Land South of Harrisons Lane

Halesworth, Suffolk

Client:
Richborough Estates Ltd & Mrs N. Barrett-Nobbs.

Date:
November 2017

HWT 053 / ESF 25783
Geophysical Survey Report
SACIC Report No. 2017/100
Author: Timothy Schofield HND BSc MCIfA

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Author: Timothy Schofield

Illustrator: Timothy Schofield

Editor: Stuart Boulter

Report Date: November 2017

HER Information

Site Code:	**HWT 053**
Event Number:	**ESF 25783**
Site Name:	**Land South of Harrisons Lane, Halesworth, Suffolk**
Report Number	**2017/100**
Planning Application No:	**TBC**
Date of Fieldwork:	**31st October – 7th November 2017**
Grid Reference:	**TM 3941 7802**
Oasis Reference:	**293416**
Curatorial Officer:	**Rachael Abraham**
Project Officer:	**Catherine Douglas/Timothy Schofield**
Client/Funding Body:	**Richborough Estates Ltd & Mrs N. Barrett-Nobbs**
Client Reference:	**n/a**

Digital report submitted to Archaeological Data Service:
http://ads.ahds.ac.uk/catalogue/library/greylit

Prepared By: Timothy Schofield
Date: November 2017

Approved By: Stuart Boulter
Position: Senior Project Officer
Date: November 2017

Signed:

Contents

List of Figures

List of Appendices

Summary

In October and November 2017 Suffolk Archaeology Community Interest Company (SACIC) undertook a detailed fluxgate gradiometer survey over *c*. 12.5 hectares on land south of Harrisons Lane, Halesworth, Suffolk. The survey was undertaken within five separate fields, three of which were recently harrowed and sown and two that were under short cropped grass.

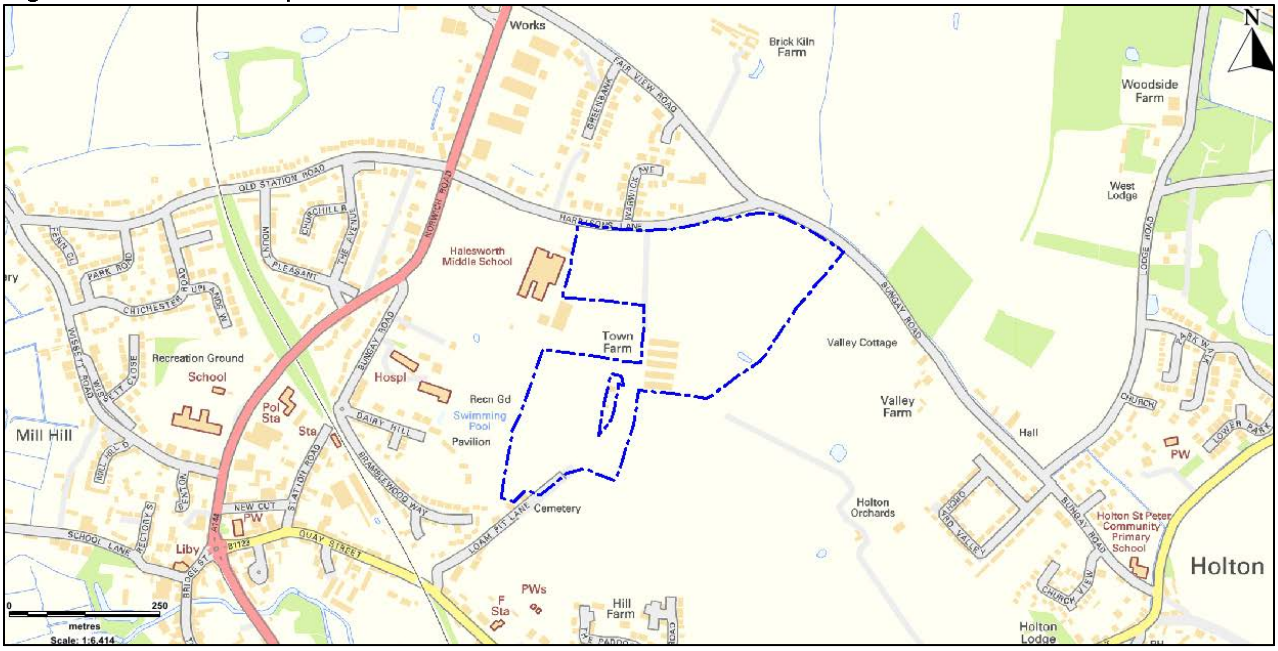
The detailed fluxgate gradiometer survey prospected a wide variety of geophysical anomalies; those of a potential archaeological origin include five backfilled ditches of which three are relic field boundaries, a possible double ditched trackway, six discrete pits and two large discrete magnetic responses interpreted as potential rubbish pits. A modern ferrous service run was prospected on the northern field boundary, areas of magnetic enhancement caused by modern dumps of material, overhead electricity cable poles and magnetic material located within and near the field boundaries. A single linear geological anomaly was further recorded running downslope in the southwestern field, and an agricultural furrow was recorded in the northeastern dataset.

1. Introduction

On the 31st October to the 7th November 2017 a detailed fluxgate gradiometer survey covering an area of *c*. 12.5 hectares within five separate fields on land to the south of Harrisons Lane, Halesworth, Suffolk (Fig.1) was undertaken by Suffolk Archaeology Community Interest Company (SACIC).

The geophysical survey was requested by Suffolk County Council Archaeological Services/Conservation Team (SCCAS/CT), in accordance with paragraphs 128, 129 and 141 of the National Planning Policy Framework; SACIC were commissioned to undertake the project by Mr Steve Logan of Owen Brown at Brown & Co.

Figure 1. Location map



2. Geology and topography

The site lies within an arable landscape (TM 3941 7802) 950m to the northeast of the centre of Halesworth. It slopes steeply up from 20m in the northeast to 35m at the centre of the site, then back down to 25m in the southwest. Five of the seven fields that comprise the 12.5ha area were suitable for survey.

Bedrock geology consists of Crag Group sand formed up to 5 million years ago in the Quaternary and Neogene Periods when the local environment was dominated by shallow seas depositing clay, silt, sand and gravel (BGS 2017).

Overlying the bedrock geology are superficial deposits of Lowestoft Formation Diamicton, formed up to 2 million years ago in the Quaternary Period during ice age conditions where glaciers scoured the landscape depositing moraines of till with outwash sand and gravel from seasonal and post glacial meltwaters (BGS 2017).

3. Archaeology and historical background

The geophysical survey was required by Rachael Abraham of SCCAS/CT to inform the archaeological evaluation brief for the proposed development.

Background research has revealed that a former isolation small pox hospital or pesthouse (HWT 020) was built in the 18th century, its remains located in the centre of the survey area, a watching brief (HWT 042) undertaken here in 2015 recorded early modern pits that were potentially related to this hospital.

A series of enclosed fields are recorded on Hodskinson’s map of Suffolk from 1783, clearly labelled within the centre of which are the words ‘pest house’. The site is bounded to the north by a lane, now called Harrisons Lane. Holton Post Mill, built in 1749, is clearly depicted on the map to the southeast with the Church of St Peter recorded to the east. The New Reach canalised end of the Blyth Navigation is recorded to the south of the site. On the 1884 Ordnance Survey (OS) map Pesthouse Farm (smallpox hospital) is printed in the centre of the site and is recorded as such until the 1927 publication, where the building becomes Pesthouse Farm, indicating that the hospital had fallen out of use. The 1884 OS map depicts internal field boundary subdivisions that are no longer present today, by the time of the 1972 OS publication the field boundary arrangement is one that can be recognised as the current configuration.

4. Methodology

Instrument type

A Bartington DualGRAD 601-2 fluxgate gradiometer was employed to undertake the detailed geophysical survey; the weather, ground and geological soil conditions were found to be suitable.

Instrument calibration and settings

One hour was allocated to allow the instruments' sensors to reach optimum operating temperature before the survey commenced each day. The weather was predominantly overcast interspersed with occasional periods of blue skies, which followed a period of precipitation which left soft underfoot conditions. Instrument sampling intervals were set to 0.25m along 1m traverses (four readings per metre).

Survey grid layout

The detailed survey was undertaken within 20m grids (Fig. 2, red, green, cyan, magenta and grey grid), orientated to best fit the alignment of the fields and geolocated employing a Leica Viva GS08+ Smart Rover RTK GLONASS/GPS, allowing an accuracy of +/- 0.03m. Data were converted to National Grid Transformation OSTN15.

Data capture

Detailed fluxgate gradiometer survey data points were recorded on an internal data logger that were downloaded and checked for quality at midday and in the evening, allowing grids to be re-surveyed if necessary. A pro-forma survey sheet was completed to allow data composites to be created. Data were filed in unique project folders and backed-up onto an external storage device and then a remote server in the evening.

Data software, processing and presentation

All of the fields had a moderately high background magnetic susceptibility. Despite this good quality raw survey data was collected allowing minimal data processing to be required. Datasets were composited and processed using DW Consulting's Terrasurveyor v.3.0.33.6; raw grid files, composites and raster graphic plots will be stored and archived in this format. Minimal processing algorithms were undertaken on the raw (Figs. 3a and 4a) and processed datasets (Figs. 3b, 3c, 4b and 4c); schedules are presented in Appendix 1.

Data composites were exported as raster images into AutoCAD. An interpretation plan based on the combined results of the raw, processed and xy trace plots has been produced (Figs. 3d, 4d and 6).

Survey grid restoration

Three virtual survey grid stations were placed on survey grid nodes along the baselines of each survey grid within each field, these reference objects will allow geophysical anomalies to be accurately retargeted (Fig. 2).

5. Results and discussion

The fields were surveyed in number order, (Halesworth 1 - 5) as depicted in Figure 2 and will be discussed under these titles below. Isolated dipolar responses (grey spots) were recorded throughout the datasets in each field and are most probably caused by ferrous objects present in the ploughsoil, presumably introduced into the soil during manuring events and general loss over the years.

Halesworth 1 (Figs. 3a – 3d, 5 and 6)

Halesworth 1 was located on a *c*. 1.4 hectare sloping field in the northwestern corner of the site. Its magnetic background was one of the quietest of the five fields surveyed, however magnetic disturbance (grey hatching) was recorded in the southwestern corner of the field caused by the presence of a building in the adjacent field. Running parallel along the northern boundary was a sequence of high and low magnetic readings (grey hatching) that peaked at around +/- 60nT, likely to be indicative of a ferrous service run also prospected in the adjacent field (Halesworth 2). Two discrete magnetic responses were further recorded in the centre of the dataset that are most likely to be large ferrous objects present in the ploughsoil, or localised areas of burning.

A series of positive linear anomalies (red hatching) recorded in the centre of the field, orientated north-northeast to south-southwest, are on the same alignment as the current field boundary configuration. These anomalies appear to form a discontinuous set of parallel ditches, potentially used to drain a trackway that once bisected the field, although an agricultural origin cannot be ruled out.

Halesworth 2 (Figs. 3a – 3d, 5 and 6)

Halesworth 2 was a large single *c*. 5 hectare field located to the west of Halesworth 1, separated by a central trackway that currently serves the farm. It sits on the side of the slope and had a similar magnetic background signature to Halesworth 1.

Two perpendicular positive linear anomalies (red hatching) are indicative of backfilled field boundary ditches, aligned with the current field boundary configuration. Field boundaries are depicted in the same locations on the Ordnance Survey (OS) mapping dating back to the 1884 publication. These ditches are recorded on OS maps until 1958, they appear to have been backfilled by the time of the 1972 publication.

The sequence of positive and negative areas of magnetic disturbance (grey hatching) prospected in Halesworth 1 and interpreted as a ferrous service run are once again recorded on the northern boundary in Halesworth 2. Areas of magnetic disturbance are further recorded on the periphery of the survey, indicative of boundary furniture and general magnetic detritus.

A single larger discrete magnetic response (magenta hatching) was recorded in the southwestern quadrant of the field, its shape is indicative of a pit that has been backfilled with ferrous material.

Five positive discrete responses (orange hatching) were prospected across the field that potentially derive from pit type anomalies of an archaeological origin. Their dispersed locations could equally indicate a more natural geological derivation.

A discrete area of magnetic disturbance (yellow hatching) records the location of an extant overhead electric pole positioned near the centre of the field.

A single negative linear trend (cyan line) recorded running parallel with the eastern boundary is likely to delineate the location of an agricultural furrow.

Halesworth 3 (Figs. 3a – 3d, 5 and 6)
Halesworth 3 is separated by a hedgerow and to the south of Halesworth 2, in a small *c*. 0.5 hectare field given over to pasture.

A single positive linear anomaly (red hatching) recorded on a northeast to southwest alignment, parallel with the eastern boundary of the field is indicative of a backfilled ditch with archaeological potential. No features are recorded on the OS cartographic sources; however an agricultural origin cannot be ruled out.

One discrete positive anomaly (orange hatching) indicative of an archaeological pit was prospected, however a modern or agricultural origin cannot be discounted.

A single large discrete area of magnetic disturbance (yellow hatching) prospected in the northeastern corner of the site records the location of an overhead electricity cable post.

Halesworth 4 (Figs. 4a – 4d, 5 and 6)
Halesworth 4 is the second largest of the five fields surveyed and covers an area of 2.5 hectares. It is located on the side of a slope in the southwestern corner of the site and had been recently ploughed, harrowed and sown. The magnetic background here was found to be moderately high, like those recorded in Halesworth 2 and 5.

A single positive linear anomaly (red hatching) indicative of a backfilled ditch, bisects the field on an east to west alignment. A field boundary is recorded here from the 1884 OS map through to the 1958 publication. By the time of the 1972 publication the ditch appears to have been backfilled, similar to the relic field boundaries of Halesworth 2.

A single weak broad positive linear anomaly (green hatching) of probable geological origin, orientated northeast to southwest running downslope was prospected. It has been interpreted as a water run-off channel or infilled dry valley that follows the natural slope of the field.

