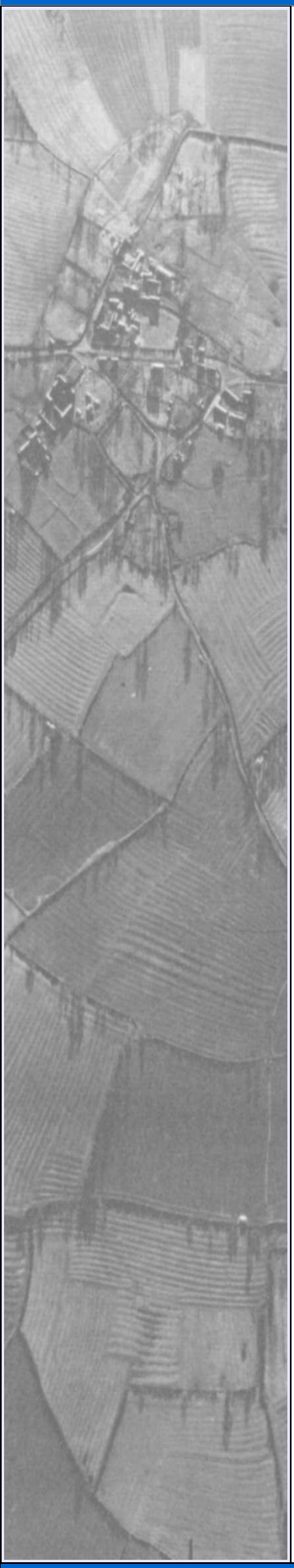

Bromham House Farm
Bromham
Wiltshire

MAGNETOMETER SURVEY REPORT

for

A J B Farming Ltd

Kerry Donaldson & David Sabin

April 2019

Ref. no. J782

ARCHAEOLOGICAL SURVEYS LTD

Bromham House Farm
Bromham
Wiltshire

Magnetometer Survey Report

for

A J B Farming Ltd

Fieldwork by David Sabin BSc (Hons) MCIfA
Report by Kerry Donaldson BSc (Hons)
Report checked by David Sabin
Primary archive location - Archaeological Surveys Ltd, Yatesbury, Wiltshire

Survey dates – 20th to 22nd, 25th & 26th March 2019
Ordnance Survey Grid Reference – **ST 97330 66160**

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SUMMARY

A geophysical survey, entailing detailed magnetometry, was carried out by Archaeological Surveys Ltd within two fields at Bromham House Farm in Wiltshire. The results have revealed a number of trackways and rectilinear enclosures that are a continuation of similar features located by Historic England to the north west of the site and are likely to be Roman in date. There are also a number of curvilinear or irregularly shaped enclosures that may pre-date the rectilinear enclosures. In the northern part of the site there appears to be further trackways, linear ditches and an enclosure, but generally there are fewer anomalies. However there is evidence for industrial activity within the northern part of the site, with high magnitude magnetic anomalies suggesting iron working.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Michael Goff of Agricultural Planning and Project Management, on behalf of A J B Farming Ltd, to undertake a magnetometer survey of an area of land at Bromham House Farm in Wiltshire. A pre-application consultation with Wiltshire Council has been carried out by the client and their agent for a proposed development of greenhouses and the survey forms part of an archaeological assessment. The geophysical survey was carried out in accordance with a Written Scheme of Investigation (WSI) produced by Archaeological Surveys (2019).

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 development of the site. The methodology is considered an efficient and effective approach to archaeological prospection.

1.2.2 Geophysical survey can provide useful information on the archaeological potential of a site; however, the outcome of any survey relies on a number of factors and as a consequence results can vary. The success in meeting the aims and objectives of a survey is, therefore, often impossible to predetermine.

1.3 Standards, guidance and recommendations for the use of this report

1.3.1 The survey and report generally follow the recommendations set out by: European Archaeological Council (2015) *Guidelines for the Use of Geophysics in Archaeology;* Institute for Archaeologists (2002) *The use of Geophysical Techniques in Archaeological Evaluations.* The work has been carried out to the Chartered Institute for Archaeologists (2014) *Standard and*

Guidance for Archaeological Geophysical Survey. Note: currently Historic England (2018) no longer support the guidelines set out in English Heritage (2008) *Geophysical survey in archaeological field evaluation* and there are currently no plans to update the document. As a consequence other sources of written guidance referring to this document may be out of date and/or contain unsupported information *(e.g. Chartered Institute for Archaeologists, 2014).*

1.3.2 Archaeological Surveys Ltd provide a detailed geophysical survey report and it is recommended that where possible the contents should be considered in full. The Summary provides a brief overview of the results with more detail available in the Discussion and/or Conclusion. The *List of anomalies* within the Results provides a detailed assessment of the anomalies within separate categories which can be useful in inferring a level of confidence to the interpretation. Quality and factors influencing the interpretation of anomalies is also set out within the results.

