



Hallgates to Elms Farm, Leicester

Gradiometer Survey Report

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County Leicestershire

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Summary

A gradiometer survey was conducted across a 97.6 ha linear scheme located between Roecliffe Road, Woodhouse Eaves and Taverner Drive, and the village of Ratby, Leicester (NGR 453403 311449 to 452654 305960). The project was commissioned by Severn Trent Water with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features in support of a planning application for the development of a water pipeline.

The site comprises arable fields located along a 11 km linear scheme between Hallgates and Elms Farm, north-east Leicester, in the county of Leicestershire. An overall coverage of 78.5 ha was achieved. Several areas were unable to be surveyed due to livestock, overgrown vegetation or were tree plantations that could not be surveyed. The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team across two separate deployments between 04 – 22 August and 10 – 19 November 2025. The seasonal variation between survey deployments has not affected the gradiometer data.

The gradiometer survey has demonstrated the presence of a number of anomalies of potential archaeological interest in Sections 1 and 2 predominantly, with no clear archaeological anomalies detected in either the Bradgate Park Section or Section 3.

The majority of possible archaeological features are too weak or isolated to offer a confident interpretation. The anomalies could be related to possible unmapped former field boundary features; however, an archaeological origin could not be discounted.

Three historic landscape features noted on historic OS mapping have been detected in the survey. This included two ponds, possibly initially areas of extraction and a single path/road.

The site's agricultural past is also evidenced by areas of medieval ridge and furrow across the site. Post-medieval agriculture is seen in the form of former boundaries that correlate with those recorded on first-edition OS mapping.

The remaining anomalies are thought to be modern or natural in origin. The modern anomalies include ploughing, drains, and services.

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The fieldwork was undertaken by Callum Jarvis, Cameron Lane, Daniele Clementi, Jack Trueman, Ffion Lister and Matt Hasell. Cameron Lane, Filippo Carrozzo and Jack Trueman processed the and interpreted the geophysical data. Filippo Carrozzo prepared the illustrations, and Jack Trueman wrote the report. The geophysical work was quality controlled by Filippo Carrozzo. The project was managed on behalf of Wessex Archaeology by Alastair Trace.



Hallgates to Elms Farm Leicester

Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

- 1.1.1 Wessex Archaeology was commissioned by Severn Trent Water to carry out a geophysical survey across a linear scheme located between Roecliffe Road, Woodhouse Eaves and Taverner Drive, and the village of Ratby, Leicester (NGR 453403 311449 to 452654 305960 (**Figure 1**). The survey forms part of an ongoing programme of archaeological works being undertaken in support of a planning application for the development of a water pipeline.

1.2 Scope of document

- 1.2.1 This report presents a brief description of the methodology followed by the survey results and the archaeological interpretation of the geophysical data.

1.3 The site

- 1.3.1 The geophysical survey area comprises the route of a proposed pipeline, which is made up of four sections selected during the optioneering phase. These sections are Bradgate Park, Section 1, Section 2, and a proposed area for the cross-connection options (Section 3). For brevity, each is referred to as Bradgate Park and then Section 1 – 3 within this document but, where required, is collectively discussed as ‘the site’
- 1.3.2 The site is located north of the village of Newton Lindford, 8 km north-west of Leicester, in the county of Leicestershire.
- 1.3.3 Bradgate Park forms the northern half of the site along with Section 1 and begins on land south of Roecliffe Road, Woodhouse Eaves. This section travels east running through a number of agricultural fields before turning north over Roecliffe Road, Woodhouse Eaves and conjoins into Section 1.
- 1.3.4 Section 1 also forms the northern half of the site and begins at Roecliffe Road, Woodhouse Eaves. It travels east before running south through agricultural fields around Cropston Reservoir and crossing southwest through agricultural fields before ending at Bradgate Road to the west of the village of Anstey.
- 1.3.5 Section 2 continues south from Bradgate Road but curves around the outskirts of Anstey and Groby village through several agricultural fields. Culminating north of the A46, just north of Rothley Brooke.
- 1.3.6 The final portion at Section 3 lies south-east of Ratby within grass covered fields and includes a vegetation-lined watercourse (connected to Rothley Brook) crossing through it on a north-east to south-west alignment as well as a hedge line field boundary on a northwest to southeast alignment.



- 1.3.7 The topography across the site is variable. It is recorded undulating between 70 m above Ordnance Datum (aOD) and 113 m aOD. Generally, local topography falls towards Rothley Brook separating Sections 2 and 3.
- 1.3.8 Bedrock geology across the site varies. Bradgate Park and Section 1 predominantly lie within areas recorded as Gunthorpe Member and Edwalton Member Mudstone. However, there are also small pockets of Cotgrave Sandstone Member, and Bradgate Formation comprising thinly-bedded and laminated Mudstones, Siltstones and Sandstones. Section 2 predominantly comprises Edwalton Member but also has areas of Gunthorpe Member and Cotgrave Sandstone Member. Whilst Section 3 lies entirely within an area of Gunthorpe Member mudstone (BGS 2025).
- 1.3.9 Similarly, superficial deposits recorded within the site are varied with the largest being Oadby Member comprising sand, gravel, clay and silt. There are also areas of head, glaciofluvial deposits, river terrace deposits, alluvium and colluvium (BGS 2025).
- 1.3.10 The soils underlying the site are likely to consist of slowly permeable, seasonally wet acid loamy and clayey soils to the north with slightly acid loamy and clayey soils around Groby and Cropston Reservoir. To the south of Groby, soils consist of slowly permeable and seasonally wet with slightly acid but base-rich loamy and clayey (Soilscapes 2025). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

2 ARCHAEOLOGICAL BACKGROUND

2.1 Introduction

- 2.1.1 The archaeological and historical background was assessed in a prior desk-based assessment (DBA) (Wessex Archaeology 2024a), which considered the recorded historic environment resource within a 500 m study area of the proposed development. The following archaeological background is not exhaustive but is summarised from aspects of the DBA that are considered relevant to the interpretation of the geophysical survey data, as well as relevant publicly available online resources such as the Leicestershire Historic Environment Record (HER), the National Heritage List for England (NHLE), the Archaeological Data Service (ADS) and the results of Wessex Archaeology's previous investigations within the area.

2.2 Summary of the archaeological resource

Designated heritage assets

- 2.2.1 There are 18 Grade II listed buildings within the study area and one scheduled monument. The monument is a moated site and garden enclosure at Glenfield 385 m south of Section 2. The majority of the listed buildings are dated to the post-medieval period, from the 17th or 18th century. Other than the buildings associated with the reservoir, most of the listed buildings are within Cropston Conservation Area in the north of the Study Area, while only two are in the south of the Study Area.
- 2.2.2 Cropston Conservation Area covers a relatively small linear settlement with origins in the Anglo-Saxon period and is 35 m south-east of Section 1. Glenfield Conservation Area is based on the medieval village settlement which is now largely surrounded by extensive areas of 20th century housing development. Glenfield also likely has Anglo-Saxon roots,

and its Conservation Area is 365 m south of Section 2 and includes the moated site Scheduled Monument.

Prehistoric

- 2.2.3 One of the earliest known heritage assets within the Study Area is a flint blade which was found 490 m south-east of the southern end of Section 1. The blade is thought to be late Mesolithic or Early Neolithic in date and was found during an archaeological evaluation. A number of other prehistoric finds have been recorded within the Study Area. These include other flint findspots as well as an Iron Age pottery findspot which are dispersed over 170 m from the Site. An Iron Age or Roman beehive quern was also found near Bradgate Road north of the reservoir although its exact findspot is unknown.
- 2.2.4 The only possible prehistoric feature recorded within 500 m of the site comprises an undated earthwork bank which was recorded underlying medieval ridge and furrow. This bank is recorded within Bradgate Park, 207 m south of the site.
- 2.2.5 Outside of the Study Area, a nationally significant palaeolithic flint scatter site is recorded within Bradgate Park, near the remains of the house 680 m north-east of Section 1. A large group of worked flints was recovered from an eroding footpath in 2001, and a second large collection was recovered between 2002 and 2008 (Cooper 2012).
- 2.2.6 Five areas of possible Iron Age occupation are recorded within the Study Area north of Groby. One of these settlement areas is within 10 m of Section 2, while a second is 40 m southwest of it. Both comprise small enclosures which may be of late Iron Age or Romano-British date. A third settlement area is recorded 150 m east of the site. Evaluation and geophysical survey here have recorded enclosures, evidence of round houses and Iron Age pottery and flint.

Romano-British

- 2.2.7 Evidence of possible Romano-British settlement is found near to Section 1 and is well dispersed, with three separate settlement areas recorded between 85 m and 270 m from the Section 1. These Roman sites are located near Bybrook Lodge Farm, west of Cropston and northwest of Anstey. Large amounts of Roman pottery have been discovered at each site, as well as coins, brooches and tile. As a result of the finds present, the settlement site near Bybrook Lodge Farm has been interpreted as a possible Roman villa site, while the site west of Cropston is a possible occupation and kiln site.
- 2.2.8 Further Romano-British evidence within the vicinity of Section 1 includes a possible Roman road as well as scattered Roman pottery finds. The possible road is recorded 500 m from the site, however if it were to continue on its north-west to south-east alignment, it was expected cross through the site, it was not detected. It was identified as parallel ditches shown as cropmarks in aerial photography and was overlain by ridge and furrow. It is not visible in LiDAR data.
- 2.2.9 The Iron Age settlement recorded near Section 2 continued into the Romano-British period. These sites are over 175 m from Section 2 and are near the possible Iron Age settlements recorded here. To the west of the site, the presumed settlement sites comprise possible enclosures, pits and kilns, with finds including pottery, tile and part of a human skull. It is thought that this may be the location of a Roman villa site. The site to the east of Section 2 is interpreted as a low status Romano-British occupation site with possibly earlier origins.



- 2.2.10 Other Romano-British assets within the surrounding area include Roman roads near the northern and southern ends of the route, and findspots for a Roman coin and pottery.
- 2.2.11 Romano-British remains near Section 3 are generally found to the north near Ratby and include pottery, coins, and brooches. The closest to the Site was found approximately 45 m north of Section 3 in the 1980s and comprised 10 sherds of Roman greyware pottery.

Anglo-Saxon and Medieval

- 2.2.12 The village of Cropston, immediately east of Section 1 may have earlier origins as its name means 'Kroppr's farm' in Old English. If the settlement had earlier Anglo-Saxon origins, it was likely a small settlement as it was not included in the later Domesday Survey. Given the site's proximity to the historic centre of Cropston, it may have been in agricultural use during the Anglo-Saxon period if there was a small farming settlement present.
- 2.2.13 There are many areas of ridge and furrow recorded within the Study Area and the site. They are recorded south of Horseshoe Cottage and near Anstey. One of these areas of ridge and furrow is visible in an assessment of LiDAR imagery, while the other is not; It may still survive, however, it likely has been truncated by later agricultural works.
- 2.2.14 There is also a potential for the proposed works to impact Bradgate Park (NHLE 10000958), as Section 1 lies within the early medieval, later medieval and post-medieval extent of the park. As the section passes through the existing northern boundary, there is a particular potential for the proposed works to impact remains associated with the park pale. Otherwise, the majority of Section 1 lies within an area where remains of former structures are unlikely. Instead, isolated artefacts or small features are more likely to be present which may be associated with management and landscaping of the park or discarded artefacts from hunts. Remains of this nature could be locally to nationally significant depending on their type and survival due to the designation of the Registered Park and Garden.
- 2.2.15 Medieval activity within the Study Area is largely recorded near Glenfield Conservation Area where the 'Moated site and garden enclosure at Glenfield' Scheduled Monument (NHLE 1017680), among other assets, is located. The Scheduled Monument possibly dates to the 13th or 14th centuries. Areas of ridge and furrow are also recorded in some fields west and south-west of Anstey and Section 2 crosses through one of these areas near Bradgate Road. The earthwork system was mapped from aerial photographs and may be of medieval or post-medieval date. While no evidence of the ridge and furrow is visible in LiDAR imagery as above-ground features, there may still be remains present below the surface.
- 2.2.16 The site also crosses through a possible medieval park boundary north of Groby which was identified through the Charnwood Roots Project. The unusual pattern of curving field boundaries was interpreted as a potential deer park and in four locations the boundary survived as a bank.
- 2.2.17 Medieval remains are limited surrounding Section 3. However, findspots of medieval pottery was recorded at the watching brief 400 m north of the site, and medieval coins dated to the late 15th century have been recorded 100 m south-west of the site.
- 2.2.18 Section 3 is located near Ratby which is recorded as a settlement of 17 households in the 1086 Domesday Survey. The land comprised ploughland and there was also a mill. An assessment of LiDAR imagery shows no evidence of ridge and furrow within the site, and it is likely that settlement activity associated with Ratby was located further north.

Post-medieval

- 2.2.19 Bradgate Park was extended during the 16th and 17th centuries with formal gardens being laid out during this period as well as the construction of Bradgate House (NHLE 1008831) within this timeframe. During the early 19th century, the park was opened to the public on a regular basis, and it became a public park in 1928 and a country park in 1970 (Thomas *et al* 2019). The extent of the post-medieval park comprises the Registered Park and Garden (NHLE 1000958) which the Section 1 passes through.
- 2.2.20 As with Section 1, many post-medieval and 19th century heritage assets within the Study Area are recorded near Glenfield Conservation Area where settlement was concentrated. OS mapping from 1884 and 1885 shows the site lies predominantly within agricultural fields. As with Section 1, it is likely that these 19th century fields were in use for agriculture during the post-medieval period and were associated with the nearby scattered farmsteads and small settlements.
- 2.2.21 The 19th century heritage assets with the Study Area outside of Glenfield are largely related to industrial works within the surrounding area during this time. They include quarries north of Groby, and the Leicester to Swannington Railway/Midland Railway West Bridge branch. The southern end of the route intersects with the Groby Mineral Railway which connected the quarries to the main railway line and was constructed in the 19th century.

OS mapping from the late 19th century shows Section 3 lies across a field boundary and contains a water course on a north-east to south-west alignment. The field boundary and watercourse are consistent with the current layout of Section 3. A footpath is also shown in the south-west corner of the Site. The railway is 45 m north-west of the site, near the location of post-medieval stoneworks.

- 2.2.22 Ordnance Survey (OS) mapping from 1904 is similar to that of the late 19th century. OS mapping to 1966 and modern satellite imagery shows that the site has not undergone any significant noticeable changes, with only a few minor field boundary changes. The site is seen in 20th century mapping and aerial photographs, as well as modern satellite imagery to comprise agricultural fields, with the exception of Bradgate Park and the few locations where it intersects roads (Aerial Photo Explorer 2025; Google Earth 2025).

3 METHODOLOGY

3.1 Introduction

- 3.1.1 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team across two separate deployments between 04 – 22 August and 10 – 19 November 2025 (**Appendix Figure 1**). The seasonal variation between survey deployments has not affected the gradiometer data.
- 3.1.2 Field conditions at the time of the survey were varied throughout. An overall coverage of 78.5 ha was achieved. Several areas were unable to be surveyed due to livestock, overgrown vegetation or were tree plantations that could not be surveyed.
- 3.1.3 The methods and standards employed throughout the geophysical survey conform to that set out in the Written Scheme of Investigation (WSI) (Wessex Archaeology 2025), as well as to current best practice, and guidance outlined by the Chartered Institute for Archaeologists' (CIfA 2020) and European Archaeologiae Consilium (Schmidt *et al.* 2015).



3.2 Aims and objectives

3.2.1 The aims of the survey comprise the following:

- To determine, as far as is reasonably possible, the nature of the detectable archaeological resource within a specified area using appropriate methods and practices; and
- To inform either the scope and nature of any further archaeological work that may be required; or the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource); or a management strategy.

3.2.2 In order to achieve the above aims, the objectives of the geophysical survey are:

- To conduct a geophysical survey covering as much of the specified area as possible, allowing for on-site obstructions;
- To clarify the presence/absence of anomalies of archaeological potential; and
- Where possible, to determine the general nature of any anomalies of archaeological potential.

3.3 Fieldwork methodology

3.3.1 The cart-based gradiometer system used a Carlson BRX-7 RTK GNSS instrument, which receives corrections from a network of reference stations operated by the OS. Such instruments allow positions to be determined with a precision of 0.02 m in real-time and therefore exceeds Europae Archaeologiae Consilium recommendations (Schmidt et al. 2015).

3.3.2 The survey was conducted using four Sensys FGM650/3 magnetic gradiometers spaced at 1 m intervals and mounted on a non-magnetic cart. Data were collected with an effective sensitivity of $\pm 8 \mu\text{T}$ over $\pm 1000 \text{ nT}$ range at a rate of 100 Hz, producing intervals of 0.02 m along transects spaced 4 m apart.

3.4 Data processing

3.4.1 Data from the survey were subjected to minimal correction processes. These comprise a 'Destripe' function ($\pm 5 \text{ nT}$ thresholds), applied to correct for any variation between the sensors, and an interpolation used to grid the data and discard overlaps where transects have been collected too close together.

3.4.2 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 1**.

4 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

4.1 Introduction

4.1.1 The gradiometer survey has identified a varied number of magnetic anomalies across the site, along with possible archaeology, historic landscape features and a number of other features. Results are presented as a series of greyscale plots and archaeological interpretations at a scale of 1:5000 (**Figs 2 – 15**) and 1:2000 (**Figs 16 – 51**). The data are displayed at -2 nT (white) to +3 nT (black) for the greyscale images.

- 4.1.2 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous responses, burnt or fired objects, and magnetic trends (**Figs 3 – 15**). Full definitions of the interpretation terms used in this report are provided in **Appendix 2**.
- 4.1.3 Numerous ferrous anomalies are visible throughout the dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.
- 4.1.4 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be present than have been identified through geophysical survey.
- 4.1.5 Gradiometer survey may not detect all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g., CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

4.2 Gradiometer survey results and interpretation

Bradgate Park (BP_001 – BP_004b)

- 4.2.1 A series of broadly regularly positive linear anomalies have been recorded at **4001** in BP_001 and at **4002** in BP_004 respectively (**Figs 19 and 21**). The average distance between lines is 6 m, with the examples in BP_004 illustrating a slight curve. The anomalies are mostly on a north-south orientation with a small number in BP_001 running east-west. These anomalies have been interpreted as historic cultivation, expected to be ridge and furrow due to their broadly regular spacing. The curved examples are possibly medieval in origin due to their curved form.
- 4.2.2 A single low-magnitude amorphous anomaly was detected in the south-western corner of BP_003 at **4003** (**Fig. 21**). Due to the weak signal and diffuse shape, a confirmed origin cannot be established, it is likely to be of geomorphological origin.
- 4.2.3 Four strong dipolar linear anomalies have also been identified within the Bradgate Park Section at **4004 – 4007** (**Figs 19 and 21**). The anomalies are on an east to west or north to south alignment. The anomalies **4004** and **4005** appear to meet in the south-east corner whilst **4007** appears to be a continuation of **4006**. The magnetic strength and signature of these anomalies is indicative of modern services.

Section 1 (LP_001 – LP_026)

- 4.2.4 Three anomalies detected during the survey in Section 1 were identified as possible archaeology, located at **4101** in LP_004, **4102** in LP_008 and **4103** in LP_018 (**Figs 19, 23 and 27**).
- 4.2.5 The first in LP_004 is a discrete positive U-shaped anomaly, 11 m in total length, a diameter of 3 m with a width varying from 0.7 to 1.7 m at **4101** (**Fig. 19**). The magnetic properties are typical of a ditch like feature, possibly related to discrete ring-ditch. However, this may be a result of former agricultural activities, where an animal feeder was once located. Given little context associated with this anomaly, further investigation would be required to determine a more accurate use and origin.
- 4.2.6 At **4102**, in LP_008, a positive linear anomaly has been recorded traversing across the land parcel (**Fig. 23**). The anomaly is 90 m long and 2 m wide, on a north – east to south – west orientation. The magnetic properties of this feature are typical of ditch-like feature. Whilst this anomaly might be possibly archaeological in origin, this may be an unmapped field boundary as it appears to be on the same orientation and a continuation of a mapped field

boundary on the first edition OS mapping 1888 to the immediate north-east of the land parcel. This contained a woodland area, which is still extant in the present day.

- 4.2.7 The third anomaly identified as possible archaeology is located in LP_018 at **4103 (Fig. 27)**. This is a linear 'L-shaped' anomaly, running 62 m north-south and then 85 m east-west with a variable width between 1.5 to 3 m. The magnetic properties of this and shape are typical of a ditch-like feature and could represent the south-eastern corner of a possible enclosure. Given its proximity and shared orientation to a number of other former field boundaries in the immediate area, however, it is likely that this anomaly is an unmapped field boundary or a result of other agricultural activity, such as drainage.
- 4.2.8 Within LP_016, an amorphous area of increased magnetic response has been recorded at **4104 (Fig. 25)**. It covers an area of 70 m north-south by 60 m east-west. This increased response is likely related to the removal of historic road or track that once continued north from station road recorded on OS Six Inch, 1830s-1880s first edition mapping.
- 4.2.9 Two other discrete areas of increased magnetic response have been detected in LP_018 and LP_020 at **4105** and **4106** respectively (**Fig. 27**). They are up 33 m and 26 m in diameter, respectively. These areas correlate with undefined structures visible on the historical OS Six Inch, 1830s-1880s first edition mapping. These anomalies may be related to small agricultural storage units, ponds or indeed extraction pits
- 4.2.10 Several weakly positive linear anomalies have been identified across Section 1 at **4107 - 4116 (Figs 21, 23, 27 and 29)**. These anomalies are of various orientations and range in length from 33 to 140 m, with widths between 1 and 2 m. These anomalies are typical of ditch-like features. All ditches, however, correlate with former field boundaries recorded on 1888 OS mapping and therefore have been interpreted as such.
- 4.2.11 Multiple areas of weak, positive, parallel, linear anomalies have been recorded throughout Section 1 at **4117 – 4126 (Figs 19 – 23, 27 and 29)**. These anomalies are broadly regularly spaced, with an average distance between lines of 6 m. The orientations of these anomalies are on several alignments, with the majority, which are orientated either north-east to south-west or north-west to south-east. This is typical of ridge and furrow cultivation; some examples **4117** and **4124** are still visible in satellite images (Google Earth, 2025). Throughout these anomalies there are some examples of a curved form (**4120**), this correlated with their regular spacing indicates a possibly medieval origin.
- 4.2.12 A further series of weak, positive and dipolar, linear anomalies recorded throughout Section 1 at (**Figs 19 – 31**). These have been identified as drains likely associated with modern agricultural practices.
- 4.2.13 Two weakly positive discrete anomalies were detected in LP_008 and LP_010, respectively (**Fig. 22**). These areas are up to 39 m and 19 m, respectively. They are amorphous, and weak magnetic properties suggest it is natural in origin, likely related to variations in the surface geology.
- 4.2.14 Several additional weak trends have been identified across the Section. Due to their weak and isolated nature, an exact interpretation cannot be given; these may be ditches with an archaeological origin, or related to agricultural activities, or be due to natural gullies.
- 4.2.15 In the west of LP_001, an area of increased magnetic resonance was recorded (**Fig. 17**). This area covers 74 m north to south and 25 m east to west and is on a slope dropping 5 m from east to west. This area of increased response is likely related to the ground made from the slope related to the area to the west.

