LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

DETAILED MAGNETOMETER SURVEY

Report Number: 1048 February 2014

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DETAILED MAGNETOMETER SURVEY

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February 2014

Site Code	HYMR14	**NGR**	TL 848 092
Planning Ref.	-	**OASIS**	britanni1-169018
Approved By	Matthew Adams	**DATE**	February 2014

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ABSTRACT

A detailed fluxgate gradiometer survey was undertaken by Britannia Archaeology Ltd in two separate fields from the 3rd – 14th February 2014. A wide range of geophysical anomalies were recorded, however isolated dipolar responses were most numerous. These anomalies are believed to have been caused by modern ferrous cultural debris being introduced into the topsoil through manuring and loss rather than resulting from the presence of buried archaeological artefacts.

The survey within the southern field revealed four areas of magnetic disturbance, one weak negative linear trend (service run), three strong dipolar discretes demarcating existing overhead electric cable poles, six weak broad positive anomalies of geological origin and one large circular weak broad negative anomaly interpreted as a potential pond. Six positive discrete anomalies (potential rubbish pit type features) and seven linears in total of probable archaeological origin were recorded. Two of the linears were located on a similar alignment and in close proximity with recorded cropmarks. One positive linear anomaly is believed to be the remains of a back-filled ditch recorded on the 1955 – 1960 OS Map.

The northern field contained three areas of magnetic disturbance, three dipolar linear trends that delineate the location of buried ferrous service pipes and seventeen weak broad positive anomalies indicative of natural variations within the superficial geology. Eight positive discretes, two positive linears and three curvilinear anomalies (potential ring-ditch type features) are believed to be of an archaeological origin.

A large amount of burnt flint and pottery sherds were noted by the surveyors in the north-western quarter of the southern field and the northern half of the field to the north.

1.0 INTRODUCTION

On Monday 3rd until Friday 14th February 2014 Britannia Archaeology Ltd undertook detailed magnetometer survey over *c.*15 hectares to the north of Heybridge, Maldon, Essex (NGR TL 848 092) on land given over to agriculture.

This survey was commissioned by James Drummond-Murray of Oxford Archaeology East in advance of a proposed new housing development with associated new roads, open spaces and amenities (Figure 1). It forms part of a Historic Environment Assessment that will be submitted within the Masterplan. The brief was prepared by the Historic Environment Advisor, Place Services (HEA, PS) Maria Medlycott (dated 3rd October 2013).

2.0 SITE DESCRIPTION

The site is located over two separate fields that are currently given over to arable land. Bedrock geology is described as London Clay Formation, clay, silt and sand; a sedimentary bedrock formed approximately 34 to 56 million years ago in the Palaeogene Period, when the local environment was dominated by deep seas re-depositing infrequent slurries of shallow water sediments as graded beds (BGS, 2014).

Superficial geology to the north of the site is described as Head Clay and Silt, formed up to 3 million years ago in the Quaternary Period when the local environment was dominated by subaerial slopes forming rock from material accumulated by down slope movements including landslide, debris flow, solifluction, soil creep and hill wash (BGS 2014).

The superficial geology to the south of the site comprises River Terrace Deposits of sand and gravel, formed up to 3 million years ago in the Quaternary Period when the local environment was dominated by rivers depositing mainly sand and gravel detrital material in channels to form river terrace deposits, with fine silt and clay from overbank floods forming floodplain alluvium, and some bogs depositing peat; includes estuarine and coastal plain deposits mapped as alluvium (BGS, 2014).

3.0 PLANNING POLICIES

The geophysical survey was carried out on the recommendation of the county council (HEA, PS), following guidance laid down by the *National Planning and Policy Framework* (NPPF, DCLD 2012) which replaced *Planning Policy Statement 5: Planning for the Historic Environment* (PPS5, DCLG 2010) in March 2012. The relevant local development plan is *The Maldon District Council Local Plan (adopted November 2005)*.

3.1 National Planning Policy Framework (NPPF, DCLG March 2012)

The NPPF recognises that 'heritage assets' are an irreplaceable resource and planning authorities should conserve them in a manner appropriate to their significance when considering development. It requires developers to record and advance understanding of

the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible. The key areas for consideration are:

- The significance of the heritage asset and its setting in relation to the proposed development;
- The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance;
- Significance (of the heritage asset) can be harmed or lost through alteration or destruction, or development within its setting. As heritage assets are irreplaceable, any harm or loss should require clear and convincing justification;
- Local planning authorities should not permit loss of the whole or part of a heritage asset without taking all reasonable steps to ensure the new development will proceed after the loss has occurred; and
- Non-designated heritage assets of archaeological interest that are demonstrably of equivalent significance to scheduled monuments, should be considered subject to the policies for designated heritage assets.

3.2 The Maldon District Council Local Plan (adopted November 2005).

The Maldon District Council Local Plan recognises the importance of archaeological sites whether scheduled or not and conforms to the guidance offered in NPPF 5. The relevant policies are BE17 and BE18 and are outlined below.

Policy BE17 - Preservation of Sites of Nationally important archaeological remains and their settings:

There is a presumption in favour of the physical preservation of nationally important archaeological remains and their settings, whether scheduled or not, listed in Appendix 3. Development will not be permitted if it fails to preserve the archaeological value and interest of the remains or their settings of the sites listed in Appendix 3.

Policy BE18 - Control of Development at a site of local archaeological value:

Planning permission for development which would have a detrimental effect on remains of local archaeological value will only be granted if the importance of the development outweighs the local value of the remains. If planning permission is granted, conditions will be imposed to ensure that the remains are properly recorded and evaluated and where practicable preserved.

4.0 ARCHAEOLOGICAL BACKGROUND

A desk-based assessment was undertaken by Oxford Archaeology in May 2012 (Lawrence, L.), the findings are summarised below.

There is a low potential for early prehistoric remains to be present, only one Mesolithic microlith has been recovered, however it is well documented that prehistoric artefacts are commonly found on gravel terrace deposits similar to the geology prevalent on site.

The Neolithic and Bronze Age periods were reported as having moderate potential with a higher potential for remains present to the north of the area, where settlement evidence has been recorded.

There is a high potential for Iron Age and Roman archaeology to be present, a substantial Late Iron Age to Roman settlement has been identified *c.*1km to the south and numerous other sites have been recorded within close proximity to the proposed development area. It is not clear whether they extend in to the proposed development area, however the most northerly excavations at the Elms Farm site recorded substantial Iron Age and Roman remains. Numerous cropmarks of potential Iron Age and Roman origin have also been identified on aerial photographs within the proposed development area (see Summary Table below).

A moderate potential for Anglo-Saxon archaeology is believed likely within the proposed development area, with evidence recorded in lesser quantities than the Iron Age and Roman periods. An Anglo-Saxon findspot recorded in the northern half of the site indicates that this particular area has a higher potential.

There is thought to be a low potential for significant Medieval and Post-medieval archaeological remains because the land is believed to have been predominantly under arable cultivation. The site is also thought to have seen only a small degree of modern disturbance, therefore archaeological deposits are likely to be in a good state of preservation. However it is not known whether the arable farming techniques from the medieval and post-medieval periods have caused damage to the surviving archaeology.

Summary Table from Appendix 1, Gazetteer of known archaeology within the Study Area (Lawrence, L. 2012,).

New OA ref. No	***Feature Type***	***Description***	***Source***
87	Cropmarks	Cropmarks seen on aerial photographs. Potentially a field boundary.	AP
105	Cropmarks	Linear features seen on aerial photographs.	AP
109	Cropmarks	Linear features seen on aerial photographs.	AP, EHER 7985
110	Cropmarks	Linear features seen on aerial photographs.	AP, EHER 7977
111	Cropmarks	Linear feature, trackway.	AP, EHER 7977
113	Cropmarks	Linear features seen on aerial photographs.	AP, EHER 16243
114	Cropmarks	Cropmarks of possible trackway and natural markings.	NMR 380736, EHER 7977
115	Cropmarks	Linear Features, enclosures and ring ditches seen on aerial photographs.	AP, EHER 7977
120	Cropmarks	Rectilinear enclosure, field boundary.	EHER 16411
133	Woodland	Extent of Heybridge Wood as seen on the 1811 Enclosure Map.	HS

Summary Table of Sites (See Figure 1).

This geophysical survey formed part of a programme of archaeological works required to investigate the nature, survival and significance of any archaeological deposits which may be affected by the development.

5.0 PROJECT AIMS

Field survey by geophysical prospection was required to determine the extent and significance of subsurface features. To ensure that any below ground features and sites, were identified and recorded to an appropriate level that will allow the potential significance of below ground deposits to be considered as part of the Environmental Impact Assessment (EIA).

6.0 METHODOLOGY

6.1 Instrument Type Justification

Britannia Archaeology Ltd employed a Bartington Dual Grad 601-2 fluxgate gradiometer to undertake the survey, because of its high sensitivity and rapid ground coverage. The surveyors noted that that the superficial geology carried a relatively low magnetically susceptible background signature.

6.2 Instrument Calibration

One hour was allowed in the morning for the magnetometers sensors to settle before the start of the first grid. The instrument was zeroed after every three grids to minimise the effect of sensor drift. An area with a relatively low magnetic reading was chosen to calibrate the instrument in each field; this same point was used to zero the sensors throughout the surveys providing a common zero point. The overhead conditions were predominantly overcast with outbreaks of sunshine, high winds and rain throughout the two weeks. Sensor drift was noted throughout the survey which caused the characteristic parallel traverse 'striping' in the raw dataset (Figures 3A, 4A, 5A, 8A and 9A) especially during outbreaks of sunshine. Ground conditions were challenging with precipitation causing saturated soil underfoot, particularly in low lying areas of the site.

6.3 Sampling Interval and Grid Size

The sampling interval was set at 0.25m along 1m traverse intervals, providing 4 readings a metre, the magnetometer survey was undertaken on 20 x 20m grids.

6.4 Survey Grid Location

The survey grid was set out to the Ordnance Survey OSGB36 datum to an accuracy of ±0.1m employing a Leica Viva Glonnass Smart Rover GS08 differential global positioning system (DGPS). Data were then converted to the National Grid Transformation OSTN02 and the instrument was regularly tested using stations with known ETRS89 coordinates. The grids were positioned on a NNE-SSW alignment (Figure 2).

6.5 Data Capture

Instrument readings were recorded on an internal data logger that were downloaded to a laptop at lunchtime and then also at the end of the day. The grid order was recorded on

a BA pro-forma to aid in the creation of the data composites. Data were filed in job specific folders. These data composites were checked for quality on site by BA, allowing grids to be re-surveyed if necessary. The data were backed up onto an external storage device in the office and finally a remote server at the end of the day. A five metre exclusion zone was left between the boundaries and the survey area to reduce the amount of field boundary magnetic disturbance, which slightly reduced the area available.

6.6 Data Presentation and Processing

Data are presented in both raw and processed data plots in greyscale format (Figures 3A, 3B, 4A, 4B, 5A, 5B, 6, 8A, 8B, 9A, 9B and 10). An XY trace plot of the processed data has also been included (Figures 3C, 4C, 5C, 8C, and 9C).

The raw data is presented with no processing, and was clipped to produce uniform greyscale plots, processed data schedules are also displayed below.

Southern Field Raw Data:

Data Clipping: 4 standard deviations.
Display Clipping: 3 standard deviations.

Southern Field Processed Data:
De-spike: X diameter = 3, Y diameter = 3, Threshold = 1, centre value=mean, replace with = mean;
De-stripe: Median Sensors: All;
Edge Match: Grids 48, 49, 54, 55;
Data Clipping: 4 standard deviations;
Display Clipping: 3 standard deviations.

Northern Field Raw Data:

Data Clipping: 2 standard deviations.
Display Clipping: 3 standard deviations.

Northern Field Processed Data:
De-spike: X diameter = 3, Y diameter = 3, Threshold = 1, centre value=mean, replace with = mean;
De-stripe: Median Sensors: All;
Data Clipping: 2 standard deviations;
Display Clipping: 3 standard deviations.

An interpretation plan characterising the anomalies recorded can be found at Figures 7 & 11, drawing together the evidence collated from both greyscale and XY trace plots (Figures 3, 4, 5, 6, 8, 9 and 10). All figures are tied into the National Grid and printed at an appropriate scale.

