

TGTG18



TWYNING GREEN, TEWKESBURY, GLOUCESTERSHIRE

GEOPHYSICAL SURVEY

commissioned by Corylus Planning and Environmental
on behalf of Novus Sustainable Developments

February 2018

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PROJECT INFO:

HA Project Code **TGTG18** / NGR **SO 9048 3682** / Parish **Twynning** / Local Authority **Tewkesbury Borough Council** / OASIS Ref. **headland5-308431**

PROJECT TEAM:

Project Manager **David Harrison** / Author **David Harrison** / Fieldwork **Mark Evans, Ross Bishop** / Graphics **David Harrison, Rafael Maya Torcelly**

Approved by **David Harrison**



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PROJECT SUMMARY

Headland Archaeology (UK) Ltd, undertook a geophysical (magnetometer) survey covering 3.5 hectares, on land at Fleet Farm, Twyning Green, Gloucestershire, in advance of the submission of a planning application for a residential development. The survey has identified anomalies which are consistent with former agricultural land-use including ridge and furrow cultivation, land drainage and probable dumping/ infilling of magnetically enhanced material to the east of Fleet Farm. Three linear anomalies (probable ditches), to the west of the farm, have been ascribed a possible archaeological origin as they cannot definitely be interpreted as agricultural or modern in origin, although a modern cause is thought most likely. Therefore, on the basis of the geophysical survey, the majority of the site is assessed as having a low archaeological potential, corroborating the results of the Desk-Based Assessment. The area between Fleet Farm and the River Avon is dominated by magnetic disturbance and therefore the archaeological potential here remains unknown, but given the absence of archaeological anomalies locally, the potential here is also likely to be low.

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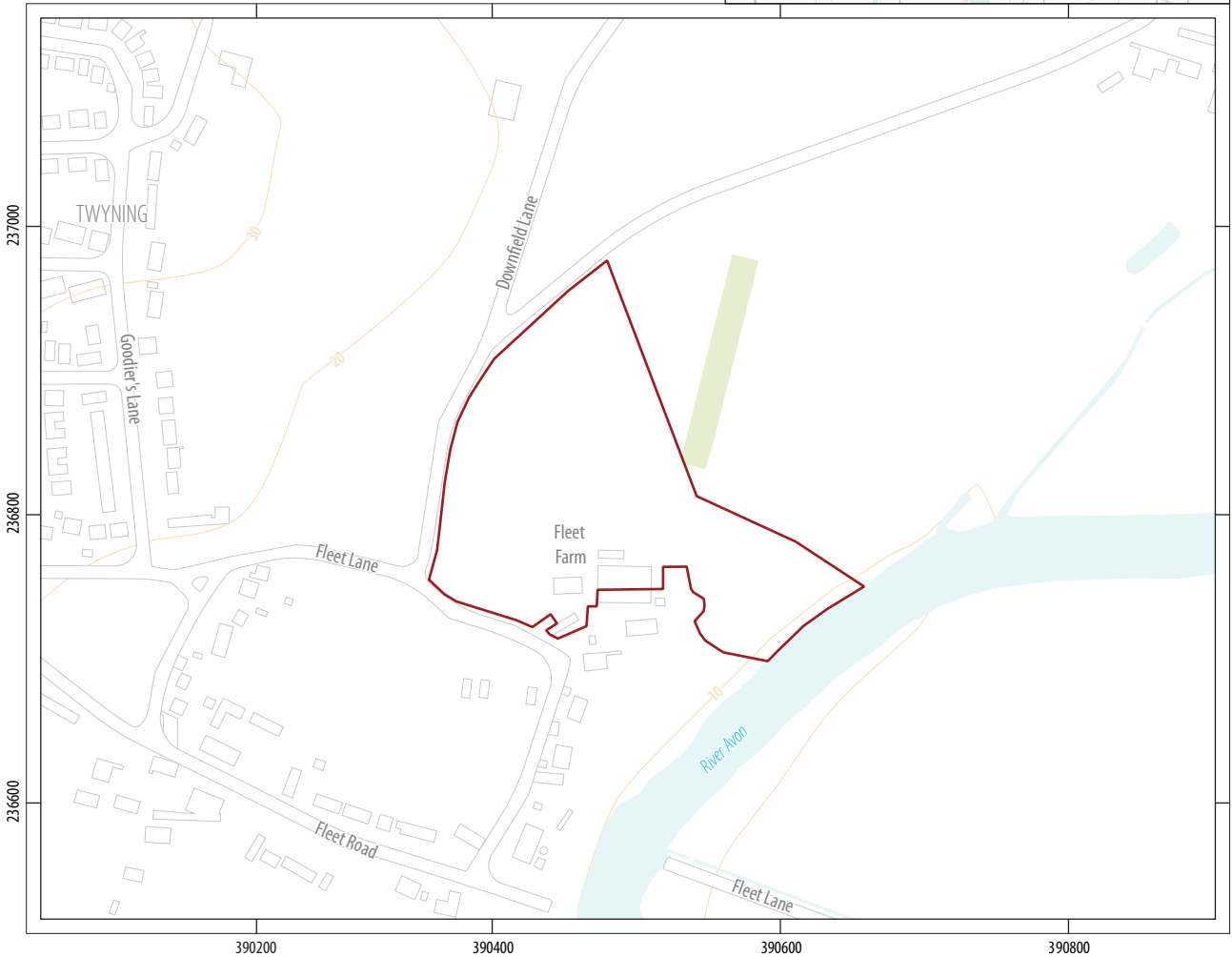
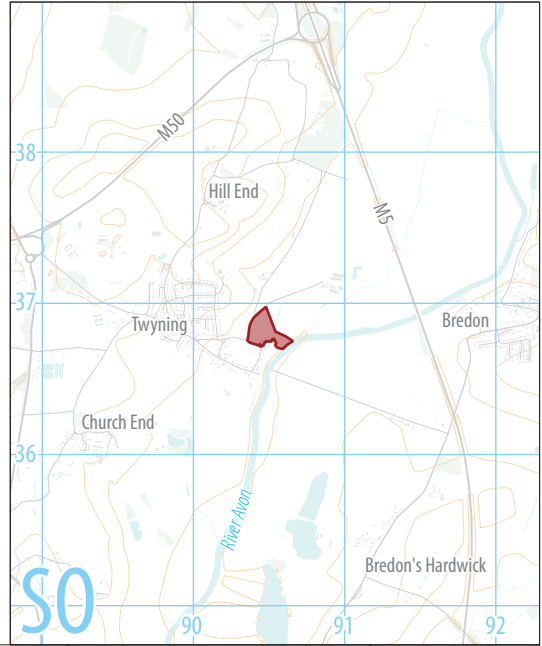
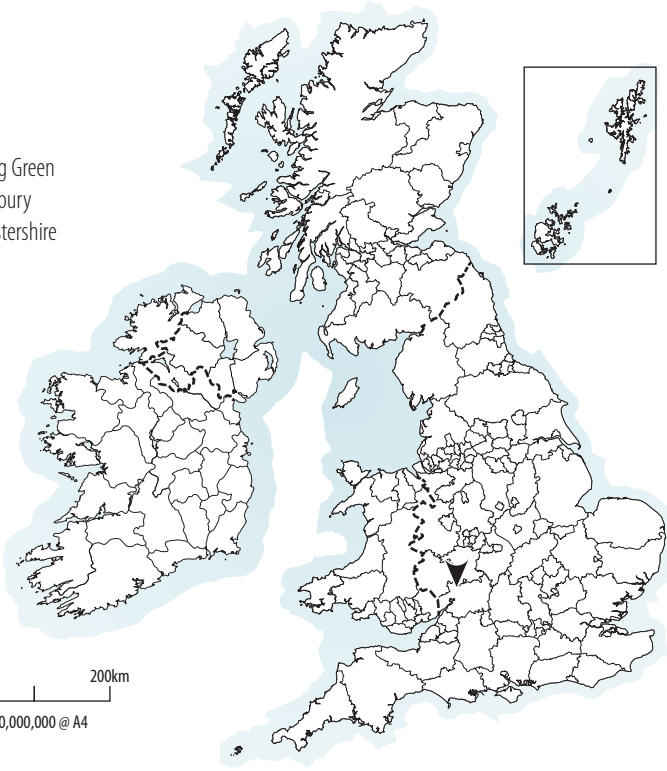
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Twynning Green
Tewkesbury
Gloucestershire

