Archaeological Services & Consultancy Ltd

# GEOPHYSICAL SURVEY:
# LAND AT WOBURN ABBEY
# WOBURN
# BEDFORDSHIRE

NGR: SP 9630 3280

*on behalf of The Bedford Estates*

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September 2013

ASC: 1624/WAG/2

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REGISTERED ORGANISATION IfA

# Site Data

| | | | |
|---|---|---|---|
| *ASC project code:* | WAG | *ASC project no:* | 1624 |
| *OASIS ref:* | 155212 | *Event/Accession no:* | 2013/14 |
| *County:* | Bedfordshire | | |
| *Village/Town:* | Woburn | | |
| *Civil Parish:* | Woburn | | |
| *NGR (to 8 figs):* | SP 9630 3280 | | |
| *Extent of site:* | c.4.4ha | | |
| *Present use:* | Parkland | | |
| *Planning proposal:* | Installation of ground source heat pump and pipework | | |
| *Local Planning Authority:* | Central Bedfordshire Council | | |
| *Planning application ref/date:* | Pre-planning | | |
| *Date of fieldwork:* | 11th - 16th August | | |
| *Commissioned by:* | The Bedford Estates<br>Bedford Estate Office<br>Woburn<br>Bedfordshire<br>MK17 9PQ | | |
| *Client:* | As above | | |
| *Contact name:* | Paul Williams | | |

**Internal Quality Check**

| | | | |
|---|---|---|---|
| *Primary Author:* | Alastair Hancock | *Date:* | 6th Sept 2013 |
| *Revisions:* | | *Date:* | |
| *Edited/Checked By:* |  | *Date:* | 9th Sept 2013 |