- 4.2.16 Several strong dipolar linear anomalies have also been identified within the site on a variety of orientations at **4127 – 4135 (Figs 19 – 31)**. The magnetic strength and properties of these anomalies is characteristic of modern services.

Section 2 (LP_027 – LP_057)

- 4.2.17 In LP_027 is a positive linear anomaly at **4201 (Fig. 33)**. The anomaly runs on a north-east to south-west orientation for 20 m with a width of 1.6 to 2 m. The shape and magnetic properties are typical of a ditch-like feature. However, a service to the east, which was also detected and identified running through a large section of the LP_027, obscures any possible continuation of the feature north. The clear ditch feature could be archaeological in origin however due to the isolated nature and lack of context other origins cannot be discounted.
- 4.2.18 The second positive linear anomaly identified is in LP_043 at **4202 (Fig. 43)**. The anomaly runs on a NNE to SSW orientation for 78.3 m and has a width varying from 1.8 to 3.2 m. The magnetic properties of the anomaly alternate from weak to strong, north to south along its form. Similarly to **4201**, a service in the north masks any continuation in that direction. The anomaly is typical of a ditch feature and may have an archaeological origin. However, its close relation to Rothley brook along the immediate southern border of the LP, it may be possible that it is related to the drainage system from the field into the brook.
- 4.2.19 A weakly positive linear anomaly has been recorded at **4203** in LP_047 (**Fig. 45**). This anomaly is on a north-west to south-east orientation, 115 m long with a consistent width of 1.1 m. The magnetic properties are typical of a ditch-like feature of possible archaeological origin. It is possible, however, that this feature may be an unrecorded field boundary or related to modern agriculture, such as drainage. Parallel to **4203** on the same orientation, 16 m to its south, a very weakly positive anomaly was also detected. This could be related to **4203**, however, due to the weakness of the anomaly, a confident interpretation could not be given. It is possible that the more faint anomaly is agricultural in origin related to a headland or modern ploughing. An archaeological origin, however, cannot be discounted entirely for these anomalies.
- 4.2.20 Several positive linear anomalies have been recorded across Section 2 at **4204 – 4210 (Figs 33 – 37 and 43)**. These linear anomalies range in length between 16 to 110 m and are 1 to 2 m in width. These have been interpreted as ditches relating to former field boundaries. All boundaries were recorded on the 1888 first edition OS mapping but are no longer present on site.
- 4.2.21 Multiple arrays of weak, positive, parallel, linear anomalies have been recorded throughout Section 2 at **4211 – 4224 (Figs 33 – 47)**. The anomalies are broadly regularly spaced, with an average distance between lines at 5 m. The orientations of these anomalies alternate across the Section, with the majority orientated either south-east to north-west or east to west. These anomalies have been interpreted as areas of ridge and furrow and are thought to be medieval due to their curved form and spacing such as **4218** and **4219**.
- 4.2.22 An area of increased magnetic response for four strong circular ferrous anomalies has been detected in LP_049 at **4225 (Fig. 45)**. The increased response covers an area 17 m by 23 m, at the centre of which the four circular anomalies are detected in a square pattern. These circular anomalies are 3.5 m in diameter and have a gap of 1.5 m between each other. This is typical of a former electrical pylon base. This pylon is visible on the 1945 OS mapping.
- 4.2.23 Evidence of the sites agricultural past has also been identified as a series of anomalies, typically very straight, consisting of positive magnetic properties, with examples in LP_035

and LP_036 (**Fig. 37**). These have been identified as modern agricultural activity such as ploughing and/or headlands. A further series of weak, speckled, linear anomalies recorded throughout Section 2. The magnetic properties of these anomalies are characteristic of drains associated either with historic or modern agricultural practices.

- 4.2.24 Isolated areas of discrete, magnetic response have been highlighted in LP_043 LP_050 (**Fig 45**). These areas are between 14 m to 30 m in diameter. have been interpreted as being areas of natural variation in the superficial geology. A more modern interpretation cannot be ruled out entirely.
- 4.2.25 Several strong dipolar linear anomalies have also been identified within the site on a variety of orientations at **4226 – 4237 (Figs. 33 – 37, 41, 43 and 47)**. The magnetic strength and signature of these anomalies is indicative of modern services.

Section 3 (LP_058 – LP_060)

- 4.2.26 The fragmented remains of several linear anomalies have been recorded in LP_059, these are all engulfed by ferrous interference at **4301 – 4304 (Fig. 50)**. The strongest examples are at **4301** and **4302**, these are 32 m and 52 m long, respectively and are 1.5 m wide. The weakest linear **4303** is 63 m long and 1 m wide. Two other anomalies, **4304** and **4305**, are both formed of more fragmented linear features with several ferrous. These are 36 m and 55 m in length with a 1 – 3 m wide. Anomalies **4301** and **4303** are oriented north-east to south-west, while **4303** is oriented north-east to south-west. Anomalies **4304** and **4305** are oriented east to west. These anomalies all correlate with the modern foot path, with the increased magnetic response and ferrous detection is due to the material used to make the current foot path. The foot path is also visible on current satellite mapping (Google Earth 2025).
- 4.2.27 A further series of weak, positive and dipolar, linear anomalies recorded (**Fig. 50**). These have been identified as drains likely associated with modern agricultural practices.

5 DISCUSSION

- 5.1.1 The gradiometer survey has demonstrated the presence of several anomalies of possible archaeological interest in Sections 1 and 2, predominantly, with no clear archaeological anomalies detected in either the Bradgate Park Section or Section 3. Although it is possible that these anomalies are representative of ditches, the majority of these are too weak or isolated to offer a confident interpretation. The anomalies could be related to possible unmapped former field boundaries; however, an archaeological origin could not be discounted entirely.
- 5.1.2 Three historic landscape features noted on historic OS mapping have been detected in the survey. This included unidentified structures, likely related to, agricultural storage, ponds or areas of extraction and a single path/road, since removed from site.
- 5.1.3 The site's agricultural past is also evidenced by areas of medieval ridge and furrow across the site. Post-medieval agriculture is seen in the form of former boundaries that correlate with those recorded on first-edition OS mapping.
- 5.1.4 The remaining anomalies are thought to be modern or natural in origin. The modern anomalies include ploughing, drains, and services.
- 5.1.5 The seasonal variation between survey deployments has not affected the gradiometer data.

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- Wessex Archaeology 2024b. *Hallgates to Elms Farm Pipeline, Ratby, Leicestershire: Archaeological Watching Brief Statement of Results*. Salisbury: unpublished report, ref. 294340.02
- Wessex Archaeology 2025. Hallgates to Elms Farm Leicester: Written Scheme of Investigation for an Archaeological Geophysical Survey. Salisbury: unpublished report, ref. 294343.01

Online resources

- British Geological Survey online viewer <http://mapapps.bgs.ac.uk/geologyofbritain/home.html> (accessed December 2025)
- British Geological Survey online viewer <http://mapapps.bgs.ac.uk/geologyofbritain/home.html> (accessed December 2025)
- English Heritage 2013 *English Heritage Thesauri*, http://thesaurus.historicengland.org.uk/thes_splash.htm (accessed December 2025)
- Google Earth website <http://earth.google.com> (accessed December 2025)
- Historic England (HE) <https://historicengland.org.uk> (accessed December 2025)
- Soilscapes <https://www.landis.org.uk/soilscapes/> (accessed December 2025)

APPENDICES

Appendix 1 Survey equipment and data processing

Survey methods and equipment

The magnetic data for this project were acquired using a non-magnetic hand-pushed cart fitted with four SenSys FGM650/3 magnetic gradiometers. The instrument has four sensor assemblies fixed horizontally 1 m apart allowing four traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 0.6 m 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 an effective resolution of $\pm 8 \mu\text{T}$ over $\pm 1000 \text{ nT}$ range. All of the data will be then relayed to a CS35 tablet, running the MONMX program, which is used to record the survey data from the array of FGM650/3 probes at a rate of 100 Hz. The program also receives measurements from a GPS system, which is fixed to the cart at a measured distance from the sensors, providing real time locational data for each data point.

The cart-based system relies upon accurate GPS location data which is collected using a Carlson BRX-7 RTK system. This receives corrections from a network of reference stations operated by the Ordnance Survey, allowing positions to be determined with a precision of 0.02 m in real-time and therefore exceed the level of accuracy recommended by European Archaeologiae Consilium (Schmidt *et al.* 2015).

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 0.01 m intervals along traverses spaced up to 0.25m apart.

Post-processing

The magnetic data collected during the detail survey were downloaded from the Sensys 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 was conducted so as not to distort the anomalies.

The cart-based system generally requires a lesser amount of post-processing than the handheld instrument. This is largely because mounting the gradiometers on the cart reduces the occurrence of operator error, caused by inconsistent walking speeds and deviation in traverse position due to varying ground cover and topography.

Typical data and image processing steps include:

- Destripe – Applying a zero-mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger – Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;



- Despiking – 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:

- 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.
- 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. (XY trace plots are available on request)

Appendix 2 Geophysical interpretation

The interpretation methodology used by Wessex Archaeology separates the anomalies into four main categories: archaeological, modern, agricultural, and uncertain origin/geological.

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.
- Possible archaeology – used for features which give a response, but which form no discernible pattern or trend.

The modern category is used for anomalies that are presumed to be relatively modern in date:

- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be observed.

The agricultural category is used for the following:

- Former field boundaries – used for ditch sections that correspond to the position of boundaries marked on earlier mapping.
- Ridge and furrow – used for broad and diffuse linear anomalies that are considered to indicate areas of former ridge and furrow.
- Ploughing – used for well-defined narrow linear responses, usually aligned parallel to existing field boundaries.
- Drainage – used to define the course of ceramic field drains that are visible in the data as a series of repeating bipolar (black and white) responses.

The uncertain origin/geological 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.
- Superficial geology – used for diffuse edged spreads considered to relate to shallow geological deposits. They can be distinguished as areas of positive, negative, or broad bipolar (positive and negative) anomalies.



Appendix 3 OASIS form

OASIS Summary for wessexar1-533827

OASIS ID (UID)	wessexar1-533827
Project Name	Magnetometry Survey at Hallgates to Elms Farm, Leicester
Sitename	Hallgates to Elms Farm, Leicester, Northern End, Southern End
Sitecode	294343
Project Identifier(s)	Hallgates to Elms Farm, Leicester
Activity type	Magnetometry Survey, MAGNETOMETRY SURVEY
Planning Id	
Reason For Investigation	Planning: Pre application
Organisation Responsible for work	Wessex Archaeology
Project Dates	04-Aug-2025 - 11-Dec-2025
Location	Hallgates to Elms Farm, Leicester NGR : SK 53772 09325 LL : 52.6789647381277, -1.206092736304692 12 Fig : 453772,309325 Northern End NGR : SK 53403 11449 LL : 52.69809333599531, -1.211206198243652 12 Fig : 453403,311449 Southern End NGR : SK 52654 05960 LL : 52.648826813449745, -1.223163781976269 12 Fig : 452654,305960
Administrative Areas	Country : England County/Local Authority : Leicestershire Local Authority District : Charnwood Parish : Anstey Parish : Newtown Linford Local Authority District : Blaby Parish : Glenfields

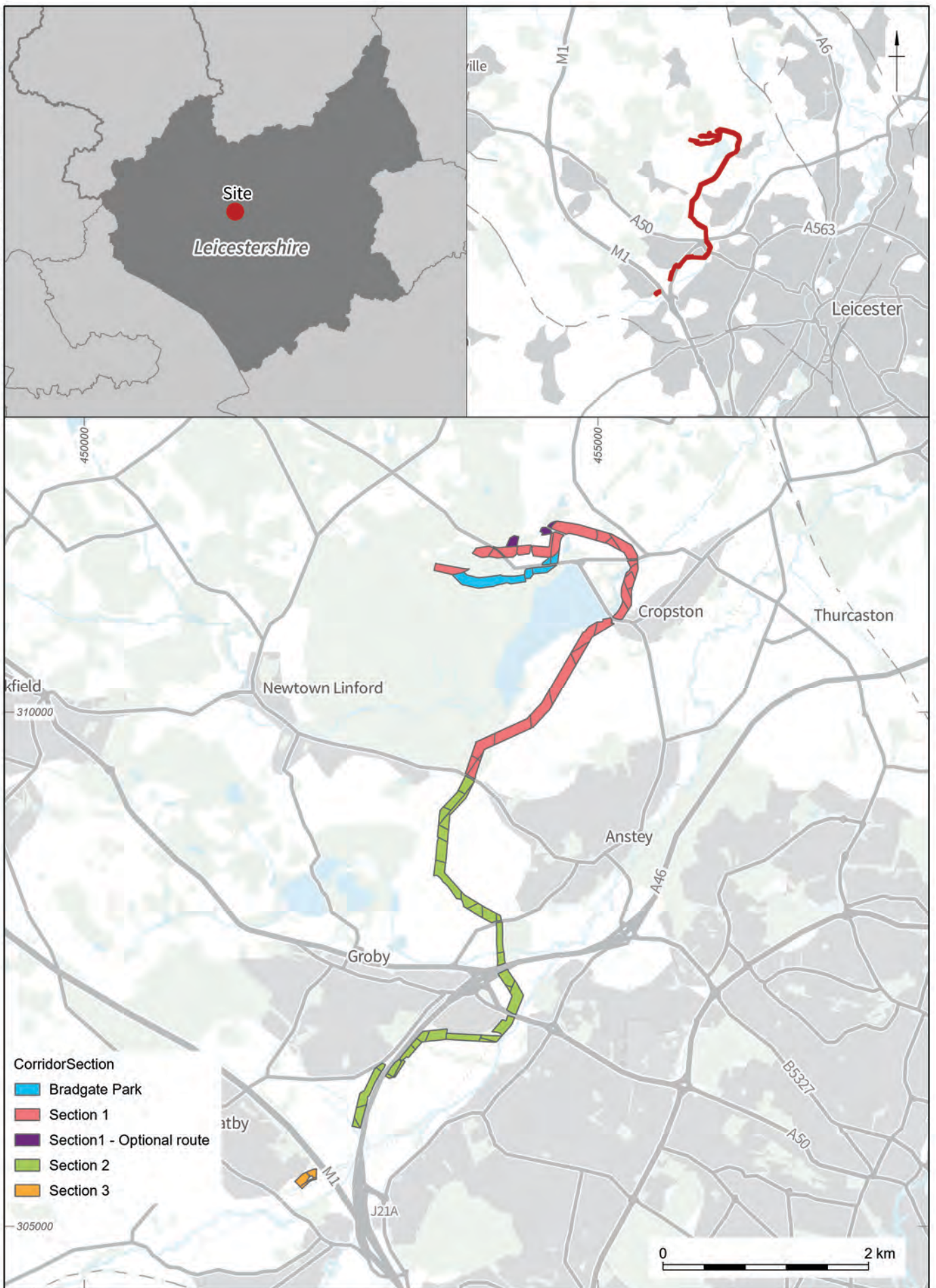


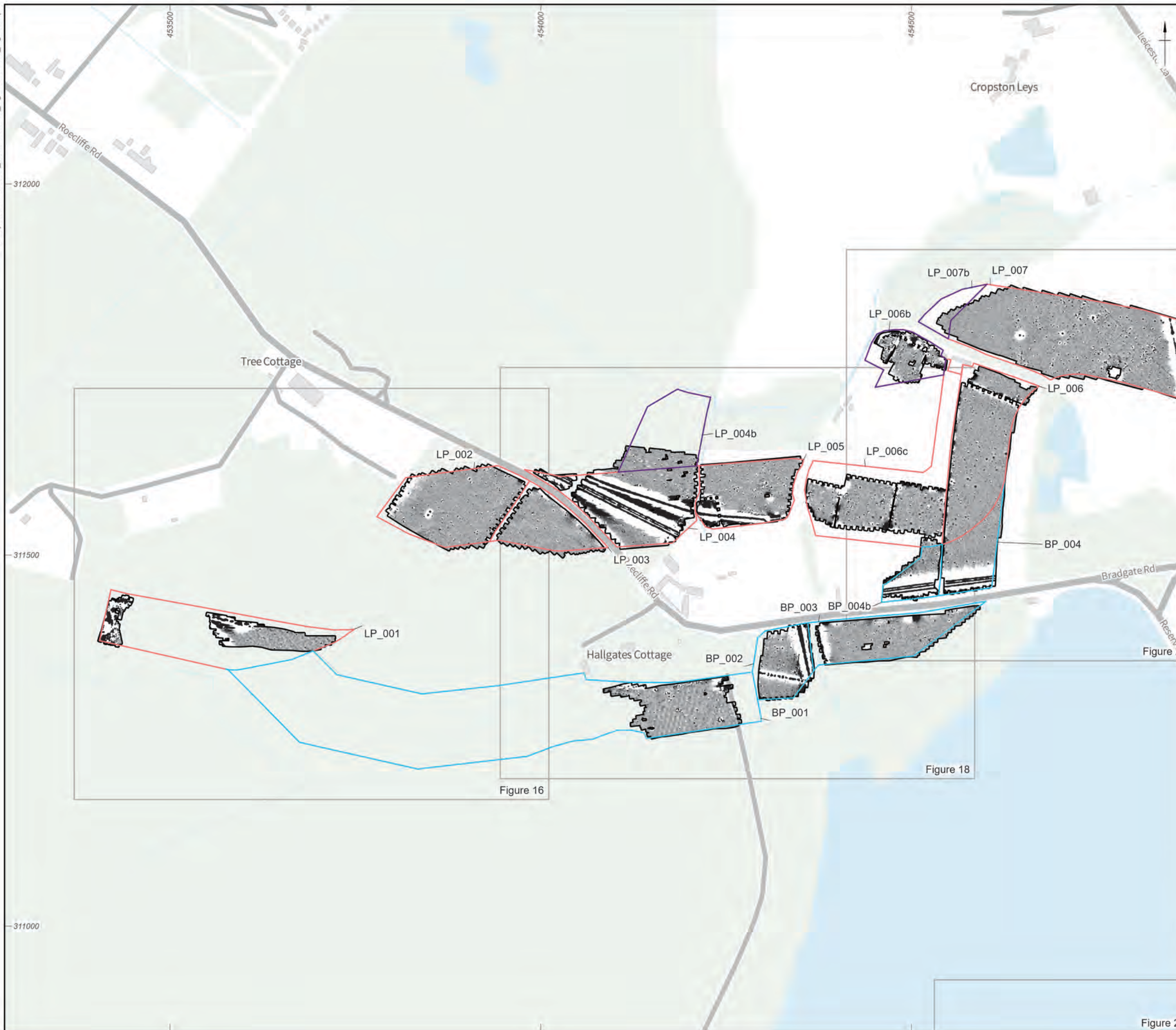
Project Methodology	3.1 Introduction 3.1.1 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team across two separate deployments between 04 – 22 August and 10 – 19 November 2025. 3.1.2 Field conditions at the time of the survey were varied throughout. An overall coverage of 78.5 ha was achieved. Several areas were unable to be surveyed due to livestock, overgrown vegetation or were tree plantations that could not be surveyed. 3.1.3 The methods and standards employed throughout the geophysical survey conform to that set out in the Written Scheme of Investigation (WSI) (Wessex Archaeology 2025), as well as to current best practice, and guidance outlined by the Chartered Institute for Archaeologists' (CIfA 2020) and European Archaeologiae Consilium (Schmidt et al. 2015). 3.2 Aims and objectives 3.2.1 The aims of the survey comprise the following: To determine, as far as is reasonably possible, the nature of the detectable archaeological resource within a specified area using appropriate methods and practices; and To inform either the scope and nature of any further archaeological work that may be required; or the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource); or a management strategy. 3.2.2 In order to achieve the above aims, the objectives of the geophysical survey are: To conduct a geophysical survey covering as much of the specified area as possible, allowing for on-site obstructions; To clarify the presence/absence of anomalies of archaeological potential; and Where possible, to determine the general nature of any anomalies of archaeological potential. 3.3 Fieldwork methodology 3.3.1 The cart-based gradiometer system used a Carlson BRX-7 RTK GNSS instrument, which receives corrections from a network of reference stations operated by the OS. Such instruments allow positions to be determined with a precision of 0.02 m in real-time and therefore exceeds Europae Archaeologiae Consilium recommendations (Schmidt et al. 2015). 3.3.2 The survey was conducted using four Sensys FGM650/3 magnetic gradiometers spaced at 1 m intervals and mounted on a non-magnetic cart. Data were collected with an effective sensitivity of $\pm 8 \mu\text{T}$ over $\pm 1000 \text{ nT}$ range at a rate of 100 Hz, producing intervals of 0.02 m along transects spaced 4 m apart. 3.4 Data processing 3.4.1 Data from the survey were subjected to minimal correction processes. These comprise a 'Destripe' function ($\pm 5 \text{ nT}$ thresholds), applied to correct for any variation between the sensors, and an interpolation used to grid the data and discard overlaps where transects have been collected too close together. 3.4.2 Further details of the geophysical and survey equipment, methods and processing are described in Appendix 1.
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Project Results	A gradiometer survey was conducted across a 97.6 ha linear scheme located between Rocliffe Road, Woodhouse Eaves and Taverner Drive, and the village of Ratby, Leicester (NGR 453403 311449 to 452654 305960) . The project was commissioned by Severn Trent Water with the aim of establishing the presence, or otherwise, and nature of detectable archaeological features in support of a planning application for the development of a water pipeline. The site comprises arable fields located along a 11 km linear scheme between Hallgates and Elms Farm, north-east Leicester, in the county of Leicestershire. An overall coverage of 78.5 ha was achieved. Several areas were unable to be surveyed due to livestock, overgrown vegetation or were tree plantations that could not be surveyed. The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team across two separate deployments between 04 – 22 August and 10 – 19 November 2025. The gradiometer survey has demonstrated the presence of a number of anomalies of potential archaeological interest in Sections 1 and 2 predominantly, with no clear archaeological anomalies detected in either the Bradgate Park Section or Section 3. The majority of possible archaeological features are too weak or isolated to offer a confident interpretation. The anomalies could be related to possible unmapped former field boundary features, however, an archaeological origin could not be discounted. Three historic landscape features noted on historic OS mapping have been detected in the survey. This included two ponds, possibly initially areas of extraction and a single path/road. The site's agricultural past is also evidenced by areas of medieval ridge and furrow across the site. Post-medieval agriculture is seen in the form of former boundaries that correlate with those recorded on first-edition OS mapping. The remaining anomalies are thought to be modern or natural in origin. The modern anomalies include ploughing, drains, and services
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Funder	Water company Severn Trent Water
HER	Leicestershire HER - unRev - STANDARD
Person Responsible for work	Alastair Trace
HER Identifiers	
Archives	

