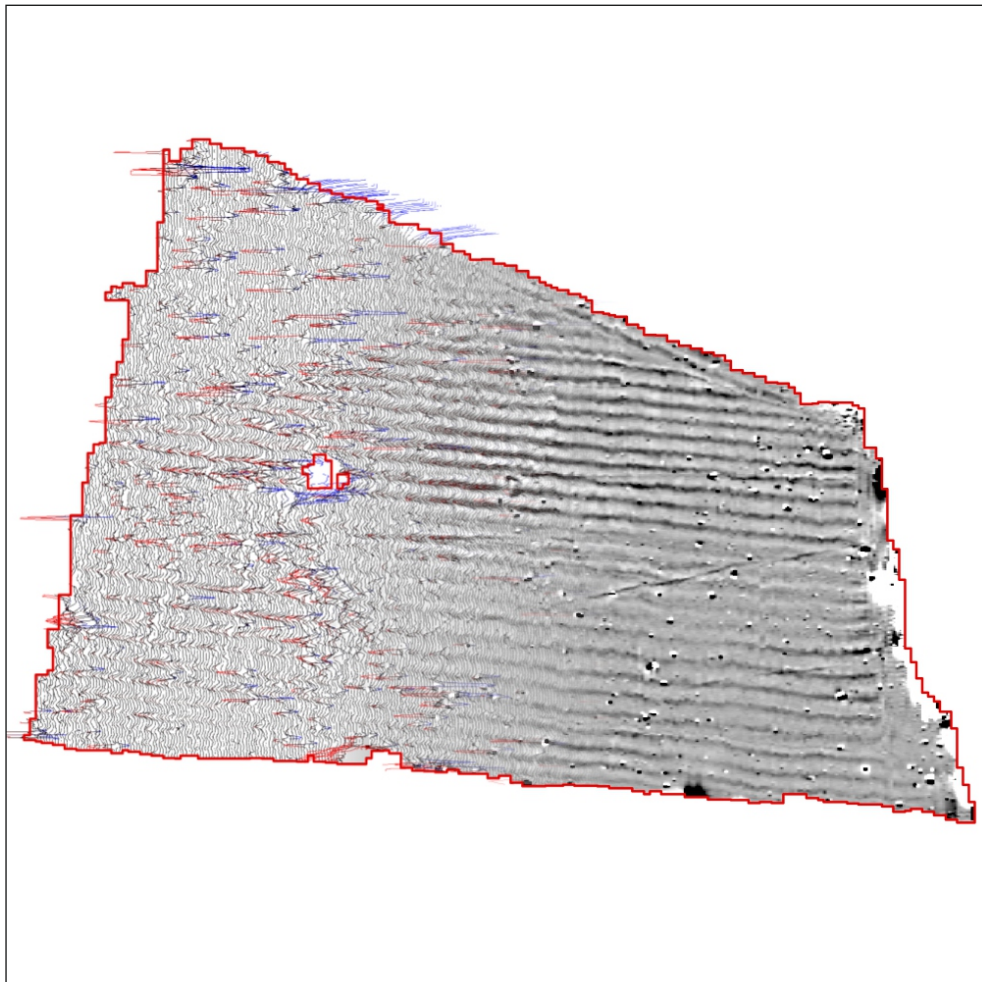




making sense of heritage

Land at Lydiard Tregoze Swindon, Wiltshire

Detailed Gradiometer Survey Report



Ref: 109210.01
May 2015



**Land at Lydiard Tregoze
Swindon, Wiltshire**

Detailed Gradiometer Survey Report

Prepared for:

Taylor Wimpey Oxfordshire Ltd
Suite J
Windrush Court
Abingdon Business Park
Abingdon, Oxfordshire
OX14 1SY

Prepared by:

Wessex Archaeology
Portway House
Old Sarum Park
Salisbury
SP4 6EB

www.wessexarch.co.uk

May 2015

Report Ref. 109210.01



Quality Assurance

Project Code	109210	Accession Code		Client Ref.	
Planning Application Ref.		Ordnance Survey (OS) national grid reference (NGR)	410355, 185010		

Version	Status*	Prepared by	Checked and Approved By	Approver's Signature	Date
v01	I	ECR	LJL		27/05/2015
File:	X:\PROJECTS\109210_Reports				
File:					
File:					
File:					
File:					
File:					

