magnitude surveys

Geophysical Survey Report

of

Land at Dover Road

Deal, Kent

For

WYG

On Behalf Of

Gladman Developments

Magnitude Surveys Ref: MSTR117

April 2017

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Abstract

Magnitude Surveys was commissioned to assess the subsurface archaeological potential of a *c*. 4.1ha area of land at Dover Road, Deal, Kent. A fluxgate gradiometer survey was successfully completed and no anomalies of a probable or possible archaeological origin have been identified. The geophysical results primarily reflect modern activity, with responses generated by surface obstacles and paddock fencing present across the survey. An ephemeral ploughing regime has been detected as well. The extent of this anthropogenic activity, particularly the recent land usages of the site, has resulted in a number of anomalies being classified as "Undetermined" in origin; although these responses are considered to more likely reflect modern, agricultural or natural processes, as opposed to archaeological activity.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by WYG on behalf of Gladman Developments to undertake a geophysical survey on a *c*. 4.1ha area of land at Dover Road, Deal, Kent (TR 3671 4960).

1.2. The geophysical survey comprised hand pulled, cart-mounted fluxgate gradiometer survey.

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. The survey was conducted in accordance with the method statement made available to White Young Green before survey commencement.

1.5. The survey commenced on 29th March 2017 and took 1 day to complete.

2. Quality Assurance

2.1. Project management, survey work, data processing and report production have been carried out by qualified and professional geophysicists to standards exceeding the current best practice (CIfA, 2014; David *et al*., 2008, Schmidt *et al*., 2015).

2.2. Magnitude Surveys is a corporate member of ISAP (International Society of Archaeological Prospection).

2.3. Director Graeme Attwood is a Member of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, as well as the Secretary of GeoSIG, the CIfA Geophysics Special Interest Group. Director Finnegan Pope-Carter is a Fellow of the London Geological Society, the chartered UK body for geophysicists and geologists, as well as a member of GeoSIG, the CIfA Geophysics Special Interest Group. Director Chrys Harris has a PhD in archaeological geophysics from the University of Bradford.

2.4. All MS managers have postgraduate qualifications in archaeological geophysics. All MS field staff have relevant archaeology or geophysics degrees and supervisors have at least three years' field experience.

3. Objectives

3.1. The geophysical survey aimed to assess the subsurface archaeological potential of the survey area.

4. Geographic Background

4.1. The site is located on the southern fringe of Deal, Kent (Figure 1). The site is bounded to the northeast by properties of Thistledown, to the southwest by land associated with properties fronting onto Dover Road, and to the northwest by Dover Road. The presence of stables, a picnic area, livestock and trees rendered areas to the northeast, southeast and southwest of the site unsurveyable. Survey was undertaken in a flat, grassy area that was subdivided into a number of paddocks (Figure 2).

4.2. The underlying geology comprises Seaford Chalk Formation chalk, and is overlain by Head clay and silt (British Geological Survey, 2017).

4.3. The soils across the survey area consist of freely draining lime-rich loamy soils (Soilscapes, 2017).

4.4. Survey considerations are described below. See Appendix 1 for the site notes, which depict the location of these features.

Survey Area	Ground Conditions	Further notes:
1	Flat, under short grass.	Was subdivided into five paddocks. The individual paddocks were divided by electric fences, some of which were on at the time of survey. Three of these contained no obstacles to survey. However, others contained a trough, animal feeder, and a pitch delineated by a series of pipes. See Appendix 1 for the location of these features and photographs of site conditions. The area is bounded to the west and south-west by a brick wall with vegetation.
2	Unsurveyable due to stable buildings and picnic area.	See Appendix 1 for photographs of site conditions and survey obstacles.
3	Unsurveyable due to access and manoeuvrability issues caused by numerous electric fence divisions.	See Appendix 1 for photographs of site conditions and survey obstacles.
4	Unsurveyable due to mature trees and vegetation.	See Appendix 1 for photographs of site conditions and survey obstacles.

5. Archaeological Background

5.1. The following section summarises the archaeological background to the site and its surrounding landscape, based on the findings of an Archaeological Appraisal by WYG (Skinner, 2017). A map regression was undertaken, using available historic mapping, to track the evolution of the site's configuration and surrounding landscape.

5.2. In 2004/5, excavation conducted by Canterbury Archaeological Trust adjacent to Dowlands, c. 100m to the northeast of the site, recorded a ditch, numerous pits, and domestic waste dating from the Late Bronze to Middle Iron Ages. Romano-British occupation of the area was evidenced by ditches and the isolated burials of a horse and a child. Following the levelling of the site in the late 2nd century, a large aisled building was constructed. Romano-British occupation evidence was recorded in the area directly adjacent to the site, the quality and character of which was such that the excavator suggested the nearby presence of a villa (Skinner 2017: 8).