6.7 Software

Raw data were downloaded using DW Consulting's Archeosurveyor v2.0 and will be stored in this format as raw data. The software used to process the data and produce the composites was also DW Consulting's Archeosurveyor v2.0. Datasets were exported into AutoCAD and placed onto the local survey grid. Interpretation plots were then produced using AutoCAD.

6.8 Grid Restoration

Britannia Archaeology Ltd did not position any reference stations on site due to the presence of crops within the fields. The grids can be relocated using the geo-referenced stations printed in Figure 2; these can also enable the accurate location of the geophysical anomalies.

7.0 RESULTS & DISCUSSION

Two separate fields were surveyed over two weeks, the first is present to the south of the site and the second is located to its north-east. The datasets from each field will be discussed separately below.

7.1 Southern Field (Figures 3 – 7)

Isolated dipolar ('iron spike') responses were most numerous and probably caused by modern ferrous cultural debris being introduced into the topsoil through manuring and loss rather than resulting from the presence of buried archaeological artefacts. These responses (yellow hatched circles) seem to be fairly evenly spaced throughout the field with no apparent concentration.

Four areas of magnetic disturbance (yellow hatching) are present predominantly on the periphery of the dataset, a 5m exclusion zone was retained throughout the survey however field boundary magnetic disturbance has still been recorded. The largest area of magnetic disturbance is located in the south-eastern corner of the field and may relate to farm activity, possibly the demolition of a previous structure relating to Grapnell's Farm. No obvious cause for these readings was noted during the survey.

The three strong dipolar discrete anomalies (magenta hatching) were recorded around the immediate vicinity of the existing overhead electricity cable poles.

Six weak broad positive anomalies (dark blue hatching) indicative of magnetically susceptible patches of superficial geology present below the topsoil were recorded during the survey. It is also possible that they are of archaeological origin (in particular the three parallel anomalies located in the south-eastern corner) but their broad, weak and discontinuous nature suggests a geological cause is more likely.

One weak negative linear trend is recorded running parallel (NNE – SSW) along the western boundary of the site. This has been interpreted as the remains of a non-ferrous

service pipe, backfilled in reverse stratigraphic sequence (with the superficial geology present at the top) causing negative readings to be recorded by the instruments sensors.

Perhaps the most intriguing anomaly recorded is the large circular, weak broad negative anomaly that is located in the north and centre of the dataset. These negative readings are likely to have been caused by very low magnetically susceptible material present within the upper strata. It is possible that this anomaly may be a pond, the centre of which has been backfilled with material of a higher magnetic susceptibility. It is also possible that this could be a natural magnetic variation within the superficial geology.

Six positive discrete anomalies are clustered in the southern section of the dataset, immediately south-east of a potentially related positive linear anomaly. They have been interpreted as being of archaeological origin, commonly rubbish pit type features. These readings are relatively strong and more discrete than those of the weak broad positive anomalies that have been interpreted as being of geological derivation.

Seven linear and two curvilinear anomalies are present within the dataset, they are all relatively narrow and strong in character which increases the probability that they could be of an archaeological nature, however a geological origin cannot be ruled out. Two are located on a similar alignment and in close proximity with cropmark anomalies 115 depicted in Figure 1. To the west of these is a very straight positive linear anomaly that was surveyed on the 1955 – 1960 Ordnance Survey Map (Lawrence, L. 2012, Figure 10) and is a continuation of the existing field boundary ditch still present to its south. A further five linear and curvilinear anomalies are present to the south-east of the weak broad negative anomaly, three of which are recorded in a recti-linear arrangement indicative of a potential former structure. Large quantities of burnt flint and pottery sherds were also noted within the topsoil in the north-western quarter of the field by the surveyors.

7.2 Northern Field (Figures 8 – 11)

Isolated dipolar ('iron spike') responses were once again most numerous throughout the dataset (yellow hatched circles), fairly evenly spaced throughout the field with no apparent concentration.

Three areas of magnetic disturbance (yellow hatched areas) were recorded that appear on the periphery of the survey area. The first is located in the north-eastern corner where the ground is particularly waterlogged and tyre rutted, it is likely that the farmer has spread material to improve traction here which also happens to have a strong magnetic signature (possibly brick hardcore). The second area of disturbance is located in the entrance to the field, centre-west of the plot. It appears that material (of a magnetic nature) has been deposited here once again to alleviate problems with drainage and tyre rutting. The south-eastern area of magnetic disturbance is likely to have been caused by the proximity of the field boundary to the instruments sensors.

Three dipolar linear trends (magenta lines) orientated WNW – ESE have been recorded traversing the centre of the plot that are likely to be ferrous metal service pipes running towards the adjacent fishing lake.

Seventeen weak broad positive anomalies (dark blue hatching) have been recorded throughout the dataset that are most likely to be of geological origin, however an archaeological derivation cannot be ruled out.

Eight positive discrete anomalies (orange hatching) are present, the majority of which are located close to both positive linear and curvilinear anomalies. These are stronger and narrower than the weaker broad positive anomalies (hatched dark blue) and therefore have a greater probability of being archaeological in origin.

Of note are the three curvilinear anomalies that are present on the south-western boundary. The northern-most is smaller in diameter and is only partially present within the plot, its course appears to run under the ditch and track located to its west. The second and third curvilinear anomalies appear to be related, and may form part of the same ring, a potential opening is located in the south-eastern corner. These anomalies are indicative of archaeological ring ditches.

Two positive linear anomalies are located in the centre of the dataset, aligned north-east to south-west, in close proximity to and maybe associated with six discrete anomalies. They have been interpreted as being of potential archaeological origin due to their relative strength and narrow nature. Large quantities of burnt flint and pottery were noted in the northern half of the field by the surveyors.

8.0 CONCLUSION

A wide range of anomalies, some of which have good archaeological potential, have been recorded during the detailed magnetometer survey. Further investigation of the anomalies assigned as having archaeological potential will enable the hypotheses given in this report to be put to test. It would be prudent to investigate some of the blank areas within the dataset to test whether any anomalies remain un-recorded due to poor contrast between the superficial geology and any surviving backfilled features. It would also be advisable to further investigate the large circular, weak broad negative anomaly present in the southern field and a selection of the weak broad positive anomalies in both fields to ascertain whether they are indeed of geological origin. A large amount of burnt flint and pottery fragments were also noted in the topsoil over wide areas in both fields, establishing that archaeological material has been ploughed into the upper matrix. Further investigation should ascertain the degree to which potential archaeological features have been damaged by plough action.

There is a general lack of correlation between the cropmark survey and the geophysical data collected with only two curvilinears in the southern field providing a partial match. The fairly high degree of burnt flint and pottery sherds present in the topsoil together with the geophysical evidence suggests that the plough has caused an impact on the archaeology below.

9.0 PROJECT ARCHIVE AND DEPOSITION

A full archive will be prepared for all work undertaken in accordance with guidance from the *Selection, Retention and Dispersion of Archaeological Collections,* Archaeological Society for Museum Archaeologists, 1993. Arrangements will be made for the archive to be deposited with the relevant museum/HER Office.

10.0 ACKNOWLEDGEMENTS

Britannia Archaeology Ltd would like to thank Mr James Drummond-Murray of Oxford Archaeology East for commissioning the project and for his input and for arranging site access, and to Maria Medlycott Historic Environment Advisor of Essex County Council Team for her advice.

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APPENDIX 1 METADATA SHEETS

South Field Raw Data

Filename	HEY SF Raw.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Surveyed by	MCA/MB/TPS on 2/7/2014
Assembled by	TPS on 2/17/2014
Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	32702.00
Dimensions	
Composite Size (readings)	1840 x 300
Survey Size (meters)	460m x 300m
Grid Size	20.00 m x 20.00 m
X Interval	0.25 m
Y Interval	1.00 m
Stats	
Max	11.42
Min	-11.03
Std Dev	1.57
Mean	0.16
Median	0.13
Composite Area	13.80 ha
Surveyed Area	8.49 ha
Program	
Name	ArcheoSurveyor

South Field Processed Data

Filename	HEY SF Pro.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Surveyed by	MCA/MB/TPS on 2/7/2014
Assembled by	TPS on 2/17/2014
Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	32702.00
Dimensions	
Composite Size (readings)	1840 x 300
Survey Size (meters)	460m x 300m
Grid Size	20.00 m x 20.00 m
X Interval	0.25 m
Y Interval	1.00 m
Stats	
Max	5.36
Min	-5.35
Std Dev	0.87
Mean	0.00

Median	-0.01
Composite Area	13.80 ha
Surveyed Area	8.49 ha
Program	
Name	ArcheoSurveyor
Version	2.5.16.0

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North Field Raw Data

Filename	HEY NF Raw.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Surveyed by	MCA/MB on 2/14/2014
Assembled by	TPS on 2/17/2014
Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	32702.00
Dimensions	
Composite Size (readings)	800 x 380
Survey Size (meters)	200.00m x 380.00 m
Grid Size	20.00 m x 20.00 m
X Interval	0.25 m
Y Interval	1.00 m
Stats	
Max	6.13
Min	-6.78
Std Dev	1.19
Mean	-0.39
Median	-0.44
Composite Area	7.60 ha
Surveyed Area	4.45 ha
Program	
Name	ArcheoSurveyor
Version	2.5.16.0

North Field Processed Data

Filename	HEY NF Pro.xcp
Description	
Instrument Type	Grad 601 (Gradiometer)
Units	nT
Surveyed by	MCA/MB on 2/14/2014
Assembled by	TPS on 2/17/2014
Direction of 1st Traverse	90 deg
Collection Method	ZigZag
Sensors	2 @ 1.00 m spacing.
Dummy Value	32702.00
Dimensions	
Composite Size (readings)	800 x 380
Survey Size (meters)	200m x 380 m
Grid Size	20.00 m x 20.00 m
X Interval	0.25 m
Y Interval	1.00 m
Stats	
Max	4.12
Min	-4.01
Std Dev	0.74
Mean	0.02
Median	0.00
Composite Area	7.60 ha
Surveyed Area	4.45 ha

Program	
Name	ArcheoSurveyor
Version	2.5.16.0

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APPENDIX 2 – TECHNICAL DETAILS

Magnetometer Survey

The magnetometer differs from the 'active' magnetic susceptibility meter by being a 'passive' instrument. Rather than injecting a signal into the ground it detects slight variations in the Earth's magnetic field caused by cultural and natural disturbance (Clark).

Thermoremanent magnetism is produced when a material containing iron oxides is strongly heated. Clay for example has a high iron oxide content that in a natural state is weakly magnetic, when heated these weakly magnetic compounds become highly magnetic oxides that a magnetometer can detect.

The demagnetisation of iron oxides occurs above a temperature known as the Curie point; for example haematite has a Curie point of 675 Celsius and magnetite 565C. At the time of cooling the iron oxides become permanently re-magnetised with their magnetic properties re-aligned in the direction of the Earth's magnetic field (Gaffney and Gater). The direction of the Earth's magnetic field shifts over time and these subtle alignment differences can be recorded. Kilns, hearths, baked clay and ovens can reach Curie point temperatures, and are the strongest responses apart from large iron objects that can be detected. Other cultural anomalies that can be prospected include occupation areas, pits, ditches, furnaces, sunken feature buildings, ridge and furrow field systems and ritual activity (David, 2011). Commonly recorded anomalies include modern ferrous service pipes, field drainage pipes, removed field boundaries, perimeter fences and field boundaries.

Fluxgate Gradiometers

Fluxgate gradiometers are sensitive instruments that utilise two sensors placed in a vertical plane, spaced 1 metre apart. The sensor above reads the Earth's magnetic (background) response while the sensor below records the local magnetic field. Both sensors are carefully adjusted to read zero before survey commences at a 'zeroing' point, selected for its relatively 'quiet' magnetic background reading. When differences in the magnetic field strength occur between the two sensors a positive or negative reading is logged. Positive anomalies have a positive magnetic value and conversely negative anomalies have a negative magnetic value relative to the site's magnetic background. Examples of positive magnetic anomalies include hearths, kilns, baked clay, areas of burning, ferrous material, ditches, sunken feature buildings, furrows, ferrous service pipes, perimeter fences and field boundaries. Negative magnetic anomalies include earthwork embankments, plastic water pipes and geological features.

