WA Heritage

Land at Seaton Heights
Devon

Detailed Gradiometer Survey Report

Ref: 68480.02

February 2008

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LAND AT SEATON HEIGHTS

DEVON

Detailed Gradiometer Survey Report

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Summary

WA Heritage was commissioned by M2 Services Limited to conduct geophysical assessment over land north-west of Seaton, Devon, ahead of a proposed development centred on NGR 323380 091370. Of the proposed total of 2.2ha, 0.9ha of the study area was suitable for detailed gradiometer survey. The remainder of the land was under dense vegetation, modern buildings and a car park.

A Desk-based Assessment was undertaken by Wessex Archaeology in advance of this survey, which identified a number of archaeological sites and findspots in the immediate vicinity. The most important of these are two Scheduled Monument sites; Seaton Down Promontory Fort and Honeyditches, both of which have been the subject of archaeological investigations from the 1860s to the present day.

Honeyditches, to the south of the survey area, presents significant evidence for early prehistoric and Bronze Age activity, followed by an Iron Age and Romano-British farmstead and villa complex. Seaton Down Promontory Fort, to the north of the survey area, confirms a strong Romano-British presence in the immediate vicinity. It is likely that the agrarian character of the surrounding area continued throughout the Saxon and medieval periods.

The detailed gradiometer survey did not identify any anomalies of clear archaeological potential, although several discrete responses may have some significance. A possible former field boundary has been identified, along with a number of linear trends on a similar alignment, which are possibly related to former agricultural practices. Much of the dataset is dominated by the responses from modern services and construction. It is possible that the anomalies caused by these modern features may have masked any weaker archaeological responses. The magnetic background of the remainder of the survey area was relatively quiet, suggesting that anomalies of archaeological significance would have been detected if present.

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Acknowledgements

The detailed gradiometer survey was commissioned by M2 Services Limited, through their agents EMG Architects, and WA Heritage is grateful to Eamon McGurnaghan in this regard.

The fieldwork was directed by Ben Urmston, and assisted by Robert Fry. Ben Urmston and Robert Fry processed and interpreted the geophysical data and wrote this report. The geophysical work was organised and quality controlled by Paul Baggaley. Illustrations were prepared by Karen Nichols. The project was managed on behalf of WA Heritage by Rob Armour Chelu.

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Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 WA Heritage was commissioned by M2 Services Limited, on behalf of EMG Architects, to undertake geophysical survey on land at Seaton Heights, Devon (**Figure 1**), centred on NGR 323380 091370 (hereafter 'the Site').

1.1.2 The aim of the project was to conduct a geophysical survey to establish the presence/absence, extent, character and date of archaeological remains at the Site.

1.1.3 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

1.2 Archaeological and historical background

1.2.1 The archaeological background to the Site is set out in detail in the desk-based assessment (Wessex Archaeology 2008), and is thus only presented in summary below.

1.2.2 The Site lies between two Scheduled Monuments, a Romano-British settlement to the south and an Iron Age promontory fort to the north. Archaeological investigations within the Site's environs have recorded further archaeological sites, deposits and findspots dating from the Mesolithic to the modern period, with much of the known and potential archaeological resource relating to the position of the Site on the rising slope above the Axe valley.

1.3 Survey areas

1.3.1 The Site comprised 2.2ha, of which 0.9ha was available for detailed geophysical survey. The remainder of the land was under dense vegetation, modern buildings and a car park. The detailed survey was divided into two areas due to the position of the car park and access road, although they area considered as one area through the text.

1.3.2 The Site slopes gently down from north-west to south-east, with no significant topographic features. A steeper break of slope is apparent to the east and south-east of the Site.

1.3.3 The superficial drift geology underlying the Site largely comprises stagnogleyic argillic and palaeo-argillic brown earths of the 572f Whimple 3 and 582a Batcombe associations (SSEW 1983). These soils are likely to produce a magnetic contrast suitable for identification of archaeological remains through survey with the Bartington Grad 601-2 gradiometer.

2 METHODOLOGY

2.1 Introduction

2.1.1 The methodology employed for the Site comprised detailed gradiometer survey using a Bartington Grad 601-2 dual gradiometer system in accordance with English Heritage Guidelines for Geophysical Surveys (1995).