Report generated on: 11 Dec 2025, 14:32





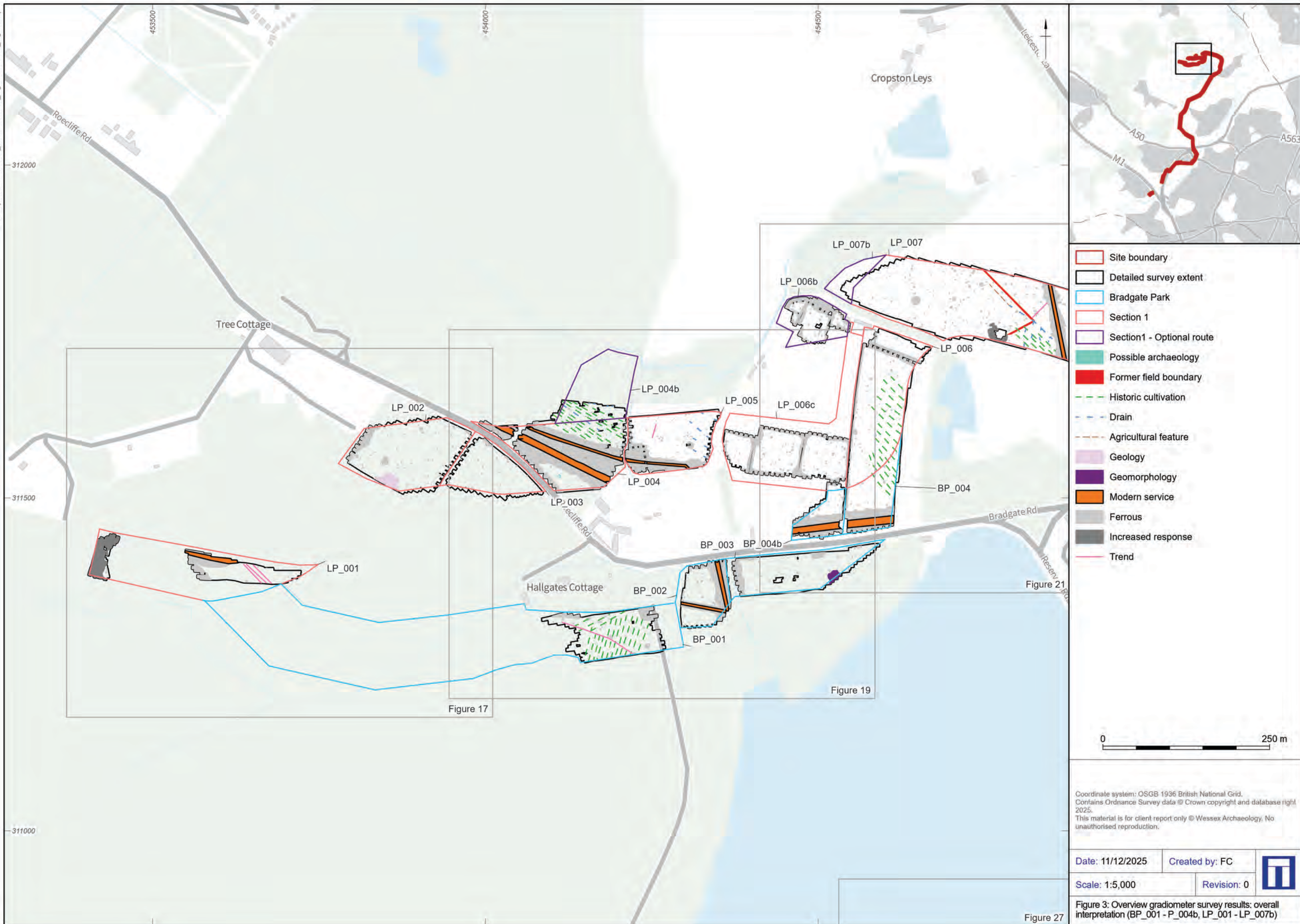
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- Bradgate Park
- Section 1
- Section1 - Optional route



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Figure 2: Overview gradiometer survey results: overall greyscale plots (BP_001 - P_004b, LP_001 - LP_007b)

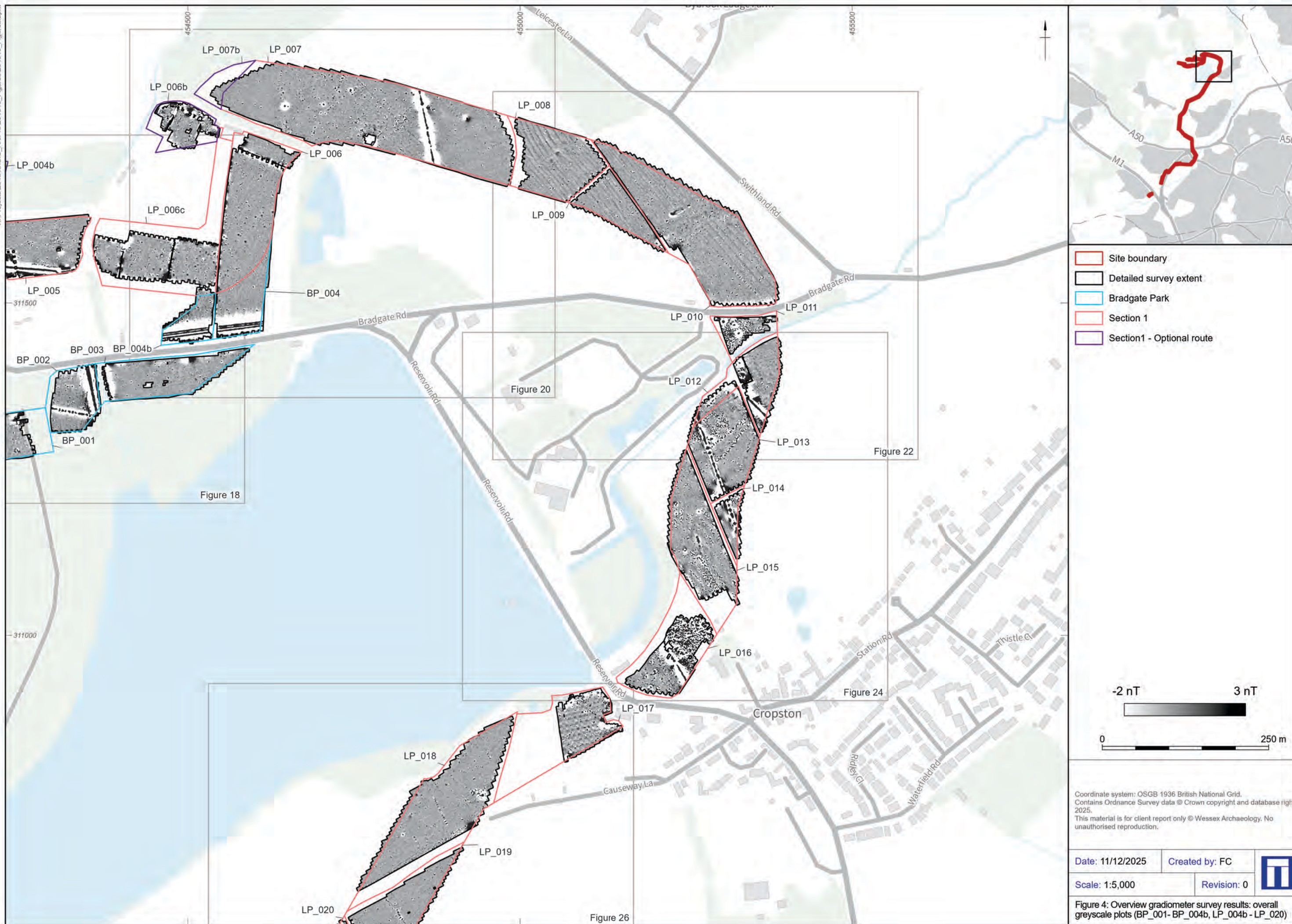


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- Bradgate Park
- Section 1
- Section 1 - Optional route
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- Historic cultivation
- Drain
- Agricultural feature
- Geology
- Geomorphology
- Modern service
- Ferrous
- Increased response
- Trend

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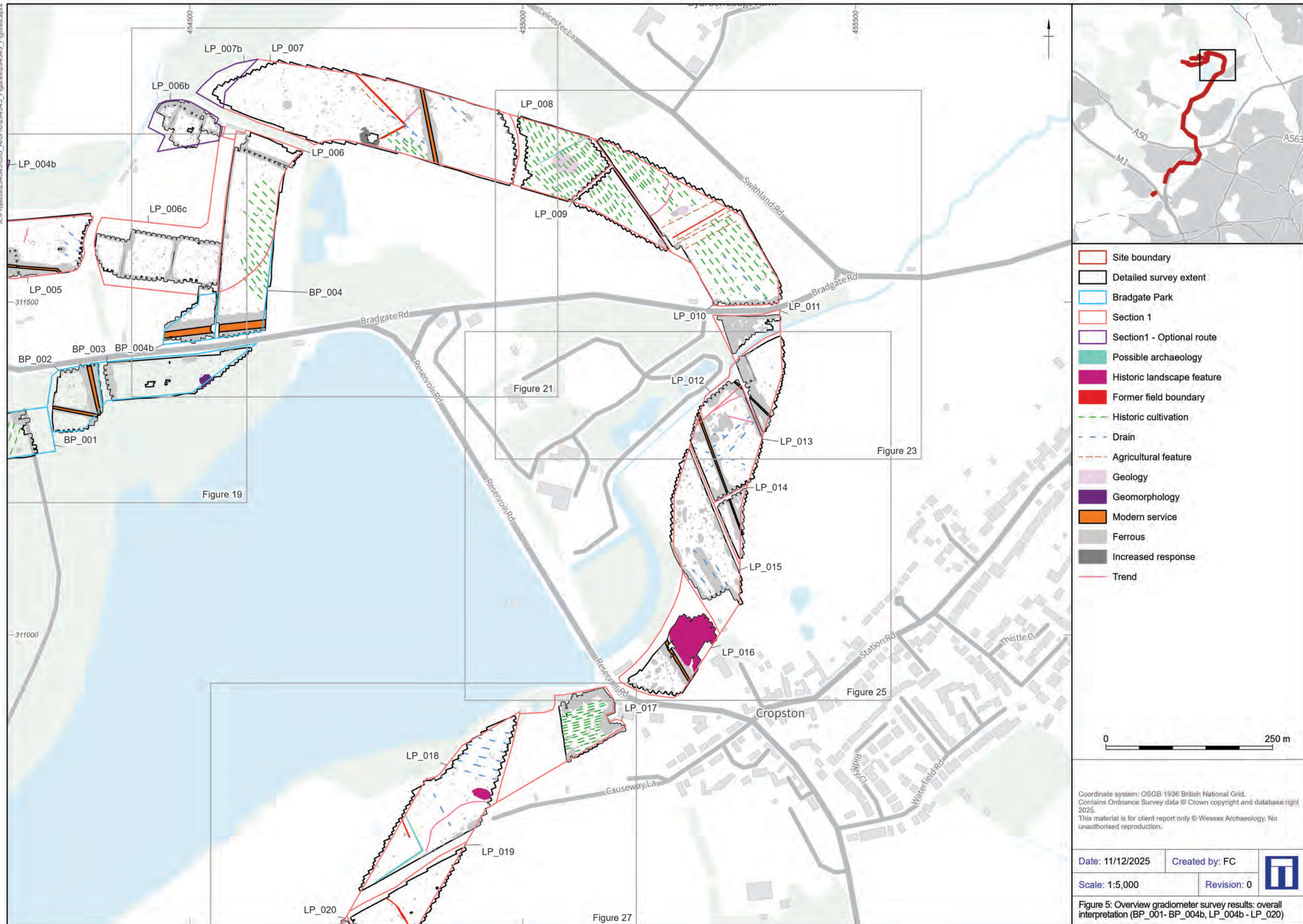
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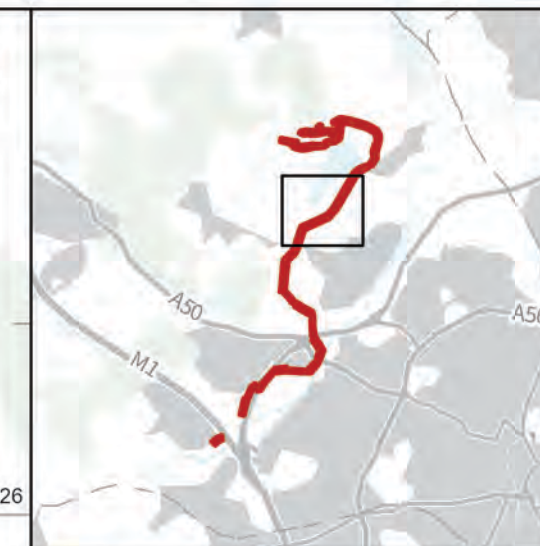
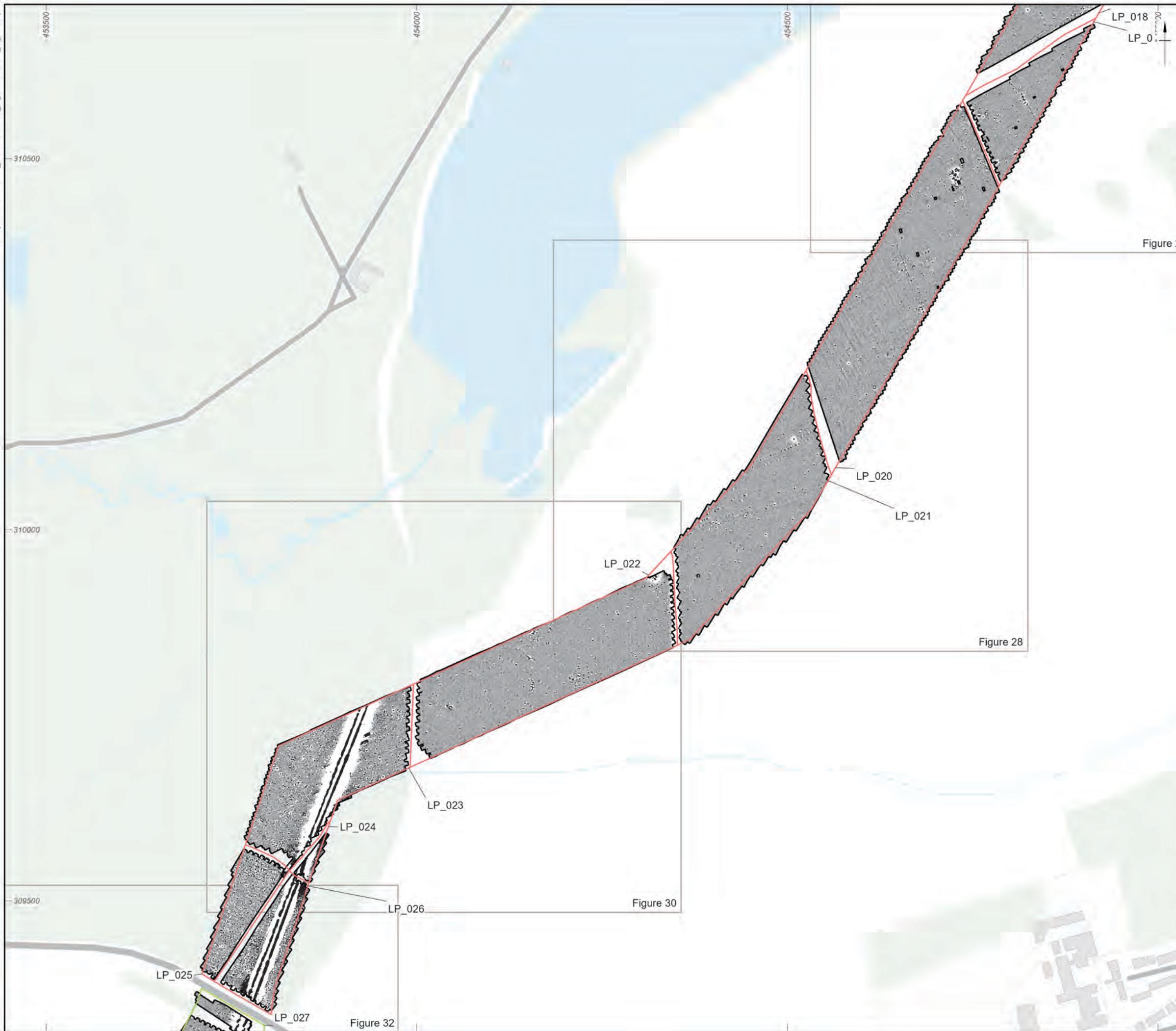


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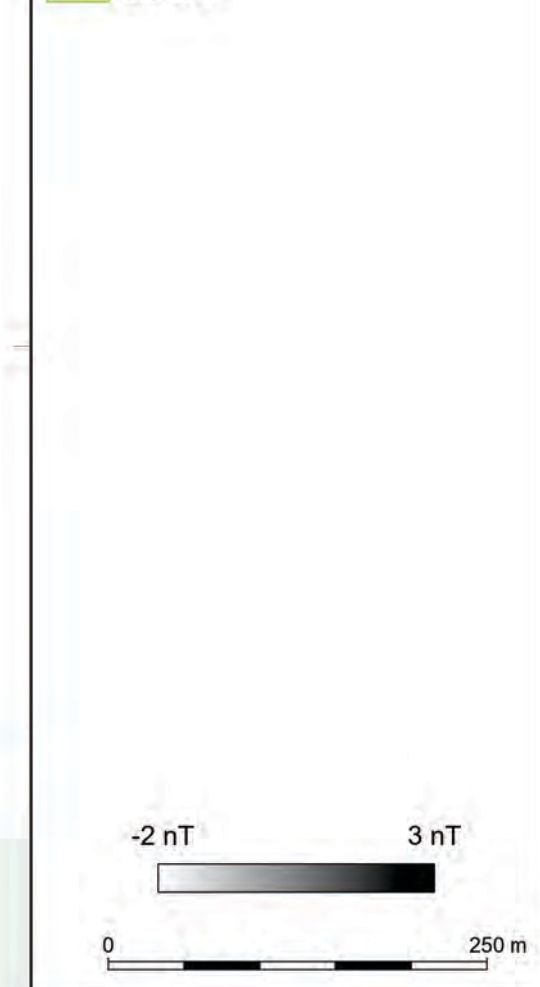
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Figure 4: Overview gradiometer survey results: overall greyscale plots (BP_001- BP_004b, LP_004b - LP_020)



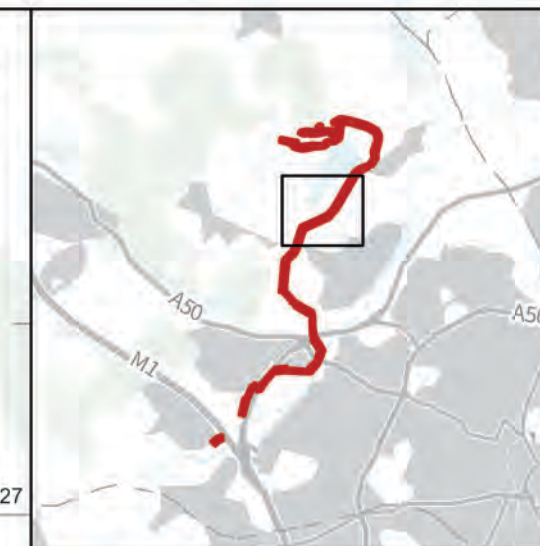
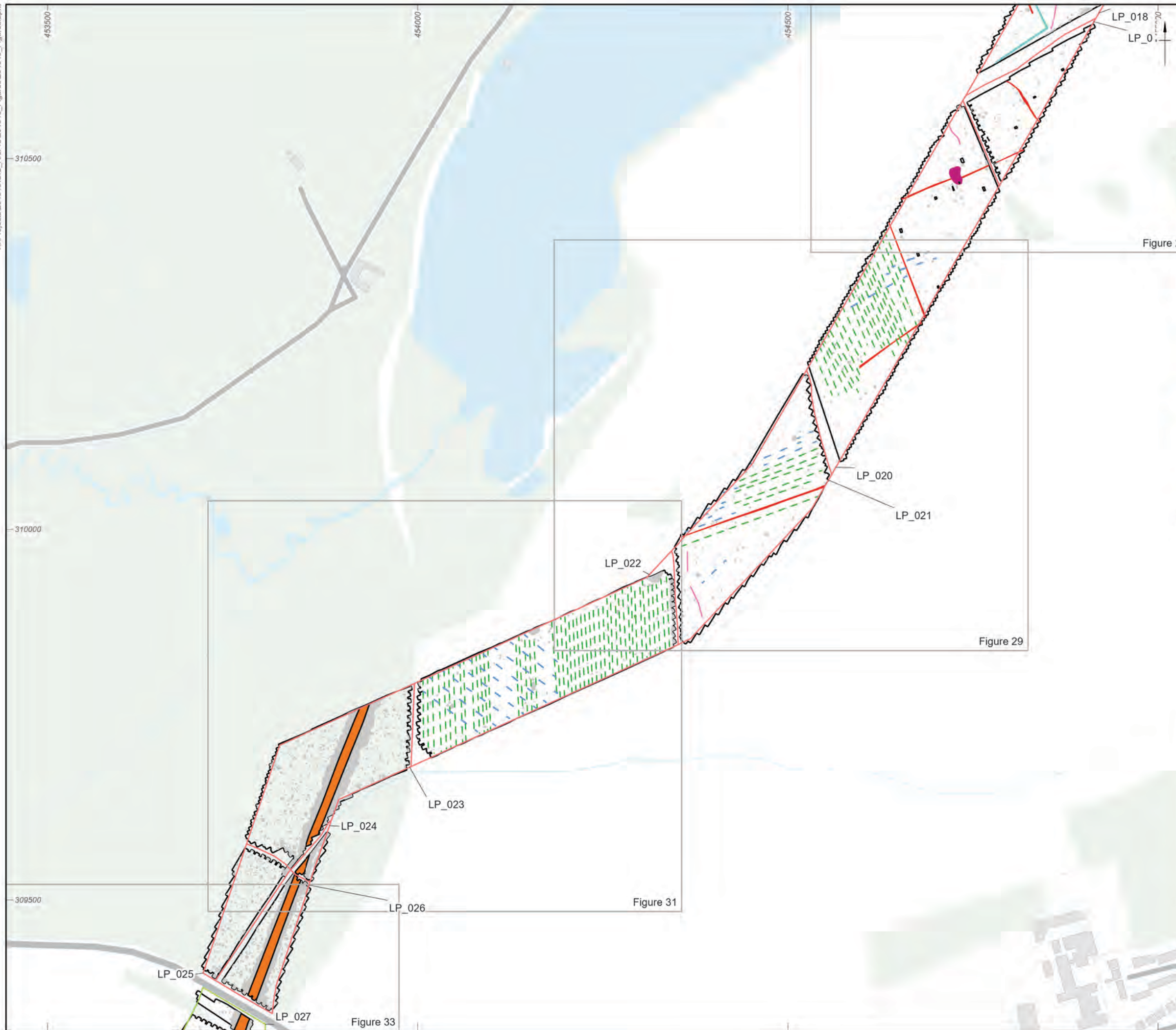