5.3. The 2nd Edition Ordnance Survey map records the presence of the buildings of King's Barn in the northern corner of the site; the exact location of the buildings and nature of the enclosure boundaries varies over the following decades. The farm is no longer present on the 1974 Ordnance Survey 1:1250 Plan. Early Ordnance Survey maps (*i.e.*1872-7) record a narrow, linear enclosure with trees running southwest from the farm, along Dover Road and the northwestern boundary of site. The southeastern extent of this enclosure formed a Liberty Boundary; while the administrative boundary was maintained into the 20th century, the field boundary itself is not marked on Ordnance Survey mapping after 1877, although it is fossilized in a line of trees on the 1974 OS map. No evidence of the boundary was visible on the ground at the time of survey. Two boundary stones are marked on the 2nd Edition Ordnance Survey map, located in the western corner and centre of the southwestern site of site, marking directional changes of the Liberty Boundary. A further field boundary, running parallel to (on the southeastern side of) the Liberty Boundary and the northwestern site boundary, is recorded on the 2nd Edition mapping (Figure 6), although it is no longer present on the 1938 Ordnance Survey County Series map. A small square reservoir, first marked on the 1898 Ordnance Survey County Series map, is located just outside the southeastern boundary of the survey area and adjacent to this former field boundary.

6. Methodology

6.1. Data Collection

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

6.1.2. Table of survey strategies:

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

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

6.1.3.1. MS' cart system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a Hemisphere S321 GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The Hemisphere S321 GNSS Smart Antenna is accurate to 0.008 m + 1 ppm in the horizontal and 0.015 m + 1 ppm in the vertical.

6.1.3.2. 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.

6.1.3.3. Rows of temporary sight markers were established in each survey area to guide the surveyor and ensure full coverage with the cart. Data were collected by traversing the survey area along the longest possible lines, efficient collection and processing.

6.2. Data Processing

6.2.1. 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 sect 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.

6.3. Data Visualisation and Interpretation

6.3.1. This report presents the gradient of the sensors' total field data as greyscale images. Multiple greyscales images at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plot (Figure 7). XY trace plots visualise the magnitude and form of the geophysical response, aiding in anomaly interpretation.

6.3.2. Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street mapping, satellite imagery, historic mapping, LiDAR data, and soil and geology mapping. Google Earth (2017) was consulted as well, to compare the results with recent land usages.

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 of further work in order to constantly improve our knowledge and service.

7.2. Discussion

7.2.1. The geophysical results are presented in consideration with satellite imagery (Figure 5) and historic mapping (Figure 6).

7.2.2. The modern features and paddocks noted on the ground surface (see Section 4.4 and Appendix 1) have been detected by the fluxgate gradiometer survey. The survey results largely reflect the current land use, with discrete ferrous responses attributable to surface objects. An ephemeral ploughing trend is discernible towards the eastern half of the survey area. A number of curvilinear and linear responses have been classified as "Undetermined" origin and are considered likely to reflect associated modern or agricultural activity, and potentially natural variations. No anomalies of a probable or possible archaeological origin have been identified.

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. **Undetermined** – Anomalies are classified as Undetermined when the anomaly origin is ambiguous through the geophysical results and there is no supporting or correlative evidence to warrant a more certain classification. These anomalies are likely to be the result of geological, pedological or agricultural processes--although an archaeological origin cannot be entirely ruled out. Undetermined anomalies are generally not ferrous in nature.

7.3.1.3. **Ferrous (Discrete/Spread)** – Discrete ferrous-like, dipolar anomalies are likely to be the result of modern metallic disturbance on or near the ground surface. A ferrous spread refers to a concentrated scattering of these discrete, dipolar anomalies. Broad dipolar ferrous responses from modern metallic features, such as fences, gates, neighbouring buildings and services, may mask any weaker underlying archaeological anomalies should they be present.

7.3.2. Magnetic Results - Specific Anomalies

7.3.1.4. **Modern and Ferrous** – Anomalies ascribed the "Modern" classification correlate with the paddock boundaries and the pitch constructed of pipes recorded in the sites notes (Appendix 1). Discrete ferrous responses within the western half of the survey can be attributed to the animal feeders and troughs.

7.3.1.5. **Magnetic Disturbance** – A linear band of magnetic disturbance, approximately 8-15m in width, is present along the north-western edge of the survey area. This may stem from origins such as the dumping of material during the construction of Dover Road, from alternative land use during the period when this area was enclosed (see Section 5.3), or more recent usage of the site.