0 200km
1:10,000,000 @ A4



0 100m
1:5,000 @ A4

 survey area



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TWYNING GREEN, TEWKESBURY, GLOUCESTERSHIRE

GEOPHYSICAL SURVEY

1 INTRODUCTION

Headland Archaeology (UK) Ltd was commissioned by Corylus Planning and Environmental on behalf of Novus Sustainable Developments (the Client), to undertake a geophysical (magnetometer) survey at Fleet Farm, Twyning Green, where an application for a residential development is being considered. The results of the survey will inform future archaeological strategy at the site.

The work was undertaken in accordance with a Written Scheme of Investigation (Harrison 2018) which was submitted to and approved by Charles Parry (Archaeological advisor to Tewkesbury Borough Council), and with guidance contained in the National Planning Policy Framework (DCLG 2012). All work was undertaken in line with current best practice (Chartered Institute for Archaeologists 2014, English Heritage 2008). The survey was carried out on 26th January 2018.

1.1 SITE LOCATION, LAND-USE AND TOPOGRAPHY

The survey area comprises two fields (F1 and F2) located to the north, east and west of Fleet Farm, Twyning Green, Gloucestershire, centred at SO 9048 3682 (see Illus 1). It is bound to the west by Downfield Lane, to the south by Fleet Lane and Fleet Farm, to the south-east by the River Avon and to the east by a caravan park. The north-eastern site boundary is unbound. At the time of the survey, both fields were under short pasture (see Illus 2-4).

The site generally slopes gently down from Downfield Lane in the west, ranging from 18m Above Ordnance Datum (AOD), to 11m AOD at the River Avon in the east.

1.2 GEOLOGY AND SOILS

The bedrock geology comprises Charmouth Mudstone Formation which is mainly overlain by Wasperton Sand and Gravel Member. Alluvium (clay, sand, silt and gravel) is recorded close to the River Avon in F2 (NERC 2018).

The soils overlying the majority of the survey area are classified in the Soilscape 6 association, characterised as freely draining, slightly acid loams. Close to the River Avon, the soils are classified in the Soilscape 20 association, characterised as floodplain soils with naturally high groundwater (Cranfield University 2018).

2 ARCHAEOLOGICAL BACKGROUND

The information below is abstracted from the Archaeological Desk-Based Assessment (Richards, 2018).

