown clay (202), overlain by a 0.15m-thick layer of firm yellowish-brown silty clay mixed with limestone fragments (201), which was in turn overlain by a 0.20m-thick layer of mid-brown friable silty-clay topsoil (200) that contained <5% small angular stone inclusions.

Trench 3

5.11 Trench 3 (**Plate 3**) was situated near the southern edge of Area 2. The trench was aligned ENE-WSW and measured 20m x 1.6m.

5.12 The horizontal sequence comprised limestone bedrock with patches of natural orangey-brown clay (303), overlain by a 0.18m-thick layer of firm yellowish-brown silty clay mixed with limestone fragments (302), which was in turn overlain by a 0.14m-thick layer of dark-brown friable silty clay topsoil (300).

5.13 There was a low ridge of limestone bedrock towards the eastern end of the trench. This outcrop roughly corresponds with a negative linear anomaly identified in the geophysical survey (**Appendix 2**).

Trench 4

5.14 Trench 4 (**Plate 4**) was situated near the southern edge of Area 2. The trench was aligned NNW to SSE and measured 30m x 1.6m.

5.15 The horizontal sequence comprised limestone bedrock with patches of natural orangey-brown clay (402), overlain by a 0.05m to 0.20m-thick layer of firm orangey-brown silty clay mixed with limestone fragments (401), which was in turn overlain by a 0.30m to 0.35m-thick layer mid-brown friable silty clay topsoil (400) that contained <5% small angular limestone inclusions. Two pieces of struck flint and single sherd of Romano-British pottery were recovered from topsoil 401.

5.16 Natural deposits at the northern end of the trench were far more clayey than those in the rest of the trench; this, coupled with the fact that layers 400-1 were deeper at the northern end of the trench, accounts for the ENE-WSW linear anomaly identified in the geophysical survey.

5.17 A discrete pit-like geophysical anomaly situated near the southern end of the trench can be identified as a clay-filled hollow; this was investigated and shown to be a natural feature, probably created by animal burrowing.

Trench 5

5.18 Trench 5 (**Plate 5**) was situated near the northern edge of Area 2. The trench was aligned NE-SW and measured 20m x 1.6m.

5.19 The horizontal sequence comprised limestone bedrock interspersed with areas of natural orangey-brown clay (504), overlain by up to 0.30m of firm yellow silty clay sub-soil mixed with limestone fragments (503), which was in turn overlain by 0.05m-thick layer of mixed silty clay topsoil and sub-soil (502), that contained a small quantity of abraded early to middle Iron Age and Romano-British pottery. Layer 502 was overlain by up to 0.20m of dark brown friable silty clay topsoil (501). A single sherd of Romano-British pottery was recovered from the topsoil.

5.20 In trench 5 the bedrock was fractured into large boulders, some of which were up to *c* 1m wide, and outcropped only 0.20m below the surface. A ridge of these boulders crossed the centre of the trench, and probably accounts for the anomalies identified in the geophysical survey.

Trench 6

5.21 Trench 6 (**Plate 6**) was situated near the centre of Area 1. The trench was aligned N-S and measured 20m x 1.6m.

5.22 The horizontal sequence comprised limestone bedrock (605), overlain by up to 0.20m of firm yellowish-brown silty clay mixed with degraded limestone fragments (604), which was in turn overlain by patches of mid yellowish-brown silty clay (603) up to 0.18m thick. Layers 603-5 had been horizontally truncated to form a level surface for the make-up layers of the hockey pitch. The pitch itself comprised a 0.40m-thick layer of angular grey gravel (602), surfaced with a 0.04m-thick layer of reddish grey 'Redgra' (a mixture fine gravel and sand) (601).

5.23 An area of 'pit-like' geophysical anomalies in the centre of the trench can be identified as a group of shallow clay-filled depressions in the bedrock.

Trench 7

5.24 Trench 7 (**Plate 7**) was situated near the northern edge of Area 1. The trench was aligned ENE-WSW and measured 20m x 1.6m.

5.25 The horizontal sequence comprised heavily truncated limestone bedrock (704), cut by a 0.8m wide, N-S aligned modern service trench [702]. The service trench was filled with dark grey angular gravel (703). Trench fill 704 was covered by the make-up layers of the hockey pitch, which comprised a 0.14m to 0.20m-thick layer of angular grey gravel (701), overlain by a 0.05m thick layer of reddish grey 'Redgra' (700).

6. FINDS

6.1 A total of 16 finds were recovered during the evaluation. The finds comprise 10 sherds of pottery, 4 pieces of struck flint, and 2 pieces of ceramic building material (CBM). The finds were cleaned and marked with the Roman Bath Museum and Pump Rooms Accession Number BATRM 2012.8 and a context number. The finds were identified and catalogued according to material type.

6.2 None of the finds are of more than site importance and no further work is recommended.

6.3 The finds are discussed separately by type below.

Pottery & CBM by Mark Corney

Introduction and Methodology

6.4 The excavation recovered a small assemblage of prehistoric and Roman-British pottery comprising 10 sherds with a total weight of 46gms and 2 pieces of CBM weighing 41gm. The material displays a restricted range of fabrics. All the ceramics have been sorted into fabric types and correlated with the local fabric codes prepared by Bidwell and Croom (1999) and employed by Brown (2007) in recent work on prehistoric and Romano-British pottery assemblages from Bath. The material was examined with the aid of a x10 hand lens and quantified by number and weight; the small assemblage and the size of the sherds (average weight of 4.6gms) precluded an assessment of the minimum number of vessels. The incidence of each fabric by context is given in Table 1.

Fabrics

6.5 Three fabrics have been identified:

Fabric 1. Sandy clay matrix with common oolitic limestone inclusions. Hand made, of early to middle Iron Age date and common in the Bath area (Brown 2007, 22-3).

Fabric 2: CRW. Coarse Reduced Wares. This category comprises reduced grey and largely sandy fabrics in the assemblage. The lack of detailed analysis of these products in the Bath region makes attribution to a particular source difficult although the majority of the vessels are likely to be of local origin. Roman (Brown 2007, 92-3).

Fabric 3: MEORW. A medium coarse oxidised fabric with occasional calcareous and/or quartzite inclusions. Roman (Brown 2007, 92-3).

