

Ide Park and Ride, Alphington, Devon

Report of a Detailed Gradiometer Survey and an Archaeological Watching Brief of a Geotechnical Soil Survey



Ref: 69871.01

November 2008

ALPHINGTON, DEVON

Report of a Detailed Gradiometer Survey and an Archaeological Watching Brief of a Geotechnical Soil Survey

Prepared for: **Parsons Brinckerhoff** The Forum Barnfield Road Exeter EX1 1QR

By:

Wessex Archaeology Portway House Old Sarum Park Salisbury SP4 6EB

Ref: 69871.01

November 2008

© Wessex Archaeology Limited 2008 Wessex Archaeology Limited is a Registered Charity No.287786

ALPHINGTON, DEVON

Report of a Detailed Gradiometer Survey and an Archaeological Watching Brief of a Geotechnical Soil Survey

Contents

10	REFERENCES	10
	9.3 Security copy	9
	9.1 Preparation and Deposition	9 9
3	ARGHIVE	
٩	ARCHIVE	٩
	8.2 Watching brief	8
-	8.1 Geophysical survey	8
8	CONCLUSION	8
7	ENVIRONMENTAL	8
6	FINDS	8
	 5.2 Detailed survey results and interpretation 5.3 Watching brief results 	6 7
	5.1 Geophysical survey results	6
5	RESULTS AND INTERPRETATION	6
	4.3 Health and Safety	6
	4.2 Archaeological watching brief	5 5
-+	4.1 Geophysical survey	3 5
4		5
	3.2 Archaeological watching brief	4
•	3.1 Geophysical survey	4
3	AIMS AND OBJECTIVES	4
	2.3 Archaeological and Historical Background	3
	2.1 Introduction	2 2
2	ARCHAEOLOGICAL AND HISTORICAL BACKGROUND	2
	1.2 Survey areas	1
	1.1 Project background	1
1	INTRODUCTION	1
	Acknowledgements	IV V
	Summary	iv

APPENDIX 1:	SURVEY EQUIPMENT AND DATA PROCESSING
APPENDIX 2:	GEOPHYSICAL INTERPRETATION13
APPENDIX 3:	BOREHOLE DEPOSIT RECORDS TABLES14

FIGURES

- Figure 1Site location, survey extents and borehole locations
- Figure 2 Greyscale plot of geophysical results
- **Figure 3** XY plot of geophysical results
- Figure 4Interpretation of geophysical results

ALPHINGTON, DEVON

Report of a Detailed Gradiometer Survey and an Archaeological Watching Brief of a Geotechnical Soil Survey

Summary

Wessex Archaeology was commissioned by Parsons Brinkerhoff (Exeter) acting on behalf of Devon County Council (The Client) to undertake a Geophysical survey, (Detailed Gradiometer Survey) and an Archaeological Watching Brief to monitor a Geotechnical Soil Survey on the proposed IDE Park and Ride, Alphington, Devon, centred on National Grid Reference (NGR) 291100, 090360 (**Figure 1**).

As detailed in the Devon County Council Local Transport Plan the Site is proposed for the development of an approximately 780 space Park and Ride facility to serve the southern approaches to the city of Exeter.

An Archaeological Desk-based Assessment (DBA) was prepared by Wessex Archaeology (WA 2008) to inform the baseline for an assessment of the effects of the proposed development on the cultural heritage resource as part of an Environmental Statement, which will accompany the planning application for the Site.

To further inform the results of the DBA a Geophysical Survey of the Site was undertaken by Wessex Archaeology shortly prior to the Watching Brief. The Watching Brief comprised the archaeological monitoring of twenty boreholes across the Site.

Results from the Geophysical Survey highlighted a number of anomalies interpreted to be of an anthropogenic origin. Of these, a linear feature running on a north-west to south-east orientation appears to correlate well with cartographic and topographic evidence for the location of a former 19th century mill race.

Further anomalies identified may represent features associated with this mill race and former field boundaries within the area. In addition, a number of modern services crossing the Site were recorded.

The watching brief identified in two of the twenty boreholes areas of made ground. Deposits of mixed gravelly clays and sandy silty clays interpreted as 'made ground' were recorded within Boreholes 12 and 14. Within Borehole 12, which was located over a linear feature identified in the geophysical survey to the north of the mill race, these deposits were recorded to a depth of 0.64m. In Borehole 14, which was located within the mill race the deposits were recorded to a depth of 1.20m from present ground surface. The remaining eighteen boreholes were consistent with the known geology comprising of thin Holocene alluvium overlying River Terrace gravel deposits.

ALPHINGTON, DEVON

Report of a Detailed Gradiometer Survey and an Archaeological Watching Brief of a Geotechnical Soil Survey

Acknowledgements

The geophysical survey and watching brief were commissioned by Parsons Brinckerhoff and the assistance of Letitia Hoff and Phil Limage in this regard is gratefully acknowledged.