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- Section 1
- Section 2



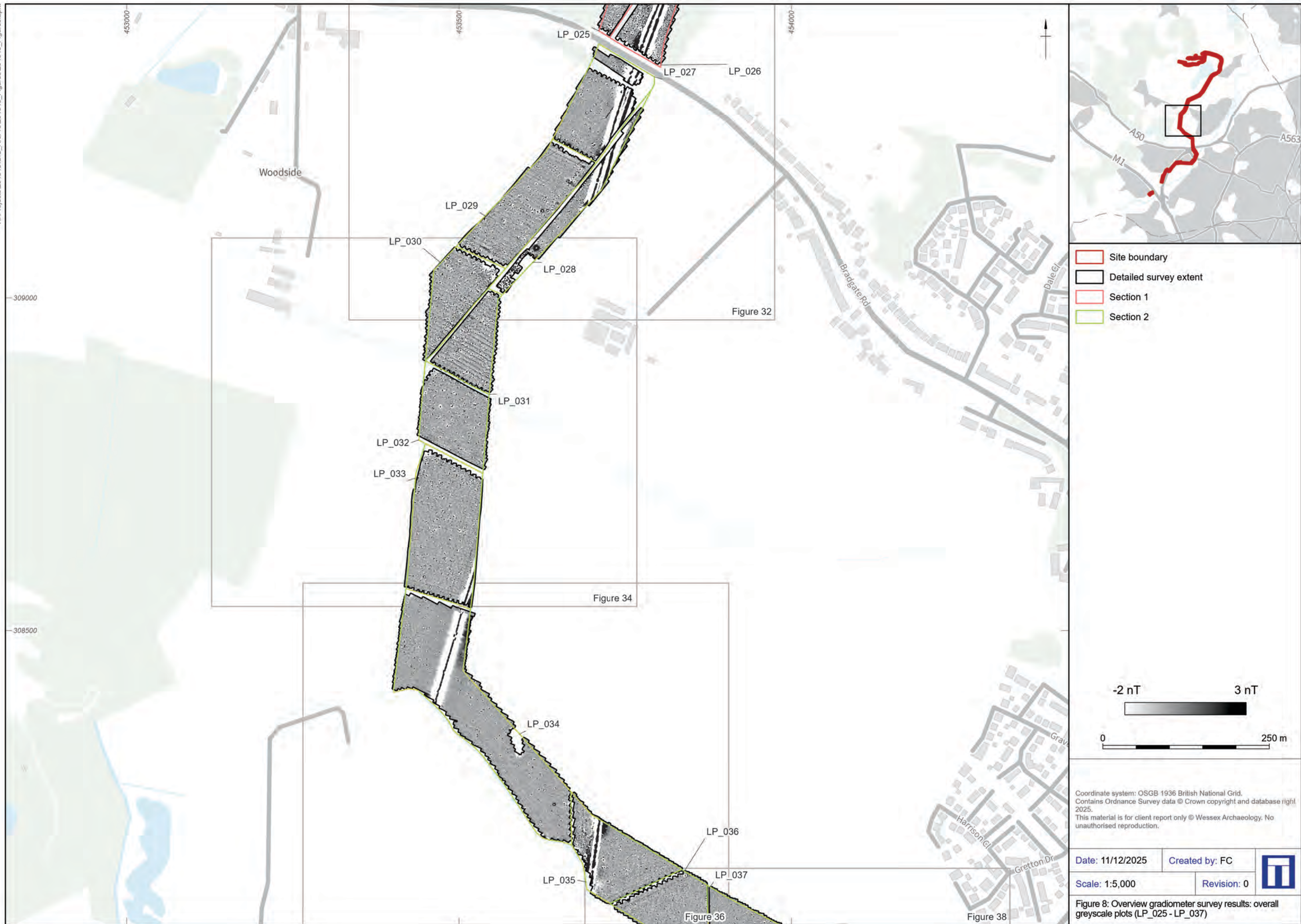
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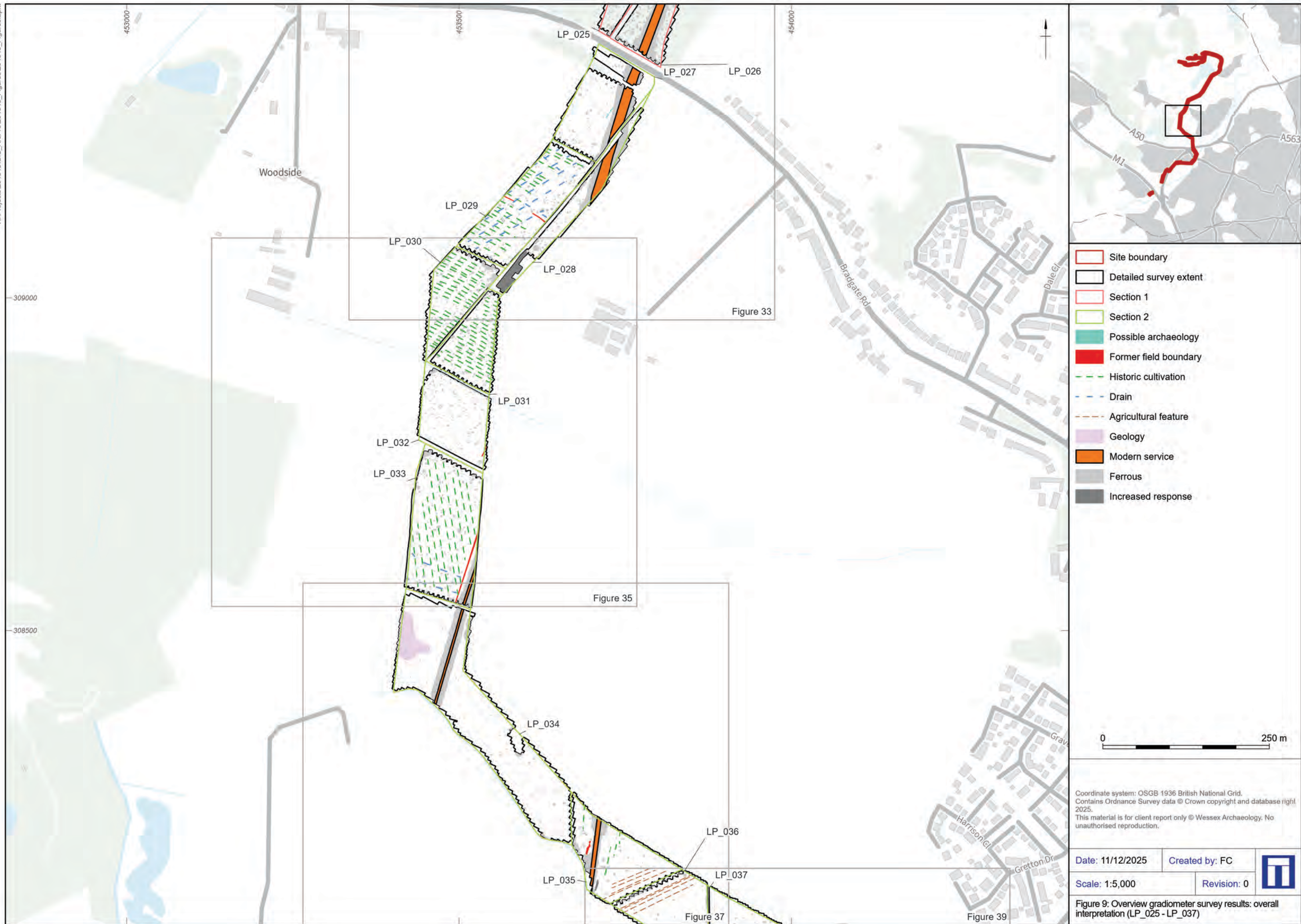
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Figure 6: Overview gradiometer survey results: overall greyscale plots (LP_018 - LP_027)		



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Figure 7: Overview gradiometer survey results: overall interpretation (LP_018 - LP_027)		







- Site boundary
- Detailed survey extent
- Section 2



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Figure 10: Overview gradiometer survey results: overall greyscale plots (LP_033 - LP_042)		

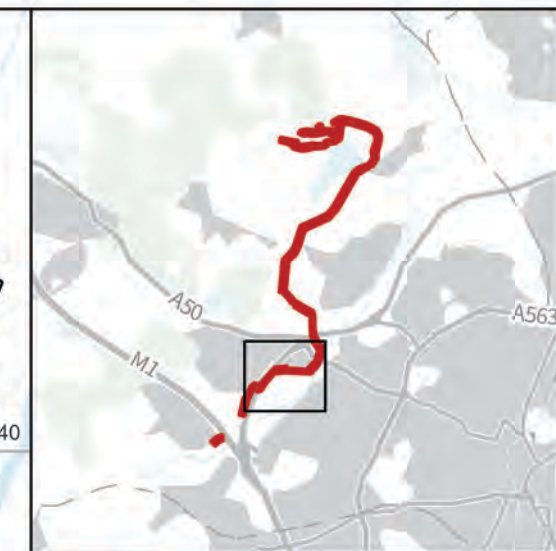
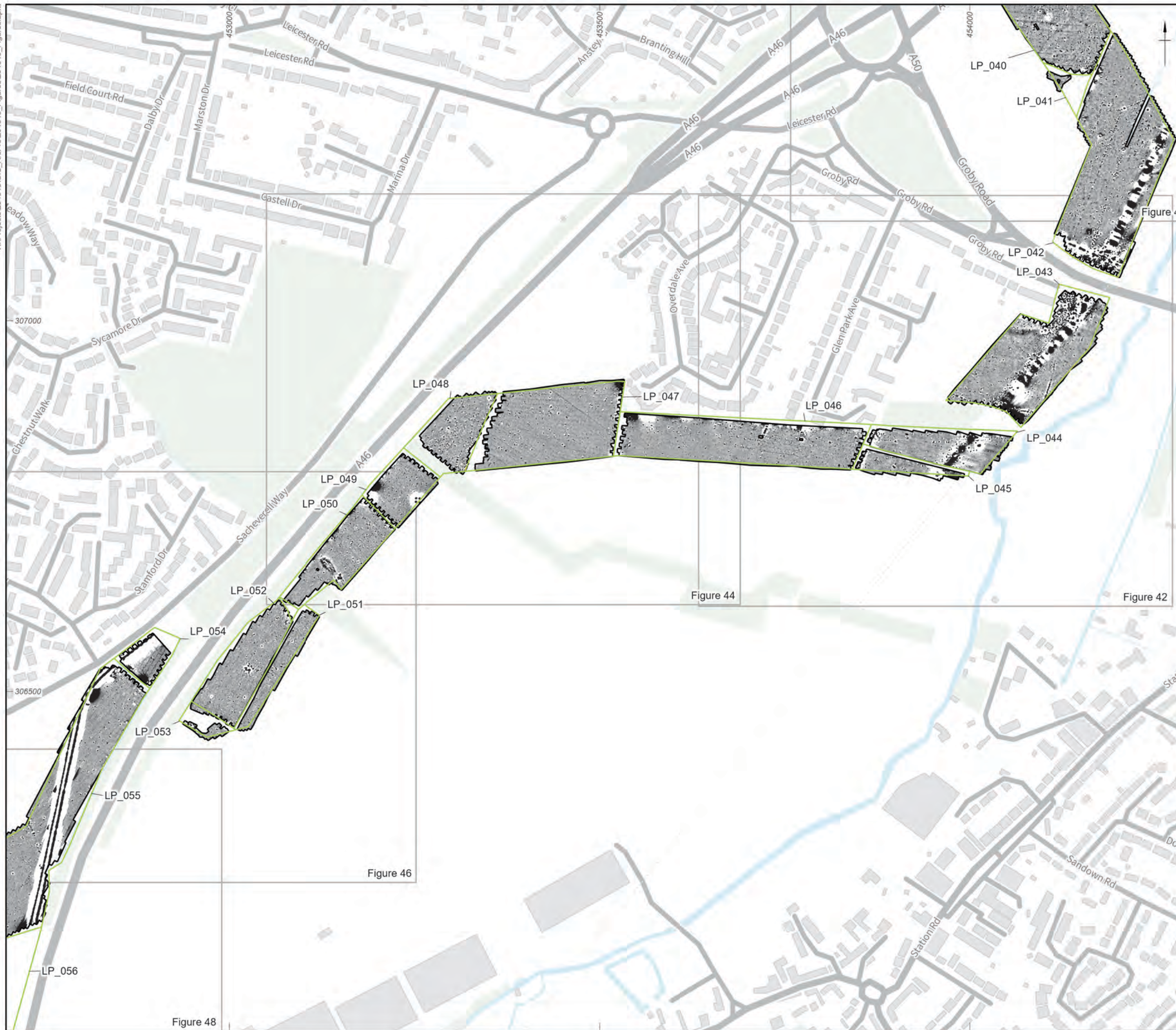


- Site boundary
- Detailed survey extent
- Section 2
- Possible archaeology
- Former field boundary
- Historic cultivation
- Drain
- Agricultural feature
- Geology
- Modern service
- Ferrous
- Increased response
- Trend



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Figure 11: Overview gradiometer survey results: overall interpretation (LP_033 - LP_042)		



- Site boundary
- Detailed survey extent
- Section 2



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Figure 12: Overview gradiometer survey results: overall greyscale plots (LP_040 - LP_056)

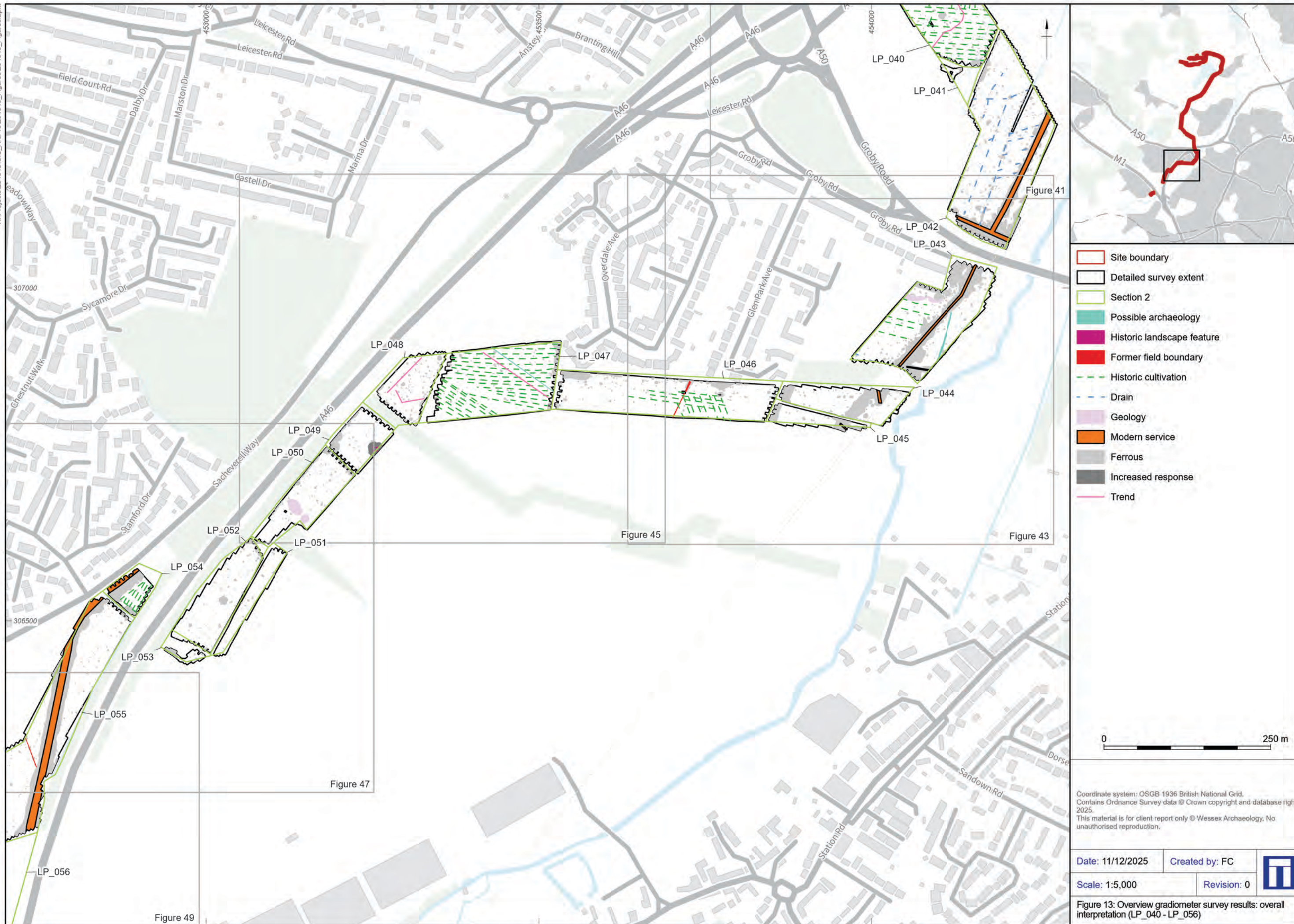
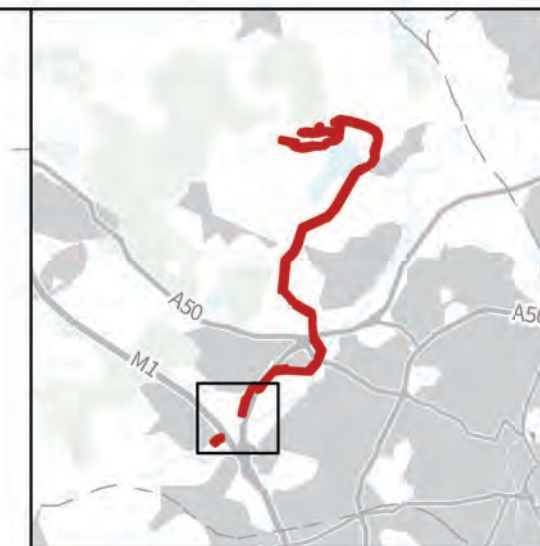




Figure 46

Figure 48

Figure 50



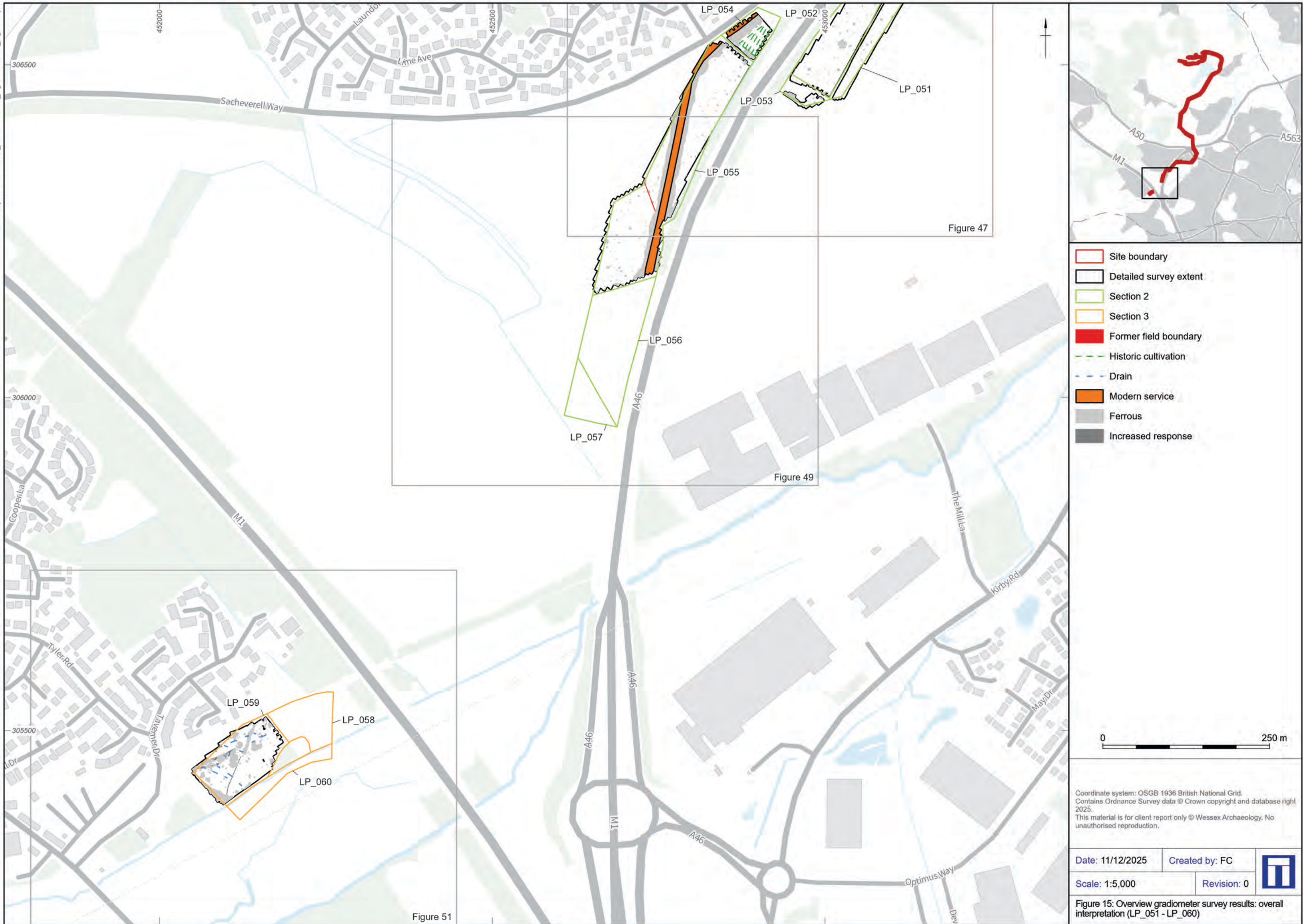
- Site boundary
- Detailed survey extent
- Section 2
- Section 3