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

DISCLAIMER

THE MATERIAL CONTAINED IN THIS REPORT WAS DESIGNED AS AN INTEGRAL PART OF A REPORT TO AN INDIVIDUAL CLIENT AND WAS PREPARED SOLELY FOR THE BENEFIT OF THAT CLIENT. THE MATERIAL CONTAINED IN THIS REPORT DOES NOT NECESSARILY STAND ON ITS OWN AND IS NOT INTENDED TO NOR SHOULD IT BE RELIED UPON BY ANY THIRD PARTY. TO THE FULLEST EXTENT PERMITTED BY LAW WESSEX ARCHAEOLOGY WILL NOT BE LIABLE BY REASON OF BREACH OF CONTRACT NEGLIGENCE OR OTHERWISE FOR ANY LOSS OR DAMAGE (WHETHER DIRECT INDIRECT OR CONSEQUENTIAL) OCCASIONED TO ANY PERSON ACTING OR OMITTING TO ACT OR REFRAINING FROM ACTING IN RELIANCE UPON THE MATERIAL CONTAINED IN THIS REPORT ARISING FROM OR CONNECTED WITH ANY ERROR OR OMISSION IN THE MATERIAL CONTAINED IN THE REPORT. LOSS OR DAMAGE AS REFERRED TO ABOVE SHALL BE DEEMED TO INCLUDE, BUT IS NOT LIMITED TO, ANY LOSS OF PROFITS OR ANTICIPATED PROFITS DAMAGE TO REPUTATION OR GOODWILL LOSS OF BUSINESS OR ANTICIPATED BUSINESS DAMAGES COSTS EXPENSES INCURRED OR PAYABLE TO ANY THIRD PARTY (IN ALL CASES WHETHER DIRECT INDIRECT OR CONSEQUENTIAL) OR ANY OTHER DIRECT INDIRECT OR CONSEQUENTIAL LOSS OR DAMAGE.



Land at Lydiard Tregroze Swindon, Wiltshire

Detailed Gradiometer Survey Report

Contents

Summary.....	ii
Acknowledgements.....	iii
1 INTRODUCTION.....	1
1.1 Project background.....	1
1.2 The Site.....	1
1.3 Archaeological Background.....	1
2 METHODOLOGY.....	3
2.1 Introduction.....	3
2.2 Method.....	3
3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION.....	3
3.1 Introduction.....	3
3.2 Gradiometer Survey Results and Interpretation.....	4
4 CONCLUSION.....	4
5 REFERENCES.....	5
APPENDIX 1: SURVEY EQUIPMENT AND DATA PROCESSING.....	6
APPENDIX 2: GEOPHYSICAL INTERPRETATION.....	8

Figures

Figure 1	Site location
Figure 2	Greyscale plot
Figure 3	XY trace plot
Figure 4	Archaeological interpretation



Land at Lydiard Tregoze Swindon, Wiltshire

Detailed Gradiometer Survey Report

Summary

This report presents the results from a geophysical survey undertaken by Wessex Archaeology on land at Lydiard Tregoze, Swindon, Wiltshire centred on National Grid Reference 410355, 185010. The survey was commissioned by Taylor Wimpey (UK) Ltd ahead of proposed development of the land. The survey area comprises of almost 6ha over one arable field, with just under 5ha surveyed.

The survey was undertaken between 6th May 2015 and 9th May 2015. Field conditions at the time of survey were good with grass under foot and favourable weather.

The detailed gradiometer survey has been successful in revealing anomalies of possible archaeological origin alongside agricultural trends, ploughing trends, areas of increased magnetic response and unidentified ferrous responses. Of particular note are strongly magnetic anomalies in the eastern part of the survey area which are of possible archaeological interest.

Linear trends on a different alignment to the ploughing trends would suggest earlier farming practices of unknown provenance.

The presence of alluvium on site may mask features from being detected by the gradiometer and result in archaeological features being under represented in the data.



Land at Lydiard Tregroze Swindon, Wiltshire

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by Taylor Wimpey (UK) Ltd. The assistance of Sally Appleyard and Steven Neal 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 directed by Jennifer Smith with the assistance of Stewart Wareing. Lizzie Richley processed and interpreted the geophysical data in addition to writing 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 Andrew Manning.



