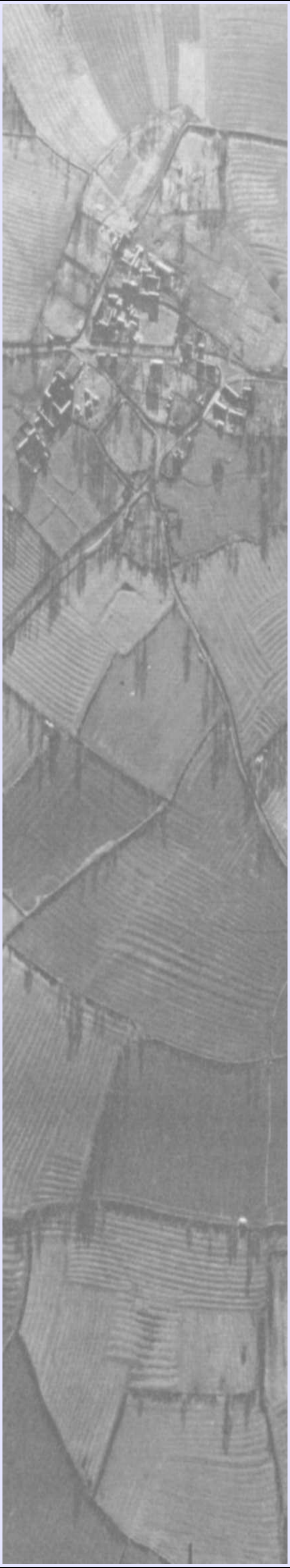

Bullimore Farm, Shepton Mallet, Somerset

MAGNETOMETER SURVEY REPORT

for

Neil Edwards

David Sabin and Kerry Donaldson

February 2012

Ref. no. 386

ARCHAEOLOGICAL SURVEYS LTD

Bullimore Farm, Shepton Mallet, Somerset

Magnetometer Survey

for

Neil Edwards

Fieldwork by David Sabin and Jack Cousins
Report by David Sabin BSc (Hons) MIFA and Kerry Donaldson BSc (Hons)

Survey dates – **8th, 9th, 12th December 2011 and 2nd & 3rd February 2012**
Ordnance Survey Grid Reference – **ST 628 421**

Somerset HER number 31576

Archaeological Surveys Ltd
PO Box 2862, Castle Combe, Chippenham, Wiltshire, SN14 7WZ
Tel: 01249 782234 Fax: 0871 661 8804
Email: info@archaeological-surveys.co.uk
Web: www.archaeological-surveys.co.uk

Archaeological Surveys Ltd is a company registered in England and Wales under registration number 6090102, Vat Reg no. 850 4641 37.
Registered office address, Griffon House, Seagry Heath, Great Somerford, Chippenham, SN15 5EN.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

SUMMARY

Archaeological Surveys Ltd carried out a magnetometer survey of land at Bullimore Farm, to the south east of Shepton Mallet, Somerset. The work was commissioned by Michael Goff on behalf of the landowner, Neil Edwards. The survey was undertaken in order to assess the archaeological potential of the site so as to provide information for future land use and management. The site includes part of Scheduled Monument No. 22803, a Romano-British linear village.

The results of the survey indicate the presence of a number of anomalies of archaeological potential in the north western part of the site. These consist of linear and discrete positive anomalies and are consistent with ditches, pits and enclosures. Linear positive anomalies extending south and south east from the north western part of the site indicate ditches that may relate to former boundaries or trackways. Some negative linear anomalies were also located in the north western part of the site and it is possible that these relate to structural remains, though the interpretation is tentative.

Many linear and discrete anomalies have been classified as uncertain in origin due to their weak and fragmented nature or indistinct morphology. Cross referencing with early Ordnance Survey mapping has demonstrated anomalies associated with the removal of several field boundaries and the infilling of a railway cutting. Many anomalies of uncertain origin may relate to agricultural practices, land drainage and other boundary changes within the site. However, their archaeological potential should not be dismissed given the close proximity of Roman and prehistoric sites.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Michael Goff on behalf of Neil Edwards, to undertake a magnetometer survey of an area of land at Bullimore Farm to the south east of Shepton Mallet, Somerset. The archaeological potential of the site is being assessed to inform future use and management.

1.1.2 The site includes part of Scheduled Monument No. 22803, *an area of the Romano-British linear village at Fosse Lane, Shepton Mallet* (Appendix A). A licence, under Section 42 of the 1979 Ancient Monuments and Archaeological Areas Act (as amended by the National Heritage Act 1983), was granted by English Heritage prior to commencement of fieldwork within the scheduled area. The geophysical survey was carried out in accordance with a Method Statement produced by Archaeological Surveys (2011) and issued in application for the Section 42 licence. Somerset County Council Historic Environment Service also issued HER number 31576 for the work.

1.2 Survey objectives and techniques

1.2.1 The objective of the survey was to use magnetometry to locate geophysical anomalies that may be archaeological in origin, so that they may be assessed prior to determining any future use of the site.

1.2.2 The methodology is considered an efficient and effective approach to archaeological prospection. The survey and report generally follow the recommendations set out by: English Heritage, 2008, *Geophysical survey in archaeological field evaluation;* and Institute for Archaeologists, 2002, *The use of Geophysical Techniques in Archaeological Evaluations*.

1.3 Site location, description and survey conditions

1.3.1 The site is located at Bullimore Farm, to the south east of Shepton Mallet in Somerset. It is centred on Ordnance Survey National Grid Reference (OS NGR) ST 628 421, see Figures 01 and 02.

1.3.2 The geophysical survey covers approximately 7ha, split between two pasture fields. For the purposes of this report, the northern field is referred to as Area 1 and the southern field, Area 2. The majority of Area 1, except for the south eastern corner, lies within the scheduled area which also extends approximately 14m into the northern part of Area 2.