The instruments are usually held approximately 0.30m to 0.50m above the ground surface and can detect to a depth of between 1-2metres. Best practice dictates that the optimal direction of traverse in Britain is east to west.

Magnetic Anomalies

Linear trends

Linear trends can be both positive and negative magnetic responses. If they are broad, relatively weak or negative in nature they may be of agricultural or geological origin, for example periglacial channels, land drains or ploughing furrows. If the responses are strong positive trends they are more likely to be of archaeological origin. Archaeological settlement ditches tend to be rich in highly magnetic iron oxides that accumulate in them via anthropogenic activity and humic backfills. Conversely surviving banks will be negative in nature, the material is derived from subsoil deposits that is less likely to be positively magnetic. Curvilinear trends can also be recorded and are indicative of archaeological structures such as drip-gullies.

Discrete anomalies

Discrete anomalies appear as increased positive responses present within a localised area. They are caused by a general increase in the amount of magnetic iron oxides present within the humic back-fill of for example a rubbish pit.

'Iron spike' anomalies

These strong isolated dipolar responses are usually caused by ferrous material present in the topsoil horizon. They can have an archaeological origin but are usually introduced into the topsoil during manuring.

Areas of magnetic disturbance

An area of magnetic disturbance is usually associated with material that has been fired. For example areas of burning, demolition (brick) rubble or slag waste spreads. They can also be caused by ferrous material, e.g. close proximity to barbwire or metal fences and field boundaries, buried services, pylons and modern rubbish deposits.

APPENDIX 3 – OASIS FORM

OASIS ID: britanni1-169018

Project details

Project name	Land North of Heybridge, Maldon, Essex; Detailed Magnetometer Survey
Short description of the project	A detailed fluxgate gradiometer survey was undertaken by Britannia Archaeology Ltd in two separate fields from the 3rd - 14th February 2014. A wide range of geophysical anomalies were recorded, however isolated dipolar responses were most numerous. These anomalies are believed to have been caused by modern ferrous cultural debris being introduced into the topsoil through manuring and loss rather than resulting from the presence of buried archaeological artefacts. The survey within the southern field revealed four areas of magnetic disturbance, one weak negative linear trend (service run), three strong dipolar discretes demarcating existing overhead electric cable poles, six weak broad positive anomalies of geological origin and one large circular weak broad negative anomaly interpreted as a potential pond. Six positive discrete anomalies (potential rubbish pit type features) and seven linears in total of probable archaeological origin were recorded. Two of the linears were located on a similar alignment and in close proximity with recorded cropmarks. One positive linear anomaly is believed to be the remains of a back-filled ditch recorded on the 1955 - 1960 OS Map. The northern field contained three areas of magnetic disturbance, three dipolar linear trends that delineate the location of buried ferrous service pipes and seventeen weak broad positive anomalies indicative of natural variations within the superficial geology. Eight positive discretes, two positive linears and three curvilinear anomalies (potential ring-ditch type features) are believed to be of an archaeological origin. A large amount of burnt flint and pottery sherds were noted by the surveyors in the northwestern quarter of the southern field and the northern half of the field to the north.
Project dates	**Start:** 03-02-2014 **End:** 12-02-2014
Previous/future work	Yes / Yes
Any associated project reference codes	P1051 - Contracting Unit No.
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 3 - Operations to a depth more than 0.25m
Monument type	NONE None
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Housing estate
Prompt	Direction from Local Planning Authority - PPS
Position in the planning process	Pre-application
Solid geology	LOWER CAMBRIAN
Drift geology	RIVER TERRACE DEPOSITS
Techniques	Magnetometry

Project location

Country	England
Site location	ESSEX MALDON HEYBRIDGE Land North of Heybridge, Maldon, Essex
Study area	15.00 Hectares
Site coordinates	TL 848 092 51.7504495826 0.677523270619 51 45 01 N 000 40 39 E Point
Height OD / Depth	**Min:** 5.00m **Max:** 10.00m

Project creators

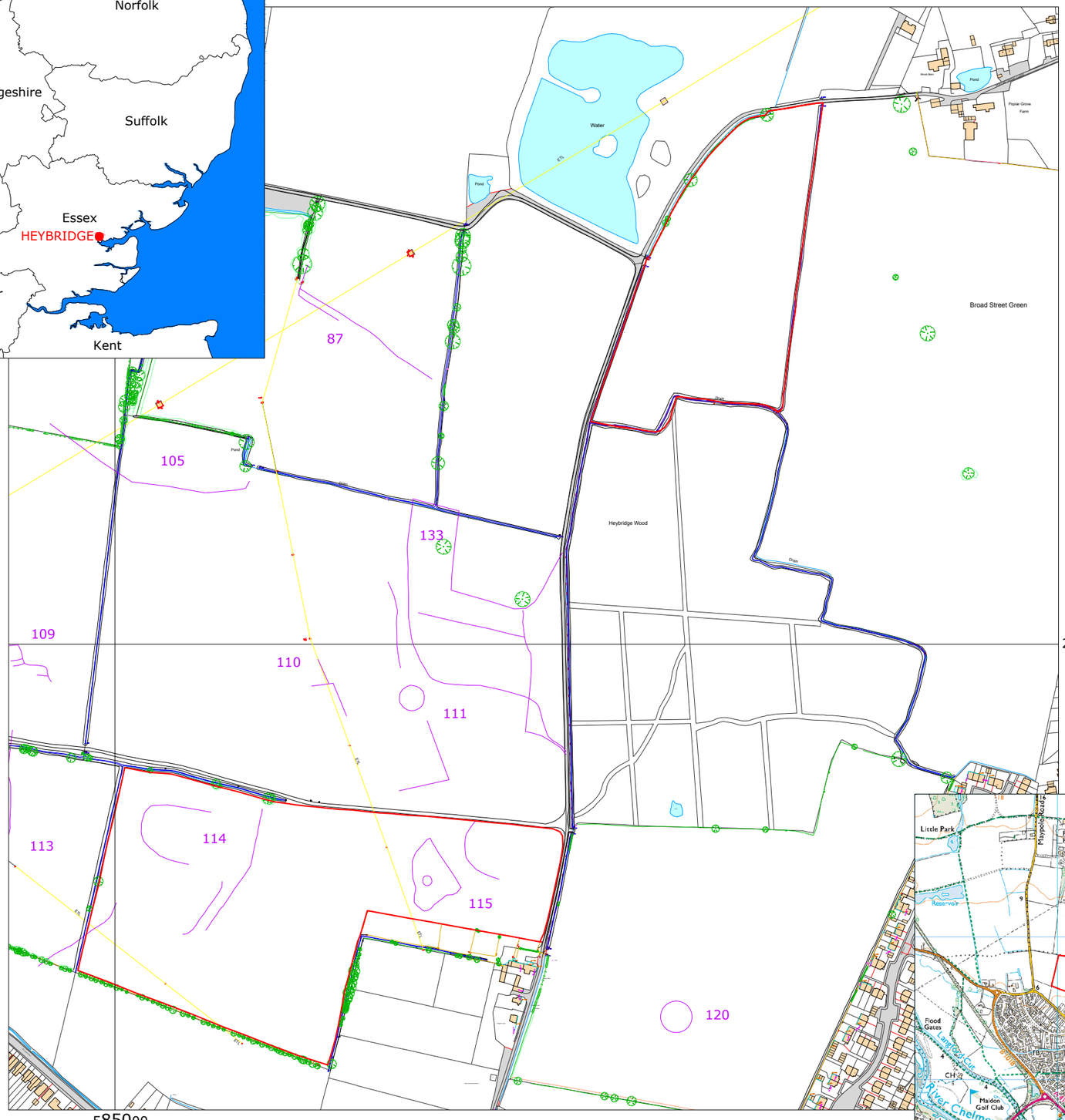
Name of Organisation	Britannia Archaeology Ltd
Project brief originator	Local Authority Archaeologist and/or Planning Authority/advisory body
Project design originator	Timothy Schofield
Project director /manager	Timothy Schofield
Project supervisor	Timothy Schofield
Type of sponsor/funding Body	Landowner

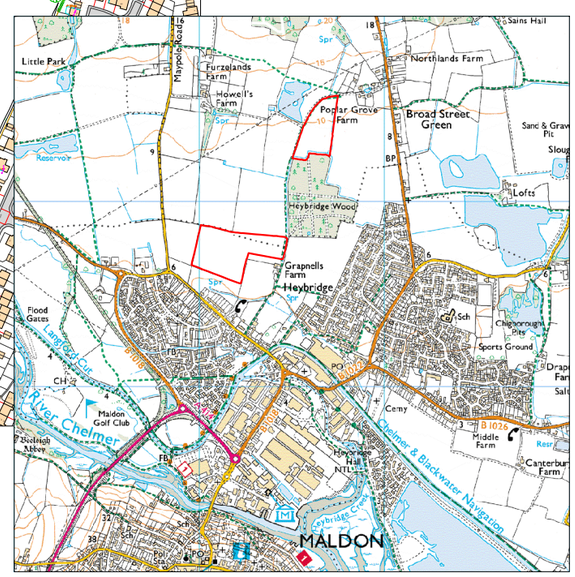
Project archives

Physical Archive Exists?	No
Digital Archive recipient	Colchester Museums
Digital Contents	"Survey"
Digital Media available	"Images vector", "Survey", "Text"
Paper Archive recipient	Colchester Museums
Paper Contents	"Survey"
Paper Media available	"Map", "Plan", "Report", "Survey ", "Unpublished Text"

Project bibliography 1

Publication type	Grey literature (unpublished document/manuscript)
	Title Land North of Heybridge, Maldon, Essex; Detailed Magnetometer Survey
Author(s)/Editor(s)	Schofield, T.P
Other bibliographic details	R1048
Date	2014
Issuer or publisher	Britannia Archaeology Ltd
Place of issue or publication	Stowmarket
Description	A4 Bound Report with A3 Fold-out Figures.
URL	www.britannia-archaeology.com
Entered by	Tim Schofield (tim@britannia-archaeology.com)
Entered on	25 April 2014





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	Location of Overhead Electric Cables
115	Digitised Cropmarks
	Site Boundaries

NGR: TL 848 092	REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxfordarchaeology eastwestsouth