Land at Lydiard Tregoze Swindon, Wiltshire

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

- 1.1.1 Wessex Archaeology (WA) was commissioned by Taylor Wimpey (UK) Ltd to carry out a geophysical survey of land at Lydiard Tregoze (**Figure 1**), hereafter “the Site” (centred on NGR 410355, 185010). The survey was undertaken ahead of potential development of the land and to support a planning application.
- 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 arable land across one field (**Figure 1**), lying at around 101m above Ordnance Datum (aOD) in the western edge and sloping gently to 98m aOD in the east. Detailed Gradiometer survey was undertaken over all accessible parts of the Site, the proposed survey area totalled 5.95ha.
- 1.2.2 The survey area was delimited by the field extents with field boundaries on all sides. The Tewkesbury Way road runs along the northern extent of the Site and to the east is a housing estate. Pasture land exists to the south and west. No watercourses are present on site
- 1.2.3 The solid geology under the Site comprises of mudstone of the Amptill Clay Formation and Kimmeridge Clay Formation, which is sedimentary bedrock formed approximately 151 to 161 million years ago in the Jurassic Period. The superficial geology is classified as alluvium of clay silt, sand and gravel formed up to 2 million years ago in the Quaternary period.
- 1.2.4 The soils underlying the site are listed as coming from the Denchworth 712b soil association and are slowly permeable seasonally waterlogged clayey soils.
- 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 however it should be noted that alluvium and clayey soils can mask archaeological features depending upon the over burden of the soil.

1.3 Archaeological Background

- 1.3.1 An archaeological Desk-Based Assessment (DBA) undertaken by CSa Environmental Planning (2015) examined the potential for the survival of buried archaeological remains



within the development area and a 1km Study Area. This DBA used information provided by the Wiltshire and Swindon Historic Environment Record (WSHER) and the National Heritage List for England (NHLE). The following background is summarised from the DBA.

- 1.3.2 There are no designated historical assets within the Site area. There are no identified World Heritage Sites, Scheduled Monuments, Conservation Areas or Historic Battlefields identified within the 1km Study Area however one Registered Park and Garden and eight listed buildings are recorded.

Prehistoric and Romano-British

- 1.3.3 The only prehistoric evidence recorded within the survey area is the discovery of three Iron Age potsherds which have been found along with Roman pottery in an excavation 325m east of the Site. A prehistoric flint tool was found 825m southwest of the Site and 21 pieces of prehistoric worked flint were also recovered in an excavation at Lydiard Park 300m south.
- 1.3.4 Building works 250m southeast of the Site uncovered a ditch containing waster potsherds and metallic slag. This is thought to be related to a potential Roman kiln site found in archaeological investigations 550m southeast. Further Roman ditches containing pottery have been uncovered 250m west, 300m south and 925m southeast. A gully containing pot and tile sherds was also uncovered suggesting a possible settlement 800m south.
- 1.3.5 Approximately 350m to the south, a northeast-southwest aligned building was uncovered during archaeological excavation. The building measured at least 4.1m x 3.7 and contained reused building materials, pottery and tiles from a high status origin. A large pit immediately west of this structure was recorded to contain mortar, wall-plaster, roof and box-flue tiles, pottery and iron slag. This pit was cut by another smaller pit containing further pottery, plaster and tile fragments.

Saxon, Medieval and Post-Medieval

- 1.3.6 A possible medieval settlement is recorded from aerial photography with associated field boundaries immediately west of the Site. Further to this, earthworks are recorded 250m to the east, possible linear earthworks 400m to the east and two small building platforms have been identified 700m to the east. A medieval deer park is recorded 500m to the south of the Site.
- 1.3.7 A medieval coin hoard was found approximately 75m north of the Site and multiple find spots of medieval pottery have been identified 250m-1km from the Site.

Post-medieval and Undated

- 1.3.8 Lydiard Park, a Grade II listed Registered Park and Garden, is located directly south of the Site and covers an area of 149 hectares. Officially laid out in the mid-18th century, the park incorporates earlier features from a 17th century formal park and garden. The park also contains four listed buildings. The Grade I listed Church of St Mary, a 13th century church located 300m south of the Site. Railings, piers and chest tombs are also Grade II listed. Lydiard Park Mansion is a 17th century Grade I listed building, located 300m south of the Site. A walled garden, an icehouse and revetments to a former lake dam are all Grade II listed and within 250-450m of the Site. Three Grade II listed farmhouses are also located between 300-800m of the site.



