1.07

PLANNING STATEMENT

Outline Residential Development
102 East Road
West Mersea

Appendix VII
Geophysical Survey

The Johnson Dennehy Planning Partnership
The Coach House
Beacon End House
London Road
Stanway
Colchester
Essex, CO3 0NY

magnitude surveys

Geophysical Survey Report

of

Land at 102 East Road,

West Mersea, Essex

For

Colchester Archaeological Trust

On Behalf Of

Blue Square Homes (New Build Developments)

Magnitude Surveys Ref: MSTM824

HER Event Number: ECC4579

December 2020

magnitude surveys

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Abstract

Magnitude Surveys was commissioned to assess the subsurface potential of c. 1.76ha of land at 102 East Road, West Mersea, Essex. A fluxgate gradiometer survey was completed across the survey area. No anomalies indicative of possible archaeology have been identified within the survey data. Strong modern interference was identified close to residential properties in the north of the survey area, along the perimeter of the survey area, and to around metallic objects, such as goal posts, which were extant during the survey. Natural variations within the local superficial deposits, possible agricultural cultivation and field drains were interpreted from the survey data. Possible historic cultivation and the possible backfill of a former pond or extraction pit were also identified; however, there is little further supporting evidence for such interpretations.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by Colchester Archaeological Trust on behalf of Blue Square Homes (New Build Developments) to undertake a geophysical survey over a c. 1.76ha area of land at 102 East Road, West Mersea, Mersea Island, Essex (TM 02530 13430).

1.2. The geophysical survey comprised hand-pulled, cart-mounted GNSS-positioned fluxgate gradiometer survey. Magnetic survey is the standard primary geophysical method for archaeological applications in the UK due to its ability to detect a range of different features. The technique is particularly suited for detecting fired or magnetically enhanced features, such as ditches, pits, kilns, sunken featured buildings (SFBs) and industrial activity (David *et al.*, 2008).

1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England (David *et al.*, 2008), the Chartered Institute for Archaeologists (CIfA, 2014) and the European Archaeological Council (Schmidt *et al.*, 2015).

1.4. It was conducted in line with a WSI produced by MS (Swinbank 2020).

1.5. The survey commenced on 17/12/2020 and took one day to complete.

2. Quality Assurance

2.1. Magnitude Surveys is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, and a corporate member of ISAP (International Society of Archaeological Prospection).

2.2. The directors of MS are involved in cutting edge research and the development of guidance/policy. Specifically, Dr Chrys Harris has a PhD in archaeological geophysics from the University of Bradford, is a Member of CIfA and is the Vice-Chair of the International Society for Archaeological Prospection (ISAP); Finnegan Pope-Carter has an MSc in archaeological geophysics and is a Fellow of the London Geological Society, as well as a member of GeoSIG (CIfA Geophysics Special Interest Group); Dr Kayt Armstrong has a PhD in archaeological geophysics from Bournemouth University, is a Member of CIfA, the Editor of ISAP News, and is the UK Management Committee representative for the COST Action SAGA; Dr Paul Johnson has a PhD in archaeology from the University of Southampton, has been a member of the ISAP Management Committee since 2015, and is currently the nominated representative for the EAA Archaeological Prospection Community to the board of the European Archaeological Association.

2.3. All MS managers have degree qualifications relevant to archaeology or geophysics. All MS field and office staff have relevant archaeology or geophysics degrees and/or field experience.

2.4. Data collection for one traverse was repeated to demonstrate the consistency and reliability of the geophysical survey. Data for these traverses are presented below:

Traverse 79: Traverse 83:

3. Objectives

3.1. The objective of this geophysical survey was to assess the subsurface archaeological potential of the survey area.

4. Geographic Background

4.1. The survey area was located to the east of West Mersea, Mersea Island, Essex (Figure 1). Gradiometer survey was undertaken across one field of undifferentiated grassland. The survey area was bounded by residential properties along East Road to the north, Cross Lane to the west, arable fields to the south, and undifferentiated grassland to the east (Figure 2).

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	The area consisted of undifferentiated grassland, with short mown grass. The ground gently sloped downhill north-northwest to south-southeast	The area was bounded by fencing to the northwest and west, and hedges to northeast, east and south. Goal posts were located in the northwest of the survey area, and two metal animal feeders were located in the northern half of the survey area. A tree and bird house, which prevented a small section of survey were located towards the west and southwest of the survey area respectively.