Forms

6.6 Only one form could be confidently identified, this being part of a flagon in Fabric 3 and comprises part of the neck and the stump of a handle. The remaining sherds are too small for identification of form.

Discussion and Dating

6.7 The assemblage is too small for meaningful comment although the identification of the early to middle Iron Age material represented by the seven sherds in Fabric 1, all from context 502, is of note. The flagon may be of 2nd or 3rd century AD date.

Ceramic Building Material

6.8 Two pieces of CBM were examined. Both are from roof-tiles and are of post-medieval date.

Table 1: Pottery and CBM

Context	Pottery		Fabric	Date
	No. of sherds	Weight (gm)		
401	1	4	3	Roman
501	1	18	3	Roman
502	7	21	1	Iron Age
502	1	4	2	Roman
Context	**CBM**			**Date**
	No.	Weight (gm)		
301	1	26	-	Post-medieval
401	1	15	-	Post-medieval

Flint by Cai Mason

6.9 A total of 4 pieces of worked flint were recovered during the evaluation. All of the worked flints are small undiagnostic flakes of debitage. Three flakes were recovered from topsoil (401); one was recovered from topsoil/natural interface layer (201).

7. DISCUSSION AND CONCLUSIONS

7.1 A geophysical survey was carried out by Stratascan prior to the evaluation, this revealed a number of anomalies that were interpreted as possible archaeological features. The evaluation demonstrated that apart from a modern drain in area 1, most of the geophysical anomalies appear to be natural features, primarily caused by variations in the underlying geology.

7.2 The evaluation showed that the northern end of area 1 had been severely truncated by the construction of a hockey pitch. Area 2 (the playing field) does not appear to have been affected by any recent landscaping works.

7.3 Although no recognisable archaeological features could be identified during the evaluation, it is still possible that some of the linear geophysical anomalies in area 2 may be anthropogenic. One possible explanation is that although magnetic differences in the soil are often caused by buried features such as in filled ditches, there can be other causes, such as the difference between a ploughed and an unploughed soil, and one possibility that should be considered is that the linear anomalies on this site indicate the position of former hedge lines between fields. The fact that rocky outcrops survive along some of these lines would not be particularly surprising, as the underlying rocks beneath a cultivated field would have been more susceptible to a combination of chemical and mechanical weathering, and the deliberate removal or breaking up of large boulders. The soils on Claverton Down are very thin, with hard rock occurring near the surface. This, and the fact that the land is relatively well drained could mean that digging ditches was seen as unnecessary, particularly when a thick hedge could provide a perfectly adequately boundary, but one that would leave little indication of its presence in the archaeological record.

7.4 A small quantity of early to middle Iron Age and Romano-British pottery was recovered from topsoil and topsoil/natural interface layers. Although the pottery sherds are small and abraded, their presence is significant in that it does suggest that some form of prehistoric and Romano-British activity was occurring somewhere near the site. The fact that most of the pottery was found towards the northern end of trench 5 may indicate that any such activity was located to the north or east of the proposed development area. The area immediately north of trench 5 is now covered with school buildings and a hockey pitch, and it is probable that any remains in that area would have been severely truncated or destroyed.

7.5 The relative absence of worked flint is somewhat surprising given that hundreds of scrapers and several barbed and tanged arrowheads were reportedly found on the site in 1935, and some attempt should be made to explain this apparent discrepancy. The absence of finds from area 1 is unsurprising given the heavy truncation caused by construction of the hockey pitch. Area 2 does not appear to have been truncated, and a possible explanation for the near total absence of worked flint may lie in the HER description of the site, for although the grid reference places the find spot in the centre of the playing fields, the site is also described as: '*Located in the field immediately east of Combe Down Quarries and south of the house, "St Winifred"*.' This may indicate that the grid reference is inaccurate, and that the flints were in fact found in what is now the rear garden of St Winifred, or on the land between the school and the former quarry.

7.5 Although there is no evidence of any archaeological features within the proposed development area, the small quantity of finds recovered from the playing field adds to the evidence for some form of prehistoric and Romano-British somewhere in the vicinity of Ralph Allen School. The focus of this activity remains unknown, and although archaeological remains may survive in one of the remaining undeveloped areas in or around the school grounds, it is possible they have been destroyed by modern development.

8. BIBLIOGRAPHY AND SOURCES CONSULTED

BaRAS (2005). *Site Manual.* Unpublished.

Bidwell, P. & Croom, A. (1999). *The Roman Pottery*, in Davenport (1999). Oxford: Brit Archaeol Rep (Brit Ser) 284.

Brown, L. (2007). *The Roman Pottery*, in Davenport, Poole & Jordan (2007). Oxford: Oxford Archaeology

British Geological Survey. (2012). Geology of Britain Viewer. Available: http://www.bgs.ac.uk/discoveringGeology/geologyOfBritain/viewer.html. Last accessed 30 March 2012.

Davenport, P. (1999). *Archaeology in Bath: Excavations 1984-1989.* Oxford: Brit Archaeol Rep (Brit Ser) 284.

Davenport, P., Poole, C. & Jordan, D. (2007) *Archaeology in Bath: Excavations at the New Royal Baths (the Spa) and Bellott's Hospital 1998-1999*. Oxford: Oxford Archaeology.

DCLG (2012). *National Planning Policy Framework.* London: TSO.

IfA. (2008). *Standard and Guidance for archaeological field evaluation.* Reading: IfA.

O.S. Archaeology Branch (1949). Annotated Ordnance Survey map (1939 Rev.) held at BaRAS offices.

9. ACKNOWLEDGMENTS

BaRAS would like to thank Bath and North East Somerset Council for funding the project. We would also like to thank Vanessa Dale (Development & Major Projects B&NES) for her assistance throughout the project, and Richard Sermon (B&NES Archaeological Officer) for his advice.

The archaeological work was managed by John Bryant (Acting Manager BaRAS). Plans, figures, and plates in this report were prepared by Ann Linge (Design and Production Officer BaRAS). The archaeological work was undertaken by Cai Mason (Project Officer BaRAS), Roy Krakowicz and Tracey Smith.

