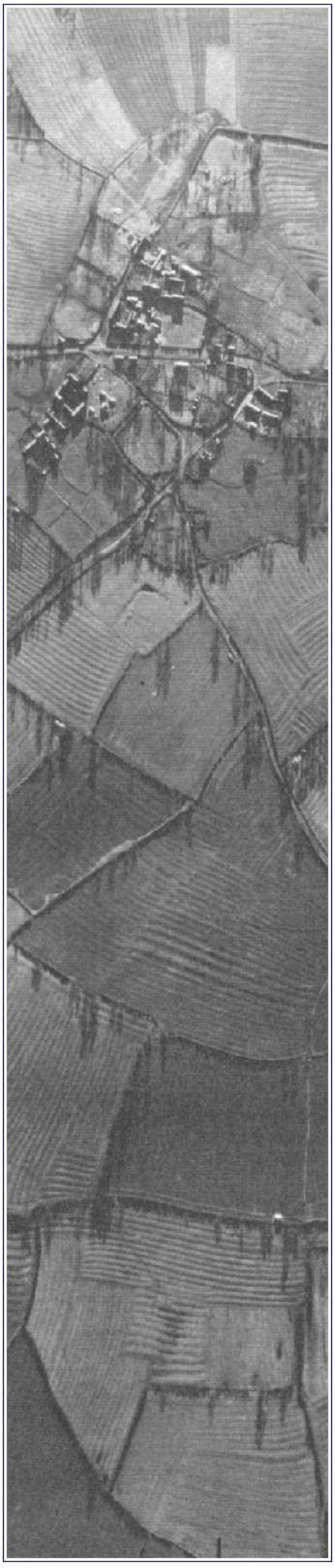

ARCHAEOLOGICAL SURVEYS LTD

GEOPHYSICAL SURVEY REPORT

Truckle Hill Roman Villa
North Wraxall
Wiltshire

Magnetometry and Earth Resistance Survey

for

Wiltshire County Council
Archaeology Service

David Sabin and Kerry Donaldson

March 2008

Ref. no. 226

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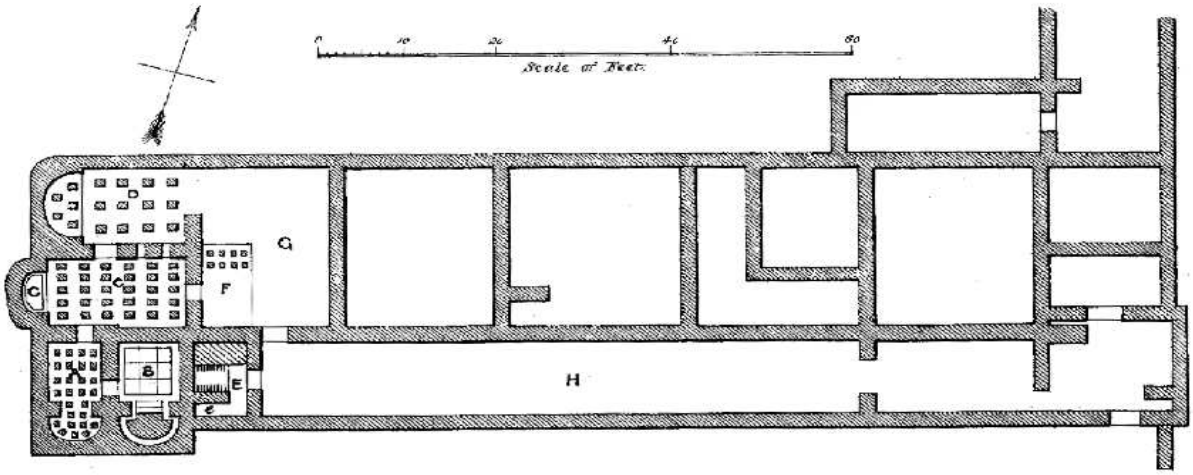

Truckle Hill Roman Villa
North Wraxall
Wiltshire

Magnetometry and Earth Resistance Survey

for

Wiltshire County Council Archaeology Service

Fieldwork by David Sabin, Kerry Donaldson, Paul Hadley and Francis Sabin
Report by David Sabin BSc (Hons) MIFA and Kerry Donaldson BSc (Hons)

Survey date - **from 7th to 24th March 2008**
Ordnance Survey Grid Reference – **ST 836 758**

Printed on 100% recycled paper

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SUMMARY

A geophysical survey was carried out at the Scheduled Ancient Monument of Truckle Hill Roman Villa, North Wraxall, Wiltshire using both magnetometry and earth resistance measurement.

Magnetometry survey covered approximately 11ha within a single field, the northern part of which contains the scheduled area including and surrounding the villa site. Earth resistance survey was carried out across approximately 0.5ha and targeted a substantial building revealed by the magnetometry survey.

The magnetometer response to Roman walls was clearer than expected possibly due to clearance of structural debris during mid 19th century excavations at the site. Negative magnetic anomalies indicating the position of stone walls correlated well with the mid 19th century plan produced during the original excavations. The magnetometry has provided a precise location for the plan within the survey area and has indicated that it is an accurate portrayal of the excavated features. Variable magnetic response, correlating with the location of some of the buildings visible in the plan, indicates the possibility of severe disturbance to some parts of the site by ploughing.

The survey has revealed evidence of a large ditch to the west and south of the villa complex possibly indicating a substantial defensive work and, from the geophysical evidence, it has been tentatively interpreted as a possible late Roman feature. Weak curvilinear anomalies to the south of the enclosure ditch may, by contrast, be indicative of early Roman or late prehistoric features; the interpretation is tentative.

Crossing the central part of the surveyed area, a ditch located by magnetometry lies immediately north of a low earth bank still extant within the field and also visible within LiDAR (Light Detection and Ranging) data. This feature may be defensive and could be the northern part of a naturally defended promontory. Ditch-like anomalies located at the southern tip of this promontory include a circular enclosure approximately 45m in diameter, and a prehistoric origin is suspected.

LiDAR data have been used to complement and develop the interpretation of the geophysics and of features within the surrounding landscape. An earthwork, crossing woodland to the north and north west of the survey area, can be observed within the LiDAR data and may indicate a Roman road linking the villa to the Fosse Way.

The geophysics has successfully demonstrated the high archaeological potential of the site, and has provided an invaluable record to aid management and interpretation, as well as provide accurately located features for future archaeological investigations.

1 INTRODUCTION

1.1 Survey background

1.1.1 Archaeological Surveys Ltd was commissioned by Wiltshire County Council Archaeology Service, with funding from English Heritage, to undertake a geophysical survey of an area of land surrounding the Scheduled Ancient Monument (SAM) of Truckle Hill Roman Villa, North Wraxall, Wiltshire (WI 878).

1.1.2 A Method Statement prepared prior to the survey (Archaeological Surveys, 2008) formed part of an application to English Heritage for a licence to carry out geophysical survey. The licence was granted with regard to Section 42 of the 1979 Ancient Monuments and Archaeological Areas Act (as amended by the National Heritage Act 1983). The licence period commenced on the 22.02.08 and ceased on 22.05.08. The survey and report generally follow the recommendations set out by English Heritage, 1995: *Geophysical survey in archaeological field evaluation. Research and Professional Service Guideline No. 1.*

1.1.3 The exact location of the villa, its layout and state of preservation were poorly understood prior to the survey. Mid 19th century excavations and their associated plans indicate at a site of considerable status, and it is hoped that the geophysical survey has provided complementary and supporting evidence. Recent archaeological investigations have revealed a bath-house some 150m north east of the Scheduled Monument, and earthworks within the vicinity suggest an extension of Romano-British remains further to the north.

1.2 Survey objectives and techniques

1.2.1 The objectives of the survey were to improve understanding of the layout, location and state of preservation of the villa and to determine the accuracy and validity of excavation plans produced in the mid 19th century. The survey area extended well to the south of the Scheduled Monument boundary in order to determine the archaeological potential of the immediate environs of the villa and the relevance of the boundary itself.

1.2.2 Prior to fieldwork, both magnetometry and earth resistance survey were considered likely to produce useful data across the site. The former technique is considerably more efficient than the latter, and a suitable strategy was conceived in order to optimise the resources available. Earth resistance survey tends to produce better results than magnetometry across buried structural remains such as building footings, while magnetometry is considered more effective for locating former cut features such as ditches and pits. A wide area magnetometry survey, covering the field in which the Scheduled Monument is located, was followed by targeted earth resistance survey across the remains of a substantial Roman building.

1.2.3 The geophysical survey work has been supported by the analysis of 19th century Ordnance Survey mapping, a walk over survey of adjacent areas, an excavation report and plans produced in the mid 19th century and LiDAR (Light Detection and Ranging) data.

1.3 Site location, description and survey conditions

1.3.1 Truckle Hill is located within the north eastern corner of the parish of North Wraxall in Wiltshire and is centred on Ordnance Survey National Grid Reference ST 836 758.

1.3.2 The geophysical survey covers an area of approximately 11ha of pasture land grazed by sheep during the survey period, see Plates 1 - 3. The area is contained within a single field and lies on a tongue-shaped elevated plateau at around 125m ODN. There are steep sided valleys from the west through the south to the eastern side and an area of deciduous woodland lies on flatter land immediately to the north. The valley sides are mostly covered with coniferous trees except for some steep grassland beyond the western field boundary. An isolated building, Truckle Hill barn which has been converted to a residential building, lies immediately to the west of the survey area. A small lane leading to this property from the west also allows vehicular access to the site.

1.3.3 The survey area contains seven circular tree and shrub plantations that are approximately 40m in diameter and surrounded by steel wire, see Plate 1. There are several individual saplings within the south western corner of the field that have been individually fenced. In addition, saplings form a wide margin along the northern and north western edges of the field and are also bounded by steel wire fencing. A lamb feeder constructed from steel was located within the field towards the south west. All modern ferrous objects are considered a source of substantial magnetic disturbance.

1.3.4 Ground conditions were generally good for survey with short grass cover and well-drained soil. Weather conditions produced very poor conditions for surveying with an extended period of very high winds and rainfall resulting in several days of abandoned survey.

Plate 1: Survey area - looking south east

Plate 2: Eastern side of survey area - looking south

Plate 3: Survey area and Truckle Hill Barn - looking west

1.4 Site history and archaeological potential

1.4.1 Truckle Hill Roman Villa (SAM number WI 878) was excavated in 1859-60 by George Poulett Scrope of Castle Combe. The excavations revealed a substantial villa containing sixteen rooms, including a bath suite, within a large building towards the north-eastern corner of the field, see Plates 4 - 6. A courtyard, two further sets of buildings and a cemetery including four burials were also discovered (Scrope, 1862).

1.4.2 Recent archaeological investigations by Wessex Archaeology (Wessex Archaeology, 2008), with funding from English Heritage, have involved excavating and recording the remains of a Roman bath-house approximately 150m to the north east of the villa and set into the western side of a narrow valley. There is evidence that this bath-house was richly appointed and was constructed in two phases between the late 2nd and the late 3rd or early 4th centuries. Subsequently, part of the building was used as a corn drying oven during the 4th century.

1.4.3 The potential to locate anomalies with an archaeological origin was considered to be very high prior to the survey. Magnetometry was expected to produce evidence of cut features with high resolution earth resistance survey expected to produce evidence of structural remains.

