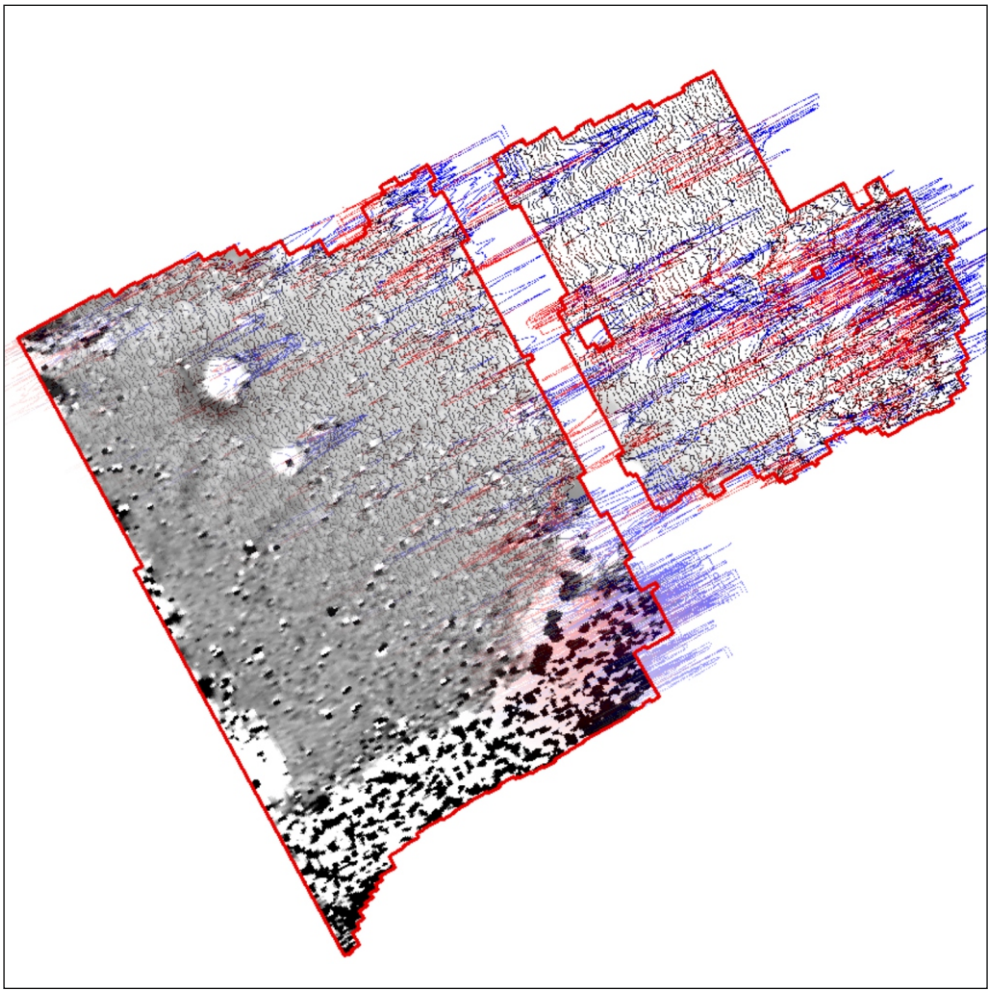
making sense of heritage

Northway Lane, Tewkesbury Gloucestershire

Detailed Gradiometer Survey Report



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geoservices

Northway Lane, Tewkesbury, Gloucestershire

Detailed Gradiometer Survey Report

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Northway Lane, Tewkesbury, Gloucestershire

Detailed Gradiometer Survey Report

Contents

Figures

Northway Lane, Tewkesbury, Gloucestershire

Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land off Northway Lane, Tewksbury, Gloucestershire. The project was commissioned by NMC Nomenca with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features on the site ahead of a proposed development.

The Site is located north east of Tewkesbury town centre on Northway Lane. It covers three green fields in an irregular parcel of land bound by an industrial estate to the south and housing estate to the north. The Site lies approximately 1.4km west of the M5 motorway with the village of Walton Cardiff lying some 1.3km southeast of the Site. The gradiometer survey covered 3.5ha and has demonstrated the presence of anomalies of possible archaeological interest within the survey area, along with many regions of increased magnetic response and a modern service.

Few anomalies considered to be of possible archaeological interest were identified, comprising several pit-like anomalies within the southwestern portions of the site. Other weak trends were visible, although there is no obvious overall distribution and it is likely that most relate to near-surface soil changes.

Geological responses consistent with former stream channels can be seen, particularly within the northeastern extent of the site; it is possible that a former course of the Carrant Brook lies to the north of Tewkesbury Industrial Estate, but there is no direct evidence for associated archaeological remains.

