

**Burderop Park
Chiseldon
Swindon**

MAGNETOMETER SURVEY REPORT

for

Cotswold Archaeology

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ARCHAEOLOGICAL SURVEYS LTD

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Chiseldon
Swindon**

Magnetometer Survey Report

for

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SUMMARY

Detailed magnetometry was carried out by Archaeological Surveys Ltd over several areas of lawn within the grounds of Burderop Park, Chiseldon, Swindon for Cotswold Archaeology. The site has been outlined for a proposed residential development, with a number of new builds within areas currently occupied by car parks and office buildings and also a number of conversions of the listed buildings within the site. The survey was conducted across six survey areas: Area 1 within the main area of lawns forming the eastern part of the site, Areas 2 to 4 within very small areas of lawn adjacent to buildings and car parks, Area 5 within the walled garden in the northern part of the site and Area 6 in the southern part of the site to the south of a cottage. The results demonstrate the presence of a number of anomalies that relate to the remains of an 18th century brewhouse that was excavated in 1995. A sarsen and chalk block wall and floor were also excavated, possibly relating to a medieval grange building. Further north a number of negative linear and rectilinear anomalies may indicate walling, some surrounding a rectangular positive response which could indicate a former structure. The anomalies are all parallel with the current and former boundaries and buildings within the site and could relate to unmapped garden features. Other anomalies within the site relate to ground disturbance and make-up, services, and garden features. Several discrete positive responses have been located; however, it is possible that many of these are associated with removed trees.

1 INTRODUCTION

1.1 *Survey background*

- 1.1.1 Archaeological Surveys Ltd was commissioned by Cotswold Archaeology to undertake a magnetometer survey of several areas of land at Burderop Park, Chiseldon, Swindon. The site has been outlined for a proposed residential development with 54 new builds within a number of existing car parks and on the site of the demolished pavilion office buildings and walled garden with conversion of the manor house and ancillary buildings into 25 dwellings. There will be retention of the lawned area as open space in the eastern part of the site and some of the walled garden as a communal garden and community orchard. Within the southern part of the site it is also proposed to reinstate the access route northwards from the B4005. The survey forms part of an archaeological assessment of the site.
- 1.1.2 The geophysical survey was carried out in accordance with a Written Scheme of Investigation (WSI) produced by Archaeological Surveys (2017) and approved by Melanie Pomeroy-Kellinger, County Archaeologist for Wiltshire Council, prior to commencing the fieldwork.

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 The survey and report generally follow the recommendations set out by: English Heritage (2008) *Geophysical survey in archaeological field evaluation*; 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*.

1.3 Site location, description and survey conditions

- 1.3.1 The site is located within the grounds of Burderop Park, Chiseldon, Swindon. It is centred on Ordnance Survey National Grid Reference (OS NGR) SU 16625 80147, see Figs 01 and 02. The site covers 12.75ha with 4.36ha outlined for potential geophysical survey. Due to tree cover, hedges and other obstacles the actual surveyable area was 2.5ha within several lawned areas labelled 1 - 6.
- 1.3.2 Area 1 lies within the eastern part of the site and is subdivided into smaller zones by trees and hedges, see Plates 1 and 2. The area is generally flat or gently undulating although tends to fall away steeply along the northern and north eastern periphery. Low earthworks within some parts of the area may indicate former garden features and terracing, and at the time of survey a parched linear bank, indicating the line of a former access track from the south east, was noted.



Plate 1: Area 1 looking north east



Plate 2: Western part of Area 1 looking north

- 1.3.3 Area 2 is small zone of grass situated to the west of the western pavilion building. Survey was impeded by tree cover. Area 3 is also a small zone of grass to the north and west of the car park in the north western corner of the site. Area 4 is located within the northern part of a small walled garden that contains a granary on staddle stones, see Plate 3. Area 5 is located within the main walled garden in the northern part of the site. Survey was impeded by concrete pads used to raise former temporary buildings and garden beds, see Plate 4. Area 6 covers a lawn immediately to the south of the cottage in the southern part of the site.



Plate 3: Area 4 looking north west towards the granary.



Plate 4: Area 5 looking north west towards concrete pads

- 1.3.4 The ground conditions across the site were generally considered to be favourable for the collection of magnetometry data. However, numerous sources of magnetic disturbance relating to modern ferrous objects were present and avoided where possible. Weather conditions during the survey were fine and hot.

1.4 Site history and archaeological potential

- 1.4.1 An Archaeological Desk-Based Assessment has been produced for the site (Archaeological Solutions, 2016). It outlines that the site lies within the grounds of Burderop Park which contains the Grade II* listed mid 17th century manor house with 18th century additions, but the site is believed to have medieval origins. From the 9th century much of the parish of Chiseldon was owned by the Benedictine monks at Winchester as it had been left to them in the will of King Alfred. In 899 they surrendered the land to Alfred's son, Edward the Elder who regranted it to his new Abbey of St Peter, known as New Minster, later known as Hyde Abbey when it moved to Hyde to the north of Winchester. By 1305 the land was part of an estate called the manor of Burderop, although still held by Hyde Abbey until the Dissolution when it was granted with a grange called Monkebaron and Chiseldon to Sir John Bridges of Blunsdon, and purchased in 1562 by the Stephens family who had tenanted the property since the 15th century. They rebuilt the farmhouse in the late 16th century as a mansion house and added the stable block. The site still included the grange called Monkebaron during the 17th century but it had gone by 1731 when the house was rebuilt and a brewhouse constructed to the east of the stable block. The brewhouse included an oven, a brewing copper and a mash vat. Although mentioned in an inventory in 1829, the brewhouse was demolished in the 1830s.