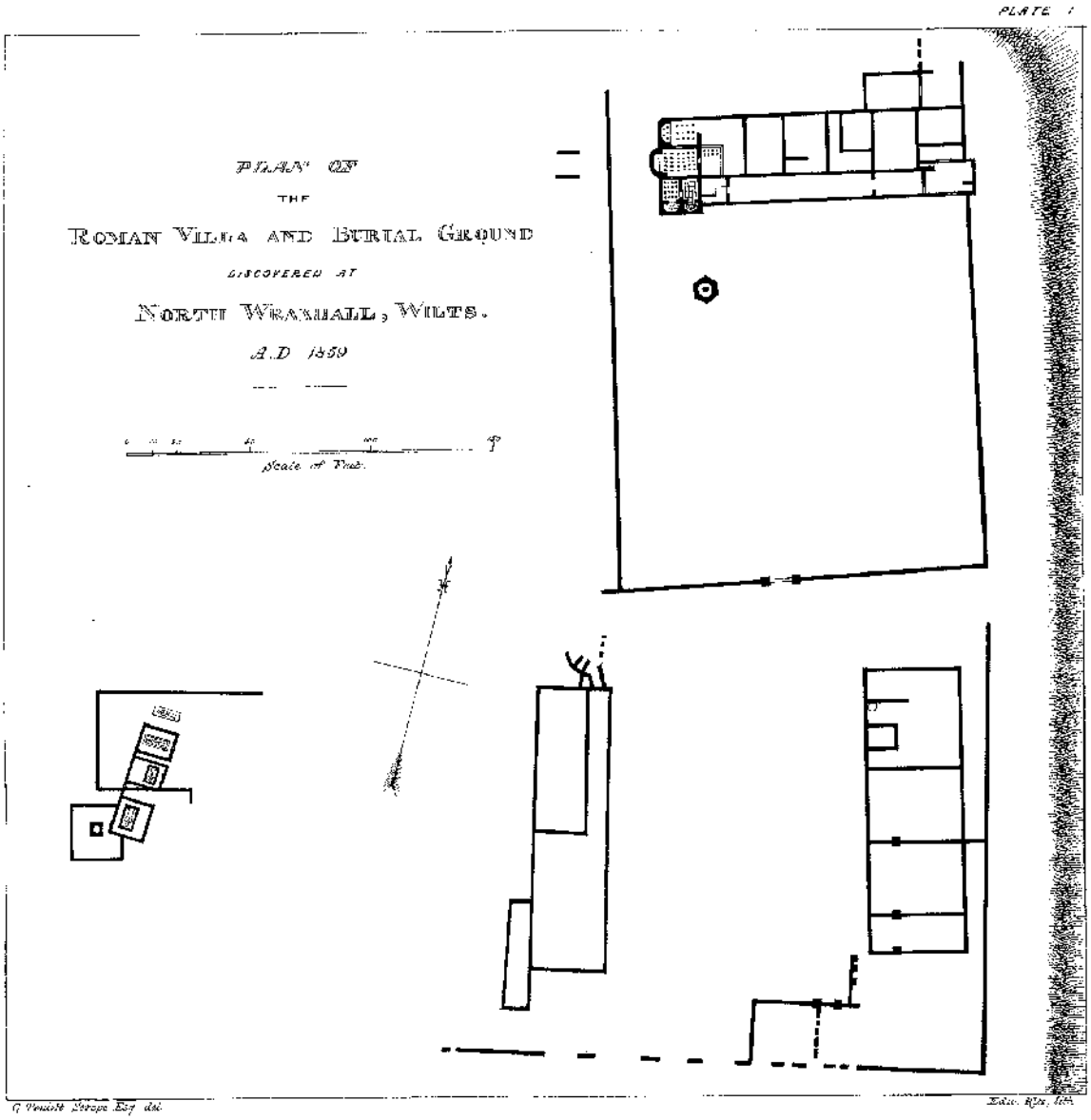


Plate 4: George Poulett Scrope's 1859 plan of the Roman Villa and Burial Ground (Scrope, 1862)

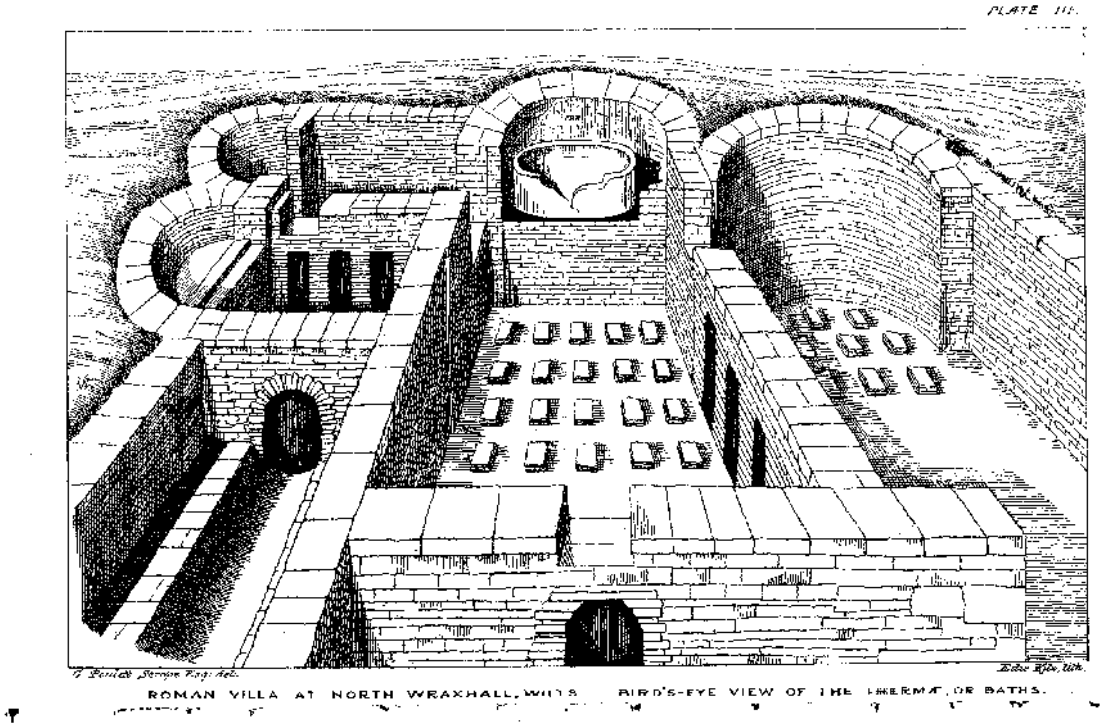


Plate 5: George Poulett Scrope's 'Bird's-eye view of the thermae or baths'

(Scrope, 1862)

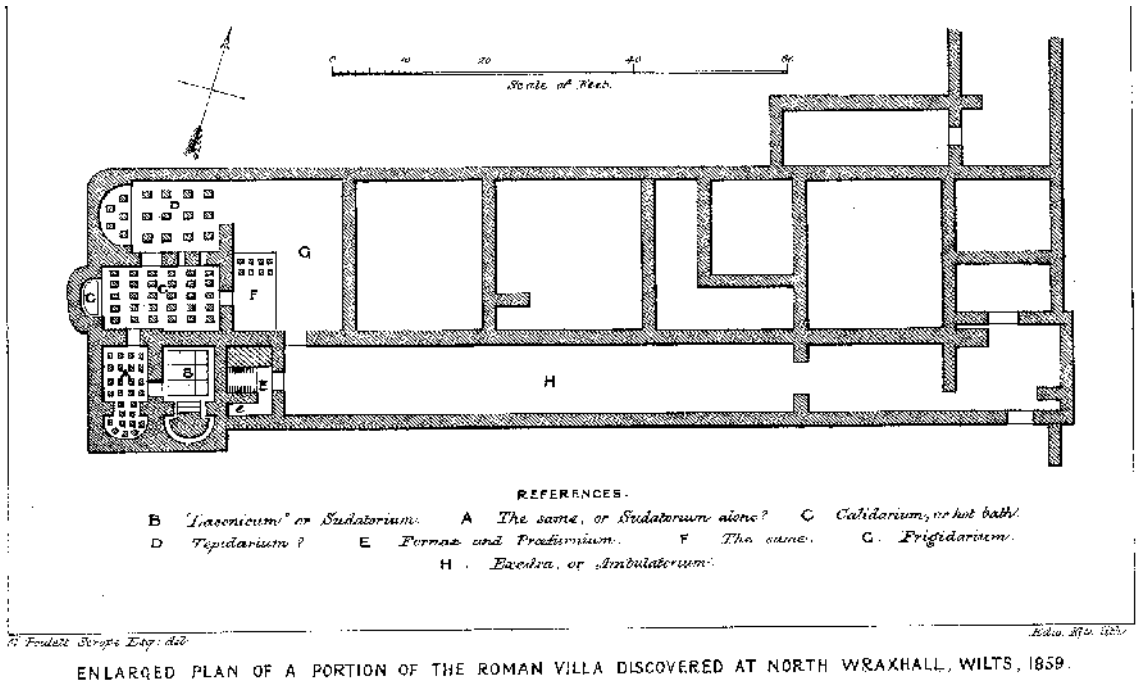


Plate 6: George Poulett Scrope's enlarged plan of a portion of the Roman villa

(Scrope, 1862)

1.5 Geology and soils

1.5.1 The underlying geology is Jurassic Great Oolite (BGS, 2001). No overlying drift deposits are present within the survey area although zones of localised colluviation are possible particulary along sloping ground close to the eastern boundary.

1.5.2 The overlying soils across the site are from the Elmton 1 association which are brown rendzinas. These consist of shallow, well-drained brashy, calcareous fine loamy soils over limestone (Soil Survey of England and Wales, 1983).

1.5.3 The geological and pedological conditions are generally considered favourable for magnetometry and earth resistance survey. Natural anomalies, such as cracking associated with cambering and shallow irregularities within the soil/rock interface, may produce magnetic anomalies. Earth resistance survey may respond to natural features especially where solid geology is shallow.

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 magnetic 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 during magnetic prospection.

2.1.3 Magnetic thermoremnance can occur when ferrous minerals have been heated to high temperatures such as in a kiln, hearth or associated with other industrial processes. 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).

2.1.5 The electrical resistance or resistivity of the soil depends upon the moisture content and distribution within the soil. Buried features, such as walls, can affect the

moisture distribution and are usually more moisture resistant than other features, such as the infill of a ditch. A stone wall will generally give a high resistance response, and the moisture retentive content of a ditch can give a low resistance response. Localised variations in resistance are measured in ohms (Ω) which is the SI unit for electrical impedance or resistance.

2.1.6 The Twin Probe configuration used in this survey is favoured for archaeological prospection and can give a response to features up to 1m in depth with a mobile probe separation of 0.5m.

2.2 Equipment configuration, data collection and survey detail

2.2.1 The detailed magnetic survey was carried out using a Bartington Grad601-2 gradiometer. This instrument effectively measures a magnetic gradient between two fluxgate sensors mounted vertically 1m apart. Two sets of sensors are mounted on a single frame 1m apart horizontally. The instrument is extremely sensitive and is able to measure magnetic variation to 0.1nanoTesla (nT). All readings are saved to an integral data logger for analysis and presentation

2.2.2 The instrument is operated according to the manufacturer's instructions with consideration given to the local conditions. An adjustment procedure is required, prior to collection of data, in order to balance the sensors and remove the effects of the Earth's magnetic field; further adjustment is required during the survey due to instrument drift often associated with temperature change. It is often very difficult to obtain optimum balance for the sensors due to localised magnetic vectors that can be associated with large ferrous objects, geological/pedological features, 'magnetic' debris within the topsoil and natural temperature fluctuations. Imperfect balance results in a heading error often visible as striping within the data; this can be effectively removed by software processing and generally has little effect on the data unless extreme. Archaeological Surveys use a non-magnetic tripod with an additional supporting structure to raise the instrument during the set-up procedure, and this has been found to improve the sensor balance.

2.2.3 The Bartington gradiometer undergoes regular servicing and calibration which is carried out by the manufacturer. A current assessment of the instrument is shown in Table 1 below.

Date of calibration/service	21st May 2007
Sensor type	Bartington Grad - 01 – 1000 Nos. 084 and 085
Bandwidth	12Hz (100nT range) both sensors
Noise	<100pT peak to peak
Adjustable errors	<2nT

Table 1: Bartington fluxgate gradiometer sensor calibration results

The instrument was considered to be in good working order prior to the survey with no known faults or defects.

2.2.4 Data were collected at 0.25m centres along traverses 1m apart. The survey area was separated into 30m by 30m grids giving 3600 recorded measurements per grid. This sampling interval is very effective at locating archaeological features and is the recommended methodology for archaeological prospection (English Heritage, 1995).

2.2.5 The earth resistance survey was carried out using TR Systems Ltd Resistance Meter TRCIA 1.31 using a mobile Twin Probe array. The standard mobile frame for the TRCIA instrument has a 0.5m electrode separation and readings were recorded at 0.5m intervals along 0.5m traverses across the site.

2.2.6 The survey grids were set out to the Ordnance Survey OSGB36 datum using a Penmap RTK GPS. The GPS is used in conjunction with Leica's Smartnet service where positional corrections are sent via a mobile telephone link. Positional accuracy of around 10 – 20mm is possible using the system.

2.2.7 The fixed orientation of survey grids, based on the OSGB36 datum, was considered appropriate given that the orientation of land boundaries and obstructions was variable and consequently partial survey grids were unavoidable. In addition, there is an optimum north – south traverse direction for magnetic survey (English Heritage,1995). Survey in this direction exploits the greater contrast of magnetic features which is a function of their presence within the Earth's magnetic field. A fixed grid across the site also simplifies its relocation should that be required.

