Archaeological geophysical survey of the Gatherley to Lyd pipeline route for the Roadford Pumped Storage project Lifton, Devon

Addendum report
Additional works, April 2023

Report No: 23/036

Author: John Walford

Illustrator: Adam Meadows

Project Manager: John Walford
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OASIS REPORT FORM

Roadford Pumped Storage (Gatherley to Lyd)			**OASIS No: Molanort-507471**	
ACTIVITY TYPE				
Project/Activity type	Geophysical survey			
Reason for investigation	Planning: Infrastructure			
PROJECT LOCATION				
National grid ref	239200 083600			
Site name	Gatherley to Lyd pipeline, Lifton			
REVIEWERS/ ADMIN				
HER for project	Devon			
National organisation	Historic England			
WORK UNDERTAKEN				
Methodological summary	Magnetometer survey with a cart-mounted array of Bartington Grad601 fluxgate gradiometers.			
Previous work?	No		Future works?	Yes
Dates - Start date:	17th April 2023		End date:	19th April 2023
GEOPHYSICS				
Geology	Crackington Formation Liddaton Formation Teign Chert Formation			
Land use	Pasture			
Survey type	Magnetometer survey			
Size of survey area	5.8ha			
Instrumentation	Bartington Grad-01-1000L			
Configuration	Multiple			
Spatial resolution	Traverse spacing	0.8m	Sample interval	0.25m
Resolution (data values)	0.1nT			
BIBLIOGRAPHY				
Title	Archaeological geophysical survey of the Gatherley to Lyd pipeline route for the Roadford Pumped Storage project, Lifton, Devon, Addendum report. Additional works, April 2023			
Author	Walford, J.			
Publisher, place and date	MOLA Northampton / Northampton / 2023			
Report number	23/036			
Report release delay?	6 months			
PEOPLE				
Organisation	MOLA Northampton			
Project manager	John Walford			
Project supervisors	Adam Meadows			
Funding body	South-West Water			
KEYWORDS				
Monuments found/ date	Ring ditch - undated Quarry pit - undated Hollow way - undated Field boundary – post-medieval			
RESULTS				
Description of outcomes	The survey identified a possible prehistoric ring ditch and a number of other ditches, as well as some historic field boundaries and a quarry pit.			
ARCHIVES				
Accession ID	None			
Paper Archive repository	None			
Digital Archive repository	Archaeology Data Service			
No finds made during survey - no finds archive to be deposited				

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ABSTRACT

MOLA (Museum of London Archaeology) undertook a geophysical survey on the route of a proposed pipeline between Gatherley and the River Lyd, near Lifton, Devon in 2022. This work was in connection with the Roadford Pumped Storage project. Further work was commissioned in 2023, following a change to the eastern part of the proposed pipeline alignment, and forms the subject of this addendum report. The new survey identified a possible prehistoric ring ditch and one other ditch, as well as some historic field boundaries and a quarry pit.

1 INTRODUCTION

MOLA (Museum of London Archaeology) was commissioned by South West Water to conduct a magnetometer survey on the route of the proposed Gatherly to Lyd pipeline, near Lifton, Devon (central NGR SX 399 845) (Fig A1). The aim of the survey was to identify archaeological remains that might be disturbed by the laying of a new water pipe in connection with the Roadford Pumped Storage project.

The original survey was conducted from June to September 2022, and a full report was produced that same year (Walford 2022). This new report is an addendum, describing the results of further survey work undertaken on 18th and 19th April 2023, following a change to the eastern portion of the proposed pipeline route.

The 2023 survey complied with the methodology set out in the original Written Scheme of Investigation for the project (Arkley 2022), taking account of the Chartered Institute for Archaeologists and European Archaeological Council geophysics guidelines (CIfA 2020 and Schmidt *et al* 2015) and Devon County Council's generic requirements for geophysical survey (DCC 2022).

2 BACKGROUND

2.1 Location and land use

The area surveyed in 2023 was approximately 1km long and passed through nine fields, covering a total area of 5.8ha. It extended south from the River Lyd, passed immediately east of Coleman's Farm and continued on a south to south-westerly heading, passing west of Ridgecombe Farm as it did so (Fig A1). The land use along this route was a combination of pasture and hay meadows.

The fields along the new survey route were numbered from X1 to X9, for ease of reference, distinguishing them from Fields G01 to G30 of the original survey route (Fig A1). The numbering system is used in this report and also in the project archive.

2.2 Topography and geology

The 2023 survey route ascended a north-facing slope, from *c*59m above Ordnance Datum (aOD) in the north, by the River Lyd, to a maximum elevation of *c*145m aOD in the south.