1.3.3 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data. Some areas of waterlogging were encountered within Area 2 and very hard and uneven conditions were encountered in Area 1 due to solidly frozen ground. Weather conditions during the survey were variable with periods of heavy rain and high winds in December followed and very cold conditions in February.

1.4 Site history and archaeological potential

1.4.1 The northern half of the site lies within the scheduled area of monument number 22803, *an area of the Romano-British linear village at Fosse Lane, Shepton Mallet* (see Appendix A). This lies either side of the Fosse Way, and in 1988 excavations identified a linear Romano-British settlement, three cemeteries and underlying Neolithic and Iron Age archaeological remains.

1.4.2 A previous geophysical survey was carried out within parts of the site (Geophysical Surveys, 1991) and this located a number of geophysical anomalies that appear to relate to a settlement enclosure and associated field systems within the northern part of the site. A smaller sample within the southern part of the site located a number of ditch-like and pit-like features.

1.4.3 A geophysical survey carried out by Archaeological Surveys (2008) on land 150m to the west, located a number of positive linear and discrete anomalies that related to ditches and pits likely to be prehistoric in date.

1.4.4 The site also contains the infilled cutting of the Somerset and Dorset Joint Railway, opened in 1874, which was dismantled in 1966 and infilled by 1992. This is likely to contain highly magnetic ferrous material, and would have truncated any underlying archaeology.

1.5 Geology and soils

1.5.1 The underlying solid geology across the site is from the Langport Member, Blue Lias Formation and Charmouth Mudstone Formation (BGS, 2010). The overlying soil across the survey area is from the Evesham 1 association which is a typical calcareous pelosol. It consists of a slowly permeable, calcareous clayey soil (Soil Survey of England and Wales, 1983).

2 METHODOLOGY

2.1 Technical synopsis

2.1.1 Magnetometry survey records localised magnetic fields that can be associated with features formed by human activity. Magnetic susceptibility and magnetic thermoremnance are factors associated with the formation of localised fields. Additional details are set out below and within Appendix B.

2.1.2 Iron minerals within the soil may become altered by burning and the break down of biological material; effectively the magnetic susceptibility of the soil is increased, and the iron minerals become magnetic in the presence of the Earth's magnetic field. Accumulations of magnetically enhanced soils within features, such as pits and ditches, may produce magnetic anomalies that can be mapped by magnetic prospection.

2.1.3 Magnetic thermoremnance can occur when ferrous minerals have been heated to high temperatures such as in a kiln, hearth, oven etc. On cooling, a permanent magnetisation may be acquired due to the presence of the Earth's magnetic field. Certain natural processes associated with the formation of some igneous and metamorphic rock may also result in magnetic thermoremnance.

2.1.4 The localised variations in magnetism are measured as sub-units of the Tesla, which is a SI unit of magnetic flux density. These sub-units are nano Teslas (nT), which are equivalent to 10^{-9} Tesla (T).

2.2 Equipment configuration, data collection and survey detail

2.2.1 The detailed magnetic survey was carried out using Bartington Grad 601-2 gradiometers. The instruments effectively measure a magnetic gradient between two fluxgate sensors mounted vertically 1m apart. Two sets of sensors are mounted on a single frame 1m apart horizontally.

2.2.2 The instruments are extremely sensitive and are able to measure magnetic variation to 0.01nanoTesla (nT), with an effective resolution of 0.03nT. The data are limited to ±100nT when surveying with the highest sensitivity. All readings are saved to an integral data logger for analysis and presentation.

2.2.3 The instruments are operated according to the manufacturer's instructions with consideration given to the local conditions. An adjustment procedure is required, prior to collection of data, in order to balance the sensors and remove the effects of the Earth's magnetic field; further adjustment is required during the survey due to instrument drift often associated with temperature change.

2.2.4 It can be very difficult to obtain optimum balance for the sensors due to localised magnetic vectors that may be associated with large ferrous objects, geological/pedological features, 'magnetic debris' within the topsoil and natural temperature fluctuations. Imperfect balance results in a heading error often visible as striping within the data; this can be effectively removed by software processing and generally has little effect on the data unless extreme.

2.2.5 The Bartington gradiometers undergo regular servicing and calibration by the manufacturer. A current assessment of the instruments is shown in Table 1 below.

Sensor type and serial numbers	Bartington Grad - 01 – 1000 Nos. 084, 085, 242 and 396
Date of certified calibration/service	Sensors 084 and 085 - 6th August 2010 (due Aug 2012) Sensors 242 and 396 - 14th October 2011 (due Oct 2013)
Bandwidth	12Hz (100nT range) both sensors
Noise	<100pT peak to peak
Adjustable errors	<2nT

Table 1: Bartington fluxgate gradiometer sensor calibration results

The instruments were considered to be in good working order prior to the survey, with no known faults or defects.

2.2.6 Data were collected at 0.25m centres along traverses 1m apart. The survey area was separated into 30m by 30m grids (900m²) giving 3600 recorded measurements per grid. This sampling interval is very effective at locating archaeological features and is the recommended methodology for archaeological prospection (English Heritage, 2008).

2.2.7 The survey grids were set out to the Ordnance Survey OSGB36 datum using a Penmap RTK GPS. The GPS is used in conjunction with Leica's SmartNet service, where positional corrections are sent via a mobile telephone link. Positional accuracy of around 10 – 20mm is possible using the system. The instrument is regularly checked against the ETRS89 reference framework using Ordnance Survey ground marker C1ST7784 (Horton).

2.3 Data processing and presentation

2.3.1 Magnetometry data downloaded from the Grad 601-2 data logger are analysed and processed in specialist software known as ArcheoSurveyor. The software allows greyscale and trace plots to be produced for presentation and display. Survey grids are assembled to form an overall composite of data (composite file) creating a dataset of the complete survey area. Appendix D contains specific information concerning the survey and data attributes and is derived directly from ArcheoSurveyor; this should be used in conjunction with information provided by Figure 02.