2.3 Data processing and presentation

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

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

- clipping of the raw data at ±20nT to improve greyscale resolution,
- clipping of processed data at ±5nT to enhance low magnitude anomalies,
- clipping of trace plots at ±100nT in order to minimise strong readings obscuring low magnitude responses,

- de-stagger is used to enhance linear anomalies,
- zero median/mean traverse is applied in order to balance readings along each traverse.

Reference should be made to Appendix B for processing details.

Data processing explanation notes:

Clipping
Clipping replaces the values outside the specified minimum and maximum with those values. The process is useful for displaying detail as extreme values are removed, allowing greyscale shades to be allocated to a narrower range of values, which improves the definition of anomalies.

Zero Median/Mean Traverse
The median (or mean) of each traverse is calculated ignoring data outside a threshold value, the median (or mean) is then subtracted from the traverse. The process is used to equalise slight differences between the set-up and stability of gradiometer sensors and can remove striping.

De-stagger
Compensates for small positional errors within data collection by shifting the position of the readings along each traverse by a specified amount.

2.3.3 Data logged by the resistance meter is downloaded and processed within ArcheoSurveyor software. Raw data is analysed and displayed within the report as well as processed data. The following processing has been carried out on data in this survey:

- clipping of the raw data between 75Ω and 135Ω,
- clipping of processed data between -10Ω and +10Ω (negative values are a function of the mathematical operation carried out across the data during filtering),
- range and edge match have been used to balance variability in the data between grids,
- data passed through a high pass Gaussian filter in order to enhance archaeological features.

Reference should be made to Appendix B for processing details.

Edge Match
Calculates the mean of the 2 lines (rows or columns) of data either side of the edge to match. Subtracts the difference between the means from all datapoints in the selected area. The process attempts to remove differences in the data caused by the movement of remote probes between survey grids. Irregularities are also visible in data captured at different times.

Range Match
Range Match determines the minimum and maximum of a percentage of the (rows or columns) of data either side of the edge of a selection. It then calculates an offset and stretching factor to match the two datasets. The process then subtracts the offset from all datapoints in the selected area and multiplies them by the stretching factor. This can be particularly effective when matching resistivity grids that have been surveyed at different times.

High-Pass Filter
Uses a Gaussian weighted window to remove low frequency components in a survey and effectively enhances high frequency anomalies. The process can enhance the contrast of subtle anomalies within the data.

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

2.3.5 The main form of data display used in this report is the greyscale plot. Both 'raw' and 'processed' data have been plotted followed by an abstraction and interpretation. Trace plots have not been plotted but are included on CD with this report.

2.3.6 Graphic raster images in Bitmap format are initially prepared in ArcheoSurveyor. Regardless of survey orientation, data captured along each traverse is displayed and processed by ArcheoSurveyor from left to right. This corresponds to a direction of south to north in the field for the survey. Prior to displaying against base mapping, raster graphics require a rotation of 90° anticlockwise to restore north to the top of the image. Greyscale images are rotated using NIP2 graphic processing software.

2.3.7 The raster images are combined with base mapping using MapInfo Professional creating TAB file formats. All A3 plots are derived from MapInfo. A digital archive including raster images is produced with this report allowing separate analysis if necessary, see Appendix C.

3 RESULTS

3.1 General overview - magnetometry

3.1.1 The magnetometry survey was carried out over approximately 11ha. Geophysical anomalies located can be generally classified as:

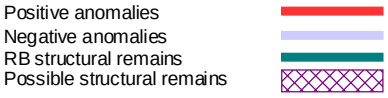
- positive and negative responses of archaeological potential,
- positive and negative anomalies of an uncertain origin,

- linear anomalies of an agricultural origin,
- areas of magnetic disturbance,
- strong discrete dipolar anomalies relating to ferrous objects.

Anomalies located within each survey area have been numbered and will be outlined below with subsequent discussion in Section 4.

3.1.2 The listing 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, and a basic key is indicated to allow cross reference to the abstraction and interpretation plot (Figure 07). Sub-headings are then used to group anomalies with similar characteristics for each survey area.

Anomalies with an archaeological origin



The category is used where anomalies have the characteristics of a range of archaeological features such as pits, ring-ditches, enclosures etc.. Features associated with positive anomalies are often cut into the underlying subsoil or solid geology although can also relate to accumulations of soil with enhanced magnetic susceptibility. Negative anomalies may relate to low soil magnetic susceptibility caused by subsoil or rock and could indicate the position of a former bank or wall. Negative linear anomalies identified as Romano-British structural remains have been categorised separately. The negative response is likely to have been caused by the comparatively low magnetic susceptibility of rock used for walling or wall footings. Areas of variable magnetic response have been interpreted as possible structural remains/debris.

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.

Anomalies relating to former field boundaries

Anomalies within this category may appear as positive or/and negative linear response. Negative response may relate to former stone walling or subsoil; positive response may be associated with boundary ditches. The anomalies are often long

and/or form rectilinear elements, they may also be visible as boundaries on early maps and may be known or removed by existing landowners.

Anomalies with an agricultural origin

Agricultural anomalies

Where confidence is high that anomalies have been caused by agricultural features this category is applied. 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. Abstraction and interpretation plots do not attempt to define all such anomalies, only the general trend.

Anomalies with a modern origin

Magnetic disturbance 

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.

Anomalies associated with magnetic debris

Strong discrete dipolar anomaly 

Strong discrete dipolar anomalies are caused by shallow ferrous objects; the archaeological potential of these anomalies cannot be determined.

3.2 Magnetometry - list of anomalies

See Figures 03 – 09

Anomalies with an archaeological origin

(1) – Negative linear anomalies within the north eastern corner of the survey area have been caused by stone walls or wall footings associated with Truckle Hill Villa. The anomalies indicate the presence of a substantial building, extending beyond the north eastern limit of the surveyed area, with a courtyard immediately to the south. Another large building (or buildings) is located to the south of the courtyard. The layout of anomalies appears to correlate strongly with Scrope's mid 19th century plan.

(2) – A positive linear anomaly is related to a large ditch to the west and south of the villa complex effectively forming an enclosure. The feature is visible as a shallow ditch towards the northern end of the geophysical response.

(3) – Positive linear anomalies have been caused by ditch-like features within the enclosure formed by (2) and parallel to its southern side. These may represent land division and/or drainage.

(4) – Positive zones located within and adjacent to Roman structures probably represent magnetically enhanced soils derived from burning, occupation debris etc..

(5) – A zone of variable magnetic response south of the villa courtyard may indicate building debris. The response correlates with a building visible on Scrope's plan.

(6) – A zone of variable magnetic response similar to (5) located to the west of the villa may indicate building debris.

(7) – A zone of variable magnetic response to the south of the villa complex may indicate occupational or structural debris. Low magnitude curvilinear anomalies are apparent within this zone.

(8) – Discrete positive anomalies, within the south western corner of the possible enclosure formed by (2), correlate with the position of graves indicated on Scrope's plan.

(9) – Low magnitude linear and curvilinear anomalies may indicate ditch-like features of early Roman or prehistoric date.

(10) – A positive linear anomaly caused by a large ditch crossing the survey area centrally from west to east. Part of the feature has not been surveyed due to the presence of trees and shrubs. A low and broad earthwork, immediately to the south of the geophysical anomaly, is likely to be the remains of a former bank.

(11) – Positive linear anomalies located parallel to (10) are caused by ditch-like features. These anomalies may define a land boundary but may also be associated with water management.

(12) – Linear and curvilinear anomalies at the southern end of the survey area have been caused by cut ditch-like features and may be of prehistoric date. Anomalies are likely to extend into woodland to the south and into a circular area of trees and shrubs within the survey area.

Anomalies with an uncertain origin

(13) – Positive linear anomalies within the northern half of the survey area probably represent cut ditch-like features and may indicate former field boundaries.

(14) – Positive linear and curvilinear anomalies within the central part of the survey area cannot be confidently interpreted but are likely to represent cut ditch-like features.

(15) – Negative linear anomalies cannot be confidently interpreted but are likely to represent subsoil or rock of low magnetic susceptibility.

(16) – Discrete positive anomalies likely to represent in-filled depressions and pit-like features. A number of these anomalies may indicate areas of quarrying.

Anomalies relating to former field boundaries

(17) – Linear anomalies associated with field boundaries removed in the 20th century.

(18) – Former boundary close to Truckle Hill barn.

Anomalies with an agricultural origin

(19) – Low magnitude linear anomalies visible across much of the survey area have been caused by relatively modern ploughing.

Anomalies with a modern origin

(20) – Parallel negative linear anomalies near the south western corner of the survey area correlate with agricultural vehicle tracks.

(21) – Magnetic disturbance caused by wire fencing surrounding saplings.

(22) – Magnetic disturbance caused by an animal feeder.

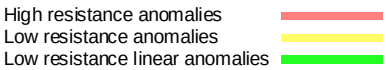
3.3 General overview – earth resistance

3.3.1 The earth resistance survey was carried out over approximately 0.5ha. Anomalies located have been generally classified as high resistance anomalies caused by structural remains and low resistance anomalies associated with ditch-like features and backfilled soil.

3.3.2 Earth resistance survey often produces optimum results in late summer when soil moisture is at its lowest; however, where structural remains are shallow and drainage good, useful results can be obtained at any time. The results of the earth resistance survey indicate a wide range of values and good contrast. Problems were caused by the presence of sheep within the survey area; remote probes were disturbed and wiring damaged, and two grids were resurveyed due to data errors resulting from the disturbance. Survey grids surveyed at different times have produced slightly different responses requiring additional data processing, some data artefacts remain after processing.

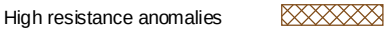
3.3.3 The listing of sub-headings below attempts to define a number of separate categories that reflect the range and type of features located during the earth resistance survey. A basic explanation of the characteristics of the anomalies is set out for each category in order to justify interpretation, and a basic key is indicated to allow cross reference to the abstraction and interpretation plot (Figure 12). Sub-headings are then used to group anomalies with similar characteristics for each survey area.

Anomalies with an archaeological origin



High resistance anomalies of linear or rectilinear form are likely to be associated with structural remains. Areas of low resistance located within structural remains may indicate backfilling. Low resistance linear anomalies indicate ditch fills. Magnetometry data and Scrope's mid 19th century plan are used to support the interpretations.

Anomalies with a modern origin



An area of high resistance caused by ground make-up or modern ground disturbance.

3.4 Earth resistance - list of anomalies

See Figures 10 – 12

Anomalies with an archaeological origin

(23) – Linear and rectilinear high resistance anomalies correlate with structural remains of a substantial building identified by magnetometry.

(24) – Linear high resistance anomalies associated with courtyard walls.

(25) – High resistance anomaly correlating with the position of a well as derived from Scrope's mid 19th century excavation plan.

(26) – High and low resistance linear anomalies representing features within the courtyard area.

(27) – High resistance anomaly possibly representing a structure to the north west of the villa building (23).

(28) – A low resistance linear anomaly representing a ditch-like feature.

(29) – An area of low resistance within structural remains may indicate moisture retentive soil used to backfill Scrope's mid 19th century excavation.

Anomalies with a modern origin

(30) – A zone of high resistance probably represents ground make-up or disturbance close to the field entrance.

4 DISCUSSION

4.1 Magnetometry

4.1.1 The magnetometry survey has produced distinct negative linear anomalies indicating the location and layout of wall remains and wall footings. Magnetometry can produce a negative response where soil has been displaced by material of lower magnetic susceptibility, such as limestone, in general though, results are often indistinct and earth resistance survey is preferred where structural remains are suspected. The magnetic response at Truckle Hill has helped define the walls of at least two large buildings and has revealed internal divisions relating to individual rooms, a courtyard wall has also been defined. It is possible that excavation work carried out in the 19th century has aided the geophysical response by removing structural debris adjacent to wall lines.

4.1.2 The distinct response to wall remains has allowed an assessment of the accuracy of Scrope's mid 19th century plan of the site, see Plate 7 below. The excavation plan has been rectified and displayed along with the magnetometry abstraction, see Figure 13. It can be seen that there is a very strong correlation between the two plots. A positional error visible towards the southern end of Scrope's plan may be associated with inappropriate control points, or error in interpretation and positioning of control points, rather than any gross error within the original plan itself. It is, therefore, possible to view the plan with some degree of confidence.

4.1.3 Structure A of Plate 7 is referred to in Scrope's report as 'a continuous oblong building of about 180' by 36' (Scrope, 1862, p59). The corresponding geophysical response suggests a building of approximately 40m (131.232') by 12m (39.36'). The dimensions indicated within the text of Scrope's report are clearly inaccurate approximations. Scaling from Scrope's excavation plan above, Plate 7, and from the enlarged plan of Structure A indicated by Plate 5 (see section 1.4), the dimensions correlate closely with those derived directly from the geophysical anomalies strongly suggesting the original site plans were surveyed accurately.