The solid geology of the route comprised a sequence of Devonian and Carboniferous sedimentary units (BGS 2023). The Crackington Formation underlay the lowest ground in the north, and bands of the Teign Chert Formation and Liddaton Formation occurred successively upslope. Some recent alluvium was also present in the north, alongside the River Lyd.

2.3 Historical and archaeological background

A full account of the archaeological background to the project can be found in the Historic Environment Desk-Based Assessment (Robinson 2022), and a summary is presented in the main geophysical survey report (Walford 2022). In brief, the Devon Historic Environment Record (HER) lists four presumed medieval field banks along the originally proposed course of the pipe (HER No's MDV130187 to MDV130190) and a few prehistoric and Roman sites in the surrounding landscape. The 2022 geophysical survey results added to this information, having identified a probable small ring ditch, a number of less certain ditches and pits, some possible hollow ways, and various other historic features.

The re-routed section of the pipeline dealt with in this report encompassed one additional HER record, MDV22721, which relates to the former course of Tavistock and Launceston branch of the South Devon Railway alongside the southern bank of the River Lyd in Field X1. The new route also passed within 200m of a historic farmstead at Ridgecombe (MDV122096).

The earliest detailed map of the survey area is the tithe map of Lifton (1840). This, and subsequent Ordnance Survey maps, show a number of historic field boundaries, quarry pits and other landscape features which are no longer extant.

3 METHODOLOGY

3.1 Fieldwork

The magnetometer survey was undertaken with a Bartington magnetometer cart. This is a two-wheeled, lightweight sensor platform operated by hand. The cart incorporates a bank of six vertically-mounted Bartington Grad-01-1000L magnetic sensor tubes, spaced at 0.8m intervals along a bar aligned crossways to the direction of travel. It also incorporates a Leica Geosystems Viva GNSS antenna, mounted on the central axis.

The magnetic sensors were calibrated ('zeroed') at the start of each day's work to minimise any heading errors or offsets between the zero points of each individual sensor.

The cart was propelled along straight and parallel traverses across the survey area, with data logging being manually toggled on and off at the start and end of each traverse to avoid the collection of spurious data whilst turning. Traverse ends were marked with ranging poles to aid even coverage, and the evenness of coverage was further checked by monitoring the positional trace plotted in real time by the MultiGrad601 logging software.

The magnetic sensors were set to output data at a rate of eight readings per second. The GNSS antenna was set to output NMEA format data (GGA messages) at a rate of one position per second. These data streams were compiled into a single raw data file by MultiGrad601 logging software.

The speed of coverage varied according to the terrain and ground conditions but was generally well below 2m/s. The combination of sensor spacing, survey speeds and data output rates ensured that the spatial resolution of all the data sets would be better than 0.25m x 0.80m.

3.2 Data processing and presentation

The raw survey data was initially processed with MLGrad601 software, which calculated a UTM co-ordinate for each data point by interpolating the GPS readings and applying offset corrections based on the array geometry and projected heading direction. This produced an output file in XYZ format which could be imported into TerraSurveyor software for data visualisation and further processing.

The raw XYZ data exhibited striping caused by slight mis-matches in the calibration of the individual magnetic sensors. This was removed in TerraSurveyor by applying the median de-stripe function to runs of data from each sensor.

The raw and processed survey data is presented in this report as greyscale raster images which have been rotated and scaled to fit against Ordnance Survey base-mapping. A greyscale range of -/+10nT has been chosen, due to the relatively strong magnetic responses that were encountered along the survey route.

The interpretation of the data has been undertaken in a qualitative manner, based on the recognition of distinctive anomaly types and patterns and on cross-referencing historic map evidence. All major anomalies are represented on the interpretation figures, but cultivation marks are represented schematically and some other trivial anomalies and magnetic halos have been omitted altogether to avoid an excessively cluttered appearance.

4 SURVEY RESULTS

4.1 Archaeological and historic features

Possible ring ditch

A small, segmented annular anomaly, *c*9m in diameter, occurs in the south of the survey area, in Field X9 (Fig A2, inset). It has a very uneven magnetic intensity, being mostly around 15-20nT but having localised enhancements in the 40-70nT range. The most probable interpretation would be a ring ditch, round-house, or similar archaeological feature, perhaps with some patches of burnt soil causing the local magnetic enhancements. A prehistoric date seems most likely, though a more recent origin cannot be ruled out.