1.3.3 It is recommended that the full report should always be considered when using data and interpretation plots; where this is not possible, in the field for example, the abstraction and interpretation plots should retain their colour coding and be used with a corresponding legend.

1.3.4 Where targeting of anomalies by excavation is to be carried out, care should be taken to place trenches over solid lines or features visible on the abstraction and interpretation plots. Archaeological Surveys abstraction and interpretation avoids the use of dashed or dotted lines; broken or fragmented anomalies may well correspond closely with subsurface truncation.

1.4 Site location, description and survey conditions

1.4.1 The site is located at Bromham House Farm, Bromham in Wiltshire. It is centred on Ordnance Survey National Grid Reference (OS NGR) ST 97330 66160, see Figs 01 and 02.

1.4.2 The geophysical survey covers approximately 17.8ha within two fields. The southern field (Area 1) covers 12.4ha and contained maize stubble and the northern field (Area 2) covers 5.4ha and contained grass at the time of survey.

1.4.3 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data. However, some localised areas of deeply rutted and uneven ground were encountered within Area1 with slurry spread within Area 2. Weather conditions during the survey were fine.

Plate 1: Area 1 looking west

Plate 2: Area 2 looking north

1.5 Site history and archaeological potential

1.5.1 Within the western part of the site three roughly parallel ditches and further fragmented ditches of uncertain date are visible as cropmarks on aerial photographs (MWI73493). The site lies less than 100m south east of the location of a Roman villa (MWI4618), excavated in 1810 and in 1977, which

included two tessellated pavements, one having a design of sea creatures with a background of cream limestone tesserae.

1.5.2 A recent geophysical survey carried out by Historic England within land immediately to the north west and north east revealed a complex series of enclosure ditches, boundaries and field systems of possible Iron Age or Roman date together with three probable Bronze Age barrows (Linford et al, 2018).

1.5.3 Within the site (Area 2), a Romano-British coin hoard (MWI4638) was ploughed up in 1981; it included 20 silver *miliarenses* and 396 silver *siliquae* including one depicting the emperor Julian (the Apostate) (355-360 AD). The northern edge of the site lies within 600m of the Roman town of *Verlucio* (MWI4624).

1.5.4 The location of cropmarks and a coin hoard within the survey area, as well the array of archaeological features within the immediate and wider vicinity indicate that there is a high potential for the site to contain archaeological features.

1.5.5 The surface conditions within Area 1 were suitable for the observation of cultural material during the course of the survey. A small number of abraded sherds of Romano-British pottery were noted and a small number of worked flints.

1.6 Geology and soils

1.6.1 The underlying solid geology across the site is Lower Greensand with a band of head deposits extending along the northern edge of the northern field (BGS, 2017).

1.6.2 The overlying soil across the survey area is from the Fyfield 4 association and is a typical argillic brown earth. It consists of a deep, well drained, often stoneless, coarse, loamy and sandy soil (Soil Survey of England and Wales, 1983).

1.6.3 Magnetometry carried out over similar geology and soil has previously produced very good results. The site is, therefore, considered suitable for magnetic survey.

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 A.

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 a SENSYS MAGNETO®MXPDA 5 channel cart-based system. The instrument has 5 fluxgate gradiometers (FGM650) spaced 0.5m apart with readings recorded at 20 Hz. The cart was towed using an ATV for the majority of Area 1 and hand-pushed in Area 2 and within some small parts of Area 1. Each sensor is not zeroed in the field as the vertical axis alignment is precisely fixed leaving sensor offsets that are removed during data processing. The fixing of the vertical alignment ensures the sensors are not unduly influenced by localised magnetic fields and that the vertical component of a magnetic anomaly is measured. The gradiometers have a range of recording data between ±0.1nT and ±10,000nT. They are linked to a Leica GS10 RTK GPS with data recorded by SENSYS MAGNETO®MXPDA software on a rugged PDA computer system.

2.2.2 Due to the fixed offsets within the fluxgate sensors, as a result of the manufacturing and tensioning process, the survey data do not provide a visually useful dataset until a zero median traverse algorithm is applied. It is recognised that this has the potential to affect some anomalies detrimentally by removing linear features orientated parallel to survey transects. However, this has not been noted as a particular problem with the system due to the high resolution data collection, generally long length of traverses and variability within the magnetic characteristics of a linear anomaly.

2.2.3 Data are collected along a series of parallel survey transects to achieve 100% coverage of the surveyable land. The length of each transect is variable and relates to the size of the survey area and other factors including ground conditions. A visual display allows accurate placing of transects and helps

maintain the correct separation between adjacent traverses. Data are not collected within fixed grids and data points are considered to be random even though the data are collected in a systematic manner covering all accessible areas (Aspinall, Gaffney and Schmidt, 2009).

2.2.4 Fluxgate sensors are highly sensitive to temperature change and this manifests as drift during the course of a survey. This can be particularly noticeable during the morning as temperatures rise and the equipment warms or cools. Sensor drift within the course of a traverse will appear as a line trending from negative to positive after processing with a zero median traverse algorithm. To remove the potential for temperature drift, data were collected after a 20 minute stabilisation period and traverses were limited to a time of generally <120s.