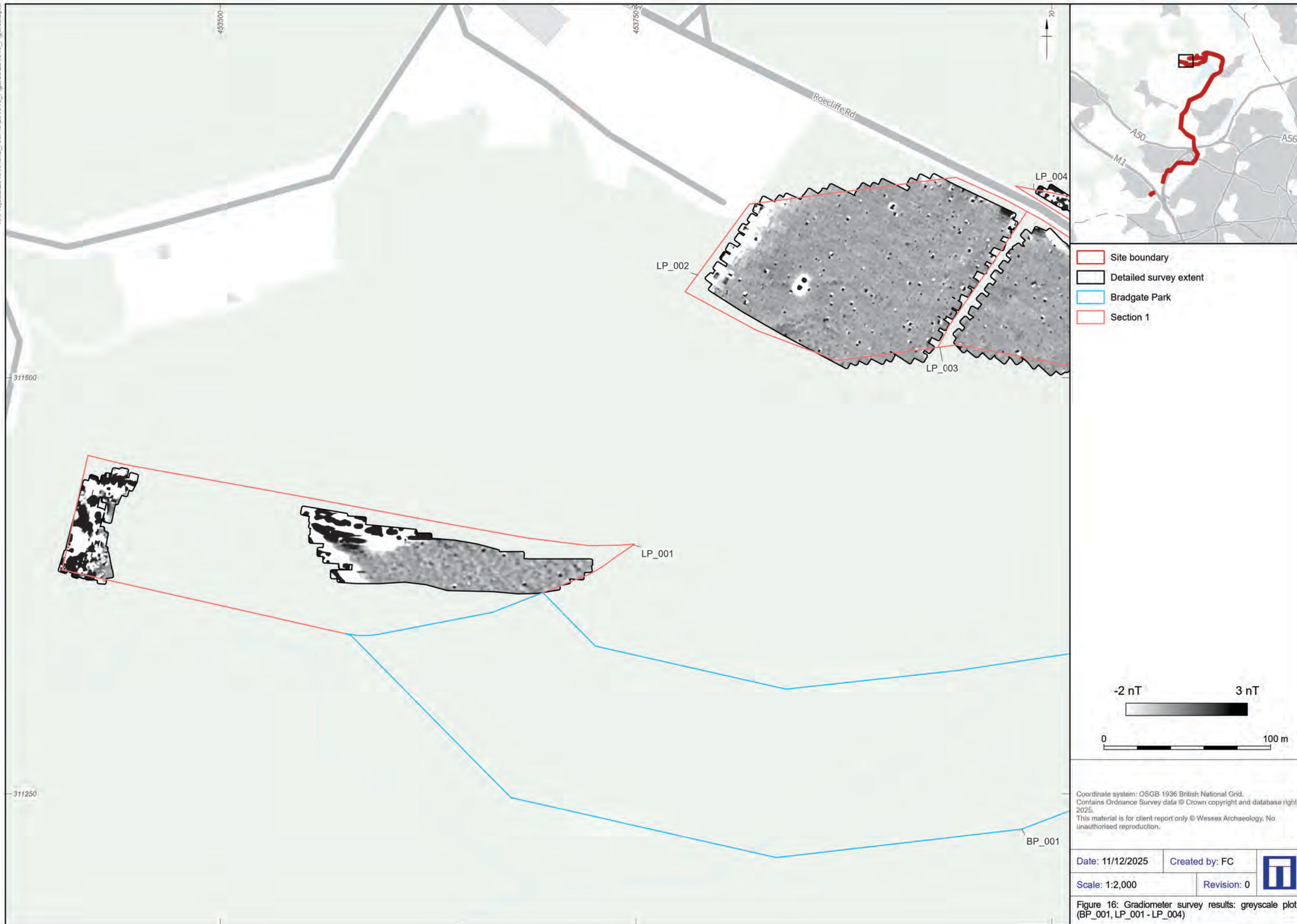


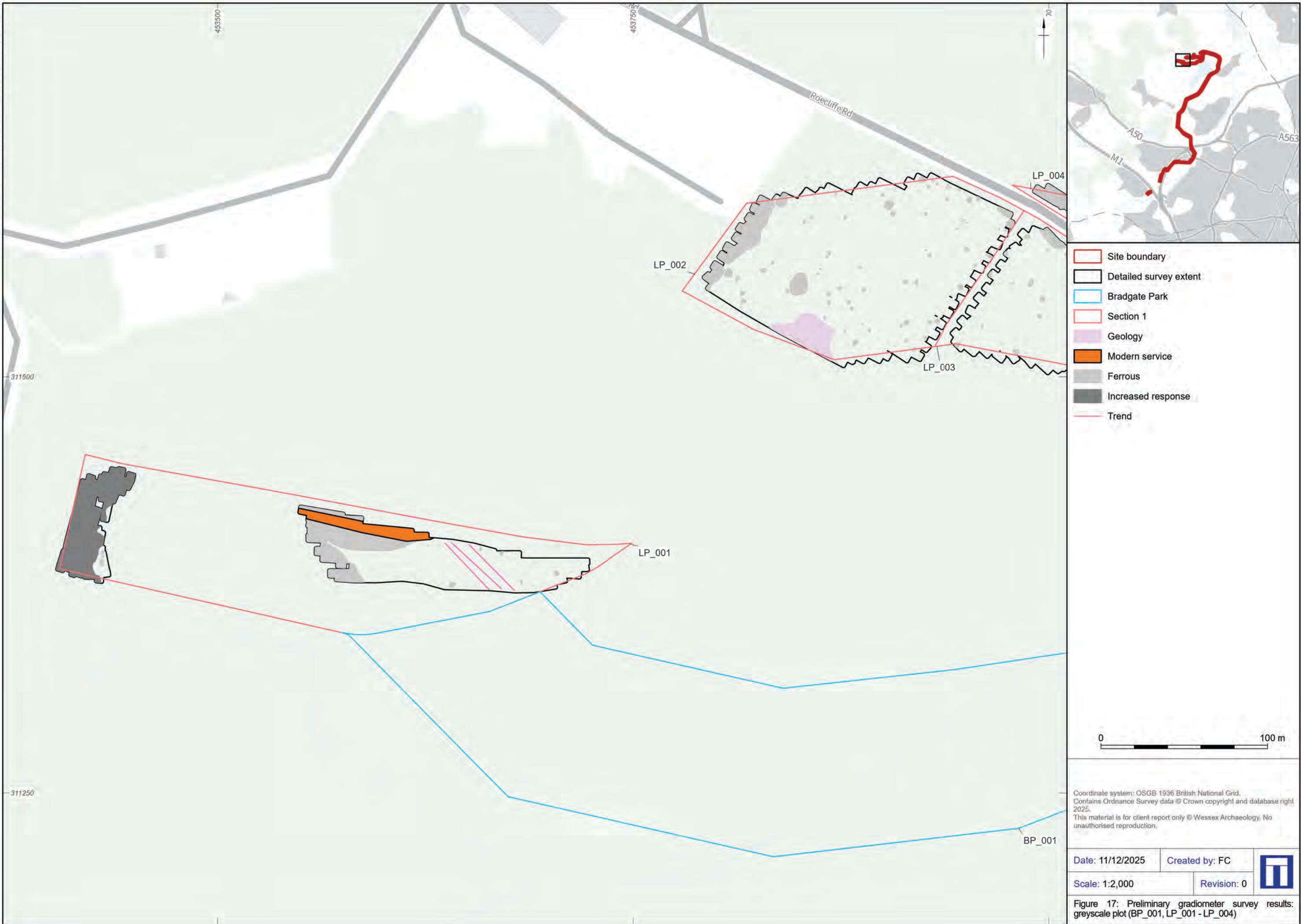
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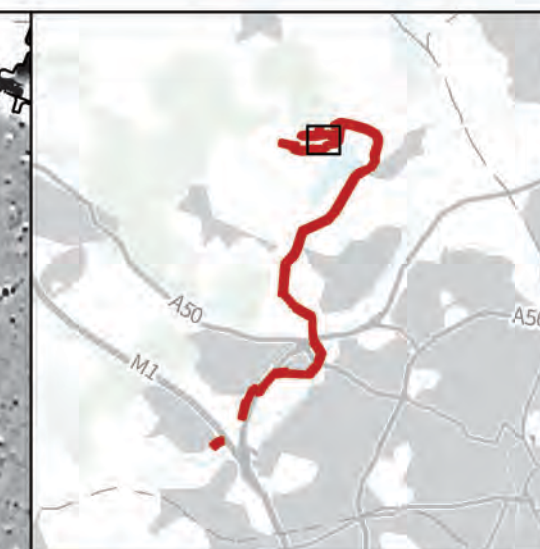
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Scale: 1:5,000	Revision: 0	

Figure 14: Overview gradiometer survey results: overall greyscale plots (LP_051 - LP_060)









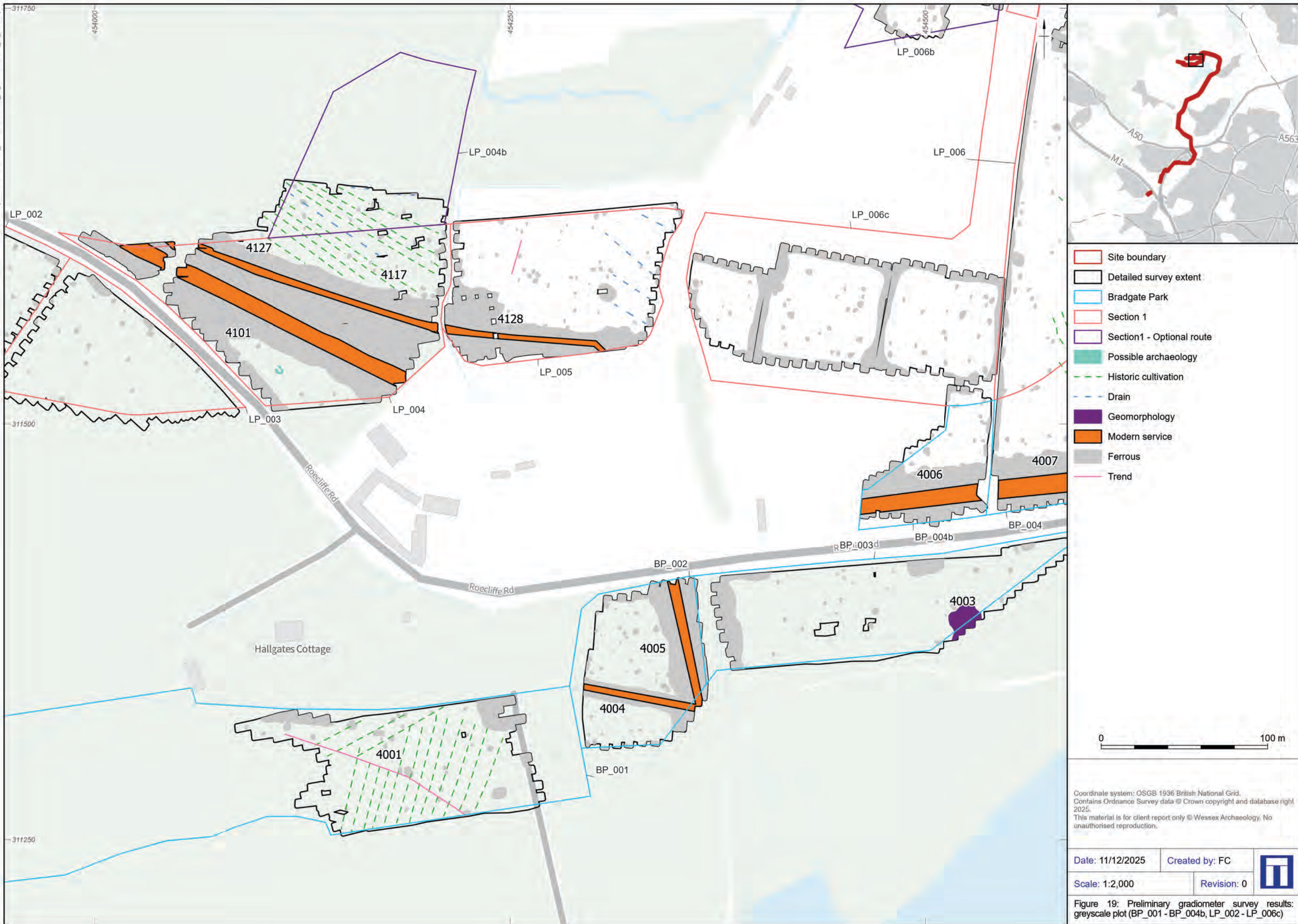
- Site boundary
- Detailed survey extent
- Bradgate Park
- Section 1
- Section1 - Optional route

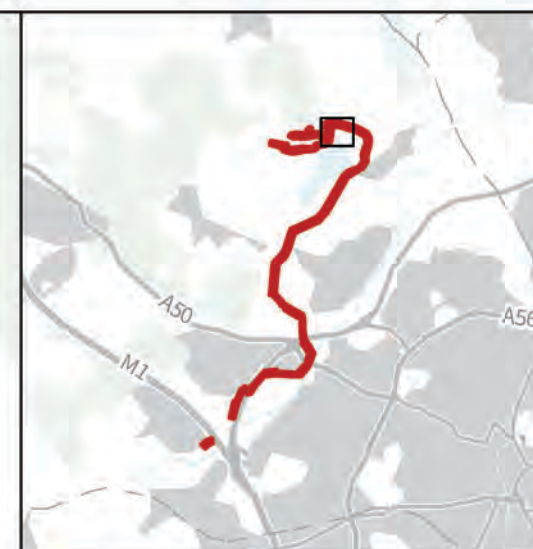
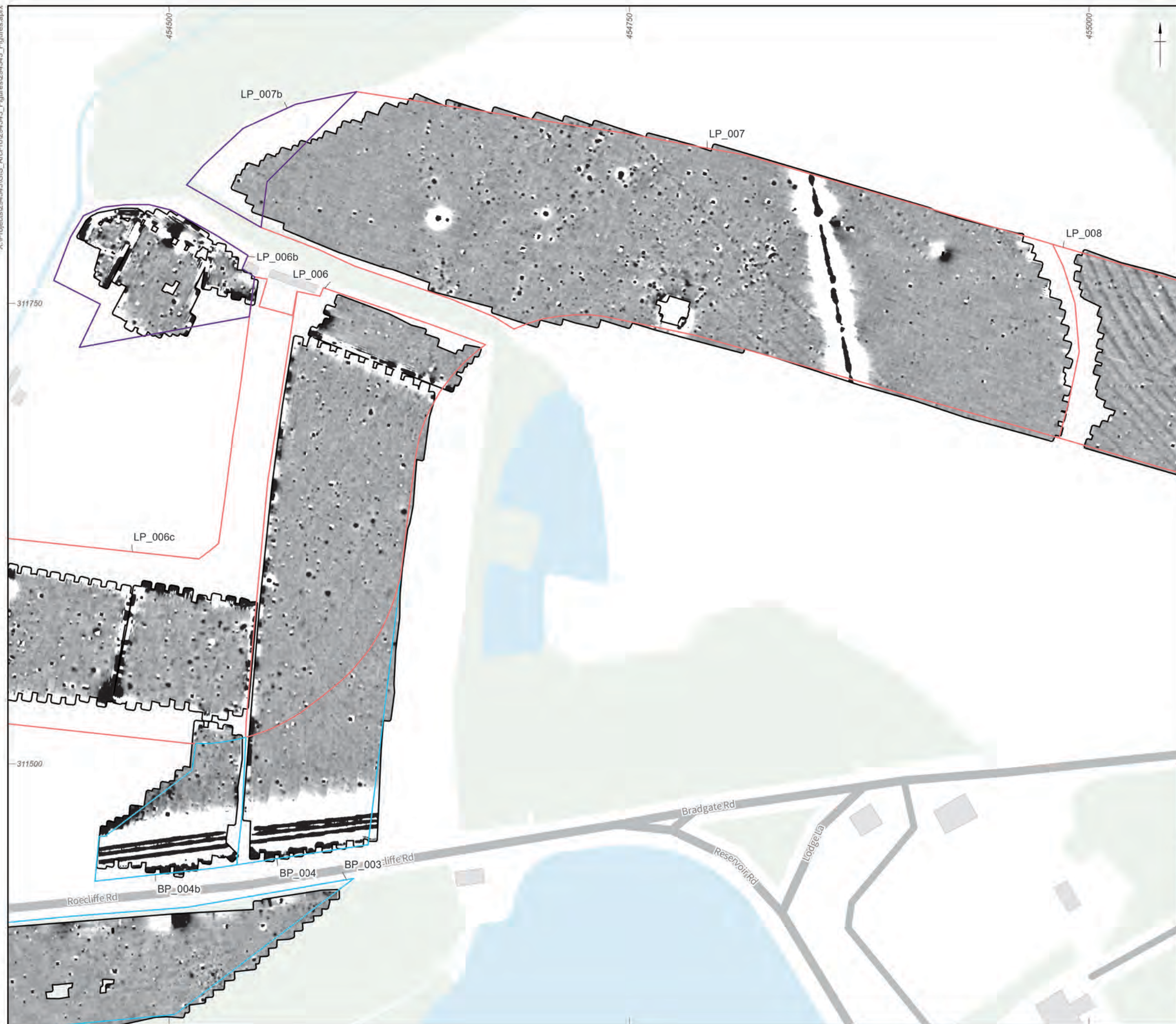


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Figure 18: Gradiometer survey results: greyscale plot (BP_001 - BP_004b, LP_002 - LP_006c)





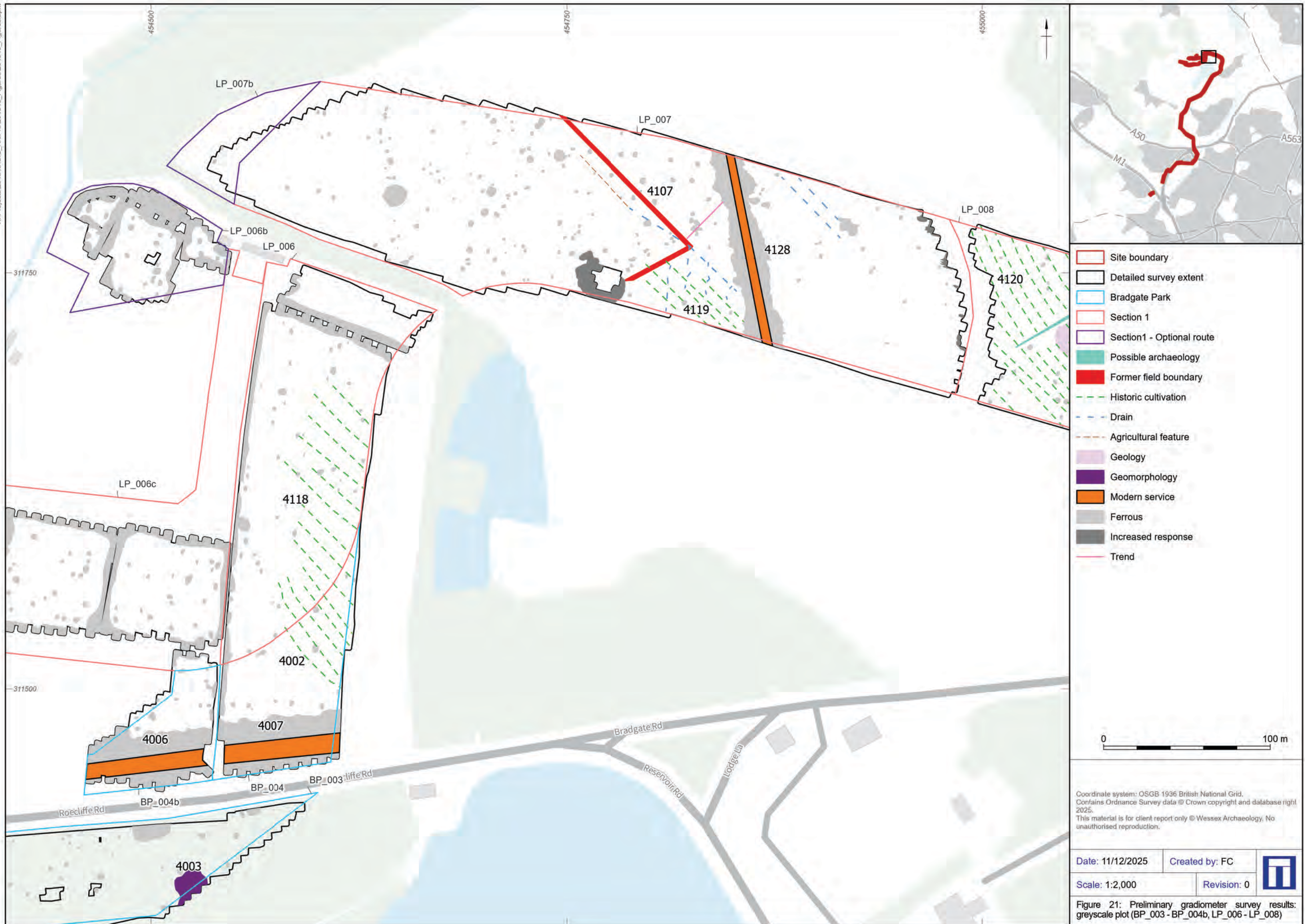
- Site boundary
- Detailed survey extent
- Bradgate Park
- Section 1
- Section1 - Optional route



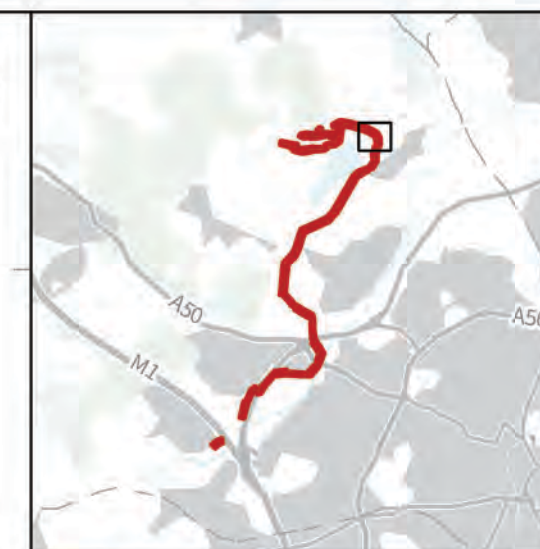
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Figure 20: Gradiometer survey results: greyscale plot (BP_003 - BP_004b, LP_006 - LP_008)



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- Site boundary
- Detailed survey extent
- Section 1