APPENDIX 1: Policy Statement

This report is the result of work carried out in the light of national and local authority policies.

NATIONAL PLANNING POLICY (ENGLAND)

The *National Planning Policy Framework* (NPPF) for England published by the UK Government in March 2012 states that the historic environment, which includes designated and non-designated heritage assets, is an irreplaceable resource and, as such, should be taken into account by Local Planning Authorities when considering and determining planning applications. This is taken to form part of a positive strategy set out in the respective Local Plan to ensure the conservation and enjoyment of the historic environment. The assigned significance of heritage assets will be key factor in terms of their conservation.

Given their irreplaceable nature, any harm to, or loss of, a heritage asset, or heritage assets, should be clearly and convincingly justified as part of a planning application. As part of this, applicants are required to describe the significance of any heritage assets affected by a proposal, including any contribution made by their setting. Where a heritage asset, or assets, are to be harmed or lost as the result of a proposal, the applicant will be required to record and advance the understanding of the significance of that asset or assets, to include making the evidence arising publicly accessible, but this will be in proportion to the significance of the asset/assets in question.

While the NPPF takes into account the historic environment as a whole, additional protection is afforded to designated heritage assets under current English Law. Any proposal that would result in harm or loss of a designated heritage asset is also required to be justified by the applicant in meeting strict criteria set out in the NPPF.

LOCAL POLICY

Bath & North East Somerset Local Plan including waste and minerals policies Revised Deposit Draft 2003 as approved for used for Development Control purposes contains the following policies:

Policy BH.11 – Development which would adversely affect Scheduled Ancient Monuments or any other sites of national importance, and their settings and does not preserve such sites in situ will not be permitted.

Policy BH.12 – Development which would harm important archaeological remains or their settings outside the scope of Policy BH.11 will not be permitted unless the adverse impact of the development proposal on the remains can be mitigated.

Policy BH.13 – Development which adversely affects significant archaeological remains within Bath will not be permitted unless the preservation in situ of these remains can be achieved through a detailed design and construction scheme.

Two Supplementary Planning Guidance (SPG) documents *'Archaeology in Bath & North-East Somerset*' and *'Archaeology in the City of Bath'* (both 2004) have been adopted. Their principal purpose is to supplement Policies BH.11, BH.12 & BH.13 of the existing and emerging Bath & North East Somerset Local Plan and should be read in conjunction with these.

APPENDIX 2: Geophysical Survey

STRATASCAN

Geophysical Survey Report

Ralph Allen School, Bath

for

BARAS

February 2012

Job ref. J3051

Melanie Biggs BSc (Hons)

Document Title:	**Geophysical Survey Report Ralph Allen School, Bath**
Client:	**BARAS**
Stratascan Job No:	**3051**
Survey Date:	**February 2012**
Techniques:	**Detailed magnetic survey (gradiometry)**
National Grid Ref:	**ST 770 626**

Field Team:	**Sean Parker BSc (Hons) and Alex Portch MA**
Project Manager:	**Simon Haddrell B.Eng (Hons) AMBCS PIFA**
Report written by:	**Melanie Biggs BSc (Hons)**
CAD illustration by:	**Melanie Biggs BSc (Hons)**
Checked by:	**Peter Barker C.Eng MICE MCIWEM MIFA FCInstCES Richard Smalley BA (Hons) AIFA**

Stratascan Ltd.
Vineyard House
Upper Hook Road
Upton upon Severn
WR8 0SA

Tel: 01684 592266
Fax: 01684 594142
Email: ppb@stratascan.co.uk
www.stratascan.co.uk

LIST OF FIGURES

1 SUMMARY OF RESULTS

A detailed gradiometry survey was conducted over approximately 2.93 hectares of playing fields and a hockey pitch at the Ralph Allen School in Bath. The survey has revealed a number of anomalies of possible archaeological background. These include a series of irregular shaped pit-like anomalies, various strong and weak linear cut features and a series of strong and weak negative linear anomalies arranged in the form of a partial enclosure network.

Nearby metallic objects, such as hockey stands and goal posts, have produced a level of magnetic disturbance in the data; the majority being across the eastern half of Area 1.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation being undertaken by BARAS.

2.2 Site location

The site is located on the hockey pitch (Area 1) and sports fields (Area 2) of the Ralph Allen School, Bath at OS ref. ST 770 626.

2.3 Description of site

The survey area is approximately 2.93 hectares of playing fields and a clay hockey pitch at the Ralph Allen School, Bath.

2.4 Geology and soils

The underlying geology is Limestone of the Chalfield Oolite formation (British Geological Survey website). There is no drift geology recorded at this site (British Geological Survey website).

The overlying soils are known as Elmton 1 which are typical brown rendzinas. These consist of shallow, well drained, brashy calcareous fine loamy soils over limestone (Soil Survey of England and Wales, Sheet 5 South West England).

2.5 Site history and archaeological potential

No specific details were available to Stratascan.

2.6 Survey objectives

The objective of the survey was to locate any features of a possible archaeological origin in order that they may be assessed prior to development.

2.7 Survey methods

Detailed magnetic survey (gradiometry) was used as an efficient and effective method of locating archaeological anomalies. More information regarding this technique is included in the Methodology section below.

3 METHODOLOGY

3.1 Date of fieldwork

The fieldwork was carried out on Thursday 16th February 2012. Weather conditions during the survey were dry and cold.

3.2 Grid location

The location of the survey grids has been plotted in Figure 2 together with the referencing information. Grids were set out using a Leica Smart Rover RTK GPS.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station re-broadcasts the phase of the carrier it measured, and the

mobile units compare their own phase measurements with those they received from the base station. A SmartNet RTK GPS uses Ordnance Survey's network of over 100 fixed base stations to give an accuracy of around 0.01m.

3.3 Survey equipment and gradiometer configuration

Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTeslas (nT) in an overall field strength of 48,000nT, can be accurately detected using an appropriate instrument.

The mapping of the anomaly in a systematic manner will allow an estimate of the type of material present beneath the surface. Strong magnetic anomalies will be generated by buried iron-based objects or by kilns or hearths. More subtle anomalies such as pits and ditches can be seen if they contain more humic material which is normally rich in magnetic iron oxides when compared with the subsoil.