# CONTENTS



**Figures:**



**Appendices:**

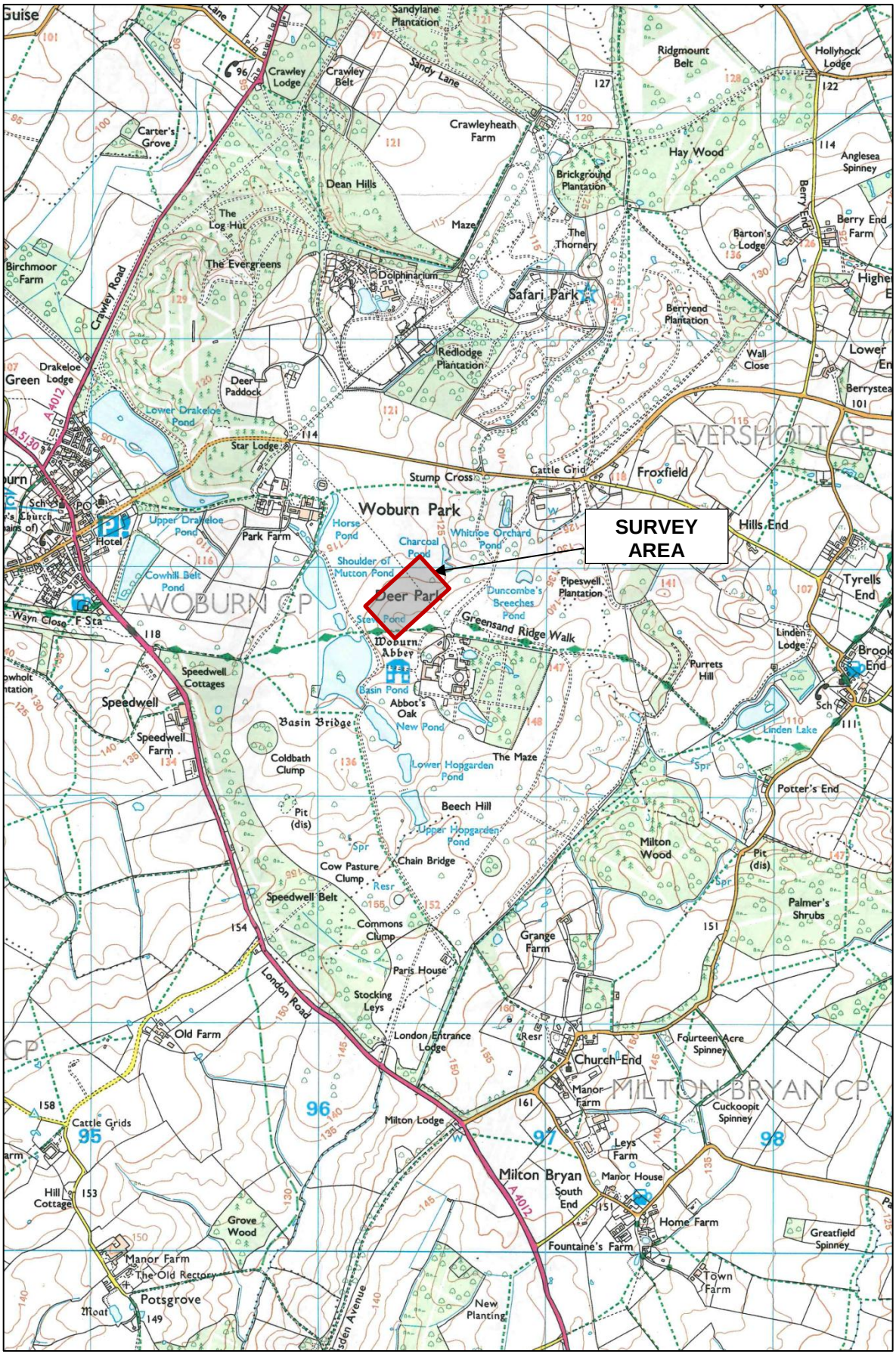


**Figure 1:** General location *(scale 1:25,000)*

# Summary

*Detailed resistance survey of 4.4 hectares was carried out by ASC Ltd at parkland located slightly to the northwest of Woburn Abbey. The survey results show that large parts of the east of the surveyed area has been impacted by undated extraction; elsewhere the survey has defined resistance anomalies interpreted as having a geological or modern (services and drainage) origin. It is probable that the survey area has not been included within the different phases of formal gardens located closer to the Abbey and that structural features are absent.*


# 1. Introduction

## 1.1 *General*

In August 2013 *Archaeological Services and Consultancy Ltd* (ASC) carried out detailed resistance survey of *c.*4.4 hectare of land located at Woburn Abbey, Woburn Bedfordshire. The project was commissioned by *The Bedford Estates*, and was carried out according to a written scheme of investigation prepared by ASC (Rouse 2013), which was approved by the *Central Bedfordshire Council Archaeologists*, archaeological advisors (AA) to the local planning authority (LPA), *Central Bedfordshire Council*.

## 1.2 *Planning Background*

The resistance survey was required under the terms of the *National Planning Policy Frameworks* (NPPF), and was defined in discussion with *Central Bedfordshire Council Archaeologists* the Archaeological Advisor (AA) to the local planning authority (LPA), *Central Bedfordshire Council*. The survey was completed to inform a proposed planning/Listed Building application.

## 1.3 *Archaeological Services & Consultancy Ltd*

ASC is an independent archaeological practice providing a full range of archaeological services including consultancy, field evaluation, mitigation and post-excavation studies, historic building recording and analysis. ASC is recognised as a *Registered Organisation* by the Institute for Archaeologists and is also accredited ISO 9001, in recognition of its high standards and working practices.

## 1.4 *The Site*

### 1.4.1 *Location & Description*

The site is located within the district of Central Bedfordshire, the parish of Woburn, and comprises part of the Woburn Abbey estate. It is centred on NGR SP 9630 3280 (Fig. 1). The survey area comprises a sub- rectangular parcel of land, located to the north west of Woburn Abbey. The land is in use as open parkland (Fig. 2).

### 1.4.2 *Topography & Geology*

The soils of the area belong to the Evesham 3 Association, which are described as *slowly permeable calcareous clayey, and fine loamy over clayey soils. Some slowly permeable seasonally waterlogged non-calcareous soils* (Soil Survey 1983, 411c). The underlying geology comprises quaternary Till (BGS, Sheet 220) which overlies the Woburn Sands Formation of the Greensand Ridge. The site slopes moderately downward from south east to north west, and has a central elevation of *c.*125mAOD.

### 1.4.3 *Proposed Development*

Installation of ground source heat pump and associated pipework (Fig. 2)


**Figure 2:** Proposed ground source heat pump pipe array (red) and superimposed geophysical survey area (green) *(scale 1:3000)*

# 2. Archaeological & Historical Background

2.1 The following section provides a summary of the readily available archaeological and historical background to the development site and its environs. This section has been compiled with information from the Central Bedfordshire Historic Environment Record (HER) and other readily available sources.

2.2 ***Prehistoric*** *(before 600BC-AD43)*

Currently there is no recorded evidence for Prehistoric activity within the immediate vicinity of Woburn Abbey.

2.3 ***Roman*** *(AD43-c.450)*

There is no definite evidence for Roman settlement in the immediate vicinity of Woburn Abbey, although Roman pottery was found in Woburn Park in the late 19th century (HER38). The Viatores have suggested that Leighton Street, the east-west aligned road passing through Woburn, follows the line of a Roman road, but this has not been proven (Viatores 1964).

2.4 ***Saxon*** *(c.450-1066)*

The earliest mention of Woburn is in the Saxon charter for 'Aspley', which dates to 969, where it is referred to as 'Woburninga Genaere' (EUS 2003), but there is no direct evidence that a settlement existed at this time.

2.5 ***Medieval*** *(1066-1500)*

Woburn is mentioned in the Domesday Survey of 1086, which records that it was held by Alric, a thegn of King Edward, prior to the conquest, suggesting a settlement had been established by the end of the Saxon period (EUS 2003).

