STRATASCAN

Geophysical Survey Report

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Gloucester

for

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1 SUMMARY OF RESULTS

Field H has identified the extents of an enclosure first revealed in a survey carried out by Stratascan in 2002 (J1721). A number of smaller areas of archaeological interest have been identified across a further six fields. Evidence for ridge and furrow has been identified across the entire survey area.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by Crest Strategic Projects Ltd to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation of an area outlined for proposed development for housing and mixed uses. This survey is a continuation of the geophysical survey carried out by Stratascan in October-November 2002 (J1721).

2.2 Site location

The site is located at Hunts Grove in Hardwicke, near Gloucester at OS ref. SO809117.

2.3 Description of site

The survey area is approximately 40ha of agricultural land. Fields A, B and H had been recently ploughed whilst the other fields were under pasture at the time of survey. The topography across the site varies with an area of higher ground to the east (Field H), sloping down to the southwest where the ground becomes flat.

View south westwards over (recently ploughed) Field A

2.4 Geology and soils

The underlying geology is Lower Lias (British Geological Survey South Sheet, Third Edition Solid, 1979). The overlying soils across the higher ground on the northeast are known as Evesham 2 soils which are typical calcareous pelosols and consist of slowly permeable calcareous clayey soils. In the southwest over the flatter ground the soils are Badsey 2 soils which are typical brown calcareous earths. These consist of well drained fine calcareous soils (Soil Survey of England and Wales, Sheet 5 South West England).

2.5 Site history and archaeological potential

The following information has been taken from a desk based assessment by Wessex Archaeology commissioned initially by Landscape Design Associates and later by Crest Strategic projects Ltd.

2.4.1 *Prehistoric period*

No evidence for activity of prehistoric date has been recorded within the Site or the Study Area. This is comparable with that for the general locality, which has produced only a few isolated scatters of worked flint tools, the closest at Rea Bridge, 2.5km to the north (Sermon 1994). Two dubious Neolithic long barrows were recorded west of Brook Farm, Whaddon, northeast of the Study Area, in 1930.

2.4.2 *Roman period*

The site lies 6-7 km to the southwest of the Roman town of *Glevum,* and 500m to the south-east of the major Roman road which connected the town with the port at *Abonae*.

On the eastern edge of the survey area on the higher ground two sites are known. In Area 6 a cemetery was discovered in 1847 with an unspecified number of burials. Less than 100m further to the north in Area 5, a site was located within a field recorded on the Hardwicke tithe map as “Burnt Piece” which has been taken to refer to a possible settlement. No indication of any features within these two areas could be seen on aerial photographs beyond a former field boundary running southeast from Hunts Grove.

Immediately to the northwest of Area 2 a single burial was found. Although undated, it has been presumed to be Romano-British in date, due to its close proximity with the Roman road and possible settlement sites. Further on to the northwest approximately parallel to the route of the present A38 is the probable course of the Gloucester to Sea Mills Roman road. To the north of Area 1 a field boundary containing 2nd - 3rd century material was discovered during evaluation of a block of land at Waterwells Farm. Round to the southeast of the site on the east side of the railway and the M5 is the site of a possible 2nd - 3rd century settlement which was identified from surface scatters of building material and pottery found in association with a series of shallow depressions and banks.

To the southwest of the survey area at Junction 12 of the M5 the desk based assessment identified two sites within the fields immediately to the southwest of Haresfield Lane

running to Colethrop Farm. A scatter of material close to Summerhouse Farm may indicate the location of a possible settlement site. A series of possibly related linear and enclosure cropmarks has been noted adjacent to Haresfield Lane, 200m to the west of Colethrop Farm. While a Roman or prehistoric date for this complex has been put forward the complex may well be later in date. Although no clear indication of the main complex was visible on viewed aerial photographs, the small oval area of retarded cereal growth noted during the Walkover Survey by Wessex Archaeology was in a similar location to that shown on plots of the complex.

2.4.3 *Post-Roman and Anglo Saxon periods*

No evidence relating to post-Roman or Anglo-Saxon activity has been found within the survey area. However, by the end of the Anglo-Saxon period, the land is likely to have been divided between a number of manor estates within the Hundred of Whitstone, i.e. Haresfield, Hardwick and Stanish, etc. Many of these estates were themselves part of larger estates and remained un-named in the Domesday Book of 1086. One example of this is Quedgeley, which was contained within Gloucester Abbey's Standish estate.

