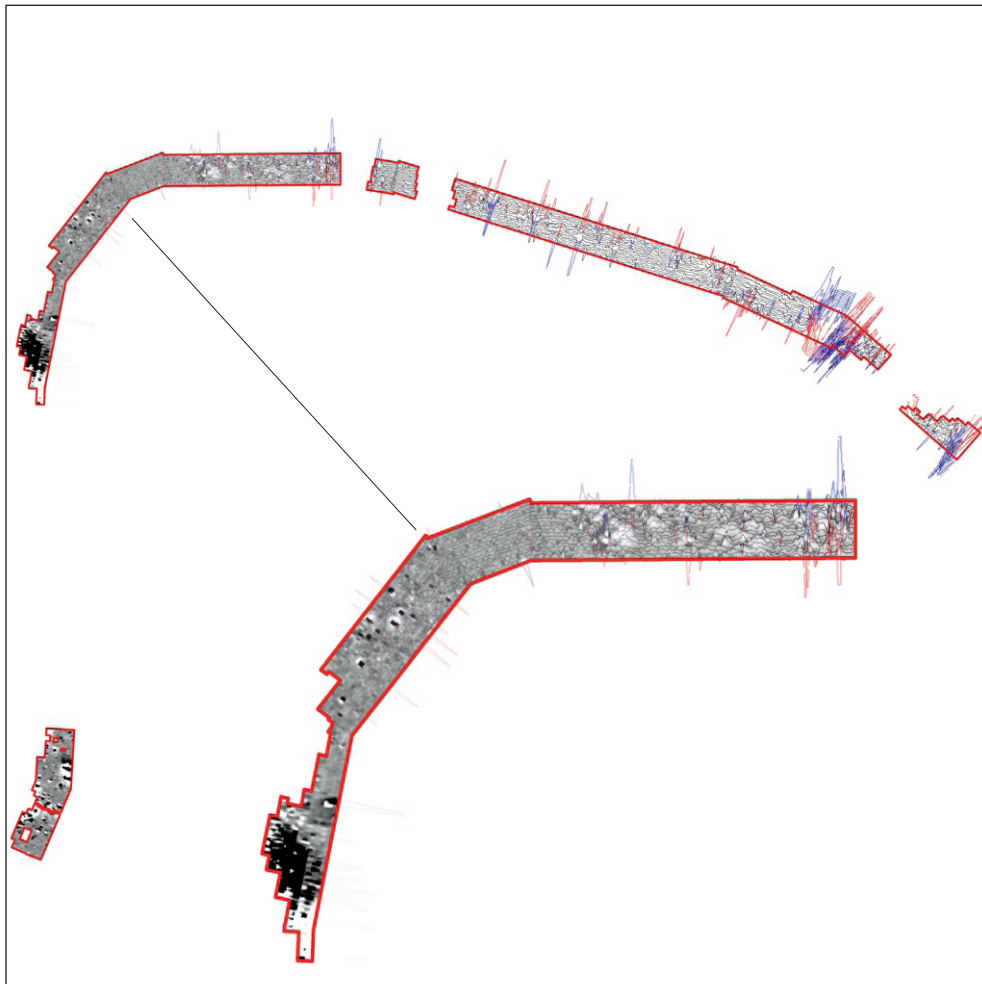




making sense of heritage

Access Road, Dunsbury Hill Farm, Waterlooville, Hampshire

Detailed Gradiometer Survey Report



Ref: 103200.01
March 2014



**Access Road, Dunsbury Hill Farm,
Waterlooville, Hampshire**

Detailed Gradiometer Survey Report

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Access Road, Dunsbury Hill Farm, Waterlooville, Hampshire

Detailed Gradiometer Survey Report

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Detailed Gradiometer Survey Report

Summary

A detailed gradiometer survey was conducted over land at Waterlooville, Hampshire. The project was commissioned by CgMs Consulting with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features on the site ahead of a proposed development.