2.3.2 Only minimal processing is carried out in order to enhance the results of the survey for display. Raw data are always analysed, as processing can modify anomalies. The following schedule sets out the data and image processing used in this survey:

- clipping of the raw data at ±30nT to improve greyscale resolution,
- clipping of processed data at ±3nT to enhance low magnitude anomalies,
- zero median/mean traverse is applied in order to balance readings along each traverse.

Reference should be made to Appendix C for further information on the specific processes carried out on the data. Appendix D metadata includes details on the processing sequence used for each survey area.

2.3.3 An abstraction and interpretation is offered for all geophysical anomalies located by the survey. A brief summary of each anomaly, with an appropriate reference number, is set out in list form within the results (Section 3) to allow a rapid and objective assessment of features within each survey area. Where further interpretation is possible, or where a number of possible origins should be considered, more subjective discussion is set out in Section 4.

2.3.4 The main form of data display prepared for this report is the greyscale plot. Both 'raw' and 'processed' data and an abstraction plot have been shown at a scale of 1:1250 for the whole site, together with processed data for each survey area shown at a scale of 1:1000, followed by an abstraction and interpretation plot. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing.

2.3.5 Graphic raster images in bitmap format (.BMP) are initially prepared in ArcheoSurveyor. Regardless of survey orientation, data captured along each traverse are displayed and processed by ArcheoSurveyor from left to right; this corresponds to a direction of south to north in the field. Prior to displaying against base mapping, raster graphics require a rotation of 66° anticlockwise for Area 1 and 74° for Area 2 to restore north to the top of the image upon insertion into AutoCAD.

2.3.6 The raster images are combined with base mapping using ProgeCAD Professional 2009 and AutoCAD LT 2007, creating DWG file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. Quality can be compromised by rotation of graphics in order to allow the data to be orientated with respect to grid north; this is considered acceptable as the survey results are effectively georeferenced allowing relocation of features using GPS, resection method etc.

2.3.7 A digital archive is produced with this report, see Appendix E below. The main archive is held at the offices of Archaeological Surveys Ltd.

3 RESULTS

3.1 General assessment of survey results

3.1.1 The detailed magnetic survey was carried out over two survey areas covering approximately 7ha.

3.1.2 Magnetic anomalies located can be generally classified as positive linear and discrete positive responses of archaeological potential, positive and negative linear anomalies of an uncertain origin, linear anomalies of an agricultural origin, linear anomalies relating to land management, areas of magnetic debris and disturbance, strong discrete dipolar anomalies relating to ferrous objects and strong multiple dipolar linear anomalies relating to buried services or pipelines.

3.1.3 Anomalies located within each survey area have been numbered and are described below with subsequent discussion in Section 4.

3.2 Statement of data quality

3.2.1 Data are considered representative of the magnetic anomalies present within the site. No significant defects are present within the dataset. Some minor data artefacts were produced during processing of grids that contain high levels of magnetic disturbance.

3.2.2 Magnetic disturbance was encountered within both survey areas, and this has the potential to obscure weak anomalies of archaeological potential. Most significantly, magnetic disturbance and debris were present within and adjacent to an infilled railway cutting. However, although features of archaeological potential may have been obscured, it is highly likely that there has been complete truncation and removal of archaeological features during the original construction of the cutting.

3.3 Data interpretation

3.3.1 The list of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the survey. A basic explanation of the characteristics of the magnetic anomalies is set out for each category in order to justify interpretation, a basic key is indicated to allow cross referencing to the abstraction and interpretation plot. CAD layer names are included to aid reference to associated digital files (.dwg/.dxf). Sub-headings are then used to group anomalies with similar characteristics for each survey area.

Report sub-heading CAD layer names and plot colour	**Description and origin of anomalies**
Anomalies with archaeological potential AS-ABST MAG POS LINEAR ARCHAEOLOGY AS-ABST MAG POS DISCRETE ARCHAEOLOGY	Anomalies have the characteristics (mainly morphological) of a range of archaeological features such as pits, ring ditches, enclosures, etc..
Anomalies with an uncertain origin AS-ABST MAG POS LINEAR UNCERTAIN AS-ABST MAG NEG LINEAR UNCERTAIN AS-ABST MAG POS DISCRETE UNCERTAIN AS-ABST MAG POS AREA UNCERTAIN	The category applies to a range of anomalies where there is not enough evidence to confidently suggest an origin. Anomalies in this category may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered. Positive anomalies are indicative of magnetically enhanced soils that may form the fill of 'cut' features or may be produced by accumulation within layers or 'earthwork' features; soils subject to burning may also produce positive anomalies. Negative anomalies are produced by material of comparatively low magnetic susceptibility such as stone and subsoil.
Anomalies relating to land management AS-ABST MAG BOUNDARY	Anomalies are mainly linear and may be indicative of the magnetically enhanced fill of cut features (i.e. ditches). The anomalies may be long and/or form rectilinear elements and they may relate to topographic features or be visible on early mapping. Associated agricultural anomalies (e.g. headlands, plough marks and former ridge and furrow) may support the interpretation.
Anomalies with an agricultural origin AS-ABST MAG AGRICULTURAL	The anomalies are often linear and form a series of parallel responses or are parallel to extant land boundaries. Where the response is broad, former ridge and furrow is likely; narrow response is often related to modern ploughing.
Anomalies associated with magnetic debris AS-ABST MAG DEBRIS AS-ABST MAG STRONG DIPOLAR	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. It often occurs where there has been dumping or ground make-up and is related to magnetically thermoremnant materials such as brick or tile or other small fragments of ferrous material. This type of response is occasionally associated with kilns, furnace structures, or hearths and may therefore be

	archaeologically significant. It is also possible that the response may be caused by natural material such as certain gravels and fragments of igneous or metamorphic rock. Strong discrete dipolar anomalies are responses to ferrous objects within the topsoil.
Anomalies with a modern origin AS-ABST MAG DISTURBANCE AS-ABST MAG SERVICE	The magnetic response is often strong and dipolar indicative of ferrous material and may be associated with extant above surface features such as wire fencing, cables, pylons etc.. Often a significant area around such features has a strong magnetic flux which may create magnetic disturbance; such disturbance can effectively obscure low magnitude anomalies if they are present. Fluxgate sensors may respond erratically and with hysteresis adjacent to strong magnetic sources. Buried services may produce characteristic multiple dipolar anomalies dependant upon their construction.