- 1.3.9 A number of undated features have been identified in aerial photography, crop marks and past geophysical surveys within the surrounding area. These include linear features 660m to the southwest and 900m to the east. Possible building foundations 700m to the south and geophysical surveys have identified linear and curvilinear features 1km southwest with discreet pit features recorded 1km to the south.

2 METHODOLOGY

2.1 Introduction

- 2.1.1 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between 6th and 8th May. Field conditions at the time of the survey were good with favourable weather conditions. A total of 4.94ha was surveyed.
- 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 30m x 30m intervals using a Leica Viva RTK GNSS system, which is precise to approximately 0.02m 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 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m 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 (± 5 nT 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 possible archaeological interest across the Site alongside regions of increased magnetic response, agricultural features, ploughing trends and several unidentified linear trends.
- 3.1.2 Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2000 (**Figures 2 to 4**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale images whilst the XY trace plots are presented at ± 25 nT 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 (**Figures 2 to 4**). 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 It should also be noted that 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 No modern services have been identified in the geophysical data however it should be noted that gradiometer survey may not detect all 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 field contains several positive magnetic features, in particular at **4000** and **4001**. The significance of these anomalies is unknown however the strength of reading (measuring between 6-10nT) suggests they are ferrous or of burnt origin coupled with their alignment from northwest to southeast suggests they are of possible archaeological interest rather than modern debris.
- 3.2.2 Linear ditches **4002** to **4006** are distinctive against the background ploughing trends due to their different alignment. These linear ditches run parallel with each other on a east-northeast to west-southwest alignment and all have a similar reading (0.5-2nT) it is possible that these linear features are associated with linear **4007** that runs on a tangent east-northeast to west-southwest alignment. Linear anomalies **4003** to **4006** end at the point where **4007** crosses them though **4002** continues further north. Whilst no dating has been established these ditches have been interpreted as being of agricultural origin. Stratigraphic relationships are not possible to define from the gradiometer data alone and further investigation would be needed to fully understand the relationship of these features.
- 3.2.3 Further linear features **4008** to **4010** follow the same alignment as **4007** and are thought to be of similar provenance. These have been interpreted as agricultural features and are likely to relate to previous agricultural activity at the Site.
- 3.2.4 Linear trend **4011** crosses the site on from southwest to northeast and is thought to relate to the modern track way currently visible.
- 3.2.5 Further unidentified linear trends are present across the site but their provenance is unknown and may be related to agricultural activity and/or modern disturbance. Regions of increased magnetic response surround the possible archaeological features and may be related to their disturbance of these features.

4 CONCLUSION

- 4.1.1 The detailed gradiometer survey has been successful in detecting anomalies of possible archaeological interest within the Site, agricultural features and ploughing trends in addition to regions of increased magnetic response,



- 4.1.2 Strong magnetic features have been identified in eastern part of the Site (**4000** to **4001**), the provenance of these features is unknown but their distinct alignment from northwest to southeast and the strength of their readings (6-10nT) would suggest they of possible archaeological interest.
- 4.1.3 Linear trends across the site on two different alignments suggest ditches associated with earlier agricultural activity. The location of a medieval house nearby would suggest that these lands may have been used for strip farming and linear features **4002** to **4006** may be related to medieval farming practices however further investigation would be needed to ascertain a true interpretation of these features. Linear trends **4007** to **4010** have unknown provenance but are thought to be derived from agricultural practices.
- 4.1.4 The relative changes in magnetic variance across the Site, in particular the central region, is categorised by strong ploughing trends whereas to the northeast and southwest these trends are weaker. This is a likely result of the alluvium that is noted across the site and may signify variance in the depths of the gravel, clay, silt and sand deposits. This geological aspect of the site may also mask features and as a result the archaeological potential of the Site may be under represented in the gradiometer results.

5 REFERENCES

CSa Environmental Planning, 2014. *Land at Lydiard Tregroze, Wiltshire. Archaeological Assessment*. Unpublished Client Report.

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.



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 ± 100 nT 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 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 0.02m 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 0.25m 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 detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m 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 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m 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;
- Despiking – 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 suppress 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.