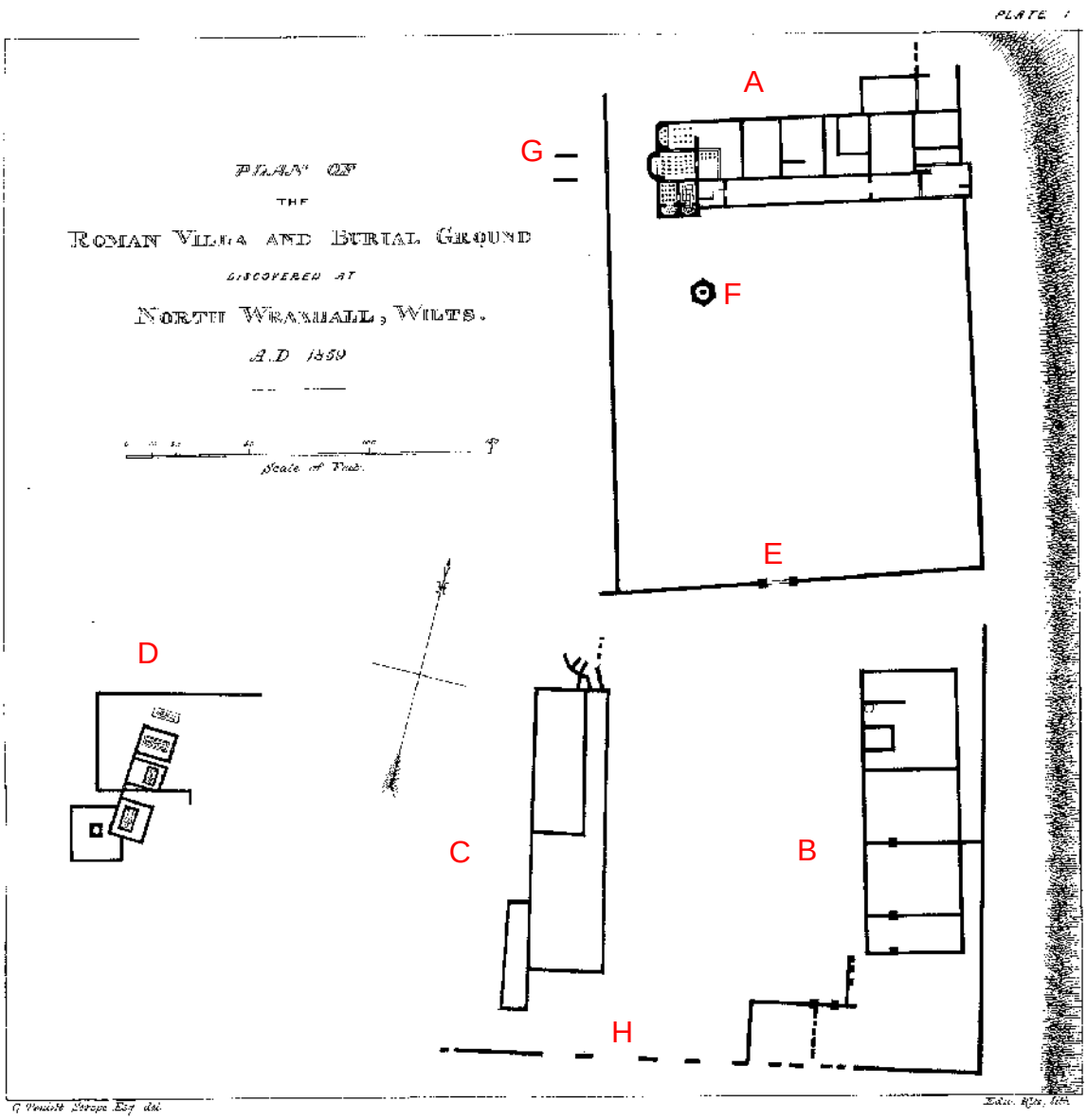


Plate 7: Scrope's plan with labelled features - see text

4.1.4 Scrope's dimensions for the courtyard, E Plate 7, surrounding structure A are given in the report as 220' by 155' (Scrope, 1862, p65) which can be confirmed from the original site plan. The corresponding dimensions derived from the magnetic anomalies are approximately 80m (262.46') by 50m (164.04'). The 80m long wall forming the western side of the courtyard, as derived from the geophysics, perhaps indicates limited investigation by Scrope to the north and north west of building A.

4.1.5 Scrope states (1862, p66) that to the south of the courtyard wall 'the foundations were uncovered of at least two other separate ranges of buildings, each possessing several apartments or small courts, and the whole inclosed

by other boundary walls to the south and east, the latter being the prolongation at a very obtuse angle of the eastern wall of the first described inclosure [referring to the courtyard]'. The 'two separate ranges' referred to are considered to be structures B and C in Plate 4 above. The magnetometry data indicate survival of walls for structure B with a layout consistent with Scrope's plan; the prolongation of the eastern courtyard wall cannot be determined. Unlike structures A and B, no clear evidence for wall survival can be seen in the magnetometry data for structure C. The survey has revealed a zone of variable magnetic response (dipolar 'noise') which could be consistent with building remains, or other occupational/industrial debris, and may indicate considerable disturbance and poor survival of walls. Scrope's report indicates wall disturbance down to the foundations at several points either as a result of removal for use elsewhere or by ploughing (Scrope, 1862, p66).

4.1.6 The magnetometry data have not revealed wall-like anomalies that correspond with features labelled H, Plate 4. A large ditch-like anomaly, (2) Figure 07, within the vicinity of H, has not been identified by Scrope. The broken lines drawn on the excavation plan suggest fragmented survival and disturbance to this part of the site. Two short sections of wall, features G to the north west of the courtyard, do correlate with broad positive responses and suggest an extension of archaeological features to the west and north west of the courtyard.

4.1.7 A cemetery located by the 19th century excavations is labelled D in Plate 4. Scrope appears to have located at least four burials: two within sarcophagi, one within a wooden coffin at a depth of five feet, one within a cist and the ashes of one body within a cinerary urn placed within a cavity cut into a large stone (Scrope, 1862, p69). The magnetometry survey has located at least three pit-like anomalies that correlate closely with the location of the graves indicated by Scrope's plan. There is no clear indication of walls associated with these pits, as indicated in the original plan, and it is again possible that the survival of the archaeology is poor perhaps as a result of ploughing.

4.1.8 A substantial ditch-like anomaly, (2) Figure 07, can be seen as a depression within the field close to the northern field boundary. The geophysical response suggests a maximum width of approximately 5m. The south eastern end of the anomaly has produced the highest magnetic gradient, at over 30nT, suggesting the inclusion of a significant proportion of burnt material within the ditch fill; the higher readings are probably indicative of a 'habitation effect' where soil enhancement increases considerably close to areas of former occupation.

4.1.9 The morphology of ditch-like anomaly (2), Figure 07), could be consistent with a defensive enclosure ditch. The natural steep valley side beyond the eastern field boundary would function as a defensive feature and to complete the enclosure, except for a short section near its south eastern corner, a continuation of the ditch to the valley edge is expected beyond the northern limit of the survey area. The course of the ditch to the north cannot currently be determined. Considering the depth of the depression within the field, a

similar feature would be expected within Out Woods immediately to the north. No feature was visible during a walk over survey within the woods and no feature is apparent within LiDAR data where other low earthworks are visible within the woodland (LiDAR V_ASCII data 'bare earth' Digital Terrain Model, see 4.3 below). It is tentatively suggested that the ditch like depression visible within the northern part of the field could have been enhanced or resulted from more recent erosion.

4.1.10 The terminus at the south eastern end of anomaly (2) may indicate an entrance or utilisation of masonry walls as part of the enclosure. It should be considered that if the ditch was backfilled with a significant proportion of limestone derived from adjacent structures, there may be little or no magnetic response due to the relatively low magnetic susceptibility of the rock.

4.1.11 A number of more minor positive linear anomalies (3), Figure 07, were located within the enclosure formed by (2) and to the south of its southern side. It is suggested that these may represent land division and/or drainage. The narrow and straight appearance of these features contrasts with the broad rather more irregular shape of (2). Although superimposition cannot generally be determined from magnetometry results, the narrow ditch immediately south of the possible enclosure ditch (2) turns to the north west and meets the larger ditch (2) (also having turned to the north west) at an acute angle. This relationship hints at an initial phase of formal well-defined land boundary ditches, associated with the development of a high status Romano-British villa complex, followed by a requirement for defensive earthworks forming a protected enclosure.

4.1.12 The mid 19th century excavations revealed a well that was cleared to a depth of 68' (approximately 20m) before the influx of water prevented further work. Within the fill of the well, human skeletal remains were discovered at a depth of 25' (approximately 7m) and 40' (approximately 12m). The well appeared to have been deliberately filled with masonry and included broken columns and other mouldings; coins of the 4th century were also discovered. Although there is no evidence for the period of time over which the well was infilled, and certainly the feature may have been a useful dumping ground for human remains etc., the presence of substantial masonry fragments suggests some considerable effort involved during its infilling. It would be tempting to consider this evidence, along with the substantial enclosure ditch revealed by the geophysics, as indicators of civil unrest in the late or sub-Roman periods. Recent excavation work carried out on a bath-house 150m to the north west of the villa (Wessex Archaeology, 2008) has clearly demonstrated a change of use to corn drying in the 4th century, indicating the possibility of considerable changes in the function and status of the site particularly in the later Roman period.

4.1.13 A positive linear anomaly representing a ditch-like feature crosses the central part of the survey area with an east west orientation, anomaly (10) Figure 07. The anomaly suggests a substantial ditch approximately 3-4m wide and the magnetic response is moderate between approximately 1 and 7nT. The

anomaly is associated with a low and broad earth bank that runs along its southern side and tends to be most distinct where the geophysical response is wider towards the western end. Two positive linear anomalies (11) are located to the north of anomaly (10) and appear to run parallel to it, these also represent ditches but are much narrower and appear less irregular in construction. It is possible that anomalies (11) are linked to buildings forming part of the villa complex; the northern most of the pair appears to 'dog leg' towards structures labelled C, in Plate 7 above, or converges with the enclosure ditch, anomaly (2).

4.1.14 Ditch-like anomaly (10), and its associated earth bank, could be consistent with a defended promontory. The field to the south of the feature is 'tongue' shaped and surrounded from the east through south to the west by steep valley sides. Effectively, anomaly (10) creates a defended area by creating a significant obstruction to access from the north. Such a feature could be consistent with a prehistoric date; ditch-like anomalies (11) appear to respect the general shape of the feature suggesting that it was extant during the Roman period and possibly served as a land boundary.

4.1.15 Several ditch-like anomalies were located at the southern end of the survey area, (12) Figure 07, and include a possible circular enclosure that extends into woodland to the south. The morphology of the features may be consistent with prehistoric activity and occupation. No clear relationship between these features and the possible promontory enclosure ditch (10) can be established from the geophysics. The evidence available does, however, suggest some significant prehistoric activity at Truckle Hill. Very low magnitude curvilinear anomalies were noted within the vicinity of (9), Figure 07, perhaps indicating a precursor settlement to the Roman villa complex in the early Roman or later prehistoric period; the survey results are, however, unclear within this area.

4.2 Earth resistance survey

4.2.1 The earth resistance survey targeted structural remains identified by magnetometry within the the north eastern part of the site. Approximately 0.5ha was surveyed at high resolution i.e. 0.5m spacing along transects separated by 0.5m. The technique is considerably slower than magnetometry and subject to seasonal variation related to soil moisture content. The results have indicated the potential of the technique as they have provided a complementary dataset to the magnetometry and revealed anomalies not apparent within the magnetic data. The response to individual walls is, on the whole, rather unclear when compared to the magnetometry. The resistance data required enhancement using a high pass filter.

4.2.2 Although the response to individual walls is less well-defined compared to the negative response visible within the magnetometry data, there are indications of further structural remains that have not produced corresponding magnetic anomalies. Anomaly (27), Figure 12, located towards the north west of the main villa building (23), could indicate a separate building. Positive amorphous

anomalies revealed by the magnetometry suggest magnetically enhanced soils correlating with the location of (27), and the western side of the courtyard wall may, in part, be responsible for the high resistance anomaly.

4.2.3 To the south of the main villa structure (27), high and low resistance anomalies probably indicate features within the courtyard area. High resistance anomaly (25) correlates with the position of a well revealed during the mid 19th century excavations, feature F, Plate 7. Anomalies may indicate a formal 'garden' layout although could be caused by building remains.