A previous desk-based assessment undertaken by Wessex Archaeology highlighted the probable site of a former mill near the central part of the survey area. No anomalies directly associated with former structures were identified within the gradiometer dataset, although magnetic disturbance along the northern boundary is consistent with the presence of demolition rubble or the formalised course of Carrant Brook. It is possible that the linear nature of geological responses within the eastern part of the site indicate their use as a leat, although there is no clear evidence for this from the geophysical survey.

A single modern service was detected within the Site, oriented NE-SW across the southern extent of the westernmost survey area.

Extensive magnetic disturbance associated with the services and proximity to the industrial estate and numerous small-scale ferrous responses were seen throughout the dataset.

Northway Lane, Tewkesbury, Gloucestershire

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by NMC Nomenca. The assistance of Nick Russell is gratefully acknowledged in this regard.

The fieldwork was carried out by Philip Roberts and Philipp Maier. The geophysical data was processed and interpreted by Ross Lefort and Alistair Salisbury. This report was written by Alistair Salisbury and Philip Roberts. The geophysical work was quality controlled by Dr. Paul Baggaley and Ben Urmston. Illustrations were prepared by Richard Milwain and Karen Nichols. The project was managed on behalf of Wessex Archaeology by Richard O'Neill.

Northway Lane, Tewkesbury, Gloucestershire

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology was commissioned by NMC Nomenca to carry out a geophysical survey over land adjacent to Northway Lane, Tewksbury, Gloucestershire (centred on NGR 390560 233400; **Figure 1**), hereafter "the Site". The survey forms part of an ongoing programme of archaeological works being undertaken ahead of 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 is located north east of Tewkesbury town centre on Northway Lane. It covers three green fields in an irregular parcel of land covering 4.9ha; it is bounded by an industrial estate to the south and housing estate to the north (**Figure 1**).

1.2.2 Most of the Site is under short grass with two hedgerows running in a northwest to southeast alignment from the banks of Carrant Brook to Northway Lane. A tributary of Carrant Brook also runs across the Site.

1.2.3 The Site is located on a relatively flat piece of land with the eastern end lying at 12m above Ordinance datum (aOD) quickly rising to a plateau of 14m before dropping back to 12m at the western end.

1.2.4 The soils underlying the Site comprise of the typical river terrace gravel of the 511h (Badsey 1) association (SSEW 1983). It is likely that fine loamy soils will be overlaying the river gravels. To the east of the Site soils of the 411b (Evesham 2) association may have been encountered. These comprise of Jurassic and Cretaceous clays, both calcareous and non-calcareous. During periods of extended wet weather these soils may become waterlogged.

1.2.5 The Site geology is composed of Charmouth Mudstone Formation in the west with the eastern half underlain by the Rugby Limestone Member. These are both overlain by alluvium (British Geological Survey Sheet 216, Tewkesbury).

1.3 Archaeological and Historical Background

1.3.1 WA has prepared a Desk-Based Assessment (DBA, 2014) for the Site, which identified a high potential for medieval and later archaeology. The results are summarised briefly here, and are discussed as appropriate with regard to the geophysical survey.

1.3.2 The primary focus of this activity is the site of a former mill to the north of the Site, with 18th and 19th century mapping indicating the presence of leats and sluices associated with the mill; the location of the building is not entirely clear due to the age of the mapping, but it is likely to lie near or just outside the northern extent of the central part of the present Site boundary.

1.3.3 Further agricultural activity is expected across the Site, as it is known to have been used as water meadows for grazing throughout the post-medieval and historic periods.

1.3.4 Prehistoric, Romano-British and Saxon archaeology has been discovered within the general vicinity, although the potential within the Site is unknown, given the lack of recorded finds or sites within the Study Area.

2 METHODOLOGY

2.1 Introduction

2.1.1 The detailed magnetometer survey was conducted using a Bartington Grad601-2 dual fluxgate gradiometer system. The survey was conducted in accordance with English Heritage guidelines (2008).

2.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between 26th and 28th March 2014. Field conditions at the time of the survey were poor with persistent rain showers, although conditions were firm under foot.

2.2 Method

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

2.2.2 The magnetometer 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 EH guidelines (2008). Data were collected in the zigzag method.

2.2.3 Data from the survey were 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.

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 several anomalies of possible archaeological interest across the Site, along with a possible modern service and some geological responses. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2,000 (**Figures 2** and **3**). The data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 50nT per cm for the XY trace plots.

3.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (**Figure 4**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.