Table 2: List and description of interpretation categories

3.4 List of anomalies - Area 1

Area centred on OS NGR 362900 142244, see Figures 06 & 07.

Anomalies of archaeological potential

(1) – A group of positive linear anomalies form a rectilinear enclosure with other linear anomalies both within and beyond its limits. There are pit-like anomalies or discrete areas of magnetic enhancement and also a negative linear anomaly which is a response to material of low magnetic susceptibility, such as stone. The orientation of the anomalies is generally north to south and east to west. The group is associated with anomalies (2) and (3) and corresponds to anomalies located during the 1991 survey. Levels of enhancement peak at around 7nT although the majority of the readings are <3nT.

(2) – A positive linear anomaly (<3nT) extends from the western edge of anomaly group (1) for 75m in a southerly direction where it appears to join another positive linear anomaly to form a “T” shape. It is possible that it extends into Area 2 to the south as anomaly (14).

(3) – Positive linear anomalies (<3nT) extending from the north western corner of the survey area towards the south east. They appear to be directly associated with anomaly group (1), possibly indicating boundary ditch features.

(4) – Positive linear anomalies located close to the northern edge of the survey area. The orientation of these anomalies is different to anomalies (1) to (3), they are parallel with the adjacent Fosse Way (north-north-east to south-south-west).

Anomalies with an uncertain origin

(5) – Weakly positive and negative linear and rectilinear anomalies and positive

discrete anomalies located between anomalies (1), (2) and (3). The positive anomalies may indicate ditch-like and pit-like features, and the negative responses material with low magnetic susceptibility, such as stone. However, a cautious approach has been adopted with the interpretation of these features. Their low magnitude and lack of coherent morphology, together with the fact that they are parallel with modern and relatively recently removed field boundaries, suggests that although they may have archaeological potential, this is not certain.

(6) – Weakly positive linear anomalies located within the north western part of the survey area may relate to anomalies located to the east beyond the dismantled railway line. It is possible that they relate to cut features, such as former field boundary ditches with some archaeological potential, although due to their weak response (<1nT) and truncation by the dismantled railway, the full extent and layout of these anomalies cannot be seen clearly.

(7) – Located in the north eastern part of the survey area are several weakly positive linear, rectilinear and discrete anomalies, and several negative linear anomalies of uncertain origin.

(8) – Weakly positive linear anomalies to the south of anomalies (7) may be associated with them. Although they appear parallel with other anomalies in the site, they are spaced approximately 7-9m apart, and are also parallel with modern and relatively recently removed field boundaries, which may indicate a relatively recent agricultural origin, or possibly ridge and furrow.

Anomalies associated with land management

(9) – A positive linear anomaly and narrow band of magnetic debris indicate the location of a field boundary that bordered the eastern edge of the railway line and was removed between 1972 and 1992.

(10) – A linear series of strong dipolar anomalies, and associated magnetic disturbance, extends approximately 45m westwards from the dismantled railway line and is likely to relate to former fence posts associated with a field boundary removed by 1961.

Anomalies associated with magnetic debris

(11) – A broad linear zone of magnetic debris extends across the central part of the survey area with a north – south orientation. This is a response to ferrous material, probably used within construction or infill of the Somerset and Dorset Joint Railway line that crossed the site between 1874 and 1966. Its cutting was infilled by 1992.

(12) – The survey area contains several strong discrete dipolar anomalies that relate to ferrous objects within the topsoil.

Anomalies with a modern origin

(13) – A strongly magnetic dipolar linear anomaly lies close to the western field

boundary and is a response to a buried service or pipeline. It also extends southwards into Area 2 where it is parallel with the western field boundary.

3.5 List of anomalies - Area 2

Area centred on OS NGR 362851 142070, see Figures 08 & 09.

Anomalies of archaeological potential

(14) – A positive linear anomaly extends from the northern edge of the survey area in a south-south-easterly direction for approximately 100m. The response ends at a linear series of strong dipolar anomalies which may have obscured or truncated the feature in the southern part of the survey area. The position and orientation of anomaly (14) may suggest that it is an extension of anomaly (2).

(15) – A possible suggestion of a weakly positive linear anomaly. It has a similar orientation to, and may be a southern extension of anomaly (3).

Anomalies with an uncertain origin

(16) – Two parallel positive linear anomalies, flanking a negative linear anomaly, are located to the south of anomaly (15) and may indicate ditch-like features flanking material with low magnetic susceptibility, such as subsoil or stone. Other positive linear anomalies extend eastwards from them.

(17) – Discrete positive anomalies located close to the western edge of the survey area. These anomalies are 10-20nT which indicates that they may relate to pit-like features containing strongly magnetically enhanced material, or to magnetically thermoremnant features, possibly indicating areas of burning.

(18) – Fragmented positive curvilinear anomalies located in the northern half of the survey area.

(19) – The survey area contains several weakly positive, discrete anomalies which may indicate pit-like features.

(20) – Weak, broadly linear or curvilinear anomaly is a response to weakly magnetically enhanced material.