- 1.4.2 In 1995 parchmarks within the grass 28m east of the stable block were excavated by a combined team from the Chiseldon and Wroughton History Groups revealing the foundations, stone and brick walls and floors associated with the brewhouse. Ashpits and a coal heap were also identified. Just to the south of the brewhouse were a row of sarsen stones and hard chalk blocks, many of which had been dressed on the outside edge and related to part of a building foundation. Associated glazed roof tile were identified, dating to the mid 13th to possibly early 15th century from the tile kilns near Salisbury at Laverstock or Alderbury. A cobbled yard was also excavated with 14th and 15th century pottery from Laverstock and Minety. It is believed that the medieval foundations are part of the grange of Monkebaron and parchmarks were also identified at the time extending eastwards for another 30m, possibly indicating a continuation of the grange building (Passmore, 1998).
- 1.4.3 Also within the grounds excavations of a sewer trench in 1977 cut through a 4.2m wide, east west running Iron Age ditch. Approximately 150m west within the sports field are the location of two curvilinear features identified from aerial photographs, with further cropmarks and earthworks of a possible deserted medieval settlement 200m to the east. Approximately 100m to the north, within Burderop Camp, is the location of an undated kite-shaped earthwork. Iron Age pottery with ox and sheep bones and teeth have also been recorded in the interior of the earthwork and also Roman pits containing pottery and bone. Just to the north of the earthwork, 250m north west of the site, is the location of an undated burial recorded in 1984. Burderop Camp was utilised during the First and Second World Wars as a military training camp, being the first to receive American servicemen when it became the 7050th USA Field Hospital.
- 1.4.4 Former mapping of the site shows a curving boundary defining the western edge of the area known as The Lawn in the eastern part of the site in 1884. Between 1885 and 1899 there was a rectangular boundary to the east and north of the house and a formal pathway heading northwards. By 1924 the eastern boundary was relocated further east to the position it is in today and the path no longer mapped. Burderop Park was bought by the construction company Halcrow in 1977, with a number of office pavilions constructed, later taken over by CH2M in 2011 and purchased for redevelopment by City and Country in 2015.
- 1.4.5 The location of a medieval structure, 18th century brewhouse and substantial Iron Age ditch with a number of Iron Age, Roman, medieval, post medieval and modern heritage assets in the wider vicinity, indicate that there is potential for the survey areas to contain further archaeological features. However, garden features, planting, landscaping, buildings and paths have restricted and fragmented the survey.

1.5 *Geology and soils*

- 1.5.1 The underlying solid geology across the site is from the West Melbury Marly Chalk Formation and Zig Zag chalk Formation (BGS, 2017)

- 1.5.2 The overlying soil across the survey area is from the Wantage 1 association and is a grey rendzina. It consists of a well drained, calcareous, silty soil in places shallow over argillaceous rock (Soil Survey of England and Wales, 1983).
- 1.5.3 Magnetometry survey carried out across similar soils has produced good results. The underlying geology and soils are therefore considered acceptable 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 is pushed at walking speed and not towed. 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 $\pm 0.1\text{nT}$ and $\pm 10,000\text{nT}$. 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 is manifest 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 $<100\text{s}$.

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 $\pm 10000\text{nT}$ and clipped for display at $\pm 10\text{nT}$ within Areas 1 and 5 and at $\pm 20\text{nT}$ within Areas 2 to 4. 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 is considered by the manufacturer to be data that is 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 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 also 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.
- 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 five survey areas covering approximately 2.5ha.
- 3.1.2 Magnetic anomalies located can be generally classified as positive and negative responses of archaeological potential, positive and negative anomalies of an uncertain origin, linear anomalies associated with cultivation, anomalies associated with garden features, 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 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. Localised zones of magnetic debris and disturbance have the potential to obscure weak anomalies of archaeological potential. The zones are associated with ferrous objects, services and magnetically thermoremnant material such as brick and tile.
- 3.2.2 The survey area is also fragmented by trees, garden beds, hedges, buildings, etc. which may limit the full extent of anomalies located by the magnetometer and impede interpretation.