4.3. The underlying geology comprises clay, silt and sand of the Thames Group. No superficial deposits have been recorded for most of the survey area, though sand and gravel have been recorded in the northeast corner and immediately to the west of the survey area (British Geological Survey, 2020).

4.4. The soils consist of slightly acid loamy and clayey soils, with impeded drainage in the southern half of the survey area, soils in the north of the survey area are unclassified (Soilscapes, 2020).

5. Archaeological Background

5.1. Awaiting background Information (Desk Based Assessment or other) from Client.

6. Methodology

6.1. Magnetometer surveys are generally the most cost effective and suitable geophysical technique for the detection of archaeology in England. Therefore, a magnetometer survey should be the preferred geophysical technique unless its use is precluded by any specific survey objectives or the site environment. For this site, no factors precluded the recommendation of a standard magnetometer survey. Geophysical survey therefore comprised the magnetic method as described in the following section.

6.2.Data Collection

6.2.1.Geophysical prospection comprised the magnetic method as described in the following table.

6.2.2.Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Magnetic	Bartington Instruments Grad-13 Digital Three-Axis Gradiometer	1m	200Hz reprojected to 0.125m

6.2.3.The magnetic data were collected using MS' bespoke hand-pulled cart system.

6.2.3.1. MS' cart system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a multi-channel, multi-constellation GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The RTK GPS is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

6.2.3.2. Magnetic and GPS data were stored on an SD card within MS' bespoke datalogger. The datalogger was continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allowed for data collection, processing and visualisation to be monitored in real-time as fieldwork was ongoing.

6.2.3.3. A navigation system was integrated with the RTK GPS, which was used to guide the surveyor. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient collection and processing.

6.3. Data Processing

6.3.1. Magnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to Historic England's standards for "raw or minimally processed data" (see Section 4.2 in David *et al.*, 2008: 11).

Sensor Calibration – The sensors were calibrated using a bespoke in-house algorithm, which conforms to Olsen *et al.* (2003).

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

6.4. Data Visualisation and Interpretation

6.4.1. This report presents the gradient of the sensors' total field data as greyscale images. The gradient of the sensors minimises external interferences and reduces the blown-out responses from ferrous and other high contrast material. However, the contrast of weak or ephemeral anomalies can be reduced through the process of calculating the gradient. Consequently, some features can be clearer in the respective gradient or total field datasets. Multiple greyscale images of the gradient and total field at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plot (Figure 6). XY trace plots visualise the magnitude and form of the geophysical response, aiding anomaly interpretation.

6.4.2. Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street maps, satellite imagery, historical maps, LiDAR data, and soil and geology maps. Google Earth (2020) was also consulted, to compare the results with recent land use.

6.4.3. Geodetic position of results – All vector and raster data have been projected into OSGB36 (ESPG27700) and can be provided upon request in ESRI Shapefile (.SHP) and Geotiff (.TIF) respectively. Figures are provided with raster and vector data projected against vector mapping provided by the client.

7. Results

7.1. Qualification

7.1.1. Geophysical results are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible, an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports, as well as reports from further work, in order to constantly improve our knowledge and service.

7.2. Discussion

7.2.1. The geophysical results are presented in combination with satellite imagery and historical maps (Figure 5).

7.2.2. Fluxgate magnetometer survey has been affected in the north of the survey area by modern interference, likely resulting from the proximity of residential properties (see Section 4.1 and Figure 3). Further interference in the form of magnetic disturbance is also identified along the perimeter of the survey area and around metallic features such as the goalposts and the animal feeders (see Section 4.2). Towards the centre of the survey area, away from the magnetic disturbance, anomalies of agricultural and natural origins have been identified (Figure 4).

7.2.3. Several anomalies suggestive of drainage features have been identified across the survey area. Linear striations run in two different orientations across the survey area which are consistent with possible cultivation (Figures 3 and 4). Some of these anomalies in the northern half of the survey area have a more curving form, which could suggest a possible historical origin.

7.2.4. Anomalies interpreted as being of natural origin are present across the centre and south of the survey area (Figures 3 and 4). The anomalies could relate to possible sands and gravel deposits, though they could also reflect differential soil drainage across the survey area (see Section 4.3).

7.2.5. Located in the southeast of the survey area is an area of concentrated anomalies consistent with the backfilling of ponds or extraction pits with high ferrous content debris (Figures 3-4). However, no such features have been recorded on available historical OS maps making the backfill interpretation tentative (Figure 5).