The geophysical fieldwork was carried out by Nathan Thomas and Daryl Freer. Nathan Thomas processed and interpreted the geophysical data. The watching brief was conducted by Kevin Ritchie. This report was written by Nathan Thomas and Kevin Ritchie.

The geophysical work was managed and quality controlled by Paul Baggaley and the watching brief by Damian De Rosa. This project was facilitated by Abigail Bryant Illustrations were prepared by Liz James. The project was managed on behalf of Wessex Archaeology by Paul Baggaley and Damian De Rosa.

ALPHINGTON, DEVON

Report of a Detailed Gradiometer Survey and an Archaeological Watching Brief of a Geotechnical Soil Survey

1 INTRODUCTION

1.1 Project background

- 1.1.1 Wessex Archaeology was commissioned by Parsons Brinkerhoff (Exeter) acting on behalf of Devon County Council (The Client) to undertake a Geophysical Survey and an Archaeological Watching Brief to monitor a Geotechnical Soil Survey on the proposed IDE Park and Ride, Alphington, Devon (hereafter 'the Site'). The Site is centred on National Grid Reference (NGR) 291100, 090360 (**Figure 1**).
- 1.1.2 As detailed in the Devon County Council Local Transport Plan the Site is proposed for the development of an approximately 780 space Park and Ride facility to serve the southern approaches to the city of Exeter. The Site would comprise parking facilities, including a bus shelter and welfare facilities, lit with low level lighting and screened by a combination of hard landscaping and planting.
- 1.1.3 An Archaeological Desk-based Assessment (DBA) for the Site was prepared by Wessex Archaeology (WA 2008a) to inform the baseline for an assessment of the effects of the proposed development on the cultural heritage resource as part of an Environmental Statement, which will accompany the planning application for the Site.
- 1.1.4 To further inform the results of the DBA it was recommended that a Geophysical Survey and an Archaeological Watching Brief to monitor a geotechnical soil survey at the Site should be undertaken.
- 1.1.5 Written Schemes of Investigation (WSI) for the Geophysical Survey (WA 2008b) and Watching Brief (WA 2008c) were prepared by Wessex Archaeology and submitted to and approved by the Archaeological Officers for Exeter City and Devon County Council prior to fieldwork commencing.
- 1.1.6 The Geophysical Survey was undertaken on the 27th October 2008 and the Watching Brief was carried out on the 28th and 29th October 2008.

1.2 Survey areas

1.2.1 The Site covers an area of approximately 6 hectares, of which 3.25ha has been proposed for the Park and Ride development, located on flat ground on the north-western edge of the village of Alphington, on the southern edge of Exeter. The Alphin Brook flows along the northern edge of the Site joining the Exeter Canal 1.5km to the south-east. Bounded to the west by Crab Lane and along its southern and eastern sides by the carriageways of the A30 and the A377. The Site at the time of the Geophysical Survey and Watching Brief was under pasture.

- 1.2.2 A total area of 3.25ha was subject to detailed gradiometer survey (**Figure 1**). Additional survey grids were positioned to ensure full coverage of the development footprint.
- 1.2.3 The survey area was divided into two separate fields that were partitioned by a wire fence. For the purposes of this report the two fields will be considered as a single entity.
- 1.2.4 The underlying geology of the Site comprises a combination of different drift deposits of quaternary age, with Holocene alluvium present within the central area and river terrace deposits to the south. Alphington Breccia and Head deposits are also mapped locally (Geological Survey of Great Britain 1:50,000 map sheet 325).
- 1.2.5 The soils underlying the Site are pelo-alluvial gleys of the Fladbury 1 series (813b). Further typical brown earth soils (541e) of the Crediton series are also found in the local area, and may be present at the Site (SSEW 1983). These types of soils have been shown to produce magnetic contrasts suitable for the detection of archaeological features through detailed survey utilising the Bartington Grad 601-2 gradiometer.

2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

2.1 Introduction

2.1.1 The Devon Historic Environment Record (DHER) holds information relating to all known archaeological and historical sites within the county. Wessex Archaeology was commissioned by the Client to carry out a Desk-based Assessment (WA 2008a) as part of the current developments. The known archaeological and historical potential of the Site using the information from the DHER was compiled within a 500m radius study area of the Site. A summary of these results is presented below.

2.2 **Previous studies**

- 2.2.1 Several previous archaeological studies have been undertaken in the area around the Site. In 2000 an archaeological evaluation by Exeter Archaeology was carried out ahead of the proposed development of Exwick Primary School. The investigation recovered post-medieval pottery from the dumped material associated with the railway development. Crop marks that may relate to archaeological features were also noted in the area.
- 2.2.2 Before construction of a new supermarket complex approximately 700m to the north-east of the Site, a series of archaeological investigations were undertaken by Exeter Archaeology. The line of the Roman road leading out of Exeter was thought to cross the development area but the investigation found no remains of Romano-British date. The only other intrusive archaeological work to be carried out in the Study Area was a watching brief carried out in 2001 by Exeter Archaeology, 500m east of the eastern

boundary of the Site, which recovered no features or finds of archaeological significance.