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 DISCRETE ARCHAEOLOGY AS-ABST MAG POS ARCHAEOLOGY AS-ABST MAG NEG STRUCTURAL ARCHAEOLOGY AS-ABST MAG NEG LINEAR ARCHAEOLOGY AS-ABST MAG NEG ARCHAEOLOGY | Anomalies have the characteristics (mainly morphological) of a range of archaeological features such as pits or areas of burning, magnetically enhanced areas or zones with low magnetic susceptibility that could indicate banks, walls, 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 NEG DISCRETE UNCERTAIN  | The category applies to a range of anomalies where <u>there is not enough evidence to confidently suggest an origin</u> . Anomalies in this category <u>may well be related to archaeologically significant features, but equally relatively modern features, geological/pedological features and agricultural features should be considered</u> . 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 garden features AS-ABST MAG DISCRETE GARDEN FEATURE AS-ABST MAG PATH AS-ABST MAG CULTIVATION AS-ABST MAG NEG GARDEN FEATURE  | Anomalies relate to visible or mapped garden features, such as walls, terraces, banks, paths or fences. |
| 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 thermoremanent 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 <u>may therefore be archaeologically significant</u> . 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 1: List and description of interpretation categories

3.4 List of anomalies - Area 1

Area centred on OS NGR 416732 180095, see Figs 03 - 06.

Anomalies of archaeological potential

(1) - Negative rectilinear anomalies likely to relate to the excavated remains of the 18th century brewhouse located 28m east of the stable block. They enclose an area of 8.5m by 6.5m. There are a number of discrete positive responses within and outside of the structural remains, and other negative linear and rectilinear anomalies to the north and south which may be associated. The structure has been truncated by a cable (11) recorded during the 1995 excavations.

(2) - Located 45m north east of the house is a rectangular positive response with

dimensions of 12.5m by 4.75m. It is surrounded by negative rectilinear anomalies that may be indicative of structural remains. Similar responses can also be seen to the north, west and continuing to the east. They may relate to structural remains such as walls, possibly associated with garden features, although none have been mapped in this position.

(3) - Located 12m to the south of, and parallel with anomalies (2) is a broad negative rectilinear response with an associated positive response on the southern side. The anomalies may indicate a former garden feature or boundary.

Anomalies with an uncertain origin

(4) - The survey area contains a number of discrete positive responses, some individual, some clustered. The site contains a number of mature trees, but a large number of others have been removed in the past. It is likely that several of the responses are related to the removal of trees; however, an archaeological origin should also be considered.

(5) - A group of mainly negative responses, but with a small number of positive responses are located on the corner of a low terrace scarp to the east of anomaly (1). Although some of the anomalies may be associated with material within the terrace, several negative linear and rectilinear anomalies could indicate further structural remains, although their response is poorly defined and, therefore, uncertain in origin.

(6) - A small number of weakly positive linear anomalies have been located throughout the survey area. They have a weak response and lack a coherent morphology preventing confident interpretation.

Anomalies associated with garden features

(7 & 8) - Located in the vicinity of anomalies (2) & (3) are a number of linear series of discrete responses. Anomalies (7) correspond to the line of a formerly mapped path, and are likely to relate to former planting along the sides of the path. Anomalies (8) could also relate to former planting; however, there are some strong dipolar responses, which may indicate that they relate to fence posts associated with a former boundary mapped between 1885 and 1889, but removed by 1924.

Anomalies associated with magnetic debris

(9) - There is widespread magnetic debris adjacent to the buildings and also zones within the lawned area. Several of these appear to be associated with formerly mapped trees, indicating that magnetically thermoremanent material has been used to infill possible depressions left once the trees were removed.

Anomalies with a modern origin

(10 & 11) - A number of services and/or cables can be seen within the southern and western parts of the survey area.

3.5 *List of anomalies - Area 2*

Area centred on OS NGR 416580 180165, see Figs 03 - 06.

Area 2 is situated immediately west of an office pavilion and the response indicates magnetic debris and disturbance, especially close to the building.

3.6 *List of anomalies - Area 3*

Area centred on OS NGR 416405 180207, see Figs 03 & 04

Area 3 covers a small patch of grass on the western and northern sides of a car park. There are responses to patches of magnetic debris indicating made-ground or dumped magnetic material and also strong magnetic responses associated with steel lamp posts and parked cars.

3.7 *List of anomalies - Area 4*

Area centred on OS NGR 416672 180190, see Figs 03 - 06.

Area 4 lies within an area of lawn between the granary and some formal box hedging. The area contains very strongly magnetic debris, indicating that ferrous material is contained within made-ground.

3.8 *List of anomalies - Area 5*

Area centred on OS NGR 416648 180224, see Figs 03 - 06.

Anomalies with an uncertain origin

(12) - A broad positive linear anomaly is parallel with a series of weaker responses (15) which appear to relate to cultivation. The response is likely to be associated, but it is much wider and stronger at 11-19nT than the other linear responses (15).

(13) - A negative linear anomaly on a similar orientation to anomalies (15) and which may also relate to former cultivation. However, a linear zone of highly magnetic anomalies (17) are situated to the south of (13) and a dividing pathway, and (13) may indicate a continuation of (17) using less magnetic material.

Anomalies associated with garden features

(14) - A strongly magnetic response extending through the centre of the site from north to south is associated with a formal path within the walled garden.