2.2 Detailed survey

2.2.1 The detailed survey was conducted by Wessex Archaeology's in-house geophysics team in accordance with English Heritage Guidelines and was undertaken on the 14th February 2008. Survey grids were established at 20m x 20m using a Leica 500 RTK GPS system, which is able to provide locations in real-time, accurate to within 2cm, and therefore exceeds English Heritage recommendations (1995) for geophysical surveys.

2.2.2 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix I**.

3 RESULTS AND INTERPRETATION

3.1 Introduction

3.1.1 The geophysical survey identified a number of anomalies of anthropogenic origin and the results are presented as greyscale and XY trace plots (**Figure 2**). The results are discussed numerically.

3.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, trends, ferrous/burnt or fired objects, areas of general increased magnetic response, and anomalies of probable geological origin (**Figure 3**). Full definitions of these terms are provided in **Appendix II**.

3.1.3 Numerous small-scale ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to in the interpretation, unless considered relevant to the archaeological interpretation.

3.2 Detailed survey results and interpretation

3.2.1 Amorphous anomaly **4001** is located within a linear region of increased magnetic response. It is difficult to determine the nature of this anomaly given its proximity to the field boundary and the limited survey area. The morphology of the response suggests that **4001** may represent the remains of a former field boundary.

3.2.2 Other small-scale anomalies of possible archaeological origin, typified by **4002** and **4003**, appear within the dataset and are largely confined to the eastern portion of the survey area. As with **4001**, the limited survey area and the magnetic disturbance caused by field boundaries and modern intrusion makes it difficult to offer any further interpretation.

3.2.3 The region of increased magnetic response **4004** near the centre of the survey area may have some archaeological significance. However, its location, adjacent to the modern car park, suggests that it is more likely to

be of modern origin, although an archaeological interpretation cannot be ruled out given the extensive Romano-British sites known nearby.

3.2.4 In the south-eastern corner of the survey area, a number of linear trends, aligned approximately north-west/south-east, are probably the result of former agricultural practices. It is difficult to characterise the linear and curvilinear trends appearing elsewhere given the limited area available for survey.

3.2.5 Rectilinear anomaly **4005** is characteristic of a ferrous pipe, and is of probable modern origin. Given that it turns westward towards its northern extent, it is likely to be associated with the water tower to the west. A ferrous anomaly, aligned north-east/south-west, meets **4005** and perhaps reflects another service running from the water tower towards the buildings to the north. It should be noted that the anomaly produced by the access road running from the B3172 to the car park appears as an extension of **4005**, bordered to the south by numerous small-scale ferrous responses. Rectilinear anomaly **4006** is likely to be the result of another modern service.

3.2.6 The smaller survey area, separated from the main detailed survey by the car park, is dominated by ferrous anomalies **4007**, with only very limited regions of relatively quiet magnetic background. Modern landscaping is evident throughout the survey area and the pipe feeding the tank and water feature to the south is evident as a strong positive anomaly aligned northwest-southeast. No anomalies of archaeological potential have been identified in this area.

4 CONCLUSION

4.1 Introduction

4.1.1 The Site comprised 2.2ha, of which 0.9ha was suitable for detailed survey. The rest of the land was under dense vegetation, modern buildings and a car park.

4.1.2 Few anomalies of archaeological potential have been identified. A number of amorphous anomalies and regions of increased magnetic response may have some archaeological significance, although their interpretation is made difficult given the limited area suitable for survey and the effect of modern services and buildings.

4.2 Conclusions

4.2.1 It is possible that a former field boundary has been detected aligned approximately north-west/south-east.

4.2.2 Linear trends in the south-eastern corner of the survey may reflect former agricultural practices, given their possible alignment with the tentatively-identified former field boundary.

4.2.3 A number of rectilinear anomalies, consistent with modern services, are apparent throughout the survey area. Any weaker responses from archaeological sources will have been masked by these extensive modern intrusions.

5 REFERENCES

English Heritage, 1995. *Geophysical survey in archaeological field evaluation*. Research and Professional Service Guideline No 1.

Soil Survey of England and Wales, 1983. *Soils of South West England: Sheet 5*. Ordnance Survey, Southampton.