2.3 Archaeological and Historical Background

Prehistoric

- 2.3.1 Throughout the prehistoric period, the fertile Exe Valley would have attracted activity as a source of natural resources and the records of prehistoric date are indicative of at least a background level of human occupation across the Study Area during this period. The relatively low density of prehistoric material recovered from across the Study Area may partly be due to a lack of intrusive archaeological investigation as opposed to an actual absence of human activity
- 2.3.2 The earliest datable archaeological evidence recognised is a collection of worked flint found 200m to the west of the Site of likely Neolithic date. A total of sixteen pieces were recovered in advance of road construction, including one core and ten re-touched flakes.
- 2.3.3 Although there has been a lack of Bronze Age material recovered within the area, several early river channels have been identified to the north of the Site dating to this period although nothing has been recovered which is indicative of occupation.
- 2.3.4 A fan-shaped enclosure, recognised as a crop mark on aerial photographs *c*.500m to the south of the Site is probably an agricultural enclosure dating to the prehistoric period.

Iron Age and Romano-British (700BC-410AD)

- 2.3.5 The Site and Study Area would have probably lain within a settled agrarian landscape during the Iron Age and been an integrated part of the hinterland of Exeter during the Romano-British period. The Site is situated 1.5km to the south of the Roman military town of *Isca Dumnoniorum* (Exeter).
- 2.3.6 An isolated find of a Roman coin *c*.450m north of the Site's northern boundary may be related to the projected course of the Roman road that ran south of Exeter. The route, which was constructed between Exeter to Newton Abbott and Plymouth, may be preserved in the line of Church Road. However, archaeological evaluations conducted in another location of the presumed route recovered no evidence of the road. The exact line of the route, although not determined, is likely to be located somewhere in the Alphington district.

Saxon (AD410-AD1066)

- 2.3.7 Alphington is recorded as a settlement at the time of Domesday (1086) and the place name is also of Saxon origin and is translated as the estate or farmstead of 'Ælf' (Room 2003, 10).
- 2.3.8 No archaeological evidence of Saxon date has been recovered within the area and activity in the early Saxon period is poorly understood across the region. Exeter appears to have become a focus for settlement again after the 9th century, possibly under the impetus of King Alfred. It is likely that the Site formed part of the agricultural hinterland of Exeter and Alphington at this time.

Medieval (AD1066-1499)

- 2.3.9 Throughout the medieval period Exeter developed as a centre for trade partly due to its good surrounding road network. The historic core of the city developed on the eastern bank of the River Exe, linked to the St. Thomas and Alphington area by the medieval Exe Bridge.
- 2.3.10 Alphington continued to develop from its Saxon foundation throughout the medieval period, reflected in the built heritage of the area such as the 15th century church of St. Michael and All Angels, approximately 1km south-east of the Site. Historic mapping demonstrates that post-medieval parliamentary enclosure has fossilised the sinuous field boundaries of the medieval period, suggesting that the Site continued to form part of the rural hinterland of Exeter and Alphington during this period.

Post-medieval (1499-1799) and modern (1800-present)

- 2.3.11 The landscape of the Site remained largely unchanged from the medieval period until the later 19th century, when Exeter expanded rapidly. The residential areas of the developing city spread east, south-east as well as to the west of the River Exe in the Alphington area. The recorded 19th century resource is characterised by buildings, partly a result of this expansion, and remains of the industrial processes which increased across the region throughout the period.
- 2.3.12 In the early part of the 19th century Alphington Mill, located 250m south-east of the Site's eastern boundary, was constructed. A mill race was constructed between Ball's Farm and Crabb Lane approximately 65m south of the Brook. The mill closed in the 1930s and is no longer standing but the north-west to south-east mill race is extant as an earthwork within the Site.
- 2.3.13 Whilst the Site itself has remained as undeveloped agricultural land during the 20th Century, the Marsh Barton Trading Estate has been developed to the north of the Site and Alphington has continued to expand. In 1903 the Teign Valley Railway was constructed, a section of which passed adjacent to the south-eastern edge of the Site.
- 2.3.14 The most significant recent change in the 20th century is the development of the A30 dual carriageway, which now forms the Site's south-western boundary and the A377 which comprises the south-eastern edge of the Site (**Figure 1**).

3 AIMS AND OBJECTIVES

3.1 Geophysical survey

3.1.1 The aim of the geophysical survey was to determine the presence/absence, extent, character and date of archaeological remains at the Site

3.2 Archaeological watching brief

- 3.2.1 The aims of the Archaeological Watching Brief were to:
 - clarify the presence/absence and extent of any buried archaeological remains within the Site that may be threatened by development.

- identify, within the constraints of the watching brief, the date, character, condition and depth of any surviving remains within the Site.
- assess the degree of existing impacts to sub-surface horizons and to document the extent of archaeological survival of buried deposits.
- 3.2.2 The watching brief was carried out in accordance with guidance given in the Institute of Field Archaeologist's *Standard and Guidance for Archaeological Watching Briefs* (2001).