(15) - A series of parallel linear anomalies can be seen in the northern part of the survey area and appear to relate to former cultivation.

Anomalies associated with magnetic debris

(16) - A group of strong, discrete, dipolar anomalies appear to define a negative response in the northern part of the site. Although no structure has been mapped in this location, it is possible that the response indicates metal posts surrounding a structure, similar to a greenhouse.

(17) - A linear zone of highly magnetic responses towards the south eastern corner of the walled garden could relate to a former boundary fence or possibly a service continuing northwards as anomaly (13).

Anomalies with a modern origin

(18) - Magnetic disturbance and strong, discrete, dipolar responses are associated with reinforced concrete pads that once held temporary buildings.

3.9 List of anomalies - Area 6

Area centred on OS NGR 416607 180018, see Figs 03 - 07.

Anomalies with an uncertain origin

(19) - A positive linear anomaly appears to have been truncated by a negative linear anomaly relating to a wall at the base of a terrace. The positive response could indicate a ditch-like feature, but the anomaly is parallel with and orthogonal to the orientation of the extant garden features. It may relate to an earlier garden feature. There are several other parallel and orthogonal positive and negative linear anomalies within the northern half of the survey area and these are likely to relate to the former land use within the site, possibly former beds or cultivation.

(20) - A positive curvilinear anomaly surrounds a negative response and is located centrally within the northern part of the lawn a short distance to the south of a circular flower bed. This response could indicate an earlier flower bed or similar garden feature.

(21) - A negative linear anomaly is located in the north western part of the survey area. It is not generally parallel with other extant features or anomalies and it appears to extend beneath the road at the western edge of the survey area. This

type of response could indicate a service but its origin is uncertain.

(22) - A number of pit-like responses can be seen within the survey area. Some could relate to former planting, post-holes and trees associated with the garden.

Anomalies associated with garden features

(23) - Negative linear anomalies are parallel with and situated on the northern side of three terraces within the survey area. They appear to relate to a revetment along the base of the terraces.

Anomalies with a modern origin

(24) - A number of strong, discrete, dipolar responses have resulted in surrounding magnetic disturbance. Several are located immediately to the east of the road, indicating possible posts.

4 DISCUSSION

- 4.1.1 Within Area 1, to the east of the stable block, is the location of a number of anomalies (1) associated with the excavated remains of an 18th century brewhouse demolished in the 1830s. The 1995 excavation revealed walls, foundations, flooring, partitions and ash pits associated with the brewhouse but also a row of sarsen and chalk blocks to the south which were associated with 14th and 15th century pottery and which could have been associated with the medieval grange building (Passmore, 1998). The negative linear and rectilinear responses relate to the excavated remains, and although a further number of negative linear and rectilinear responses are located within the vicinity, it is not clear if they relate to further unrecorded remains either associated with the brewhouse or grange. A number of discrete positive responses have also been located close to the excavated remains and indicate pit-like responses or zones of magnetic enhancement which may be associated with burnt material, probably associated with the brewhouse. Situated approximately 15m east of anomalies (1) are a number of poorly defined negative and positive responses. Some are within the corner of a terrace and may be associated. During the 1995 excavations further parchmarks were revealed extending 30m east and were interpreted as the extent of the grange building. Although there are negative responses to the east and north east, the lack of coherent morphology and poor definition means it is not possible to determine their origin or establish an association with any of the excavated remains.
- 4.1.2 Located 45m north east of the house and 100m north of the excavated brewhouse, is a rectangular positive response (2) with dimensions of 12.5m by 4.75m. It is on the same orientation as the other buildings, walls and boundaries within the site, including the same axis as the granary, situated 40m to the west. The response is variable, generally 4-7nT, peaking towards the south western corner at 14nT. There

are also some negative responses of -1nT to -6nT. Although the anomaly could relate to a former garden feature, such as an infilled formal pond, there is none indicated on any former mapping. The response also indicates a magnetically enhanced fill with no ferrous or magnetically thermoremanent material indicative of a relatively 'clean' soil. The response is surrounded by negative rectilinear anomalies, which may indicate structural remains with similar responses located further north, to the west and also extending eastwards. Again these negative anomalies may relate to garden features such as walling, but they pre-date the existing layout of the garden, underlying a hedge that was mapped in 1924. To the south is a broad negative response with a positive response to the south which may indicate a former bank (3). There does appear to be a low earthwork on the ground surface. Together with the negative linear anomalies extending eastwards to the north (2), they form a series of three sub-divisions 12m apart. Although they could relate to 19th or 20th century garden features, none have been mapped in this position and their archaeological potential should be considered.

- 4.1.3 A number of discrete positive responses have also been located within Area 1, and it is possible that some relate to cut, pit-like features. However, a number of mature trees within the parkland have been removed over the years and it is possible that some of the responses are associated. Patches of magnetic debris also appear to be associated with ground make-up or consolidation.