2.3 Data processing and presentation

2.3.1 Magnetic data collected by the MAGNETO®MXPDA cart-based system are initially prepared using SENSYS MAGNETO®DLMGPS software. The software effectively allocates a geographic position for each data point and can compensate for fixed offsets present within the FGM650 sensors. The offsets are positive or negative values present on all fluxgate gradiometer sensors. Some systems use manual or electronic balancing to effectively zero the sensors; however, this is a short term measure that is prone to drift through temperature changes and vibration and can easily be incorrectly set due to localised magnetic fields. The FGM650 sensors are very accurately aligned to the vertical magnetic gradient and are highly stable showing negligible drift on long traverses. The offset values are removed using TerraSurveyor software.

2.3.2 Survey tracks are analysed and georeferenced raw data (UTM Z30N) are then exported in ASCII format for further analysis and display within TerraSurveyor. The removal of offset values (compensation) of the sensors is also carried out in TerraSurveyor using a zero median traverse function. Data are then considered to be minimally processed. Note: without the zero median traverse function it is not possible to create a meaningful data plot as all sensors have a different offset value. Although a zero median traverse algorithm can remove anomalies aligned with the survey tracks, in practice this rarely occurs due to the use of long traverses, high resolution measurement and variability within the magnetic susceptibility of long linear features.

2.3.3 The minimally processed data are collected between limits of ±10000nT and clipped for display at ±5nT. Data are interpolated to a resolution of effectively 0.5m between tracks and 0.15m along each survey track.

2.3.4 Appendix C contains metadata concerning the survey and data attributes and is derived directly from TerraSurveyor. Reference should be made to Appendix B for further information on processing.

2.3.5 A TIF file is produced by TerraSurveyor software along with an associated

world file (.TFW) that allows automatic georeferencing (OSGB36 datum) when using GIS or CAD software. The main form of data display used in the report is the minimally processed greyscale plot. With regard to the Sensys MXPDA, minimally processed data are considered by the manufacturer to be data that are compensated by SENSYS MAGNETO DLMGPS software, see 2.3.1 and 2.3.2. Note: traceplots are not considered to be appropriate as they do not provide an accurate or useful assessment of the magnetic anomalies due to the very high density of data collection.

2.3.6 The raster images are combined with base mapping using ProgeCAD Professional 2016, creating DWG (2010) file formats. All images are externally referenced to the CAD drawing in order to maintain good graphical quality. The CAD plots are effectively georeferenced facilitating relocation of features using GPS, resection method, etc.

2.3.7 An abstraction and interpretation is drawn and plotted for all geophysical anomalies located by the survey. Anomalies are abstracted using colour coded points, lines and polygons. All plots are scaled to landscape A3 for paper printing. Appendix E sets out CAD layer names with colour and graphic content for each interpretation category, see 3.3.

2.3.8 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.

2.3.9 A digital archive is produced with this report, see Appendix D 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 a total of two survey areas covering approximately 17.8ha.

3.1.2 Magnetic anomalies located can be generally classified as positive responses of archaeological potential, positive anomalies of an uncertain origin, linear anomalies of an agricultural origin, 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. Anomalies located within each survey area have been numbered and are described in 3.4 below with subsequent discussion in Section 4.

3.2 Statement of data quality and factors influencing the interpretation of anomalies

3.2.1 Data are considered representative of the magnetic anomalies present within the site. There are no significant defects within the dataset.

3.2.2 The soils across the site appear to support strongly contrasting magnetic susceptibility between topsoil and subsoil and numerous anomalies of archaeological potential have been located. However, the contrast has also produced numerous linear anomalies associated with modern cultivation within Area 1 and widespread discrete anomalies likely to be of natural origin.

3.2.3 The mass specific magnetic susceptibility of a single soil sample was obtained from Area 1 using a Bartington MS2 with MS2B desk-top coil. The sample was taken from an area away from anomalies of archaeological potential. It produced a value of (X_{lf}) = **61.82** $10^{-8}m^3kg^{-1}$ which probably demonstrates a relatively high value of natural enhancement due to the ferruginous nature of the sandy soil. The value obtained would infer very good conditions for magnetometry.

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, see Table 1.

Interpretation category	Description and origin of anomalies
Anomalies with archaeological potential	Anomalies have the characteristics (mainly morphological) of a range of archaeological features such as pits, ring ditches, enclosures, etc. The category is used where there is a high level of confidence which may be due to additional supporting information where morphology is unclear or uncharacteristic.
Anomalies with an uncertain origin	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. Morphology may be unclear or uncharacteristic and there may be a lack of additional supporting information. 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 with an agricultural origin	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. This category does not include agricultural features of early date or considered to be of archaeological potential (e.g. animal stockades, enclosures, farmsteads, etc).
Anomalies with a natural origin	Naturally formed magnetic anomalies are caused by localised variability in the magnetic susceptibility of soils, subsoils and other drift or solid geologies. Anomalies may be amorphous, linear or curvilinear and may appear 'fluvial' or discrete; the latter are almost impossible to distinguish from pit-like anomalies with an anthropogenic origin. Fluvial, glacial and periglacial processes may be responsible for their formation within drift material and subsoil. Igneous and metamorphic activity can lead to anomalies within more solid geology.