Wessex Archaeology, 2008. *Seaton Heights Hotel Complex: Seaton, Devon. Archaeological Desk-Based Assessment*. Report 68480.01

6 APPENDIX I: SURVEY EQUIPMENT AND DATA PROCESSING

Survey Methods and Equipment

The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have a resolution of 0.1nT over a ±3000nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

WA undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20m site grid, which is achieved using a Leica 1200 RTK GPS system and then extended using tapes. The Leica 1200 RTK GPS system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined to an accuracy of 1-2cm in real-time and therefore exceed the level of accuracy recommended by English Heritage (1995) for geophysical surveys.

Scanning surveys consist of recording data at 0.25m intervals along transects spaced 10m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detail surveys consist of 20m x 20m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. This gives 1600 measurements per grid and is the recommended methodology for archaeological surveys of this type (English Heritage, 1995).

Post-Processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:

- Destripe – Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;

- Destagger – Shifting each traverse forward or backward by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Clipping – Limiting the displayed range of the processed data to either ±3nT or ±3s.d. in order to enhance the appearance of smaller anomalies.
- Despike – Filtering any data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings caused by modern, small ferrous objects at the surface

Typical displays of the data used during processing and analysis:

- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This image can include a hidden line algorithm to remove certain lines and enhance the image. This type of image is useful as it shows the full range and shape of individual anomalies.
- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

7 APPENDIX II: GEOPHYSICAL INTERPRETATION

The interpretation methodology used by WA separates the anomalies into two main categories: archaeological and unidentified responses.

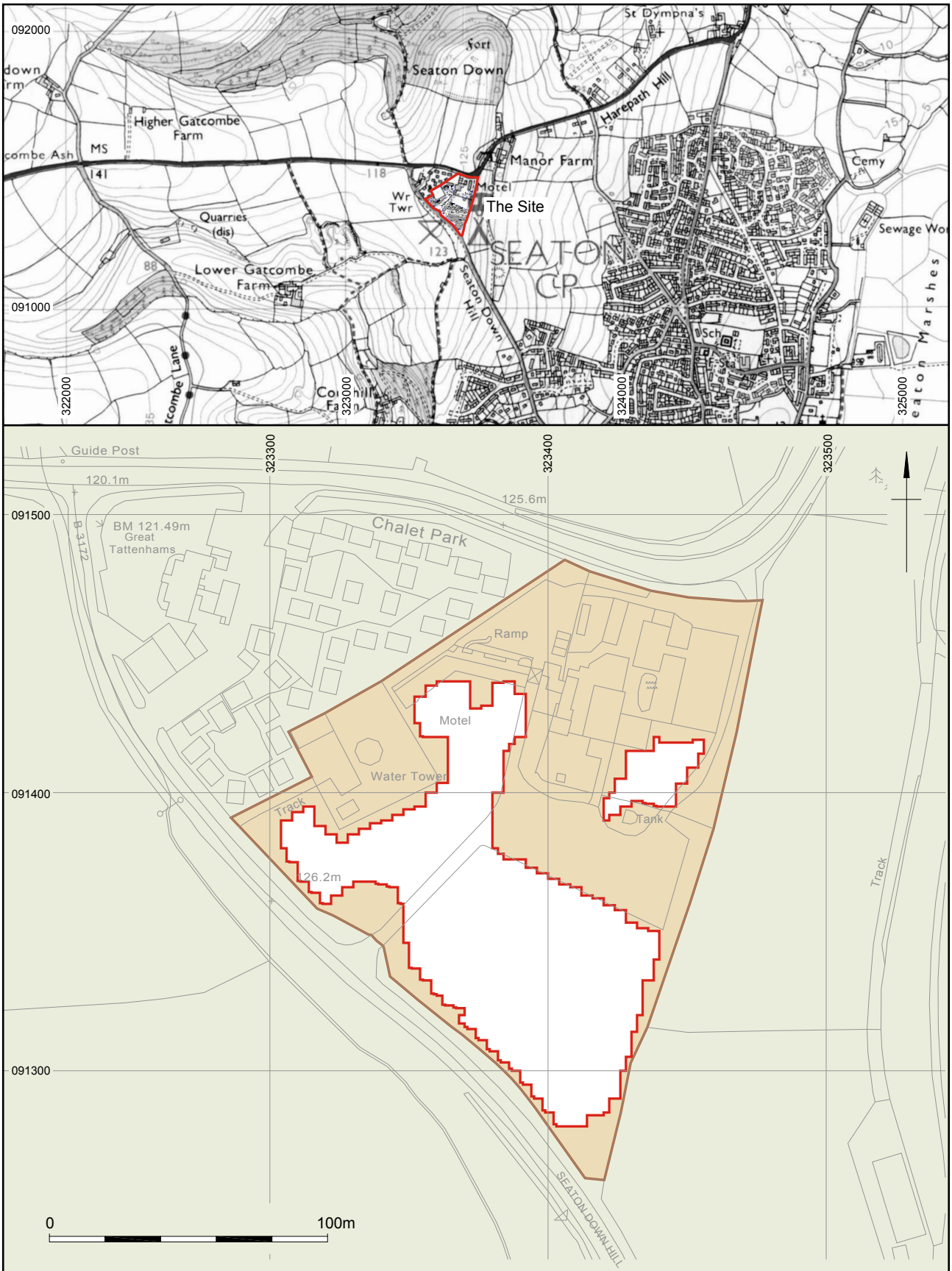
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Probable archaeology – used for features which give a clear response but which form incomplete patterns.