7.3.Interpretation

7.3.1. General Statements

7.3.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually.

7.3.1.2. **Ferrous (Spike)** – Discrete dipolar anomalies are likely to be the result of isolated pieces of modern ferrous debris on or near the ground surface.

7.3.1.3. **Ferrous/Debris (Spread)** – A ferrous/debris spread refers to a concentration of multiple discrete, dipolar anomalies usually resulting from highly magnetic material such as rubble containing ceramic building materials and ferrous rubbish.

7.3.1.4. **Magnetic Disturbance** – The strong anomalies produced by extant metallic structures, typically including fencing, pylons, vehicles and service pipes, have been classified as 'Magnetic Disturbance'. These magnetic 'haloes' will obscure weaker anomalies relating to nearby features, should they be present, often over a greater footprint than the structure causing them.

7.3.2. Magnetic Results - Specific Anomalies

7.3.2.1. **Agricultural (Trend)** – Located across the centre and northeast of the survey area are weak slightly curving striations with separations typically of c. 5-10m [**1a**] (Figures 3 and 4). The slightly curving form of the anomalies is possibly consistent with a historical form of cultivation. However, given the ephemeral nature of these anomalies a confident interpretation such as ridge and furrow cannot be given, as drainage or a more recent origin cannot be ruled out.

7.3.2.2. **Drainage Features** – Located across the survey area are several linear anomalies, which appear to adjoin with each other and predominantly follow directions heading to field boundaries (Figures 3 and 4). The morphology of the anomalies are consistent with field drains and the occurrence of some anomalies with linear alignment of dipoles suggests the presence of ceramic land-drains.

7.3.2.3. **Debris** – Located towards the southeast of the survey area is a concentrated area of strong dipolar anomalies consistent with ferrous debris [**1b**] (Figures 3, 4 and 6). This type of concentration of debris material is often associated with the backfill of former extraction pits and ponds, though the possibility of made ground or deposition of waste material cannot be ruled out (Figure 7).

8. Conclusions

8.1. A fluxgate magnetometer survey was successfully completed across the commissioned survey area. Significant magnetic disturbance from modern interference has been identified in the north of the survey area close in proximity to residential properties and along the survey perimeter. Though this modern interference may have masked weaker anomalies in its immediate vicinity, it was still possible to identify anomalies reflecting natural variations, possible cultivation and the presence of field drains in other areas.

8.2. Some of the anomalies associated with cultivation have a slightly curved form, which could be indicative of historical cultivation practices. Debris in the southeast corner is suggestive of the infilling of a former pond or extraction pit, though this interpretation is speculative as neither have been identified on historical OS maps in this location.

9. Archiving

9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.

9.2. MS contributes reports to the ADS Grey Literature Library upon permission from the client, subject to any dictated time embargoes.

10. Copyright

10.1. Copyright and intellectual property pertaining to all reports, figures and datasets produced by Magnitude Services Ltd is retained by MS. The client is given full licence to use such material for their own purposes. Permission must be sought by any third party wishing to use or reproduce any IP owned by MS.