Two discrete areas of magnetic disturbance (yellow hatching) were located where an overhead electric cable post attached to a stabilising cable were extant.

Two areas of magnetic enhancement (blue hatching) were recorded in the dataset, the first area is located on the southern boundary and is most likely to be caused by a building material spread associated with the housing estate that lies adjacent. The second area records a rubble hardcore spread located in the field entrance to the east.

Two large areas of magnetic disturbance (grey hatching) were recorded in the field, the first is present in the northwestern corner of the field and is of unknown origin. The second in the northeastern corner is located where egress from the farm track is gained. it is likely that a concentration of hardcore rubble was dumped in this area to provide sufficient traction, however no material was observed in the entrance by the surveyors.

One discrete magnetic response (magenta hatching) was recorded in the northern half of the field, it potentially derives from a large ferrous object, a buried pit containing ferrugenic material or it could be indicative of an area of burning.

Halesworth 5 (Figs. 4a – 4d, 5 and 6)

Halesworth 5 is located on a plateau in the southeastern corner of the site, to the east of the extant trackway that divides it from Halesworth 4, the magnetic background here was found to be moderately high. Both southern fields were surveyed employing the same grid.

A single area of magnetic disturbance (grey hatching) was recorded in the northwestern corner of the field that is likely to have been caused by ferrous material located within the field boundary.

A single discrete area of magnetic disturbance (yellow hatching) locates the position of an extant overhead electricity cable post that was present in the northeastern corner of the field.

6. Conclusion

Overall the fields were found to have a moderately high magnetic background partly due to magnetic material being introduced into the ploughsoil during manuring events, presumably to help break-up the heavy clay soil. Ceramic building material and general rubbish was observed within the ploughsoil horizon by the surveyors across all fields. Ferrous readings from material located in the field boundaries, a ferrous service pipe on the northern boundary and discrete areas of magnetic disturbance derived from the extant overhead electricity poles and their stabilising cables have further increased the magnetic background of the fields. Magnetic material dumps possibly deriving from the construction of the housing estate and from deposits laid down to improve traction into this field for agricultural plant, were further recorded in Halesworth 4.

The anomalies prospected do not reveal that a settlement is likely to be present on site. Those with the highest archaeological potential include the positive discrete anomalies (orange hatching) interpreted as potential archaeological pits, the discrete magnetic anomalies (magenta hatching) interpreted as rubbish pits, the positive linear anomalies (red hatching) indicative of a former trackway in Halesworth 1 and the ditch in Halesworth 3, all of which are not recorded on Ordnance Survey maps.

It would be prudent to undertake further targeted archaeological investigations to examine and define the full range of anomalies recorded during the magnetometer survey. Blank areas should be further investigated to verify the veracity of the magnetometer survey results.

7. Archive deposition

The paper and digital archive will be kept at the SACIC office in Needham Market, before deposition in the Suffolk County Council Stores in Bury St Edmunds.

8. Acknowledgements

Fieldwork was undertaken by Catherine Douglas, Cameron Bate, Tim Schofield and directed by Catherine Douglas, with Project management from Rhodri Gardner. The report and illustrations were created by Tim Schofield and edited by Stuart Boulter.

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Websites

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Survey Station	Easting	Northing
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STN 03	639380.061	278117.351
STN 04	639393.002	278200.493
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STN 06	639393.002	278060.493
STN 07	639464.503	278019.471
STN 08	639448.924	277961.529
STN 09	639541.759	277998.433
STN 10	639213.188	278021.117
STN 11	639169.767	277888.020
STN 12	639264.836	277857.007
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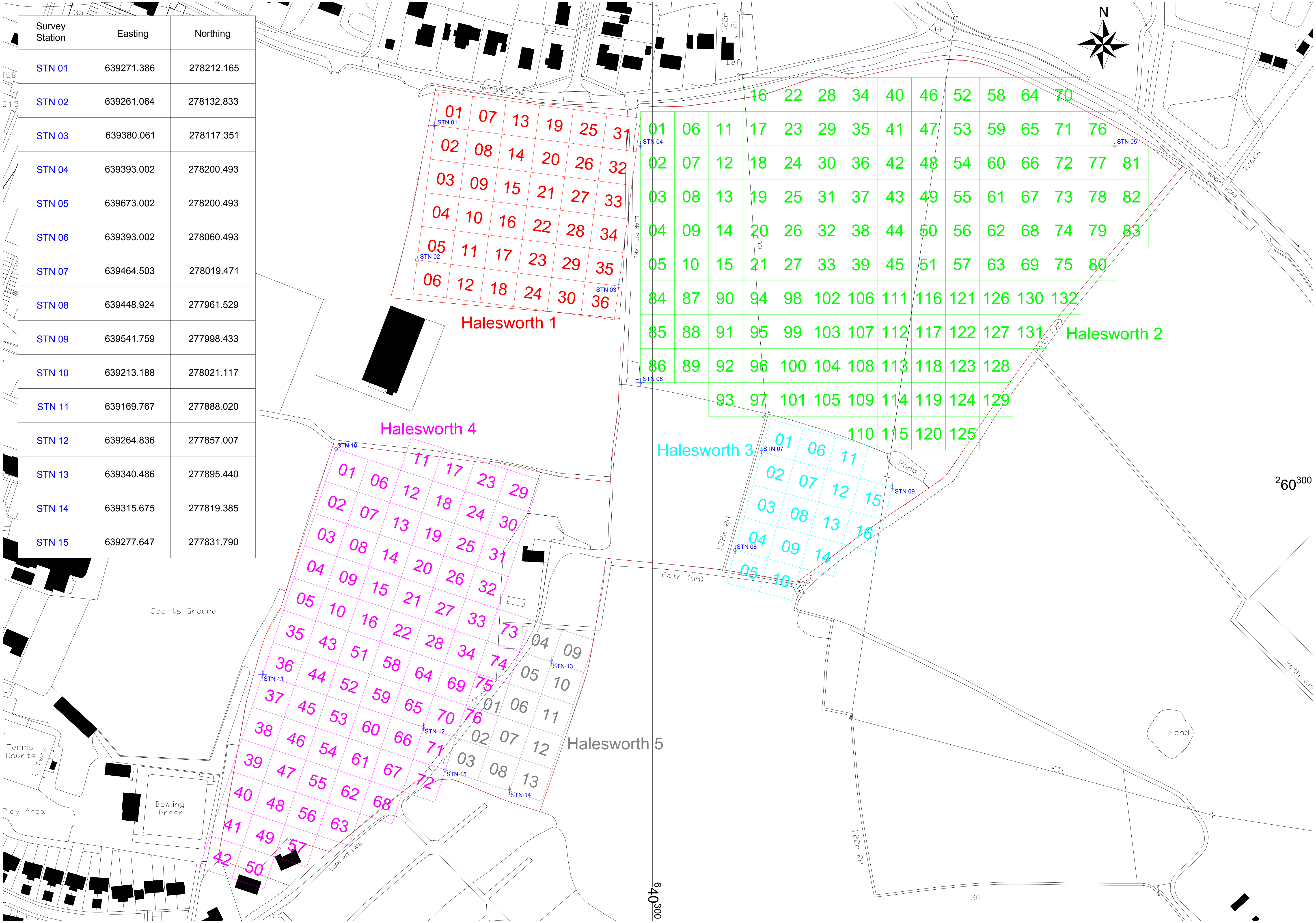