The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- Possible archaeology – used for features which give a response but which form no discernable pattern or trend.
- Increased magnetic response – used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend – used for low amplitude or indistinct linear anomalies.
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.

Finally, services such as water pipes are marked where they have been identified.



Reconnaissance area

Detailed survey area

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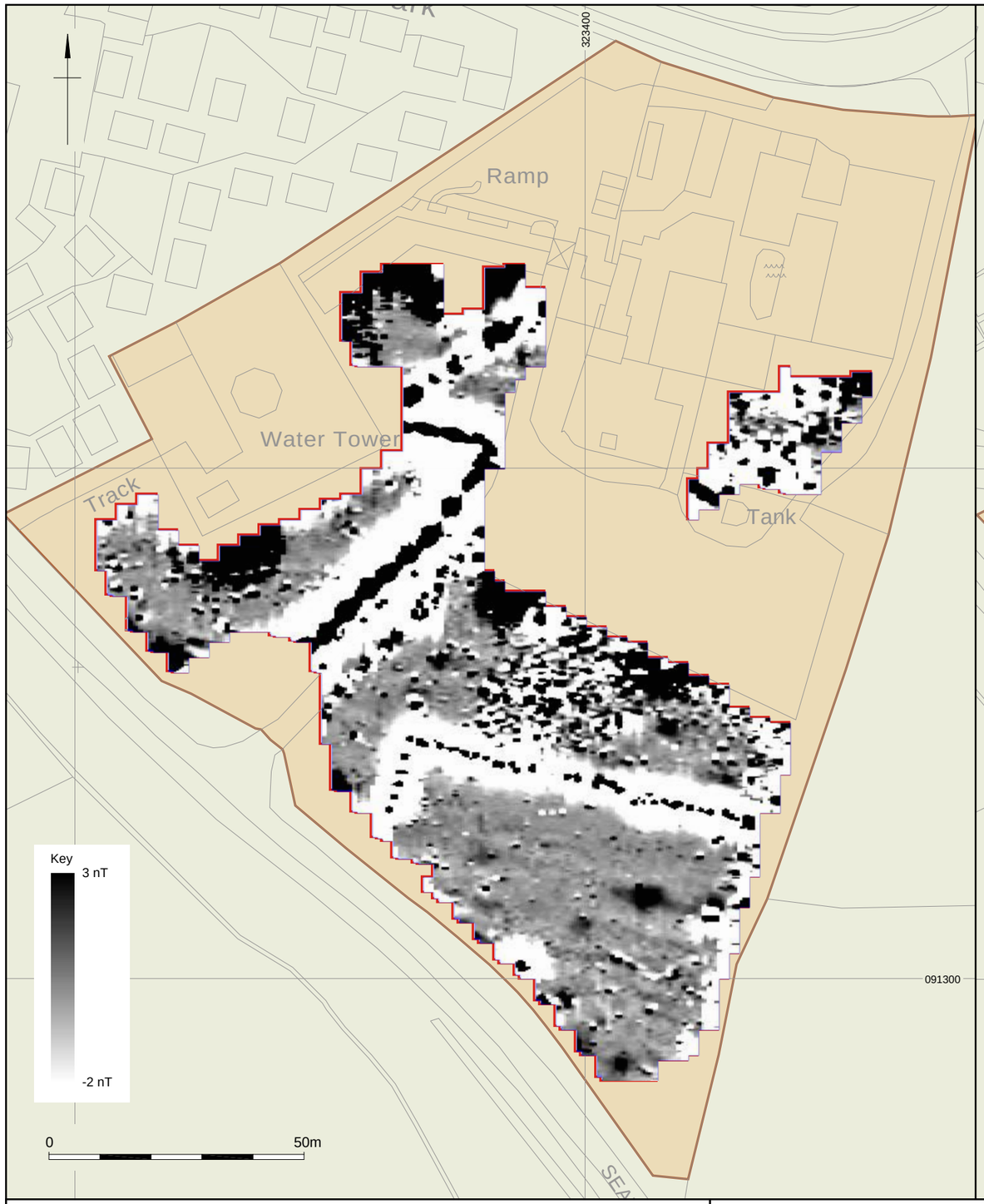
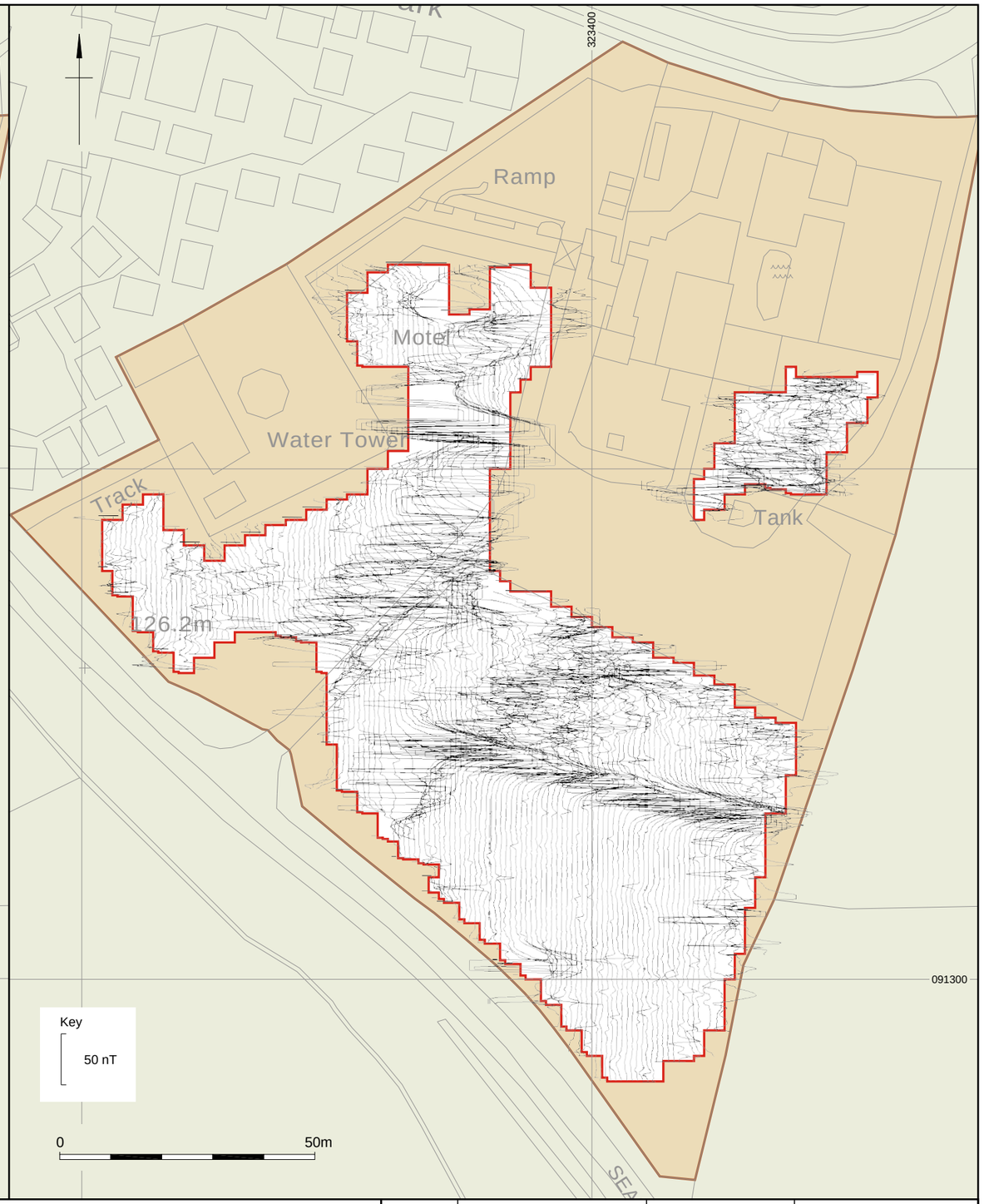
Site location and survey extents