Anomalies associated with magnetic debris	Magnetic debris often appears as areas containing many small dipolar anomalies that may range from weak to very strong in magnitude. They often occur where there has been dumping or ground make-up and are 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, hearths and nail spreads from former wooden structures or rooves 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	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 these 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 adjacent to strong magnetic sources. Buried services may produce characteristic multiple dipolar anomalies dependant upon their construction.

Table 1: List and description of interpretation categories

3.4 List of anomalies - Area 1

Area centred on OS NGR 397266 166098, see Figs 05 – 08.

Anomalies of archaeological potential

(1) - A series of at least three linear ditches relate to a former trackway that extends across the northern part of the survey area. It diverges towards enclosure (3) in the south west, but it it is not clear if it is associated. The southern and central linear can be seen to extend north westerly as a trackway within the area surveyed by Historic England.

(2) - Parallel linear ditches relate to another trackway extending across the central part of the survey area. It continues north westerly into the area previously surveyed by Historic England.

(3) - A five-sided enclosure up to 65m wide is located in the centre of the survey area. The strength of the anomaly is strongest to the south (25nT) and north east (15nT) where it is attached to other smaller external enclosures, with a response of less than 2nT on the western side. It is possible that it has a south west facing entrance; however, it is not clear if this is deliberate or if this has been caused by erosion through ploughing.

(4 & 5) - Situated on the eastern side of anomaly (3) are a number of irregularly shaped (4) and also rectilinear enclosures (5). There appear to be several phases of development and use with the irregularly shaped enclosures (4) attached to enclosure (3) and with the trackway (2) respecting the orientation of these enclosures. They then appear to be overlain by rectilinear enclosures (5), which are partly directly associated with the northern trackway ditch.

(6) - A number of discrete pits are evident within the confines of the irregularly shaped enclosures (4); however, a small number of strong, discrete anomalies can

be seen within the rectilinear enclosures (5). They have a response of 12-16nT and could be associated with burning, rather than pits. Such anomalies may relate to features such as crop driers.

(7) - Situated in the south western corner of the survey area are a number of rectilinear enclosures, generally parallel with and orthogonal to the trackway ditches (2). There appears to be several phases of use and development and the strength of the responses within the fill of the enclosure ditches varies from less than 2nT to over 65nT. There are a number of discrete responses indicating pits and also several stronger positive responses that may relate to areas of burning.

(8) - Located 60m south of enclosure (3) is another irregularly shaped enclosure. It appears to contain a number of pits, but these appear to be part of the zone of natural features (17) seen in the southern part of the survey area.

(9) - Further rectilinear enclosures are located in the south eastern part of the survey area. These are on the same orientation to those seen further west (7) and are parallel with and orthogonal to the trackway (2) to the north. They appear likely to extend further east beyond the limits of the survey area.

(10) - Rectilinear anomalies towards the north eastern part of the survey area, are parallel with, but do not utilise, the northern ditch of trackway (1).

(11) - Situated in the western part of the survey area are a number of linear, rectilinear and irregular anomalies. There may also be evidence of small curvilinear anomalies, which could suggest ring ditches associated with Iron Age settlement; however, this is not clear and can only be tentatively suggested.

(12) - A positive linear anomaly along the northern edge of the survey area could relate to a ditch associated with a track or field boundary located further to the north west during the Historic England survey. A second parallel linear anomaly is located 32m to the south, with a third much stronger, though shorter, linear anomaly extending from the north east corner between the two.

(13) - In the north western corner of the survey area are a group of positive responses. Some are linear, some amorphous and some are discrete. The discrete responses are 15-22nT which could indicate an association with burning, possibly industrial activity. The amorphous responses appear to overlie a north east to south west oriented linear anomaly that could be a continuation of anomaly (24) in Area 2.

Anomalies with an uncertain origin

(14) - Positive linear anomalies appear to extend south westwards from anomalies (1), through anomaly (3). It is possible that they are an extension of anomalies (1); however, they may just relate to agricultural activity.

(15) - A positive linear anomaly could relate to a cut feature although an agricultural origin is likely.

(16) - A zone of numerous pit-like anomalies can be seen in the northern part of the survey area extending into the southern part of Area 2 (28). It is not clear if they are of natural origin, as anomalies (17) or of archaeological origin.

Anomalies with a natural origin

(17) - A zone containing a large number of discrete and elongated pit-like anomalies is evident in the southern part of the survey area. Although some may have archaeological potential and have been highlighted as of uncertain origin, it appears likely that the majority relate to natural features.

