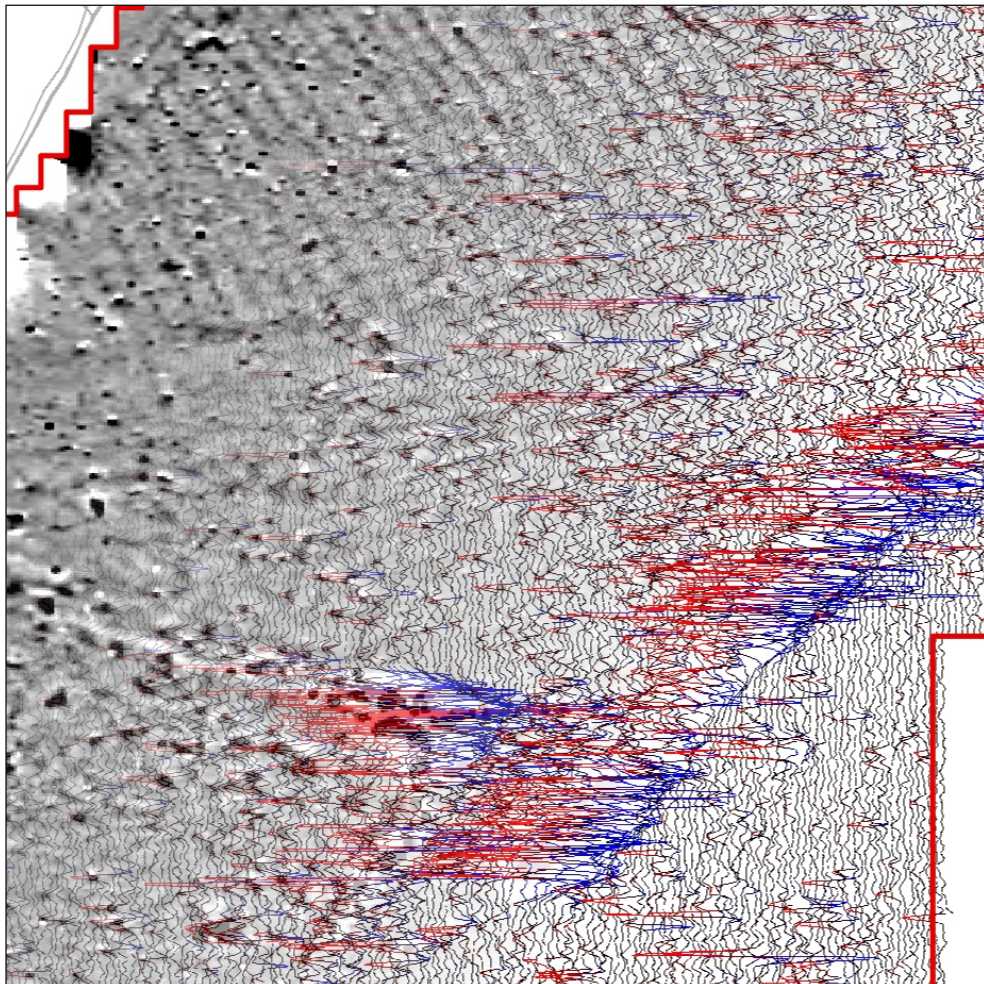




making sense of heritage

Land at Forest Farm Chippenham, Wiltshire

Recorded Scanning and
Detailed Gradiometer Survey Report



Ref: 109920.02
August 2015



Land at Forest Farm, Chippenham, Wiltshire

Recorded Scanning and Detailed Gradiometer Survey Report

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* I= Internal Draft; E= External Draft; F= Final

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Land at Forest Farm Chippenham, Wiltshire