To illustrate this point, the cutting and subsequent silting or backfilling of a ditch may result in a larger volume of weakly magnetic material being accumulated in the trench compared to the undisturbed subsoil. A weak magnetic anomaly should therefore appear in plan along the line of the ditch.

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. The instrument consists of two fluxgates very accurately aligned to nullify the effects of the Earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background. The Grad601-2 consists of two high stability fluxgate gradiometers suspended on a single frame. Each gradiometer has a 1m separation between the sensing elements so enhancing the response to weak anomalies.

3.4 Sampling interval, depth of scan, resolution and data capture

3.4.1 Sampling interval

Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid.

3.4.2 Depth of scan and resolution

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m, though strongly magnetic objects may be visible at greater depths. The collection of data at 0.25m centres provides an optimum methodology for the task balancing cost and time with resolution.

3.4.3 Data capture

The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each site survey, data is transferred to the office for processing and presentation.

3.5 Processing, presentation of results and interpretation

3.5.1 Processing

Processing is performed using specialist software. This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves 'flattening' the background levels with respect to adjacent traverses and adjacent grids. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following schedule shows the basic processing carried out on all minimally processed gradiometer data used in this report:

1. *Destripe* (Removes striping effects caused by zero-point discrepancies between different sensors and walking directions)

2. *Destagger* (Removes zigzag effects caused by inconsistent walking speeds on sloping, uneven or overgrown terrain)

3.5.2 Presentation of results and interpretation

The presentation of the data for each site involves a print-out of the minimally processed data both as a greyscale plot (Figure 3) and a colour plot showing extreme magnetic values (Figure 4). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site (Figure 5).

4 RESULTS

The following list of numbered anomalies refers to numerical labels on the interpretation plot (Figure 5).

Probable Archaeology

There have been no anomalies identified which are considered to be of probable archaeological origin.

Possible Archaeology

1. A series of irregular shaped cut features characteristic of pits appear just north-west of centre in Area 1. One of these anomalies appears to form a small ring feature (**1a**) which may be considered worthy of further investigation. Three small pits appear down the west side of Area 2 (**1b**).

2. A weak positive curvilinear feature appears to run north to south (**2c**) and off to the south-east (**2a**) in Area 1. A stronger positive pit-like feature (**2b**) seems to define the change in direction between 2c and 2a. This feature appears in close proximity to Anomaly 1, but it is difficult to assess whether the anomalies are related due to the background magnetic disturbance across the dataset (most likely to do with the hockey pitch surface).

3. A number of positive anomalies run across Area 2 in a similar alignment to the current field boundaries. Two of these anomalies appear to be associated with negative anomalies (**3a**).

4. A series of negative linear anomalies span across Area 2 in a similar alignment to the current field boundaries. It is possible that this is a field drainage system, so it has been tentatively marked as possible archaeology. A smaller partial rectilinear negative anomaly (**4a**) appears just west of the centre of the field.

5. A number of magnetic 'spikes' (strong focussed values with associated antipolar response) indicate ferrous metal objects. Although most of these are likely to be modern debris, some may be of archaeological interest.

Other Anomalies

6. Areas of magnetic disturbance are the result of substantial nearby ferrous metal objects such as fences and underground services. These effects can mask weaker archaeological anomalies, and as a significant amount of Area 1 has been wiped out by these effects, masking cannot be ruled out.

7. A buried utility appears to cross Area 2 from the school in a south-westerly direction out of the survey area. Parallel linear anomalies running the length of Area 1 (**8a**) are most likely to be associated with a drainage system.

5 CONCLUSION

The survey conducted at Ralph Allen School, Bath has identified a number of anomalies of possible archaeological origin. These include a series of irregular shaped pit-like anomalies (Anomalies 1 and 5), various strong and weak linear cut features (Anomalies 2 and 3) and a network of negative linear features which appear to form a loose set of enclosures (Anomaly 4).

There is a large amount of magnetic disturbance caused by nearby ferrous objects in the form of hockey stands, fences and goal posts. In Area 1 especially, this has wiped out a large proportion of the eastern half of the data. In general, there seems to be a medium level of background 'noise' to the data set. This is most likely to be associated with the ground conditions of the site as a result of its use as sports fields.

6 REFERENCES

British Geological Survey, n.d., *website*: (http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps) Geology of Britain viewer.

Soil Survey of England and Wales, 1983. *Soils of England and Wales, Sheet 5 South West England*.

APPENDIX A – Basic principles of magnetic survey

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremanent* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremanence is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremanent archaeological features can include hearths and kilns and material such as brick and tile may be magnetised through the same process.

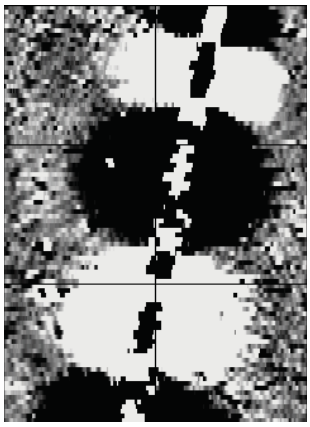
Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically either 0.5 or 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity, disturbance from modern services etc.

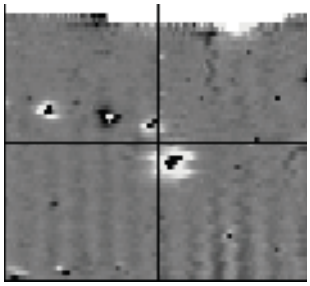
APPENDIX B – Glossary of magnetic anomalies

Bipolar



A bipolar anomaly is one that is composed of both a positive response and a negative response. It can be made up of any number of positive responses and negative responses. For example a pipeline consisting of alternating positive and negative anomalies is said to be bipolar. See also dipolar which has only one area of each polarity. The interpretation of the anomaly will depend on the magnitude of the magnetic field strength. A weak response may be caused by a clay field drain while a strong response will probably be caused by a metallic service.