Anomalies with an agricultural origin

(18) - The survey area contains a series of parallel linear anomalies relating to recent agricultural activity.

(19) - Negative linear anomalies are associated with agricultural vehicle ruts.

Anomalies associated with magnetic debris

(20) - A zone of magnetic debris in the south eastern corner of the survey area is likely to relate to magnetically thermoremnant material possibly associated with construction material for the nearby farm access track.

3.5 List of anomalies - Area 2

Area centred on OS NGR 397456 166298, see Figs 09 – 10.

Anomalies of archaeological potential

(21) - Located in the western part of the survey area are a group of positive linear and discrete anomalies. The discrete anomalies are very magnetically enhanced, generally 50-100nT, with one peaking at over 200nT. This indicates an association with very intense burning, possibly relating to iron working. Magnetic debris surrounds the area, which could also be associated with iron working.

(22) - In the far east of the survey area is another group of positive linear and discrete responses surrounded by magnetic debris. The discrete responses are 30-50nT, with one peaking at over 60nT, not as strong as some anomalies (21) but still indicating an association with intense burning and likely industrial activity.

(23) - A possible oval enclosure with several fragmented positive linear anomalies located in the vicinity of anomalies (22) that could be associated.

(24) - A positive linear anomaly appears to extend towards, but not join anomaly (25). It also appears to extend towards the south western corner of the site and joins another linear to form a possible enclosure. It appears to have been truncated

by anomaly (27).

(25) - In the northern part of the survey area are a number of weakly positive linear anomalies. They correspond with a what appears to be a natural hollow in the field; however, they could also relate to a former trackway. In the north west they appear to relate to a triple ditch, in the east, only one ditch can be seen. In the centre there are a cluster of pits, with some evidence of strongly enhanced discrete features (30nT) which could relate to burning.

(26) - Short, positive linear anomalies extend southwards from the northern edge of the survey area. They appear to relate to the flanking ditches of a trackway seen immediately to the north in the Historic England data.

(27) - Two positive linear anomalies that flank a negative response may relate to a former trackway; however, only the western linear is well defined, the eastern one is short and truncated.

Anomalies with an uncertain origin

(28) - A zone of pit-like responses can be seen in the central southern part of Area 2, extending into Area 1 as anomalies (16). It is not clear if they are natural or of archaeological origin.

(29) - A weakly magnetic band extends through the centre of the survey area, with another towards the western edge. It is not possible to determine if this is natural, or if it relates to anthropogenic activity.

Anomalies with a modern origin

(30) - Two pipes or services within the eastern part of the survey area.

4 DISCUSSION

4.1.1 The site contains a number of former trackways and enclosures that appear to be a direct continuation of those seen within a previous survey by Historic England in 2018 immediately to the north west and north east.

4.1.2 Within Area 1 there are several sets of trackways crosssing north west to south east (1 & 2). These appear to have rectilinear enclosures extending from them or parallel with them (5, 7 & 10), but there are also a number of curvilinear or irregularly shaped enclosures. A five-sided enclosure (3) has ditches which appear to truncate the trackway ditches (2); however, this may just indicate that the enclosure has deeper, more substantial ditches than the trackway flanking ditches. The trackway appears to deviate as it approaches the enclosure (3) and this may suggest that it post-dates it. The trackway ditches indicate several phases, with some complexity within trackway (1)

which appears to extend towards enclosure (3) but there is no obvious entrance on its northern side. Other curvilinear and irregularly shaped enclosures are attached to enclosure (3) on the north western (4) and southern (14) sides with another located 60m to the south east (8). The majority of the remaining enclosures within Area 1 are rectilinear and parallel with the trackways. Along the northern edge there appears to be another parallel linear ditch (12) which could relate to a further trackway running along the existing field boundary.

4.1.3 The northern survey area (Area 2) contains further linear ditches, but with some trackways (25) that are either parallel with trackways (1 & 2) or extending towards them (27). Within Area 2 there is evidence for industrial activity, possibly iron working (21 & 22), with a similar anomalies in the north western corner of Area 1 (13). An oval enclosure (23) appears associated with nearby cut features and industrial area (22).

5 CONCLUSION

5.1.1 The detailed magnetometer survey has located widespread evidence for archaeological features dating to the Roman and possibly prehistoric periods with the two survey areas. This includes a number of trackways and enclosures with a concentration in the central and western part of the site. In the northern part of the site there is evidence for further, but less concentrated, linear ditches, possible trackways, enclosures and also industrial activity.

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Appendix A – 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 SENSYS gradiometer is a passive instrument consisting of two fluxgate sensors mounted vertically 65cm apart. The instrument is carried about 10-20cm 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 magnetic field. The difference between the two sensors will relate to the strength of the magnetic field created by the buried feature.

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 B – 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 ±3nT 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 (destripe) 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 differences between the baseline value of gradiometer sensors.

High Pass Filtering

A mathematical process used to remove low frequency anomalies relating to survey tracks, modern agricultural features and other large magnetic bodies within or adjacent to survey areas.