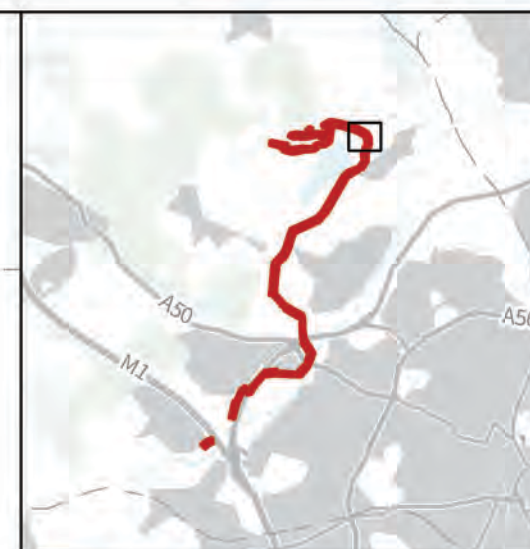
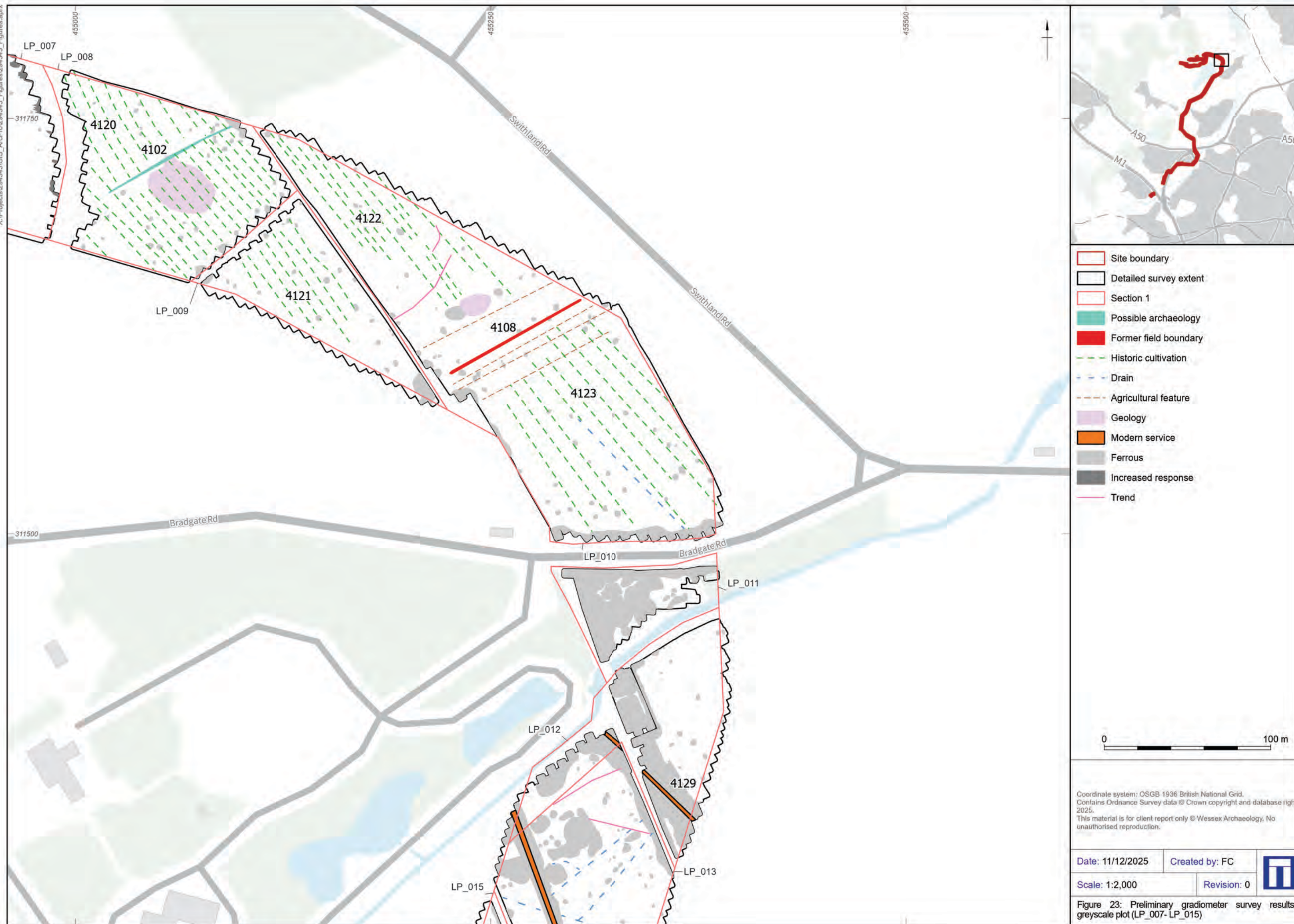


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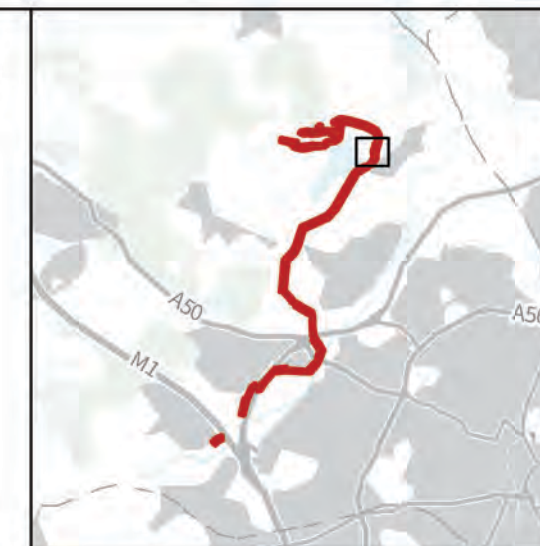
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Figure 22: Gradiometer survey results: greyscale plot (LP_007- LP_015)

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- Site boundary
- Detailed survey extent
- Section 1
- Possible archaeology
- Former field boundary
- Historic cultivation
- Drain
- Agricultural feature
- Geology
- Modern service
- Ferrous
- Increased response
- Trend

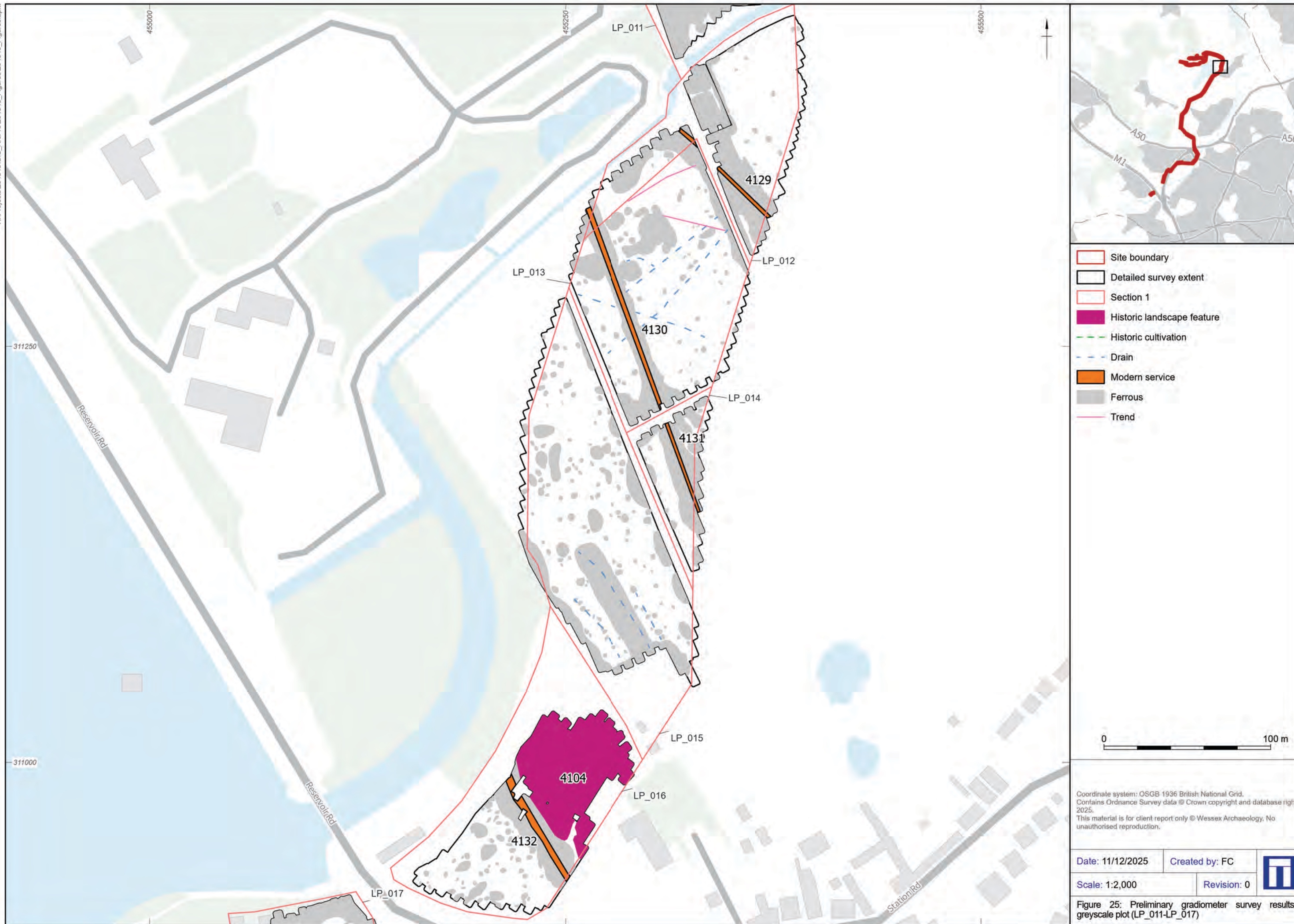


- Site boundary
- Detailed survey extent
- Section 1



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Figure 24: Gradiometer survey results: greyscale plot (LP_011-LP_017)		

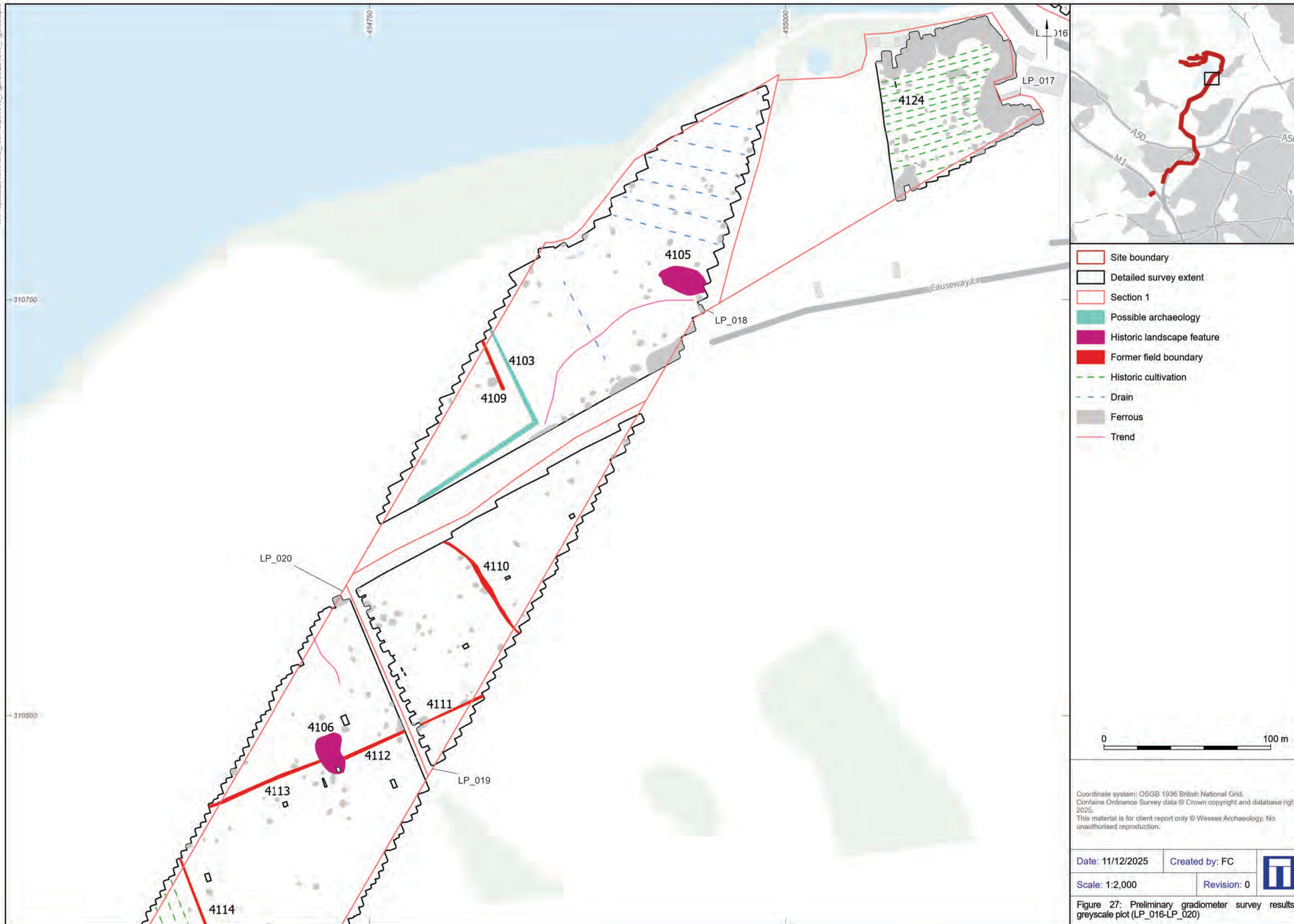


- Site boundary
- Detailed survey extent
- Section 1
- Historic landscape feature
- Historic cultivation
- Drain
- Modern service
- Ferrous
- Trend

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Figure 25: Preliminary gradiometer survey results greyscale plot (LP_011-LP_017)		





- Site boundary
- Detailed survey extent
- Section 1
- Possible archaeology
- Historic landscape feature
- Former field boundary
- Historic cultivation
- Drain
- Ferrous
- Trend

0 100 m

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Figure 27: Preliminary gradiometer survey results: greyscale plot (LP_016-LP_020)



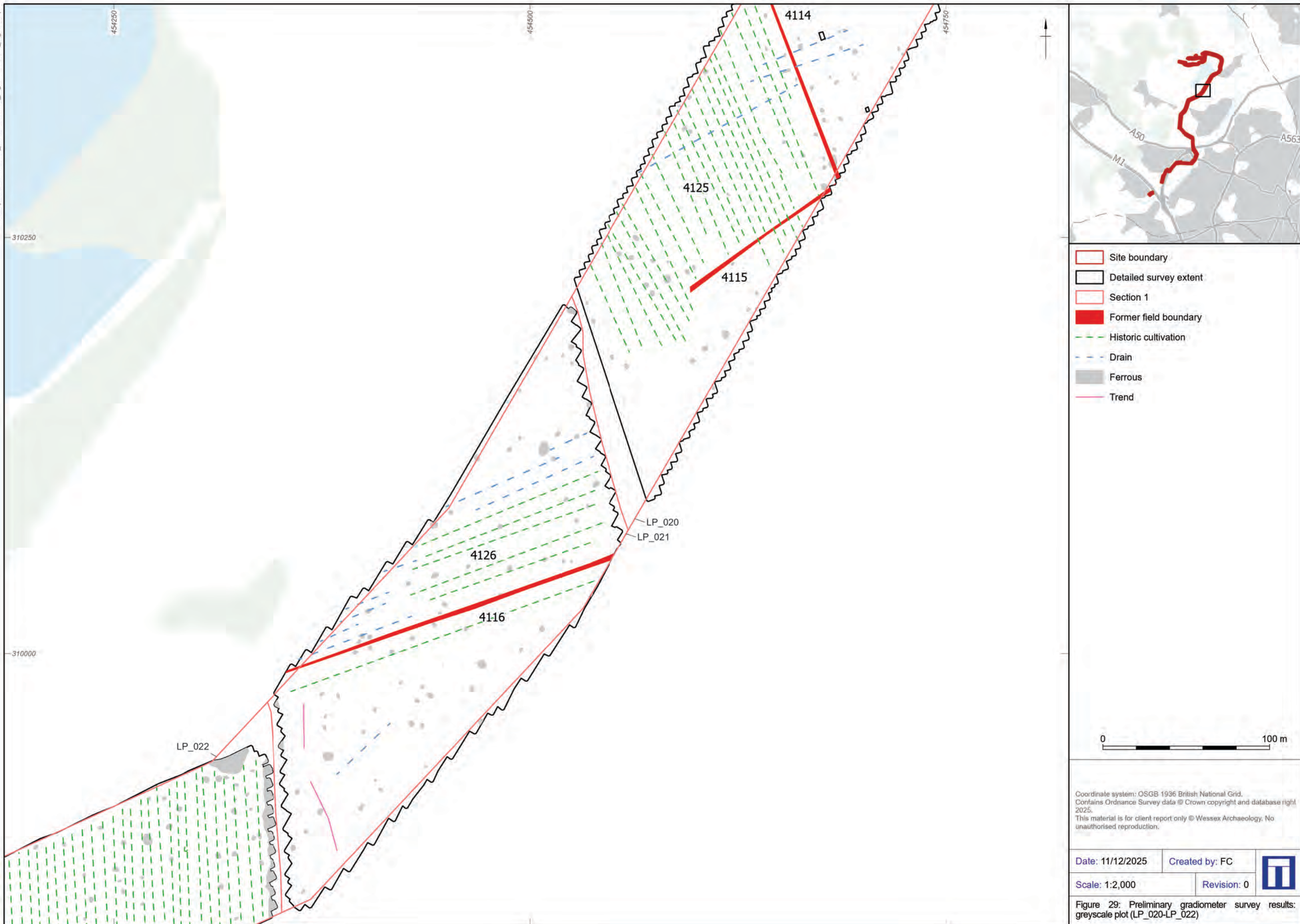
- Site boundary
- Detailed survey extent
- Section 1



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Figure 28: Gradiometer survey results: greyscale plot (LP_020-LP_022)



- Site boundary
- Detailed survey extent
- Section 1
- Former field boundary
- Historic cultivation
- Drain
- Ferrous
- Trend



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Figure 29: Preliminary gradiometer survey results: greyscale plot (LP_020-LP_022)

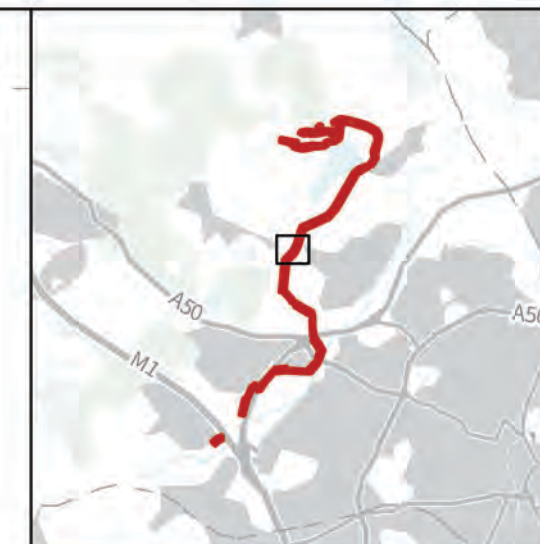


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Figure 31: Preliminary gradiometer survey results: greyscale plot (LP_021- LP_026)



-  Site boundary
 Detailed survey extent
 Section 1
 Section 2



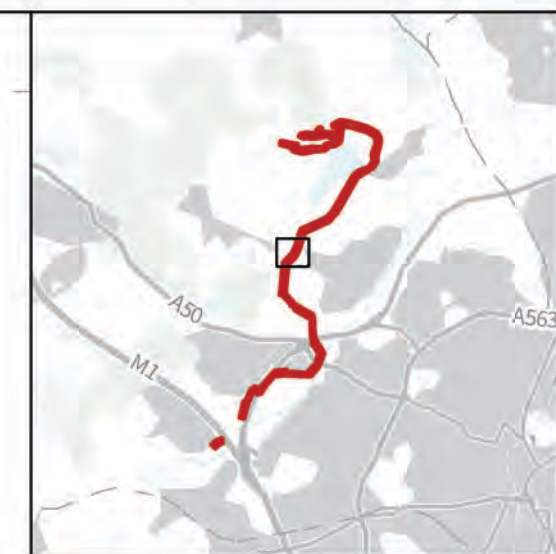
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Figure 32: Gradiometer survey results: greyscale plot (LP_025-LP_031)



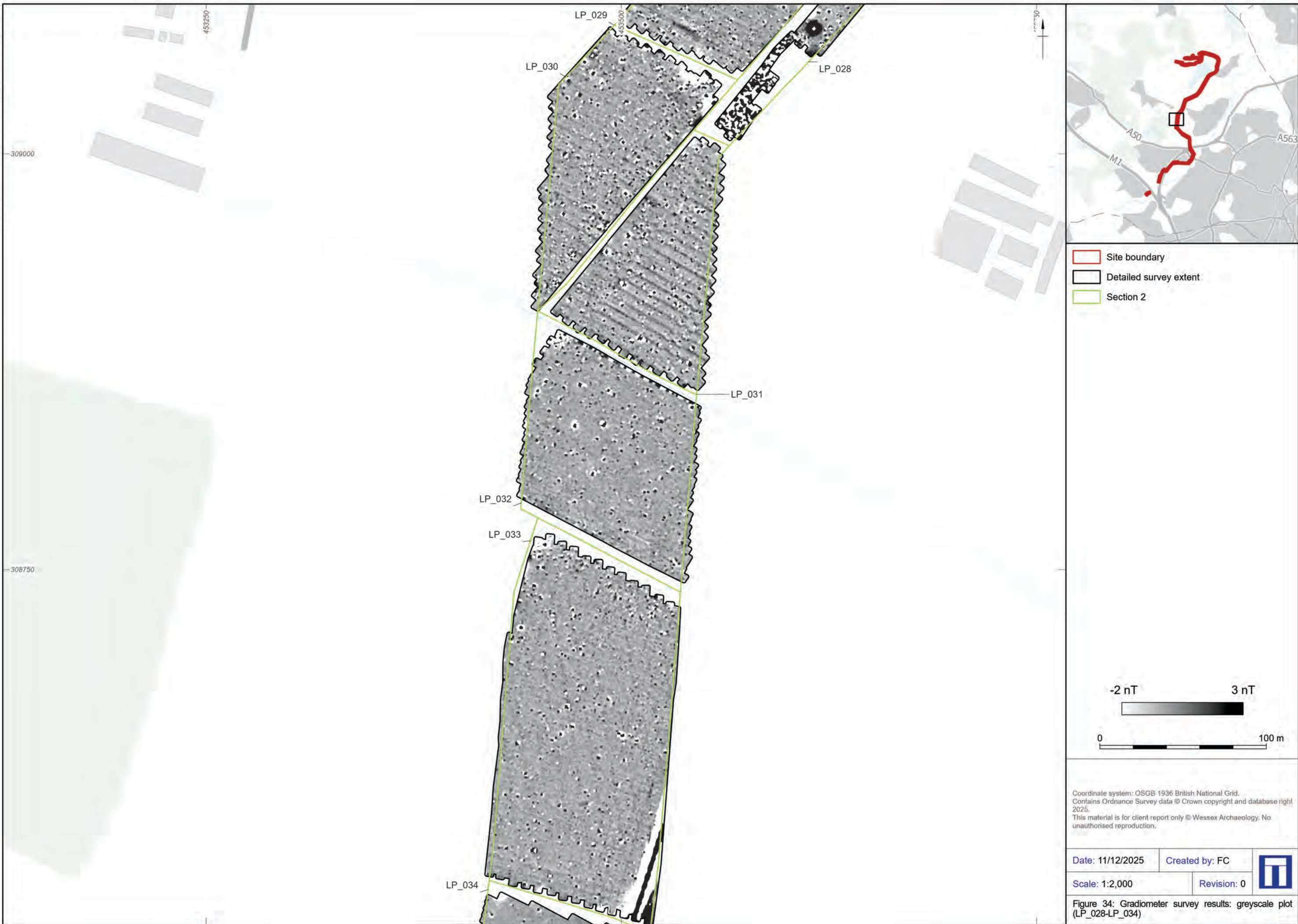
- Site boundary
- Detailed survey extent
- Section 1
- Section 2
- Possible archaeology
- Former field boundary
- Historic cultivation
- Drain
- Modern service
- Ferrous
- Increased response