4 METHODOLOGY

4.1 Geophysical survey

- 4.1.1 A geophysical specification was prepared by WA (WA 2008b) to investigate the proposed study areas. The methodology consisted of detailed gradiometer survey conducted using a Bartington Grad 601-2 dual gradiometer systems. The survey was conducted in general accordance with English Heritage Guidelines for Geophysical Surveys (2008).
- 4.1.2 The geophysical survey was conducted by Wessex Archaeology's in-house geophysics team. Survey grids were established at 30m x 30m and located using a Leica 1200 RTK GPS system, which is precise to within 0.02m and therefore exceeds English Heritage recommendations.
- 4.1.3 The detailed gradiometer survey was conducted using a Bartington Grad 601-2 Gradiometer system over 30m x 30m grids with a sample interval of 0.25m along transects spaced 1m apart. Data were collected in the zigzag method.
- 4.1.4 Results from the survey were subject to limited processing. Processes applied to the data were; de-stripe/zero mean traverse (±5 nT thresholds applied) and de-stagger.
- 4.1.5 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

4.2 Archaeological watching brief

- 4.2.1 The Soil Survey comprised the formation of twenty boreholes across the Site in locations decided as the work progressed. The locations of the boreholes were partly determined, where possible, by the results of the geophysical survey and are shown in **Figure 1**.
- 4.2.2 A small one man tracked hydraulic crawler rig using a maximum 500mm bore was employed during the Soil Survey. An archaeologist was in attendance at all times to guide and monitor the machine work.
- 4.2.3 Excavated material from the boreholes was examined to determine the type of deposits and the depths at which they occur, with particular emphasis being placed on determining the presence of archaeological deposits and features and the interface and depth of the underlying natural geology
- 4.2.4 Excavated material was visually examined for archaeological material and recorded using Wessex Archaeology's *pro forma* recording sheets.

- 4.2.5 Digital photography was employed as appropriate to record soil deposits, borehole methodologies employed and the Site as a whole.
- 4.2.6 Borehole locations were recorded using a Leica GPS 1200 SmartNet Rover, accurate to within 0.02m.

4.3 Health and Safety

- 4.3.1 All work was carried out in accordance with the Health and Safety at Work Act (1974) and the Management of Health and Safety regulations (1992) and all other relevant Health and Safety legislation and regulations and codes of practice in force at the time.
- 4.3.2 A Risk Assessment was prepared by Wessex Archaeology prior to the commencement of fieldwork.
- 4.3.3 As part of the Project Briefing, all staff were made aware of their responsibilities and site specific hazards identified under the Risk Assessment.

5 RESULTS AND INTERPRETATION

5.1 Geophysical survey results

- 5.1.1 The geophysical survey identified a number of anomalies of anthropogenic origin and the results are presented as both a greyscale (**Figure 2**) and an XY trace plot (**Figure 3**) of the entire Site.
- 5.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, trends, ferrous/burnt or fired objects and areas of general increased magnetic response. The interpretation is shown for the entire Site in **Figure 4**. Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.
- 5.1.3 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to in the interpretation, unless considered relevant to the archaeological interpretation.

5.2 Detailed survey results and interpretation

5.2.1 The geophysical survey has detected a number of anomalies of archaeological interest. Linear anomaly **4001** runs on an approximate northwest to south-east orientation and coincides with the extant earth works of the former mill race that crosses the Site. The form and orientation of the anomaly, with a change of direction to a more west-east course towards the north-west of the Site, closely matches the cartographic record of the mill race in early ordnance survey maps discussed in the DBA (WA 2008). Along the length of the anomaly, especially to the east of the Site, numerous strong dipolar anomalies may indicate areas of ferrous material either within the backfill or the fabric of the mill race structure. The strong responses referred to at the east end of this anomaly also coincide with an area of disturbed ground/earth works that may be of modern origin, although an archaeological feature associated with the mill race cannot be ruled out.