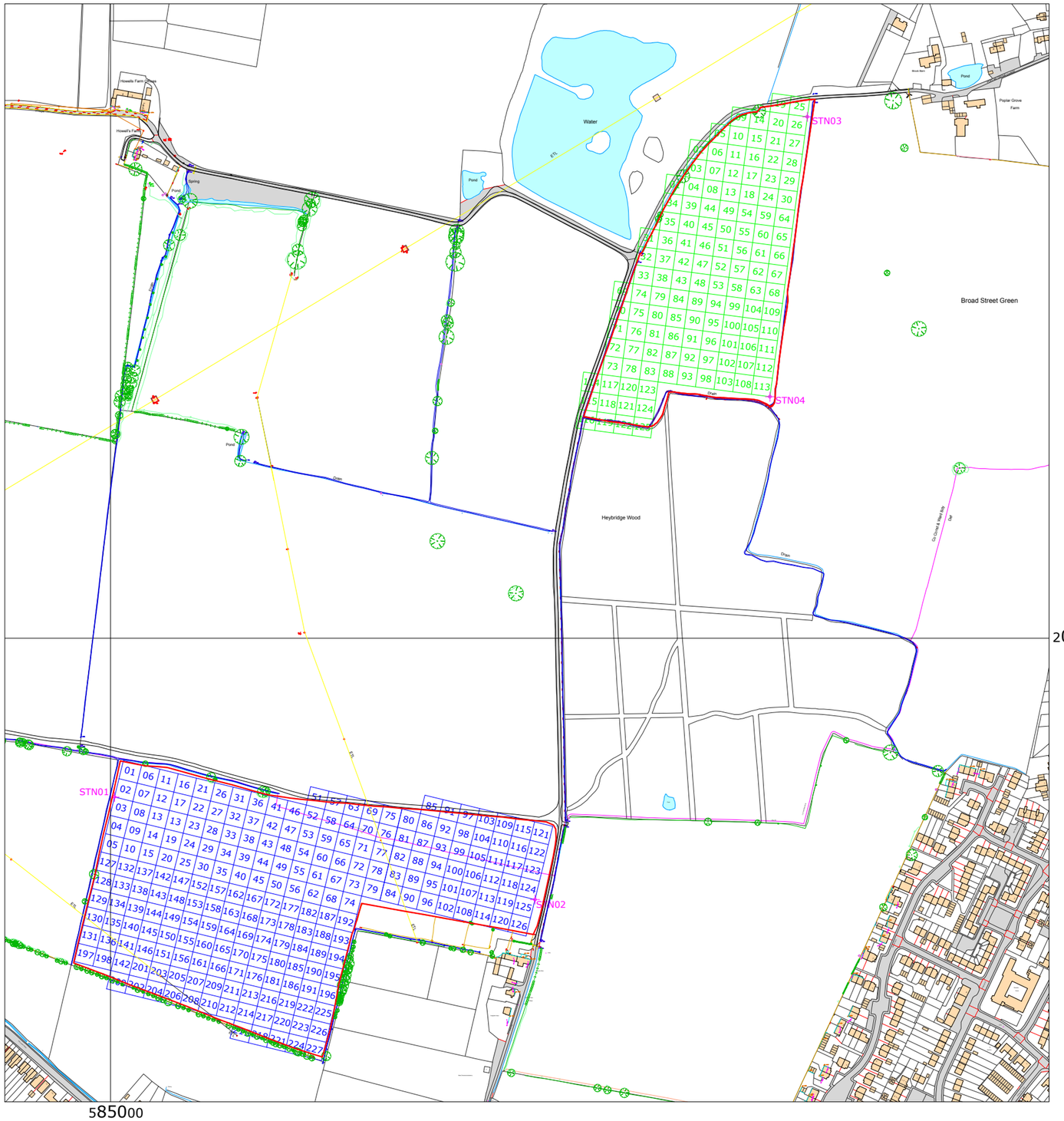
DESCRIPTION:
SITE LOCATION, TOPOGRAPHIC & CROPMARK PLAN

BRITANNIA ARCHAEOLOGY LTD

115 OSPREY DRIVE, STOWMARKET, SUFFOLK
IP14 5UX

T: 01449 763034
E: info@britannia-archaeology.com
W: www.britannia-archaeology.com

SCALE: 1:5000	0 200m	
PLOT: A3	APPROVED: MCA	VERSION: 01
DATE: FEB 2014	AUTHOR: TPS	FIGURE: 01



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03	585740.588	209553.670
04	585700.930	209256.331

	Location of Northern Field Survey Grids
	Location of Southern Field Survey Grids
	Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION:
SITE, SURVEY GRID & REFERENCING INFORMATION

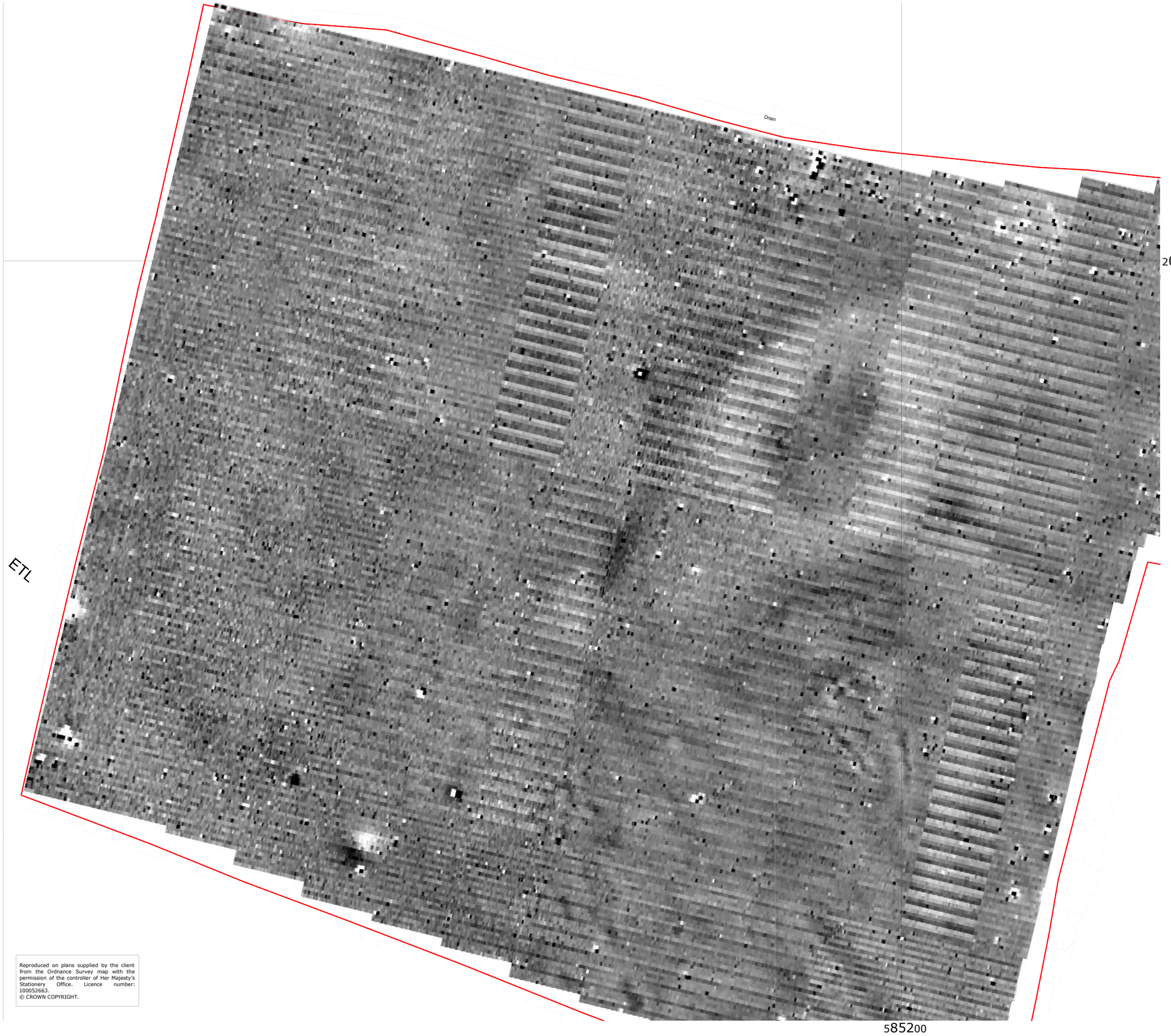
BRITANNIA ARCHAEOLOGY LTD

115 OSPREY DRIVE, STOWMARKET, SUFFOLK
IP14 5UX

T: 01449 763034
E: info@britannia-archaeology.com
W: www.britannia-archaeology.com

SCALE: 1:5000 (0 – 200m)

PLOT:	APPROVED:	VERSION:
A3	MCA	01
DATE:	AUTHOR:	FIGURE:
FEB 2014	TPS	02



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Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION:
SOUTH FIELD, RAW MAGNETOMETER GREYSCALE PLOT

BRITANNIA ARCHAEOLOGY LTD

115 OSPREY DRIVE, STOWMARKET, SUFFOLK
IP14 5UX

T: 01449 763034
E: info@britannia-archaeology.com
W: www.britannia-archaeology.com

SCALE: 1:1000

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PLOT: A3

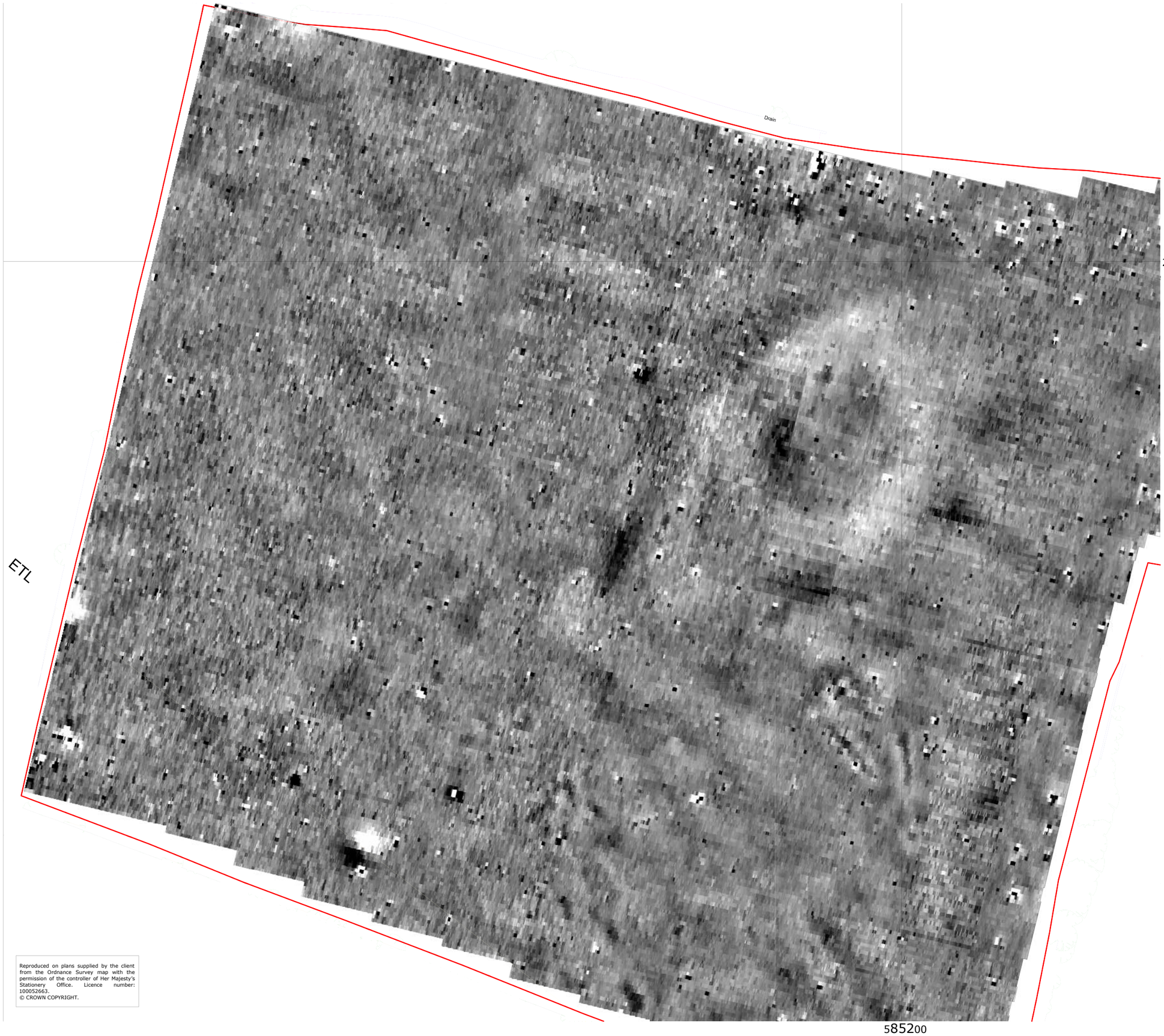
APPROVED: MCA

VERSION: 01

DATE: FEB 2014

AUTHOR: TPS

FIGURE: 03A



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Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION:
SOUTH FIELD, PROCESSED MAGNETOMETER GREYSCALE PLOT

