East Chickerell
Weymouth, Dorset

Detailed Gradiometer Survey Report

Prepared for:
Pegasus Planning Group – Cirencester
Querns Business Centre
Whitworth Road,
Cirencester
GL7 1RT

On behalf of:
OM Holidays Ltd – Weymouth
Dorset
DT3 6HA

Prepared by:
Wessex Archaeology
Portway House
Old Sarum Park
Salisbury
SP4 6EB

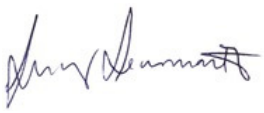
www.wessexarch.co.uk

May 2015

Report Ref. 73311.02

Quality Assurance

Project Code	73311	**Accession Code**		**Client Ref.**	
Planning Application Ref.		**Ordnance Survey (OS) national grid reference (NGR)**	365145, 80660		

Version	Status*	Prepared by	Checked and Approved By	Approver's Signature	Date
v01	E	*ECR*	*LJL*		19/05/2015
File:					
File:					
File:					
File:					
File:					

* I = Internal Draft; E = External Draft; F = Final

East Chickerell
Weymouth, Dorset

Detailed Gradiometer Survey Report

Contents

Figures

East Chickerell
Weymouth, Dorset

Detailed Gradiometer Survey Report

Summary

This report presents the results from a geophysical survey undertaken by Wessex Archaeology on land east of Chickerell, Weymouth Dorset, centred on National Grid Reference 365145, 80660. The survey was commission by Pegasus Planning Ltd Cirencester on behalf of OM Holidays Ltd – Weymouth. The survey area comprises 22 ha over ten arable fields.

A desk-based assessment was undertaken by Wessex Archaeology in 2015 covering the survey area covered in this report plus land further east which concluded that there is low to moderate potential for recovering remains relating to Romano-British, medieval or post-medieval activity within the Site. The detailed gradiometer survey was a continuation of this work.

The survey was undertaken between 20th April 2015 and 24th April 2015. Field conditions at the time of the survey were good with grass under foot and favourable weather.

The detailed gradiometer survey has been successful in revealing several anomalies of definite, probable and possible archaeological origin alongside trends, services and unidentified ferrous responses.

The survey data from the northernmost field reveals a number of features of potential archaeological interest, including two parallel ditch-like features, several possible archaeological features and an old field boundary alongside a possible palaeochannel and agricultural features. Evidence of an early 19th century lime kiln has been identified within the data alongside possible archaeological features and trends.

Across the rest of the site are several other possible archaeological features and four modern services.

East Chickerell
Weymouth, Dorset

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by Pegasus Planning Ltd - Cirencester on behalf of OM Holidays Ltd - Weymouth. The assistance of Simon Chamberlayne is gratefully acknowledged in this regard. Wessex Archaeology would also like to thank the landowners for granting access to the survey areas.

The fieldwork was undertaken by Alistair Salisbury, Diana Chard, Chris Hirst, Stewart Wareing, Hannah Holbrook, Matt Tooke and Eleanor Claxton-Mayer. Alistair Salisbury and Genevieve Shaw processed and interpreted the geophysical data and Lizzie Richley wrote this report. The geophysical work was quality controlled by Genevieve Shaw and Lucy Learmonth. Illustrations were prepared by Lizzie Richley and Karen Nichols. The project was managed on behalf of Wessex Archaeology by Caroline Budd.

East Chickerell
Weymouth, Dorset

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology (WA) was commissioned by Pegasus Planning Ltd - Cirencester on behalf of OM Holidays Ltd - Weymouth to carry out a geophysical survey of land east of Chickerell, Weymouth, Dorset (**Figure 1**), hereafter "the Site" (centred on NGR 365145, 80660). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development at the Site.

1.1.2 The aim of the geophysical survey was to establish the presence/absence, extent and character of detectable archaeological remains within the survey area.

1.1.3 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

1.2 The Site

1.2.1 The Site occupies largely flat pastoral land across ten fields (**Figure 1**), lying at around 46 m above Ordnance Datum (aOD) in the far north of the survey area, gently sloping to 12 m aOD towards the south. Detailed gradiometer survey was undertaken over all accessible parts of the Site. The total area surveyed amounted to 21.9 ha. The survey area was bordered by field boundaries to the north, east and south and residential buildings to the west.