- 5.2.2 Linear anomalies **4002** and **4003** appear to form a long single anomaly, running on a north-west to south-east orientation. Although the anomalies are interrupted in a number of places, it is possible they represent a former field boundary or drain.
- 5.2.3 Anomaly **4004** consists of a pair of roughly parallel linear anomalies on a north-east to south-west orientation. The anomaly appears to weaken as it progresses northwards across the Site, but is still detectable as a weak trend in the magnetic response. It is possible that this anomaly represents a former track way (series of wheel ruts), drain or field boundary.
- 5.2.4 Anomaly **4005** is a sinuous curvilinear anomaly that runs to the north of and roughly parallel with the aforementioned mill race (**4001**). At its northernmost extent this anomaly appears to branch into a series of short linear anomalies. Given its proximity, it is possible that this anomaly is associated with the mill race, either as part of the water management system or an associated track way; it is also possible that this anomaly is part of a larger system of enclosures.
- 5.2.5 Elsewhere in the survey area, numerous isolated anomalies may have some archaeological significance. Such an interpretation is hampered by the lack of coherent distribution and the small scale of many of the anomalies.
- 5.2.6 Numerous weak trends on various alignments have been highlighted across the Site. It is possible that these reflect former field divisions or drainage systems. A number of curvilinear anomalies may be of archaeological interest although the lack of contrast with the magnetic background weakens such an interpretation.
- 5.2.7 Strong linear dipolar and isolated ferrous anomalies appear throughout the dataset. A modern service **4006** is apparent to the east of the survey area, crossing the Site approximately north-south. Similarly, to the west of the Site another anomaly attributable to modern services/drainage is apparent and is coincident with a manhole cover **4007** on the surface. The linear nature of anomaly **4008**, along with the numerous ferrous responses along its length, suggests a former boundary or backfilled drain.
- 5.2.8 In the centre of the Site an area of increased magnetic disturbance has been indicated. This is characterised by an increase in the magnetic background and by the presence of numerous small dipolar anomalies (ferrous). This area may have been subject to increased activity within the past, or may be derived from modern dumping/ horse paddocks.
- 5.2.9 Wire fencing, enclosing the southern and western edges of the Site are accountable for the strong magnetic responses visible within the dataset at these extremes.

5.3 Watching brief results

- 5.3.1 A tabulated summary of the borehole deposits is provided in **Appendix 3** of this report.
- 5.3.2 Eighteen of the boreholes described on Site are consistent with thin Holocene alluvium overlying River Terrace gravel deposits (Boreholes 1-11,

13 and 15-20). In places the reddish-brown concreted sandstone fragments (described as ironstone) are likely attributable to the Alphington Breccia, mapped as underlying the undifferentiated Terrace gravels (British Geological Survey Sheet 325).

- 5.3.3 Deposits of mixed gravelly clays and sandy silty clays interpreted as 'made ground' were recorded within Boreholes 12 and 14. Within Borehole 12, which was located to the north of the millrace these deposits were recorded to a depth of 0.64m. In Borehole 14, which was located within the mill race the deposits were recorded to a depth of 1.20m from present ground surface.
- 5.3.4 The River Terrace gravels may have some potential to contain redeposited Palaeolithic artefactual material.

6 FINDS

6.1.1 No finds were identified during the course of the watching brief.

7 ENVIRONMENTAL

7.1.1 No archaeological features or deposits suitable for environmental sampling were identified during the watching brief.

8 CONCLUSION

8.1 Geophysical survey

- 8.1.1 A linear anomaly running approximately north-west to south-east across the survey area, in conjunction with cartographic and topographic evidence, is interpreted as relating to the former mill race crossing the Site. Further linear and curvilinear anomalies may represent additional features of anthropogenic origin.
- 8.1.2 Geophysical survey at the IDE Park and Ride Site has enhanced our understanding of the potential archaeology present within the proposed development area.

8.2 Watching brief

- 8.2.1 Borehole 12 was sited over a linear feature identified in the geophysical survey (anomaly 4005) that may be contemporary with the mill race associated with the 19th century Alphington Mill. The linear feature (anomaly 4005) was located to the north of and parallel with the north-west to southeast aligned mill race and was identified in the geophysical survey as c.150m in length terminating in the east. At the features western extent it curved slightly to the southwest and appears to join the mill race.
- 8.2.2 Borehole 14 was sited over the mill race, (geophysical anomaly **4001**) and identified deposits of made ground within this 19th century feature.

- 8.2.3 The remaining eighteen boreholes were consistent in identifying the known geology comprising of thin Holocene alluvium overlying River Terrace gravel deposits.
- 8.2.4 Although the nature of the geotechnical soil survey had a limited potential to identify archaeological features and deposits, taken in conjunction with the geophysical survey results and the DBA, it indicates that the Site has a low potential for archaeological remains.

9 ARCHIVE

9.1 **Preparation and Deposition**

9.1.1 The complete project archive was prepared in accordance with Wessex Archaeology's Guidelines for Archive Preparation and in accordance with *Guidelines for the preparation of excavation archives for long-term storage* (*UKIC 1990*). On completion of the project, the archive will be deposited with the County Museum Service or similar repository to be agreed with the Local Authority's Archaeological Advisors.

9.2 Copyright

9.2.1 The full copyright of the written/illustrative archive relating to the Site will be retained by Wessex Archaeology Ltd under the *Copyright, Designs and Patents Act 1988* with all rights reserved. The Museum, however, will be granted an exclusive licence for the use of the archive for educational purposes, including academic research, providing that such use shall be non-profit making, and conforms to the Copyright and Related Rights regulations 2003.

9.3 Security copy

9.3.1 In line with current best practice, on completion of the project a security copy of the paper records will be prepared, in the form of microfilm. The master jackets and one diazo copy of the microfilm will be submitted to the National Monuments Record Centre (Swindon); a second diazo copy will be deposited with the paper records at the museum, and a third diazo copy will be retained by Wessex Archaeology.