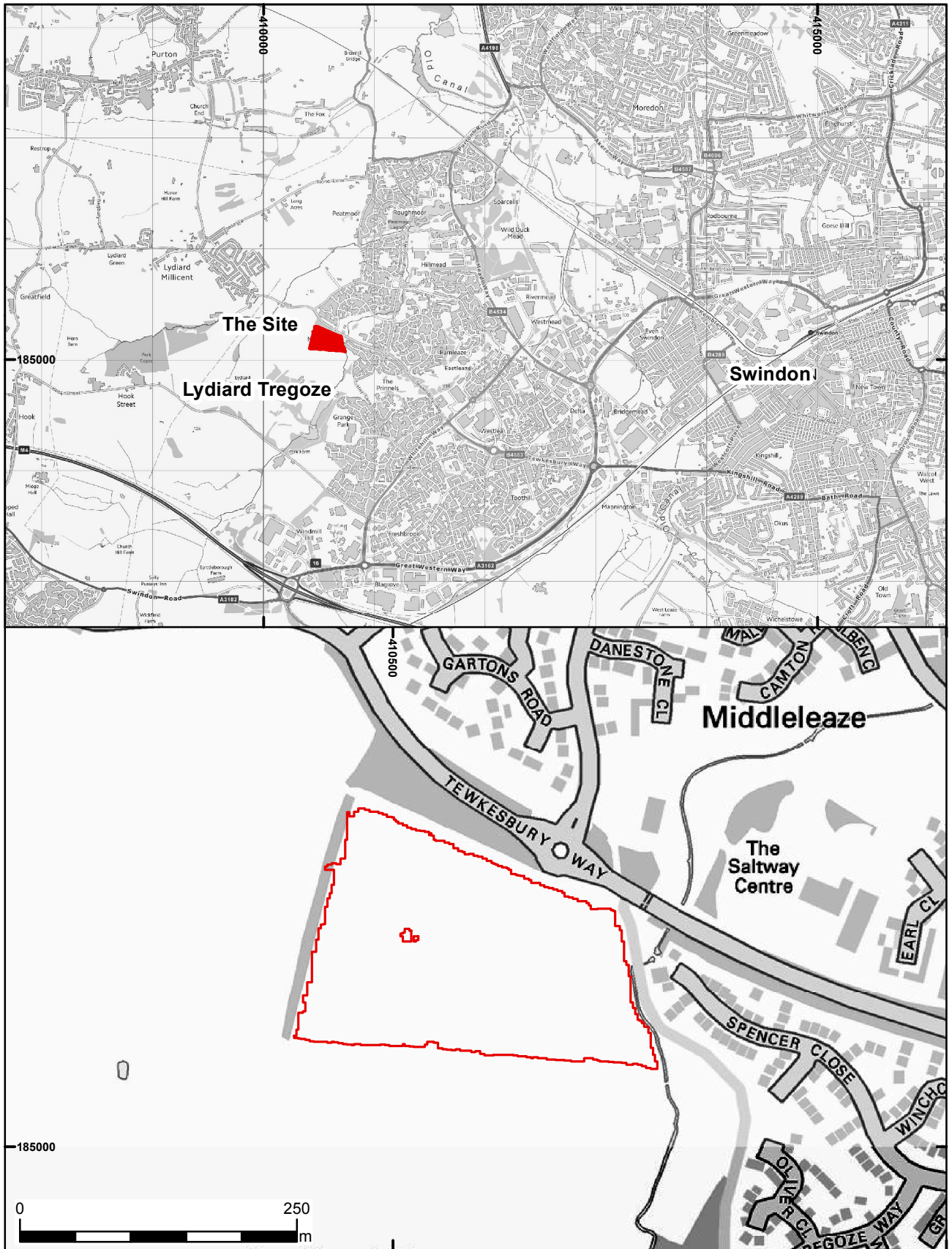
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided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