11. References

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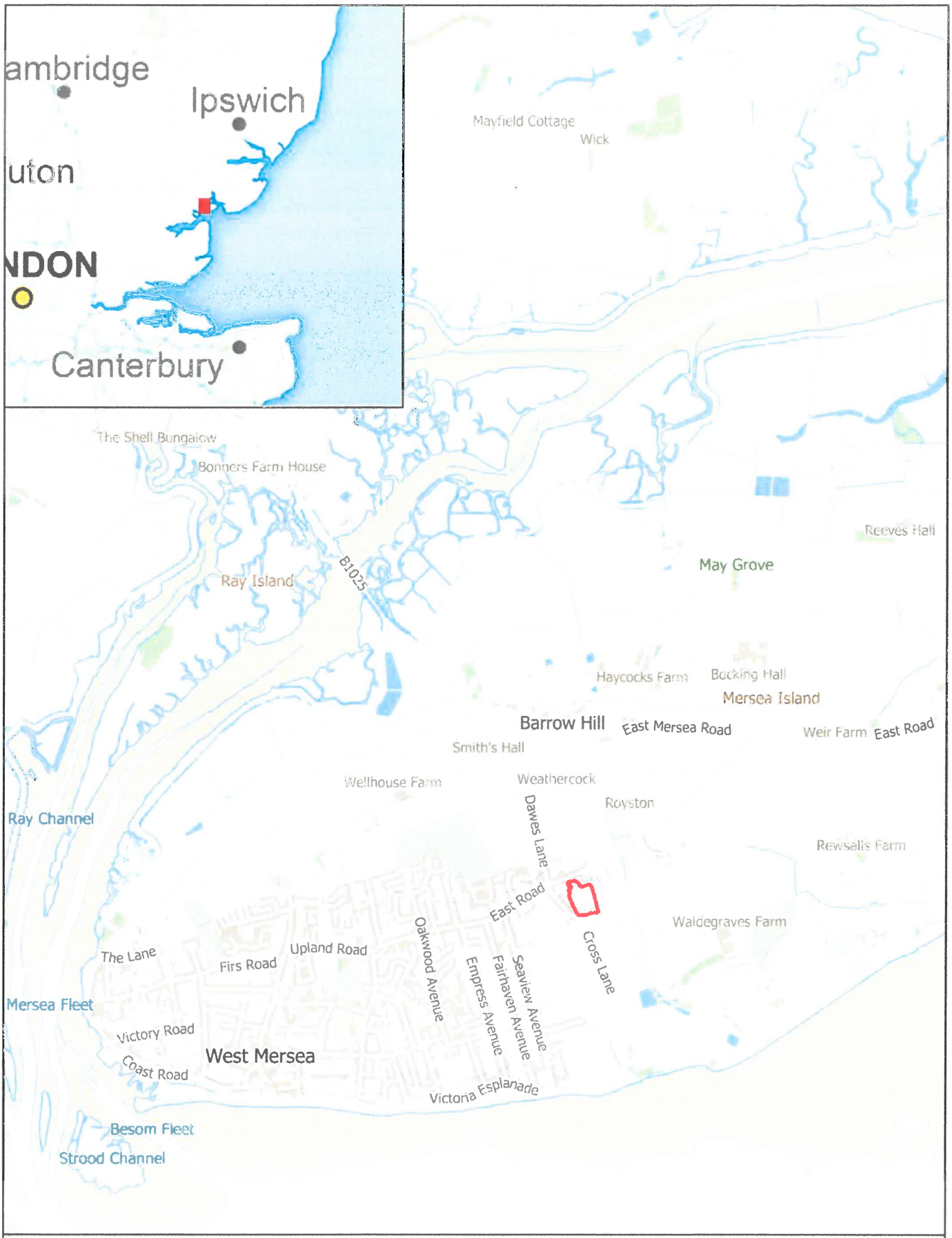
12. Project Metadata

MS Job Code	MSTM824
Project Name	Land at 102 East Road, West Mersea, Essex
Client	Colchester Archaeological Trust
Grid Reference	TM 02530 13430
Survey Techniques	Magnetometry
Survey Size (ha)	1.76ha (Magnetometry)
Survey Dates	2020-12-17 to 2020-12-17
Project Lead	Leanne Swinbank, BA ACIfA
HER Event No	ECC4579
OASIS No	N/A
S42 Licence No	N/A
Report Version	0.2

13. Document History

Version	Comments	Author	Checked By	Date
0.1	Initial draft for Project Lead to Review	RL	LS	22 December 2020
0.2	Draft after Project Lead corrections. Sent for director approval.	RL	LS/ PSJ	23 December 2020



MSTM824 - Land at 102 East Road, West Mersea, Essex
Figure 1 - Site Location
1:25,000 @ A4

Site Boundary

N

0 0.5 1 km

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MSTM824 - Land at 102 East Road, West Mersea, Essex
Figure 2 - Location of Survey Area
1:2,000 @ A3

Survey Extent

N

0 50 100 150 m

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MSTM824 - Land at 102 East Road, West Mersea, Essex
Figure 3 - Magnetic Gradient
1:1,000 @ A3

Background mapping provided by the client

-1 nT 2

N

0 25 50 75 m

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MSTM824 - Land at 102 East Road, West Mersea, Essex
Figure 4 - Magnetic Interpretation
1:1,000 @ A3

Background mapping provided by the client

Natural (Strong)
Natural (Weak)
Magnetic Disturbance
Ferrous/Debris (Spread)
Agricultural (Trend)
Drainage Feature
Service
Ferrous (Spike)