7.3.1.6. **Agricultural** – A series of weak, parallel linear trends have been detected on a SW-NE alignment across the eastern end of the survey area. The patterning of these responses is characteristic of agricultural activity, such as ploughing. Given the weak, ephemeral nature of the magnetic response, a relative age for these features cannot be ascribed. There is no visible ploughing activity in recent satellite imagery that correlates with the orientation and extent of these responses (Google Earth, 2017).

7.3.1.7. **Natural** – Magnetic anomalies caused by natural variations in the soils and superficial geology have been detected across the site. As these weak, background variations are prevalent across the site, only certain responses have been indicatively categorised for clarity of the overall interpretation.

7.3.1.8. **Undetermined** – Of the anomalies classified as "Undetermined," the most coherent feature comprises a curvilinear response located in the northern part of the survey area, on a sub northwest-southeast alignment before turning to run

northeast [**1a**]. A similar, concentric response has also been detected immediately to the north [**1b**]; although the clarity of this response is less clear. It is possible that [**1a**] reflects a boundary associated with the former King's Barn farm previously present in the north of the area or may relate to more recent land usage of the site. A number of more ephemeral trends in the results are visible to the south of this anomaly, running across the survey area. Such anomalies are likely to be the result of natural variations in the soil or geology, or reflect modern usage of the land; however, given the ambiguous nature of response, an archaeological origin cannot be categorically ruled out.

8. Conclusions

8.1. A fluxgate gradiometer survey has been successfully undertaken across the accessible areas of the site (see Figure 2). The results primarily reflect modern activity associated with the recent utilisation of the land (see Appendix 1), including the wire fencing of paddocks, animal feeders, troughs, and a rectangular pitch made of a series of pipes. Agricultural activity has also been identified, as well as weak variations in the soil and geology. No anomalies have been identified as possible or probable archaeological in origin. While a number of anomalies have been classified as "Undetermined," these are considered more likely to reflect modern, agricultural and natural processes.

8.2. Agricultural activity is evident in a weak, ephemeral ploughing regime detected towards the eastern half of site. A relative age for this ploughing cannot be derived.

8.3. An area of magnetic disturbance runs along the northwestern edge of the site. The exact origins of this disturbance are unclear, but the nature of response indicates a dumping of mixed material.

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 all reports to the ADS Grey Literature Library subject to any time embargo dictated by the client.

9.3. Whenever possible, MS has a policy of making data available to view in easy to use forms on its website. This can benefit the client by making all of their reports available in a single repository, while also being a useful resource for research. Should a client wish to impose a time embargo on the availability of data, this can be achieved in discussion with MS.

10. Copyright

10.1. Copyright and the 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.

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12. Appendix 1

MSTR117 - Land at Dover Road, Deal, Kent
Figure 1 - Site Location
1 : 25,000 @ A4

Site Boundary

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637000

Area 1

Area 2

Area 3

Area 4

MSTR117 - Land at Dover Road, Deal, Kent
Figure 2 - Location of Survey Areas
1:2500 @ A3

Surveyable Extent
Vegetation

N

0 50 100 150 m

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636500 636600 636700 636800 636900

149700 149700

149600 149600

149500 149500

MSTR117 - Land at Dover Road, Deal, Kent
Figure 3 - Magnetic Greyscale
1:1250 @ A3

-1 nT 2

N

0 25 50 75 m

magnitude surveys

MSTR117 - Land at Dover Road, Deal, Kent
Figure 4 - Magnetic Interpretation
1:1250 @ A3

- Agricultural (Trend)
- Undetermined (Trend)
- Undetermined (Strong)
- Undetermined (Weak)
- Modern
- Ferrous (Dipolar)
- Magnetic Disturbance
- Natural (Weak)
- Natural (Spread)