The present house at Woburn Abbey (HER 4949) is built on the site of a Cistercian abbey founded in 1145 and dissolved in 1538. There is very little documentary evidence relating to the Abbey before its dissolution. The exact location of the buildings is not known, though it is believed that the present house is located on the site of the cloister. Small scale investigations and observations have located the remains of a medieval wall under the north west corner of the present house, which may relate to the west end of the church. Skeletons are reported to have been found to the north of the house (HER 40).

2.6 ***Post-Medieval*** *(1500-1900)*

The current Woburn Abbey is a 17th century Grade I listed building in the Neo-classical style with rustication. It is home to the Russell family, the Dukes of Bedford, to whom the land was granted in 1547. Originally built in 1630, it was extensively reworked between 1747 and 1790 (HER 4949).

The grounds surrounding the house comprise Woburn Park (HER 8762), a landscape park and pleasure grounds which include a number of other listed buildings. The park is Grade I Listed in the English Heritage Register of Historic Parks and Gardens and its development and some of the listed buildings within it are briefly described below.

The pleasure ground and park began to be established during the mid-17th century and by 1661 a series of enclosed gardens had been laid out to the west of the house within a park enclosing various areas of woodland with straight rides cut through. The park was extended and further formalised during the early part of the 18th century through creation of the circular Basin Pond (HER 8762) as part of a grand west approach to the house designed by George London. Charles Bridgeman was consulted in the 1730s and he was responsible for removal of much of the formal 17th century gardens surrounding the house. The fifth Duke employed Henry Holland (1745-1806) who, amongst other works, was responsible for construction of the Chinese Dairy (HER4955: Grade I), the Sculpture Gallery (HER4951: Grade I) and the London Entrance Lodge and Screen Walls (HER 5776: Grade II*). At the same time the informal gardens to the east and south were enclosed and developed.

The sixth Duke employed Humphry Repton (1752-1818) in 1804. Repton produced his Red Book for Woburn in January 1805, with suggestions covering both park and gardens. The *c.*12ha pleasure grounds were remodelled by Repton to largely comprise informal mature woodland and lawns enclosing extant features such as the Chinese Dairy and the circular hedged maze with its central Chinese Pavilion (HER 4954: Grade II*). Repton's work included naturalisation of Basin Pond and its inclusion as part of a chain of informal ponds culminating in Lower Drakeloe Pond, lying 1.5km north-west of the Abbey. Some of Repton's suggested features were not completed until after his death when the park was again extended. The pleasure grounds are enclosed by a ha-ha to the south and east, and an iron fence and gates to the north. The park is bounded by a high red brick wall along stretches which border roads.

2.7 ***Modern*** *(1900-present)*

The gardens were further developed by Percy Cane c 1930, and in 1955 the house and grounds were opened to the public. The safari park was established at the north of the park during the 1950's (although a collection of exotic animals has been kept since at least the 19th century). Other visitor facilities were constructed in the same period close to the house.

To the SW of Woburn Abbey is the site of a satellite landing ground from World War II. The area had a large L laid out in the landing area and the grass runway was used by single to 4 engine planes (HER 18006).

# 3. Aims, Methods and Report Presentation

## 3.1 *Aims*

In line with the *Written Scheme of Investigation* (WSI: Rouse 2013) the aims of the geophysical (detailed resistance) survey were:

- To determine the presence or absence of subsurface archaeological features.
- To define the spatial extent of any detected archaeological features.
- To attempt interpretation of the form, function and if possible phasing of any detected archaeological features.
- To inform an appropriate strategy to mitigate the impact of proposed development to any detected heritage assets.

## 3.2 *Methods*

The survey was carried out in accordance with the methodology set out in the WSI which was:

- Detailed twin probe resistance survey of all suitable parts of the designated survey area (4.4ha) with mobile probes set at 0.5m spacing and at a sample interval of 1.0m along traverses spaced 1.0m apart.

## 3.3 *Standards*

The work conformed to the *Written Scheme of Investigation* (Rouse 2013) as approved by the AA, to the Institute for Archaeologists' *Standard & Guidance Notes* (*e.g.* IFA 2008, 2011), *Code of Conduct* (IFA 2010) and other relevant IFA by-laws, to the Association of Local Government Archaeological Officers East of England Region *Standards for Field Archaeology in the East of England* (ALGAO 2003), to English Heritage guidelines (EH 2006, 2008), and to the relevant sections of ASC's own *Operations Manual.* Data collected during the geophysical survey was treated and archived in accordance with Archaeology Data Service guidelines (Schmidt, A. and E. Ernenwein 2011).

## 3.4 *Report Presentation*

3.4.1 Figure 1 (1:25,000) shows a general location plan and the proposed development with the geophysical survey superimposed is shown in Figure 2 (1:3,000). The processed resistance data and accompanying interpretation are presented in Figures 3 and 4 (1:1250). A plot of the unprocessed "raw" resistance data is presented in Appendix 4.