Figure 2. Site, survey grid and georeferencing information

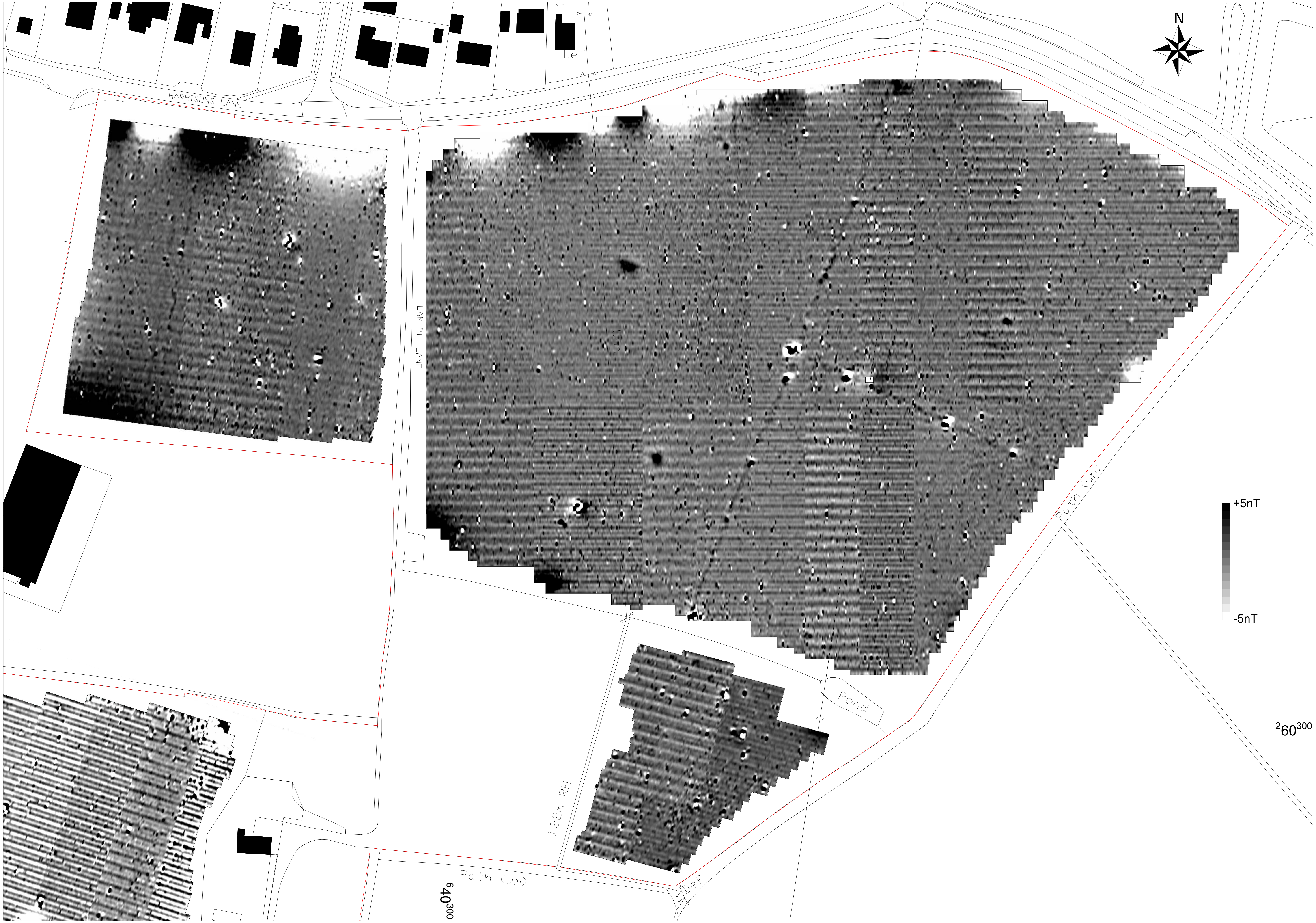

Figure 3A. Raw magnetometer greyscale plot, northern fields

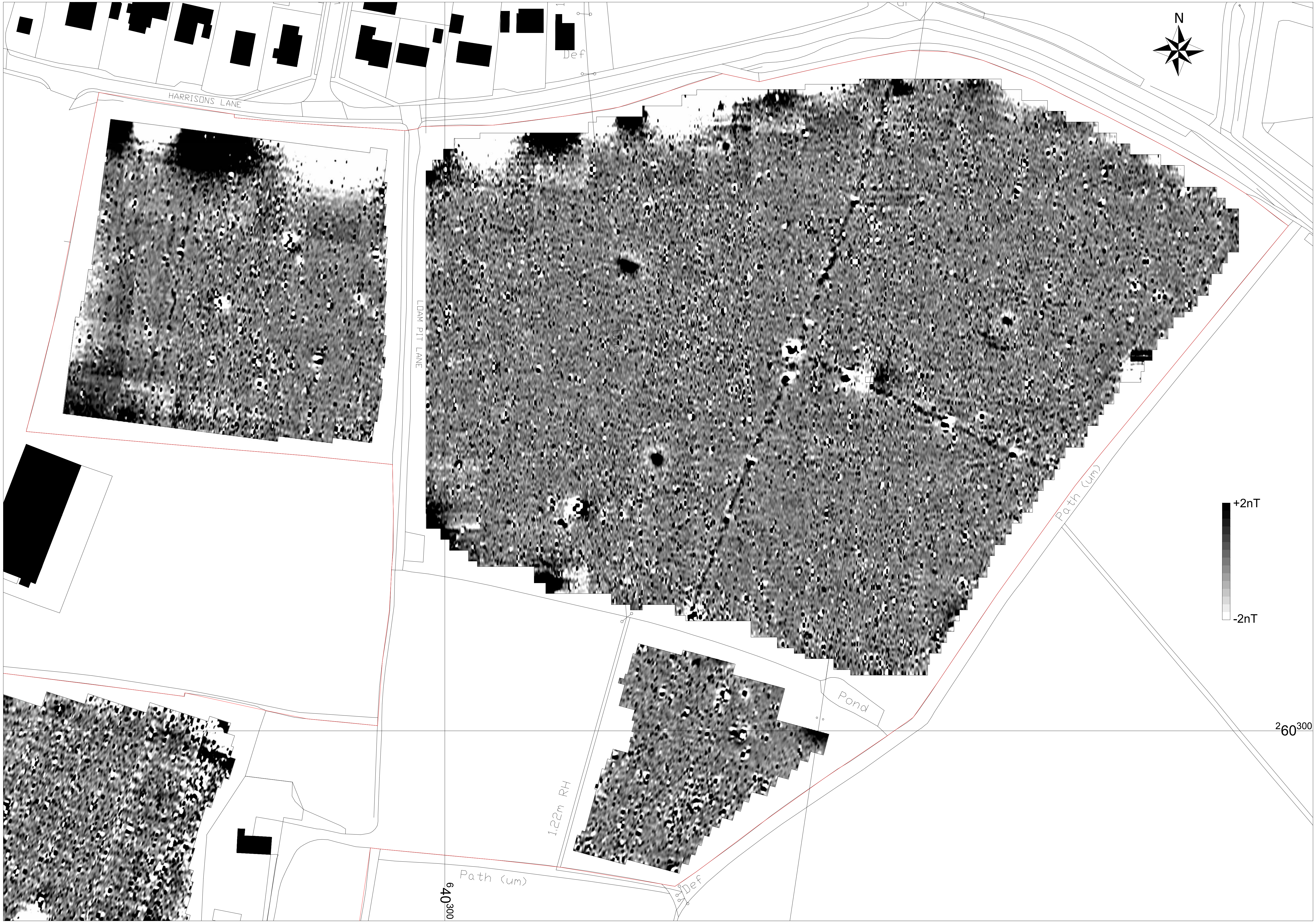

Figure 3B. Processed magnetometer greyscale plot, northern fields

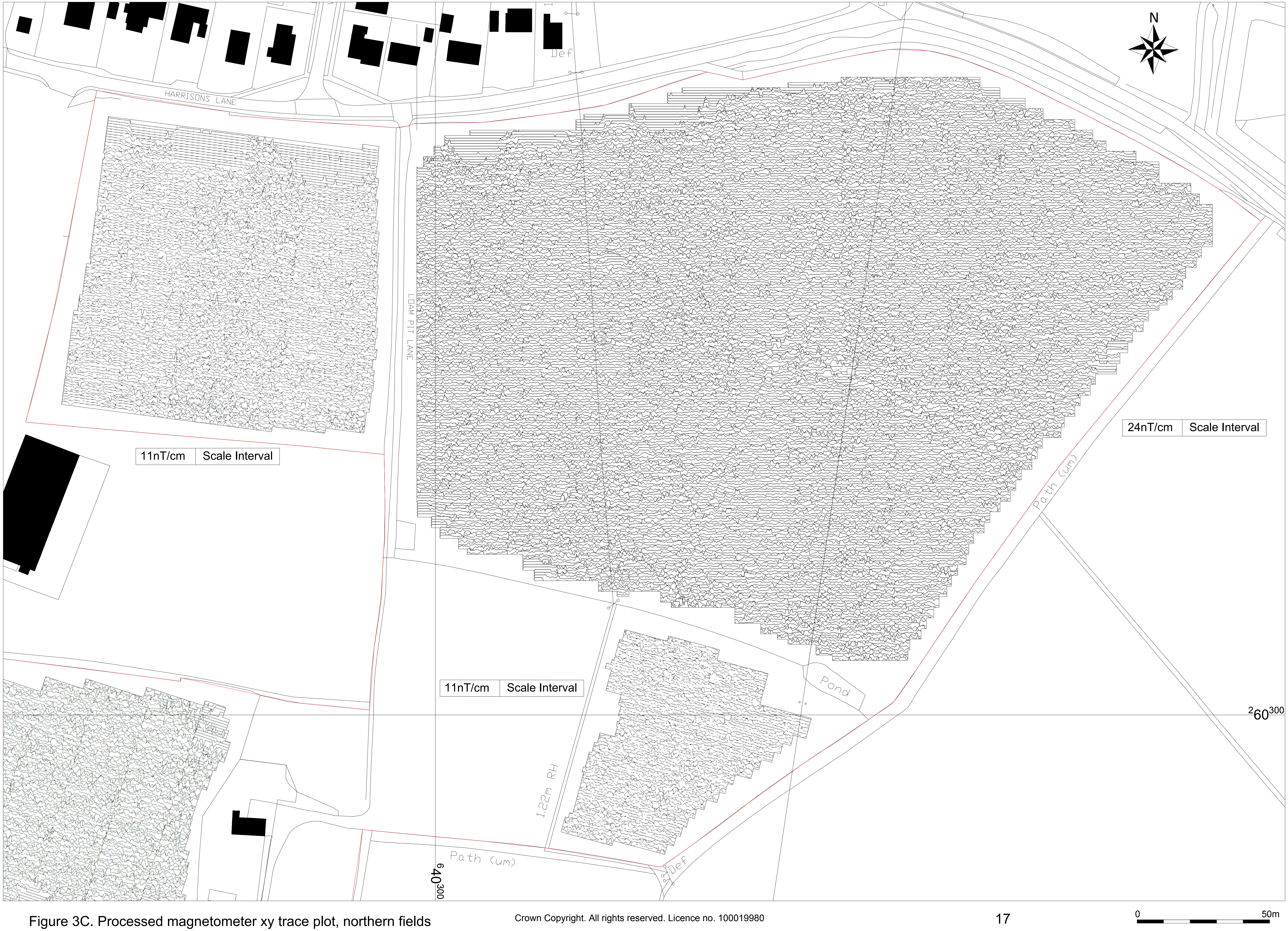

Figure 3C. Processed magnetometer xy trace plot, northern fields

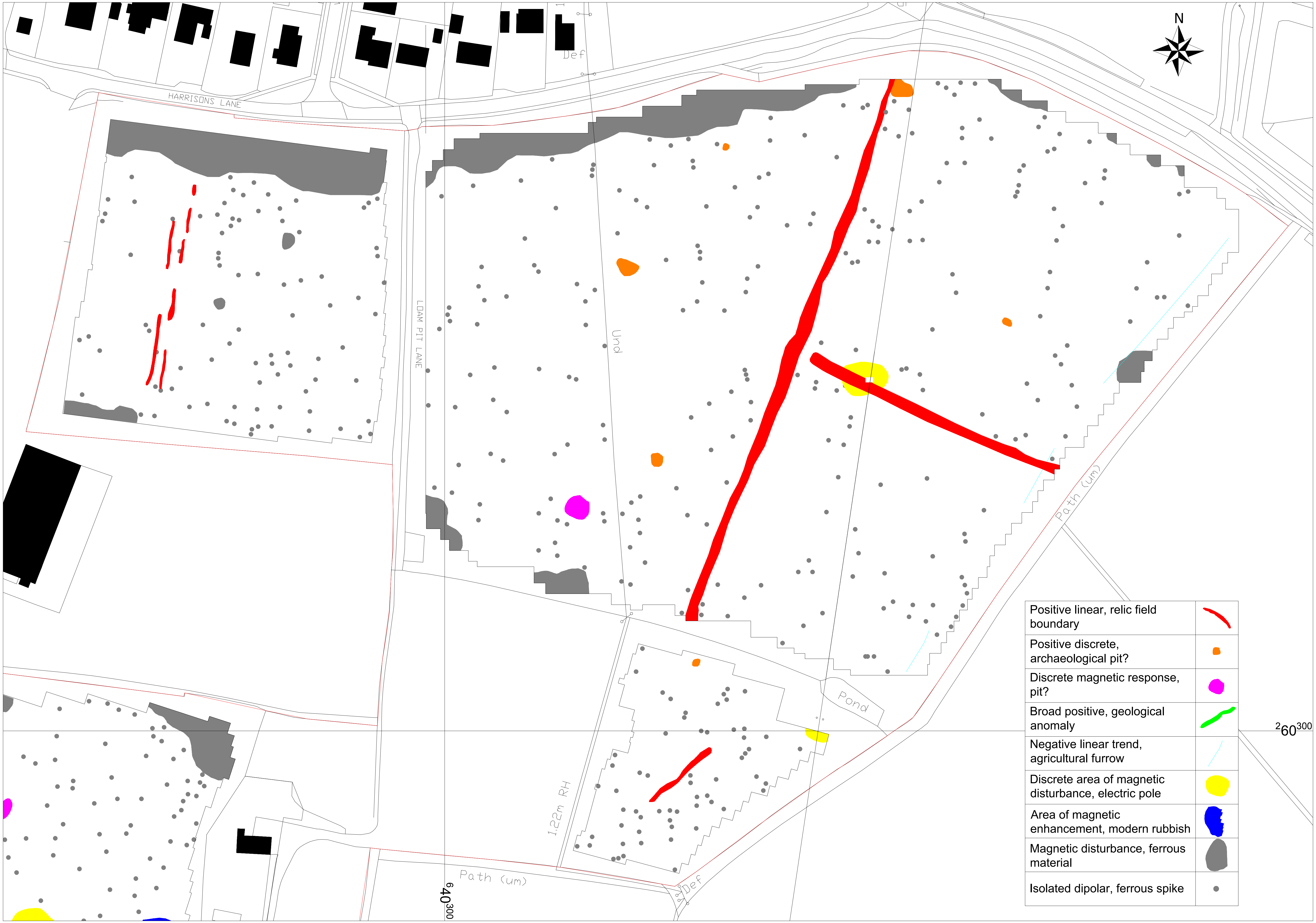

Figure 3D. Interpretation plot of magnetometer anomalies, northern fields

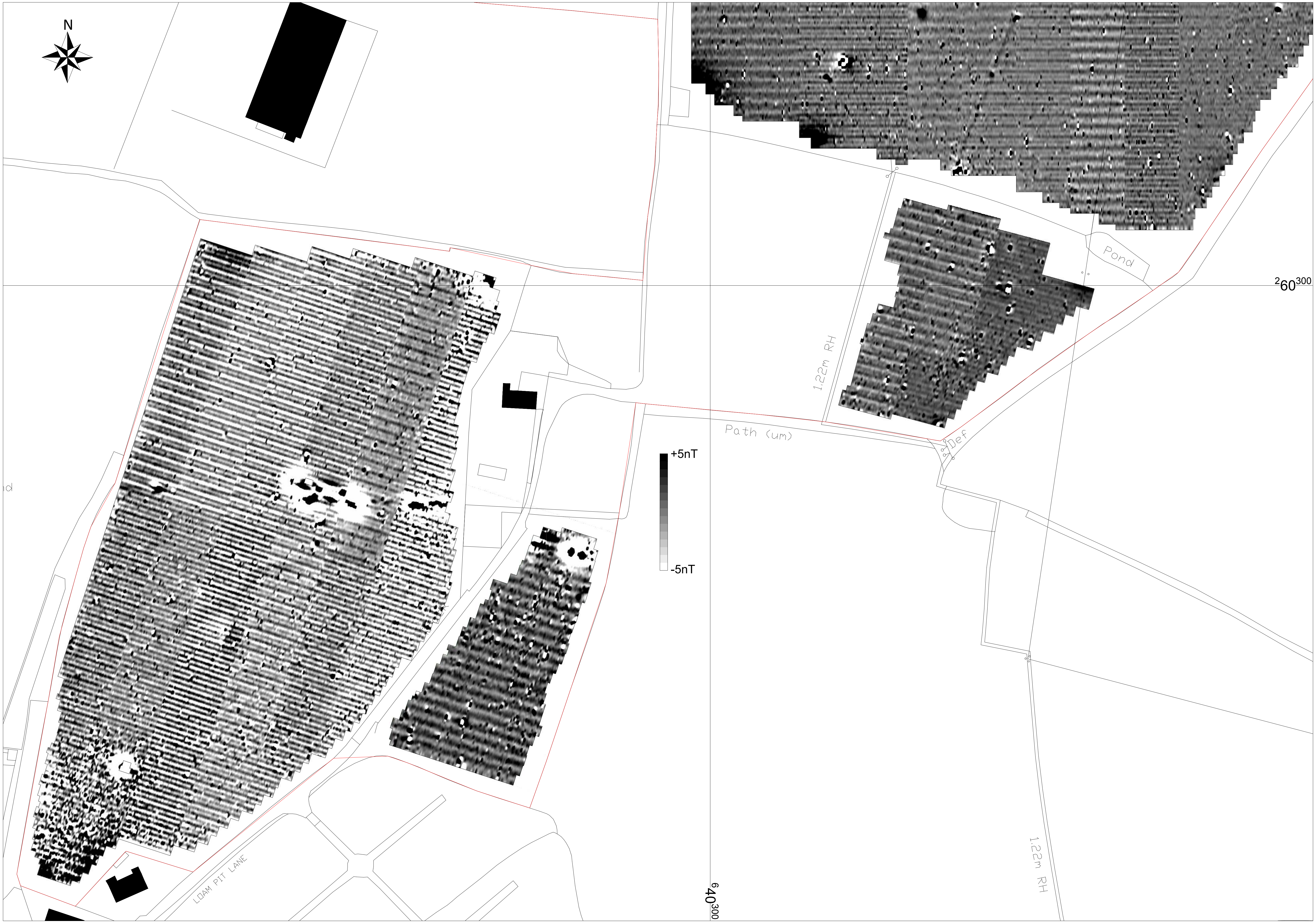

Figure 4A. Raw magnetometer greyscale plots, southern fields

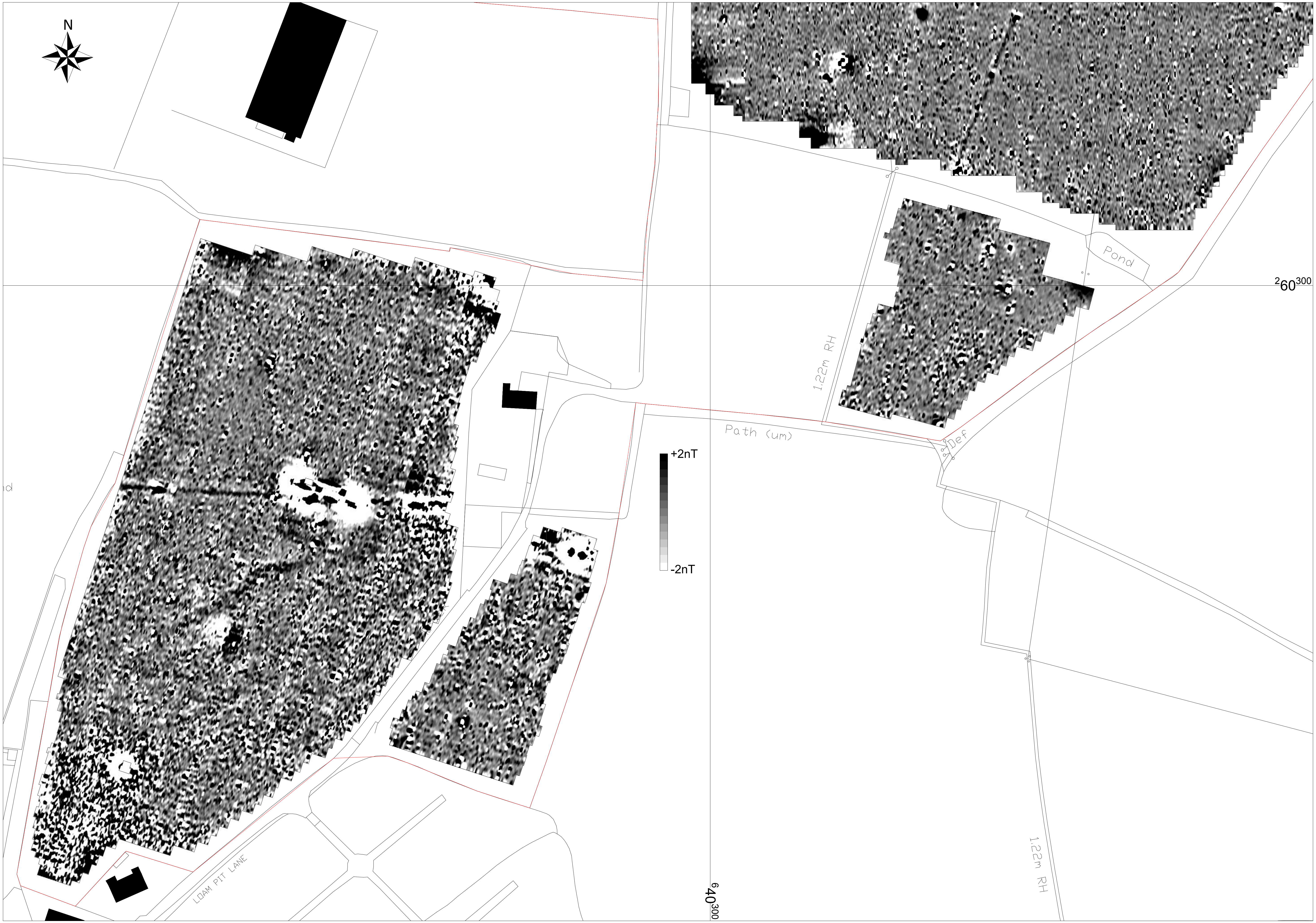