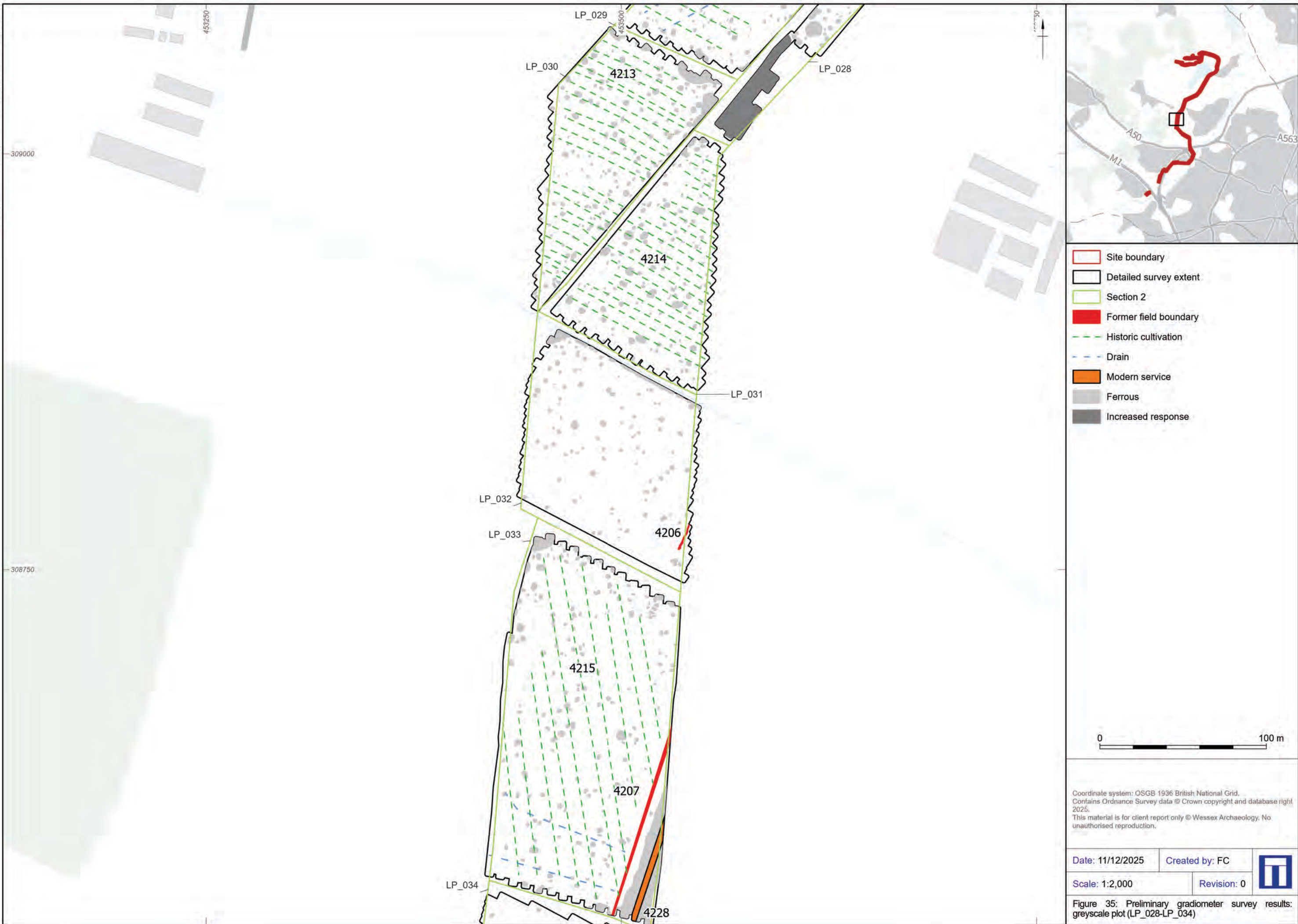


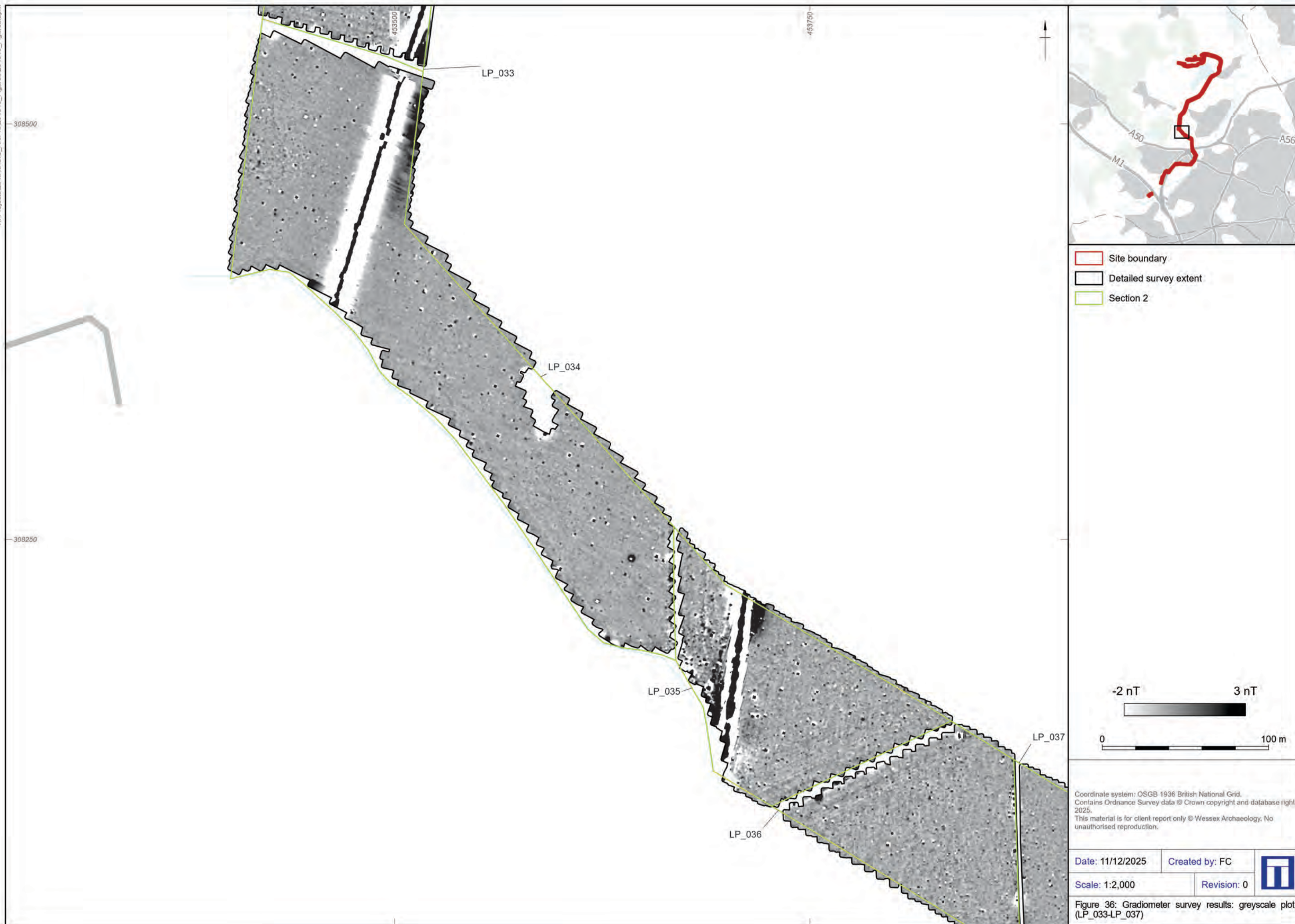
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Figure 33: Preliminary gradiometer survey results: greyscale plot (LP_025-LP_031)

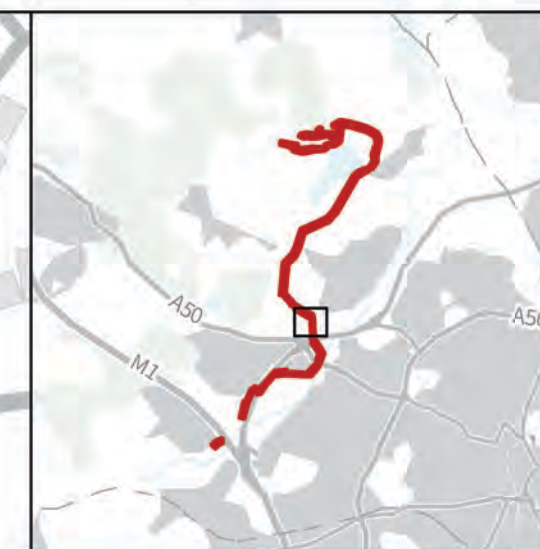
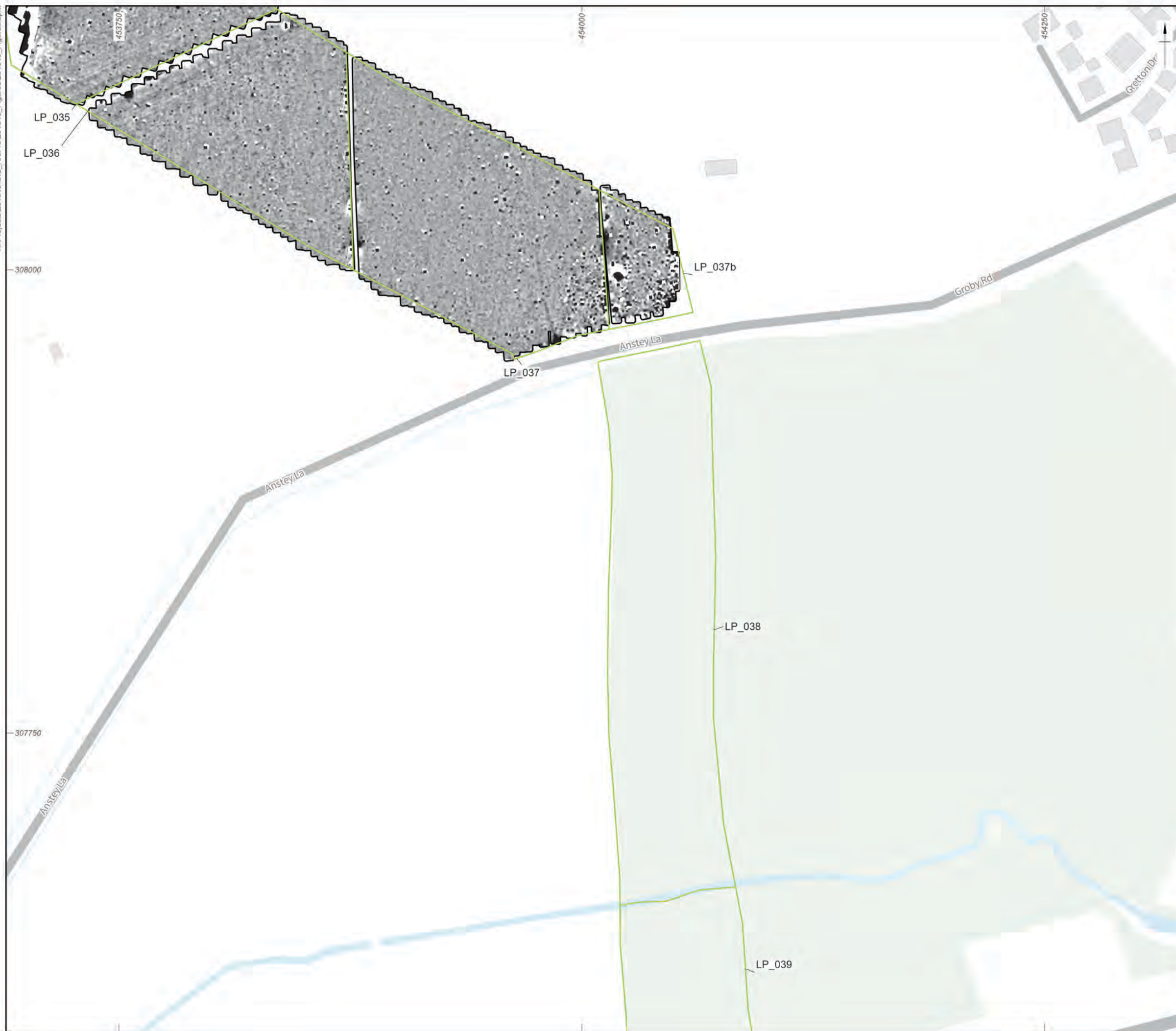








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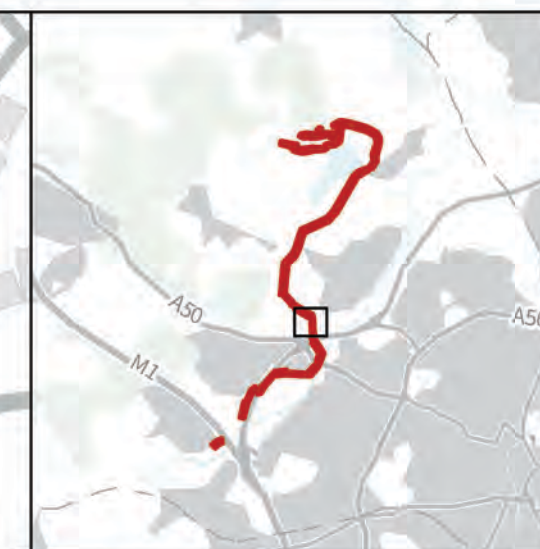
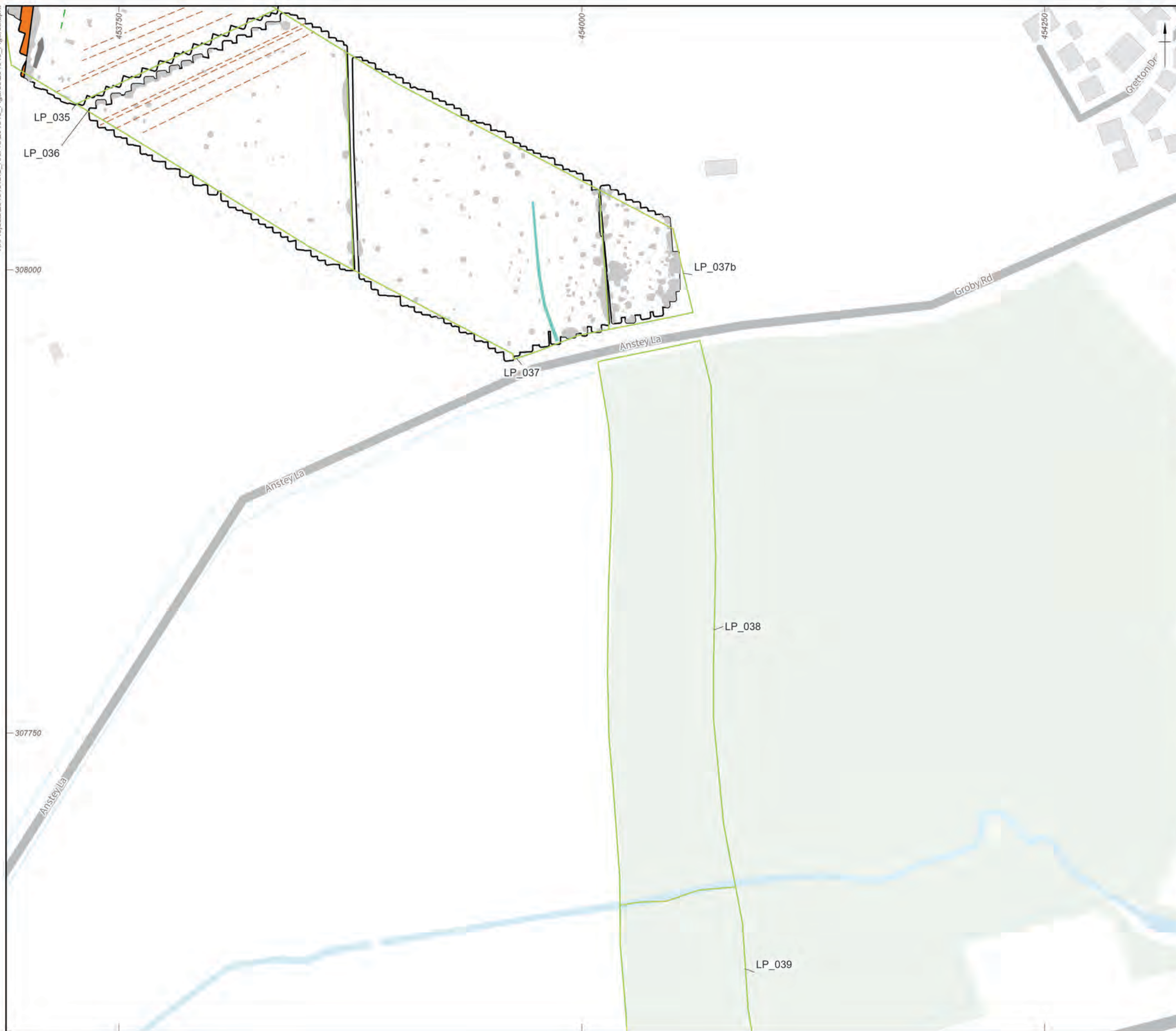
- Site boundary
- Detailed survey extent
- Section 2



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Figure 38: Gradiometer survey results: greyscale plot (LP_035-LP_039)		

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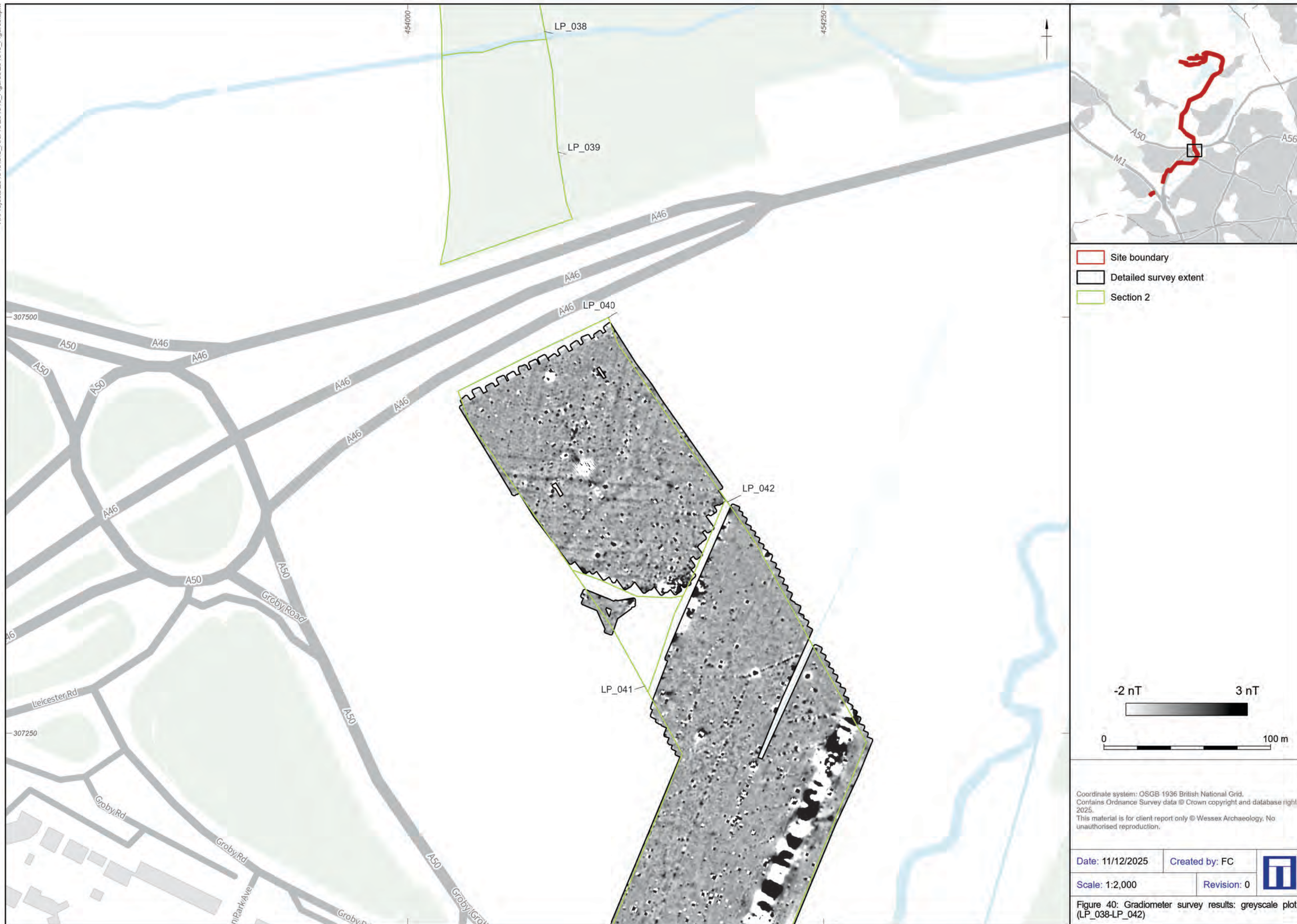
- Site boundary
- Detailed survey extent
- Section 2
- Possible archaeology
- Historic cultivation
- Agricultural feature
- Modern service
- Ferrous
- Increased response