The National Mapping Programme identified the northern part of the survey area as having evidence of ridge and furrow cultivation. This is not identified as a heritage asset in the HER and such traces of medieval cultivation are very commonplace.



ILLUS 2 Field 1, looking south

The survey area appears to have been agricultural hinterland associated with settlement at Twyning from the early medieval period onwards and is unlikely to contain archaeological remains other than evidence of agricultural use. There have been finds of Roman material in the vicinity indicative of some settlement, however, the site on the south side of Fleet Lane revealed no evidence of archaeological features or finds and the archaeological potential of the survey area is considered to be moderate at most, and more likely low.

3 AIMS, METHODOLOGY AND PRESENTATION

The general aim of the geophysical survey was to provide sufficient information to establish the presence/absence, character and extent of any archaeological remains within the survey area. This will, therefore, enable an assessment to be made of the impact of the proposed development on any sub-surface archaeological remains if present.

The specific archaeological objectives of the geophysical survey were:

- › to provide information about the nature and possible interpretation of any magnetic anomalies identified;

- › to, therefore, model the presence/absence and extent of any buried archaeological features; and
- › to prepare a report summarising the results of the survey.

3.1 MAGNETOMETER SURVEY

Magnetic survey methods rely on the ability of a variety of instruments to measure very small magnetic fields associated with buried archaeological remains. A feature such as a ditch, pit or kiln can act like a small magnet, or series of magnets, that produce distortions (anomalies) in the earth's magnetic field. In mapping these slight variations, detailed plans of sites can be obtained as buried features often produce reasonably characteristic anomaly shapes and strengths (Gaffney & Gater 2003). Further information on soil magnetism and the interpretation of magnetic anomalies is provided in Appendix 1.

The survey was undertaken using four Bartington Grad601 sensors mounted at 1m intervals (1m traverse interval) onto a rigid carrying frame. The system was programmed to take readings at a frequency of 10Hz (allowing for a 10-15cm sample interval) on roaming traverses (swaths) 4m apart. These readings were stored on an external weatherproof laptop and later downloaded for processing and interpretation. The system was linked to a Trimble R8s Real Time Kinetic (RTK) differential Global Positioning System (dGPS) outputting in NMEA mode to ensure a high positional accuracy for each data point.



ILLUS 3 Field 2, looking south-east

MLGrad601 and MultiGrad601 (Geomar Software Inc.) software was used to collect and export the data. Terrasurveyor V3.0.32.4 (DWConsulting) software was used to process and present the data.

3.2 REPORTING

A general site location plan is shown in Illus 1 at a scale of 1:5,000. Illus 2-4 are site condition photographs. Illus 5 is a 1:2,500 scale survey location plan showing the GPS swaths. The survey location is shown overlying the 1888-1913 six inch OS map in Illus 6, also at 1:2,500. The fully processed (greyscale) data, minimally processed data (XY traceplot) and accompanying interpretative plot are presented at a scale of 1:2,500 in Illus 7 to Illus 9 inclusive.

Technical information on the equipment used, data processing and magnetic survey methodology is given in Appendix 1. Appendix 2 details the survey location information and Appendix 3 describes the composition and location of the site archive. Data processing details are presented in Appendix 4. A copy of the OASIS entry (Online Access to the Index of Archaeological Investigations) is reproduced in Appendix 5.

The survey methodology, report and any recommendations comply with the Written Scheme of Investigation (Harrison 2018) and guidelines outlined by Historic England (English Heritage 2008) and by the Chartered Institute for Archaeologists (CIfA 2014). All illustrations from Ordnance Survey mapping are reproduced with

the permission of the controller of Her Majesty's Stationery Office (© Crown copyright).

The illustrations in this report have been produced following analysis of the data in 'raw' and processed formats and over a range of different display levels. All illustrations are presented to most suitably display and interpret the data from this site based on the experience and knowledge of management and reporting staff.

4 RESULTS AND DISCUSSION

The ground conditions across the survey area were generally good and accordingly the data quality is good throughout. No survey could be undertaken close to the River Avon due to the presence of flood water.

A variable magnetic background has been identified across the site. Against this background, numerous anomalies have been identified. All are discussed below and cross-referenced to specific anomalies on the interpretative drawings, where appropriate.

4.1 FERROUS ANOMALIES

Ferrous anomalies, characterised as individual 'spikes', are typically caused by ferrous (magnetic) material, either on the ground surface or in the plough-soil. Little importance is normally given to such anomalies, unless there is any supporting evidence for an



ILLUS 4 Field 2 (east), looking east

archaeological interpretation, as modern ferrous debris is common on most sites, often being present as a consequence of manuring or tipping/infilling. There is no obvious clustering to these ferrous anomalies which might indicate an archaeological origin. Far more probable is that the 'spike' responses are likely caused by the random distribution of ferrous debris in the upper soil horizons.

The eastern part of F1 and almost the whole of F2 is dominated by high magnitude magnetic disturbance. This is almost certainly modern in origin, probably resulting from dumping/infilling of magnetically enhanced material. Any low magnitude anomalies of archaeological potential, if present, may be masked in the affected areas, although there is no reason to suspect that this is the case.

Magnetic disturbance around the field edges is due to ferrous material within or close to the adjacent field boundaries and is of no archaeological interest.