Another possible ditch

One slightly curved positive linear anomaly in the west of Field X9 is likely to represent a ditch. It is thought unlikely to be a historic field boundary, as it does not correspond to anything recorded on historic maps of the area and its east-west alignment fits poorly with the surrounding pattern of field boundaries.

Quarry pit

A large zone of incoherent magnetic response in the north of Field X3 corresponds to a quarry pit which appears on the First Edition Ordnance Survey Map (*c*1880). A similarly sized and located feature is marked on the Lifton Tithe map (1840), but it is unclear whether this is the quarry pit itself or a preceding land parcel.

Possible hollow ways

Two linear anomalies in Field X4 are comparable to a series of anomalies which were detected in the 2022 survey and suspected to represent historic hollow ways (Walford 2022, 5-6). The interpretation is less secure in this case, given the very slight evidence available, although the alignment of the anomalies relative to the adjacent modern road is suggestive.

Field boundaries

Some linear anomalies correspond to parts of former field boundaries which are depicted on the Lifton tithe map and subsequent Ordnance Survey maps. One, in Field X9, has a ‘double linear’ form, which is commonly encountered in south-west England (Gaffney and Gater 2003, 123-125) and is presumed to indicate the remains of a field bank with a relatively magnetic stone cladding around a less magnetic earthen core. The others have a range of forms representing various combinations of banks and ditches.

Two linear anomalies in Field X1 have been tentatively identified as field boundaries despite a lack of supporting map evidence. This interpretation rests largely on their position and alignment relative to adjacent boundaries.

4.2 Ploughing

Much of the survey data contains sets of parallel linear anomalies caused by ploughing. In the main, these are closely spaced and likely to relate to relatively modern ploughing, though a few more widely spaced anomalies located towards the centre of Field X9 are mildly suggestive of medieval ridge and furrow.

4.3 Pipes, cables and drains

An intense linear anomaly with variable magnetic polarity (*ie* alternative positive and negative sections) occurs along the northern edge of Fields X5 and X6. This is

characteristic of a metal pipe, presumably a continuation of the one previously detected in the north of Field G26 (Walford 2022, figs 5 and 9).

4.4 Ferrous objects

Small magnetic dipoles occur sporadically along the survey route. Such anomalies are very common on agricultural land and are generally caused by small pieces of iron and steel debris (*eg* horseshoes, plough fittings and similarly trivial scrap metal) buried in the topsoil. A few larger pieces of metal have produced the correspondingly larger and more conspicuous dipoles in Fields X1, X2 and X9.

A dense concentration of small dipoles occurs in the southern part of Field X1, resulting in a distinct patch of 'noisy' data. This is likely to represent a spread of modern debris; possibly the remnants of an old rubbish heap or a patch of hardcore containing pieces of scrap metal.

One large negative magnetic halo in the middle of Field X4 is associated with an upstanding telegraph pole.

4.5 Uncertain features

The interpretative category 'uncertain' has been used for a range of anomalies which cannot be confidently fitted into any of the preceding categories. These comprise two sets of parallel linear features at the edges of Fields X3 and X9, which might be ditches or drains, and two negative linear anomalies in Field X2 which are of obscure origin but seem more likely to be man-made than natural.

4.6 Geology

Some irregular positive anomalies, of probable geological origin, occur in the northern and southern ends of the survey data. Those in Field X1, in the north, lie parallel to the River Lyd and probably relate to former channels or to other bands of riverine sediment. Others, in Fields X8 and X9 cannot be interpreted in detail.

5 CONCLUSION

The new survey work has identified a 9m diameter annular feature in Field X9. This might be a small prehistoric ring ditch or roundhouse, and bears comparison with a 7m diameter ring ditch which the preceding survey detected in Field G02, at the western end of the overall pipe route (Walford 2022).

Apart from the suspected ring ditch, the survey has identified an undated ditch, some historic field boundaries and, in Field X3, part of a quarry pit which historic mapping shows to have been open in the late 19th century.