4.3 LiDAR data

4.3.1 LiDAR (Light Detection and Ranging) data was made available to Archaeological Surveys by Wiltshire County Council Archaeology Service. The LiDAR data have been collected by airborne mapping surveys carried out by the Environment Agency. The data were collected at 1m resolution during 2005, vertical accuracy figures of around ±8cm are possible over some surfaces (Environment Agency, 2008). A Digital Terrain Model (DTM) produced from 'bare earth' measurements, derived from filtering out surface features such as trees and buildings, proved the most informative. Analysis of LiDAR was not part of the original objectives of the survey but has been included in the report. A number of features visible within the dataset provide support to the interpretation of the geophysical survey results and indicate the presence of important extant earthworks in the villa environs.

4.3.2 A greyscale plot of the LiDAR DTM along with an abstraction and interpretation map can be seen within Figure 14. The LiDAR data have been lit from an angle of 45° in order to highlight surf ace variations. The woodland around the survey area has been removed from the LiDAR DTM by filtering clearly revealing earthwork features. Reference to Figure 01 will indicate the position of woodland around the site.

4.3.3 Low earthworks, L1 Figure 14, correlate with the position of buildings within the villa complex, structures A and B, Plate 7. The earthworks were noted during the geophysical survey also. A low linear bank, L2, appears to be associated with the southern limit of the villa complex.

4.3.4 A linear ditch, L3, can be traced within the LiDAR data, the northern end of this feature forms an obvious depression within the field. The ditch relates to a corresponding geophysical anomaly, (2) Figure 07, associated with a possible enclosure, and the feature is also clearly visible on aerial photographs of the site.

4.3.5 A low linear bank, L4, crosses the field from west to east and lies immediately south of a substantial ditch revealed by the magnetometry survey, anomaly (10) Figure 07. The feature may form part of a defended promontory to the south.

4.3.6 A linear depression, L5, appears to run from the south eastern corner of the villa courtyard down the steep valley side to the east. The feature may relate to a drainage channel.

4.3.7 Within Out Woods, to the north of the survey area, a broad low linear bank, L6, appears to extend from the villa complex to the north west. It then turns to the west, close to the valley edge, and it appears to split with a spur turning northwards and changing to a holloway down the valley side. The earthwork continues westerly from the point of the spur and eventually crosses a section of open land before disappearing at the valley edge (not visible in Figure 14). The feature can be traced clearly for a distance of approximately 800m and has been confirmed by walk over survey as a low earthwork, approximately 6m wide, within the woods. The feature does not appear similar to more modern tracks within the woodland, that are cut or worn into the surface rather than built up, and the morphology of the feature is not consistent with a land boundary. The earthwork is, therefore, considered likely to be the remains of a well constructed Roman road linking the site to the Fosse Way. It is unclear as to whether earthwork L7, clearly visible within the survey area, is linked to L6 but this may represent the continuation of the road along the western side of the villa complex.

5 CONCLUSION

5.1

5.1.1 Geophysical survey at Truckle Hill Roman Villa has proved effective for both magnetometry and earth resistance survey. Negative linear anomalies have provided a useful plan of wall lines allowing comparison with the findings of mid 19th century excavations carried out at the site. The negative magnetic response is unusually well-defined and was unexpected prior to the survey. It is possible that the clearance and exposure of walls by Scrope, in the 1850's and 60's, has provided conditions suitable for the location of the wall lines by magnetometry.

5.1.2 Earth resistance survey has provided evidence of structural remains and other features that were not visible on analysis of the magnetic data and are not related to features visible on the mid 19th century excavation plan. The potential for effective earth resistance survey has been indicated by the results obtained across a relatively small proportion of the site. Any further non-intrusive investigations at the site should consider the potential of earth resistance survey.

5.1.3 The geophysical survey results indicate a high level of accuracy within Scrope's plans of the site. There is little doubt that the original plans have been skilfully drawn, the extent of the original excavation remains, however, somewhat uncertain. Geophysical anomalies suggest features immediately adjacent to Scrope's wall lines, such as ditches, that have not been indicated on the plan.

5.1.4 There is some evidence of development within the site suggesting a long period of occupation. Very weak curvilinear anomalies, immediately to the south of the villa complex, may represent early settlement at the site within the late prehistoric or early Roman periods. The evidence is tentative, and further higher resolution survey could perhaps clarify the anomalies. A large ditch, surrounding the western and southern sides of the villa complex, could relate to a defensive enclosure; the geophysics gives some support to the interpretation of this ditch as a late feature although it is likely that only intrusive investigation would confirm this.

5.1.5 Evidence of a ditch and bank feature, crossing the central part of the survey area to the south of the villa complex, has been revealed by the geophysics and analysis of LiDAR data. The feature could be interpreted as the northern defences of a promontory when considered along with the steep sided valley slopes that lie to the west, south and east. Close to the southern limit of the survey area, magnetometry has revealed several ditches including part of a circular enclosure approximately 45m in diameter.

5.1.6 LiDAR data have proved very valuable in assisting interpretation of geophysical anomalies and has demonstrated the presence of earthworks both within the survey area itself and in the surrounding environs. An 800m long section of possible Roman road has been revealed by LiDAR data within woodland immediately to the north of the villa, and earthworks within the valley to the north and north east may also be of archaeological potential.

5.1.7 The information derived from the geophysical survey has demonstrated the archaeological potential of Truckle Hill. The survey provides a useful record of the remains for archiving and future management, and it is hoped that further archaeological investigations will help develop interpretation of the anomalies.

6 ACKNOWLEDGEMENTS

Thanks are due to Wiltshire County Council and English Heritage who have made available the resources to allow this geophysical survey to be carried out. In particular the efforts and enthusiasm of Melanie Pomeroy-Kellinger (Wiltshire County Archaeologist), Helena Cave-Penney (Assistant Archaeologist – Wiltshire), and Phil McMahon (English Heritage Inspector – South West Region) are noted as key to the implementation of the survey. Many thanks to Antony Little for supporting the work and allowing permission to access and survey the site.

7 REFERENCES

British Geological Survey, 1977. *Geological Survey Ten Mile Map, South Sheet, First Edition (Quaternary)*, Scale 1:625 000.

British Geological Survey, 2001. *Solid Geology Map, UK South Sheet, 1:625 000 scale, 4th edition.*

English Heritage, 1995. *Geophysical survey in archaeological field evaluation. Research and Professional Service Guideline No.1.*

Scrope, G. P., 1862. *On A Roman Villa, Discovered at North Wraxall.* Wiltshire Archaeological Magazine 1862, **7**, pp59-74.

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

Wessex Archaeology, 2008. *A detached Roman Bath-house at Truckle Hill, North Wraxall, Wiltshire. Assessment Report on an Archaeological Excavation, Recording and Outreach Programme. (Ref 58521.01).* Unpublished typescript report.

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

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

Appendix B – metadata

Raw magnetometry data

COMPOSITE
Filename: mag-raw.xcp
Instrument Type: Grad 601 (Magnetometer)
Units: nT
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 2 @ 0.00 m spacing.
Dummy Value: 32702
Origin: Zero

Dimensions
Composite Size (readings): 2280 x 330
Survey Size (meters): 570 m x 330 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 20.00
Min: -20.00
Std Dev: 2.58
Mean: 0.37

Processes: 3
1 Base Layer
2 Clip from -30 to 30
3 Clip from -20 to 20

Source Grids: 158
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Processed magnetometry data

COMPOSITE
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Instrument Type: Grad 601 (Magnetometer)
Units: nT
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 2 @ 0.00 m spacing.
Dummy Value: 32702
Origin: Zero

Dimensions
Composite Size (readings): 2280 x 330
Survey Size (meters): 570 m x 330 m
Grid Size: 30 m x 30 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 5.04
Min: -5.00
Std Dev: 1.68
Mean: 0.08

Processes: 35
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2 Clip from -100 to 100
3 Clip from -50 to 50
4 Clip from -10 to 10
5 DeStripe Median Traverse: Grids: 69.xgd 66.xgd 67.xgd 68.xgd 63.xgd 64.xgd 59.xgd 60.xgd 61.xgd 55.xgd 56.xgd 57.xgd 51.xgd 52.xgd 53.xgd 47.xgd 48.xgd 49.xgd 43.xgd 44.xgd 45.xgd 39.xgd 40.xgd 41.xgd 35.xgd 36.xgd 37.xgd 31.xgd 32.xgd 33.xgd 27.xgd 28.xgd 29.xgd 23.xgd 24.xgd 25.xgd 19.xgd 20.xgd 21.xgd 15.xgd 16.xgd 17.xgd 11.xgd 12.xgd 13.xgd
6 DeStripe Median Traverse: Grids: 07.xgd 08.xgd 04.xgd 05.xgd 01.xgd 02.xgd
7 DeStripe Median Traverse: Grids: 09.xgd 06.xgd 03.xgd
8 DeStripe Median Traverse: Grids: 38.xgd 34.xgd 30.xgd 26.xgd 22.xgd 18.xgd 14.xgd 10.xgd
9 DeStripe Median Traverse: Grids: 70.xgd 71.xgd
10 DeStripe Mean Traverse: Grids: 72.xgd Threshold: 2 SDs
11 DeStripe Median Traverse: Grids: 73.xgd
12 DeStripe Mean Traverse: Grids: 74.xgd 75.xgd 77.xgd 78.xgd 80.xgd 81.xgd Threshold: 2 SDs
13 DeStripe Median Traverse: Grids: 76.xgd 79.xgd 82.xgd
14 DeStripe Median Traverse: Grids: 85.xgd 89.xgd 93.xgd 97.xgd 101.xgd 105.xgd 109.xgd 113.xgd 117.xgd
15 DeStripe Median Traverse: Grids: 88.xgd 92.xgd 96.xgd 100.xgd 104.xgd 108.xgd 112.xgd 116.xgd
16 DeStripe Median Traverse: Grids: 83.xgd 87.xgd 91.xgd 95.xgd 99.xgd 103.xgd 107.xgd 111.xgd 115.xgd
17 DeStripe Mean Traverse: Grids: 84.xgd Threshold: 2 SDs
18 DeStripe Median Traverse: Grids: 86.xgd 90.xgd 94.xgd 98.xgd 102.xgd 106.xgd 110.xgd 114.xgd
19 DeStripe Median Traverse: Grids: 158.xgd
20 DeStripe Mean Traverse: Grids: 157.xgd Threshold: 2 SDs
21 DeStripe Median Traverse: Grids: 155.xgd 152.xgd 149.xgd
22 DeStripe Median Traverse: Grids: 156.xgd 153.xgd 154.xgd 150.xgd 151.xgd 147.xgd 148.xgd
23 DeStripe Median Traverse: Grids: 145.xgd 146.xgd 143.xgd 144.xgd 141.xgd 142.xgd 139.xgd 140.xgd 138.xgd
24 DeStripe Median Traverse: Grids: 118.xgd 122.xgd 126.xgd 130.xgd 134.xgd
25 DeStripe Median Traverse: Grids: 119.xgd 123.xgd
26 DeStripe Median Traverse: Grids: 120.xgd 124.xgd 128.xgd
27 DeStripe Median Traverse: Grids: 136.xgd
28 DeStripe Median Traverse: Grids: 121.xgd 15.xgd 16.xgd 125.xgd 11.xgd 12.xgd 129.xgd 07.xgd 08.xgd 133.xgd 04.xgd 05.xgd 137.xgd 01.xgd 02.xgd
29 De Stagger: Grids: 105.xgd Mode: Both By: -1 intervals
30 De Stagger: Grids: 104.xgd Mode: Both By: -1 intervals
31 De Stagger: Grids: 99.xgd Mode: Both By: -1 intervals
32 De Stagger: Grids: 98.xgd Mode: Both By: -1 intervals
33 De Stagger: Grids: 73.xgd Mode: Outbound By: 1 intervals
34 Clip from -5 to 5
35 De Stagger: Grids: 29.xgd Mode: Outbound By: 1 intervals

Raw resistance data

COMPOSITE
Filename: res-raw.xcp
Instrument Type: TR/CIA (Resistance)
Units: ohm
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 0 @ 0.00 m spacing.
Dummy Value: -2147483648
Origin: Zero

Dimensions
Composite Size (readings): 120 x 180
Survey Size (meters): 60 m x 90 m
Grid Size: 30 m x 30 m
X Interval: 0.5 m
Y Interval: 0.5 m

Stats
Max: 207.31
Min: 74.19
Std Dev: 15.27
Mean: 105.29

Processes: 1
1 Base Layer

Source Grids: 6
1 Col:0 Row:0 grids\05.asg
2 Col:0 Row:1 grids\03.xgd
3 Col:0 Row:2 grids\04.xgd
4 Col:1 Row:0 grids\01.xgd
5 Col:1 Row:1 grids\06.xgd
6 Col:1 Row:2 grids\02.xgd

Processed resistance data

COMPOSITE
Filename: res-proc.xcp
Instrument Type: TR/CIA (Resistance)
Units: ohm
Direction of 1st Traverse: 0 deg
Collection Method: ZigZag
Sensors: 0 @ 0.00 m spacing.
Dummy Value: -2147483648
Origin: Zero

Dimensions
Composite Size (readings): 120 x 180
Survey Size (meters): 60 m x 90 m
Grid Size: 30 m x 30 m
X Interval: 0.5 m
Y Interval: 0.5 m

Stats
Max: 10.00

Min: -10.00
Std Dev: 3.19
Mean: -0.09

Processes: 10
1 Base Layer
2 Range Match (Area: Top 120, Left 0, Bottom 179, Right 59) to Top edge
3 Edge Match (Area: Top 120, Left 0, Bottom 179, Right 59) to Top edge
4 Edge Match (Area: Top 0, Left 60, Bottom 59, Right 119) to Left edge
5 Range Match (Area: Top 0, Left 0, Bottom 59, Right 119) to Bottom edge
6 High pass Gaussian filter: Window: 21 x 21
7 Clip at 3 SD
8 Clip from -10 to 10
9 Search & Replace From: -2 To: 2 With: -2147483648 (Area: Top 106, Left 94, Bottom 115, Right 98)
10 Clip from -10 to 10

Appendix C – digital archive

Survey results are produced in hardcopy using A4 for text and A3 for plots (all plots are scaled for A3). In addition digital data created during the survey are supplied on DVD. Further information on the production of the report and the digital formats involved in its creation are set out below.