(21) – Positive linear anomalies with a general west-north-west to east-south-east orientation may relate to agricultural activity, possibly indicating former ridge and furrow.

(22) – The survey area contains several positive and some negative linear anomalies. The positive anomalies may relate to ditch-like features; however, their origin is uncertain.

Anomalies associated with land management

(23) – The survey area contains many positive linear anomalies, oriented almost east-west and north-south, that relate to former field boundaries, the majority being removed in the 1960s.

Anomalies with an agricultural origin

(24) – A series of linear anomalies, oriented east-west and parallel with the removed field boundaries, relate to former agricultural activity.

(25) – A series of parallel negative linear anomalies are located close to the northern edge of the survey area. They are likely to relate to agricultural activity, possibly indicating land drains.

Anomalies associated with magnetic debris

(26) – A patch of magnetic debris is located close to the southern field boundary and is a response to magnetically thermoremnant material that may have been used for infilling.

(27) – A broad linear zone of strongly magnetic debris and associated magnetic disturbance is associated with ferrous material used to infill a railway cutting.

(28) – A linear zone of magnetic disturbance is associated with multiple strong dipolar anomalies. It is possible that this is associated with a former field boundary, although none is mapped between 1887 and 1992.

4 DISCUSSION

4.1.1 The detailed magnetometer survey located a number of geophysical anomalies within the northern part of Area 1 that indicate the presence of ditches, pits and enclosures with archaeological potential. Some of these anomalies are not parallel or orthogonal with the Fosse Way, which may indicate that some pre-date it, or that there are minor Roman roads linking to the Fosse upon which settlement features are orientated.

4.1.2 A group of weakly positive linear, rectilinear and discrete anomalies appear to be associated with several negative linear and rectilinear anomalies in the south western part of Area 1. Although it is possible that they relate to magnetically enhanced material within cut features or areas of burning and material with a low magnetic susceptibility such as stone, their weak and fragmented response prevents confident interpretation.

4.1.3 The eastern half of Area 1 contains numerous weakly positive linear, rectilinear and discrete anomalies that appear to relate to ditch-like and pit-like features. However, due to their weak response, and the fact that they are parallel with modern and relatively recently removed field boundaries, their origins are uncertain.

4.1.4 Area 2 contains a positive linear anomaly (14), that appears on a similar orientation to anomaly (2) within Area 1 to the north. Although anomaly (2) appears to end abruptly in a "T" shaped feature, with no visible extension to the south within Area 1, the position and orientation of anomaly (14) may suggest that it is a southerly extension of this cut feature across Area 2. Linear anomaly (15) is very weak, although its position and orientation may indicate that it is a south easterly extension of anomaly (3).

4.1.5 Area 2 contains a grouping of relatively strongly enhanced pit-like anomalies close to the western edge. The strength of these anomalies suggests they contain moderately enhanced material, possibly associated with areas of burning. They do appear to be bounded by a linear anomaly, but their archaeological potential cannot be determined.

4.1.6 The interpretation of many of the anomalies has been hindered by the fact that many are parallel with the modern and relatively recently removed field boundaries. The majority of the anomalies have an almost east-west, or an east-north-east to west-south-west, and a north-south or south-south-east to north-north-west orientation, as do the modern field boundaries. Many of the anomalies that have been classified as uncertain in origin may well relate to cut features with an archaeological origin; however, it is not possible to determine if these are prehistoric or Roman features, or if they relate to medieval, post-medieval or modern activities and agricultural practices.

5 CONCLUSION

5.1.1 The detailed magnetometer survey located a number of geophysical anomalies that appear to relate to ditches, pits and enclosures with archaeological potential in the northern western part of survey Area 1. These anomalies may define the southern extent of Romano-British and prehistoric features located to the north of the site. Several negative linear anomalies could be consistent with former structural remains, although this interpretation is tentative.

5.1.2 Linear anomalies extending south and south east from the north western part of Area 1 and into Area 2 may be associated with ditches forming ancient boundaries and/or trackways. The general orientation of features of archaeological potential appears to reflect the orientation of these southerly and south easterly extensions; however, a small number of anomalies in the north western corner also reflect the orientation of the Fosse Way. It is unclear as to whether the difference in the orientations represents different phases and periods of activity, or whether features are merely orientated on other lesser Roman tracks that link to the Fosse immediately north of the surveyed area.

5.1.3 Many linear and discrete positive anomalies of uncertain origin were located in both of the survey areas. Further interpretation from the geophysical data is impossible as the anomalies are generally weak and fragmented, and they do not have any distinct morphological characteristics that would allow further comment on their archaeological potential. Many anomalies do appear to be related to former agricultural activity and removed field boundaries, and it is possible that many of the anomalies of uncertain origin are also agricultural in nature.

6 REFERENCES

Archaeological Surveys, 2008. *Gore End Farm, Shepton Mallett, Somerset, Magnetometer Survey Report.* Unpublished typescript document.

Archaeological Surveys, 2011. *Bullimore Farm, Shepton Mallet, Geophysical Survey Method Statement.* Unpublished typescript document.

British Geological Survey, 2011. *Geology of Britain viewer, 1:50 000 scale [online]* available from http://maps.bgs.ac.uk/geologyviewer/ [accessed 9/12/2011].

English Heritage, 2008. *Geophysical survey in archaeological field evaluation. Research and Professional Service Guideline No.1.* 2nd ed. Swindon: English Heritage.

Geophysical Surveys, 1991. *Report on Geophysical Survey, Shepton Mallet Bypass.* Report 90/94.

Institute for Archaeologists, 2002. *The use of Geophysical Techniques in Archaeological Evaluations*. IFA Paper No. 6. IFA, University of Reading.