2.4.4 *Medieval Period*

Apart from the Romano-British period, the Medieval period provides the main evidence for settlement within the survey area. The Domesday Book demonstrates that lands within the general area were part of different manorial estates at the beginning of the Medieval period. As far as a settlement date can be determined, place-name evidence suggests that Haresfield to the south was occupied at least by the 11th century, and Hardwick to the west by the early 13th century. The general economic and social character of the parishes of Hardwicke and Haresfield throughout the Medieval period was essentially rural.

The proposed development area lies adjacent to the main Medieval route from Gloucester to Bristol (now the A38) and two local roads established by the end of the 13th century. Haresfield Lane runs through to the south of the survey area to Haresfield.

Excavations during the construction of the M5 motorway recorded low earthworks and a hollow way belonging to a possible Medieval shrunken farmstead located within the southern halve of a field bisected by the motorway immediately to the south of Colethrop Farm.

Between Areas 1 and 5 is the Hunts Grove woodland wherein undated evidence of coppicing and a possible ditched boundary identified during the Walkover Survey at the fringes of Medieval settlement, suggest that at least some of the present woodland parcel may be ancient in origin. The Shorn Brook to the south which sub-divides the Site is documented in the late 13th and early 14th century as "Turdels Brook" and "Pike Brook" respectively. This formed part of the boundary of the Colethrop Estate which contained the present Colethrop Farm. Although the manor of Colethrop was first documented in 1618, the manor may have had earlier origins, since Medieval settlement was recorded at Colethrop, to the south-east of the proposed development area.

In addition to the three possible fragments of ridge and furrow cultivation noted around Colethrop Farm in Areas 7, 9 and 12 during the Walkover Survey by Wessex

Archaeology, a large concentration of ridge and furrow was noted in Area 2 from aerial photographs.

To the north, east and southwest of the survey area settlement sites have been suggested from cropmark evidence and Tithe Map field names.

2.4.5 *Post-medieval and modern periods*

Within the survey area only one significant Post-medieval site is present, that of Colethrop Farm. Although the main structure of the redbrick farmhouse dates to the early 19th century, the ashlar foundations and adjacent stone barn are likely to be at least early Post-medieval in date. The existence of a Medieval farm at this location cannot be ruled out, especially given the close proximity of the farm to large concentrations of ridge and furrow cultivation and Haresfield Lane.

To the east is the mid 19th century Birmingham to Bristol railway line, built initially by the Cheltenham and Great Western Union Railway (CGWUR), but completed by the Great Western Railway (GWR).

The 19th century tithe and inclosure award map for Hardwicke covers the majority of the site and shows that by the mid 19th century the inclosure of the former Medieval open fields appears to have been completed. Ordnance Survey maps from 1886 onwards show relatively little change in the pattern of field boundaries, with only a small number of fields being sub-divided or enlarged at the eastern and western edges of the site, and meadows immediately to the east of Colethrop Farm.

Two major impacts are evident immediately outside the boundaries of the Site. The first was the construction of the RAF Quedgeley supply depot in 1939-40 west of Area 1 and north of Area 2. Some of the buildings there have significant historical/industrial archaeological value in their own right. Wartime photographs appear to show at least three possible bomb craters at the junction of the A38 and Haresfield Lane. The second major impact was the construction of the M5 motorway in the early 1970s which cut across a number of enclosed fields.

2.6 Survey objectives

The objective of the survey was to locate any features of possible archaeological significance in order that they may be assessed prior to development.

2.7 Survey methods

Detailed magnetic survey (gradiometry) was used as an efficient and effective method of locating archaeological anomalies. More information regarding this technique is included in the Methodology section below.

3 METHODOLOGY

3.1 Date of fieldwork

The fieldwork was carried out over 22 days from 5.04.2005-4.05.2005. Weather conditions during the survey were variable, occasionally very wet.

3.2 Grid locations

The location of the survey grids has been plotted in Figure 2 together with the referencing information. The survey area was set out using GPS to position a number of points at 60m intervals across the site. These points were then used to position baselines from which the 30m survey grids were set out.

3.3 Survey equipment

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. The Grad601-2 consists of two high stability fluxgate gradiometers suspended on a single frame. Each sensor has a 1m separation between the sensing elements increasing the sensitivity to small changes in the Earths magnetic field.

3.4 Sampling interval, depth of scan, resolution and data capture

3.4.1 Sampling interval

Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid.

3.4.2 Depth of scan and resolution

The Grad601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. The collection of data at 0.25m centres provides an appropriate methodology balancing cost and time with resolution.