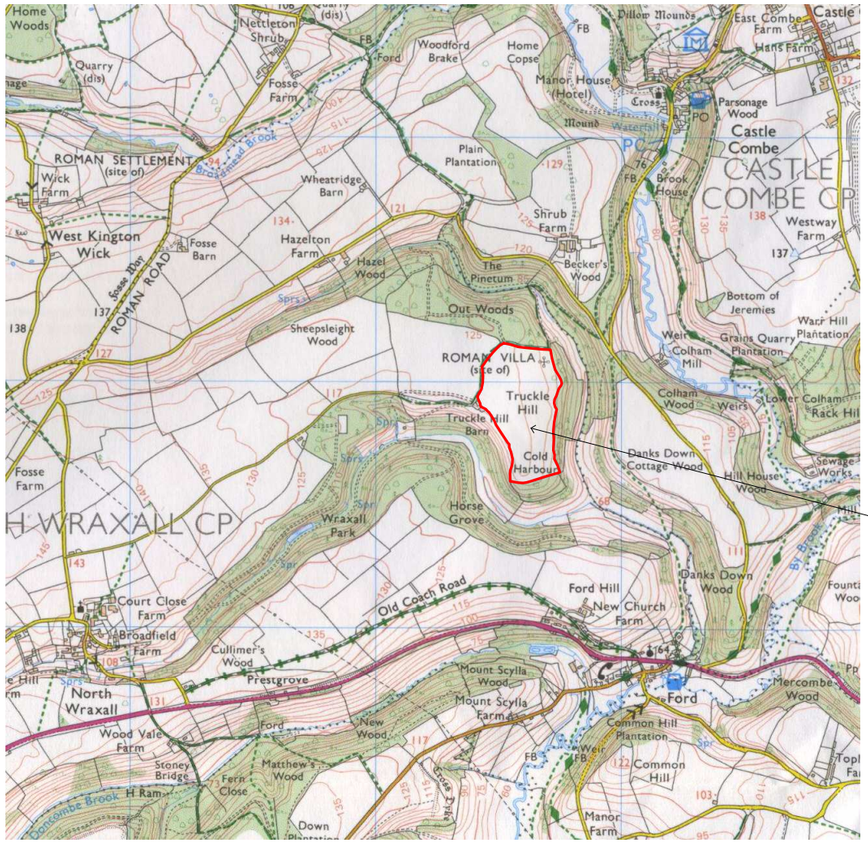
This report has been prepared using the following software on a Windows XP platform:

- ArcheoSurveyor version 2.2.0.0 (geophysical data analysis),
- MapInfo Professional 9 (report figures),
- NIP2 (image rotation),
- OpenOffice.org 2.4 Writer (document text),
- PDF Creator version 0.9 (PDF archive).

Digital data are supplied on DVD which includes the following files:

- ArcheoSurveyor grid and composite files for all geophysical data,
- CSV files for raw and processed composites,
- geophysical composite file graphics as Bitmap images,
- MapInfo TAB files,
- abstraction as DXF file,
- report text as OpenOffice.org ODT file,
- report text as Word 2000 doc file,
- report text as rich text format (RTF),
- report text as PDF,
- PDFs of all figures,
- photographic record in JPEG format.

The DVD structure is formed from a tree of directories under the title J226 Truckle Hill – DVD. Directory titles include Data, Documentation, CAD/MapInfo, PDFs and Photos. Multiple directories exist under Data and hold Grid, Composite and Graphic files with CSV composite data held in Export.



Survey area

Mapping reproduced from OS Explorer map no. 156 1:25 000 by permission of Ordnance Survey on behalf of The Controller of Her Majesty's Stationery Office. Crown copyright. All rights reserved. Licence number 100043739.

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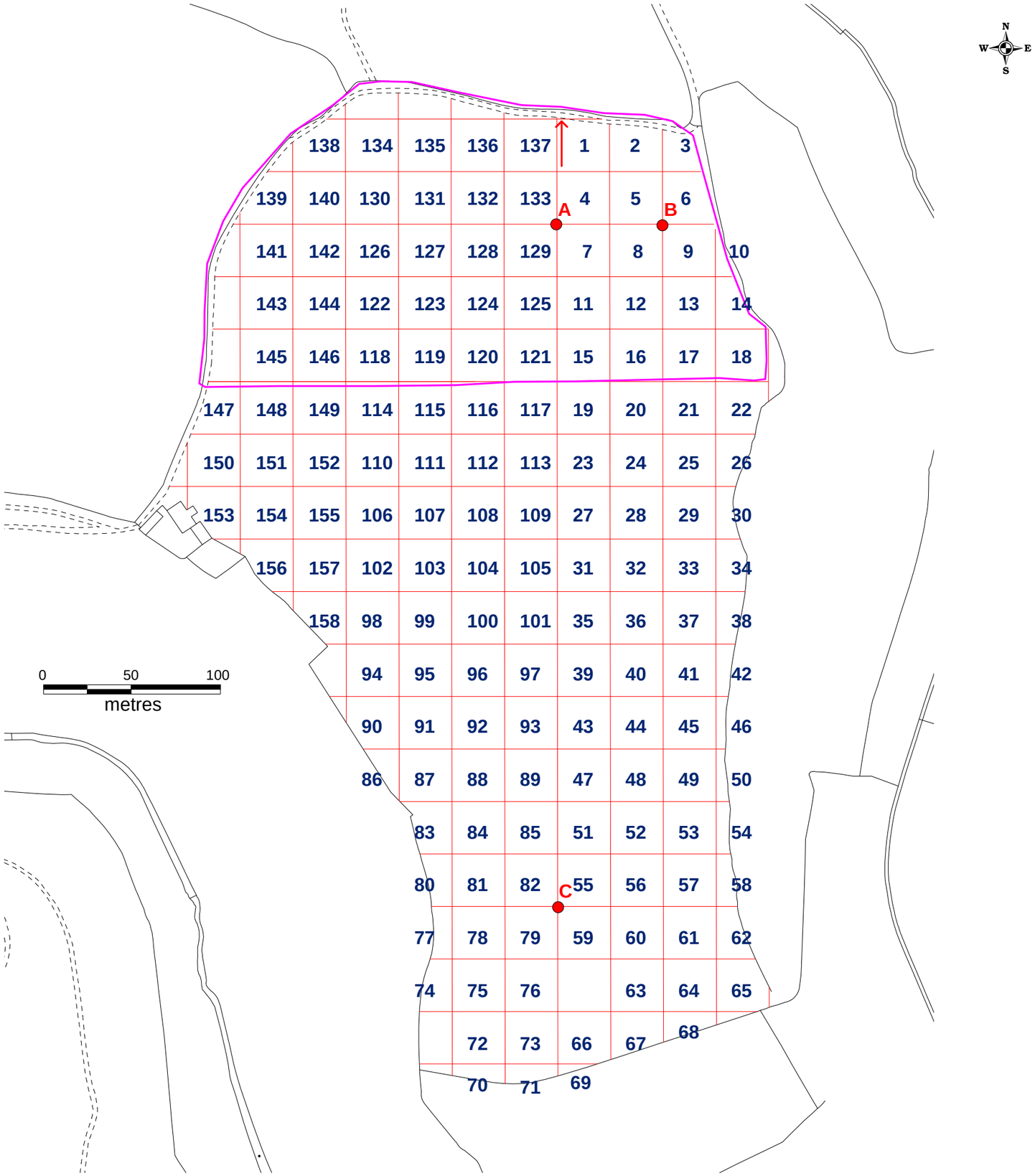
Truckle Hill Roman Villa
North Wraxall
Wiltshire

Survey location map

1:25 000

Scale true at A3

Fig 01



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North Wraxall
Wiltshire

Grid Referencing

Start traverse and direction

Scheduled Ancient Monument boundary

Survey grid set to OSGB36 coordinates using RTK GPS (Leica Smartnet system RTCMv2)

Node positional accuracy better than 20mm

A 383630, 176080
B 383690, 176080
C 383630, 175690

1:2500

Scale true at A3

Fig 02

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North Wraxall
Wiltshire

Greyscale plot of
raw magnetometry data

+20nT

-20nT

1:2500

Scale true at A3

Fig 03

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Truckle Hill Roman Villa
North Wraxall
Wiltshire

Greyscale plot of processed magnetometry data

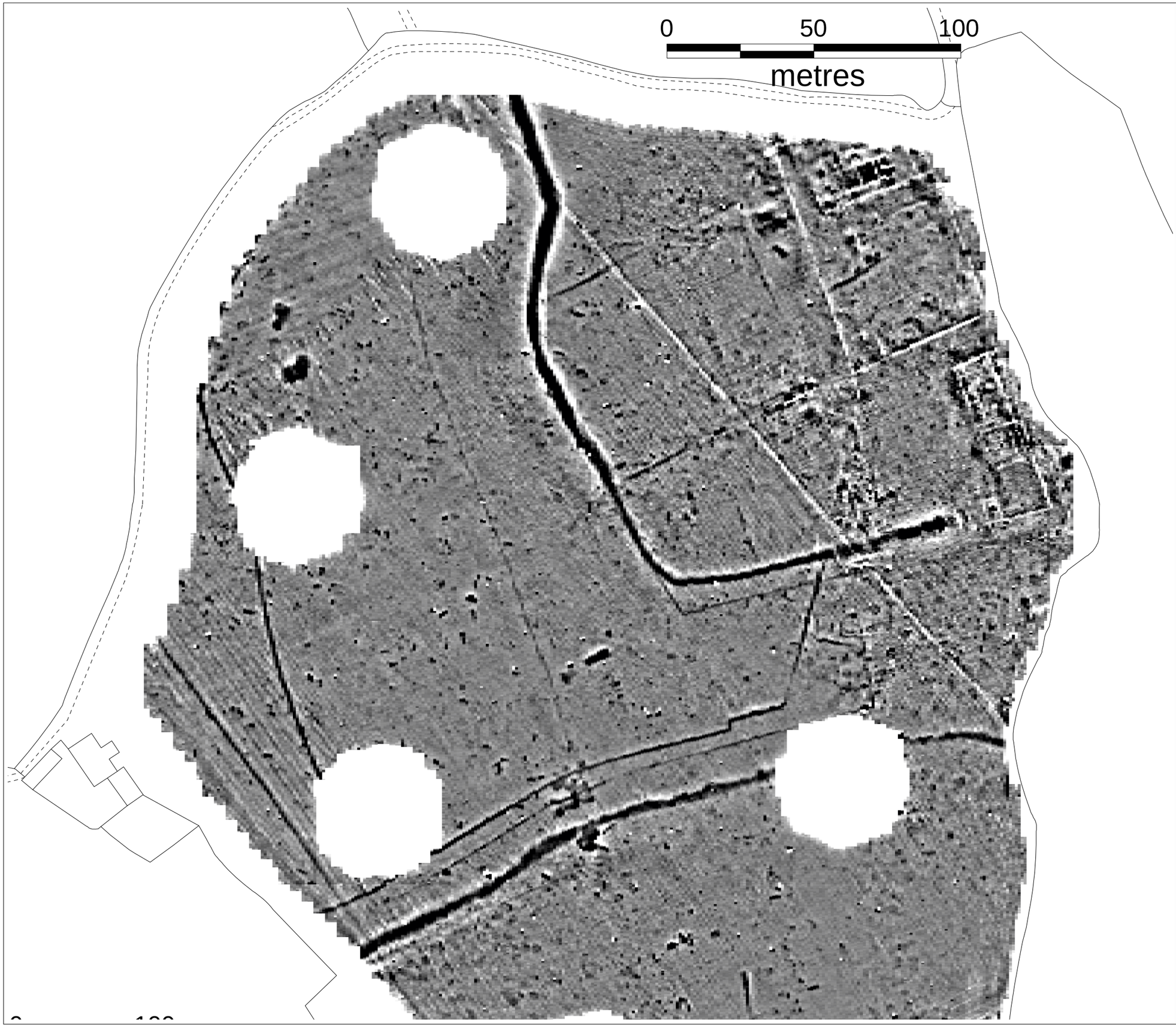
+5nT

-5nT

1:2500

Scale true at A3

Fig 04



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Truckle Hill Roman Villa
North Wraxall
Wiltshire