Figure 4B. Processed magnetometer greyscale plots, southern fields

Figure 4C. Processed magnetometer xy trace plots, southern fields

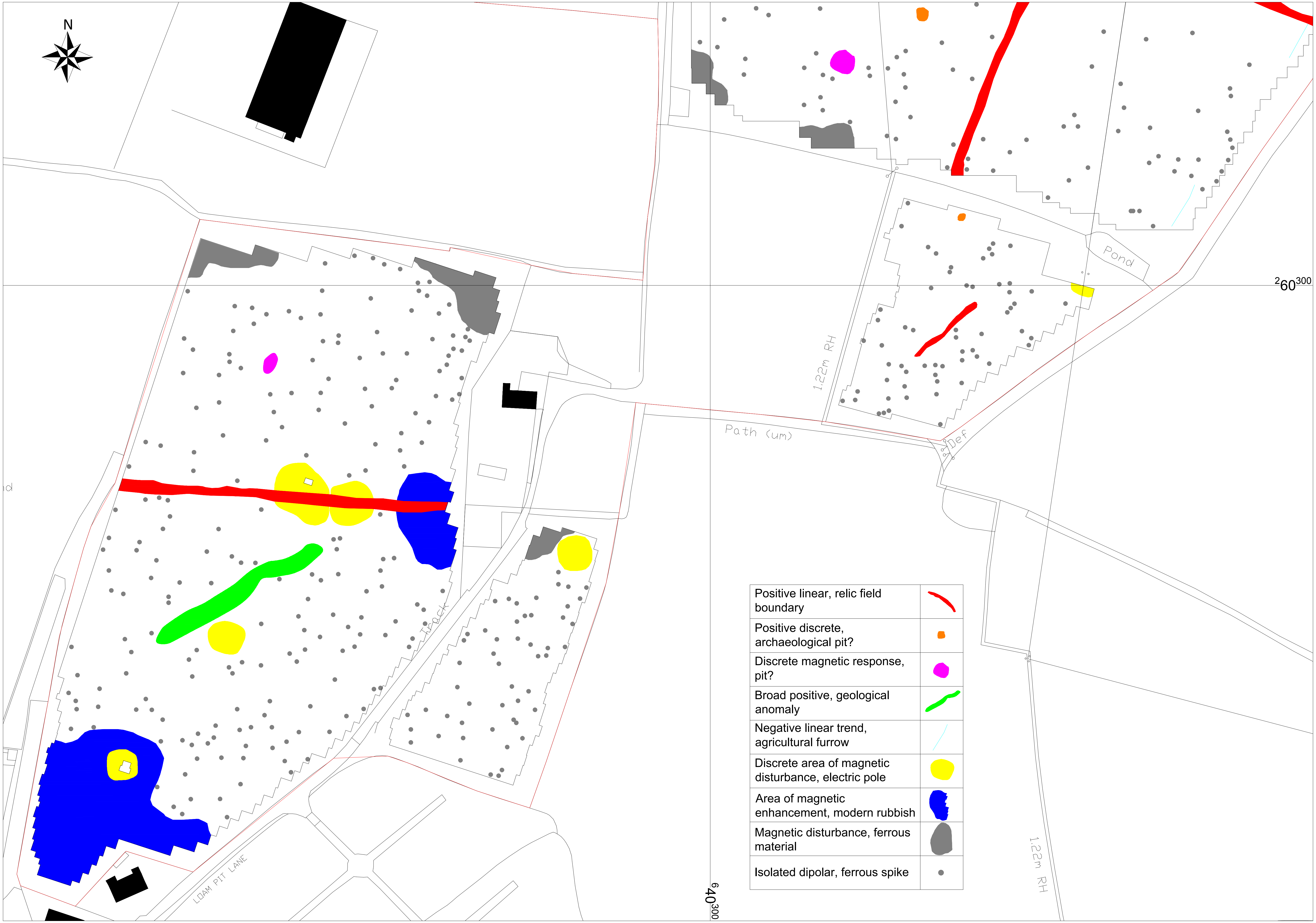

Figure 4D. Interpretation plot of magnetometer anomalies, southern fields

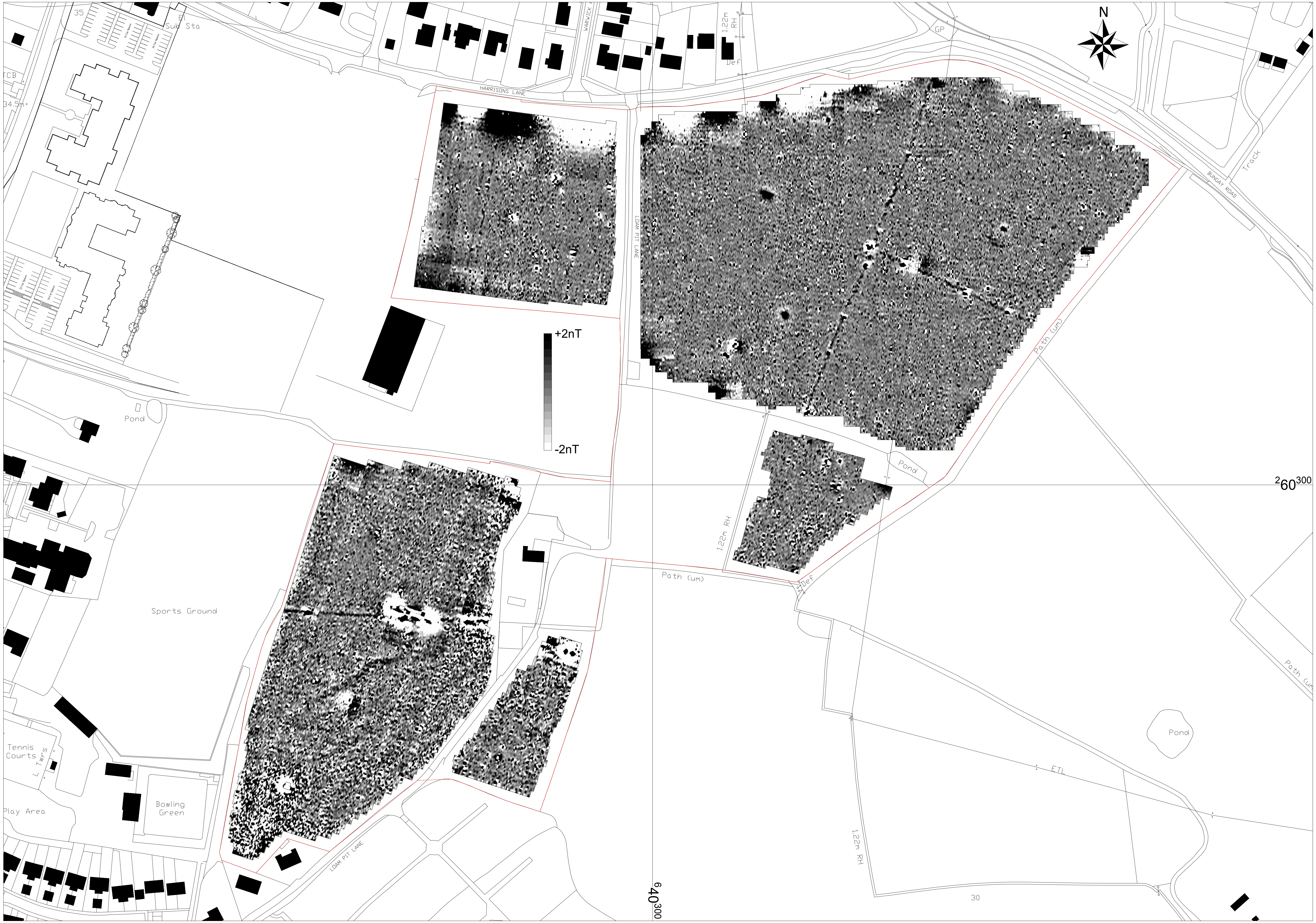

Figure 5. Combined processed magnetometer greyscale plots

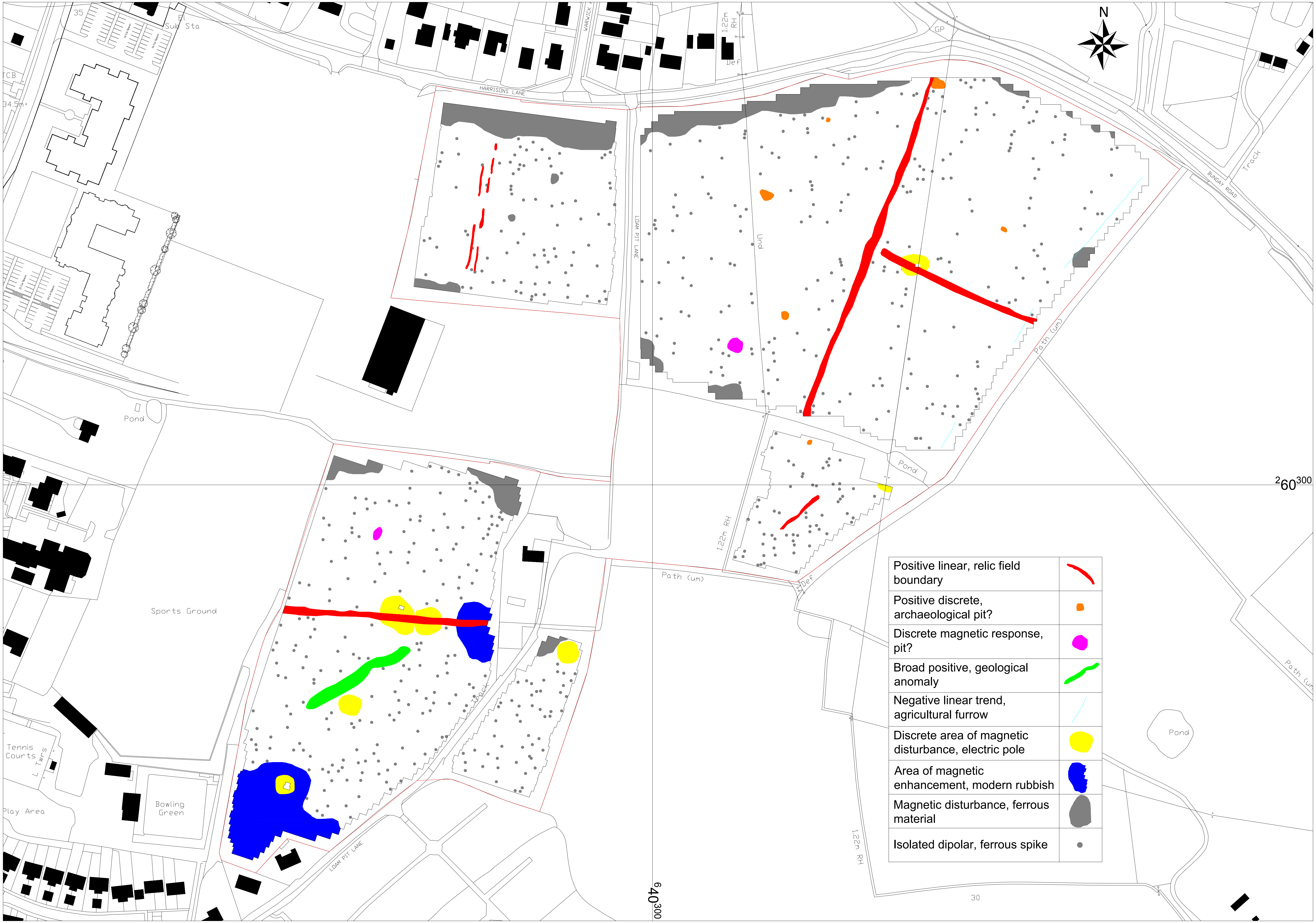

Figure 6. Combined interpretation plot of magnetometer anomalies

Appendix 1. Metadata sheets

Halesworth 1

Grids

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35 Col:5 Row:4 grids\35.xgd
36 Col:5 Row:5 grids\36.xgd