The Site comprises the route of a proposed access road crossing a series of arable fields. The gradiometer survey covered 0.89 ha and has demonstrated the presence of anomalies of possible archaeological interest within the survey area, along with regions of magnetic disturbance and increased response, ferrous anomalies and modern services.

Isolated pit-like responses comprise the majority of anomalies of possible archaeological interest, as it is not possible to exclude this interpretation entirely; it is possible that some are the result of natural processes or agricultural activity, however. It is possible that a cluster of such anomalies near the centre of the Site is more likely to be of archaeological interest, although little coherency can be seen within their distribution.

A series of parallel trends has been identified, which is consistent with historic ploughing as they are not oriented parallel with existing field boundaries. A series of regions of increased magnetic response are consistent with agricultural or geological activity, and are therefore not considered to be of archaeological interest.



Access Road, Dunsbury Hill Farm, Waterlooville, Hampshire

Detailed Gradiometer Survey Report

Acknowledgements

The detailed gradiometer survey was commissioned by CgMs Consulting. The assistance of Chris Clarke is gratefully acknowledged in this regard.

The fieldwork was directed by Clara Dickinson, Alistair Salisbury and Rachel Williams. Clara Dickinson processed and interpreted the geophysical data, and Rachel Williams wrote this report. The geophysical work was quality controlled by Ben Urmston. Illustrations were prepared by Richard Milwain. The project was managed on behalf of Wessex Archaeology by Paul Baggaley.



Access Road, Dunsbury Hill Farm, Waterlooville, Hampshire

Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

- 1.1.1 Wessex Archaeology was commissioned by CgMs Consulting to carry out a geophysical survey of land at Waterlooville, Hampshire (**Figure 1**), hereafter “the Site” (NGR 470200 109005 to 469720 108795). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of proposed development at the Site.
- 1.1.2 The aim of the geophysical survey was to establish the presence/absence, extent and character of detectable archaeological remains within the survey area.
- 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 The Site

- 1.2.1 The survey area comprises of a series of arable and pasture fields immediately west of Junction 3 of the A3M and east of the Calshot Road area of Leigh Park approximately 1 mile southeast of the centre of Waterlooville (**Figure 1**). Detailed gradiometer survey was undertaken over all the accessible parts of the proposed access road, a total of 0.89 ha.
- 1.2.2 The Site occupies an area of relatively flat land with a gentle slope from c. 25m above Ordnance Datum (aOD) to the north to 20m aOD by Hermitage Stream.
- 1.2.3 The soils underlying the Site are likely to be the typical stagnogley soils of the 711h (Wickham 4) association (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through gradiometer survey.

2 METHODOLOGY

2.1 Introduction

- 2.1.1 The detailed gradiometer survey was conducted using a Bartington Grad601-2 dual fluxgate gradiometer system. The survey was conducted in accordance with English Heritage guidelines (2008).
- 2.1.2 The geophysical survey was undertaken by Wessex Archaeology’s in-house geophysics team on 27th January 2014. Field conditions at the time of the survey were good.

2.2 Method

- 2.2.1 Individual survey grid nodes were established at 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008).



- 2.2.2 The gradiometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at 0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (2008). Data were collected in the zigzag method.
- 2.2.3 Parts of the proposed route of the access road between Havant and Neville's Park were not accessible at the time of survey through the presence of existing field boundaries and dense undergrowth. This was particularly the case in the western extents of the Site (**Figure 1**), immediately southeast of Junction 3 of the A3 (M) and to the south of Hermitage Stream. Where possible, small areas suitable for survey were undertaken where vegetation permitted.
- 2.2.4 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse function ($\pm 5\text{nT}$ thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey areas, with no interpolation applied.
- 2.2.5 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