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

3.2 Gradiometer Survey Results and Interpretation

3.2.1 The magnetic background of The Tewkesbury Site was extremely noisy in certain areas due to the close proximity of the industrial estate to the south. However, the magnetic background was relatively quiet away from these areas.

3.2.2 Two zones of superficial geology at **4000** in the westernmost portion of the data may be related to changes in bedrock formation or soil type beneath the survey area, although they are perhaps more likely to be associated with former channels, given the proximity of the nearby stream.

3.2.3 Numerous scattered ferrous responses can be seen throughout the southwestern field, with two larger regions of ferrous anomalies that may be buried modern debris such as farming equipment or similar. A single small circular anomaly east of **4000** exhibits pit-like characteristics which may have archaeological implications; however, there is little to support an archaeological interpretation directly.

3.2.4 Extremely high readings are present at the southernmost extent of the dataset, consistent with spreads of modern debris, such as demolition rubble, and may relate to levelling of the area in conjunction with the construction of the industrial estate. A modern service line orientated NE-SW can be seen at the southeastern corner of the field. However this is coincident with the strong band of readings that has masked even the strong response over the pipe. Therefore it is not possible to determine where the service extends southwestwards. Centred on **4001** are a number of linear trends typically orientated loosely E-W. No clear overall distribution is visible in these linear anomalies.

3.2.5 The central survey area has a band of ferrous **4002** extending through it on an E-W orientation. Given its linear distribution, it is likely to be modern in origin and may represent a former boundary. Broad, poorly defined responses to the north of **4002** are considered likely to be geological in origin.

3.2.6 To the southwest of **4002** are a number of anomalies that may be archaeological in origin; these comprise three sub-rounded anomalies consistent with in-filled pits. More linear trends similar to those at **4001** are present here. The ferrous debris appears to be more

prevalent where the survey area borders the industrial estate in the east of this central zone, with magnetic disturbance visible within the dataset.

3.2.7 A belt of responses at **4003** aligned E-W through the centre of the survey field is indicative of geological activity, and the broadly linear alignment suggests that it may indicate a former channel or mill race, although it is not clear whether this was deliberately infilled. Surrounding the perimeter is an array of strong readings that are likely to be related to fences or rubble from the neighbouring industrial estate.

4 CONCLUSION

4.1.1 The detailed gradiometer survey has been successful in detecting a limited number of anomalies of possible archaeological interest within the Site, in addition to many regions of increased magnetic response, one modern service and areas of superficial geology.

4.1.2 The geophysical survey has identified very few anomalies considered to be of possible archaeological interest. However, faint trends and weakly magnetised geological responses have been detected, suggesting that more substantial archaeological features should have produced measurable magnetic anomalies, were any to be present.

4.1.3 It should be noted that no anomalies directly relating to the former mill have been identified, although regions of magnetic disturbance along the northern border of the Site are consistent with demolition rubble or the formalisation of the course of Carrant Brook.

4.1.4 It is possible that linear band of increased response **4003** relates to a former canalised branch of Carrant Brook, although there is little further evidence to support this interpretation aside from the linear orientation of the geological responses. Archaeological features typically produce anomalies with well-defined boundaries, whereas the broad and indistinct nature of **4003** is characteristic of natural and geological features. Current and historic mapping (WA 2014) shows evidence for management of the waterways in the immediate vicinity, suggesting that canalisation would at least be conceivable.

4.1.5 The large regions of magnetic disturbance associated with the industrial estate would have effectively masked weaker anomalies from any source; this disturbance is limited to the areas immediately adjacent to the modern infrastructure, however.

4.1.6 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; it is assumed that the centreline of services is coincident with the centreline of their anomalies, however. Similarly, it is difficult to estimate the depth of burial of the services through gradiometer survey.

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 3, Soils of Midland and Western England*. Ordnance Survey, Southampton.

Wessex Archaeology, 2014. *Northway Lane, Tewkesbury: Archaeological Desk-Based Assessment*. Client report 102150.01

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 0.25m. 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;
- 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)

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.