N

0 25 50 75 m

magnitude surveys

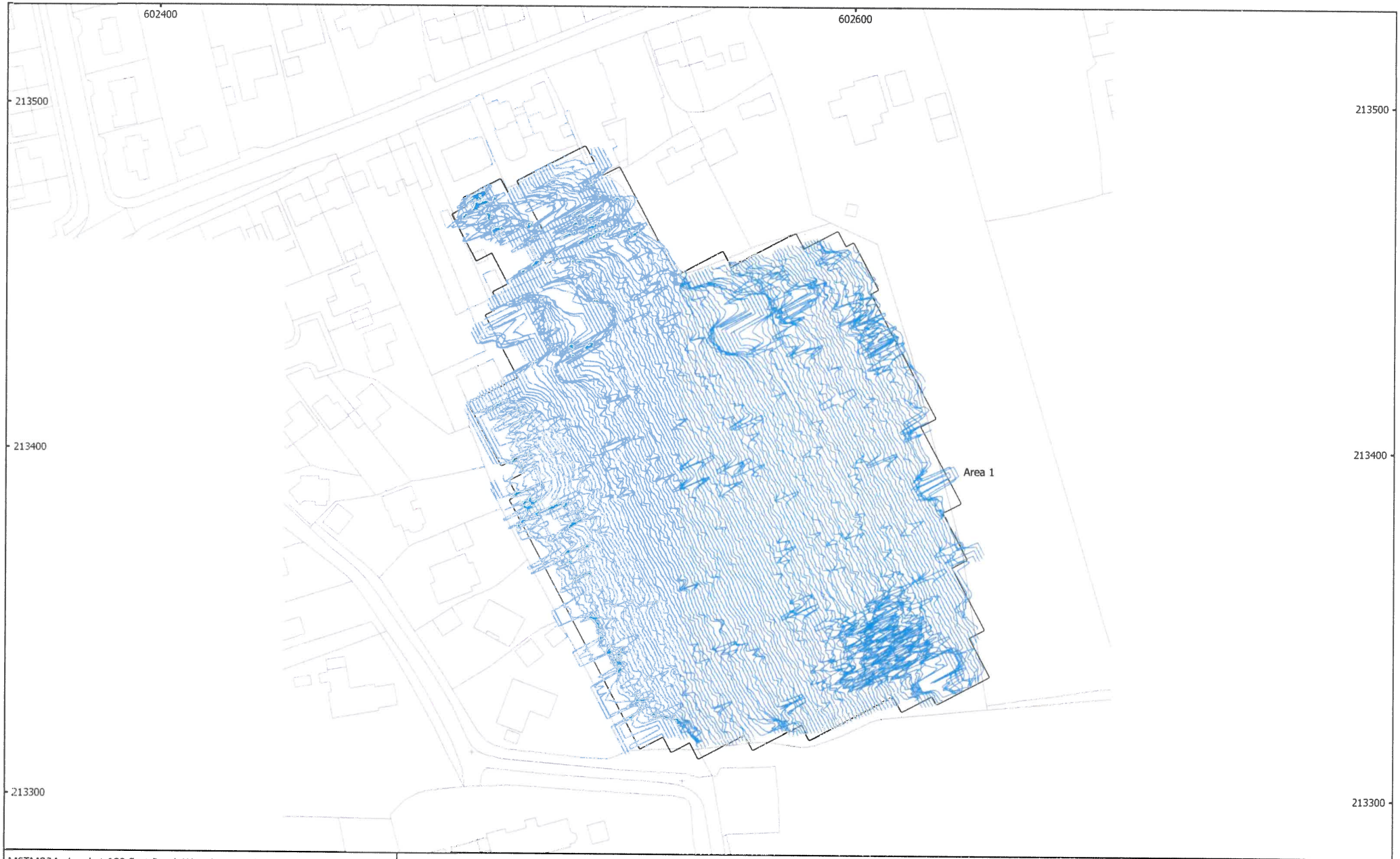
MSTM824 - Land at 102 East Road, West Mersea, Essex
Figure 5 - Magnetic Interpretation Over Historical Maps and Satellite Imagery
1:2,000 @ A3

Natural (Strong)
Natural (Weak)
Magnetic Disturbance
Ferrous/Debris (Spread)
Agricultural (Trend)
Drainage Feature
Service
Ferrous (Spike)

N

0 50 100 150 m

magnitude surveys



MSTM824 - Land at 102 East Road, West Mersea, Essex
Figure 6 - XY Trace Plot
20nT/cm at 1:1,000 @ A3

Background mapping provided by the client

N

0 25 50 75 m

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