BRITANNIA ARCHAEOLOGY LTD

115 OSPREY DRIVE, STOWMARKET, SUFFOLK
IP14 5UX

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E: info@britannia-archaeology.com
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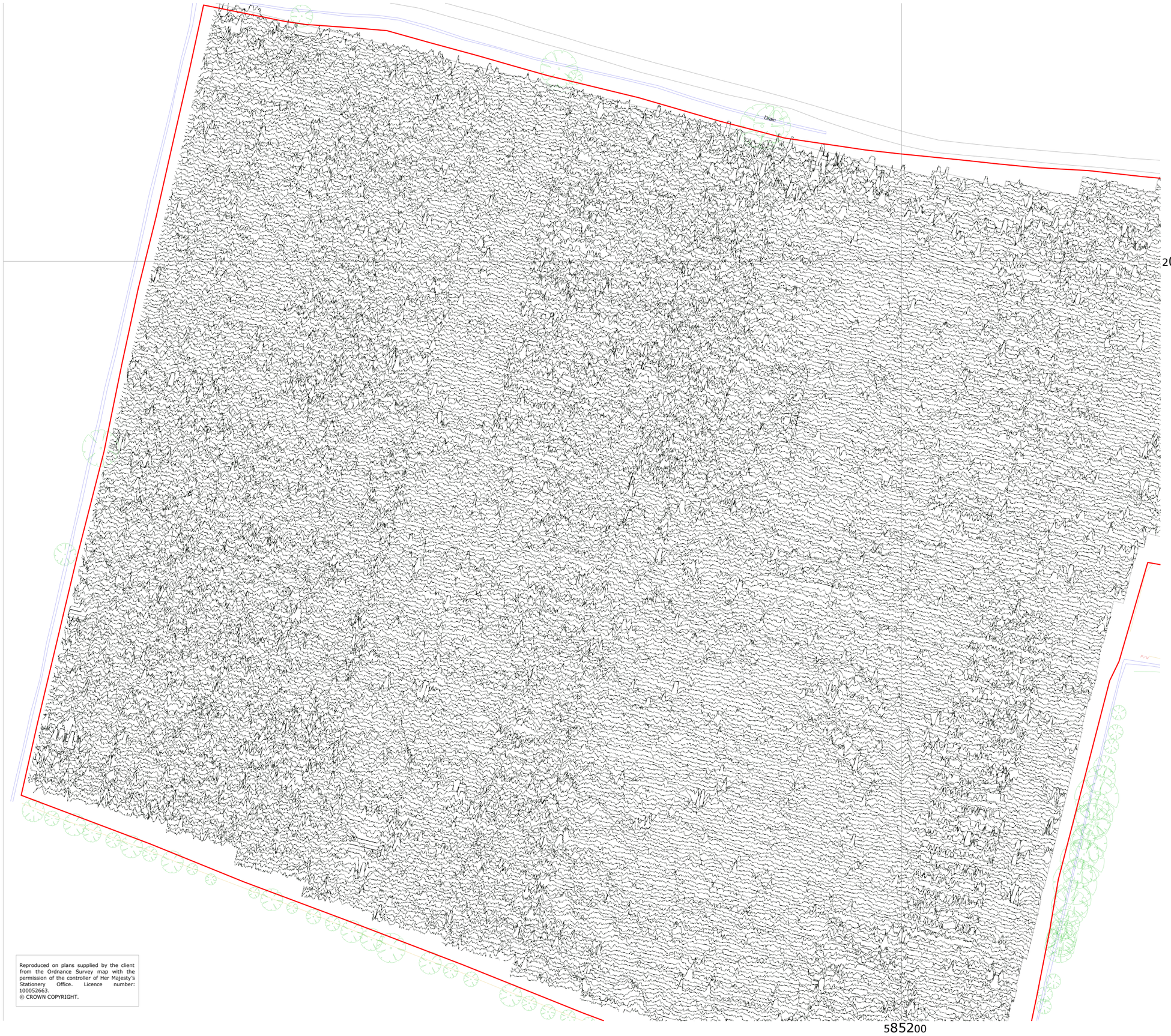
SCALE: 1:1000 (0 – 40m)

PLOT:	APPROVED:	VERSION:
A3	MCA	01

DATE:	AUTHOR:	FIGURE:
FEB 2014	TPS	03B



N

25nT/cm	Scale Interval
	Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION:
SOUTH FIELD, PROCESSED MAGNETOMETER XY TRACE PLOT

BRITANNIA ARCHAEOLOGY LTD

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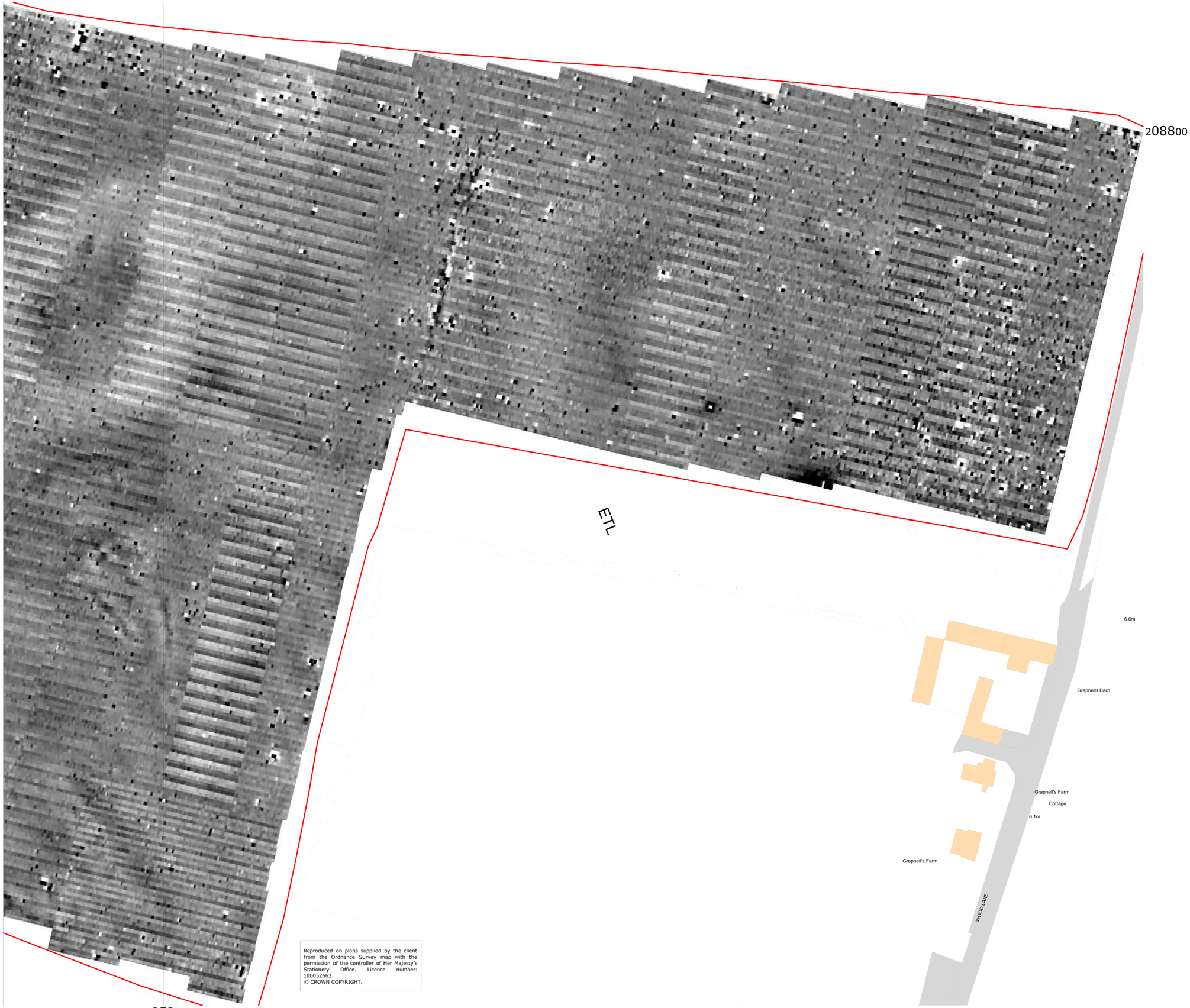
SCALE: 1:1000 — 0 — 40m

PLOT:	APPROVED:	VERSION:
A3	MCA	01

DATE:	AUTHOR:	FIGURE:
FEB 2014	TPS	03C



Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxfordarchaeology eastern east

DESCRIPTION:
SOUTH FIELD, RAW MAGNETOMETER GREYSCALE PLOT

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SCALE: 1:1000

0 40m

PLOT: A3

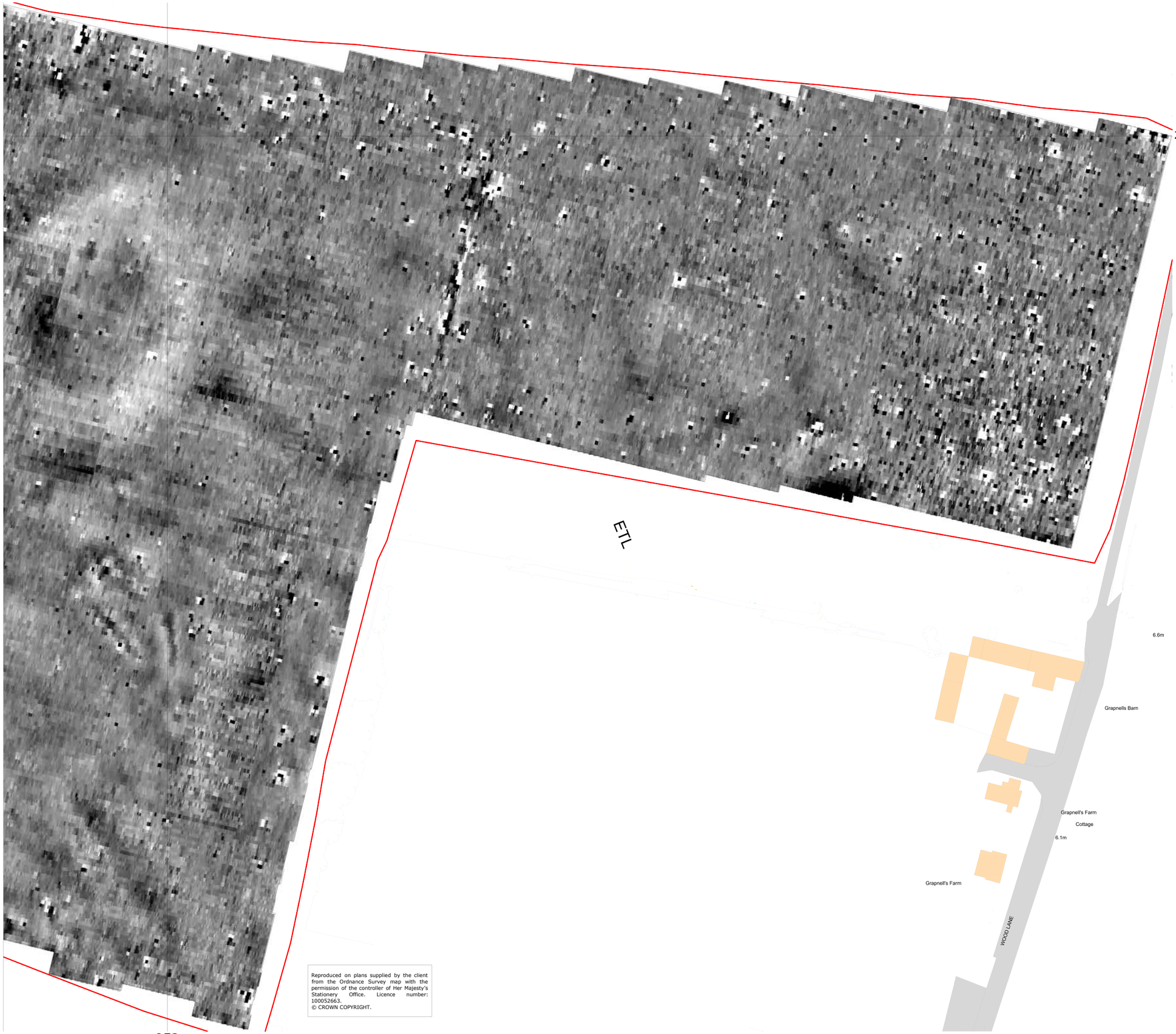
APPROVED: MCA

VERSION: 01

DATE: FEB 2014

AUTHOR: TPS

FIGURE: 04A



Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxfordarchaeology east

DESCRIPTION:
SOUTH FIELD, PROCESSED MAGNETOMETER GREYSCALE PLOT

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SCALE: 1:1000

0 40m

PLOT: A3

APPROVED: MCA

VERSION: 01

DATE: FEB 2014

AUTHOR: TPS

FIGURE: 04B

25nT/cm | Scale Interval

Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:

LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION:

SOUTH FIELD, PROCESSED MAGNETOMETER XY TRACE PLOT

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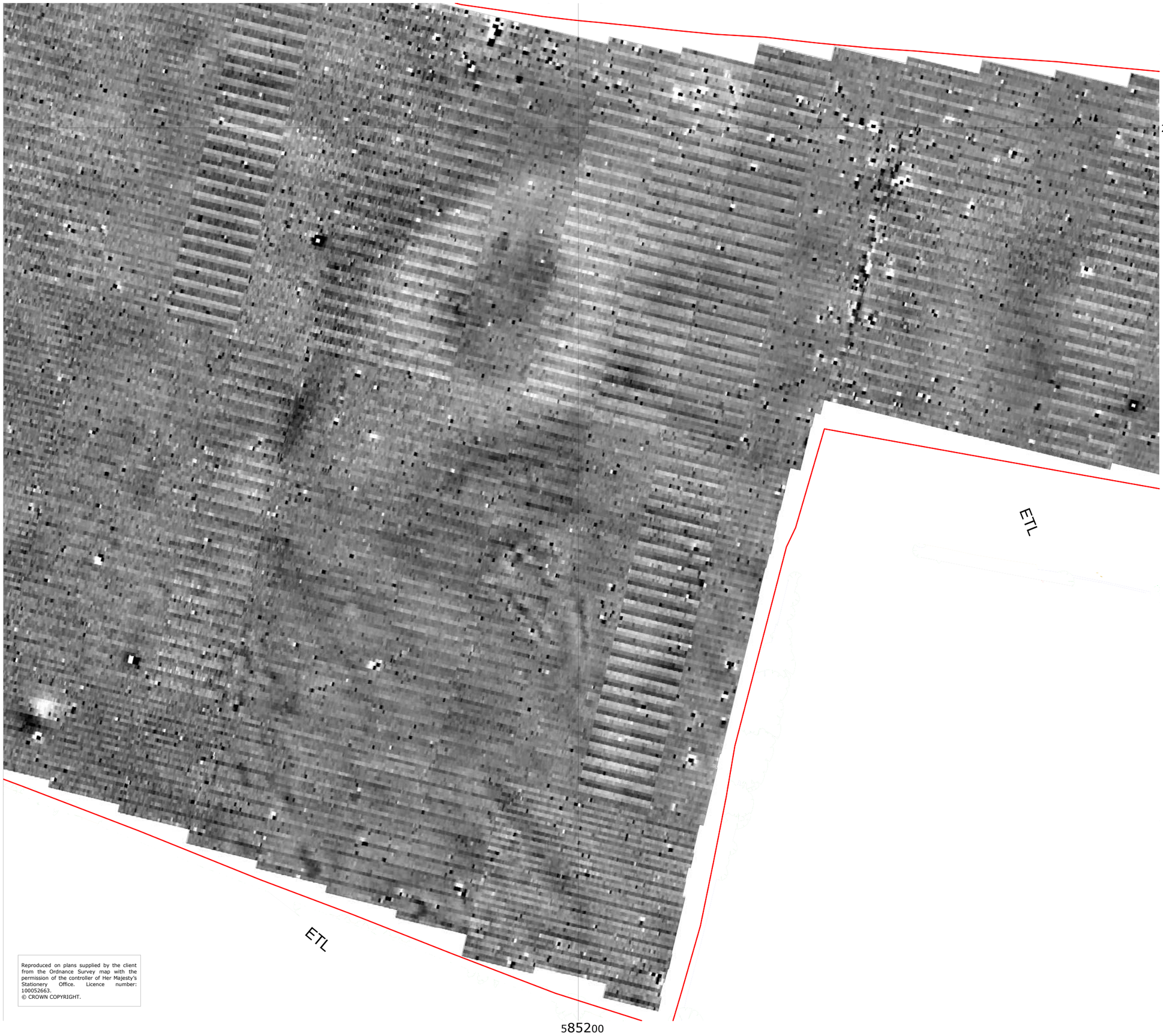
SCALE: 1:1000 (0 – 40m)

PLOT: A3 | APPROVED: MCA | VERSION: 01

DATE: FEB 2014 | AUTHOR: TPS | FIGURE: 04C



N

+11.42nT

-11.03nT

Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT: LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION: SOUTH FIELD, RAW MAGNETOMETER GREYSCALE PLOT

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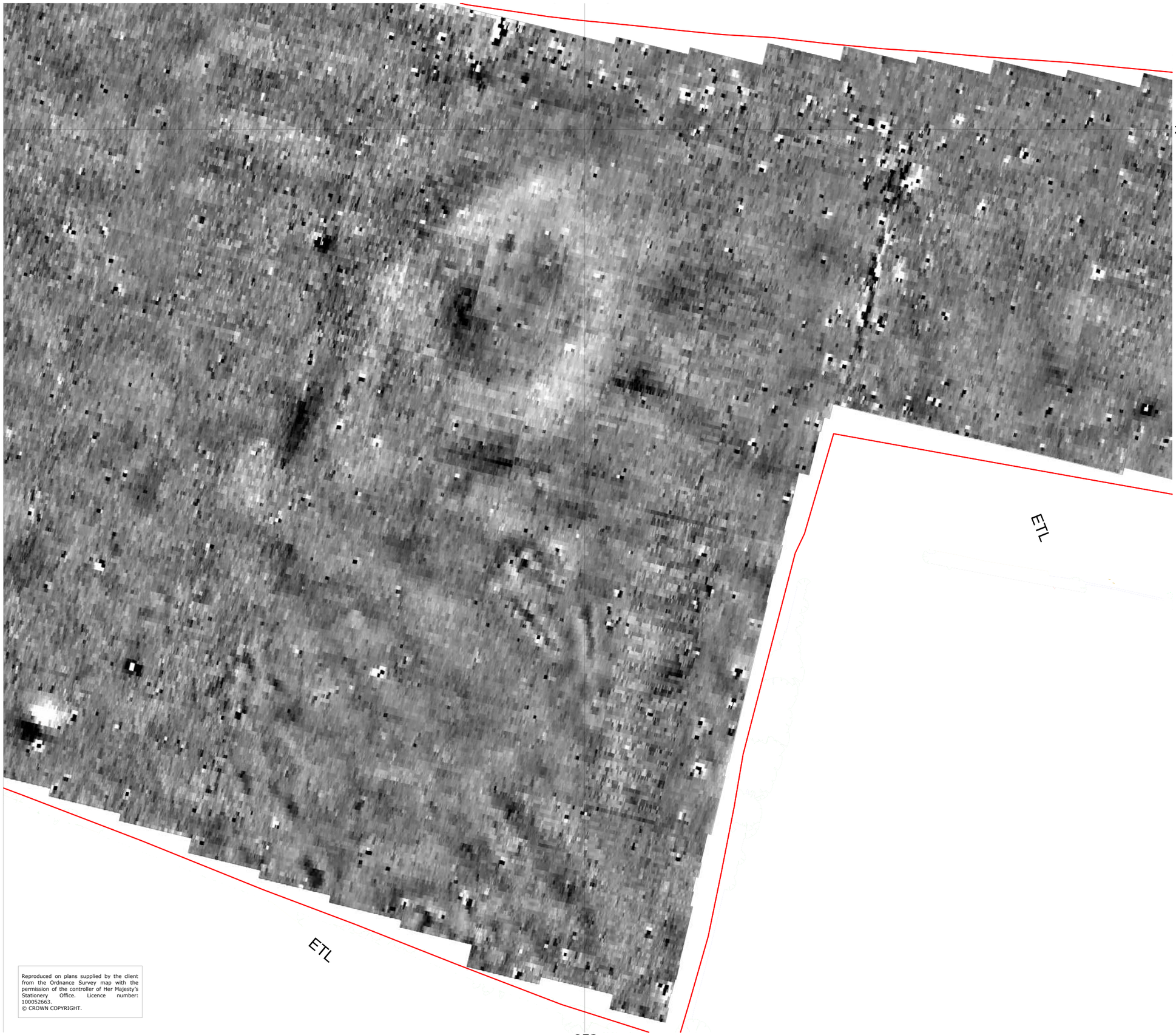
SCALE: 1:1000

0 40m

PLOT:	APPROVED:	VERSION:
A3	MCA	01

DATE:	AUTHOR:	FIGURE:
FEB 2014	TPS	05A



N

+5.36nT

-5.35nT

Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION:
SOUTH FIELD, PROCESSED MAGNETOMETER GREYSCALE PLOT

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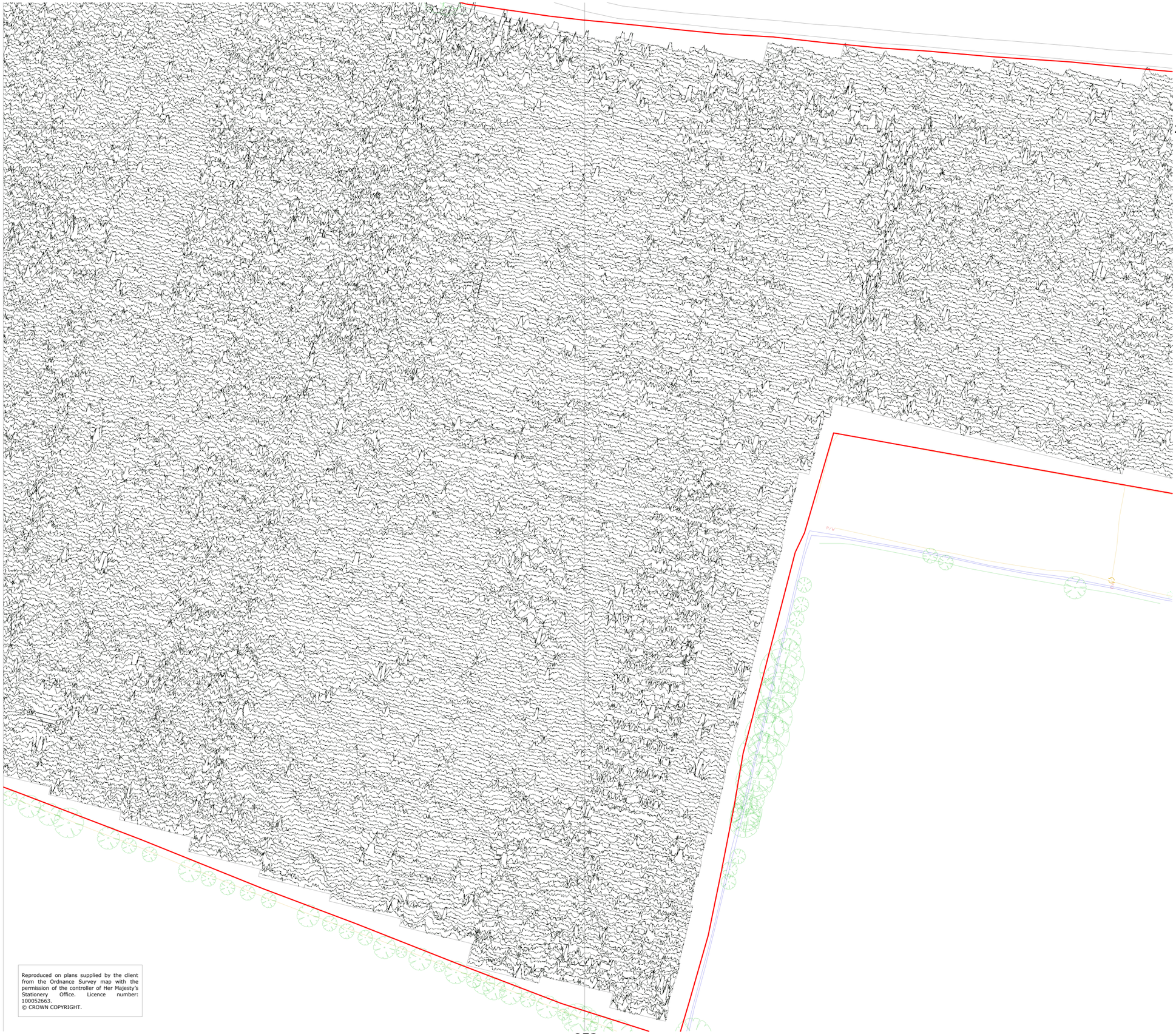
SCALE: 1:1000