10 REFERENCES

- English Heritage, 2008. *Geophysical survey in archaeological field evaluation*. Research and Professional Service Guideline No 1, 2nd edition.
- Geological Survey of Great Britain 1995, *Exeter Solid and Drift: 1:50000 Geological Map*, sheet 325
- Soil Survey of England and Wales, 1983. *Soils of South West England: Sheet 5.* Ordnance Survey, Southampton.
- Wessex Archaeology 2008a, *IDE Park and Ride, Alphington, Devon. Desk*based Assessment. WA Ref: 69870.01
- Wessex Archaeology 2008b, *IDE Park and Ride, Alphington, Devon. Geophysical Survey Method Statement.*
- Wessex Archaeology 2008c, *IDE Park and Ride, Alphington, Devon. Written* Scheme of Investigation for an Archaeological Watching Brief of a Soil Survey. WA Ref: 69872.01

APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING

Survey Methods and Equipment

The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have a resolution of 0.1nT over a $\pm 3000nT$ range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20m or 30m site grid, which is achieved using a Leica 1200 RTK GPS system and then extended using tapes. The Leica 1200 RTK GPS system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined to an accuracy of 1-2cm in real-time and therefore exceed the level of accuracy recommended by English Heritage (1995) for geophysical surveys.

Scanning surveys consist of recording data at 0.25m intervals along transects spaced 10m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detail surveys consist of 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. This gives 3600 measurements per grid and is the recommended methodology for archaeological surveys of this type (English Heritage, 2008).

Post-Processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:

- Destripe Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger Shifting each traverse forward or backward by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Clipping Limiting the displayed range of the processed data to either ±3nT or ±3s.d. in order to enhance the appearance of smaller anomalies.
- Despike Filtering any data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings caused by modern, small ferrous objects at the surface

Typical displays of the data used during processing and analysis:

- XY Plot Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This image can include a hidden line algorithm to remove certain lines and enhance the image. This type of image is useful as it shows the full range and shape of individual anomalies.
- Greyscale Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

APPENDIX 2: GEOPHYSICAL INTERPRETATION

The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.

The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- Probable archaeology used when there is a clear geophysical response and anthropogenic pattern.
- Possible archaeology used for features which give a clear response but which form incomplete patterns.

The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Increased magnetic response used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend used for low amplitude or indistinct linear anomalies.
- Ferrous used for responses caused by ferrous material. These anomalies are likely to be of modern origin.

Finally, services such as water pipes are marked where they have been identified.

APPENDIX 3: BOREHOLE DEPOSIT RECORDS TABLES

Borehole No: 1		Surfac	e Height (MaOD): 17.41m
Depth	Colour	Textural Class	Description
0 – 0.80m	Reddish brown	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots. Slightly compact but friable with some gravel inclusions.
0.80 – 1.30m	Reddish brown	Sandy silty clay	Compact, grey mottling with some gravel inclusions.
1.30 – 2m +	Dark reddish brown	Silty clay	Compact with gravel present throughout.

Borehole No: 2		Surface	e Height (MaOD): 15.528m
Depth	Colour	Textural Class	Description
0 – 0.36m	Brown	Sandy silty clay loam	Topsoil, upper 0.06m turf with roots. Friable with some gravel inclusions.
0.36 – 1m+	Light brown	Sandy silty clay	Compact but friable with some gravel inclusions.

Borehole No: 3			e Height (MaOD): 17.175m
Depth	Colour	Textural Class	Description
0 – 0.25m	Brown	Sandy silty clay loam	Topsoil, upper 0.05m turf with roots. Friable with some gravel inclusions.
0.25 – 0.40m	Light brown	Sandy silty clay	Compact but friable with some gravel inclusions.
0.40 – 0.50m	Light brown	Sandy silty clay	Compact but friable with rare gravel and common black iron stone inclusions.
0.50 – 1.15m	Light brown	Sandy silty clay	Compact but friable with some-rare gravel inclusions.
1.15 – 1.40m	Brown	Sandy silty clay	Compact but friable with some gravel inclusions and grey mottling throughout.
1.40 – 1.70m	Brown	Sandy silty clay	Compact with some gravel inclusions.
1.70 – 1.80m	Brown	Sandy silty clay	Compact with some gravel and common black iron stone inclusions.
1.80 – 2.80m+	Reddish brown	Gravelly clay	Very compact.

Borehole No: 4		Surface	e Height (MaOD): 15.692m
Depth	Colour	Textural Class	Description
0 – 0.25m	Dark brown	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots. Friable with common gravel inclusions.
0.25 – 0.90m+	Brown	Sandy silty clay	Compact but friable with common gravel inclusions.