1.2.2 A Desk-based Assessment (DBA) was carried out by WA in 2015 that identified archaeological sites, deposits and find spots dating from the prehistoric to the modern period, with much of the known and potential archaeological resource relating to the Romano-British, medieval and post-medieval periods. There are no statutorily designated sites or monuments within the Site itself however historic mapping denotes an early 19th century lime kiln within the Site extents.

1.2.3 The Site lies across two types of solid geology. The northern area comprises of sandstone, limestone and argillaceous rocks of the Great Oolite Group, which is sedimentary bedrock, formed approximately 165 to 168 million years ago in the Jurassic Period. The southern area comprises mudstone, siltstone and sandstone of the Kellaways and Oxford Clay formation.

1.2.4 Similarly to the solid geology, the soils underlying the site are from two groups. The north is categorised by slowly permeable calcareous clayey soils of the 411b Evesham 2 association whereas the south is of the Denchworth 712b soil association.

1.2.5 Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through gradiometer survey.

2 METHODOLOGY

2.1 Introduction

2.1.1 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysical specialists between 20th April 2015 and 24th April 2015. Field conditions at the time of the survey were good, with grass underfoot and favourable weather.

2.1.2 The survey and report production were conducted in accordance with English Heritage guidelines (2008).

2.2 Method

2.2.1 Individual survey grid nodes were established at 30 m x 30 m intervals using a Leica Viva RTK GNSS system, which is precise to approximately 0.02 m and therefore exceeds English Heritage recommendations (2008).

2.2.2 The gradiometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1 m between sensors. Data were collected at 0.25 m intervals along transects spaced 1 m apart with an effective sensitivity of 0.03nT, in accordance with English Heritage guidelines (2008). Data were collected in the zigzag method.

2.2.3 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey areas, with no interpolation applied. In places, further data processing was undertaken to reduce the effect of periodic errors within the data resulting largely from ground conditions.

2.2.4 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

3.1 Introduction

3.1.1 The gradiometer survey has been successful in identifying anomalies of definite, probable and possible archaeological interest across the Site. Regions of increased magnetic response, near-surface geological changes and a number of modern services have also been detected.

3.1.2 Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:3500 (**Figures 2** to **4**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale images; a number of the survey areas have been displayed at -1nT (white) to +1.5nT (black) in order to enhance weakly magnetised anomalies in regions of quieter magnetic background. The XY trace plots are presented at ±25nT at 25nT per cm.

3.1.3 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends. Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.

3.1.4 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

3.1.5 Small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey.

3.1.6 Gradiometer survey alone may not detect all modern services present on Site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on Site.

3.2 Gradiometer Survey Results and Interpretation

3.2.1 The detailed gradiometer survey has been successful in identifying features of potential archaeological significance. The northernmost field contains several positive magnetic features, in particular at **4000** two parallel positive magnetic features measuring between 1-2 nT run from southwest to northeast across the field and interpreted as currently undated ditches.

3.2.2 In the central large field, a further potential archaeological feature has been identified at **4001**. This is a small feature composed of three positive magnetic responses in the order of 2-3nT. This feature is isolated so it is difficult to provide further interpretation.

3.2.3 North of the two parallel ditches at **4000** are several small possible archaeological features identified at **4002**-**4007**. **4002** shows two rectilinear anomalies measuring 0-1nT and measuring approximately 20 m. At **4003** there are three small positive anomalies on an east to west alignment. It is possible that the positive magnetic anomalies denoted by **4004**, **4005** and **4007** are related as they lie on a similar alignment. The spatial relationship of **4006** is unclear but it intersects the alignment of the preceding three possible archaeological features on a southwest to northeast alignment. It is likely that these features are ditches or old track ways/paths across the Site. The desk-based assessment (WA 2015) identified a track way and medieval (or earlier) land divisions preserved within the 17th-18th century enclosure boundaries across the Site. It is likely that these features identified are related to earlier land divisions.