3.4.3 Data capture

The readings are logged consecutively into the data logger which in turn is daily down-loaded into a portable computer whilst on site. At the end of each job, data is transferred to the office for processing and presentation.

3.5 Processing, presentation of results and interpretation

3.5.1 Processing

Processing is performed using specialist software known as *Geoplot 3.* This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves 'flattening' the background levels with respect to adjacent traverses and adjacent grids. 'Despiking' is also performed to remove the anomalies resulting from small iron objects often found on agricultural land. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The followng schedule shows the basic processing carried out on all processed gradiometer data used in this report:

1. *Despike* (useful for display and allows further processing functions to be carried out more effectively by removing extreme data values)

   Geoplot parameters:
   X radius = 1, y radius = 1, threshold = 3 std. dev.
   Spike replacement = mean

2. *Zero mean grid* (sets the background mean of each grid to zero and is useful for removing grid edge discontinuities)

   Geoplot parameters:
   Threshold = 0.25 std. dev.

3. *Zero mean traverse* (sets the background mean of each traverse within a grid to zero and is useful for removing striping effects)

   Geoplot parameters:
   Least mean square fit = off

3.5.2 Presentation of results and interpretation

The presentation of the data for each site involves a print-out of the raw data both as greyscale (Figures 3,8,13,18,23,28,33,38,43) and trace plots (Figures 4-5,9-10,14-15,19-20,24-25,29-30,34-35,39-40,44-45), together with a greyscale plot of the processed data (Figures 6,11,16,21,26,31,36,41,46,48). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site (Figure 7,12,17,22,27,32,37,42,47,49).

4 RESULTS

4.1 Field A (Figures 3-7)

Field A contains a large spread of magnetic debris towards the north of the survey area, which probably relates to modern activity. The large number of strong discrete positive anomalies with negative returns seen in the data are likely to be caused by near surface ferrous objects.

A number of low magnitude discrete positive anomalies have been identified in Field A. These anomalies may represent possible pits of archaeological origin, although the presence of a large number of ferrous objects may suggest these anomalies are caused by modern disturbance.

A number of positive linear anomalies running parallel with one another in a northeast to south west alignment run across the site, these are likely to represent agricultural marks, most probably ridge and furrow. Further sets of parallel positive linear anomalies are located to the north and south of Field A; these are also likely to be ridge and furrow.

4.2 Field B (Figures 8-12)

Towards the south of Field B, in close proximity to the M5, three positive curvilinear anomalies have been identified. These anomalies may represent cut features of archaeological origin.

Ridge and furrow has also been identified with Field B, in the form of positive and negative linear anomalies, running in a northeast to southwest alignment. A possible relict field boundary may have been identified in the form of a magnetic linear anomaly (perhaps a buried metal fence line), although due to the high amplitude readings of the linear anomaly (see Figures 9-10) it may also represent a service (possibly associated with the motorway).

In the southwest corner of Field B are large areas of magnetic debris, likely to be caused by modern activity associated with the construction of the M5. A spread of strong discrete positive anomalies with negative returns can be seen across the north and southwest corner of Field B, these are likely to represent near surface ferrous objects, associated with modern activity. A strip of magnetic disturbance at the southern edge of the field is due to the presence of the motorway.

4.3 Field C (Figures 13-17)

Field C contains evidence of ridge and furrow, in the form of parallel positive and negative linear anomalies in a northeast to southwest alignment.

The nearby road and field boundary to the west and a large tree to the east of Field C have caused two areas of magnetic disturbance. A large spread of strong discrete

positive anomalies with negative returns are present across Field C and are likely to represent near surface ferrous objects.

4.4 Field D (Figures 18-22)

Towards the northeast corner of Field D a number of positive curvilinear and linear anomalies have been identified. These anomalies may represent cut features of archaeological origin.

Ridge and furrow has been identified towards the eastern and western areas of Field D in a northeast to southwest alignment.

Areas of magnetic debris and disturbances have been identified along the edges of Field D and are likely to be caused by the presence of field boundaries and modern activity. A series of strong discrete anomalies with negative returns can be identified spread across the centre of Field D that are likely to be caused by near surface ferrous objects.

4.5 Field E (Figures 23-27)

In the centre of Field E is a positive curvilinear anomaly which creates a circular feature approximately 13m in diameter. This may be a cut feature of archaeological origin. A clear positive linear anomaly appears towards the northeast corner of Field E forming a rectilinear anomaly (approximately 20m in width). This possibly a cut feature of archaeological origin (see Figures 26-27).