Dipolar

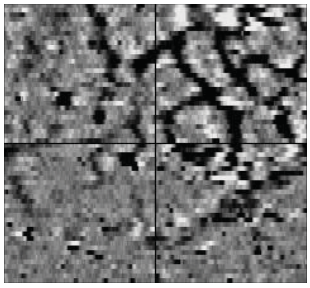


This consists of a single positive anomaly with an associated negative response. There should be no separation between the two polarities of response. These responses will be created by a single feature. The interpretation of the anomaly will depend on the magnitude of the magnetic measurements. A very strong anomaly is likely to be caused by a ferrous object.

Positive anomaly with associated negative response

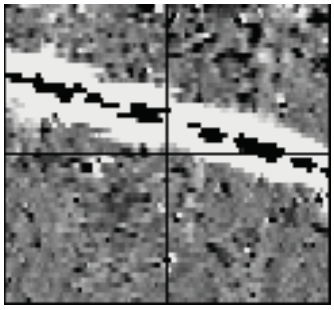
See bipolar and dipolar.

Positive linear



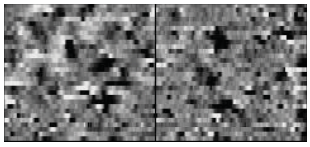
A linear response which is entirely positive in polarity. These are usually related to in-filled cut features where the fill material is magnetically enhanced compared to the surrounding matrix. They can be caused by ditches of an archaeological origin, but also former field boundaries, ploughing activity and some may even have a natural origin.

Positive linear anomaly with associated negative response



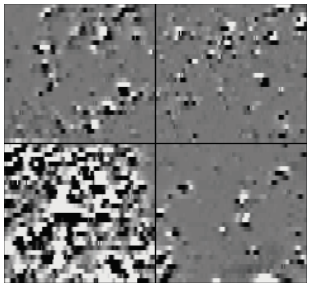
A positive linear anomaly which has a negative anomaly located adjacently. This will be caused by a single feature. In the example shown this is likely to be a single length of wire/cable probably relating to a modern service. Magnetically weaker responses may relate to earthwork style features and field boundaries.

Positive point/area



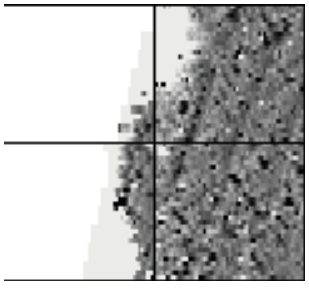
These are generally spatially small responses, perhaps covering just 3 or 4 reading nodes. They are entirely positive in polarity. Similar to positive linear anomalies they are generally caused by in-filled cut features. These include pits of an archaeological origin, possible tree bowls or other naturally occurring depressions in the ground.

Magnetic debris



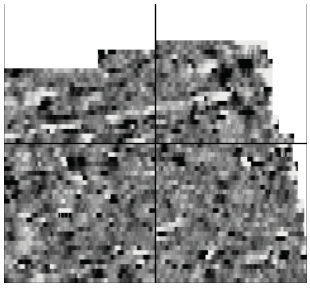
Magnetic debris consists of numerous dipolar responses spread over an area. If the amplitude of response is low (+/-3nT) then the origin is likely to represent general ground disturbance with no clear cause, it may be related to something as simple as an area of dug or mixed earth. A stronger anomaly (+/-250nT) is more indicative of a spread of ferrous debris. Moderately strong anomalies may be the result of a spread of thermoremanent material such as bricks or ash.

Magnetic disturbance



Magnetic disturbance is high amplitude and can be composed of either a bipolar anomaly, or a single polarity response. It is essentially associated with magnetic interference from modern ferrous structures such as fencing, vehicles or buildings, and as a result is commonly found around the perimeter of a site near to boundary fences.

Negative linear

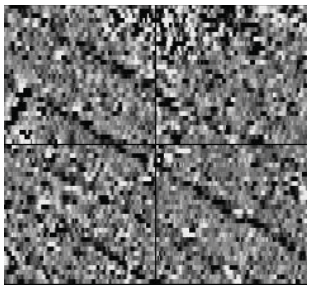


A linear response which is entirely negative in polarity. These are generally caused by earthen banks where material with a lower magnetic magnitude relative the background top soil is built up. See also ploughing activity.

Negative point/area

Opposite to positive point anomalies these responses may be caused by raised areas or earthen banks. These could be of an archaeological origin or may have a natural origin.

Ploughing activity



Ploughing activity can often be visualised by a series of parallel linear anomalies. These can be of either positive polarity or negative polarity depending on site specifics. It can be difficult to distinguish between ancient ploughing and more modern ploughing, clues such as the separation of each linear, straightness, strength of response and cross cutting relationships can be used to aid this, although none of these can be guaranteed to differentiate between different phases of activity.

Polarity

Term used to describe the measurement of the magnetic response. An anomaly can have a positive polarity (values above 0nT) and/or a negative polarity (values below 0nT).

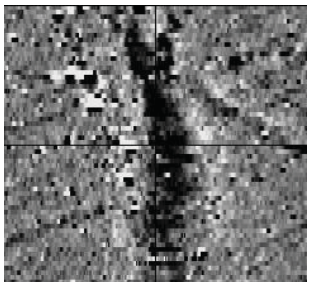
Strength of response

The amplitude of a magnetic response is an important factor in assigning an interpretation to a particular anomaly. For example a positive anomaly covering a $10m^2$ area may have values up to around 3000nT, in which case it is likely to be caused by modern magnetic interference. However, the same size and shaped anomaly but with values up to only 4nT may have a natural origin. Colour plots are used to show the amplitude of response.

Thermoremanent response

A feature which has been subject to heat may result in it acquiring a magnetic field. This can be anything up to approximately +/-100 nT in value. These features include clay fired drains, brick, bonfires, kilns, hearths and even pottery. If the heat application has occurred in situ (e.g. a kiln) then the response is likely to be bipolar compared to if the heated objects have been disturbed and moved relative to each other, in which case they are more likely to take an irregular form and may display a debris style response (e.g. ash).

Weak background variations



Weakly magnetic wide scale variations within the data can sometimes be seen within sites. These usually have no specific structure but can often appear curvy and sinuous in form. They are likely to be the result of natural features, such as soil creep, dried up (or seasonal) streams. They can also be caused by changes in the underlying geology or soil type which may contain unpredictable distributions of magnetic minerals, and are usually apparent in several locations across a site.