3.4.2 The underlying principles of resistance survey, the equipment used, general geophysical survey methodology, and data processing and display are presented in Appendix 1. Survey location information is presented in Appendix 2 and the composition of the archive described in Appendix 3.

3.4.3 The figures 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 figures are presented to most suitably display and interpret the data from this site based on the experience and knowledge of ASC staff.

# 5. Geophysical Survey: Results and Discussion

5.1 During the fieldwork the weather was consistent with conditions prevailing for a number of preceeding weeks; sunny and humid with just an occasional short lived shower. The results of the resistance survey suggest that the centre and southwest of the survey area are relatively undisturbed by human activity. However, the northeast of the survey area appears to have been subject to intensive extraction. The extraction is undated, but it is relatively large and is perhaps of medieval or more probably post medieval date. The survey results are discussed in more detail in the following sections.

5.2 ***Non Archaeological Anomalies***

5.2.1 A curving band of amorphous higher resistance anomalies runs from the southwest of the survey area to terminate near its centre. The higher resistance is correlated with the steeper part of a southeast-northwest trending slope and it is interpreted as having a natural geomorphological origin consequent to coverage of this area by relatively thin soil. As a consequence of its proposed natural origin it is not marked on the interpretation (Fig 4).

5.2.3 A small number of linear low resistance anomalies are identified at the southwest of the survey area (Fig 4). It is probable that these anomalies result from retention of water within the backfill of relatively recent service runs and modern drainage.

5.3 ***Archaeological Anomalies***

5.3.1 At the northeast of the survey area two large areas of high resistance (Fig 4) are correlated with the position of an amorphous, non-natural depression noted during the geophysical survey fieldwork. The data was examined after various processing methods had been applied; a number of discrete areas of higher resistance are evident after application of a high pass filter, which could suggest that there was more than one focus of extraction (Fig 5).

5.3.3 The large high resistance anomaly at **A** (Fig 4) is correlated with the greater part of the amorphous depression. The appearance of the depression and the presence of the high resistance anomaly suggests that at least one extraction pit is present here.

5.3.4 The large area of high resistance at **B** (Fig 4) is partly coincident with the amorphous depression mentioned in the previous section. However, at the north it is correlated with a very slight mound, perhaps formed by a residue of material originating from the extractive activity interpreted at **A**.

 