Low Pass Filtering

A mathematical process used to remove high frequency anomalies relating to uneven ground, vibration, etc.

Appendix C – survey and data information

Area 1 minimally processed data

Description: Imported as Composite from: J782-mag-Area1-proc.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y):OSGB36
Northwest corner: 397043.72, 166338.30 m
Southeast corner: 397491.92, 165858.00 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 2443400
Dimensions
Composite Size (readings): 2988 x 3202
Survey Size (meters): 448 m x 480 m
Grid Size: 448 m x 480 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 5.53
Min: -5.50
Std Dev: 1.82
Mean: 0.06
Median: 0.02
Composite Area: 21.527 ha
Surveyed Area: 12.262 ha
PROGRAM
Name: TerraSurveyor
Version: 3.0.23.0
GPS based Proce5
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -10.00 to 10.00 nT
5 Clip from -5.00 to 5.00 nT

Area 2 minimally processed data

Filename: J782-mag-Area2-proc.xcp
Description: Imported as Composite from: J782-mag-Area2.asc
Northwest corner: 397286.20, 166465.63 m
Southeast corner: 397623.55, 166143.73 m
Source GPS Points: 1749800
Dimensions
Composite Size (readings): 2249 x 2146
Survey Size (meters): 337 m x 322 m
Grid Size: 337 m x 322 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 5.53
Min: -5.50
Std Dev: 1.55
Mean: 0.02
Median: 0.01
Composite Area: 10.859 ha
Surveyed Area: 5.2648 ha
Processes: 1
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -5.00 to 5.00 nT

Appendix D – digital archive

Archaeological Surveys Ltd hold the primary digital archive at their offices in Wiltshire. 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.

A PDF copy will be supplied to the Wiltshire Historic Environment Record with printed copies on request. The greyscale images and CAD abstraction layers as a dwg can also be made available to the HER on request. The report will also be uploaded to the Online AccesS to the Index of archaeological investigationS (OASIS).

Archive contents:

File type	Naming scheme	Description
Data	J782-mag-**[area number/name]**.asc J782-mag-**[area number/name]**.xcp J782-mag-**[area number/name]**-proc.xcp	Raw data as ASCII CSV TerraSurveyor raw data TerraSurveyor minimally processed data
Graphics	J782-mag-**[area number/name]**-proc.tif	Image in TIF format
Drawing	J782-**[version number]**.dwg	CAD file in 2010 dwg format
Report	J782 report.odt	Report text in Open Office odt format

Table 2: Archive metadata

Appendix E – CAD layers for abstraction and interpretation plots

The table below sets out Archaeological Surveys Ltd CAD layer names with associated colours and graphical content. Where CAD files are available layers may be extracted for further CAD/GIS use. Note: hatched polygon boundaries are contained within layers with the RGB colour code 254, 255, 255 (near white) in order to prevent their visibility.

Report sub-heading and associated CAD layer names	Colour with RGB index		Layer content
Anomalies with archaeological potential			
AS-ABST MAG POS DISCRETE ARCHAEOLOGY		Red 255,0,0	Solid donut, point or polygon (solid)
AS-ABST MAG POS ARCHAEOLOGY		Red 255,0,0	Polygon (cross hatched ANSI37)
AS-ABST MAG POS LINEAR ARCHAEOLOGY		Red 255,0,0	Line, polyline or polygon (solid)
AS-ABST MAG STRONG DISCRETE ARCHAEOLOGY		Magenta 255,0,255	Polyline or polygon (solid)
AS-ABST MAG POS ENCLOSURE DITCH		127,0,255	Line, polyline or polygon (solid)
Anomalies with an uncertain origin			
AS-ABST MAG POS LINEAR UNCERTAIN		255,127,0	Line, polyline or polygon (solid)
AS-ABST MAG POS DISCRETE UNCERTAIN		255,127,0	Solid donut, point or polygon (solid)
AS-ABST MAG POS UNCERTAIN		255,127,0	Polygon (cross hatched ANSI37)
Anomalies with a natural origin			
AS-ABST MAG NATURAL		Yellow 255,255,0	Solid donut,
Anomalies with an agricultural origin			
AS-ABST MAG AGRICULTURAL		Green 0,255,0	Line or polyline
Anomalies associated with magnetic debris			
AS-ABST MAG DEBRIS		132, 132, 132	Polygon (cross hatched ANSI37)
AS-ABST MAG STRONG DIPOLAR		132, 132, 132	Solid donut, point or polygon (solid)
Anomalies with a modern origin			
AS-ABST MAG DISTURBANCE		132, 132, 132	Polygon (hatched ANSI31)
AS-ABST MAG SERVICE		132, 132, 132	Line or polyline