N

Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Site centred on NGR: ST 770 626

Client: BARAS

Project Title: RALPH ALLEN SCHOOL, BATH

Job No. 3051

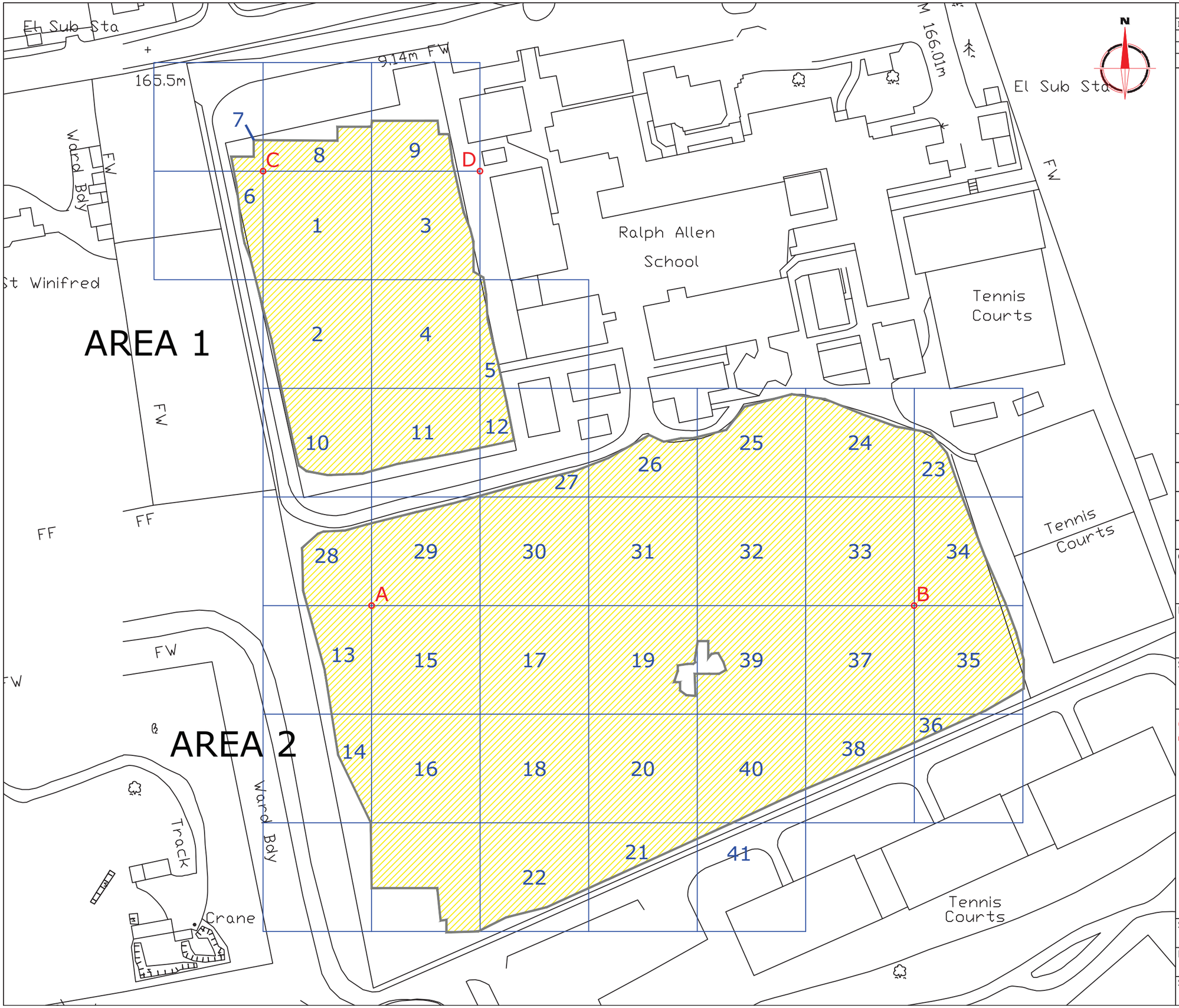
Subject: LOCATION PLAN OF SURVEY AREA

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

SUMO GROUP MEMBER

Scale 1:25000 (0m 500 1000m)

Plot	Checked by	Issue No.
A3	PPB	01
Survey date	Drawn by	Figure No.
FEB 2012	MB	1



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

OS GRID REFERENCES

A	377068.68, 162639.85
B	377218.68, 162639.85
C	377038.68, 162759.85
D	377098.65, 162759.85

Client

BARAS

Project Title — Job No. 3051

RALPH ALLEN SCHOOL, BATH

Subject

LOCATION OF SURVEY GRIDS AND REFERENCING

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

SUMO GROUP MEMBER

Scale 1:1000 (0m 10 20 30 40 50)

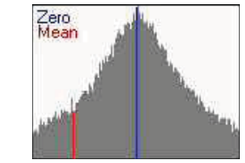
Plot	Checked by	Issue No.
A3	PPB	01
Survey date	Drawn by	Figure No.
FEB 2012	MB	2

Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters

Maximum +2nT (black)
Minimum -2nT (white)