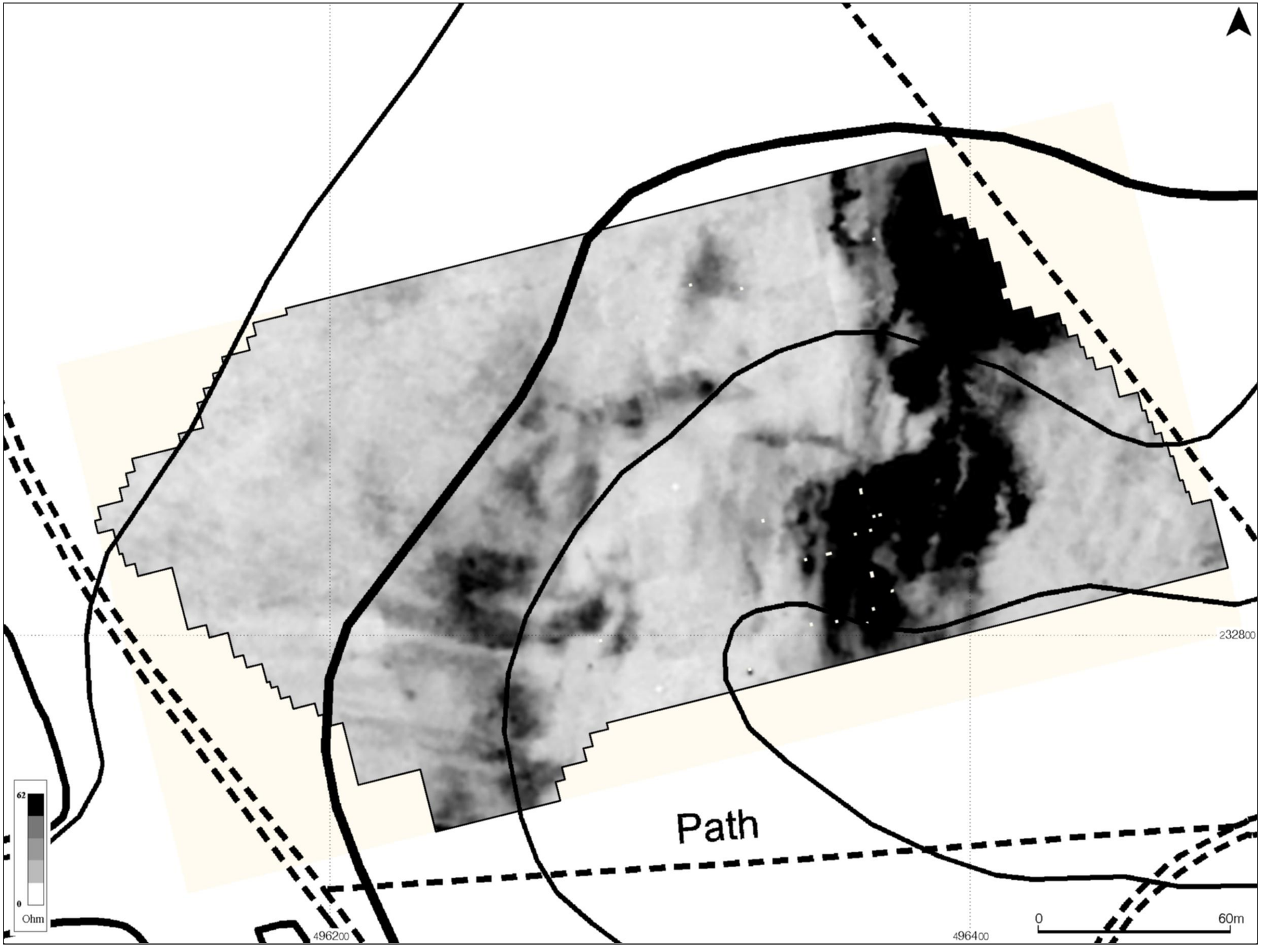


**Figure 3:** Greyscale plot of processed resistance data showing topographic contours *(scale 1:1250)*

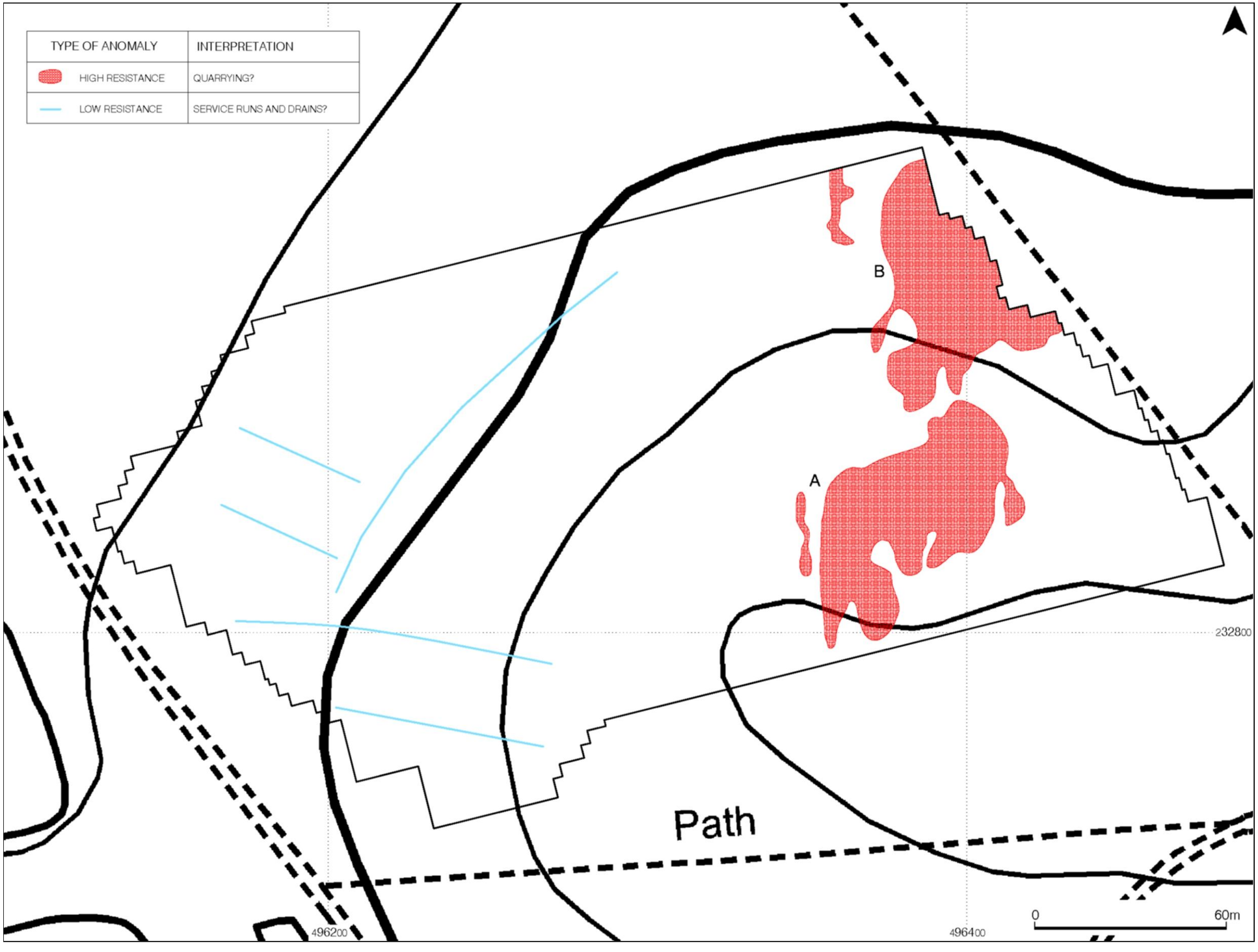


**Figure 4:** Interpretation of resistance data *(scale 1:1250)*

# 6. Conclusions

6.1 The survey results suggest that the majority of the area which will be impacted by the proposed development has seen limited human activity consistent with its longstanding use as parkland.