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

Appendix A – Scheduled monument information

EXTRACT FROM ENGLISH HERITAGE'S RECORD OF SCHEDULED MONUMENTS
MONUMENT: An area of the Romano-British linear village at Fosse Lane, Shepton Mallet
PARISH: SHEPTON MALLET
DISTRICT: MENDIP
COUNTY: SOMERSET
NATIONAL MONUMENT NO: 22803
NATIONAL GRID REFERENCE(S): ST62884239

DESCRIPTION OF THE MONUMENT

The monument includes part of a Romano-British linear village lying alongside the Fosse Way and earlier, underlying archaeological features. An additional area of the village, situated immediately to the north, with an arm extending south into the west side of the scheduling, is being developed as a business park and is not included in the scheduling at the present time.

Following the discovery of the site in 1988, exploratory excavations identified a settlement lying on both sides of the Roman road, three associated cemeteries and underlying archaeological remains of Neolithic and Iron Age date. The settlement, dating to between the first and fourth centuries AD, included stone and timber-framed structures fronting the Fosse Way with yards to the rear, streets running off at right angles to the main road, field boundaries and areas of industrial activity. Industry appears to have been an important function of the settlement and discoveries have included metal smelting ovens, traces of iron ore residues and slag and raw materials such as lead ingots.

The three cemeteries appear to exhibit changes in religious belief and burial practices. Two of the cemeteries include burials orientated north-south and are thought to be pagan; the third, with burials orientated east-west, is interpreted as Christian and has yielded a silver amulet cross. The village may have been founded on an earlier settlement of Iron Age date. Excluded from the scheduling are all modern structures including the Showerings warehouse, the modern road surfaces of Fosse Lane, the service roads, the former railway embankment and the modern embankment east of the Showerings warehouse but the ground beneath all these features is included.

ASSESSMENT OF IMPORTANCE

Rural settlement was an important part of the Roman economy but the remains are generally poorly known and understood, with archaeological work to date having concentrated on military sites and the higher status villa buildings. Only some 50 examples of Romano-British linear villages have been recorded, mostly restricted to southern and central England. Exploratory excavations at Shepton Mallet have confirmed the good survival of the archaeological remains of a significant and long-lived settlement, including important evidence of industrial activity.

MONUMENT INCLUDED IN THE SCHEDULE ON 05th September 1994

Appendix B – basic principles of magnetic survey

Iron minerals are always present to some degree within the topsoil and enhancement associated with human activity is related to increases in the level of magnetic susceptibility and thermoremnant material.

Magnetic susceptibility is an induced magnetism within a material when it is in the presence of a magnetic field. This can be thought of as effectively permanent due to the presence of the Earth's magnetic field.

Thermoremnant magnetism occurs when ferrous material is heated beyond a specific temperature known as the Curie Point. Demagnetisation occurs at this temperature with re-magnetisation by the Earth's magnetic field upon cooling.

Enhancement of magnetic susceptibility can occur in areas subject to burning and complex fermentation processes on biological material; these are frequently associated with human settlement. Thermoremnant features include ovens, hearths, and kilns. In addition thermoremnant material such as tile and brick may also be associated with human activity and settlement.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil can create an area of enhancement compared with surrounding soils and subsoils into which the feature is cut. Mapping enhanced areas will produce linear and discrete anomalies allowing an assessment and characterisation of hidden subsurface features.

It should be noted that areas of negative enhancement can be produced from material having lower magnetic properties compared to the topsoil. This is common for many sedimentary bedrocks and subsoils which were often used in the construction of banks and walls etc. Mapping these 'negative' anomalies may also reveal archaeological features.

Magnetic survey or magnetometry can be carried out using a fluxgate gradiometer and may be referred to as gradiometry. The gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 1m apart. The instrument is carried about 30cm above the ground surface and the upper sensor measures the Earth's magnetic field as does the lower sensor but this is influenced to a greater degree by any localised buried field. The difference between the two sensors will relate to the strength the magnetic field created by the buried feature. If no enhanced feature is present the field measured by both sensors will be similar and the difference close to zero.

There are a number of factors that may affect the magnetic survey and these include soil type, local geology and previous human activity. Situations arise where magnetic disturbance associated with modern services, metal fencing, dumped waste material etc., obscures low magnitude fields associated with archaeological features.

Appendix C – data processing notes

Clipping

Minimum and maximum values are set and replace data outside of the range with those values. Extreme values are removed improving colour or greyscale contrast associated with data values that may be archaeologically significant. It has been found that clipping data to ranges between ±5nT and ±1nT often improves the appearance of features associated with archaeology. Different ranges are applied to data in order to determine the most suitable for anomaly abstraction and display.

Zero Median/Mean Traverse

The median (or mean) of each traverse is calculated ignoring data outside a threshold value, the median (or mean) is then subtracted from the traverse. The process is used to equalise slight differences between the set-up and stability of gradiometer sensors and can remove striping. The process can remove archaeological features that run along a traverse so data analysis is also carried out prior its application.

De-stagger

Compensates for small positional errors within data collection by shifting the position of the readings along each traverse by a specified amount. Data lost at the end of each traverse are extrapolated from adjacent value in the same row.

Deslope

Corrects for striping and distortion caused by metal objects/services etc.. The process calculates a curve based on a polynomial best fit mathematical function for each traverse. This curve is then subtracted from the actual data.

Edge Match

Calculates the mean of the 2 lines (rows or columns) of data either side of the edge to match. It then subtracts the difference between the means from all datapoints in the selected area.

FFT (Fast Fourier Transform) spectral filtering

A mathematical process used to determine the frequency components of a traverse. Repetitive features, such as plough marks, produce characteristic spectral zones that can be suppressed allowing greyscale images to appear clearer.