N

0 25 50 75 m

magnitude surveys

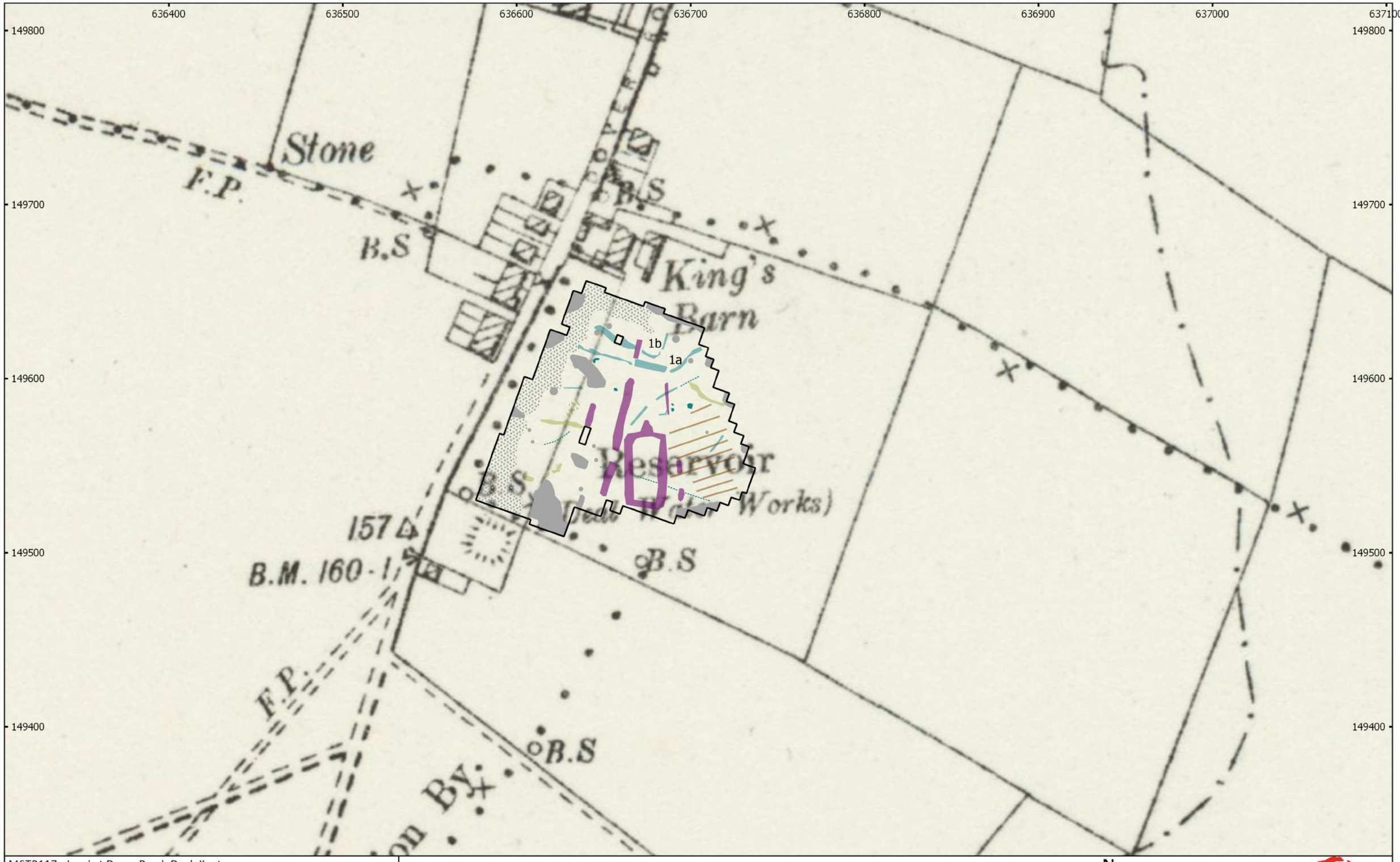
MSTR117 - Land at Dover Road, Deal, Kent
Figure 5 - Magnetic Interpretation Over Satellite Imagery
1:1250 @ A3

- Agricultural (Trend)
- Undetermined (Trend)
- Undetermined (Strong)
- Undetermined (Weak)
- Modern
- Ferrous (Dipolar)
- Magnetic Disturbance
- Natural (Weak)
- Natural (Spread)

N

0 25 50 75 m

magnitude surveys



MSTR117 - Land at Dover Road, Deal, Kent
Figure 6 - Magnetic Interpretation Over Satellite Imagery
1:2000 @ A3

Contains historic mapping: Ordnance Survey, 6" 2nd edition c. 1882-1913 © National Library of Scotland

- Agricultural (Trend)
- Undetermined (Trend)
- Undetermined (Strong)
- Undetermined (Weak)
- Modern
- Ferrous (Dipolar)
- Magnetic Disturbance
- Natural (Weak)
- Natural (Spread)

N

0 40 80 120 m

magnitude surveys

636500 636600 636700 636800 636900

149700 149700

149600 149600

149500 149500

MSTR117 - Land at Dover Road, Deal, Kent
Figure 7 - XY Trace Plot
25nT/cm at 1:1250 @ A3

N

0 25 50 75 m

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