4.2 AGRICULTURAL ANOMALIES

A series of faint, slightly curvilinear, parallel trends are identified on an east/west alignment throughout F1. The trends are characteristic of the medieval and post-medieval practice of ridge and furrow

cultivation with the anomalies being caused by the contrast between the soil-filled furrows and the former ridges.

Faint linear trends are also identified parallel with the field boundaries. For this reason, these anomalies are ascribed a probable agricultural interpretation, perhaps locating field drains.

4.3 GEOLOGICAL ANOMALIES

Numerous low magnitude discrete anomalies are identified throughout the survey area. These are generally evenly distributed and are likely to be caused by localised variations in the depth and composition of the soils and the Wasperton sands and gravels from which they derive.

4.4 POSSIBLE ARCHAEOLOGICAL ANOMALIES

Three linear anomalies (D1-D3; Illus 9) have been identified to the west of Fleet Farm. The anomalies are slightly oblique to, and of higher magnitude, than the surrounding ridge and furrow anomalies and, in the absence, of any other clear explanation, an archaeological interpretation should be considered. It is possible that the three

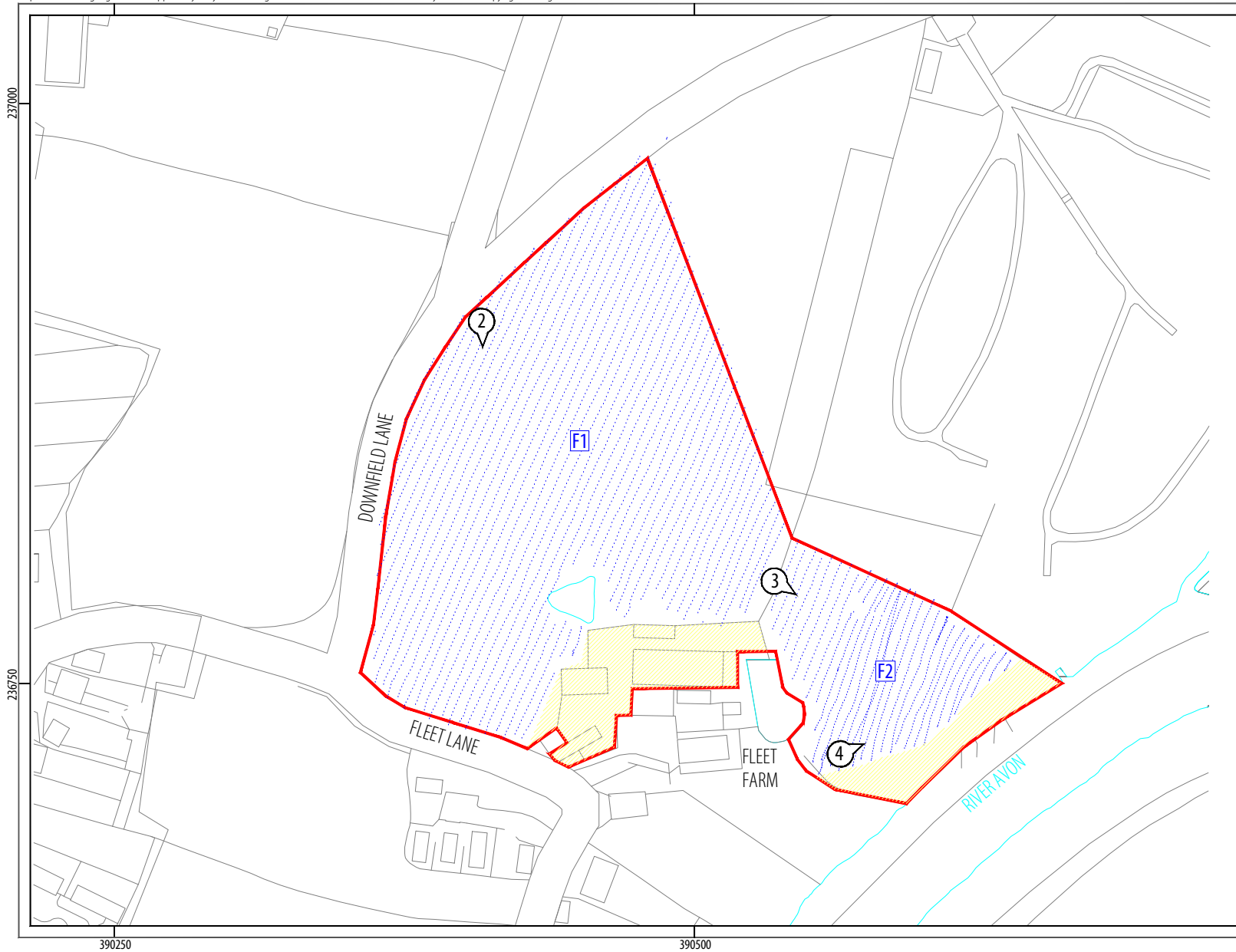
anomalies locate soil-filled ditches, although, given the lack of any clear pattern, a modern/agricultural origin is thought more likely, perhaps field drains.

5 CONCLUSION

The survey has successfully evaluated the survey area identifying anomalies which are consistent with former agricultural land-use including ridge and furrow cultivation, land drains and probable dumping/infilling of magnetically enhanced material to the east of Fleet Farm. Three linear anomalies (possible ditches), to the west of the farm, have been ascribed a possible archaeological origin as they cannot definitely be interpreted as agricultural or modern in origin, although a modern/agricultural cause is thought most likely. Therefore, on the basis of the geophysical survey, the majority of the site is assessed as having a low archaeological potential, corroborating the results of the Desk-Based Assessment. The area between Fleet Farm and the River Avon is dominated by magnetic disturbance and therefore the archaeological potential here remains unknown, but given the absence of archaeological anomalies locally, the potential here is also likely to be low.