Table 3: CAD layering

Appendix F – copyright and intellectual property

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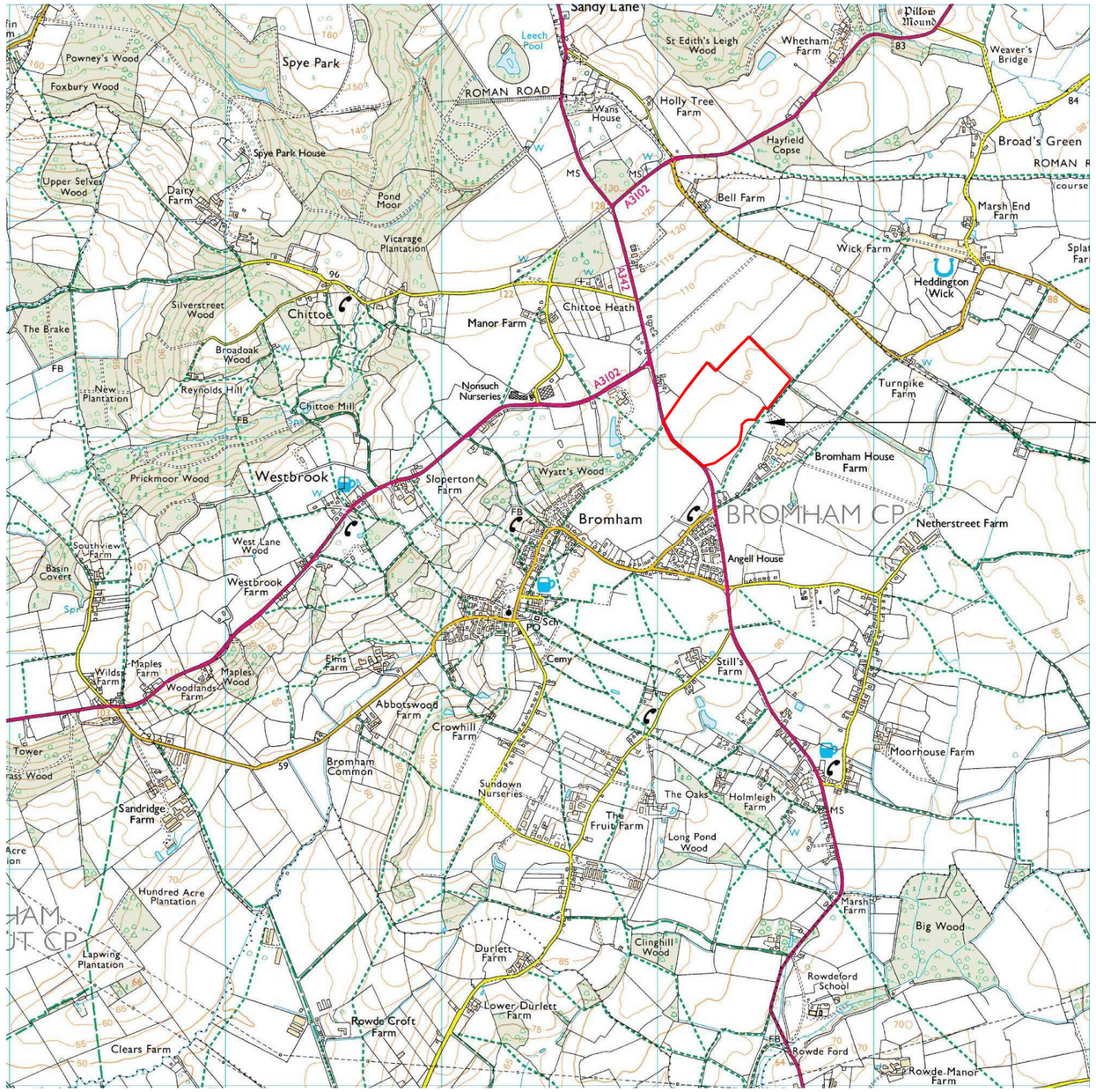
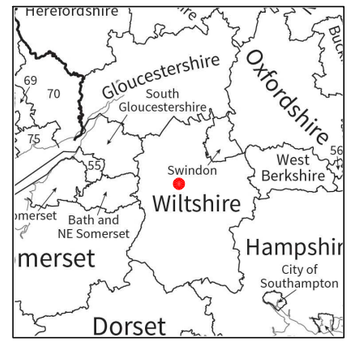
Geophysical Survey
Bromham House Farm
Bromham
Wiltshire

Map of survey area





● Survey location

Site centred on OS NGR
ST 97330 66160

SCALE 1:25 000

0m 500m 1000m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 01

Archaeological Surveys Ltd

Geophysical Survey
Bromham House Farm
Bromham
Wiltshire

Referencing information

Referencing grid to OSGB36 datum at 100m intervals

Data collected at 20Hz and georeferenced to ETRS89 zone 30 with conversion to OSGB36 using OSTN02