5 CONCLUSION

- 5.1.1 The geophysical survey located a number of anomalies to the east of the stable block that are associated with the remains of an 18th century brewhouse, excavated in 1995. The excavation also revealed a sarsen and chalk block wall and cobble yard associated with pottery from the 14th and 15th centuries and interpreted as relating to the medieval grange. It is possible that some of the anomalies may be associated with the medieval remains, but it is not clear in the data. At the time of the excavations parchmarks extending 30m to the east were interpreted as the outline of the grange. Although the survey has located a number of weak and indistinct responses in the eastern part of the site it is not possible to determine if they are associated with archaeological remains.
- 5.1.2 To the north are a series of negative anomalies, some surrounding a positive response which could indicate structural remains. However, they are parallel with all of the current and former land boundaries and buildings within the site suggesting that they may relate to garden features, such as garden walls and possibly an infilled formal pond, although no such features have been mapped at any period during the 19th and 20th centuries.
- 5.1.3 Within the walled garden in the northern part of the site (Area 5), anomalies appear to relate to former cultivation, extant features such as paths and concrete pads that once supported buildings.

- 5.1.4 In the southern part of the site (Area 6) there are three negative linear anomalies which correspond with the base of three extant terraces. These indicate possible revetment or former walling. Several other anomalies are oriented similarly to the existing garden layout and may also relate to former garden features.
- 5.1.5 High magnitude magnetic debris and disturbance were identified in the vicinity of the buildings and car parks within the site. These responses are indicative of spreads of magnetic material, services, made ground and above ground ferrous objects. The archaeological potential of zones containing magnetic debris and subject to magnetic disturbance cannot be confidently determined.

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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 thermoremanent 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.

Thermoremanent 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. Thermoremanent features include ovens, hearths, and kilns. In addition thermoremanent 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 field. The difference between the two sensors will relate to the strength 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 $\pm 5\text{nT}$ and $\pm 3\text{nT}$ 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

Filename: J721-mag-Area1-proc.xcp
 Description: Imported as Composite from: J721-mag-Area1.asc
 Instrument Type: Sensys DLMGPS
 Units: nT
 UTM Zone: 30U
 Survey corner coordinates (X/Y): OSGB36
 Northwest corner: 416627.57022689, 180262.797461293 m
 Southeast corner: 416796.47022689, 179953.947461293 m
 Collection Method: Randomised
 Sensors: 5
 Dummy Value: 32702
 Source GPS Points: 587700
 Dimensions
 Composite Size (readings): 1126 x 2059
 Survey Size (meters): 169 m x 309 m
 Grid Size: 169 m x 309 m
 X Interval: 0.15 m
 Y Interval: 0.15 m
 Stats
 Max: 11.05
 Min: -11.00
 Std Dev: 4.13
 Mean: -0.06
 Median: 0.03
 Composite Area: 5.2165 ha
 Surveyed Area: 1.8179 ha
 Processes: 1
 1 Base Layer
 GPS based Process4
 1 Base Layer.
 2 Unit Conversion Layer (Lat/Long to OSGB36).
 3 DeStripe Median Traverse:
 4 Clip from -10.00 to 10.00 nT

Area 2

Filename: J721-mag-Area2-proc.xcp
 Description: Imported as Composite from: J721-mag-Area2.asc
 Instrument Type: Sensys DLMGPS
 Units: nT
 UTM Zone: 30U
 Survey corner coordinates (X/Y): OSGB36
 Northwest corner: 416565.776352712, 180191.98065436 m
 Southeast corner: 416598.326352712, 180139.48065436 m
 Collection Method: Randomised
 Sensors: 5
 Dummy Value: 32702
 Source GPS Points: 14100
 Dimensions
 Composite Size (readings): 217 x 350
 Survey Size (meters): 32.6 m x 52.5 m
 Grid Size: 32.6 m x 52.5 m
 X Interval: 0.15 m
 Y Interval: 0.15 m
 Stats
 Max: 22.10
 Min: -22.00
 Std Dev: 15.19
 Mean: -0.49
 Median: -0.21
 Composite Area: 0.17089 ha
 Surveyed Area: 0.057312 ha
 Processes: 1
 1 Base Layer
 GPS based Process4
 1 Base Layer.
 2 Unit Conversion Layer (Lat/Long to OSGB36).
 3 DeStripe Median Traverse:

4 Clip from -20.00 to 20.00 nT

Area 3

Filename: J721-mag-Area3-proc.xcp
Description: Imported as Composite from: J721-mag-Area3.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y): OSGB36
Northwest corner: 416380.468781487, 180219.491966561 m
Southeast corner: 416446.018781487, 180172.991966561 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 21500
Dimensions
Composite Size (readings): 437 x 310
Survey Size (meters): 65.6 m x 46.5 m
Grid Size: 65.6 m x 46.5 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 22.10
Min: -22.00
Std Dev: 10.74
Mean: 0.25
Median: 0.07
Composite Area: 0.30481 ha
Surveyed Area: 0.080035 ha
Processes: 1
1 Base Layer
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -20.00 to 20.00 nT