-2nT +2nT

+2nT

-2nT

Client

BARAS

Project Title — Job No. 3051

RALPH ALLEN SCHOOL, BATH

Subject

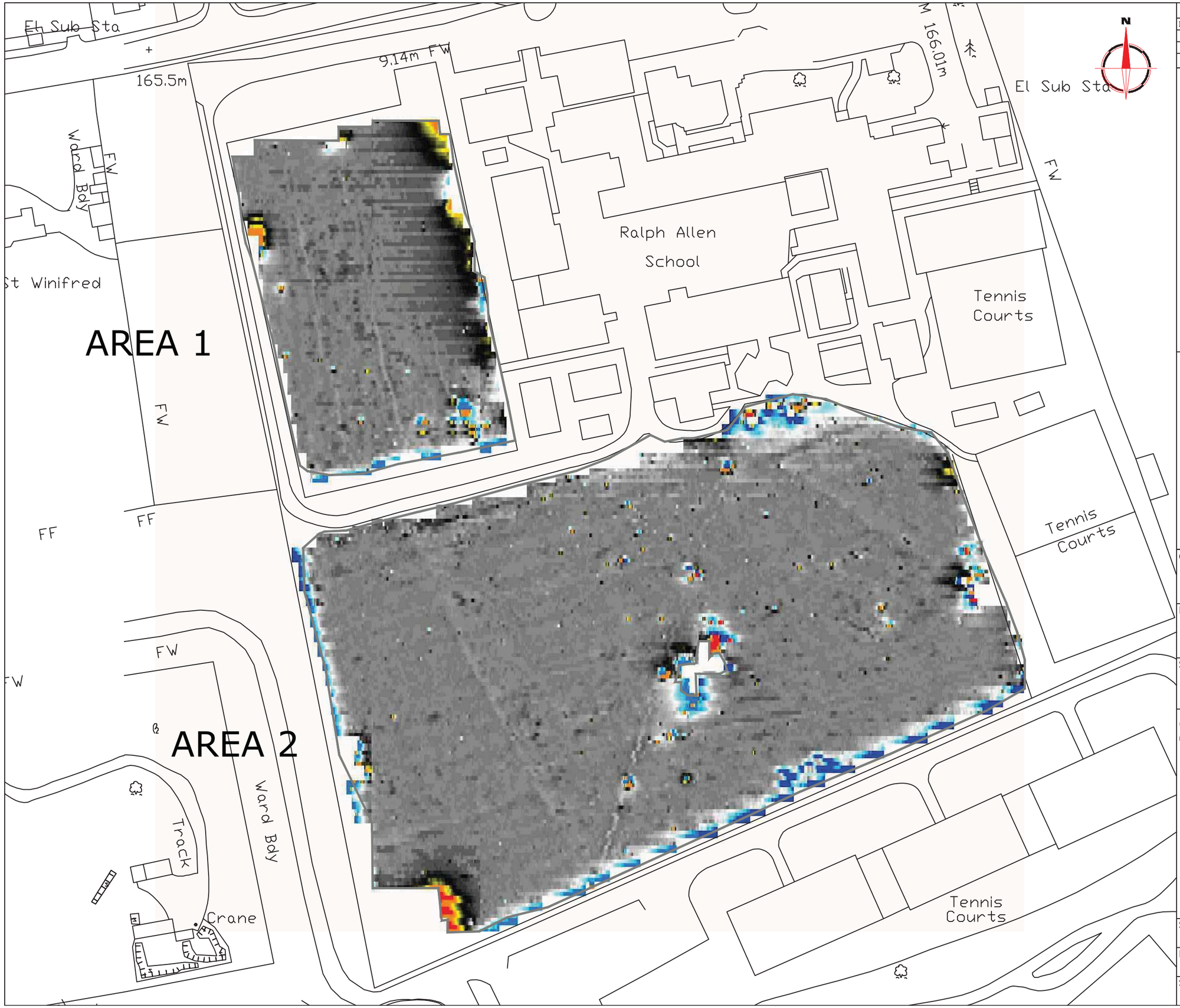
PLOT OF MINIMALLY PROCESSED GRADIOMETER DATA

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

SUMO GROUP MEMBER

Scale 1:1000 (0m 10 20 30 40 50)

Plot	Checked by	Issue No.
A3	PPB	01
Survey date	Drawn by	Figure No.
FEB 2012	MB	3



Amendments

Issue No.	Date	Description
-	-	-
-	-	-

Plotting parameters

Maximum +250nT (red)
Minimum -250nT (blue)

+250nT

-250nT

Client

BARAS

Project Title

RALPH ALLEN SCHOOL, BATH

Job No. 3051

Subject

COLOUR PLOT OF GRADIOMETER DATA SHOWING EXTREME VALUES

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

SUMO GROUP MEMBER

Scale 1:1000

0m 10 20 30 40 50

Plot	Checked by	Issue No.
A3	PPB	01
Survey date	**Drawn by**	**Figure No.**
FEB 2012	MB	4

Amendments

Issue No.	Date	Description
-	-	-
-	-	-

KEY

PROBABLE ARCHAEOLOGY

- Positive anomaly / weak positive anomaly - probable cut feature of archaeological origin
- Negative anomaly / weak negative anomaly - probable bank or earthwork of archaeological origin
- Moderate strength discrete anomaly - probable thermoremanent feature
- Widely spaced curving parallel linear anomalies - probably related to ridge-and-furrow

POSSIBLE ARCHAEOLOGY

- Positive anomaly / weak positive anomaly - possible cut feature of archaeological origin
- Negative anomaly / weak negative anomaly - possible bank or earthwork of archaeological origin
- Moderate strength discrete anomaly - possible thermoremanent feature
- Magnetic spike - probable ferrous object

OTHER ANOMALIES

- Closely spaced parallel linear anomalies - probably related to agricultural activity such as ploughing
- Linear anomaly - probably related to pipe, cable or other modern service
- Linear anomaly - possibly related to land drain
- Magnetic disturbance associated with nearby metal object such as service or field boundary
- Strong magnetic debris - possible disturbed or made ground
- Scattered magnetic debris
- Area of amorphous magnetic variation - probable natural (e.g. geological or pedological) origin

Client

BARAS

Project Title — Job No. 3051

RALPH ALLEN SCHOOL, BATH

Subject

ABSTRACTION AND INTERPRETATION OF GRADIOMETER ANOMALIES

STRATASCAN™
GEOPHYSICS FOR ARCHAEOLOGY AND ENGINEERING
VINEYARD HOUSE
UPTON UPON SEVERN
WR8 0SA
T: 01684 592266
E: info@stratascan.co.uk
www.stratascan.co.uk

SUMO GROUP MEMBER

Scale 1:1000 (0m 10 20 30 40 50)

Plot	Checked by	Issue No.
A3	PPB	01
Survey date	**Drawn by**	**Figure No.**
FEB 2012	MB	5