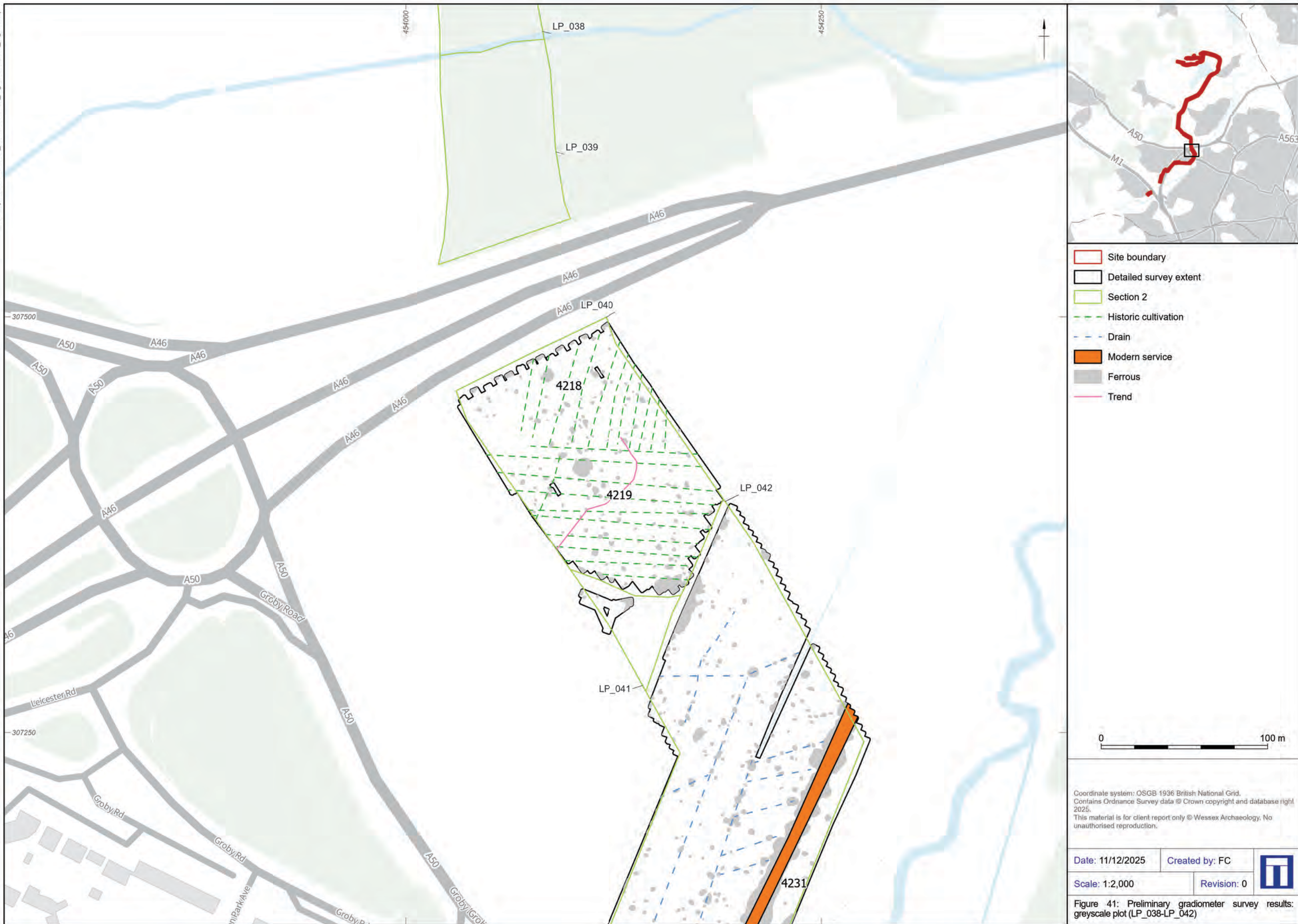


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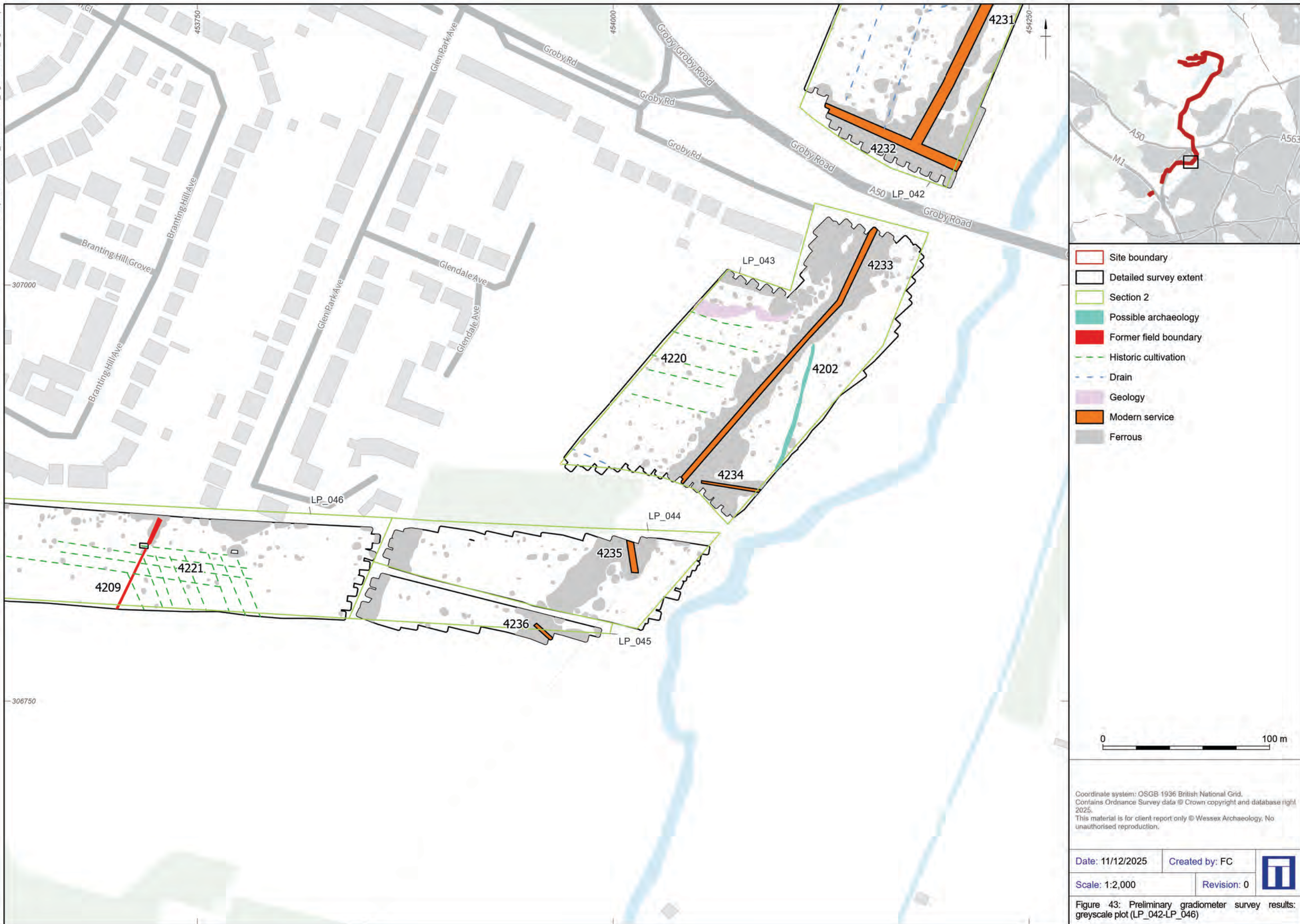
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Scale: 1:2,000	Revision: 0	

Figure 39: Preliminary gradiometer survey results: greyscale plot (LP_035-LP_039)









- Site boundary
- Detailed survey extent
- Section 2
- Possible archaeology
- Former field boundary
- Historic cultivation
- Drain
- Geology
- Modern service
- Ferrous



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Figure 43: Preliminary gradiometer survey results: greyscale plot (LP_042-LP_046)		



- Site boundary
- Detailed survey extent
- Section 2



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Figure 44: Gradiometer survey results: greyscale plot (LP_046-LP_052)

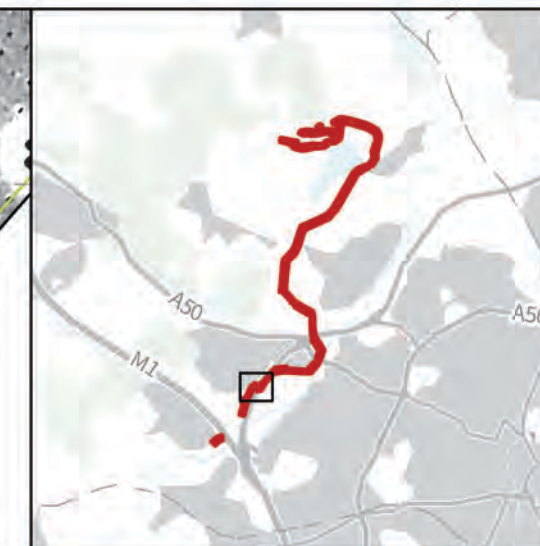


- Site boundary
- Detailed survey extent
- Section 2
- Possible archaeology
- Historic landscape feature
- Historic cultivation
- Geology
- Ferrous
- Increased response
- Trend

0 100 m

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Figure 45: Preliminary gradiometer survey results greyscale plot (LP_046-LP_052)		



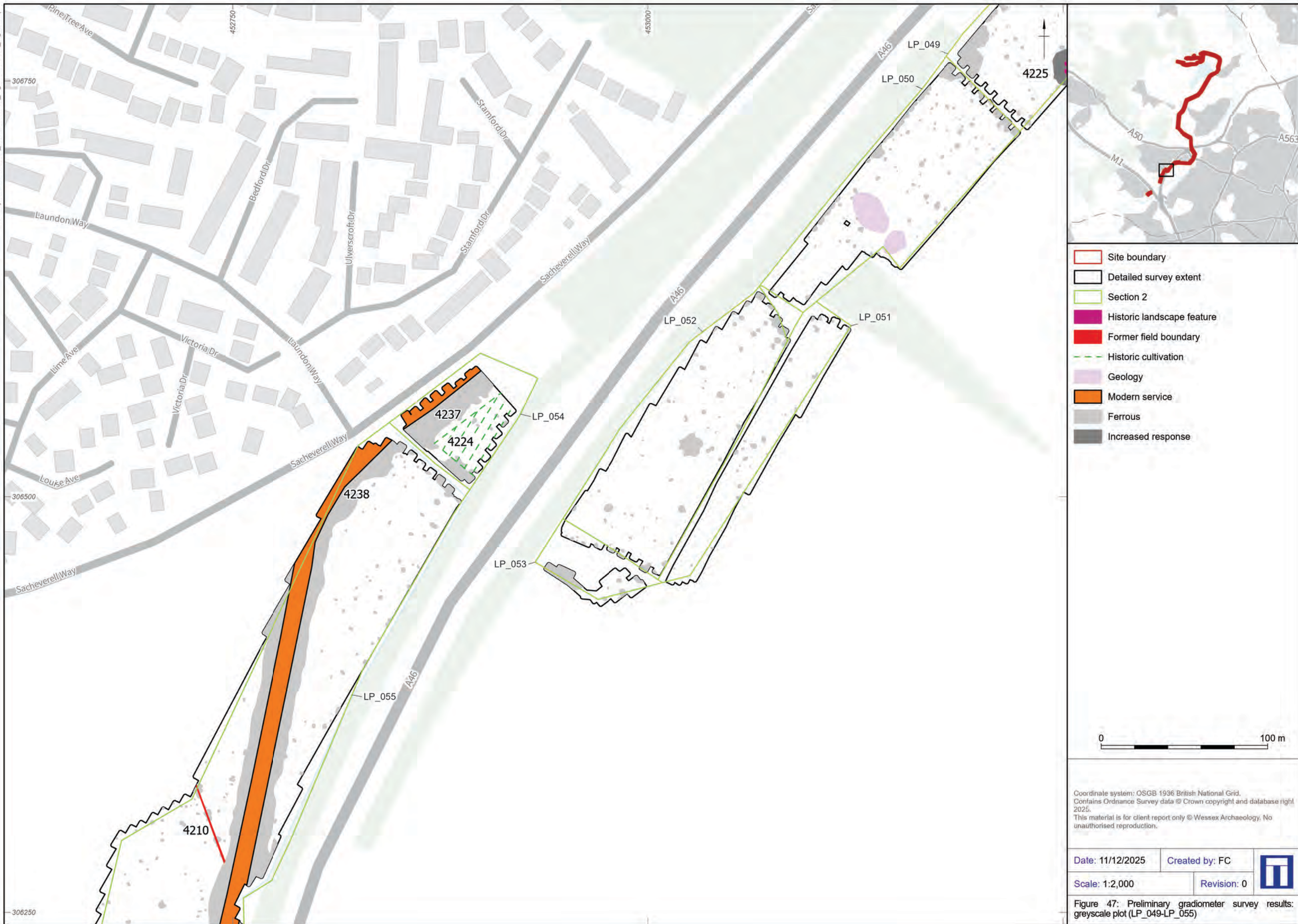
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- Detailed survey extent
- Section 2

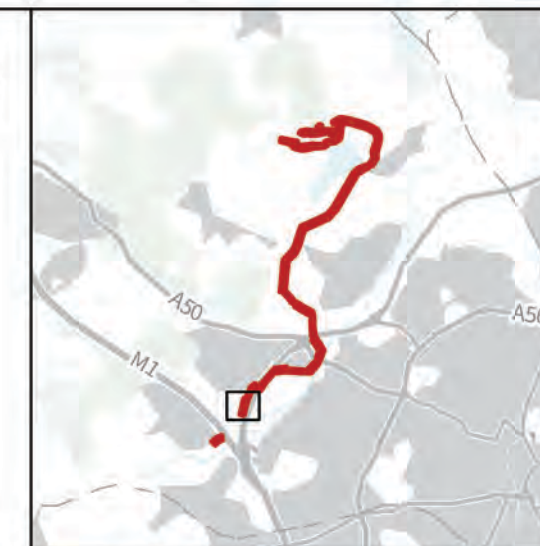


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Figure 46: Gradiometer survey results: greyscale plot (LP_049-LP_055)





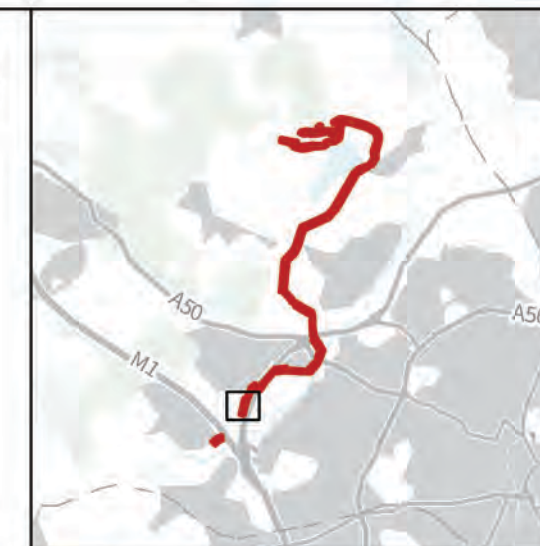
- Site boundary
- Detailed survey extent
- Section 2



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Figure 48: Gradiometer survey results: greyscale plot (LP_055-LP_057)



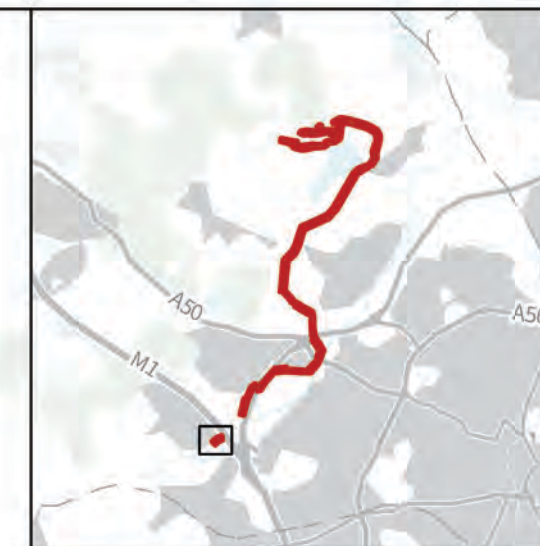
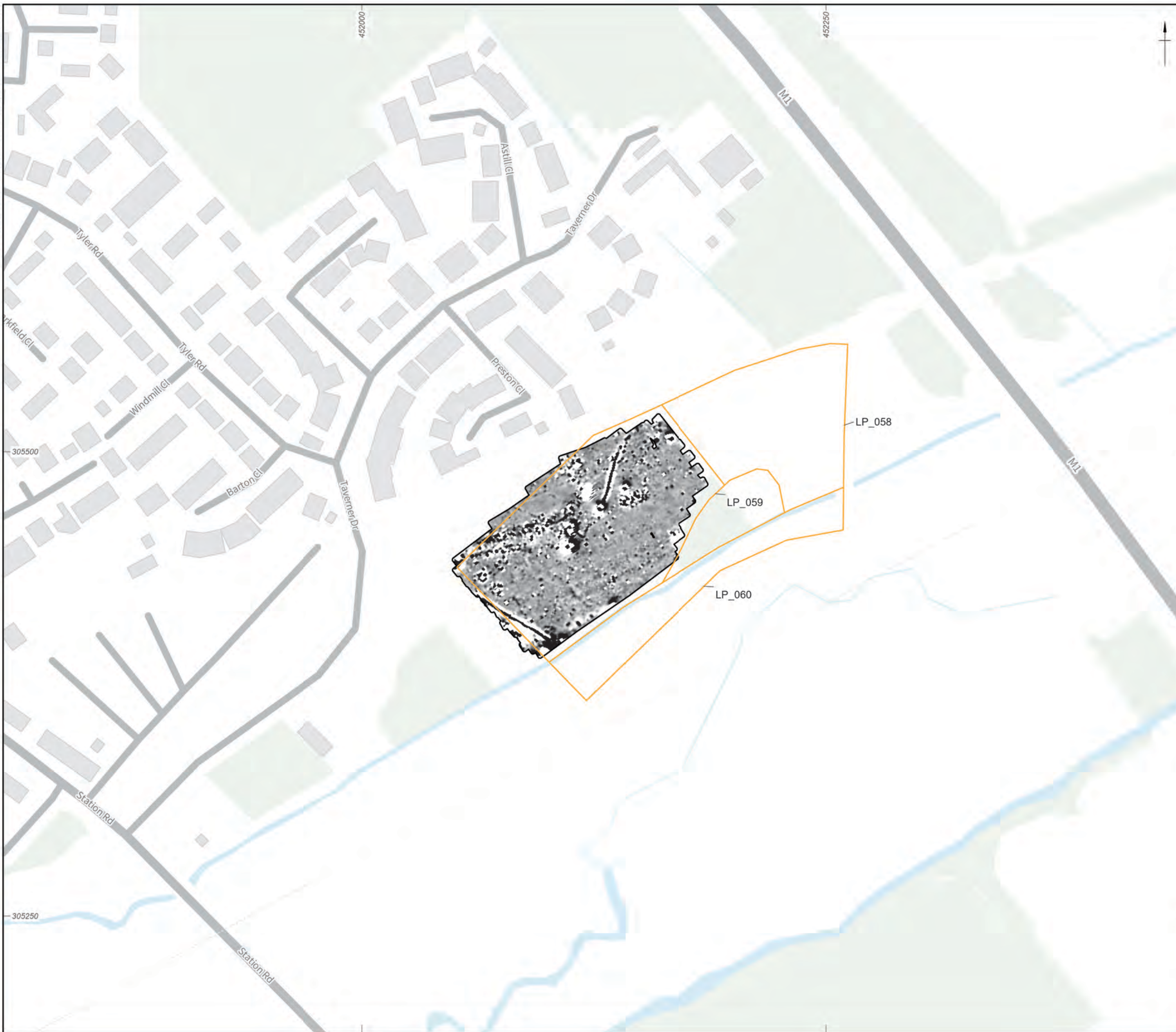
- Site boundary
- Detailed survey extent
- Section 2
- Former field boundary
- Modern service
- Ferrous

0 100 m

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Figure 49: Preliminary gradiometer survey results: greyscale plot (LP_055-LP_057)



- Site boundary
- Detailed survey extent
- Section 3

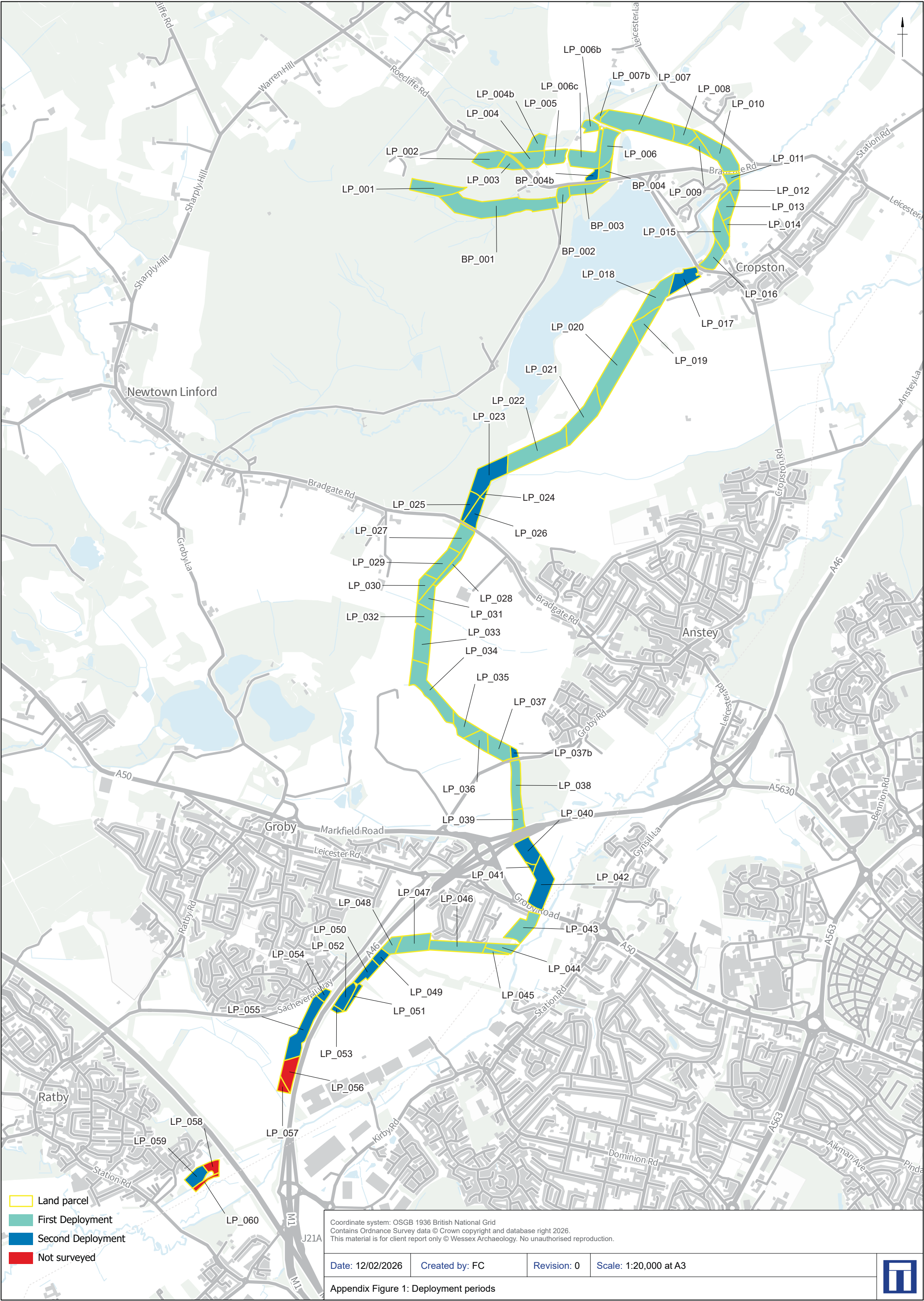


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Figure 50: Gradiometer survey results: greyscale plot (LP_058-LP_060)







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