Appendix D – survey and data information

Area 1 raw data

COMPOSITE
Filename: J386-Area1-raw.xcp
Instrument Type: Bartington (Gradiometer)
Units: nT
Surveyed by: on 03/02/2012
Assembled by: on 03/02/2012
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702

Dimensions
Composite Size (readings): 1200 x 210
Survey Size (meters): 300 m x 210 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 30.00
Min: -30.00
Std Dev: 7.49
Mean: -1.67
Median: -0.59
Composite Area: 6.3 ha
Surveyed Area: 3.1171 ha

Processes: 2
1 Base Layer
2 Clip from -30.00 to 30.00 nT

Source Grids: 48
1 Col:0 Row:0 grids\28.xgd
2 Col:0 Row:1 grids\29.xgd
3 Col:1 Row:0 grids\30.xgd
4 Col:1 Row:1 grids\31.xgd
5 Col:1 Row:2 grids\32.xgd
6 Col:1 Row:3 grids\01.xgd
7 Col:2 Row:0 grids\33.xgd
8 Col:2 Row:1 grids\34.xgd
9 Col:2 Row:2 grids\35.xgd
10 Col:2 Row:3 grids\02.xgd
11 Col:2 Row:4 grids\03.xgd
12 Col:3 Row:0 grids\36.xgd
13 Col:3 Row:1 grids\37.xgd
14 Col:3 Row:2 grids\38.xgd
15 Col:3 Row:3 grids\04.xgd
16 Col:3 Row:4 grids\05.xgd
17 Col:3 Row:5 grids\06.xgd
18 Col:3 Row:6 grids\07.xgd
19 Col:4 Row:0 grids\39.xgd
20 Col:4 Row:1 grids\40.xgd
21 Col:4 Row:2 grids\41.xgd
22 Col:4 Row:3 grids\08.xgd
23 Col:4 Row:4 grids\09.xgd
24 Col:4 Row:5 grids\10.xgd
25 Col:4 Row:6 grids\11.xgd
26 Col:5 Row:0 grids\42.xgd
27 Col:5 Row:1 grids\43.xgd
28 Col:5 Row:2 grids\44.xgd
29 Col:5 Row:3 grids\12.xgd
30 Col:5 Row:4 grids\13.xgd
31 Col:5 Row:5 grids\14.xgd
32 Col:5 Row:6 grids\15.xgd
33 Col:6 Row:0 grids\45.xgd
34 Col:6 Row:1 grids\46.xgd
35 Col:6 Row:2 grids\47.xgd
36 Col:6 Row:3 grids\16.xgd
37 Col:6 Row:4 grids\17.xgd
38 Col:6 Row:5 grids\18.xgd
39 Col:6 Row:6 grids\19.xgd
40 Col:7 Row:2 grids\48.xgd
41 Col:7 Row:3 grids\20.xgd
42 Col:7 Row:4 grids\21.xgd
43 Col:7 Row:5 grids\22.xgd
44 Col:7 Row:6 grids\23.xgd
45 Col:8 Row:4 grids\24.xgd
46 Col:8 Row:5 grids\25.xgd
47 Col:8 Row:6 grids\26.xgd
48 Col:9 Row:6 grids\27.xgd

Area 1 processed data

COMPOSITE
Filename: J386-Area1-proc.xcp

Stats
Max: 3.00
Min: -3.00
Std Dev: 1.41
Mean: -0.26
Median: -0.08
Composite Area: 6.3 ha
Surveyed Area: 3.1171 ha

Processes: 24
1 Base Layer
2 Clip from -30.00 to 30.00 nT
3 DeStripe Median Traverse: Grids: 34.xgd 35.xgd 02.xgd 37.xgd 38.xgd 04.xgd 40.xgd 41.xgd 08.xgd 43.xgd 44.xgd 12.xgd
4 DeStripe Mean Traverse: Grids: 31.xgd 32.xgd Threshold: 1 SDs
5 DeStripe Mean Traverse: Grids: 33.xgd Threshold: 0.5 SDs
6 DeStripe Mean Traverse: Grids: 36.xgd Threshold: 1 SDs
7 DeStripe Mean Traverse: Grids: 39.xgd Threshold: 0.5 SDs
8 DeStripe Mean Traverse: Grids: 42.xgd Threshold: 0.5 SDs
9 DeStripe Median Traverse: Grids: 46.xgd
10 DeStripe Median Traverse: Grids: 47.xgd
11 DeStripe Mean Traverse: Grids: 16.xgd Threshold: 0.5 SDs
12 DeStripe Mean Traverse: Grids: 03.xgd Threshold: 0.5 SDs
13 DeStripe Mean Traverse: Grids: 05.xgd Threshold: 0.5 SDs
14 DeStripe Mean Traverse: Grids: 09.xgd Threshold: 0.5 SDs
15 DeStripe Median Traverse: Grids: 14.xgd 15.xgd 18.xgd 19.xgd 22.xgd 23.xgd 25.xgd 26.xgd
16 DeStripe Mean Traverse: Grids: 06.xgd 07.xgd 10.xgd 11.xgd Threshold: 0.5 SDs
17 DeStripe Mean Traverse: Grids: 13.xgd 17.xgd Threshold: 0.5 SDs
18 DeStripe Mean Traverse: Grids: 20.xgd Threshold: 1 SDs
19 DeStripe Mean Traverse: Grids: 21.xgd Threshold: 0.5 SDs
20 DeStripe Mean Traverse: Grids: 24.xgd Threshold: 0.5 SDs
21 DeStripe Mean Traverse: Grids: 27.xgd Threshold: 0.25 SDs
22 Clip from -3.00 to 3.00 nT
23 Edge Match (Area: Top 30, Left 120, Bottom 59, Right 239) to Right edge
24 Clip from -3.00 to 3.00 nT

Area 2 raw data

COMPOSITE
Filename: J386-mag-Area2-raw.xcp
Instrument Type: Bartington (Gradiometer)
Units: nT
Surveyed by: on 12/12/2011
Assembled by: on 12/12/2011
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 32702