3.1 Introduction

- 3.1.1 The gradiometer survey has been successful in identifying several anomalies of probable and possible archaeological interest within the Site, along with areas of magnetic disturbance and ferrous responses. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:2,000 (**Figures 2 and 3**). The data is displayed at -2nT (white) to +3nT (black) for the greyscale image and $\pm 25\text{nT}$ at 25nT per cm for the XY trace plots.
- 3.1.2 The interpretation of the datasets highlights the presence of possible archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (**Figure 4**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.
- 3.1.3 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

3.2 Gradiometer Survey Results and Interpretation

- 3.2.1 Regions of magnetic disturbance can be seen at the eastern extent of the survey, e.g. **4000** and **4001**. It is possible that **4001** is associated with a modern service, although this is suggested through the magnitude of the response and there is no diagnostic anomaly typical of such a service.
- 3.2.2 The magnetic background is much quieter to the west, e.g. **4002**, with occasional regions of increased magnetic response and isolated pit-like anomalies visible. The latter have been identified as being of possible archaeological interest as this interpretation cannot be excluded entirely; however, it is possible natural features and agricultural activity to produce similar responses.



3.2.3 The dataset is broadly similar at **4003** and **4004**, with a comparably low density of pit-like anomalies and regions of increased response. A relatively quiet band of data apparently extends NW-SE across the route at **4005**. Magnetic disturbance is visible at **4006**.

3.2.4 The limited area available for survey at the southwestern extent of the Site at **4007** is dominated by magnetic disturbance and ferrous responses.

4 CONCLUSION

4.1.1 The detailed gradiometer survey has detected a number of anomalies of possible archaeological interest within the Site, in addition to regions of increased magnetic response, magnetic disturbance and linear trends. No anomalies of definite or probable archaeological interest were identified.

4.1.2 Several clusters of isolated pit-like anomalies have been identified, e.g. **4004**, although it is difficult to be certain about their origins. An archaeological interpretation cannot be excluded entirely, resulting in their classification as being of possible interest. No clear coherent spatial pattern is apparent within their distribution, however, and it is possible that they are natural or agricultural in origin.

4.1.3 An earlier archaeological desk-based assessment identified a general background of moderate potential for prehistoric remains, with a moderate to high potential for medieval and post-medieval remains, and low potential for other periods (AOC 2002). The existing environmental statement (Atkins 2012) notes that incremental work is continually improving the previously poorly understood archaeological baseline resource within the vicinity of the development.

4.1.4 In the intervening time, further archaeological work has been undertaken within the wider area, e.g. WA 2013, ASE forthcoming, which has demonstrated the existence of archaeological features dating to the later prehistoric and Romano-British periods; these recent interventions occurred some 2.5km west and 3.8km north of the geophysical survey area respectively. A relatively extensive cropmark has also been noted c. 550m north of the survey (Hampshire HER entry 64922), which apparently marks the northern portion of an undated enclosure.

4.1.5 The archaeological background appears to indicate little activity before the later Bronze Age, with subsequent settlement foci with the landscape, before a marked decline towards the end of the Romano-British period. However, a ritual monument has been identified to the west of Waterlooville, dating from the late Neolithic/early Bronze Age transition, and potentially significant sporadic use dating from the late Bronze Age through to the Romano-British period (WA 2013a and 2013b).

4.1.6 In view of the character of the archaeological resource within the immediate area and the potential for further similar archaeological remains, it is possible that the anomalies of possible archaeological interest identified through this geophysical survey relate to prehistoric activity. However, this dataset indicates that these anomalies are apparently not very extensive nor are they well-defined from the general magnetic background. Although an archaeological interpretation cannot be ruled out entirely, there is little within the character of these anomalies to suggest their form or function.

4.1.7 Ploughing trends at **4001** are not oriented parallel with existing boundaries, suggesting they may be historic in origin.



- 4.1.8 The regions of increased magnetic response seen across the central portion of the Site are consistent with geological or agricultural activity, and it is not considered likely that they will be of archaeological interest.
- 4.1.9 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of gradiometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. However, the detection of ploughing trends and other weak responses suggests that more substantial archaeological features would have produced measurable magnetic anomalies.