0 40m

PLOT:	APPROVED:	VERSION:
A3	MCA	01

DATE:	AUTHOR:	FIGURE:
FEB 2014	TPS	05B



25nT/cm	Scale Interval
	Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION:
SOUTH FIELD, PROCESSED MAGNETOMETER XY TRACE PLOT

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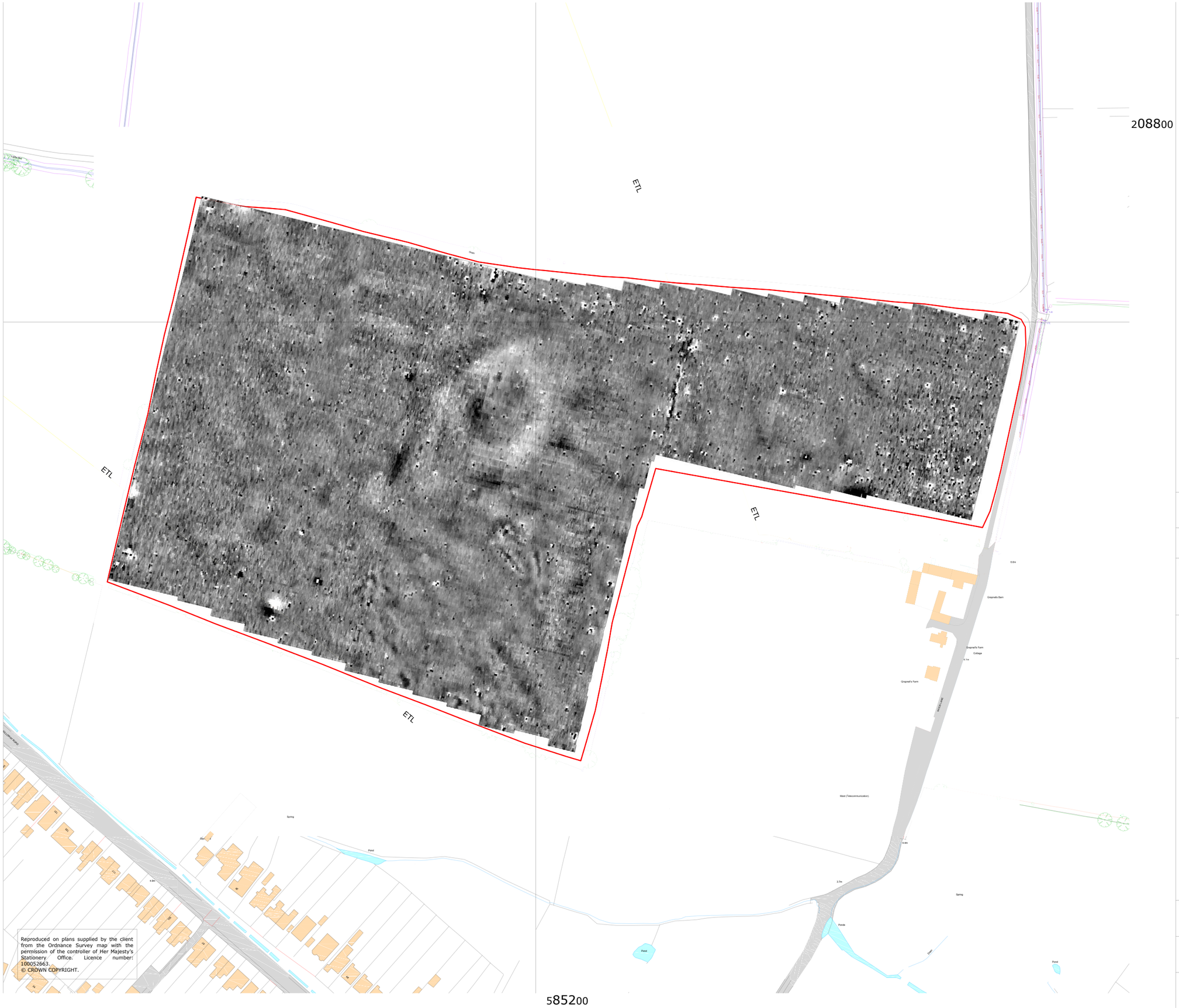
SCALE: 1:1000 (0 – 40m)

PLOT:	APPROVED:	VERSION:
A3	MCA	01

DATE:	AUTHOR:	FIGURE:
FEB 2014	TPS	05C



Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION:
COMPLETE SOUTHERN FIELD, PROCESSED MAGNETOMETER GREYSCALE PLOT

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SCALE: 1:2000

0 80m

PLOT: A3

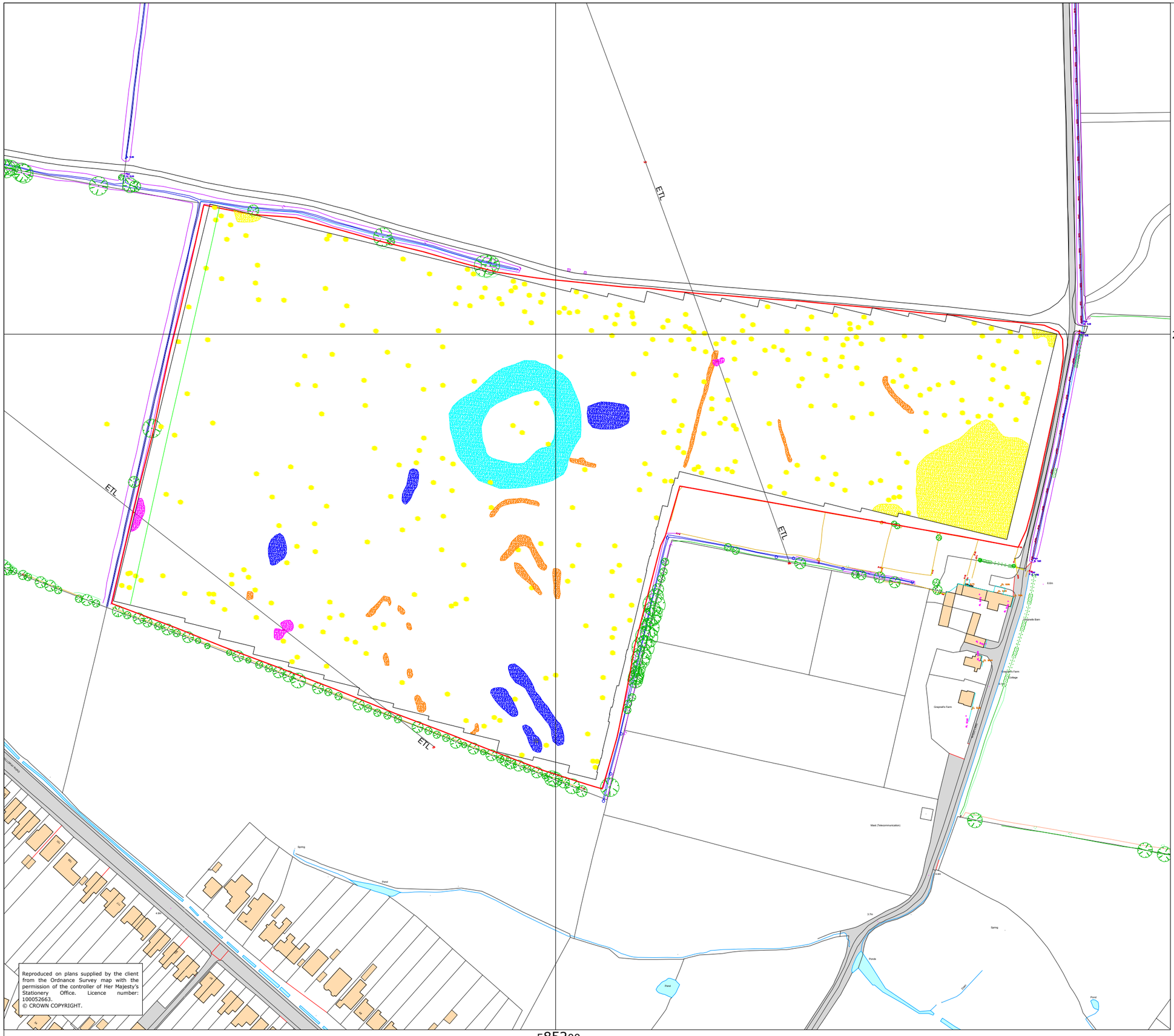
APPROVED: MCA

VERSION: 01

DATE: FEB 2014

AUTHOR: TPS

FIGURE: 06



208800

585200

N

	Positive Linear Anomaly, Archaeology?
	Positive Discrete Anomaly, Archaeology?
	Weak Broad Negative Anomaly, Geology?
	Weak Negative Linear Anomaly, Service/Land Drain
	Weak Broad Positive Anomaly, Geology?
	Strong Dipolar Discrete Anomaly, Electric Cable Pole
	Area of Magnetic Disturbance
	Isolated Dipolar Response
	Site Boundary

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxfordarchaeology east

DESCRIPTION:
COMPLETE SOUTHERN FIELD, INTERPRETATION PLOT OF MAGNETOMETER ANOMALIES

BRITANNIA ARCHAEOLOGY LTD

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SCALE: 1:2000

0 80m

PLOT:	APPROVED:	VERSION:
A3	MCA	01
DATE:	AUTHOR:	FIGURE:
FEB 2014	TPS	07

Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT: LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxfordarchaeology east

DESCRIPTION: NORTH FIELD, RAW MAGNETOMETER GREYSCALE PLOT

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SCALE: 1:1000 (0 – 40m)

PLOT:	APPROVED:	VERSION:
A3	MCA	01

DATE:	AUTHOR:	FIGURE:
FEB 2014	TPS	08A

Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION:
NORTH FIELD, PROCESSED MAGNETOMETER GREYSCALE PLOT

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SCALE: 1:1000

0 40m

PLOT: A3

APPROVED: MCA

VERSION: 01

DATE: FEB 2014

AUTHOR: TPS

FIGURE: 08B

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25nT/cm	Scale Interval
	Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION:
NORTH FIELD, PROCESSED MAGNETOMETER XY TRACE PLOT

BRITANNIA ARCHAEOLOGY LTD

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SCALE: 1:1000 (0 – 40m)

PLOT:	APPROVED:	VERSION:
A3	MCA	01

DATE:	AUTHOR:	FIGURE:
FEB 2014	TPS	08C

N

+6.13nT

-6.78nT

Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION:
NORTH FIELD, RAW MAGNETOMETER GREYSCALE PLOT

BRITANNIA ARCHAEOLOGY LTD

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SCALE: 1:1000 (0 – 40m)