Area 4

Filename: J721-mag-Area4-proc.xcp
Description: Imported as Composite from: J721-mag-Area4.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y): OSGB36
Northwest corner: 416659.945725867, 180198.468580329 m
Southeast corner: 416684.245725867, 180184.218580329 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 5400
Dimensions
Composite Size (readings): 162 x 95
Survey Size (meters): 24.3 m x 14.3 m
Grid Size: 24.3 m x 14.3 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 22.10
Min: -22.00
Std Dev: 15.66
Mean: -0.45
Median: -0.65
Composite Area: 0.034628 ha
Surveyed Area: 0.020286 ha
Processes: 1
1 Base Layer
GPS based Proce4
1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -20.00 to 20.00 nT

Area 5

Filename: J721-mag-Area5-proc.xcp
Description: Imported as Composite from: J721-mag-Area5.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y): OSGB36
Northwest corner: 416598.910796396, 180250.874457655 m
Southeast corner: 416688.910796396, 180205.424457655 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 57100
Dimensions
Composite Size (readings): 600 x 303
Survey Size (meters): 90 m x 45.5 m
Grid Size: 90 m x 45.5 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 11.05
Min: -11.00
Std Dev: 10.40
Mean: -0.57
Median: 0.07
Composite Area: 0.40905 ha
Surveyed Area: 0.20661 ha
Processes: 1
1 Base Layer

GPS based Proce4

1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -10.00 to 21.00 nT

Area 6

Filename: J721-mag-Area6.xcp
Description: Imported as Composite from: J721-mag-Area6.asc
Instrument Type: Sensys DLMGPS
Units: nT
UTM Zone: 30U
Survey corner coordinates (X/Y): OSGB36
Northwest corner: 416583.727740107, 180068.13635716 m
Southeast corner: 416629.177740107, 179965.68635716 m
Collection Method: Randomised
Sensors: 5
Dummy Value: 32702
Source GPS Points: 93100
Dimensions
Composite Size (readings): 303 x 683
Survey Size (meters): 45.5 m x 102 m
Grid Size: 45.5 m x 102 m
X Interval: 0.15 m
Y Interval: 0.15 m
Stats
Max: 11.05
Min: -11.00
Std Dev: 4.92
Mean: -0.01
Median: 0.13
Composite Area: 0.46564 ha
Surveyed Area: 0.25764 ha

Processes: 1

1 Base Layer

GPS based Proce4

1 Base Layer.
2 Unit Conversion Layer (Lat/Long to OSGB36).
3 DeStripe Median Traverse:
4 Clip from -10.00 to 10.00 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 printed copy of the report and a PDF copy will be supplied to the Wiltshire Historic Environment Record. The report will also be uploaded to the Online Access to the Index of archaeological investigations (OASIS).

Archive contents:

| Geophysical data - path: J721 Burderop Park\Data\ | | | | |
|--|--------------------------------|--|--|---------------|
| Path and Filename | Software | Description | Date | Creator |
| burderop1\MX1.prm,.dgb,.disp burderop2\MX1.prm,.dgb,.disp burderop3\MX1.prm,.dgb,.disp burderop4\MX1.prm,.dgb,.disp burderop5\MX1.prm,.dgb,.disp burderop6\MX1.prm,.dgb,.disp | Sensys MXPSA | Proprietary data formats representing magnetometer survey traverses logged to a PDA. | 07/07/17 07/07/17 07/07/17 07/07/17 07/07/17 10/08/17 | D.J.Sabin |
| burderop1\MX\J721-mag-Area1.asc burderop2\MX\J721-mag-Area2.asc burderop3\MX\J721-mag-Area3.asc burderop4\MX\J721-mag-Area4.asc burderop5\MX\J721-mag-Area5.asc burderop6\MX\J721-mag-Area6.asc | Sensys DLMGPS | ASCII CSV (tab) file representing survey area in eastings, northings (UTM Z30N), magnetic measurement, traverse file and sensor number. | 10/07/17 10/07/17 10/07/17 10/07/17 10/07/17 10/08/17 | K.T.Donaldson |
| Area1\comps\J721-mag-Area1.xcp Area2\comps\J721-mag-Area2.xcp Area3\comps\J721-mag-Area3.xcp Area4\comps\J721-mag-Area4.xcp Area5\comps\J721-mag-Area5.xcp Area6\comps\J721-mag-Area6.xcp | TerraSurveyor 3.0.23.0 | Composite data file derived from ASCII CSV. | 10/07/17 10/07/17 10/07/17 10/07/17 10/07/17 10/08/17 | K.T.Donaldson |
| Area1\comps\J721mag-Area1-proc.xcp Area2\comps\J721mag-Area2-proc.xcp Area3\comps\J721mag-Area3-proc.xcp Area4\comps\J721mag-Area4-proc.xcp Area5\comps\J721mag-Area5-proc.xcp Area6\comps\J721mag-Area6-proc.xcp | TerraSurveyor 3.0.23.0 | Processed composite data file (zmt and clipping to $\pm 10nT$). Processed composite data file (zmt and clipping to $\pm 20nT$). Processed composite data file (zmt and clipping to $\pm 20nT$). Processed composite data file (zmt and clipping to $\pm 20nT$). Processed composite data file (zmt and clipping to $\pm 20nT$). Processed composite data file (zmt and clipping to $\pm 10nT$). | 10/07/17 10/07/17 10/07/17 10/07/17 10/07/17 10/08/17 | K.T.Donaldson |
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Geophysical Survey
Burderop Park
Chiseldon
Swindon