6.2 The resistance data does not suggest the presence of formal garden or structural features. The sloping topography of much of the survey area may have precluded its incorporation into the formal gardens located adjacent to the Abbey.

6.3 The heritage assets which are identified are defined by extensive areas of high resistance. The high resistance is interpreted as resulting from the excavation of at least one extraction pit near the crest of a slope and from a slight mound of extraction residue, present near the base of the slope.

6.4 The depth of insertion of the heat source pump pipework is currently unknown, but the soils at the surveyed area may be relatively thin and the proposed network of pipes is extensive. Consequently, the proposed development could have a high impact on the identified heritage assets although it is probable that they are of low archaeological significance.

***The results and subsequent interpretation of data from geophysical surveys should not be treated as an absolute representation of the underlying archaeological and non-archaeological remains. Confirmation of the presence or absence of archaeological remains can only be achieved by direct investigation of sub-surface deposits.***

 

# 7. References

***Standards & Specifications***

ALGAO 2003 *Standards for Field Archaeology in the East of England.* East Anglian Archaeology Occasional Paper **14**.

Allen J L & Holt A St J 1986 (with later updates) *Health & Safety in Field Archaeology.* Federation of Archaeological Managers & Employers (London).

Brown DH 2007 *Archaeological Archives: a Guide to Best Practice in Creation, Compilation, Transfer & Curation.* Archaeological Archives Forum.

EH 2006 *Management of Research Projects in the Historic Environment (MoRPHE).* English Heritage.

EH 2008 *Geophysical Survey in Archaeological Field Evaluation.* English Heritage (London).

IFA 2008 Institute for Archaeologists' *Code of Approved Practice for the Regulation of Contractual Arrangements in Field Archaeology*.

IFA 2009 *Standard & Guidance for Archiving Archaeological Projects.* Institute for Archaeologists (Reading)

IFA 2010 Institute for Archaeologists' *Code of Conduct*

IFA 2011 *Standard & Guidance for Archaeological Geophysical Survey.* Institute for Archaeologists (Reading)

Schmidt A. and Ernenwein, E 2011 *Geophysical Data in Archaeology: A Guide to Good Practice.* Archaeology Data Service.

***Secondary Sources***

BGS *British Geological Survey 1:50,000 Series, Solid & Drift Geology*.

Brown N & Glazebrook J (eds) 2000 *Research and Archaeology: a Framework for the Eastern Counties, **2**: Research Agenda and Strategy.* East Anglian Archaeology Occasional Paper **8**

Medlycott M 2011 *Research and Archaeology Revisited: A Revised Framework for the East of England*. East Anglian Archaeology Occasional Papers **24**.

Oake M, Luke M, Dawson M, Edgeworth M & Murphy P 2007 *Research & Archaeology: Resource Assessment, Research Agenda and Strategy.* Bedfordshire Archaeology Monograph **9**.

Soil Survey 1983 *1:250,000 Soil Map of England and Wales, and accompanying legend* (Harpenden).

# 8. Acknowledgements

The evaluation was commissioned by Paul Williams, Estate and Property Manager for The Bedford Estates. The project was monitored by the Central Bedfordshire Council Archaeologists on behalf of the local planning authority. The project was managed for ASC by Alastair Hancock. Fieldwork was carried out by A Hancock and C. Rouse BA AI*f*A. The report was prepared by A Hancock and edited by Bob Zeepvat BA MI*f*A.

***Fieldwork***
A Hancock BSc PgDip MI*f*A and C Rouse BA AI*f*A
***Report***
A. Hancock
***Graphics***
A. Hancock

# Appendix 1: Resistance Survey: Technical Information

## 1. Earth Resistance

The resistance of the subsurface is almost entirely dependent upon the amount and distribution of moisture incorporated within it. Masonry or stones, for example, are usually less porous and possess higher resistance than clay subsoils or organic rich fills of archaeological ditches or pits.

In archaeological surveys the resistivity, strictly the resistance of a specific volume of a specific material, cannot be calculated although apparent resistivity may be. In practice equipment used to carry out this type of survey measures resistance and subsequent calculation of the apparent resistivity of the subsurface is rarely carried out, most archaeological surveys of this type should therefore more accurately be called "resistance" surveys

The success of resistance survey and correct interpretation of the results is dependent on a complex set of factors including the interaction of the composition and geometry of archaeological features, the geology, the electrode configuration used and climatic variations. E.g. surveys of this type are rarely at their most successful if carried out during extended periods of dry or wet weather.