6 REFERENCES

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- survey area
- GPS swaths
- area unsuitable for survey
- location and direction of ILLUS 2-4



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ILLUS 5 Survey location showing GPS swaths



□ survey area

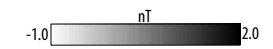
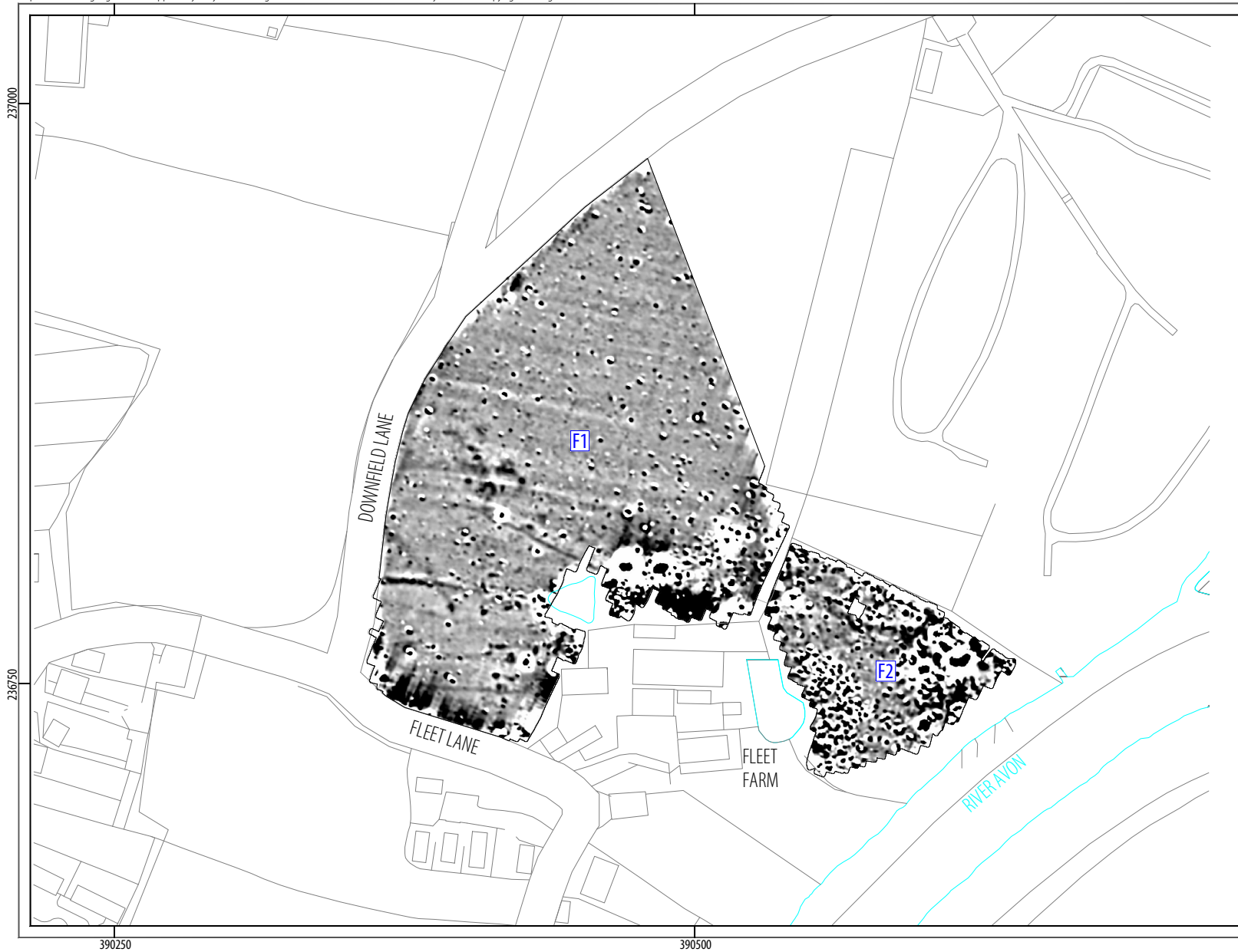


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ILLUS 6 Survey location overlying the 1888-1913 six inch OS map