3.2.4 Further possible archaeological features are located at **4008, 4009, 4010**. **4008** is a weakly positive linear feature on a south-southwest to north-northeast alignment and extends for some 40 m. Whereas **4009** and **4010** are most likely related to each other, with **4009** lying on a southwest to northeast alignment and measuring some 30 m with readings in the region of +2nT and **4010** continuing the southwest to northeast alignment before curving to the south with data readings around +1nT.

3.2.5 There are also possible archaeological features at **4011**, **4012** and **4013**. These represent 40-50 m long linear features between 1-2nT in value. Historic mapping shows a footpath across the site which coincides with feature **4011**. Feature **4012** is located adjacent to a large ferrous anomaly, the desk-based assessment (WA 2010) identified a 19th century lime kiln in this area however no extant evidence is visible in this area. It is likely the ferrous feature represents the location of the lime kiln and **4012** may well be an associated feature. Unfortunately it is difficult to provide a robust interpretation for **4013** due to its isolation however it is likely that it is a ditch perhaps associated with past agricultural activity.

3.2.6 Features **4014**-**4016** have been interpreted as probable archaeology, and are located in the northernmost field. It is likely these relate to ditches or old land divisions.

3.2.7 A curvilinear trend **4017** has been identified alongside a large scale ferrous reading. The feature's shape, form and proximity to possible archaeological features **4012** and the known location of a 19th century lime kiln (WA 2015) may suggest it to be of some archaeological significance.

3.2.8 Superficial geology has been identified at **4018** and is possibly a palaeochannel.

3.2.9 A number of modern services have been identified in the geophysical data, (**4019**, **4020**, **4021** and **4022**), however determining the function and status of these services lies beyond the remit of this geophysical survey.

4 CONCLUSION

4.1.1 The detailed gradiometer survey has been successful in detecting anomalies of definite, probable and possible archaeological interest within the Site, in addition to regions of increased magnetic response, geological changes and several modern services.

4.1.2 Archaeological investigations within and around the Site have recorded archaeological sites, deposits and find spots dating from the prehistoric to the modern period, with much of the known and potential archaeological resource relating to Romano-British, medieval and post-medieval periods. It is therefore likely that the definite, probable and possible archaeological features identified in the detailed gradiometer survey are related to these periods.

4.1.3 The archaeological feature denoted at **4000** is likely to represent earlier land divisions across the site identified in the DBA (WA 2015). The weaker defined positive magnetic features such as at **4002**, **4003** to **4006**, **4008**, and **4009** to **4010** are also likely to be related to earlier land divisions.

4.1.4 Positive identifications of the 19th century lime kiln and possible associated features **4012** and **4017** has been possible due to the large scale ferrous anomaly that would be associated with the burning at the site. **4011** is likely to be related to the footpath identified in historic mapping (WA 2015).

5 REFERENCES

English Heritage, 2008. *Geophysical Survey in Archaeological Field Evaluation*. Research and Professional Service Guideline No 1, 2nd edition.

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

Wessex Archaeology, 2015. *Land at East Chickerell, Weymouth, Dorset: Archaeological Desk-based Assessment.* Unpublished client report ref 73311.01

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 an effective resolution of 0.03nT over a ±100nT range, and measurements from each sensor are logged at intervals of 0.25 m. 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 20 m or 30 m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02 m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.

Scanning surveys consist of recording data at 0.25 m intervals along transects spaced 10 m 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 detailed surveys consist of 20 m x 20 m or 30 m x 30 m grids, and data are collected at 0.25 m intervals along traverses spaced 1 m apart. These strategies give 1600 or 3600 measurements per 20 m or 30 m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH, 2008).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125 m intervals along traverses spaced up to 0.25 m apart, resulting in a maximum of 28800 readings per 30 m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.

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 longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data)
- Periodic Filter – This function is used to reduce or remove the amplitude of regular, periodic features present in the data. This is most commonly used to correct for operator error during the collection of data;
- Low Pass Filter – The low pass filter can be used to remove small scale, high frequency spatial detail. It is used to supress noise in the data to enhance larger and weaker anomalies;
- Add – The add function simply involves adding or subtracting data values to a selected area of the data

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 type of image is useful as it shows the full range 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:

- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Probable archaeology – used for features which give a clear response but which form incomplete patterns.
- Possible archaeology – used for features which give a response but which form no discernible pattern or trend.

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.