## 2. Methodology

For any given area resistance survey is more time consuming than magnetic methods; the equipment is more cumbersome, climatic and site conditions are more critical, and data interpretation usually more complex. The efficacy of this technique for locating and defining building foundations and masonry features, and the previously outlined factors favour its use as a site investigation rather than prospection technique.

Although other probe configurations may be employed, usual survey procedure will utilise a Geoscan RM15 resistance meter in 0.5m twin probe configuration which will be set to take automatic readings at predetermined points, typically at (a maximum) 1m interval, 1m apart on zig-zag traverses within 20m by 20m square grids. These readings are stored in the memory of the instrument until exported to computer for processing and interpretation.

## 3. Data Processing and Presentation

Resistance data is presented in greyscale format as both "raw" and "processed" data. Processing steps will be detailed in technical appendices of the report. Where X-Y plots can aid interpretation these will also be included in appendices.

An X-Y plot presents the data logged on each traverse as a single line with each successive traverse incremented on the Y-axis to produce a 'stacked' plot. A hidden line algorithm is usually employed to block out lines behind major anomalies. The main advantage of this display option is that the full range of data can be viewed, dependent on the clip, so that the 'shape' of individual anomalies can be discerned and potentially archaeological anomalies differentiated from non archaeological anomalies.

TerraSurveyor was used to process the data and produce the greyscale images and any XY trace plots. All greyscale plots are displayed using a linear incremental scale.

 

# Appendix 2: Survey Location Information

1. The geophysical survey blocks were established using a Leica total station. Survey block points were set out at 60m intervals with the total station and points at 20m intervals were set out as required using 100m tapes.

2. The survey grids were geo referenced using he total station and superimposed onto an Ordnance Survey digital map base. Overall there was a good correlation between the local survey and the digital map base and it is estimated that the average 'best fit' error is better than ±2m. It should be noted that Ordnance Survey 1:2500 mapping data have an error of ±1.9m at 95% confidence. This potential error must be considered if the grid needs to be re-established from points other than those listed below or if geophysical anomalies are located using GPS technology.

| Station | Easting | Northing |
|---|---|---|
| WSW of baseline | 496228.24 | 232758.06 |
| ENE of baseline | 496480.61 | 232821.04 |

***ASC Ltd cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party or for the removal of any of the survey reference points.***

# Appendix 3: Geophysical Archive

1. The geophysical archive comprises:-
   - an archive disk containing compressed (WinZip) files of the raw data, plot meshes and composites, report text (Word 2000), and graphics files (CorelDraw12 and AutoCAD 2000) files.
   - a full copy of the report
2. At present the archive is held by ASC although it is anticipated that it may eventually be lodged with the Archaeology Data Service (ADS). Brief details may also be forwarded for inclusion on the English Heritage Geophysical Survey Database after the contents of the report are deemed to be in the public domain (*i.e.* available for consultation in the relevant Historic Environment Record Office).