- 397100 166000
- Survey tracks
- Survey track start
- Survey track stop

SCALE 1:3000

0m 20 40 60 80 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 02

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Geophysical Survey
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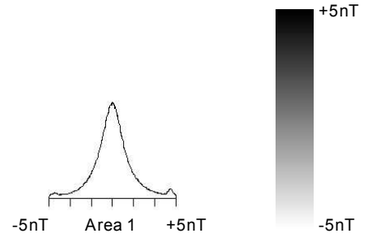
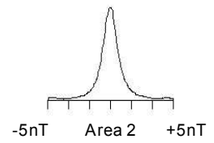
Bromham
Wiltshire

Greyscale plot of minimally processed magnetometer data





SCALE 1:2500

0m 50 100m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 03

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Bromham
Wiltshire

Abstraction and interpretation of magnetic anomalies

Area 1

Area 2

N

- Positive linear anomaly - cut feature of archaeological potential
- Positive rectilinear anomaly - enclosure ditch
- Curvilinear/irregular positive anomaly - enclosure ditch
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Discrete positive response - cut feature of archaeological potential
- Strong discrete positive response - area of burning / industrial activity
- Discrete positive response - possible pit-like feature
- Discrete positive response - of natural origin
- Positive anomaly - magnetically enhanced material of archaeological potential
- Negative anomaly - area with low magnetic susceptibility of archaeological potential
- Positive anomaly - magnetically enhanced material of uncertain origin
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:2500

0m 50 100m

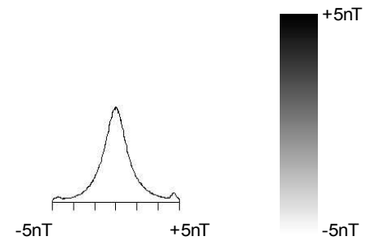
SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 04

Archaeological Surveys Ltd

Geophysical Survey
Bromham House Farm
Bromham
Wiltshire

Greyscale plot of minimally processed magnetometer data - Area 1 south



SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 05

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Bromham
Wiltshire

Abstraction and interpretation of magnetic anomalies - Area 1 south

N

1 2 3 4 5 6 7 8 9 10 11 14 15 17 19 20

- Positive linear anomaly - cut feature of archaeological potential
- Positive curvilinear/rectilinear anomaly - enclosure ditch
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Discrete positive response - cut feature of archaeological potential
- Strong discrete positive response - area of burning / industrial activity
- Discrete positive response - possible pit-like feature
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 06

Area 1

N

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Bromham House Farm
Bromham
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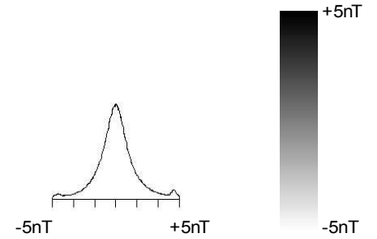
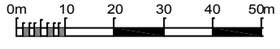
Greyscale plot of minimally processed magnetometer data - Area 1 north



SCALE 1:1250



SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 07

Area 1

N

Archaeological Surveys Ltd

Geophysical Survey
Bromham House Farm
Bromham
Wiltshire

Abstraction and interpretation of magnetic anomalies - Area 1 north

- Positive linear anomaly - cut feature of archaeological potential
- Positive rectilinear anomaly - enclosure ditch
- Curvilinear/irregular positive anomaly - enclosure ditch
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - of agricultural origin
- Discrete positive response - cut feature of archaeological potential
- Strong discrete positive response - area of burning / industrial activity
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material of archaeological potential
- Positive anomaly - magnetically enhanced material of uncertain origin
- Strong dipolar anomaly - ferrous object

SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 08

Area 2

N

Archaeological Surveys Ltd

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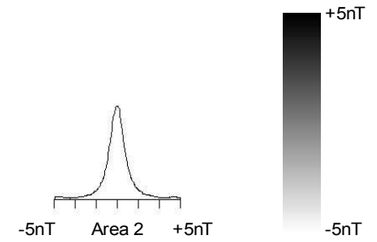
Greyscale plot of minimally processed magnetometer data - Area 2



SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 09

Area 2

N

25

21

26

24

13

27

29

23

30

28

18

12

22

16

1

10

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Geophysical Survey
Bromham House Farm
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Abstraction and interpretation of magnetic anomalies - Area 2

- Positive linear anomaly - cut feature of archaeological potential
- Curvilinear/irregular positive anomaly - enclosure ditch
- Positive linear anomaly - possible ditch-like feature
- Discrete positive response - cut feature of archaeological potential
- Strong discrete positive response - area of burning / industrial activity
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material of archaeological potential
- Negative anomaly - area with low magnetic susceptibility of archaeological potential
- Positive anomaly - magnetically enhanced material of uncertain origin
- Magnetic debris - spread of magnetically thermoremnant/ferrous material
- Magnetic disturbance from ferrous material
- Strong multiple dipolar linear anomaly - pipeline / cable / service
- Strong dipolar anomaly - ferrous object

SCALE 1:1250

0m 10 20 30 40 50m

SCALE TRUE AT A3

DRAWN BY	CHECKED BY	
KTD	DJS	FIG 10