Raw Data

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Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	2047.5
Dimensions	
Composite Size (readings)	480 x 120
Survey Size (meters)	120 m x 120 m
Grid Size	20 m x 20 m
X Interval	0.25 m
Y Interval	1 m
Stats	
Max	100.00
Min	-100.00
Std Dev	5.58
Mean	1.23
Median	1.09
Composite Area	1.44 ha
Surveyed Area	1.2004 ha
Program	
Name	TerraSurveyor
Version	3.0.33.6

Processes

Display Clip -5 +5

Processed Data

Filename	Halesworth 1 P -2 +2.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	2047.5
Dimensions	
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Survey Size (meters)	120 m x 120 m
Grid Size	20 m x 20 m
X Interval	0.25 m
Y Interval	1 m
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Min	-102.03
Std Dev	5.42
Mean	0.15
Median	0.01
Composite Area	1.44 ha
Surveyed Area	1.2004 ha
Program	
Name	TerraSurveyor
Version	3.0.33.6

Processes

Display Clip -2 +2

Graduated Shade

Destripe Median Sensors; All

Halesworth 2

Grids

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80 Col:8 Row:2 grids\48.xgd
81 Col:8 Row:3 grids\49.xgd
82 Col:8 Row:4 grids\50.xgd
83 Col:8 Row:5 grids\51.xgd
84 Col:8 Row:6 grids\116.xgd
85 Col:8 Row:7 grids\117.xgd
86 Col:8 Row:8 grids\118.xgd
87 Col:8 Row:9 grids\119.xgd
88 Col:8 Row:10 grids\120.xgd
89 Col:9 Row:0 grids\52.xgd
90 Col:9 Row:1 grids\53.xgd
91 Col:9 Row:2 grids\54.xgd
92 Col:9 Row:3 grids\55.xgd
93 Col:9 Row:4 grids\56.xgd
94 Col:9 Row:5 grids\57.xgd
95 Col:9 Row:6 grids\121.xgd
96 Col:9 Row:7 grids\122.xgd

97 Col:9 Row:8 grids\123.xgd
98 Col:9 Row:9 grids\124.xgd
99 Col:9 Row:10 grids\125.xgd
100 Col:10 Row:0 grids\58.xgd
101 Col:10 Row:1 grids\59.xgd
102 Col:10 Row:2 grids\60.xgd
103 Col:10 Row:3 grids\61.xgd
104 Col:10 Row:4 grids\62.xgd
105 Col:10 Row:5 grids\63.xgd
106 Col:10 Row:6 grids\126.xgd
107 Col:10 Row:7 grids\127.xgd
108 Col:10 Row:8 grids\128.xgd
109 Col:10 Row:9 grids\129.xgd
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111 Col:11 Row:1 grids\65.xgd
112 Col:11 Row:2 grids\66.xgd
113 Col:11 Row:3 grids\67.xgd
114 Col:11 Row:4 grids\68.xgd
115 Col:11 Row:5 grids\69.xgd
116 Col:11 Row:6 grids\130.xgd
117 Col:11 Row:7 grids\131.xgd
118 Col:12 Row:0 grids\70.xgd
119 Col:12 Row:1 grids\71.xgd
120 Col:12 Row:2 grids\72.xgd
121 Col:12 Row:3 grids\73.xgd
122 Col:12 Row:4 grids\74.xgd
123 Col:12 Row:5 grids\75.xgd
124 Col:12 Row:6 grids\132.xgd
125 Col:13 Row:1 grids\76.xgd
126 Col:13 Row:2 grids\77.xgd
127 Col:13 Row:3 grids\78.xgd
128 Col:13 Row:4 grids\79.xgd
129 Col:13 Row:5 grids\80.xgd
130 Col:14 Row:2 grids\81.xgd
131 Col:14 Row:3 grids\82.xgd
132 Col:14 Row:4 grids\83.xgd

Raw Data

Filename	Halesworth 2 R -5 +5.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	2047.5
Dimensions	
Composite Size (readings)	1200 x 220
Survey Size (meters)	300 m x 220 m
Grid Size	20 m x 20 m
X Interval	0.25 m
Y Interval	1 m
Stats	
Max	100.00
Min	-100.00
Std Dev	3.48
Mean	0.50
Median	0.48
Composite Area	6.6 ha
Surveyed Area	4.805 ha
Program	
Name	TerraSurveyor
Version	3.0.33.6

Processes

Display Clip -5 +5

Processed Data

Filename	Halesworth 2 P -2 +2.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	2047.5
Dimensions	
Composite Size (readings)	1200 x 220
Survey Size (meters)	300 m x 220 m
Grid Size	20 m x 20 m
X Interval	0.25 m
Y Interval	1 m
Stats	
Max	100.52
Min	-102.24
Std Dev	3.27
Mean	0.01
Median	0.00
Composite Area	6.6 ha
Surveyed Area	4.805 ha
Program	
Name	TerraSurveyor
Version	3.0.33.6

Processes

Display Clip -2 +2

Graduated Shade

Destripe Median Sensors; All

Halesworth 3

Grids

Source Grids: 16
1 Col:0 Row:0 grids\01.xgd
2 Col:0 Row:1 grids\02.xgd
3 Col:0 Row:2 grids\03.xgd
4 Col:0 Row:3 grids\04.xgd
5 Col:0 Row:4 grids\05.xgd
6 Col:1 Row:0 grids\06.xgd
7 Col:1 Row:1 grids\07.xgd
8 Col:1 Row:2 grids\08.xgd
9 Col:1 Row:3 grids\09.xgd
10 Col:1 Row:4 grids\10.xgd
11 Col:2 Row:0 grids\11.xgd
12 Col:2 Row:1 grids\12.xgd
13 Col:2 Row:2 grids\13.xgd
14 Col:2 Row:3 grids\14.xgd
15 Col:3 Row:1 grids\15.xgd
16 Col:3 Row:2 grids\16.xgd

Raw Data

Filename	Halesworth 3 R -5 +5.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	2047.5
Dimensions	
Composite Size (readings)	320 x 100
Survey Size (meters)	80 m x 100 m
Grid Size	20 m x 20 m
X Interval	0.25 m
Y Interval	1 m
Stats	
Max	100.00
Min	-100.00
Std Dev	4.84
Mean	1.25
Median	1.32
Composite Area	0.8 ha
Surveyed Area	0.4354 ha
Program	
Name	TerraSurveyor
Version	3.0.33.6

Processes

Display Clip -5 +5

Processed Data

Filename	Halesworth 3 P -2 +2.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	2047.5
Dimensions	
Composite Size (readings)	320 x 100
Survey Size (meters)	80 m x 100 m
Grid Size	20 m x 20 m
X Interval	0.25 m
Y Interval	1 m
Stats	
Max	98.85
Min	-102.21
Std Dev	4.67
Mean	0.14
Median	0.00
Composite Area	0.8 ha
Surveyed Area	0.4354 ha
Program	
Name	TerraSurveyor
Version	3.0.33.6

Processes

Display Clip -2 +2

Graduated Shade

Destripe Median Sensors; All

Halesworth 4

Grids

Source Grids: 76
1 Col:0 Row:1 grids\01.xgd
2 Col:0 Row:2 grids\02.xgd
3 Col:0 Row:3 grids\03.xgd
4 Col:0 Row:4 grids\04.xgd
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6 Col:0 Row:6 grids\35.xgd
7 Col:0 Row:7 grids\36.xgd
8 Col:0 Row:8 grids\37.xgd
9 Col:0 Row:9 grids\38.xgd
10 Col:0 Row:10 grids\39.xgd
11 Col:0 Row:11 grids\40.xgd
12 Col:0 Row:12 grids\41.xgd
13 Col:0 Row:13 grids\42.xgd
14 Col:1 Row:1 grids\06.xgd
15 Col:1 Row:2 grids\07.xgd
16 Col:1 Row:3 grids\08.xgd
17 Col:1 Row:4 grids\09.xgd
18 Col:1 Row:5 grids\10.xgd
19 Col:1 Row:6 grids\43.xgd
20 Col:1 Row:7 grids\44.xgd
21 Col:1 Row:8 grids\45.xgd
22 Col:1 Row:9 grids\46.xgd
23 Col:1 Row:10 grids\47.xgd
24 Col:1 Row:11 grids\48.xgd
25 Col:1 Row:12 grids\49.xgd
26 Col:1 Row:13 grids\50.xgd
27 Col:2 Row:0 grids\11.xgd
28 Col:2 Row:1 grids\12.xgd
29 Col:2 Row:2 grids\13.xgd
30 Col:2 Row:3 grids\14.xgd
31 Col:2 Row:4 grids\15.xgd
32 Col:2 Row:5 grids\16.xgd
33 Col:2 Row:6 grids\51.xgd
34 Col:2 Row:7 grids\52.xgd
35 Col:2 Row:8 grids\53.xgd
36 Col:2 Row:9 grids\54.xgd
37 Col:2 Row:10 grids\55.xgd
38 Col:2 Row:11 grids\56.xgd
39 Col:2 Row:12 grids\57.xgd
40 Col:3 Row:0 grids\17.xgd
41 Col:3 Row:1 grids\18.xgd
42 Col:3 Row:2 grids\19.xgd
43 Col:3 Row:3 grids\20.xgd
44 Col:3 Row:4 grids\21.xgd
45 Col:3 Row:5 grids\22.xgd
46 Col:3 Row:6 grids\58.xgd

47 Col:3 Row:7 grids\59.xgd
48 Col:3 Row:8 grids\60.xgd
49 Col:3 Row:9 grids\61.xgd
50 Col:3 Row:10 grids\62.xgd
51 Col:3 Row:11 grids\63.xgd
52 Col:4 Row:0 grids\23.xgd
53 Col:4 Row:1 grids\24.xgd
54 Col:4 Row:2 grids\25.xgd
55 Col:4 Row:3 grids\26.xgd
56 Col:4 Row:4 grids\27.xgd
57 Col:4 Row:5 grids\28.xgd
58 Col:4 Row:6 grids\64.xgd
59 Col:4 Row:7 grids\65.xgd
60 Col:4 Row:8 grids\66.xgd
61 Col:4 Row:9 grids\67.xgd
62 Col:4 Row:10 grids\68.xgd
63 Col:5 Row:0 grids\29.xgd
64 Col:5 Row:1 grids\30.xgd
65 Col:5 Row:2 grids\31.xgd
66 Col:5 Row:3 grids\32.xgd
67 Col:5 Row:4 grids\33.xgd
68 Col:5 Row:5 grids\34.xgd
69 Col:5 Row:6 grids\69.xgd
70 Col:5 Row:7 grids\70.xgd
71 Col:5 Row:8 grids\71.xgd
72 Col:5 Row:9 grids\72.xgd
73 Col:6 Row:4 grids\73.xgd
74 Col:6 Row:5 grids\74.xgd
75 Col:6 Row:6 grids\75.xgd
76 Col:6 Row:7 grids\76.xgd

Raw Data

Filename	Halesworth 4 R -5 +5.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	2047.5
Dimensions	
Composite Size (readings)	560 x 280
Survey Size (meters)	140 m x 280 m
Grid Size	20 m x 20 m
X Interval	0.25 m
Y Interval	1 m
Stats	
Max	100.00
Min	-100.00
Std Dev	9.95
Mean	-1.57
Median	-1.19
Composite Area	3.92 ha
Surveyed Area	2.5268 ha

Processes

Display Clip -5 +5

Processed Data

Filename	Halesworth 4 P -2 +2.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	2047.5
Dimensions	
Composite Size (readings)	560 x 280
Survey Size (meters)	140 m x 280 m
Grid Size	20 m x 20 m
X Interval	0.25 m
Y Interval	1 m
Stats	
Max	113.52
Min	-103.78
Std Dev	9.04
Mean	-0.17
Median	0.00
Composite Area	3.92 ha
Surveyed Area	2.5268 ha
Program	
Name	TerraSurveyor
Version	3.0.33.6

Processes

Display Clip -2 +2

Graduated Shade

Destripe Median Sensors; All

Halesworth 5

Grids

Source Grids: 13
1 Col:0 Row:2 grids\01.xgd
2 Col:0 Row:3 grids\02.xgd
3 Col:0 Row:4 grids\03.xgd
4 Col:1 Row:0 grids\04.xgd
5 Col:1 Row:1 grids\05.xgd
6 Col:1 Row:2 grids\06.xgd
7 Col:1 Row:3 grids\07.xgd
8 Col:1 Row:4 grids\08.xgd
9 Col:2 Row:0 grids\09.xgd
10 Col:2 Row:1 grids\10.xgd
11 Col:2 Row:2 grids\11.xgd
12 Col:2 Row:3 grids\12.xgd
13 Col:2 Row:4 grids\13.xgd

Raw Data

Filename	Halesworth 5 R -5 +5.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	2047.5
Dimensions	
Composite Size (readings)	240 x 100
Survey Size (meters)	60 m x 100 m
Grid Size	20 m x 20 m
X Interval	0.25 m
Y Interval	1 m
Stats	
Max	100.00
Min	-100.00
Std Dev	10.03
Mean	0.93
Median	1.31
Composite Area	0.6 ha
Surveyed Area	0.35635 ha
Program	
Name	TerraSurveyor
Version	3.0.33.6

Processes

Display Clip -5 +5

Processed Data

Filename	Halesworth 5 P -2 +2.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	2047.5
Dimensions	
Composite Size (readings)	240 x 100
Survey Size (meters)	60 m x 100 m
Grid Size	20 m x 20 m
X Interval	0.25 m
Y Interval	1 m
Stats	
Max	100.00
Min	-100.00
Std Dev	10.03
Mean	0.93
Median	1.31
Composite Area	0.6 ha
Surveyed Area	0.35635 ha
Program	
Name	TerraSurveyor
Version	3.0.33.6

Processes

Display Clip -2 +2

Graduated Shade

Destripe Median Sensors; All

Appendix 2. Technical data

Detailed magnetometer survey

Detailed magnetometer survey is the most commonly employed archaeological geophysical prospection method in Britain; sensitive sensors can cost-effectively cover large areas of ground, rapidly recording anomalies that are indicative of cultural settlement activity. These anomalies can then be further investigated by field archaeologists to quantify a form and function. The magnetometer is a passive instrument that detects both permanent thermoremanent and temporary magnetic responses.