# Appendix 4: Plot of Unprocessed and Processed Resistance Data

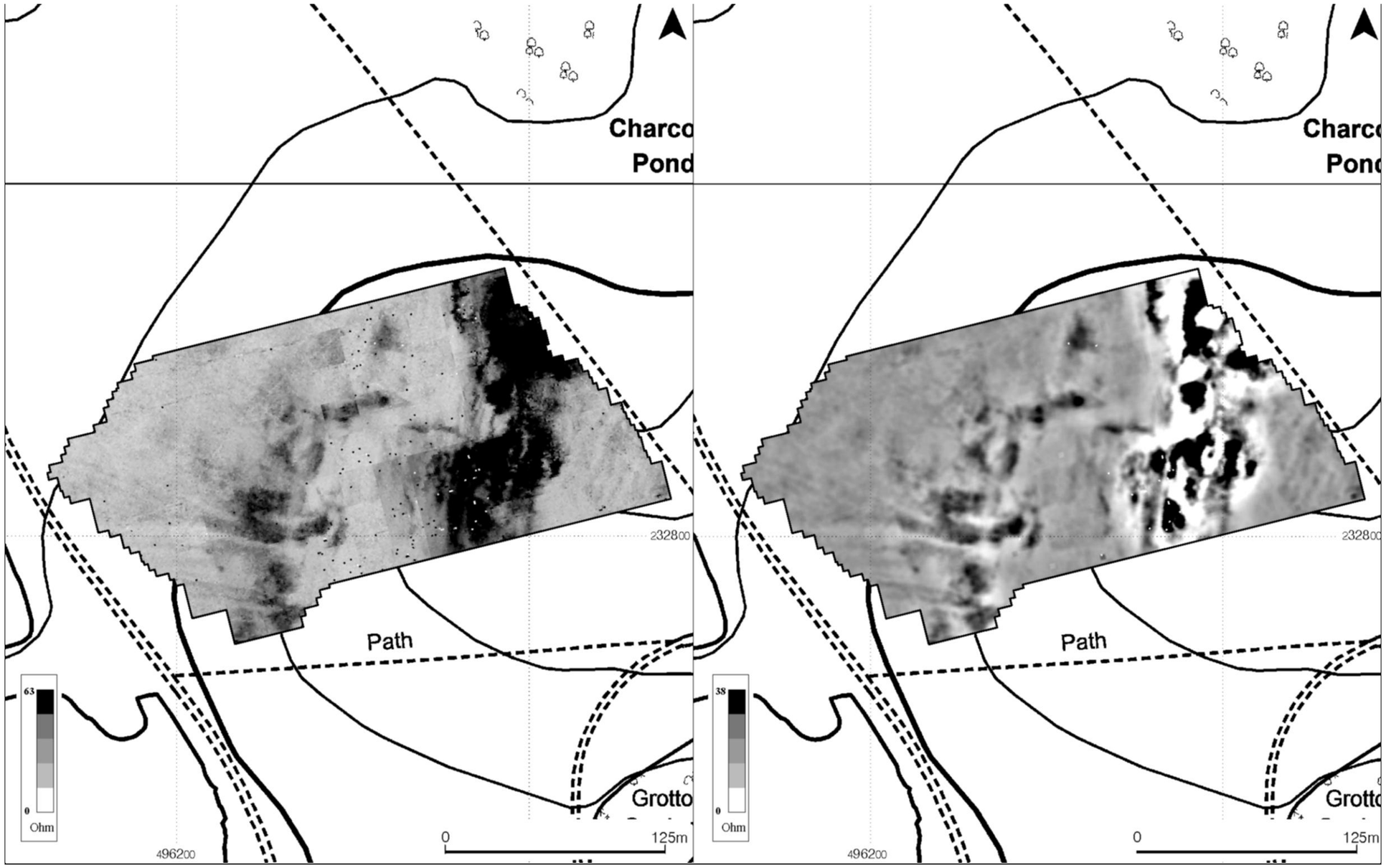


**Figure 6:** Greyscale plot of unprocessed resistance data (left) and processed resistance data (right; edge matched, high and low pass filtered) *(scale 1:2500)*

# Appendix 5: ASC OASIS Form

| **PROJECT DETAILS** | | | |
|---|---|---|---|
| Project Name: | Woburn Abbey | OASIS reference: | 155212 |
| Short Description: | Detailed resistance survey of 4.4 hectares was carried out by ASC Ltd at parkland located slightly to the northwest of Woburn Abbey. The survey results show that large parts of the east of the surveyed area has been impacted by undated extraction; elsewhere the survey has defined resistance anomalies interpreted as having a geological or modern (services and drainage) origin. It is probable that the survey area has not been included within the different phases of formal gardens located closer to the Abbey and that structural features are absent. | | |
| Project Type: | Geophysical Survey | | |
| Previous work: (eg. SMR refs) | unknown | Site status: (eg. none, SAM, listed) | Listed |
| Current land use: | Parkland | Future work: (yes/no/unknown) | unknown |
| Monument type: | na | Monument period: | na |
| Significant finds: (artefact type & period) | Quarry pit | | |
| **PROJECT LOCATION** | | | |
| County: | Bedfordshire | OS reference: (8 figs min) | SP 9630 3280 |
| Site address: (+ postcode if known) | Woburn Abbey, Woburn, Bedfordshire | | |
| Study area: (sq. m. / ha) | *c.*4.4 hectare | Height OD: (metres) | c.125m |
| **PROJECT CREATORS** | | | |
| Organisation: | Archaeological Services & Consultancy Ltd | | |
| Project brief originator: | na | Project design originator: | A Hancock |
| Project Manager: | A Hancock | Director/Supervisor: | A Hancock |
| Sponsor / funding body: | The Bedford Estates | | |
| **PROJECT DATE** | | | |
| Start date: | | End date: | |
| **PROJECT ARCHIVES** | | | |
| | Location | Content (eg. pottery, animal bone, files/sheets) | |
| Physical: | Luton Museum (Accession no. 2013/14) | None | |
| Paper: | | Fieldwork report and Project Design | |
| Digital: | | Report text, geophysical data, illustrations, basemap | |
| **BIBLIOGRAPHY** (Journal/monograph, published or forthcoming, or unpublished client report) | | | |
| Title: | Geophysical Survey: Land at Woburn Abbey, Woburn, Bedfordshire | | |
| Serial title & volume: | ASC Ltd Report ref. 1624/WAG/2 | | |
| Author(s): | A Hancock | | |
| Page nos | 1-18 | Date: | 9th Sept 2013 |