Three low discrete positive anomalies have been identified to the south of the rectilinear anomaly. These may represent possible pits of archaeological origin.

A faint positive linear anomaly is also identified in the east of Field E, in an east to west alignment. This may represent a cut feature of archaeological origin or possibly be associated with agricultural activity, a previous field boundary or ridge and furrow.

Linear anomalies typical of ridge and furrow have been identified in Field E in five separate orientations, suggesting the earlier existence of a number of small field systems (see Figures 26-27).

A spread of strong discrete positive anomalies with negative returns can be identified mainly across the northern part of Field E; these are likely to be caused by near surface ferrous objects.

4.6 Field F (Figures 28-32)

Field F contained large areas of magnetic debris and disturbance along with a high concentration of strong discrete positive anomalies with negative returns caused by the presence of ferrous objects. These anomalies are likely to be associated with the nearby road to the west and motorway directly to the south of the field.

Three positive linear anomalies have been identified in the eastern corner of Field F, these may relate to cut features of archaeological origin, ridge and furrow or to modern activity due to there close proximity to the areas of magnetic debris.

Once again evidence of ridge and furrow has been found in the form of positive linear anomalies with two linear orientations (running parallel with the present field boundary to the west and running northwest to southeast across the centre of the field, see Figures 31-32). A possible relict field boundary has been identified running in a northeast to southwest alignment, continuing the line of a track north of Field F. The anomaly contains positive linear readings with negative returns, possibly indicating a buried fence line.

4.7 Field G (Figures 33-37)

A large area in the south of Field G has been obscured due to the presence of a large service and the associated magnetic disturbance. An area of magnetic debris is present to the north of the survey area; this is likely to be caused by modern activity surrounding an access point for the field.

Three positive linear anomalies can be seen projecting from the area of magnetic debris. These linear anomalies may represent cut features of archaeological origin but may also be associated with pathways across the field.

A positive linear anomaly has been identified running parallel with the northern boundary of Field F and then curving southwards towards the motorway, this may represent a cut feature of possible archaeological origin.

Three low magnitude discrete positive anomalies have been identified in Field F. These anomalies may represent possible pits of archaeological origin, although the presence of large numbers of ferrous objects may suggest these anomalies are caused by modern disturbance.

4.8 Field H (Figures 38-42)

Field H has revealed the most interesting results of archaeological potential in the form of several positive rectilinear anomalies. The magnetometer survey has revealed the remaining extent of a series of rectilinear enclosures discovered in a previous survey carried out by Stratascan in 2002 (J1721). The enclosure is situated on the highest ground of the survey area and appears to continue downwards to the southwest corner of Field H. The abstraction of the anomalies can be seen in Figure 38 along with a complete abstraction of the survey area (including the previous survey work) in Figure 49.

Ridge and furrow has been identified across Field H in the from of positive linear anomalies with a northeast to southwest orientation.

A number of low magnitude discrete positive anomalies have been identified across the high ground along with evidence for near surface ferrous objects. These anomalies may

represent possible pits of archaeological origin, or may be caused by modern disturbances.

4.9 Field I (Figures 43-47)

A large number of positive linear and area anomalies have been identified with an approximate northwest to southeast orientation, situated in the west and south of Field I. These anomalies may represent cut features of archaeological origin. No discernable pattern can be established with confidence, possibly suggesting archaeological activity occurring over an extended timescale or the presence of modern activity and disturbances (see Figure 47).

Evidence of ridge and furrow is present towards the eastern halve of Field I in the form of positive and negative linear anomalies in a northeast to southwest orientation.

5 CONCLUSION

The magnetometer survey located many anomalies of archaeological potential across the site. The majority of the features found related to ridge and furrow, the remains of which have appeared in every field surveyed.

Within Field H the magnetometry survey successfully located cut features of archaeological origin forming a number of rectilinear enclosures. This survey identified the extents of a settlement enclosure first revealed in 2002 (J1721), situated west of Field H (see Figure 49).

A number of smaller areas of archaeological interest can be identified in the southern end of Field B, to the northwest of Fields D and F, across Fields E and I and the north of Field G. It is possible that some of these features may be related to modern or more recent agricultural practices over the site. However, most of these anomalies suggest evidence of archaeological activity.

APPENDIX A – Basic principles of magnetic survey

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremnant* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremnance is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremnant archaeological features can include hearths and kilns and material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically either 0.5 or 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity, disturbance from modern services etc.