Thermoremanent Magnetism

When a material containing iron oxides, for example clay, is heated above the Curie point, weakly magnetic compounds transform in to highly magnetic oxides that can be detected by the sensors of a magnetometer (Clark, 1996). For instance, the iron oxide haematite has a Curie temperature of 675 Celsius and magnetite 565 Celsius. Once these temperatures are reached, the oxides become demagnetised, on cooling their magnetic properties become permanently re-magnetised and align in the direction of the Earth's magnetic field (Gaffney and Gater, 2003). Over time the direction of the Earth's magnetic field changes allowing these directional differences to be detected by the magnetometer.

Strongly heated features such as hearths, kilns or furnaces frequently reach the Curie temperature and become permanently magnetised. These permanent magnetic responses are some of the strongest cultural features that can be recorded.

Temporary Magnetism

Magnetic susceptibility is the ease with which a magnetic field can pass through a material, therefore the higher the material's magnetic susceptibility, the stronger the induced magnetic field will be. Temporary magnetisation occurs within material that is magnetically susceptible, this material acquires its own local magnetic field that combines with the Earth's magnetic field causing an anomaly to stand out from the background noise (Clark, 1996). These anomalies are subtler in nature, being derived from material that has been magnetically enhanced by cultural activity which has become concentrated into features over time. Anomalies that have temporary magnetisation include backfilled pits, ditches, field systems, occupation areas, land drains, remnant and existing field boundaries (David *et al*, 2014).

The key to a successful survey is having good contrast between the magnetic susceptibility of an archaeological feature with the surrounding superficial deposits. If there is no discernible difference between the two mediums it may be unlikely that the magnetometer will successfully prospect the feature. Archaeological features can also be masked by high magnetically susceptible topsoil, or deep overlying subsoil and colluvial deposits.

Ferrous anomalies

Ferrous objects are a common source of permanent magnetism, usually isolated with a strong dipolar signature. Some of these responses may have an archaeological derivation, however they are probably more indicative of modern iron objects introduced through manuring or lost within the topsoil.

Bartington DualGRAD 601-2 Fluxgate Gradiometers

Fluxgate gradiometers are the most commonly employed class of instrument in the UK. Two 1m sensitive sensors are affixed to a frame mounted 1m apart in a vertical plane and harnessed to the trunk of a geophysical surveyor or attached to a cart. Each sensor contains two fluxgate magnetometers with a 1m vertical separation. The sensor above records the Earth's magnetic field (magnetic background) while the sensor below records the local magnetic field. The two sensors need aligning before recording can begin and a zero station is located in an area with low magnetic variation for this purpose. After the sensors have been aligned, the survey can begin. When differences in the magnetic field strength occur between the two vertical magnetometers within each sensor, a positive or negative reading is recorded that is relative to the magnetic background of the zero station. Positive anomalies include pits, ditches and agricultural furrows. Negative anomalies commonly prospected include earthwork embankments, land drains and geological features.

Sensors are normally mounted to a height of 0.30m above the surface, and can detect to a depth of between one and two metres below the ground. The first survey traverse is commonly undertaken in an east to west direction.

Magnetic Anomalies

Isolated dipolar responses

Isolated dipolar responses are commonly recorded throughout a dataset and are usually indicative of modern ferrous material deposited within the topsoil horizon. In some instances, the anomalies may be of an archaeological derivation. They are isolated, strong and dipolar in character.

Areas of magnetic disturbance

These anomalies are usually caused by building demolition rubble, ferrous boundaries, slag waste dumps, modern buried rubbish, pylons and services. Strong and dipolar in character, they are commonly recorded over a wide area.

Linear trends

Linear trends can be either positive or negative magnetic responses depending on the nature of the material present within the feature. If the anomaly is broad and weak, it is more likely to be of geological origin. Stronger positive linear trends are more likely to be of archaeological derivation, caused by settlement activity washing rich humic, charcoal and fired deposits into a feature. Negative linear trends are more commonly associated with bank deposits or land drains, with the less magnetically susceptible superficial deposits deposited at the top of the feature. Curvilinear trends are usually of archaeological origin, commonly interpreted as ring ditches or drip-gullies.

Discrete anomalies

Discrete anomalies can either be positive or negative in nature recorded within a localised area. Those that are positive are more likely to be of an archaeological origin, with negative discrete anomalies more commonly interpreted as natural geological variations.

Thermoremanent responses

These responses are caused by the heating of material containing iron to above the Curie temperature, they are strong and discrete in nature. In Britain high positive readings are recorded to the south of the anomaly with high negative readings recorded to the north.

Appendix 3. OASIS form

OASIS DATA COLLECTION FORM: England

Printable version

OASIS ID: suffolka1-293416

Project details

Project name	Land South of Harrisons Lane, Halesworth, Suffolk; Geophysical Survey
Short description of the project	In October and November 2017 Suffolk Archaeology Community Interest Company (SACIC) undertook a detailed fluxgate gradiometer survey over c. 12.5 hectares on land south of Harrisons Lane, Halesworth, Suffolk. The survey was undertaken within five separate fields, three of which were recently harrowed and sown and two that were under short cropped grass. The detailed fluxgate gradiometer survey prospected a wide variety of geophysical anomalies, those of a potential archaeological origin include five backfilled ditches of which three are relic field boundaries, a possible double ditched trackway, six discrete pits and two large discrete magnetic responses interpreted as potential rubbish pits. A modern ferrous service run was prospected on the northern field boundary, areas of magnetic enhancement caused by modern dumps of material, overhead electricity cable poles and magnetic material located within and near the field boundaries. A single linear geological anomaly was further recorded running downslope in the southwestern field, and an agricultural furrow was recorded in the northeastern dataset.
Project dates	Start: 31-10-2017 End: 07-11-2017
Previous/future work	Not known / Yes
Any associated project reference codes	ESF 25783 - HER event no.
Any associated project reference codes	HWT 053 - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 3 - Operations to a depth more than 0.25m
Monument type	ANOMALIES INDICATIVE OF RELIC FIELD BOUNDARIES Uncertain
Monument type	ANOMALIES INDICATIVE OF RUBBISH PITS Uncertain
Monument type	ANOMALIES INDICATIVE OF ARCHAEOLOGICAL PITS Uncertain
Monument type	ANOMALIES INDICATIVE OF TRACKWAY DITCHES Uncertain
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Housing estate
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	Pre-application
Solid geology (other)	Crag Group Sands

Drift geology (other)	Lowestoft Formation Diamicton
Techniques	Magnetometry

Project location

Country	England
Site location	SUFFOLK WAVENEY HALESWORTH Land South of Harrisons Lane, Halesworth, Suffolk
Study area	12.5 Hectares
Site coordinates	TM 3941 7802 52.347316227248 1.515551999692 52 20 50 N 001 30 55 E Point
Height OD / Depth	Min: 22m Max: 35m

Project creators

Name of Organisation	Suffolk Archaeology CIC
Project brief originator	Local Authority Archaeologist and/or Planning Authority/advisory body
Project design originator	Rachael Abraham
Project director/manager	Rhodri Gardner
Project supervisor	Catherine Douglas
Type of sponsor/funding body	Consultants/architects
Name of sponsor/funding body	Richborough Estates Ltd & Mrs N. Barrett-Nobbs

Project archives

Physical Archive Exists?	No
Digital Archive recipient	Suffolk HER
Digital Contents	"Survey"
Digital Media available	"Geophysics","Images raster / digital photography","Images vector","Survey","Text"
Paper Archive recipient	Suffolk HER
Paper Contents	"Survey"
Paper Media available	"Map","Plan","Report","Survey ","Unpublished Text"

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
Title	Land South of Harrisons Lane, Halesworth, Suffolk; Geophysical Survey Report
Author(s)/Editor(s)	Schofield, T. P.
Other bibliographic details	Report 2017/100

Date	2017
Issuer or publisher	Suffolk Archaeology CIC
Place of issue or publication	Needham Market
Description	A4 bound report with A3 fold-out figures.
URL	www.suffolkarchaeology.co.uk

Entered by	Tim Schofield (tim.schofield@suffolkarchaeology.co.uk)
Entered on	24 November 2017

OASIS:

Appendix 4. Written scheme of investigation

Land South of Harrisons Lane

Halesworth, Suffolk

Client:
Steve Logan, Owen Brown at Brown & Co.

Date:
August 2017

HWT 053 / ESF 25783
Written Scheme of Investigation and Risk Assessment – Geophysical Survey
Author: Tim Schofield HND BSc MCIfA

Contents

List of Figures

Appendices

Project details

Planning Application No:	TBC
Curatorial Officer:	Rachael Abraham (Suffolk CC Archaeological Service)
Grid Reference:	TM 3941 7802
Area:	*c.* 12.5ha
HER Event No/Site Code:	ESF 25783 / HWT 053
OASIS Reference:	293416
Project Start date:	TBC
Project Fieldwork Duration:	*c.* 6 days
Client/Funding Body:	Steve Logan
SACIC Project Manager:	Tim Schofield
SACIC Project Officer:	Tim Schofield
SACIC Job Code:	TBC

1. Introduction

- A program of geophysical survey is required to the south of Harrisons Lane, Halesworth, Suffolk (Fig. 1), prior to determination of a planning application in accordance with paragraph 128, 129 and 141 of the National Planning Policy Framework.
- The work required has been agreed with the archaeological adviser to the Local Planning Authority (LPA), Rachael Abraham of Suffolk County Council Archaeological Service (SCCAS).
- The development occupies an area of *c.* 12.5ha and Suffolk Archaeology (SACIC) have been contracted to carry out the geophysical survey. This Written Scheme of Investigation (WSI) details how the survey will meet the requirements as laid out in the SCCAS geophysical survey guidelines (SCCAS 2017), and has been submitted to SCCAS for approval on behalf of the LPA. It provides the basis for measurable standards and will be adhered to in full, unless otherwise agreed with SCCAS.
- It should be noted that the geophysical survey is only a first stage in a potential program of works. This WSI covers the geophysical survey only. Any further stages of archaeological work that are required in relation to the proposed development after the survey will be specified by SCCAS, and will require new documentation (Brief and WSI) and estimate of costs. Such works could have considerable time and cost implications for the development and the client is advised to consult with SCCAS as to their obligations following receipt of the geophysical survey report.

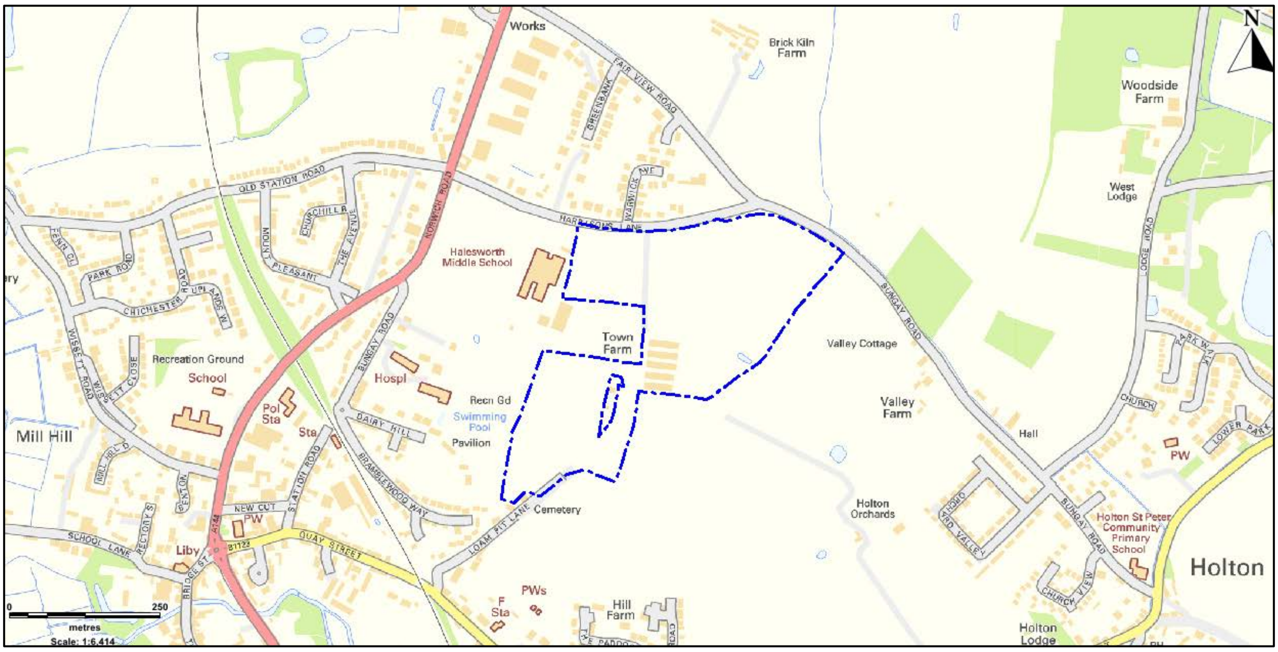

Figure 1. Location map

2. The Site

- The site lies within an arable landscape (TM 3941 7802) 950m to the northeast of the centre of Halesworth. The 12.5ha area comprises seven fields, of which five are suitable for survey. It slopes steeply from 34m in the west to 22m Above Ordnance Datum in the west.
- The bedrock geology consists of Crag Group sand formed 0 to 5 million years ago in the Quaternary and Neogene Periods when the local environment was dominated by shallow seas depositing clay, silt, sand and gravel (BGS 2017). This is overlain by superficial deposits of Lowestoft Formation Diamicton, formed up to 2 million years ago in the Quaternary Period during ice age conditions where glaciers scoured the landscape depositing moraines of till with outwash sand and gravel from seasonal and post glacial meltwaters (BGS 2017).