Map of survey area

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● Survey location

Site centred on OS NGR
SU 16625 80147

SCALE 1:25 000



SCALE TRUE AT A3



Geophysical Survey
Burderop Park
Chiseldon
Swindon

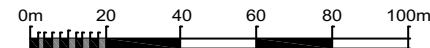
Referencing information

Referencing grid to OSGB36 datum at 50m intervals

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

● 416650 180000

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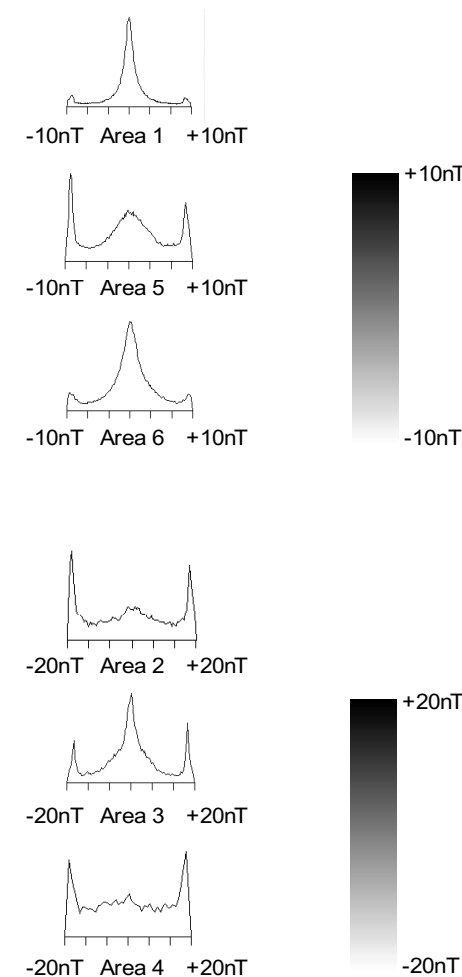
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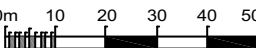


Geophysical Survey
Burderop Park
Chiseldon
Swindon

Greyscale plot of minimally
processed magnetometer data



SCALE 1:1500



SCALE TRUE AT A3

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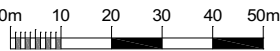