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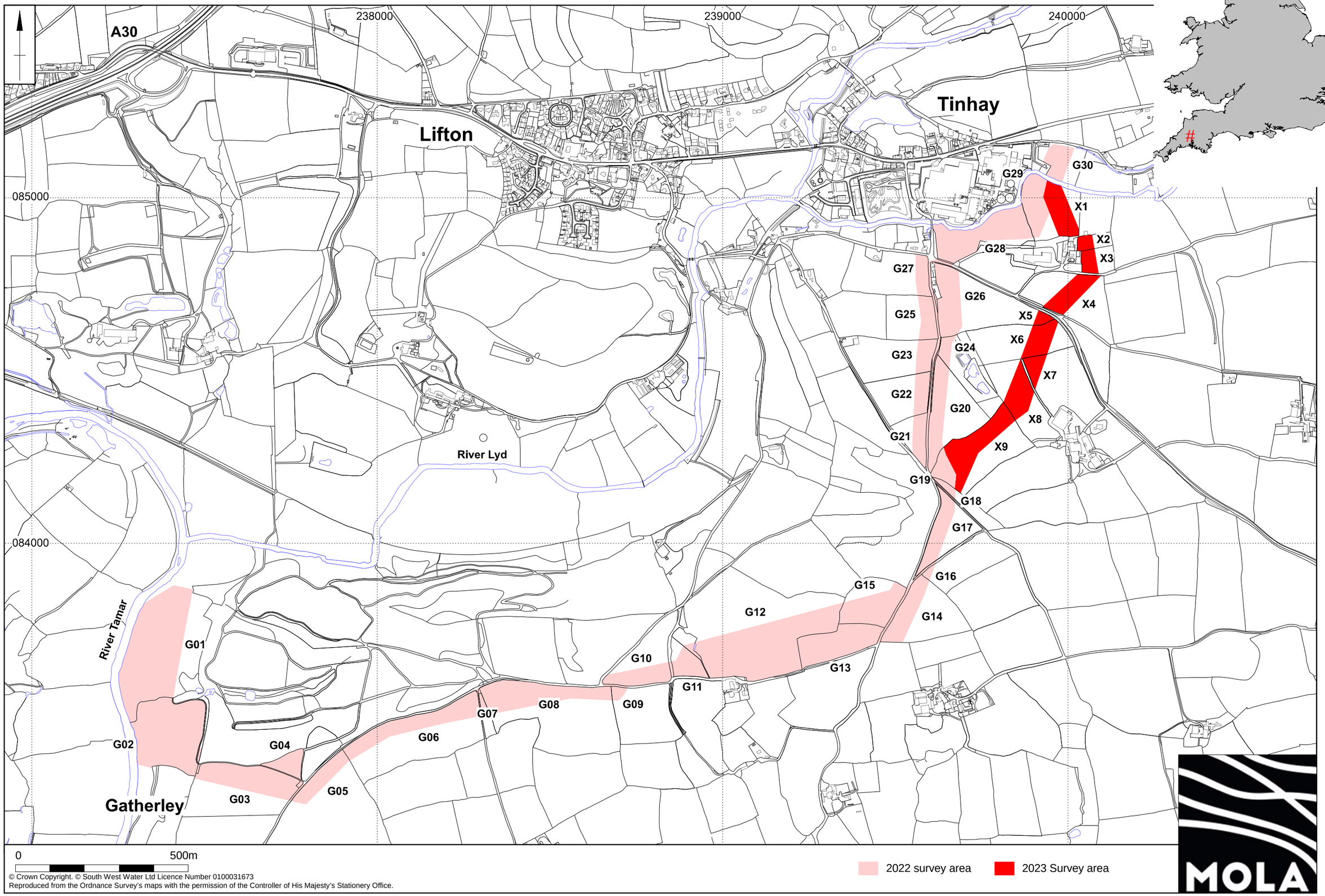
May 2023



Scale 1:10,000 (A3)

Site location Fig A1

239700
239900
240100
085000
084800
084600
084400
084200
G30
X1
G28
X2
X3
G26
X4
G25
X5
G20
X6
G23
X7
X8
G22
G20
X9
G21
G19
G17
G18
Inset: North-east of X9
Scale 1:1000, Range +/-50nT

0
125m
Magnetic anomaly
-10nT
0
+10nT
MOLA
Scale 1:2500 (A3)
Magnetormeter survey results Fig A2

239700
239900
240100
085000
084800
084600
084400
084200
G28
G30
X1
X2
X3
X4
G26
X5
G25
G20
X6
G23
X7
X8
G22
G20
G21
X9
G19
G17
G18
0
125m

Interpretation key

- Possible archaeology (ditch, pit, etc)
- Quarry pit
- Road / track?
- Former field boundary
- Possible field boundary
- Ploughing (historic?)
- Ploughing (modern?)
- Drain
- Pipe or cable?
- Uncertain
- Ferrous
- Geology
- Pylon

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Scale 1:2500 (A3)

Magnetometer survey interpretation Fig A3

239700

239900

240100

085000

084800

084600

084400

084200

X1

X2

X3

X4

X5

X6

X7

X8

X9

0 125m

Magnetic anomaly

-10nT 0 +10nT

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Scale 1:2500 (A3)

Unprocessed magnetometer data Fig A4

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