Greyscale plot of processed magnetometry data - northern section

+5nT

-5nT

1:1250

Scale true at A3

Fig 05

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Truckle Hill Roman Villa
North Wraxall
Wiltshire

Greyscale plot of processed magnetometry data - southern section

+5nT

-5nT

N

W E

S

0 50 100

metres

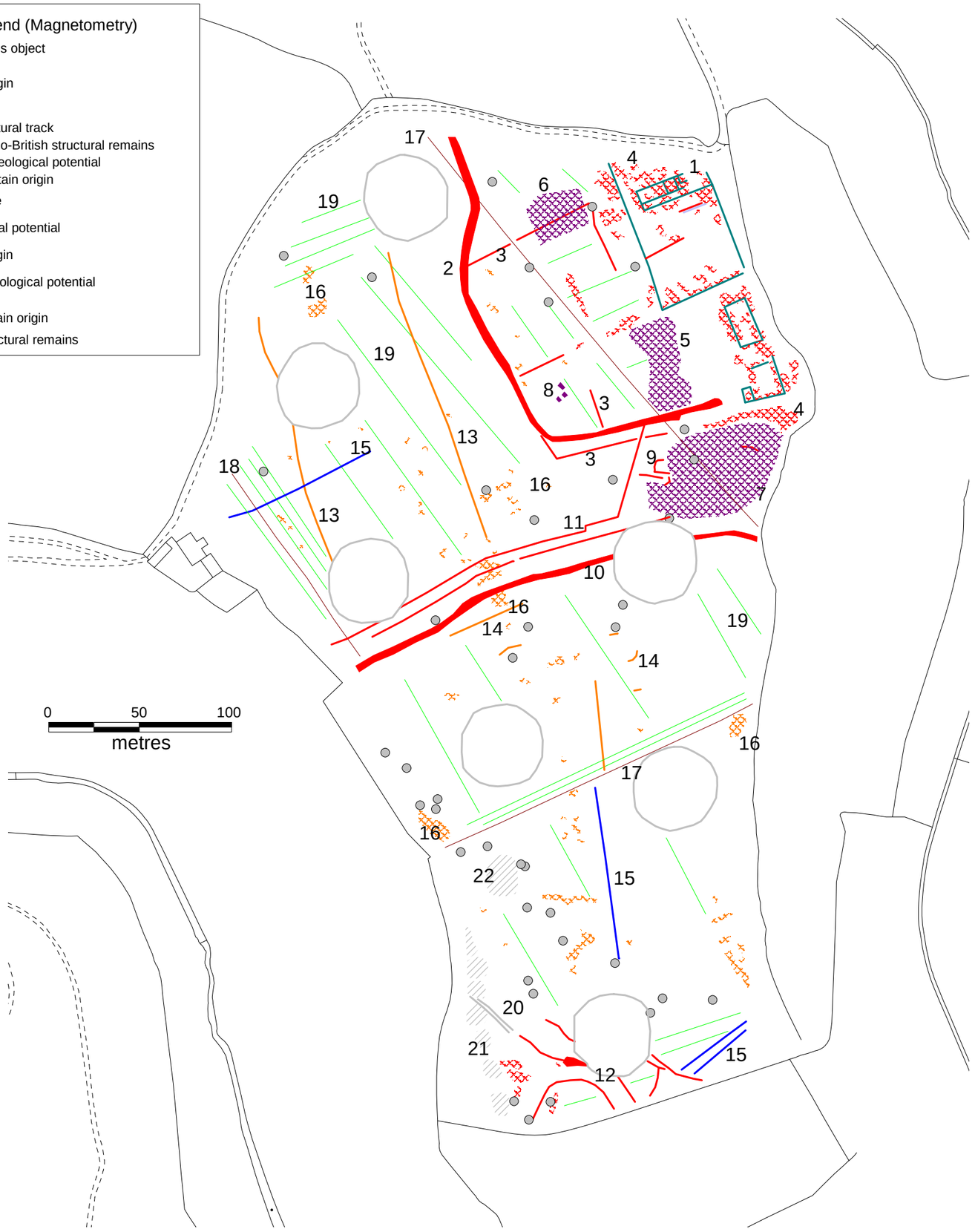
1:1250

Scale true at A3

Fig 06

Abstraction and Interpretation Legend (Magnetometry)

- Discrete dipolar response - ferrous object
- Former field boundary
- Linear anomaly of agricultural origin
- Magnetic disturbance
- Negative linear anomaly - agricultural track
- Negative linear anomaly - Romano-British structural remains
- Negative linear anomaly of archaeological potential
- Negative linear anomaly of uncertain origin
- Positive anomaly - possible grave
- Positive anomaly of archaeological potential
- Positive anomaly of uncertain origin
- Positive linear anomaly of archaeological potential - cut feature
- Positive linear anomaly of uncertain origin
- Variable response - possible structural remains



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Truckle Hill Roman Villa
North Wraxall
Wiltshire

Abstraction and interpretation of magnetometry data

1:2500

Scale true at A3

Fig 07

Abstraction and Interpretation Legend

- Discrete dipolar response - ferrous object
- Former field boundary
- Linear anomaly of agricultural origin
- Magnetic disturbance
- Negative linear anomaly - agricultural track
- Negative linear anomaly - Romano-British structural remains
- Negative linear anomaly of archaeological potential
- Negative linear anomaly of uncertain origin
- Positive anomaly - possible grave
- Positive anomaly of archaeological potential
- Positive anomaly of uncertain origin
- Positive linear anomaly of archaeological potential - cut feature
- Positive linear anomaly of uncertain origin
- Variable response - possible structural remains

0 50 100

metres

N W E S

Archaeological Surveys Ltd

Truckle Hill Roman Villa
North Wraxall
Wiltshire

Abstraction and interpretation - northern section

1:1250

Scale true at A3

Fig 08

Abstraction and Interpretation Legend

- Discrete dipolar response - ferrous object
- Former field boundary
- Linear anomaly of agricultural origin
- Magnetic disturbance
- Negative linear anomaly - agricultural track
- Negative linear anomaly - Romano-British structural remains
- Negative linear anomaly of archaeological potential
- Negative linear anomaly of uncertain origin
- Positive anomaly - possible grave
- Positive anomaly of archaeological potential
- Positive anomaly of uncertain origin
- Positive linear anomaly of archaeological potential - cut feature
- Positive linear anomaly of uncertain origin
- Variable response - possible structural remains

N
W E
S

0 50 100
metres

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Wiltshire

Abstraction and interpretation - southern section

1:1250

Scale true at A3

Fig 09

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Truckle Hill Roman Villa
North Wraxall
Wiltshire

Greyscale plot of raw resistance data

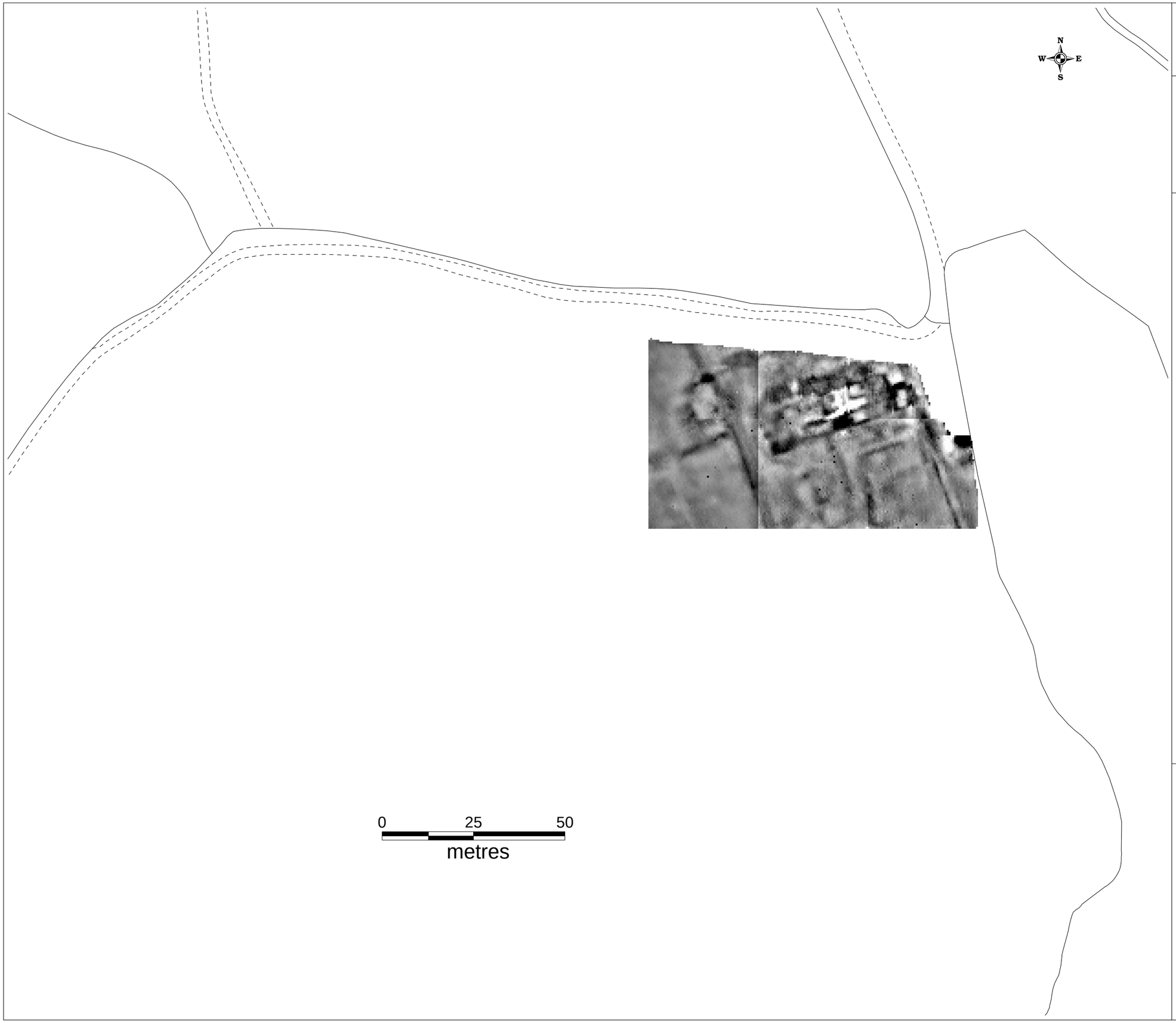
135 ohms

75 ohms

1:1000

Scale true at A3

Fig 10



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Truckle Hill Roman Villa
North Wraxall
Wiltshire