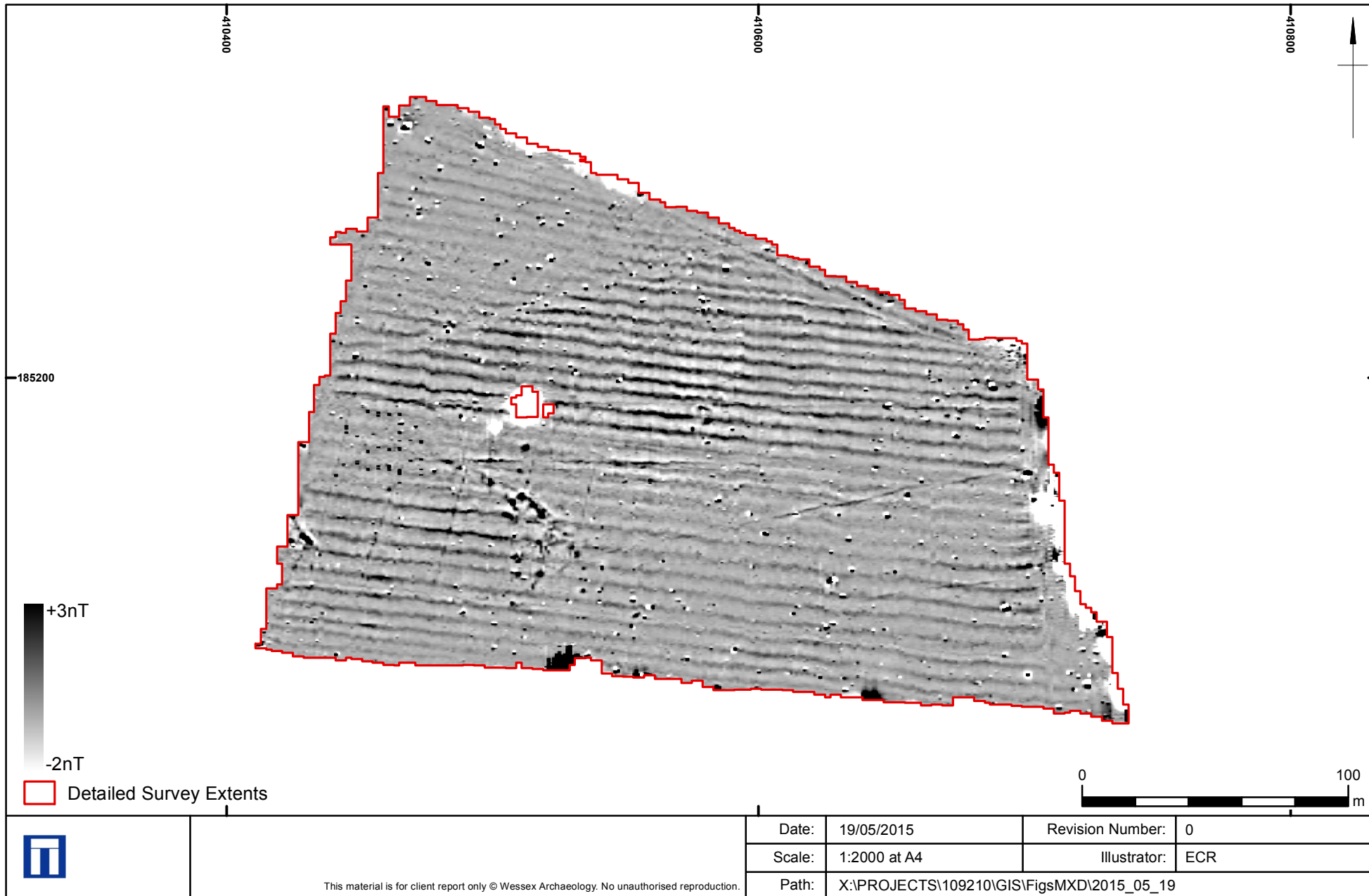
Finally, services such as water pipes are marked where they have been identified.



	 Detailed Survey Extents	Contains Ordnance Survey data © Crown copyright and database right 2015. This material is for client report only © Wessex Archaeology. No unauthorised reproduction.		
	Date:	19/05/2015	Revision Number:	0
	Scale:	1:50000 and 1:5000 at A4	Illustrator:	ECR
	Path:	X:\PROJECTS\109210\GIS\Figs\MXD\2015_05_19		