Geophysical Survey
Burderop Park
Chiseldon
Swindon

Abstraction and interpretation of
magnetic anomalies

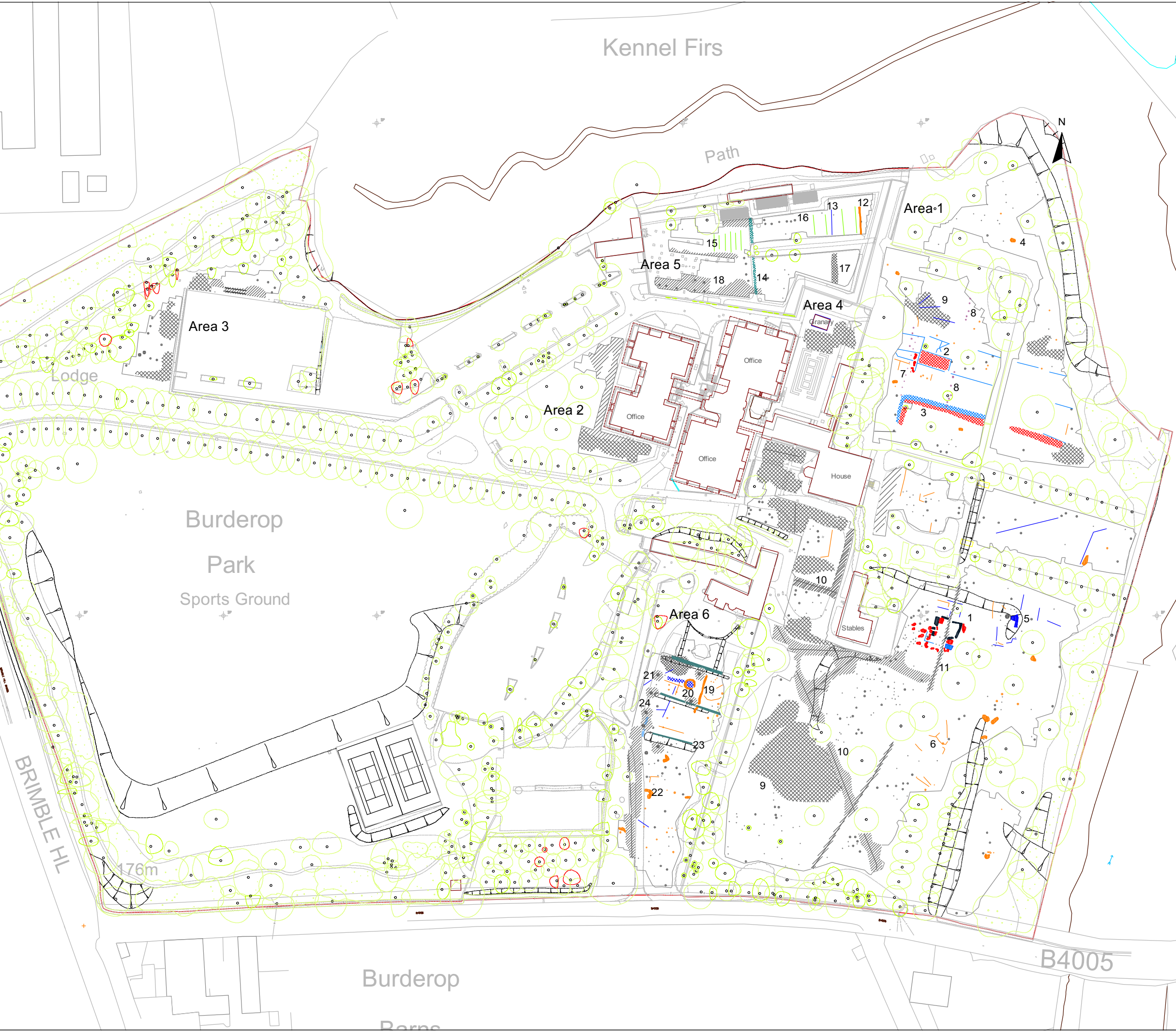
- Negative linear anomaly - material of low magnetic susceptibility of archaeological potential
- Negative linear anomaly - structural remains of archaeological potential
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - associated with former cultivation
- Negative linear anomaly - material of low magnetic susceptibility
- Negative linear anomaly - former garden feature (wall / terrace revetment)
- Discrete positive response - cut or magnetically enhanced feature of archaeological potential
- Discrete positive response - possible garden feature
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material of archaeological potential
- Negative anomaly - possible bank of archaeological potential
- Strong positive anomaly - path
- 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 1:1500



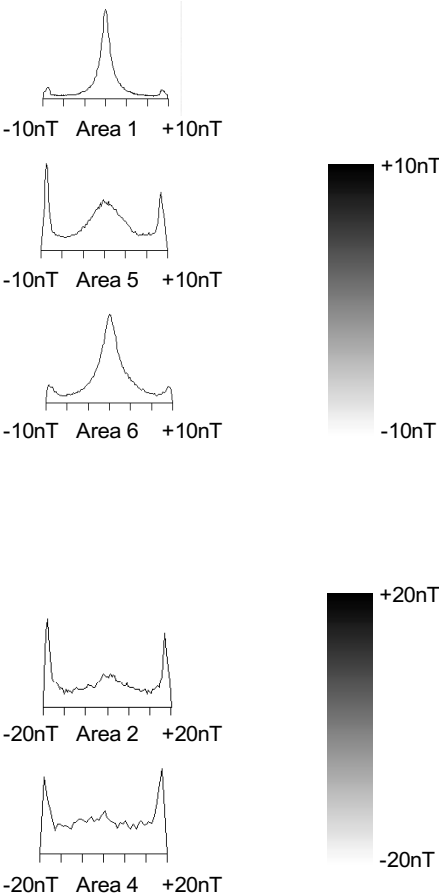
SCALE TRUE AT A3

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Geophysical Survey
Burderop Park
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Swindon

Greyscale plot of minimally
processed magnetometer data



SCALE 1:1000



SCALE TRUE AT A3

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Geophysical Survey
Burderop Park
Chiseldon
Swindon

Abstraction and interpretation of
magnetic anomalies

- Negative linear anomaly - material of low magnetic susceptibility of archaeological potential
- Negative linear anomaly - structural remains of archaeological potential
- Positive linear anomaly - possible ditch-like feature
- Linear anomaly - associated with former cultivation
- Negative linear anomaly - material of low magnetic susceptibility
- Negative linear anomaly - former garden feature (wall/ terrace revetment)
- Discrete positive response - cut or magnetically enhanced feature of archaeological potential
- Discrete positive response - possible garden feature
- Discrete positive response - possible pit-like feature
- Positive anomaly - magnetically enhanced material of archaeological potential
- Negative anomaly - possible bank of archaeological potential
- Strong positive anomaly - path
- 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 1:1000



SCALE TRUE AT A3

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Geophysical Survey
Burderop Park
Chiseldon
Swindon

Abstraction and interpretation of
magnetic anomalies - Area 6

- Positive linear anomaly - possible ditch-like feature
- Negative linear anomaly - material of low magnetic susceptibility
- Negative linear anomaly - former garden feature (wall / terrace revetment)
- Discrete positive response - possible pit-like feature
- Negative anomaly - material of low magnetic susceptibility
- 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 1:500



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