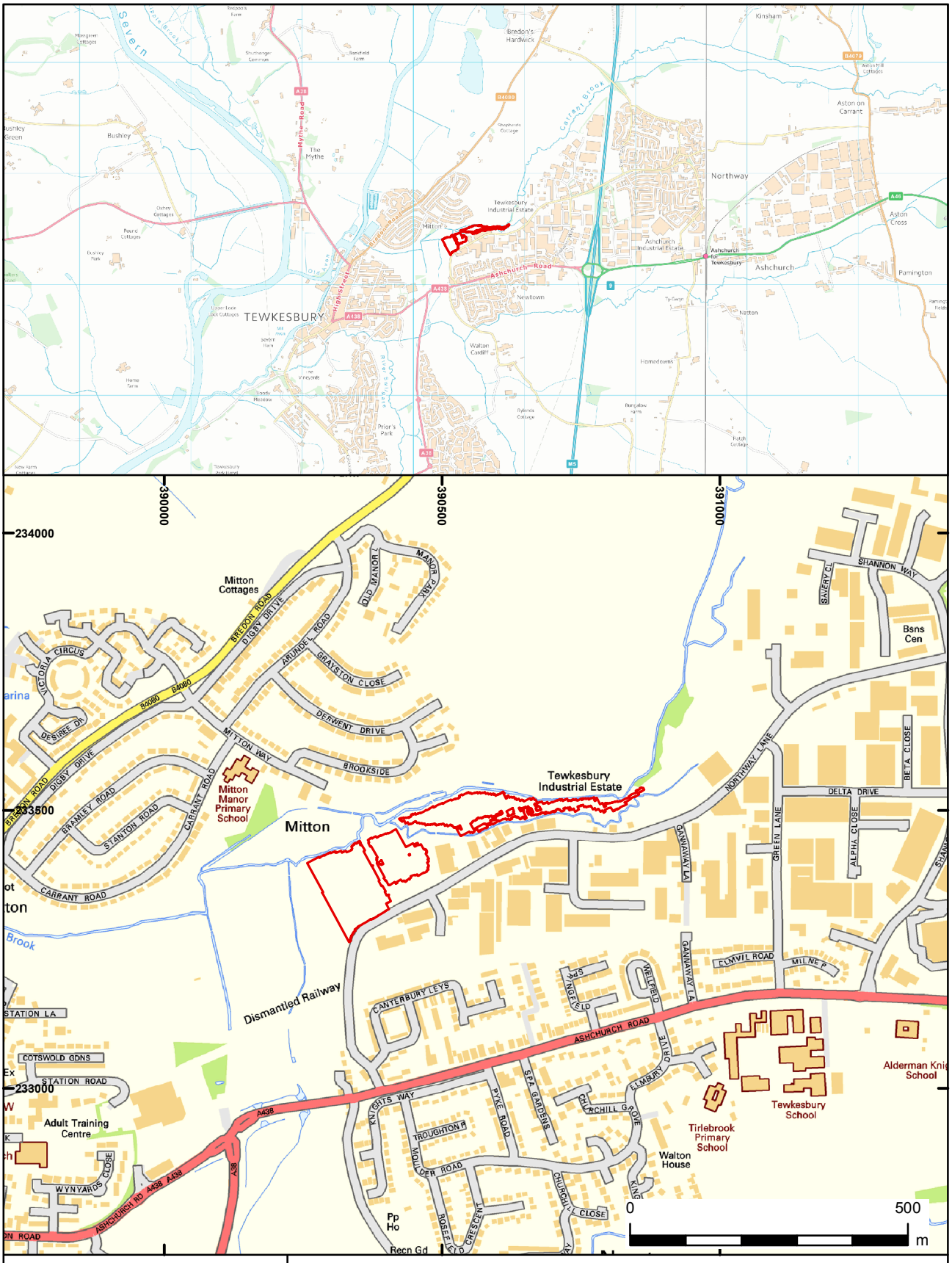
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided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



Survey Extents

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Scale:	1:50000 and 1:10000 at A4	Illustrator:	RAM
Path:	X:\PROJECTS\102150\GIS\FigsMXD\102150_Fig01.mxd		

Site location and survey extents

Figure 1

390200
390400
390600
390800
233600
233400
233200
+3nT
-2nT
0
100
m
Survey Extents

Date:	07/05/14	Revision Number:	0
Scale:	1:2000 at A3	Illustrator:	RAM
Path:	X:\PROJECTS\102150\GIS\FigsMXD\102150_Fig02.mxd		

Greyscale

Figure 2

390200
390400
390600
390800
233600
233400
233200
+25nT
-25nT
0
100
m
Survey Extents

Date:	07/05/14	Revision Number:	0
Scale:	1:2000 at A3	Illustrator:	RAM
Path:	X:\PROJECTS\102150\GIS\FigsMXD\102150_Fig03.mxd		

XY trace

Figure 3

390200
390400
390600
390800
233600
233400
233200
4000
4001
4002
4003
Survey Extents
Possible Archaeology
Modern Service
Ferrous
Trend
Ploughing
Superficial Geology
0
100
m

Date:	07/05/14	Revision Number:	0
Scale:	1:2000 at A3	Illustrator:	RAM
Path:	X:\PROJECTS\102150\GIS\FigsMXD\102150_Fig04.mxd		

Interpretation

Figure 4

wessex archaeology

salisbury rochester sheffield edinburgh

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