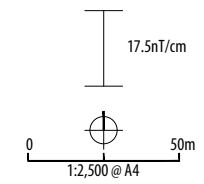
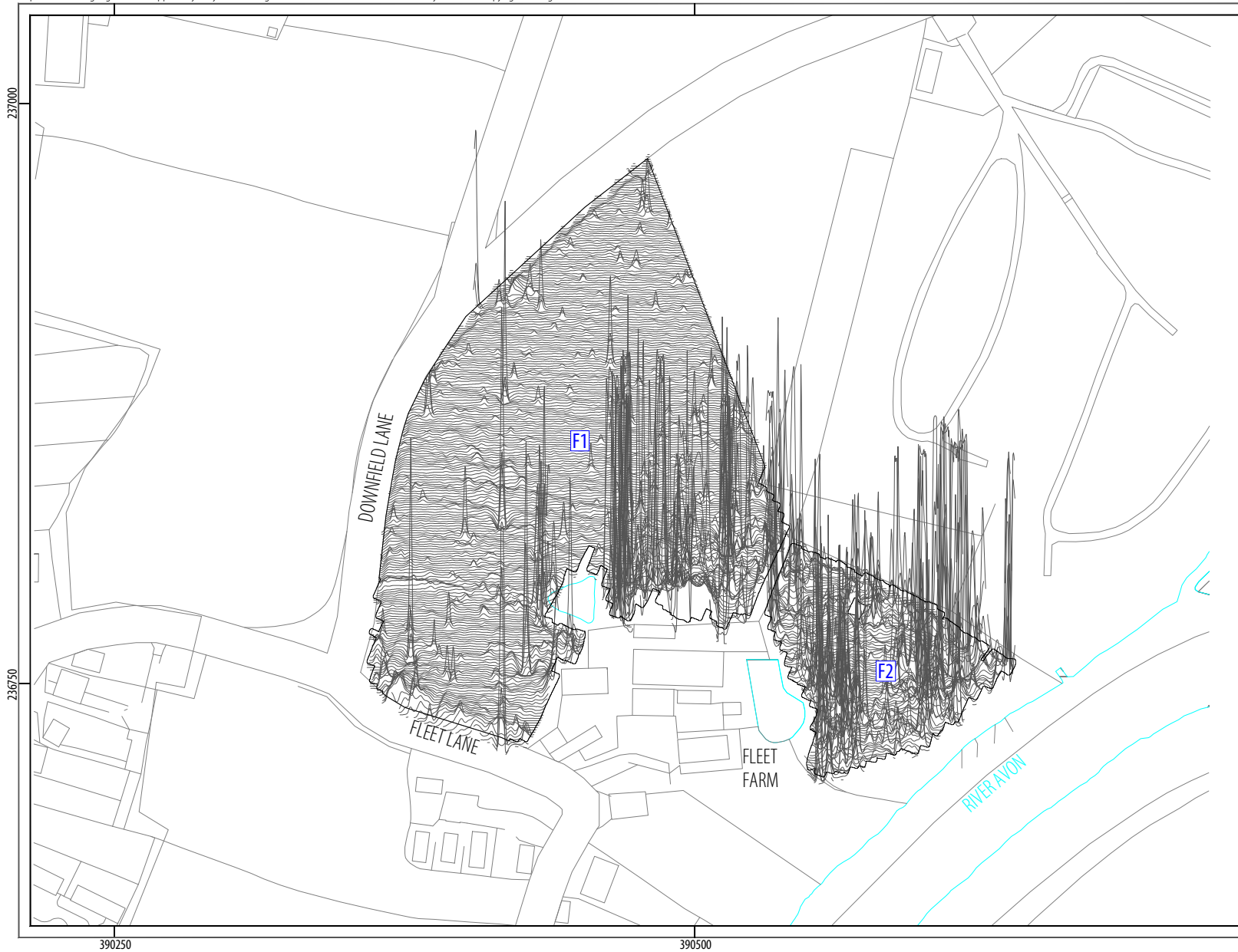


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ILLUS 7 Processed greyscale magnetometer data