3. Archaeological and Historical Background

- The geophysical survey is required by Rachael Abraham of SCCAS/CT in order to inform the archaeological evaluation brief for the proposed development.
- A full search of the Suffolk Historic Environment Record has been commissioned and will be used within the survey report. A quick background search has revealed that a former isolation small pox hospital or pesthouse (HWT 020) built in the 18th century is located in the centre of the survey area, a watching brief (HWT 042) undertaken here in 2015 recorded early modern pits potentially relating to the hospital.
- An initial examination of historic mapping held by SACIC has been made. Hodskinson's map of Suffolk from 1783 records an open field with the pest house clearly labelled within the centre. The site is bounded to the north by a lane now known as Harrisons Lane, Holton Post Mill built in 1749 is clearly depicted to the southeast and southwest and the Church of St Peter is also clearly recorded to the east. The New Reach canalised end of the Blyth Navigation has also been recorded to the south of the site. On the 1884 Ordnance Survey (OS) map Pesthouse Farm (smallpox hospital) is printed in the centre of the site that is recorded as such until the 1927 OS map where the building is called Pesthouse Farm, indicating that the hospital was probably no longer in use. The 1884 OS map depicts the outer field boundaries similar to the arrangement present today, however interior subdivisions are recorded; the 1972 OS map records the current field boundary configuration.

4. Project Objectives

- A systematic fluxgate gradiometer survey is to be undertaken across five fields suitable for geophysical survey within the proposed development.

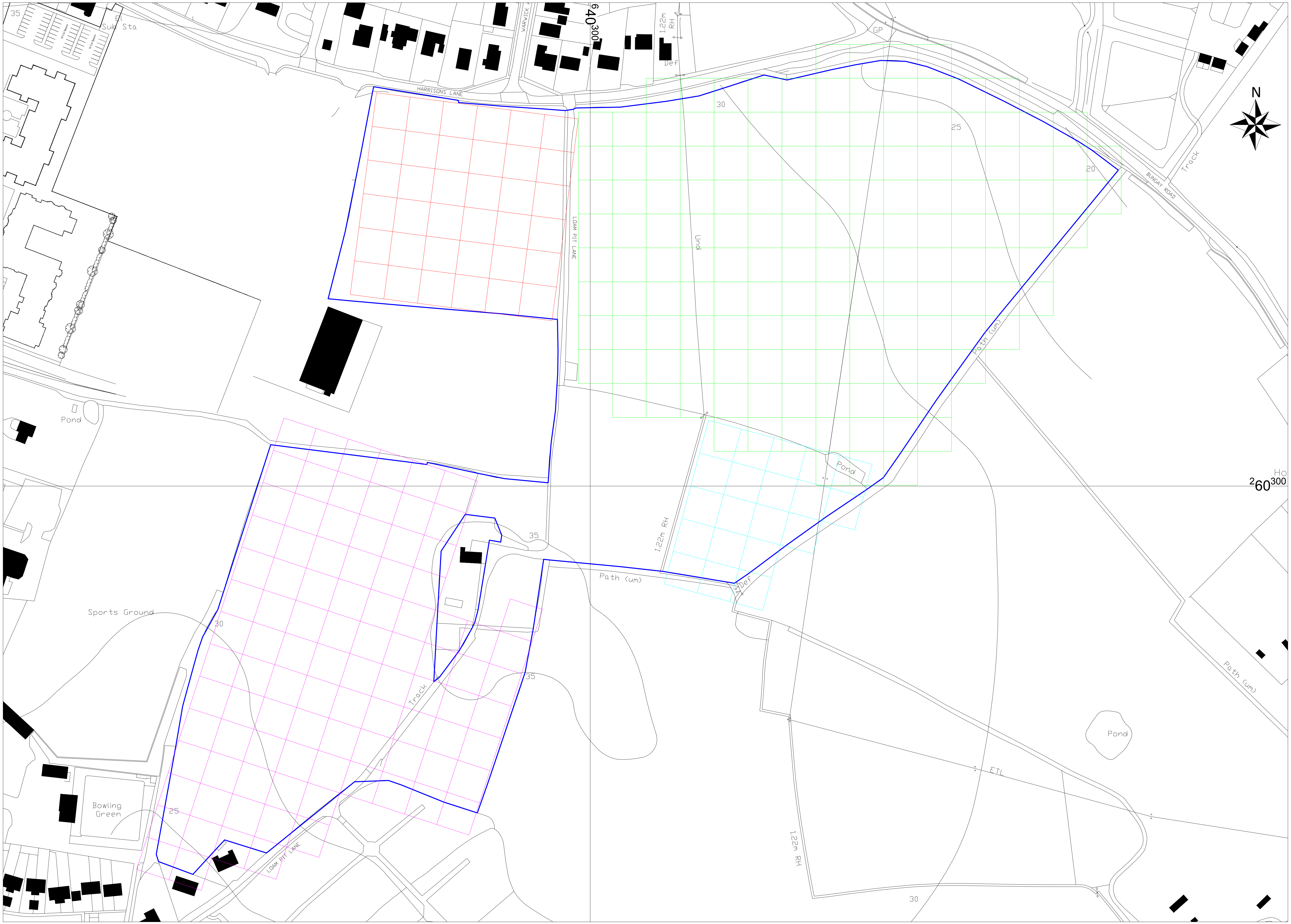

Figure 2. Proposed survey grid locations

5. Geophysical Survey Method Statement

5.1. Management

- The project will be managed by SACIC Project Officer Tim Schofield in accordance with the principles of *Management of Research Projects in the Historic Environment* (MoRPHE, Historic England 2015).
- SCCAS will be given five days' notice of the commencement of the fieldwork and arrangements made for a SCCAS site visit if required.
- Full details of project staff are given in section 6 below.

5.2. Project preparation

- An event number and site code have been obtained from the SCCAS HER Officer and will be included on all future project documentation. An HER search has been requested.
- An OASIS online record has been initiated and key fields in details, location and creator forms have been completed.
- A Risk Assessment for the project has been completed.

5.3. Fieldwork

- Fieldwork standards will be guided by 'Standards for Field Archaeology in the East of England', EAA Occasional Papers 14, and the Chartered Institute for Archaeology's (CIfA) paper 'Standard and Guidance for archaeological geophysical survey', December 2014.
- The fieldwork will be carried out by members of SACIC led by Project Officer Tim Schofield. The fieldwork team will be drawn from a pool of suitable staff at SACIC.
- The project requires the survey of *c*. 12.5 hectares over the proposed development area (Fig. 2). Minor modifications to the survey area may need to be made onsite to respect any areas of disturbance/contamination or other obstacles.
- The outline of the survey area ensures that a 5-10m exclusion zone can be

maintained from surrounding field boundaries in order to minimise the amount of associated magnetic disturbance.

Instrument type and set-up

- The site will be surveyed using a Bartington Dual-Grad 601-2 which has high sensor sensitivity combined with rapid ground coverage. Good contrast between the magnetic susceptibility of a feature's fill (charcoal rich or humic deposits providing the best soil medium) and the local magnetic background signature of the superficial deposits will be important in achieving successful survey results.
- Best practice dictates that sensors will be secured on the same side of the instrument until the completion of the survey, and sensor heights equalised to achieve a consistent elevation across the area. The instrument will be switched on and left for at least 20 minutes before the survey of the first grid to allow the sensors to reach a suitable operating temperature.
- A zero station with low magnetic susceptibility shall be prospected within the field to allow the correction of diurnal sensor drift. This unique station will be employed throughout the survey providing a common calibration location.

Sampling interval and grid size

- The 20m survey grid will be set-out using a Leica Viva Glonass Smart Rover GS08+ to the Ordnance Survey OSGB36, converted to the National Grid Transformation OSTN15 datum that has an accuracy of +/- 0.03m. Regular testing of the instruments accuracy will be undertaken employing stations with known ETRS89 coordinates. All raw data recorded by the GPS will be uploaded to the project folder, suitably labelled and kept as part of the project archive.
- A 1m traverse interval and 0.25m sample interval will be utilised.

Data capture and archiving

- A pro-forma survey sheet will be completed each day; unique grid numbers will be allocated to enable a data composite to be created. Instrument readings will be recorded on the internal data logger and downloaded to a laptop at midday and also in the evening, this will allow the data to be checked for quality on site and for grids to be re-surveyed if required.

- Data will be filed in project specific folders separated into daily datasets. The daily datasets will be combined into a single composite on completion of the fieldwork.
- Data will be stored in project specific folders that will be downloaded onto a laptop and then backed-up onto an external server in the evening of each day.
- Metadata sheets will be completed and inserted into the report as an appendix.
- All on-site derived site data will be entered onto a digital (Microsoft Access) SACIC database compatible with the Suffolk HER.

Data processing and presentation

- Raw survey data will be collected to a high standard to enable only minimal processing of the datasets to be required. Typically, these algorithms may comprise de-spike and zero mean sensor. The data will also be clipped at a suitable level to enable the anomalies to be presented with best clarity.
- Raw and processed greyscale plots and xy trace plots of the datasets shall be exported from Terrasurveyor into AutoCAD.
- An interpretation plan based on the combined interpretations of the raw, processed and xy trace plots will be produced using AutoCAD. All figures shall be georeferenced within the National Grid and printed at an appropriate scale.

Software

- The software used to process the data will be DW Consulting's Terrasurveyor v3.0.32.4. Images will be exported from Terrasurveyor into a geo-referenced grid within an AutoCAD drawing. Interpretation plans of the anomalies will then be digitised using AutoCAD.

5.4. Report

- The report will be commensurate with the results of the fieldwork and will be consistent with the principles of Management of Research Projects in the Historic Environment (MoRPHE, Historic England, 2015), Geophysical survey in Field Evaluation (Historic England, 2008) and the Standard and Guidance for Archaeological Geophysical Survey (Chartered Institute for Archaeologists, 2014), containing the following: a summary, description of the project background, site location, survey methodology, detailed description of the nature, location and extent of anomalies, discussion of the anomalies, impact assessment, site potential and possible further work. Scaled raw, processed, xy data plans and an interpretation plan will also be included.
- The report will include a summary in the established format for inclusion in the annual *'Archaeology in Suffolk'* section of the Proceedings of the Suffolk Institute of Archaeology and History.
- A copy of this Written Scheme of Investigation will be included as an appendix in the report.
- Metadata sheet tables will form one of the appendices within the report.
- A technical data sheet will be included as an appendix.
- The report will include a copy of the completed project OASIS form as an appendix.
- An unbound draft copy of the report will be submitted to SCCAS for approval within 6 months of completion of fieldwork.

5.5. Project archive

- On approval of the report a printed and bound copy will be lodged with the Suffolk HER. A digital .pdf file will also be supplied, together with a digital and fully georeferenced vector plan showing the application area and survey location, compatible with MapInfo software.
- The online OASIS form for the project will be completed and a .pdf version of the report uploaded to the OASIS website for online publication by the Archaeological Data Service. A paper copy of the form will be included in the project archive.

- A second bound copy of the report will be included with the project archive.
- A digital .pdf copy of the approved report will be supplied to the client, together with our final invoice for outstanding fees. Printed and bound copies will be supplied to the client on request.
- The project archive, consisting of all paper and digital records, will be deposited in the SCCAS Archaeological Store at Bury St Edmunds within 6 months of completion of fieldwork. The project archive will be consistent with MoRPHE (Historic England, 2015) and ICON guidelines. The project archive will also meet the requirements of SCCAS (SCCAS 2017).
- The project costing includes a sum to meet SCCAS archive charges. A form transferring ownership of the archive to SCCAS will be completed and included in the project archive.
- If the client, on completion of the project, does not agree to deposit the archive with, and transfer to, SCCAS, they will be expected to either nominate another suitable depository approved by SCCAS.

5.6. Bibliography

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SCCAS, 2017, *Requirements for a Geophysical Survey*.

Witten, A. J., 2006, *Handbook of Geophysics and Archaeology.* Equinox Publishing Ltd. London.

Websites

British Geological Survey 2017

http://mapapps.bgs.ac.uk/geologyofbritain/home.html

6. Project Staffing

6.1. Management

SACIC Manager	Dr Rhodri Gardner
SACIC Project Manager	John Craven

6.2. Fieldwork

The fieldwork team will be derived from the following pool of SACIC staff.

Name	Job Title	First Aid	Other skills/qualifications
Tim Schofield	Project Officer	Yes	Geophysical Surveyor
Catherine Douglas	Project Officer	Yes	Geophysical Surveyor
Cameron Bate	Project Assistant	No	Geophysical Surveyor
Filipe Santos	Project Assistant	No	Geophysical Surveyor
Rui Santo	Project Assistant	No	Geophysical Surveyor

6.3. Report production

The production of the site report, graphics and submission of the project archive will be carried out by Tim Schofield.

Appendix 1. Health and Safety

1. Introduction

The project will be carried out following the SACIC Health and Safety Management System at all times. The SACIC Health and Safety Policy Statement reads as follows:

Suffolk Archaeology Community Interest Company is committed to ensuring the health, safety and welfare of its employees, and it will, so far as is reasonably practicable, establish procedures and systems necessary to implement this commitment and to comply with its statutory obligations on health and safety. Our Personnel are informed of their responsibilities to ensure they take all reasonable precautions, to ensure the safety, health and welfare of those that are likely to be affected by the acts and emissions of our organisations undertakings.