Borehole No: 5		Surface	e Height (MaOD): 16.998m
Depth	Colour	Textural Class	Description
0 – 0.30m	Dark Brown	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots. Friable with common gravel inclusions.
0.30 – 0.80m	Brown	Sandy silty clay	Compact but friable with some gravel and common black iron stone inclusions.
0.80 – 0.95m+	Reddish brown	Gravelly clay	Very compact.

Borehole No: 6		Surface	e Height (MaOD): 15.725m
Depth	Colour	Textural Class	Description
0 – 0.26m	Dark brown	Sandy silty clay loam	Topsoil, upper 0.06m turf and roots. Friable with occasional gravel inclusions.
0.26 – 0.90m+	Reddish brown	Sandy silty clay	Compact but friable with some gravel inclusions.

Borehole	No: 7	Surface	e Height (MaOD): 16.541m
Depth	Colour	Textural Class	Description
0 – 0.30m	Dark brown	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots. Friable with occasional gravel inclusions.
0.30 – 0.60m	Reddish brown	Sandy silty clay	Compact but friable with some gravel and common black iron stone inclusions.
0.60 – 0.74m+	Reddish brown	Gravelly sandy silty clay	Loose with very frequent iron deposits within the gravels.

Borehole No: 8		Surface	e Height (MaOD): 15.466m
Depth	Colour	Textural Class	Description
0 – 0.26m	Brown	Sandy silty clay loam	Topsoil, upper 0.06m turf and roots. Friable with common gravel inclusions.
0.26 – 0.60m	Light brown	Sandy silty clay	Compact but friable with some gravel inclusions.
0.60 – 0.90m+	Dark brown to black	Gravelly silt	Loose with high iron stone/deposit inclusions.

Borehole I	No: 9	Surface	e Height (MaOD): 14.352m
Depth	Colour	Textural Class	Description
0 – 0.30m	Brown to dark	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots.
	brown		Friable with frequent gravel inclusions.
0.30 –	Light brown	Sandy silty clay	Compact but friable with occasional
0.46m			gravel inclusions.
0.46 –	Light brown	Very gravelly clay/sandy	Loose with some iron stone and iron
0.85m+	_	silt clay	deposits present.

Borehole	No: 10	Surface	e Height (MaOD): 14.062m
Depth	Colour	Textural Class	Description
0 – 0.20m	Brown to dark brown	Sandy silty clay loam	Topsoil, upper 0.06m turf and roots. Friable with some gravel inclusions.
0.20 – 0.55m	Light brown	Sandy silty clay	Compact but friable with some gravel inclusions.
0.55 – 0.87m	Brown	Sandy silty clay	Compact but friable with common gravel inclusions.
0.87 – 0.94m	Light brown	Sandy silty clay	Friable, no gravel inclusions noted.
0.94 – 1.74m+	Reddish brown	Sandy silty clay	Compact with very common gravel and some black iron stone inclusions.

Borehole No: 11		Surface	e Height (MaOD): 12.568m
Depth	Colour	Textural Class	Description
0 – 0.30m	Brown to dark brown	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots. Friable with occasional gravel inclusions.
0.30 – 0.67m	Pale brown	Sandy silty clay	Friable with occasional gravel inclusions.
0.67 – 0.76m	Pale brown	Sandy silty clay	Compact but friable with common black iron stone inclusions.
0.76 – 1.76m+	Reddish brown	Sandy silty clay	Compact with common gravel and black iron stone inclusions.

Borehole No: 12		Surface	e Height (MaOD): 14.101m
Depth	Colour	Textural Class	Description
0 – 0.20m	Brown to dark brown	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots. Friable with occasional gravle inclusions.
0.20 – 0.30m	Reddish grey	Very gravelly clay	Made ground. Loose with common black iron stone inclusions.
0.30 – 0.64m	Pale reddish brown	Sandy silty clay	Made ground. Compact but friable with some black iron stone inclusions.
0.64 – 1.70m+	Reddish brown	Gravelly clay	Loose with common black iron stone inclusions

Borehole No: 13		Surface Height (MaOD): 14.27m	
Depth	Colour	Textural Class	Description
0 – 0.28m	Brown to dark brown	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots. Friable with occasional gravel inclusions.
0.28 – 0.85m	Pale brown	Sandy silty clay	Friable with some gravel inclusions.
0.85 – 1.60m	Mixed re/green/grey and brown	Clayey gravel	Loose.

Borehole No: 14		Surface	e Height (MaOD): 14.443m	
Depth	Colour	Textural Cla	ISS	Description
0 – 0.15m	Dark brown	Sandy silty clay	loam	Topsoil, upper 0.05m turf and roots. Friable with common gravel inclusions.
0.15 – 0.60m	Red and brown mix	Clayey gravel		Made ground, loose.
0.60 – 0.70m	Pale brown	Sandy silty clay		Made ground, compact but friable with some gravel inclusions.
0.70 – 1m	Brown	Clayey gravel		Made ground, compact but friable.
1.00 – 1.20m	Brown	Sandy silty clay		Made ground, friable with frequent gravel inclusions.
1,20 – 1.40m	Black	Silty gravel		Very loose with very high iron content.
1.40 – 1.55m	Brown	Silty gravel		Very loose.
1.55 – 2m+	Grey	Silty gravel		Very loose.