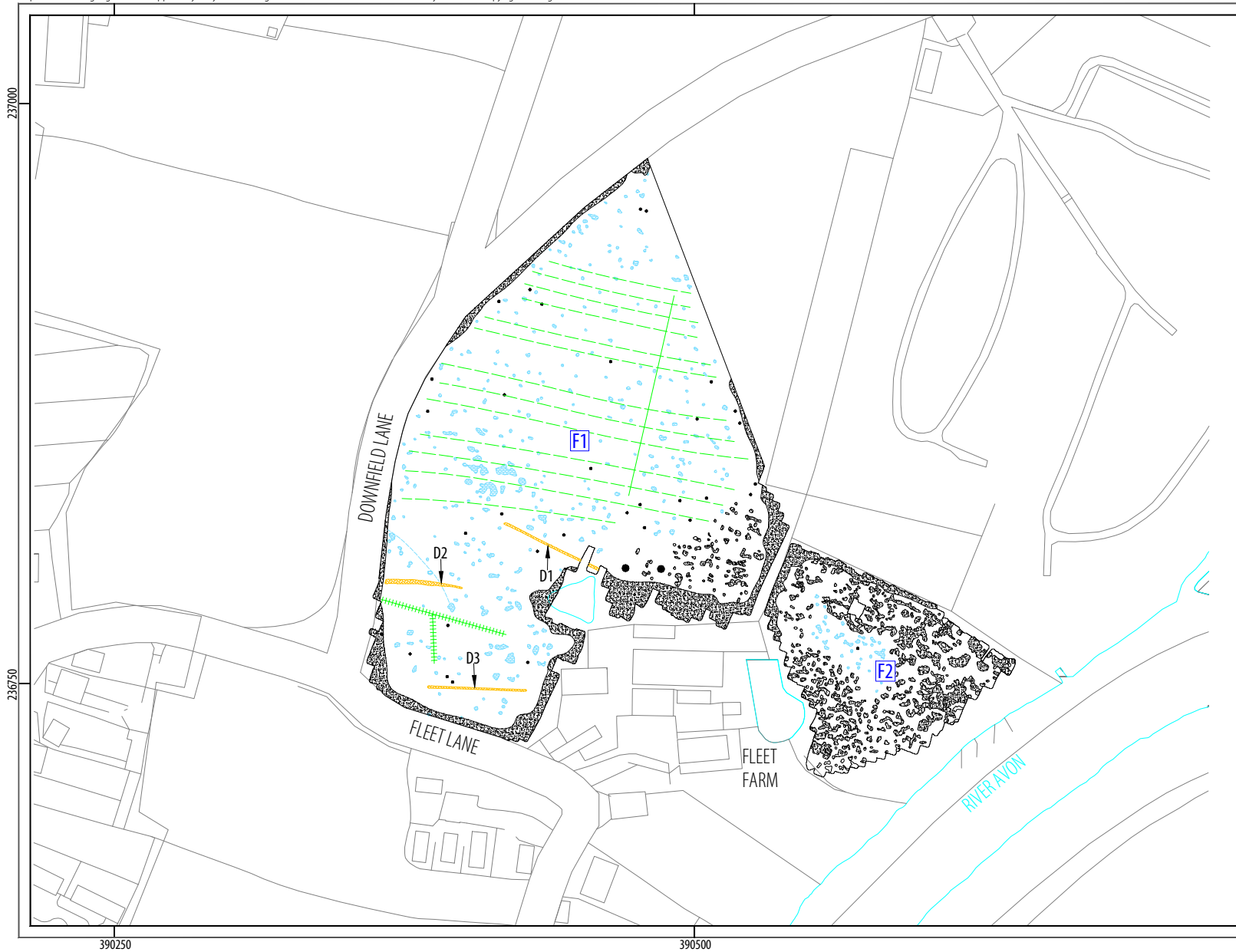


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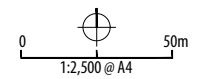


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ILLUS 8 XY trace plot of minimally processed magnetometer data



TYPE OF ANOMALY	INTERPRETATION
● dipolar isolated	ferrous material
● magnetic disturbance	ferrous material
--- linear trend	ridge and furrow
— linear trend	agricultural
--- linear trend	field drain
— linear trend	geological variation
● magnetic enhancement	geology?
● magnetic enhancement	archaeology?



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ILLUS 9 Interpretation of magnetometer data

7 APPENDICES

APPENDIX 1 MAGNETOMETER SURVEY

Magnetic susceptibility and soil magnetism

Iron makes up about 6% of the earth's crust and is mostly present in soils and rocks as minerals such as maghaemite and haematite. These minerals have a weak, measurable magnetic property termed magnetic susceptibility. Human activities can redistribute these minerals and change (enhance) others into more magnetic forms so that by measuring the magnetic susceptibility of the topsoil, areas, where human occupation or settlement has occurred, can be identified by virtue of the attendant increase (enhancement) in magnetic susceptibility. If the enhanced material subsequently comes to fill features, such as ditches or pits, localised isolated and linear magnetic anomalies can result whose presence can be detected by a magnetometer (fluxgate gradiometer).

In general, it is the contrast between the magnetic susceptibility of deposits filling cut features, such as ditches or pits, and the magnetic susceptibility of topsoils, subsoils and rocks into which these features have been cut, which causes the most recognisable responses. This is primarily because there is a tendency for magnetic ferrous compounds to become concentrated in the topsoil, thereby making it more magnetic than the subsoil or the bedrock. Linear features cut into the subsoil or geology, such as ditches, that have been silted up or have been backfilled with topsoil will therefore usually produce a positive magnetic response relative to the background soil levels. Discrete feature, such as pits, can also be detected.

The magnetic susceptibility of a soil can also be enhanced by the application of heat. This effect can lead to the detection of features such as hearths, kilns or areas of burning.

Types of magnetic anomaly

In the majority of instances, anomalies are termed 'positive'. This means that they have a positive magnetic value relative to the magnetic background on any given site. However, some features can manifest themselves as 'negative' anomalies that, conversely, means that the response is negative relative to the mean magnetic background.

Where it is not possible to give a probable cause of an observed anomaly a '?' is appended.

It should be noted that anomalies interpreted as modern in origin might be caused by features that are present in the topsoil or upper layers of the subsoil. Removal of soil to an archaeological or natural layer can, therefore, remove the feature causing the anomaly.

The types of response mentioned above can be divided into five main categories that are used in the graphical interpretation of the magnetic data:

Isolated dipolar anomalies (iron spikes) These responses are typically caused by ferrous material either on the surface or in the topsoil. They cause a rapid variation in the magnetic response giving a characteristic 'spiky' trace. Although ferrous archaeological artefacts could produce this type of response, unless there is supporting evidence for an archaeological interpretation, little emphasis is normally given to such anomalies, as modern ferrous objects are common on rural sites, often being present as a consequence of manuring.

Areas of magnetic disturbance These responses can have several causes often being associated with burnt material, such as slag waste or brick rubble or other strongly magnetised/fired material. Ferrous structures such as pylons, mesh or barbed wire fencing and buried pipes can also cause the same disturbed response. A modern origin is usually assumed unless there is other supporting information.

Linear trend This is usually a weak or broad linear anomaly of unknown cause or date. These anomalies are often caused by agricultural activity, either ploughing or land drains being a common cause.