Site Location and Detailed Survey Extent

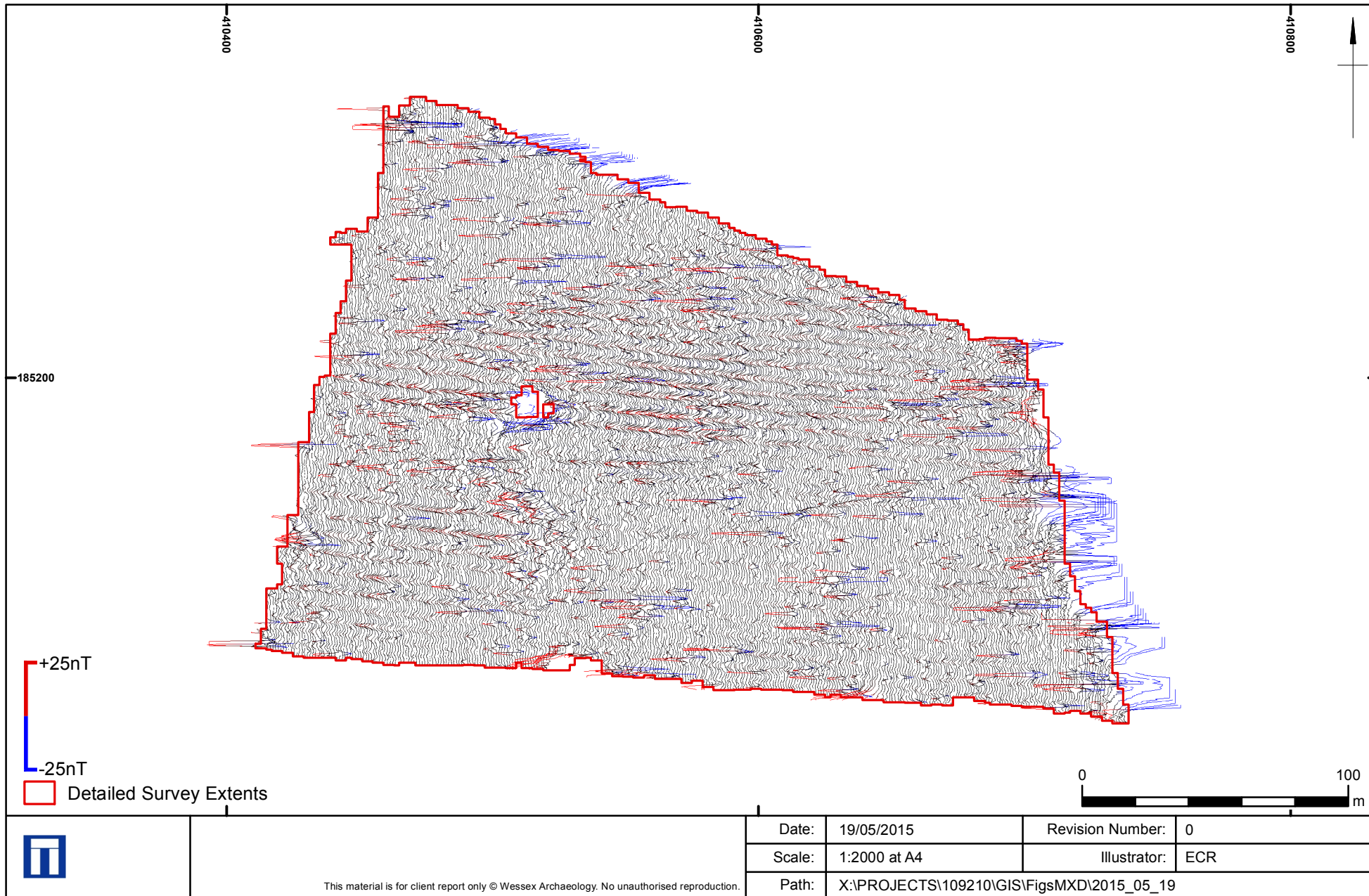
Figure 1



Greyscale Plot

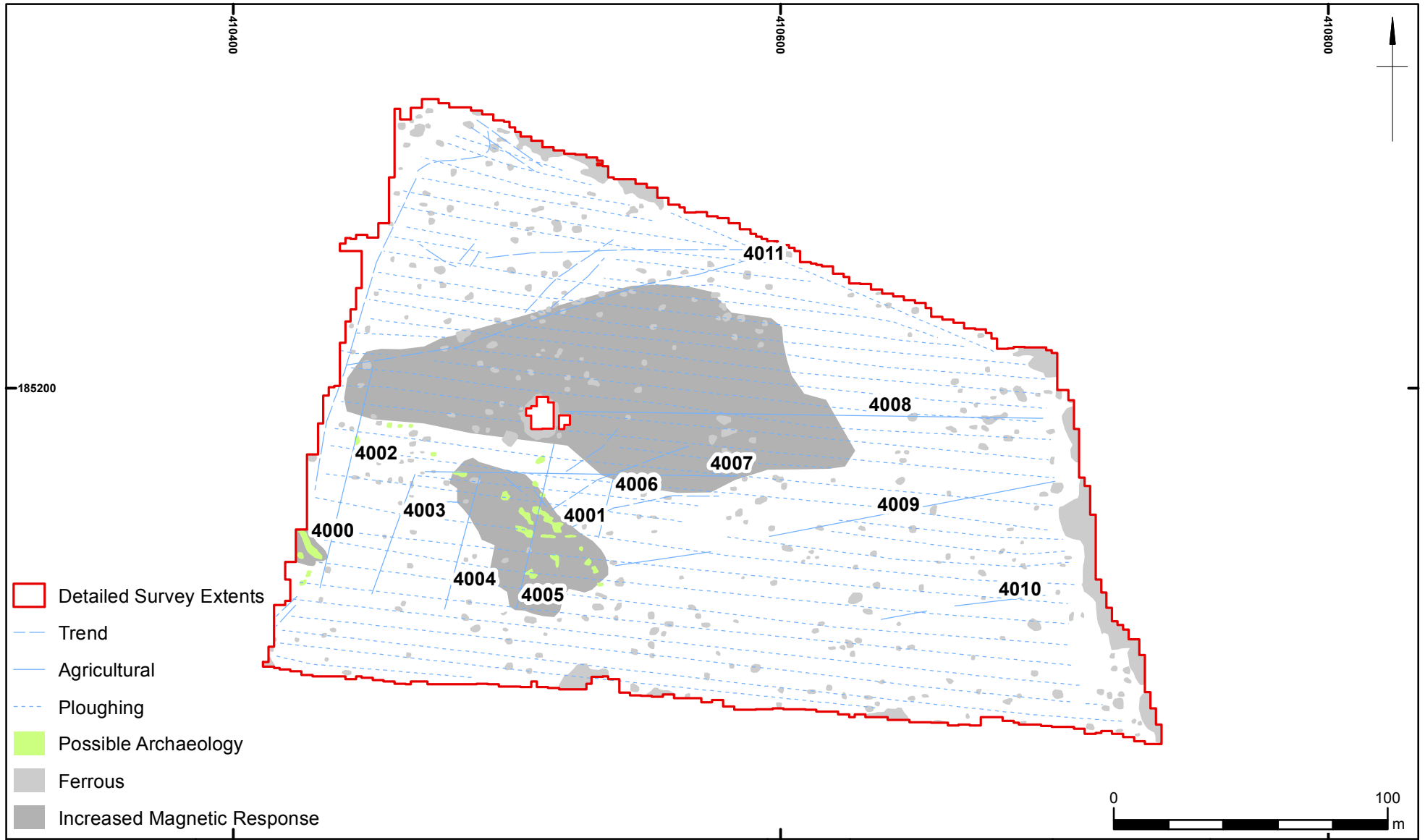
Figure 2

This material is for client report only © Wessex Archaeology. No unauthorised reproduction.




XY Trace Plot

Figure 3



- Detailed Survey Extents
- Trend
- Agricultural
- Ploughing
- Possible Archaeology
- Ferrous
- Increased Magnetic Response



	<small>This material is for client report only © Wessex Archaeology. No unauthorised reproduction.</small>	Date:	19/05/2015	Revision Number:	0
		Scale:	1:2000 at A4	Illustrator:	ECR
		Path:	X:\PROJECTS\109210\GIS\FigsMXD\2015_05_19		



Wessex Archaeology Ltd registered office Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB
Tel: 01722 326867 Fax: 01722 337562 info@wessexarch.co.uk www.wessexarch.co.uk



Wessex Archaeology Ltd is a company limited by guarantee registered in England, company number 1712772. It is also a Charity registered in England and Wales, number 287786; and in Scotland, Scottish Charity number SC042630. Our registered office is at Portway House, Old Sarum Park, Salisbury, Wiltshire SP4 6EB.