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APPENDIX 1: 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 gradiometers 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 gradiometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of 0.03nT over a ± 100 nT 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.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) 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 detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH, 2008).

Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.



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 gradiometer;
- Destagger – Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data)

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 type of image is useful as it shows the full range 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.



APPENDIX 2: GEOPHYSICAL INTERPRETATION

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

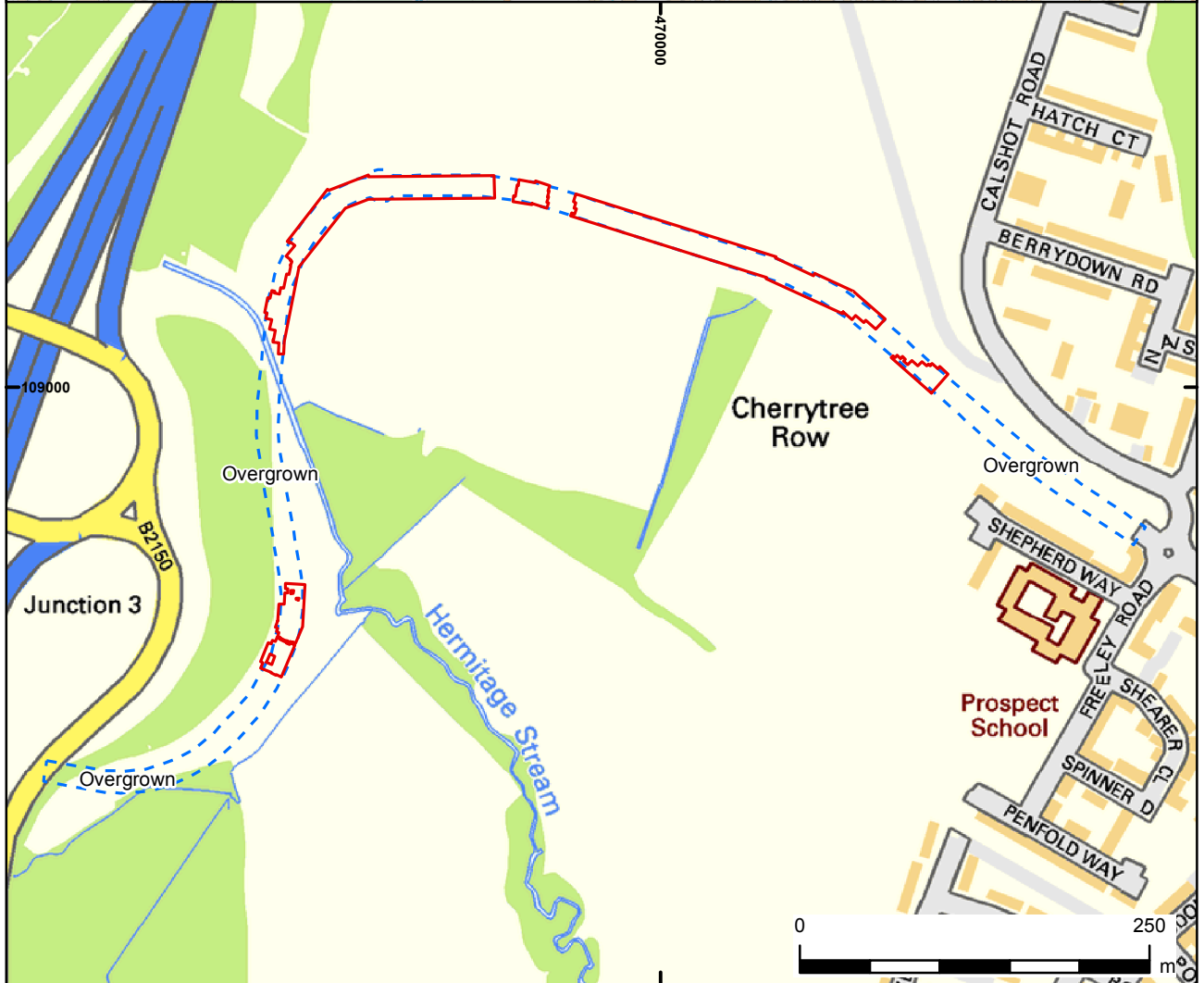
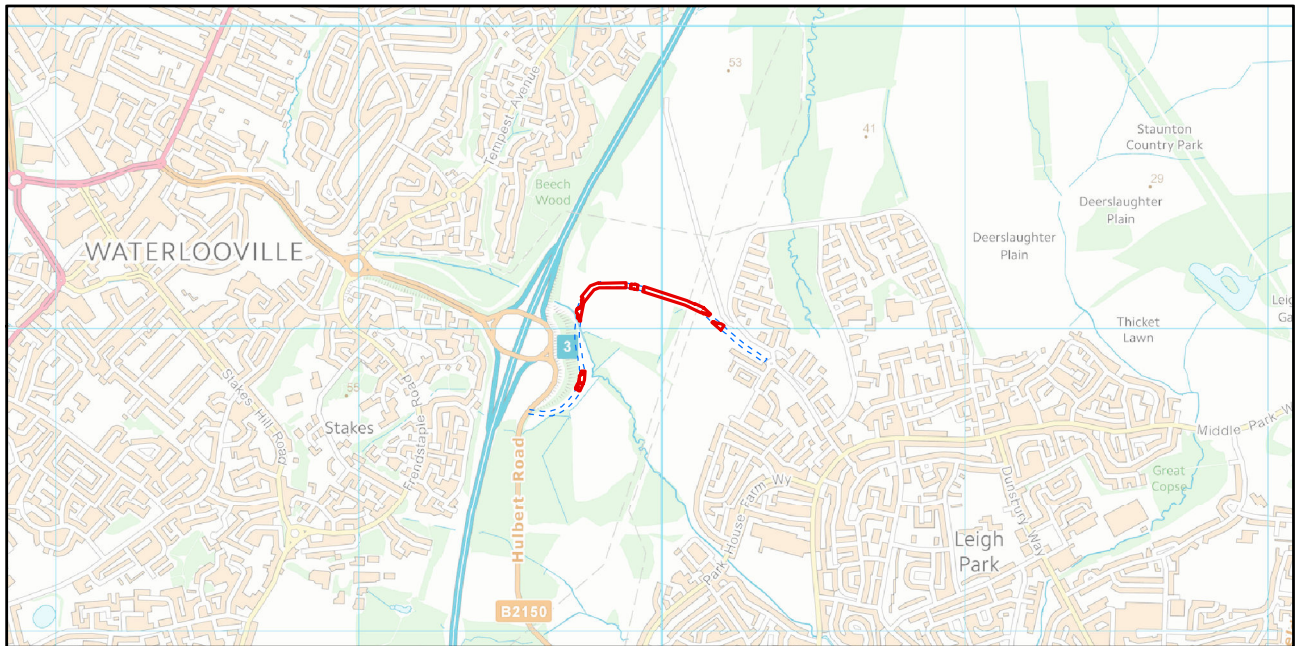
The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided 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.
- Possible archaeology – used for features which give a response but which form no discernible pattern or trend.