Borehole No: 15		Surface	e Height (MaOD): 13.801m
Depth	Colour	Textural Class	Description
0 – 0.30	Dark brown	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots. Friable with occasional gravel inclusions.
0.30 – 0.60m	Brown	Sandy silty clay	Friable with occasional gravel inclusions.
0.60 – 1m	Brown	Sandy silty clay	Compact but friable with common black iron stone inclusions.
1.00 – 1.40m	Yellow and grey	Silty clay	Very high gravel content.
1.40 – 2m+	Black	Silty gravel	Loose with high iron content.

Borehole No: 16 Surface		e Height (MaOD): 13.885m	
Depth	Colour	Textural Class	Description
0 – 0.30m	Dark brown	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots. Friable with common gravel inclusions.
0.30 – 0.50m	Pale brown	Sandy silty clay	Friable with occasional gravel inclusions.
0.50 – 0.70m	Pale brown	Sandy silty clay	Friable with common gravel and black iron stone inclusions.
0.70 – 1.20m	Brown	Silty clay gravel	Friable.
1.20 – 2m+	Greyish reddish brown	Sandy silty gravel	Friable.

Borehole No: 17		Surface Height (MaOD): 13.43m	
Depth	Colour	Textural Class	Description
0 – 0.35m	Brown to dark brown	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots. Friable with common gravel inclusions.
0.35 – 0.50m	Pale brown	Sandy silty clay	Friable with common gravel inclusions.
0.50 – 0.70m	Reddish brown	Sandy silty clay	Friable with common gravel inclusions.
0.70 – 1m+	Reddish brown	Silty gravel	Very loose and friable.

Borehole No: 18		Surface	e Height (MaOD): 14.749m
Depth	Colour	Textural Class	Description
0 – 0.30m	Dark brown	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots. Friable with occasional gravel inclusions.
0.30 – 0.50m	Reddish brown	Sandy silty clay	Compact but friable with some gravel inclusions.
0.50 – 1m+	Reddish brown	Silty clay gravel	Loose and friable.

Borehole No: 19		Surface	e Height (MaOD): 14.841m
Depth	Colour	Textural Class	Description
0 – 0.30m	Dark brown	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots. Friable with some gravel inclusions.
0.30 – 0.60m	Orangey brown	Sandy silty clay	Friable with some gravel and frequent black iron stone inclusions.
0.60 – 1.30m	Pale orangey brown	Sandy silty clay	Compact but friable with occasional gravel inclusions.
1.30 – 3m+	Reddish brown	Silty clay gravel	Loose with occasional black iron stone inclusions.

Borehole No: 20		Surface Height (MaOD): 14.433m	
Depth	Colour	Textural Class	Description
0 – 0.33m	Dark brown	Sandy silty clay loam	Topsoil, upper 0.05m turf and roots. Friable with occasional gravel inclusions.
0.33 – 0.85m	Orangey brown	Sandy silty clay	Friable with occasional gravel inclusions.
0.85 – 1m+	Brown	Sandy silty clay	Compact but friable with some gravel inclusions.





Greyscale plot of geophysical results

		1 1
291	200	/ /
		/ /
	/	
	//	
		/
	Г	
	(/	
		\backslash
		\checkmark
) /	
\sim	$\rangle \langle \rangle$	
	$\langle \rangle \rangle$	
<u> </u>		
/		
/		
/		
- Starter and the starter and		
The second s		
- Y M		
State of the second sec		
Marine and		
A second second		
and the second se	100	
14 N 16 1	Sec. 1	
1 T 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	CLIMP V	
1	an and a second	
A THE PART		
	3	
and the second second	7	
and the second second		/
Martin - man - 1 april		
and the second sec		///
and the second have		
the first and the state of the second		
and a superior	14 million	
A States	1 al and	
A CALL AND A CALL		
		/ /
	\sim	
	\square	
nance Survey licence No. 100020449		
ology. No unauthorised reproduction.		
Revis	ion Number:	0
	0.1.1.1	051
	Originator:	SEJ
	and the set of the set of the	10\00071 0
9871\Drawing Office\Report Figs\Ge	ophysics\08_11	_19\69871_Geophysics.dwg



XY plot of geophysical results



Interpretation of geophysical results





WESSEX ARCHAEOLOGY LIMITED. Registered Head Office: Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB. Tel: 01722 326867 Fax: 01722 337562 wa.heritage@wessexarch.co.uk www.wessexarch.co.uk London Office: Unit 113, The Chandlery, 50 Westminster Bridge Road, London SE1 7QY. Tel: 020 7953 7494 Fax: 020 7953 7499 london-info@wessexarch.co.uk www.wessexarch.co.uk



Registered Charity No. 287786. A company with limited liability registered in England No. 1712772.