Areas of magnetic enhancement/positive isolated anomalies Areas of enhanced response are characterised by a general increase in the magnetic background over a localised area whilst discrete anomalies are manifest by an increased response (sometimes only visible on an XY trace plot) on two or three successive traverses. In neither instance is there the intense dipolar response characteristic exhibited by an area of magnetic disturbance or of an 'iron spike' anomaly (see above). These anomalies can be caused by infilled discrete archaeological features such as pits or post-holes or by kilns. They can also be caused by pedological variations or by natural infilled features on certain geologies. Ferrous material in the subsoil can also give a similar response. It can often, therefore, be very difficult to establish an anthropogenic origin without intrusive investigation or other supporting information.

Linear and curvilinear anomalies Such anomalies have a variety of origins. They may be caused by agricultural practice (recent ploughing trends, earlier ridge and furrow regimes or land drains), natural geomorphological features such as palaeochannels or by infilled archaeological ditches.

APPENDIX 2 SURVEY LOCATION INFORMATION

An initial survey base station was established using a Trimble VRS differential Global Positioning System (dGPS). The magnetometer data were georeferenced using a Trimble RTK differential Global Positioning System (Trimble R8s model).

Temporary sight markers were laid out using a Trimble VRS differential Global Positioning System (Trimble R8s model) to guide the operator and ensure full coverage. The accuracy of this dGPS equipment is better than 0.01m.

The survey data were then super-imposed onto a base map provided by the client to produce the displayed block locations. However, it should be noted that Ordnance Survey positional accuracy for digital map data has an error of 0.5m for urban and floodplain areas, 1.0m for rural areas and 2.5m for mountain and moorland areas. This potential error must be considered if coordinates are measured off hard copies of the mapping rather than using the digital coordinates.

Headland Archaeology cannot accept responsibility for errors of fact or opinion resulting from data supplied by a third party.

APPENDIX 3 GEOPHYSICAL SURVEY ARCHIVE

The geophysical archive comprises an archive disk containing the raw data in XYZ format, a raster image of each greyscale plot with associate world file, and a PDF of the report.

The project will be archived in-house in accordance with recent good practice guidelines (http://guides.archaeologydataservice.ac.uk/g2gp/Geophysics_3). The data will be stored in an indexed archive and migrated to new formats when necessary.

APPENDIX 4 APPENDIX 4 DATA PROCESSING

The gradiometer data has been presented in this report in processed greyscale and minimally processed XY trace plot format.

Data collected using RTK GPS-based methods cannot be produced without minimal processing of the data. The minimally processed data has been interpolated to project the data onto a regular grid and de-striped to correct for slight variations in instrument calibration drift and any other artificial data.

A high pass filter has been applied to the greyscale plots to remove low frequency anomalies (relating to survey tracks and modern agricultural features) in order to maximise the clarity and interpretability of the archaeological anomalies.

The data has also been clipped to remove extreme values and to improve data contrast.

APPENDIX 5 OASIS DATA COLLECTION FORM: ENGLAND

OASIS ID: *headland5-308431*

Project details	
Project name	Twyning Green, Tewkesbury, Gloucestershire: Geophysical Survey
Short description of the project	Headland Archaeology (UK) Ltd, undertook a geophysical (magnetometer) survey covering 3.5 hectares, on land at Fleet Farm, Twyning Green, Gloucestershire, in advance of the submission of a planning application for a residential development. The survey has identified anomalies which are consistent with former agricultural land-use including ridge and furrow cultivation, land drainage and probable dumping/infilling of magnetically enhanced material to the east of Fleet Farm. Three linear anomalies (probable ditches), to the west of the farm, have been ascribed a possible archaeological origin as they cannot definitely be interpreted as agricultural or modern in origin, although a modern cause is thought most likely. Therefore, on the basis of the geophysical survey, the majority of the site is assessed as having a low archaeological potential, corroborating the results of the Desk-Based assessment. The area between Fleet Farm and the River Avon is dominated by magnetic disturbance and therefore the archaeological potential here remains unknown, but given the absence of archaeological anomalies locally, the potential here is also likely to be low.
Project dates Start:	26-01-2018 End: 26-01-2018
Previous/future work	Not known / Not known
Any associated project reference codes	TGTG18 - Site code
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	N/A None
Significant Finds	N/A None
Methods & techniques	'Geophysical Survey'
Development type	Rural residential
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology (other)	Charmouth Mudstone Formation
Drift geology (other)	Wasperton Sand and Gravel Member and Alluvium
Techniques	Magnetometry
Project location	
Country	England
Site location	GLOUCESTERSHIRE TEWKESBURY TWYNING Twyning Green

Study area	3.5 Hectares
Site coordinates	SO 9048 3682 52.029287641494 -2.138777279228 52 01 45 N 002 08 19 W Polygon
Project creators	
Name of Organisation	Headland Archaeology
Project brief originator	Headland Archaeology
Project design originator	Project brief originator
Project director/manager	Harrison, D
Project supervisor	Bishop, R
Type of sponsor/funding body	Developer
Project archives	
Physical Archive Exists?	No
Digital Archive recipient	In house
Digital Contents	'other'
Digital Media available	'Geophysics'
Paper Archive Exists?	No
Project bibliography 1	
Publication type	Grey literature (unpublished document/manuscript)
Title	Twyning Green, Tewkesbury, Gloucestershire: Geophysical Survey
Author(s)/Editor(s)	Harrison, D
Other bibliographic details	TGTG18
Date	2018
Issuer or publisher	Headland Archaeology
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Entered on	6 February 2018



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