Figure 1





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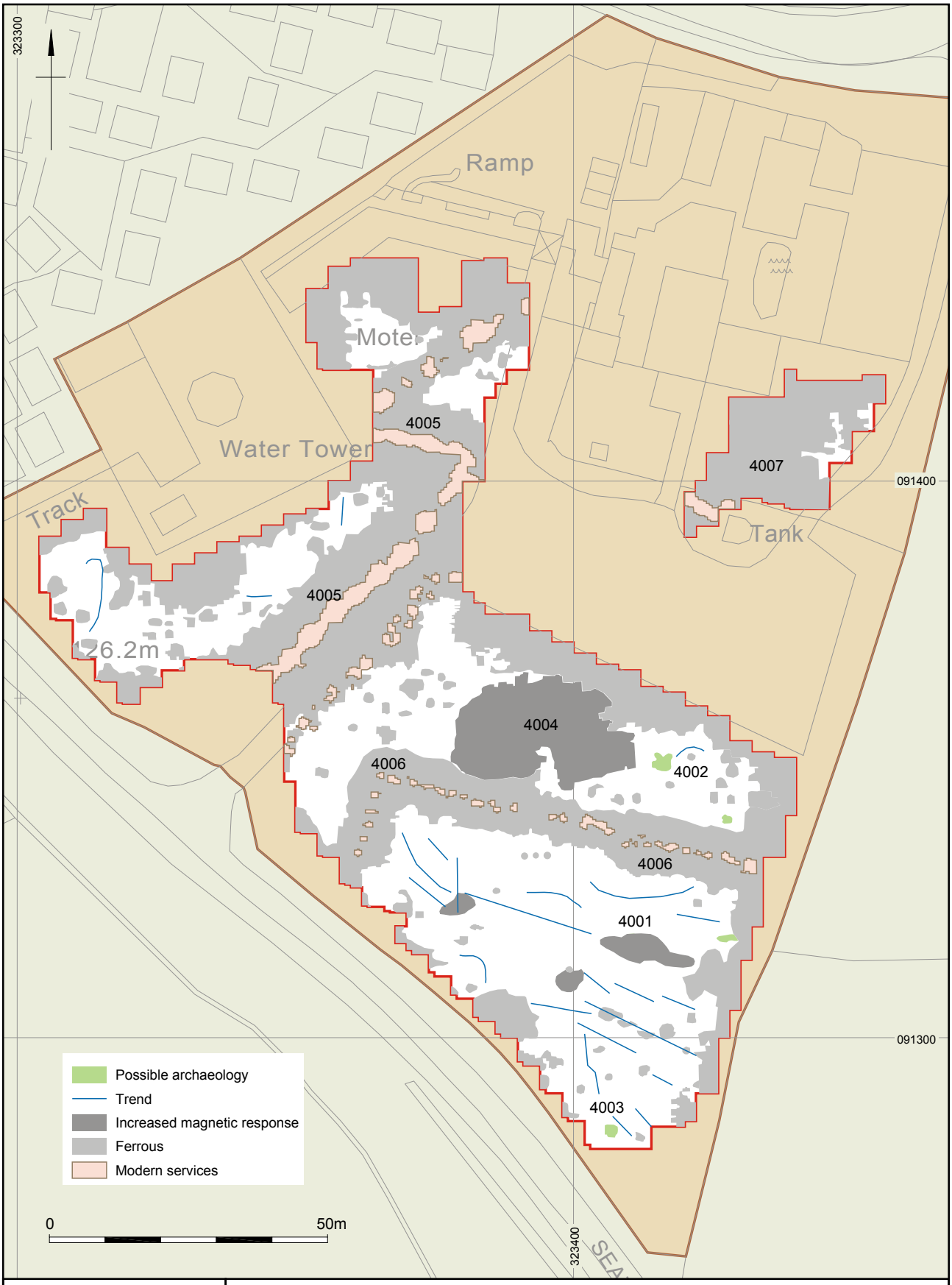
Greyscale plot and XY trace

Figure 2



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Interpretation of survey results

Figure 3

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