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:

- 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.

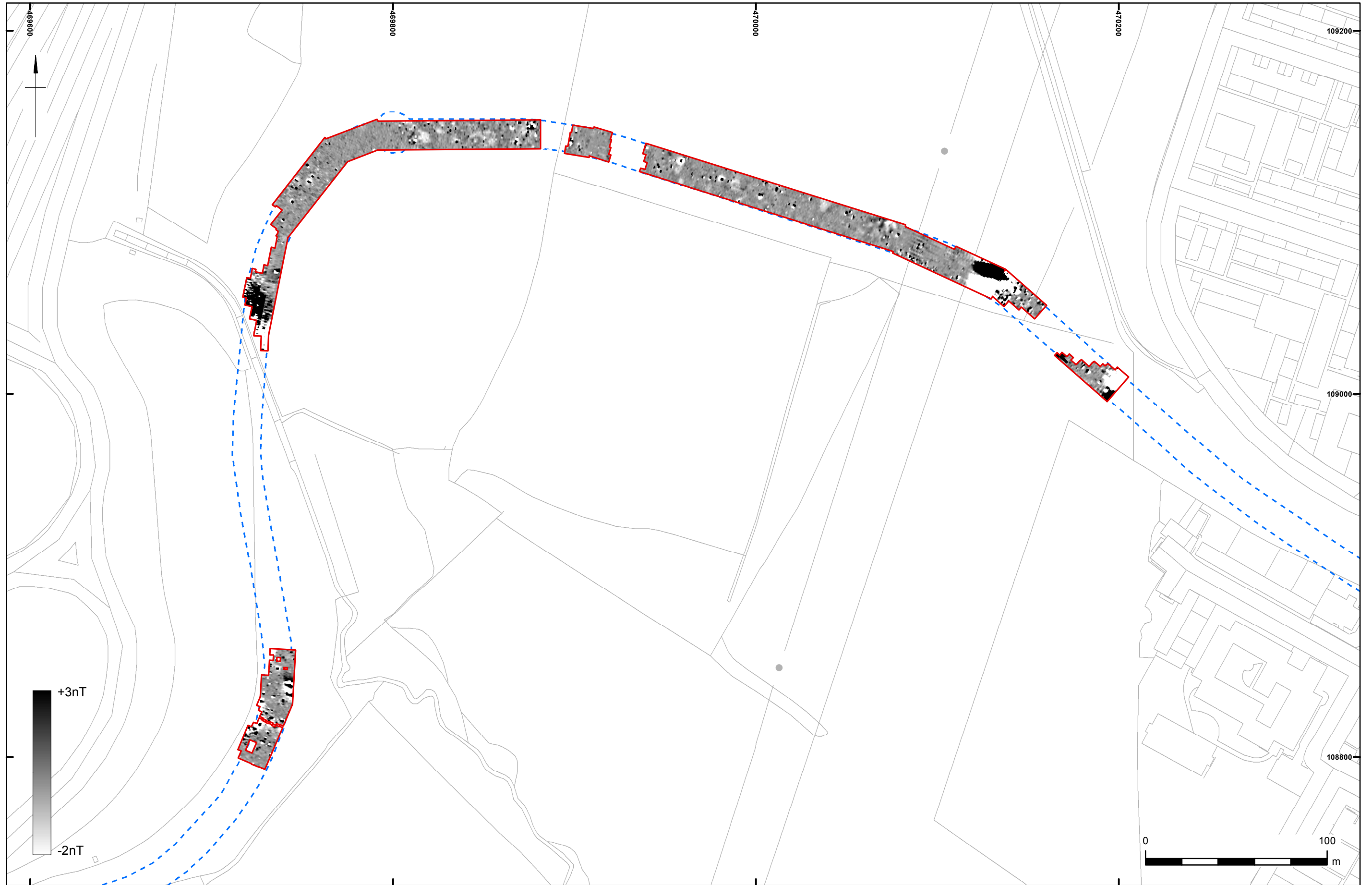
Finally, services such as water pipes are marked where they have been identified.