Dimensions
Composite Size (readings): 1080 x 210
Survey Size (meters): 270 m x 210 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 30.00
Min: -30.00
Std Dev: 12.99
Mean: -2.50
Median: -0.95
Composite Area: 5.67 ha
Surveyed Area: 3.6681 ha

Processes: 2
1 Base Layer
2 Clip from -30.00 to 30.00 nT

Source Grids: 52
1 Col:0 Row:0 grids\32.xgd
2 Col:0 Row:1 grids\33.xgd
3 Col:0 Row:2 grids\34.xgd
4 Col:0 Row:3 grids\31.xgd
5 Col:1 Row:0 grids\35.xgd
6 Col:1 Row:1 grids\36.xgd
7 Col:1 Row:2 grids\37.xgd
8 Col:1 Row:3 grids\27.xgd
9 Col:1 Row:4 grids\28.xgd
10 Col:1 Row:5 grids\29.xgd
11 Col:1 Row:6 grids\30.xgd
12 Col:2 Row:0 grids\38.xgd
13 Col:2 Row:1 grids\39.xgd
14 Col:2 Row:2 grids\40.xgd
15 Col:2 Row:3 grids\23.xgd
16 Col:2 Row:4 grids\24.xgd
17 Col:2 Row:5 grids\25.xgd
18 Col:2 Row:6 grids\26.xgd
19 Col:3 Row:0 grids\41.xgd
20 Col:3 Row:1 grids\42.xgd
21 Col:3 Row:2 grids\43.xgd
22 Col:3 Row:3 grids\19.xgd
23 Col:3 Row:4 grids\20.xgd
24 Col:3 Row:5 grids\21.xgd
25 Col:3 Row:6 grids\22.xgd
26 Col:4 Row:0 grids\44.xgd
27 Col:4 Row:1 grids\45.xgd
28 Col:4 Row:2 grids\46.xgd
29 Col:4 Row:3 grids\15.xgd
30 Col:4 Row:4 grids\16.xgd
31 Col:4 Row:5 grids\17.xgd

32 Col:4 Row:6 grids\18.xgd
33 Col:5 Row:0 grids\47.xgd
34 Col:5 Row:1 grids\48.xgd
35 Col:5 Row:2 grids\49.xgd
36 Col:5 Row:3 grids\11.xgd
37 Col:5 Row:4 grids\12.xgd
38 Col:5 Row:5 grids\13.xgd
39 Col:5 Row:6 grids\14.xgd
40 Col:6 Row:0 grids\50.xgd
41 Col:6 Row:1 grids\51.xgd
42 Col:6 Row:2 grids\52.xgd
43 Col:6 Row:3 07.xgd
44 Col:6 Row:4 08.xgd
45 Col:6 Row:5 09.xgd
46 Col:6 Row:6 10.xgd
47 Col:7 Row:3 03.xgd
48 Col:7 Row:4 04.xgd
49 Col:7 Row:5 05.xgd

50 Col:7 Row:6 06.xgd
51 Col:8 Row:5 01.xgd
52 Col:8 Row:6 02.xgd

Area 2 processed data

COMPOSITE

Filename: J386-mag-Area2-proc.xcp

Stats
Max: 3.00
Min: -3.00
Std Dev: 1.90

Mean: -0.30
Median: -0.17
Composite Area: 5.67 ha
Surveyed Area: 3.6681 ha

Processes: 6
1 Base Layer

2 Clip from -30.00 to 30.00 nT
3 DeStripe Median Traverse: Grids: 33.xgd 34.xgd 31.xgd 36.xgd 37.xgd 27.xgd 28.xgd 39.xgd 40.xgd 23.xgd 24.xgd 42.xgd 43.xgd 19.xgd 20.xgd 45.xgd 46.xgd 15.xgd 16.xgd 48.xgd 49.xgd 11.xgd 12.xgd 51.xgd 52.xgd 07.xgd 08.xgd 03.xgd 04.xgd
4 DeStripe Mean Traverse: Grids: 32.xgd 35.xgd 38.xgd 41.xgd 44.xgd 47.xgd 50.xgd Threshold: 0.5 SDs
5 DeStripe Mean Traverse: Grids: 29.xgd 30.xgd 25.xgd 26.xgd 21.xgd 22.xgd 17.xgd 18.xgd 13.xgd 14.xgd 09.xgd 10.xgd 05.xgd 06.xgd 01.xgd 02.xgd Threshold: 0.5 SDs
6 Clip from -3.00 to 3.00 nT

Appendix E – digital archive

Archaeological Surveys Ltd hold the primary digital archive at Castle Combe, Wiltshire (see inside cover for address). Data are backed-up onto an on-site data storage drive and at the earliest opportunity data are copied to CD ROM for storage on-site and off-site.

Surveys are reported on in hardcopy (recycled paper) using A4 for text and A3 for plots (all plots are scaled for A3). Printed copies will be sent to Somerset County Council HER, English Heritage South West office, Bristol and the English Heritage Geophysics team at Port Cumberland, Portsmouth.

This report has been prepared using the following software on a Windows XP platform:

- ArcheoSurveyor version 2.5.14.0 (geophysical data analysis),
- ProgeCAD Professional 2009 (report graphics),
- AutoCAD LT 2007 (report figures),
- OpenOffice.org 3.0.1 Writer (document text),
- PDF Creator version 0.9 (PDF archive).

Digital data produced by the survey and report include the following files:

- ArcheoSurveyor grid and composite files for all geophysical data,
- CSV files for raw and processed composites,
- geophysical composite file graphics as Bitmap images,
- AutoCAD DWG files in 2000 and 2007 versions,
- report text as OpenOffice.org ODT file,
- report text as Word 2000 doc file,
- report text as rich text format (RTF),
- report text as PDF,
- PDFs of all figures.