Greyscale plot of processed resistance data

+10 ohms

-10 ohms

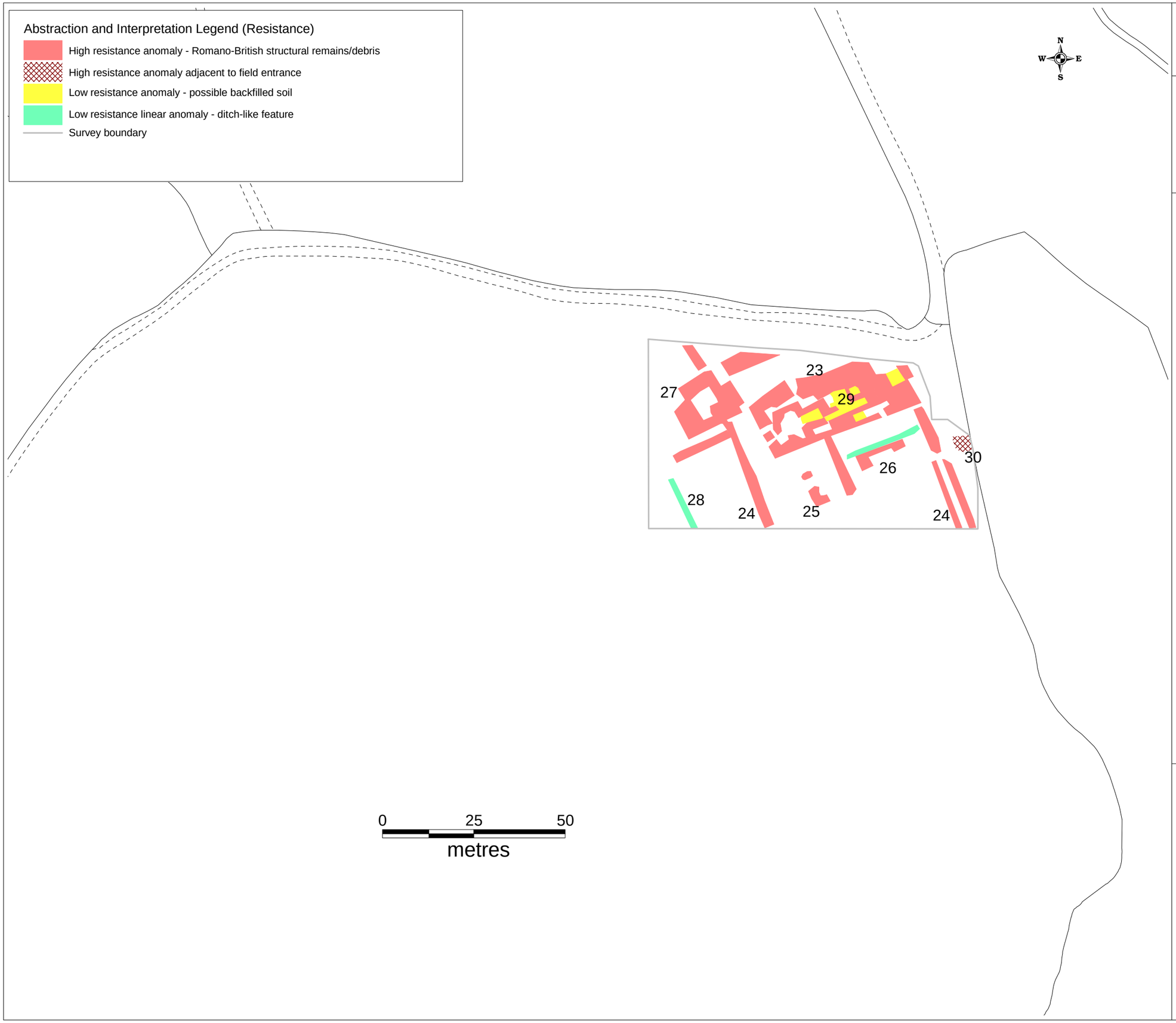
1:1000

Scale true at A3

Fig 11

Abstraction and Interpretation Legend (Resistance)

- High resistance anomaly - Romano-British structural remains/debris
- High resistance anomaly adjacent to field entrance
- Low resistance anomaly - possible backfilled soil
- Low resistance linear anomaly - ditch-like feature
- Survey boundary



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North Wraxall
Wiltshire

Abstraction and interpretation of resistance data

1:1000

Scale true at A3

Fig 12

Abstraction and Interpretation Legend (Magnetometry)

- Discrete dipolar response - ferrous object
- Former field boundary
- Linear anomaly of agricultural origin
- Magnetic disturbance
- Negative linear anomaly - agricultural track
- Negative linear anomaly - Romano-British structural remains
- Negative linear anomaly of archaeological potential
- Negative linear anomaly of uncertain origin
- Positive anomaly - possible grave
- Positive anomaly of archaeological potential
- Positive anomaly of uncertain origin
- Positive linear anomaly of archaeological potential - cut feature
- Positive linear anomaly of uncertain origin
- Variable response - possible structural remains

N W E S

0 25 50

metres

PLATE I.

THE ROMAN VILLA AND BURIAL GROUND DISCOVERED AT NORTH WRAXHALL, WILTS. A.D. 1859

Scale 16 Feet.

G. Powell Scrope Esq. del.

Archaeological Surveys Ltd

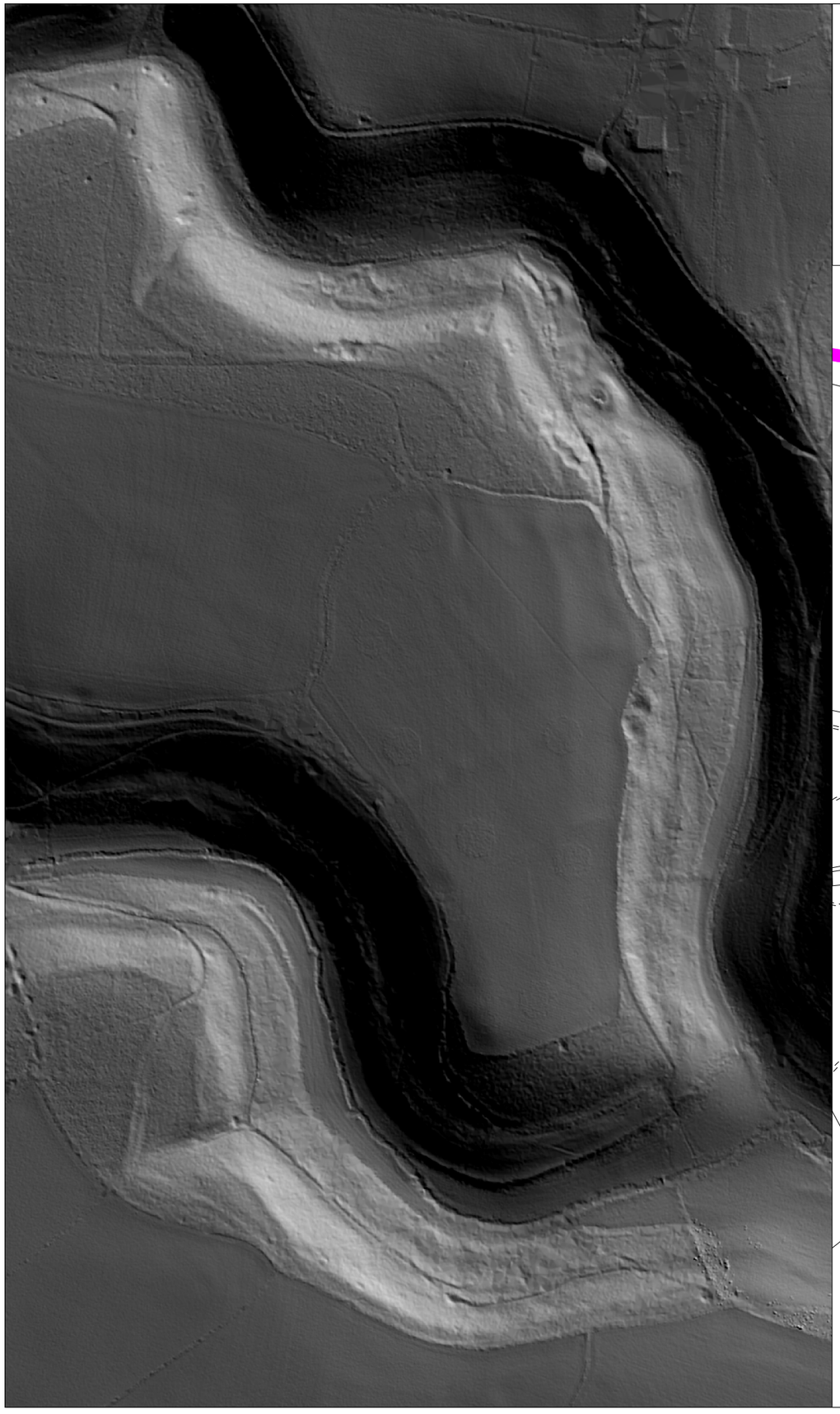
Truckle Hill Roman Villa
North Wraxall
Wiltshire

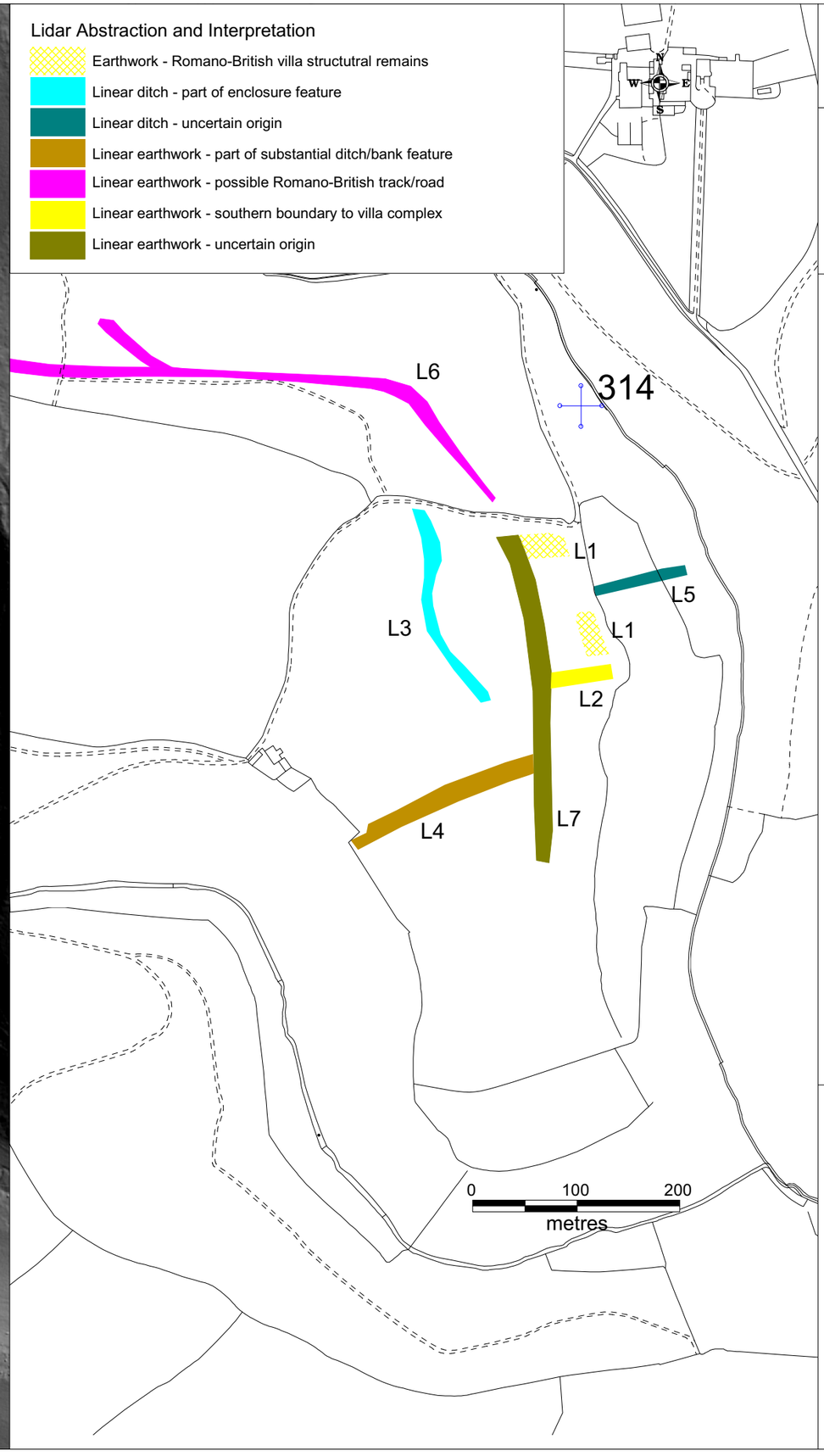
Abstraction and interpretation of magnetometry data with Scrope's mid 19th century plan

1:1000

Scale true at A3

Fig 13





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Wiltshire

Greyscale plot and abstraction and interpretation of Lidar data

1:5000

Scale true at A3

Fig 14