Fig.1 Site location plan, scale 1:10,000

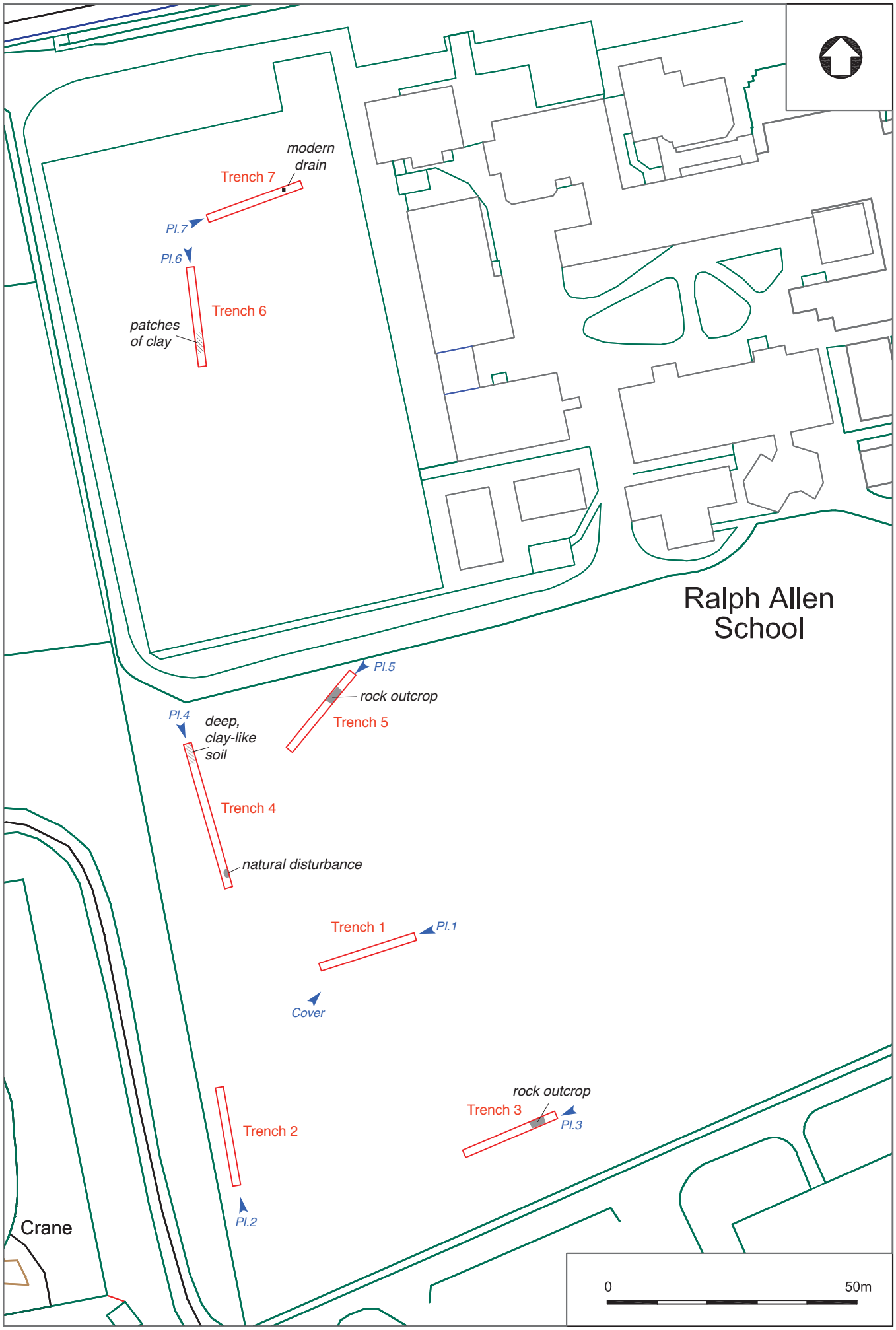


Fig.2 Trench location plan, scale 1:1000

Plate 1 Trench 1, viewed from the east

Plate 2 Trench 2, viewed from the south

Plate 3 Trench 3, viewed from the east

Plate 4 Trench 4, viewed from the north

Plate 5 Trench 5, viewed from the north-east

Plate 6 Trench 6, viewed from the north

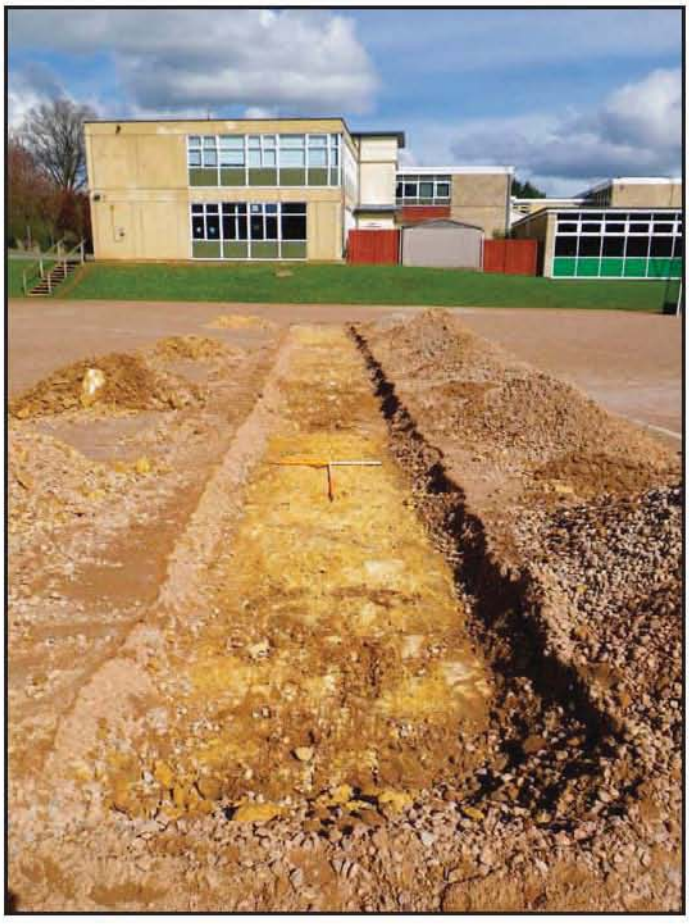


Plate 7
Trench 7, viewed from the west