PLOT: A3

APPROVED: MCA

VERSION: 01

DATE: FEB 2014

AUTHOR: TPS

FIGURE: 09A

N

+4.12nT

-4.01nT

Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION:
NORTH FIELD, PROCESSED MAGNETOMETER GREYSCALE PLOT

BRITANNIA ARCHAEOLOGY LTD

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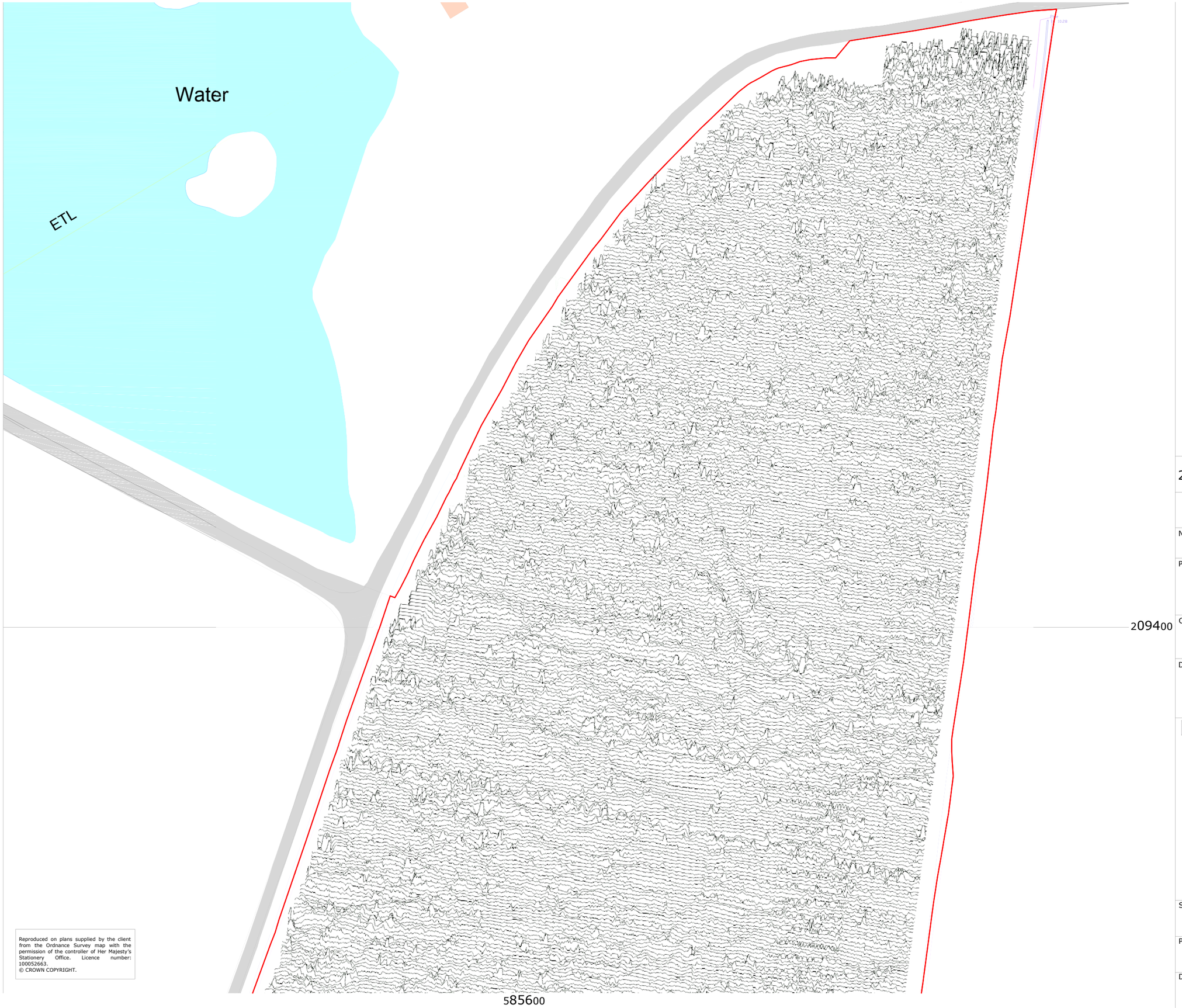
SCALE: 1:1000

0 40m

PLOT:	APPROVED:	VERSION:
A3	MCA	01

DATE:	AUTHOR:	FIGURE:
FEB 2014	TPS	09B



N

25nT/cm	Scale Interval
	Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT:
LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION:
NORTH FIELD, PROCESSED MAGNETOMETER XY TRACE PLOT

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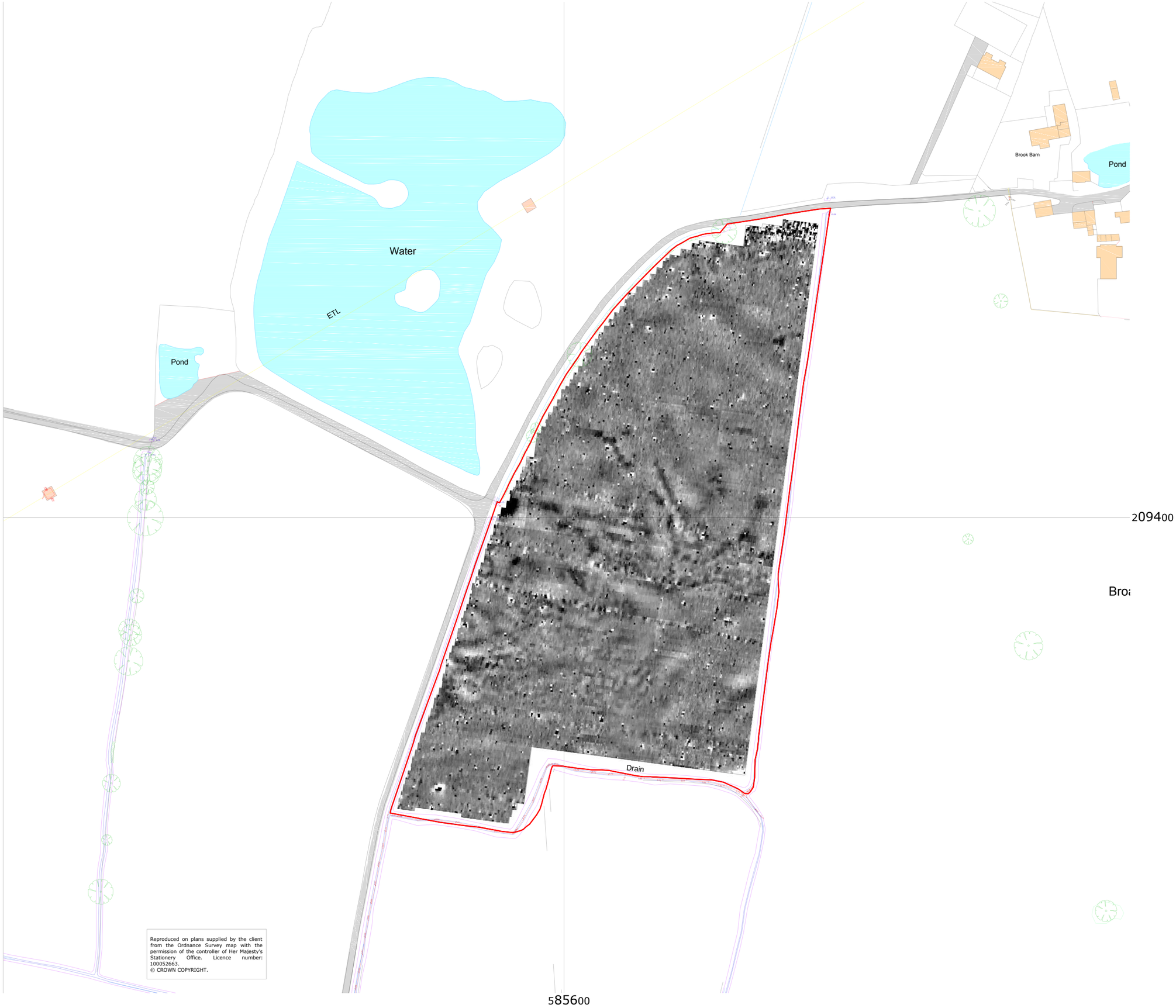
SCALE: 1:1000 (0 – 40m)

PLOT:	APPROVED:	VERSION:
A3	MCA	01

DATE:	AUTHOR:	FIGURE:
FEB 2014	TPS	09C



N

+4.12nT

-4.01nT

Site Boundaries

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT: LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxfordarchaeology east

DESCRIPTION: COMPLETE NORTHERN FIELD, PROCESSED MAGNETOMETER GREYSCALE PLOT

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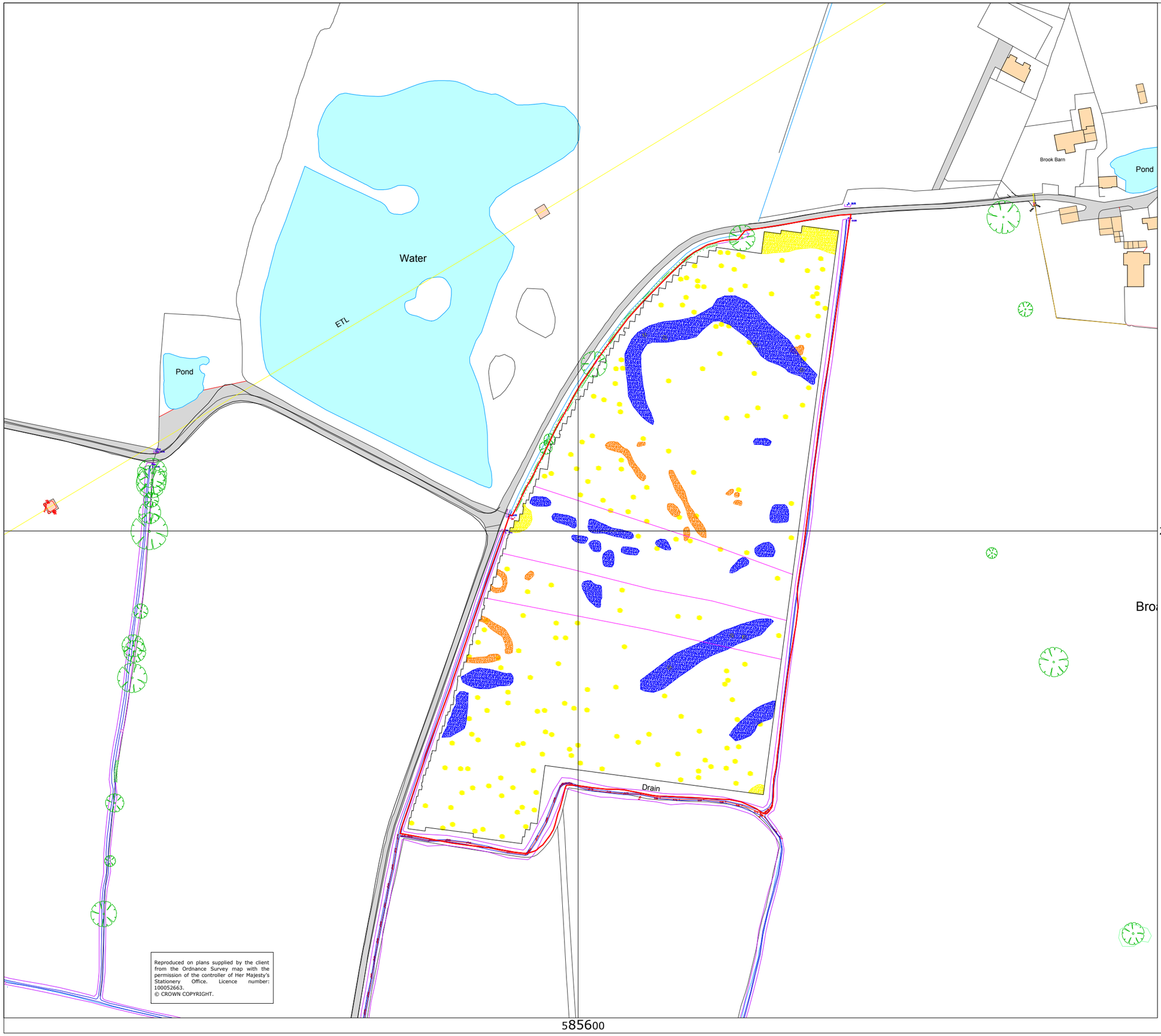
SCALE: 1:2000

0 80m

PLOT:	APPROVED:	VERSION:
A3	MCA	01

DATE:	AUTHOR:	FIGURE:
FEB 2014	TPS	10



N

	Positive Linear Anomaly, Archaeology?
	Positive Discrete Anomaly, Archaeology?
	Weak Broad Positive Anomaly, Geology?
	Dipolar Linear Trend, Ferrous Service Pipe
	Area of Magnetic Disturbance
	Isolated Dipolar Response
	Site Boundary

NGR: TL 848 092

REPORT NUMBER: 1048

PROJECT: LAND NORTH OF HEYBRIDGE, MALDON, ESSEX

CLIENT: oxford archaeology east

DESCRIPTION: COMPLETE NORTHERN FIELD, INTERPRETATION PLOT OF MAGNETOMETER ANOMALIES

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SCALE: 1:2000 (0 – 80m)

PLOT:	APPROVED:	VERSION:
A3	MCA	01
DATE: FEB 2014	AUTHOR: TPS	FIGURE: 11