Suffolk Archaeology Community Interest Company understands our duty to identify the significant hazards that may be created by our undertakings and to risk assess these accordingly to ensure that suitable and effective controls are implemented to minimise risk to a suitable level as far as is reasonably practicable.

We also acknowledge our duty, so far as is reasonably practicable:

- *To provide a safe working environment for our workforce, fulfil our statutory commitments and actively manage and supervise health and safety at work;*
- *To identify the risks associated with our business activities and ensure suitable and sufficient control measures are in place.*
- *Ensure regular consultation with our employees on matters which affect their health and Safety.*
- *To ensure that all plant and equipment used by our employees is fit for purpose and adequately maintained.*
- *To provide suitable storage and ensure safe handling of Hazardous substances.*
- *To ensure that all workers are competent to undertake their daily work activities by providing all relevant information and training, consideration will also be given to any employees who do not have English as a first language.*
- *To prevent accidents and cases of work related ill health by ensuring a robust reporting and investigation system is in place.*
- *To liaise and communicate effectively regarding health and safety matters when working on other persons premises.*
- *To ensure that there is an effective system of induction, training, communication and supervision to other persons visiting or working on our premises.*
- *To have access to competent advice, this will be provided by Agility UK (Training and Consultancy) Ltd. Who will assists us in the continuous improvement in our health and safety performance and management through regular review and revision of this policy; and to provide suitable resources required to make this policy and our Health and Safety arrangements effective.*

2. Specific project issues

Introduction

All SACIC staff will be aware that they have a responsibility to:

- Take care of their own health and safety and that of others who may be affected by what they do, or fail to do, at work.
- Follow safe systems of work and other precautions identified in the project risk assessments.
- Report any changes to personal circumstances that may affect their ability to work safely.
- Report potential hazards, incidents and near misses to the Project Officer/supervisor.

A pre-site inspection has been made of the site and applicable SACIC Risk Assessments for the project are included below.

All SACIC staff are experienced in working on a variety of archaeological sites and permanent staff all hold a CSCS (Construction Skills Certification Scheme) card. All staff have been shown the SACIC Health and Safety Manual, copies of which are held at the SACIC office in Needham Market. All staff will read the site WSI and Risk Assessments and receive a site safety induction from the Project Officer prior to starting work. All staff will be issued with appropriate PPE.

From time to time it may be necessary for site visits by other SACIC staff, external specialists, SCCAS/CT staff or other members of the public. All such staff and visitors will be issued with the appropriate PPE and will undergo the required inductions.

Site staff, official visitors and volunteers are all covered by SACIC insurance policies. SACIC also has professional negligence insurance. Copies of these policies are available on request.

Welfare facilities

Due to the limited nature of the project, it is proposed that SACIC staff will work from their vehicle and travel to public facilities if required. A vehicle will be on site at all times.

First Aid

A member of staff with the First Aiders at Work qualification will be on site at all times. A First Aid kit and a fully charged mobile will also be in vehicle/on site at all times.

Site access and security

Access to the site is via a field entrance to the west of Friston Hall. The site is private arable land, bounded by hedgerows, but is open to general access.

Contaminated ground

Details of any ground contamination have not been provided by the client. If any such is identified then groundworks will cease until adequate safety and environmental precautions are in place.

Advice will be sought from HSE and relevant authorities if required concerning any of these issues.

Hazardous Substances

No hazardous substances are specifically required in order to undertake the archaeological works.

Underground services

Details of known services have not been provided by the client.

Overhead Powerlines

No overhead powerlines cross the site.

Personal Protective Equipment (PPE)

The following PPE is issued to all site staff as a matter of course. Additional PPE will be provided if deemed necessary.

- Hard Hat (to EN397).
- High Visibility Clothing (EN471 Class 2 or greater).
- Safety Footwear (EN345/EN ISO 20346 or greater – to include additional penetration-resistant midsole).
- Gloves (to EN388).

- Eye Protection (safety glasses to at least EN 166 1F).

SACIC Environment Policy

Suffolk Archaeology is committed to the sustainable management of the local and global environment to support local communities and growth in our local economy. We will strive to reduce our carbon emissions, to protect and enhance the natural and historic environment and to tackle the issues of a changing climate. In delivering our services, we are committed to meeting all relevant regulatory, legislative and other requirements, and to the continual improvement of our environmental performance.

We will endeavour to:

- Prevent environmental pollution and minimise waste;
- Reduce our carbon emissions;
- Continually improve our energy efficiency and reduce our use of resources;
- Reduce the impact of vehicle travel by our employees;
- Implement sustainable procurement practices where possible;
- Enhance biodiversity, conserve distinctive landscapes and protect the historic environment.

All existing and new SACIC subcontractors are issued annually with an Environmental Guidance Note For Contractors.

On site the SACIC Project Officer will monitor environmental issues and will alert staff to possible environmental concerns. In the event of spillage or contamination, e.g. from plant or fuel stores, EMS reporting and procedures will be carried out in consultation with the SACIC EMS Officer.

The client and/or landowner has not informed SACIC of any environmental constraints upon the development area but none are expected as the site is wholly within arable agricultural use

All rubbish will be bagged and removed either to areas designated by the client or returned to SACIC for disposal.

3. Project Contacts

SACIC

SACIC Manager	Dr Rhodri Gardner	01449 900120
SACIC Project Manager	John Craven	01449 900121
SACIC Finds Dept	Richenda Goffin	01449 900129
SACIC H&S	John Craven	01449 900121
SACIC EMS	Jezz Meredith	01449 900124
SACIC Outreach Officer	Alex Fisher	01449 900125

Emergency services

Local Police		101
Local GP	Sole Bay Health Centre, Teal Close, Reydon, IP18 6GY	01502 722326
Location of nearest A&E	James Paget University Hospital, Lowestoft Road, Gorleston, Great Yarmouth, Norfolk, NR31 6LA	01493 452452
Environment Agency	Customer Services Line (8am to 6pm)	03708 506 506
	24 hour Emergency Hotline	0800 807060
Essex and Suffolk Water	24 hour Emergency Hotline	0845 782 0999
National Gas Emergency Service	Gas emergency hotline	0800 111 999
UK Power Networks	East England electricity emergency hotline	0800 783 8838
Anglian Water	24 hour Emergency Hotline	08457 145 145

Client contacts

Client	Steve Logan
Client Agent	
Site landowner	

Archaeological contacts

Curator	Rachael Abraham	01284 741232
Consultant		
EH Regional Science Advisor	Dr Zoe Outram	01223 582707

4. Geophysical Technical Information

Detailed magnetometer survey

Detailed magnetometer survey is the most commonly employed archaeological geophysical prospection method in Britain, sensitive sensors can cost-effectively cover large areas of ground, rapidly recording anomalies that are indicative of cultural settlement activity. These anomalies can then be further investigated by field archaeologists to quantify a form and function. The magnetometer is a passive instrument that detects both permanent thermoremanent and temporary magnetic responses.

Thermoremanent Magnetism

When a material containing iron oxides, for example clay, is heated above the Curie point, weakly magnetic compounds transform in to highly magnetic oxides that can be detected by the sensors of a magnetometer (Clark). For instance the iron oxide haematite has a Curie temperature of 675 Celsius and magnetite 565 Celsius. Once these temperatures are reached, the oxides become demagnetised, on cooling their magnetic properties become permanently re-magnetised and align in the direction of the Earth's magnetic field (Gaffney and Gater). Over time the direction of the Earth's magnetic field changes allowing these directional differences to be detected by the magnetometer.

Strongly heated features such as hearths, kilns or furnaces frequently reach the Curie temperature and become permanently magnetised. These permanent magnetic responses are some of the strongest cultural features that can be recorded.

Temporary Magnetism

Magnetic susceptibility is the ease with which a magnetic field can pass through a material, therefore the higher the materials magnetic susceptibility, the stronger the induced magnetic field will be. Temporary magnetisation occurs within material that is magnetically susceptible, this material acquires its own local magnetic field that combine with the Earth's magnetic field causing an anomaly to stand out from the background noise (Clark). These anomalies are more subtle in nature, being derived from material that has been magnetically enhanced by cultural activity and become concentrated into features over time. Anomalies that have temporary magnetisation include backfilled pits, ditches, field systems, occupation areas, land drains, remnant and existing field boundaries (David, 2011).

The key to a successful survey is having good contrast between the magnetic susceptibility of an archaeological feature with the surrounding superficial deposits. If there is no discernible difference between the two mediums it may be unlikely that the magnetometer will successfully prospect the feature. Archaeological features can also be masked by high magnetically susceptible topsoil, or deep overlying subsoil and colluvial deposits.

Ferrous anomalies

Ferrous objects are a common source of permanent magnetism, usually isolated with a strong dipolar signature. Some of these responses may have an archaeological derivation, however they are probably more indicative of modern iron objects introduced through manuring or lost within the topsoil.

Bartington DualGRAD 601-2 Fluxgate Gradiometers

Fluxgate gradiometers are the most commonly employed class of instrument in the UK. Two 1m sensitive sensors are affixed to a frame mounted 1m apart in a vertical plane and harnessed to the trunk of a geophysical surveyor or attached to a pulled cart. Each sensor contains two fluxgate magnetometers with 1m vertical separation. The sensor above records the Earth's magnetic field (magnetic background) while the sensor below records the local magnetic field. The two sensors need aligning before recording can begin, a zero station is located in an area with low magnetic variation for this purpose. After the sensors have been aligned, the survey can begin. When differences in the magnetic field strength occur between the two vertical magnetometers within each sensor, a positive or negative reading is recorded that is relative to the magnetic background of the zero station. Positive anomalies include pits, ditches and agricultural furrows. Negative anomalies commonly prospected include earthwork embankments, land drains and geological features.

Sensors are normally mounted to a height of 0.30m above the surface, and can detect to a depth of between one and two metres below the ground. The first survey traverse is commonly undertaken in an east to west direction.

Magnetic Anomalies

Isolated dipolar responses

Isolated dipolar responses are commonly recorded throughout a dataset and are usually indicative of modern ferrous material deposited within the topsoil horizon. In some instances the anomalies may be of an archaeological derivation. They are isolated, strong and dipolar in character.

Areas of magnetic disturbance

These anomalies are usually caused by building demolition rubble, ferrous boundaries, slag waste dumps, modern buried rubbish, pylons and services. Strong and dipolar in character, they are commonly recorded over a wide area.

Linear trends

Linear trends can be either positive or negative magnetic responses depending on the nature of the material present within the feature. If the anomaly is broad and weak, it is more likely to be of geological origin. Stronger positive linear trends are more likely to be of archaeological derivation, caused by settlement activity washing rich humic, charcoal and fired deposits into a feature. Negative linear trends are more commonly associated with bank deposits or land drains, with the less magnetically susceptible superficial deposits deposited at the top of the feature. Curvilinear trends are usually of archaeological origin, commonly interpreted as ring ditches or drip-gullies.

Discrete anomalies

Discrete anomalies can either be positive or negative in nature recorded within a localised area. Those that are positive are more likely to be of an archaeological origin, with negative discrete anomalies more commonly interpreted as natural geological variations.

Thermoremanent responses

These responses are caused by the heating of material containing iron to above the Curie temperature, they are strong and discrete in nature, in Britain high positive readings are recorded to the south of the feature, and high negative readings are recorded to the north.

SUFFOLK ARCHAEOLOGY
• A HISTORY OF EXPERTISE •

Geophysical Survey Risk Assessments

A pre-site inspection and assessment has been made of the site and the following SACIC Risk Assessments apply to the project and are included below.

SACIC GSRA1	Manual handling and outdoor working
SACIC GSRA2	Use of hand tools and instrumentation

Geophysical Survey Risk Assessment 1 Manual handling and outdoor working

Activity	Location	Hazard	Risks	Persons affected	Initial risk	Control measures	Residual risk	Name	Date	Rescue procedures
Manual handling of survey instruments and working outdoors.	Various.	Extremes of heat, cold and wet weather. Trip hazards.	Hypothermia, heat stroke, sunburn. Minor injuries. Carrying heavy equipment for prolonged periods.	All field staff.	9	All staff provided with appropriate clothing for weather conditions. No staff to work alone in extreme conditions. Regular sweep for trip hazards.	2	T Schofield	14/08/17	First Aid if required. Call emergency services if necessary.

	Likelihood				
Severity	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Initial Risk
Residual Risk

Likelihood	Severity	Risk (likelihood x severity)
1. Highly unlikely	1. Slight inconvenience	1-5 Low
2. May occur but very rarely	2. Minor injury requiring first aid	
3. Does occur but only rarely	3. Medical attention required	6-12 Medium
4. Occurs from time to time	4. Major injury leading to hospitalisation	
5. Likely to occur often	5. Fatality or serious injury leading to disablement	13-25 High

Geophysical Survey Risk Assessment 2 Use of hand tools and survey instruments

Activity	Location	Hazard	Risks	Persons affected	Initial risk	Control measures	Residual risk	Name	Date	Rescue procedures
Surveying, setting out and use of small hand tools and marker canes.	Various.	Splinters from poorly maintained equipment, trip hazards from unused equipment, trip hazards from uneven ground, some heavy lifting, tape winding.	Minor injuries.	All field staff.	8	Ensure all tools in serviceable condition. Careful policing of temporarily unused equipment (e.g. no discarded hand tools, hand tapes pegged down). Ensure all tools and instrumentation carried appropriately.	4	T Schofield	14/08/17	First Aid if required. Call emergency services if necessary.

	Likelihood				
Severity	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Initial Risk
Residual Risk

Likelihood	Severity	Risk (likelihood x severity)
1. Highly unlikely	1. Slight inconvenience	1-5 Low
2. May occur but very rarely	2. Minor injury requiring first aid	
3. Does occur but only rarely	3. Medical attention required	6-12 Medium
4. Occurs from time to time	4. Major injury leading to hospitalisation	
5. Likely to occur often	5. Fatality or serious injury leading to disablement	13-25 High

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