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Site location and survey extents

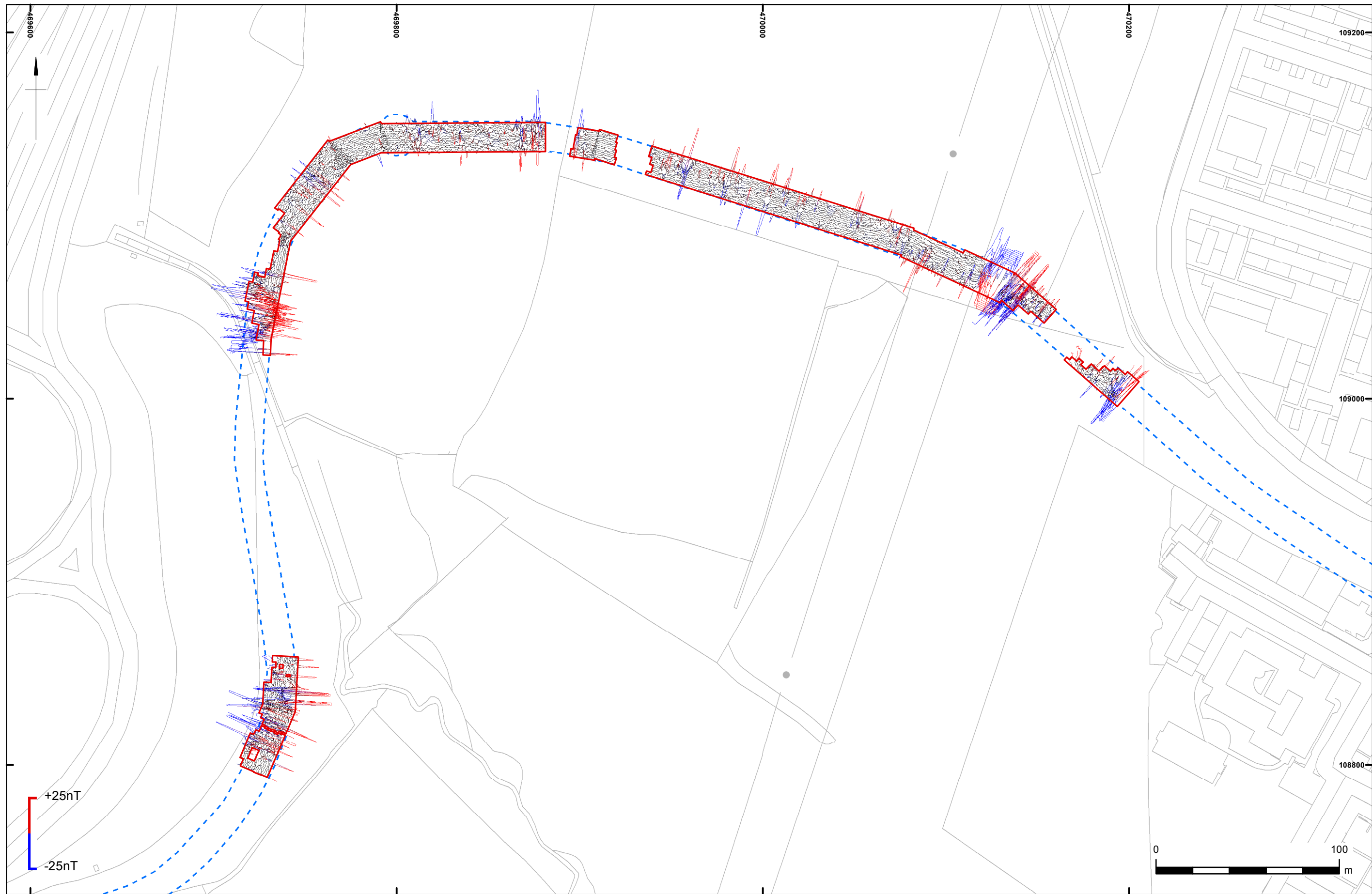
Figure 1



Survey Extents
 Proposed Survey Area

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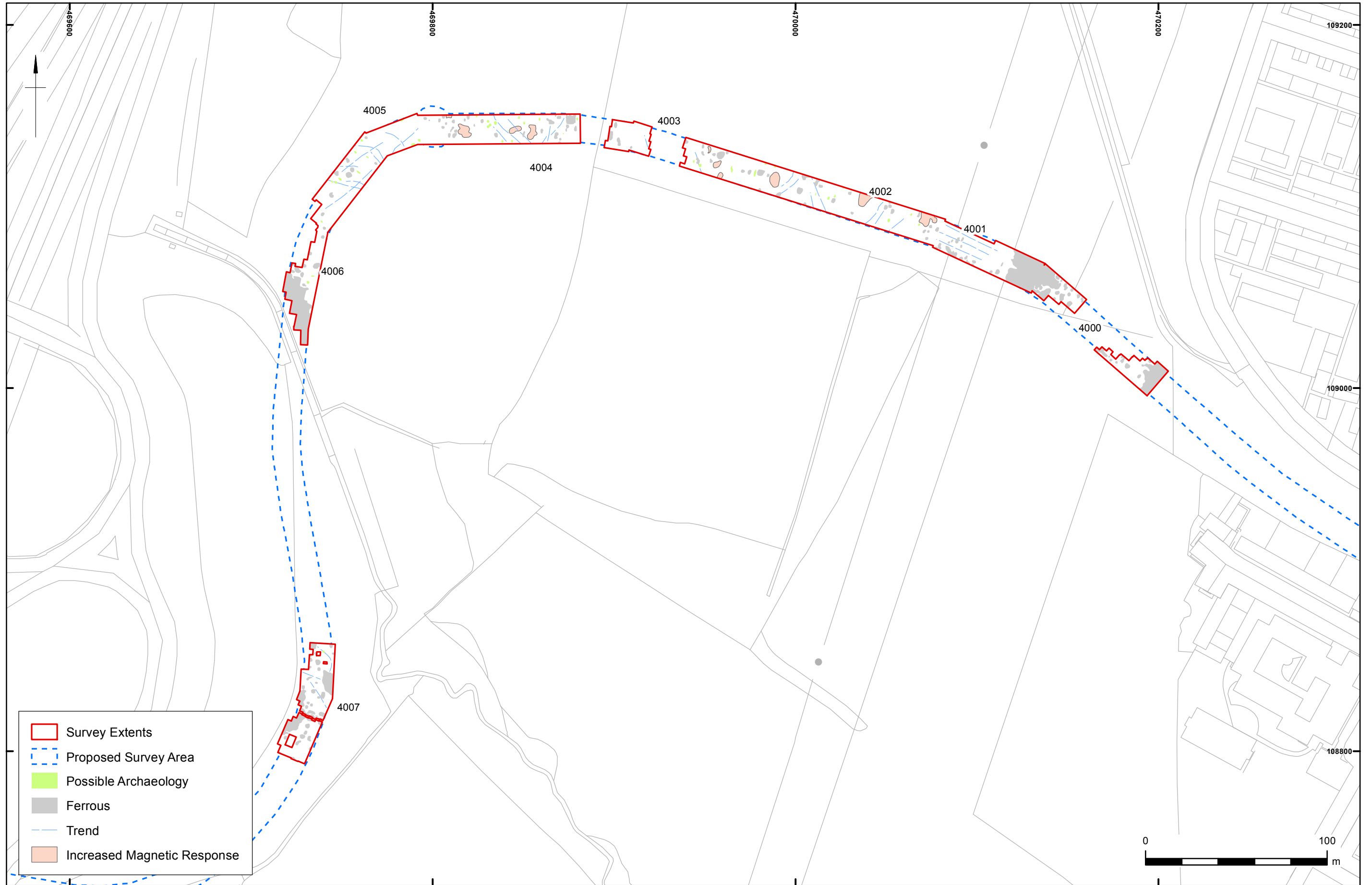
Survey Extents
 Proposed Survey Area

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XY trace

Figure 3



- Survey Extents
- Proposed Survey Area
- Possible Archaeology
- Ferrous
- Trend
- Increased Magnetic Response



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