Recorded Scanning and Detailed Gradiometer Survey Report

Contents

Summary.....	iii
Acknowledgements.....	iv
1 INTRODUCTION.....	1
1.1 Project background	1
1.2 Site location and topography	1
1.3 Soils and geology.....	2
1.4 Archaeological background.....	2
2 METHODOLOGY.....	4
2.1 Introduction	4
2.2 Method	4
3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION	5
3.1 Introduction	5
3.1 Scanning Survey results and interpretation: Fields 1- 8 (Figure 3)	5
3.2 Detailed Survey results and interpretation	6
3.3 Modern Services	9
4 CONCLUSION.....	10
5 REFERENCES.....	11
5.1 Bibliography	11
5.2 Cartographic and documentary sources	11
5.3 Online resources.....	11
APPENDIX 1: METHOD STATEMENT	12
APPENDIX 2: SURVEY EQUIPMENT AND DATA PROCESSING.....	18
APPENDIX 3: GEOPHYSICAL INTERPRETATION	20

Figures

Figure 1	Site location and survey extents
Figure 2	Recorded Scanning Results
Figure 3	Scanning survey interpretation
Figure 4	Greyscale (north-west)
Figure 5	XY Trace (north-west)



Figure 6	Interpretation (north-west)
Figure 7	Greyscale (south-east)
Figure 8	XY Trace (south-east)
Figure 9	Interpretation (south-east)
Figure 10	Greyscale (north)
Figure 11	XY Trace (north)
Figure 12	Interpretation (north)



Land at Forest Farm Chippenham, Wiltshire

Recorded Scanning and Detailed Gradiometer Survey Report

Summary

A recorded scanning survey and detailed gradiometer survey were conducted over land at Forest Farm, Chippenham, Wiltshire (centred on NGR 393950, 171700). The project was commissioned by Terence O'Rourke Limited on behalf of Gleeson Strategic Land. The aim was to establish the presence, or otherwise, and nature of detectable archaeological features in support of a future planning application for development at the site.

The site comprises 8 arable and pasture fields located to the south of London Road, approximately 2.9km southeast of Chippenham. The scanning survey covered an area of 42.9ha with a detailed gradiometer survey of 25% covering 10.8ha. The detailed gradiometer survey targeted anomalies of archaeological potential identified during the recorded scanning survey. This report includes the method and results for both the recorded scanning and the detailed gradiometer survey. The recorded scanning survey was undertaken between 6th and 9th July 2015 with a follow-up detailed gradiometer survey undertaken between 16th and 20th July 2015.

The scanning survey identified a number of potential archaeological anomalies and areas of interest which were then targeted by detailed gradiometer survey as well as a supposed 'blank' area. The follow-on detailed gradiometer survey of these areas demonstrated the presence of anomalies of definite, probable and possible archaeological interest, along with regions of increased magnetic response, areas of ridge and furrow, ploughing trends, and at least one modern service.

The anomalies of archaeological interest are primarily ditch-type features with two distinct morphologies visible of either curvilinear and smaller rectangular enclosure ditches or distinct 'ladder' type ditches in the southwest of the survey area. Areas of ridge and furrow have been identified which correspond to the recorded locations of this activity.

The remaining features detected include a backfilled area corresponding to the route of the Wiltshire and Berkshire canal channel and towing path, ploughing trends, field drains, areas of ferrous debris and at least one modern service.



Land at Forest Farm, Chippenham, Wiltshire

Detailed Gradiometer Survey Report

Acknowledgements

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The fieldwork was undertaken by Jen Smith, Alistair Black, Diana Chard, Alistair Salisbury and Rebecca Hall. Jen Smith, Genevieve Shaw, Diana Chard and Alistair Salisbury processed and interpreted the geophysical data. Jen Smith and Genevieve Shaw wrote the report. The geophysical work was quality controlled by Lizzie Richley, Garreth Davey and Lucy Learmonth. Illustrations were prepared by Richard Milwain. The project was managed on behalf of Wessex Archaeology by Lucy Learmonth.



Land at Forest Farm Chippenham, Wiltshire

Recorded Scanning and Detailed Gradiometer Survey Report

1 INTRODUCTION

1.1 Project background

1.1.1 Wessex Archaeology (WA) was commissioned by Terence O'Rourke Limited on behalf of Gleeson Strategic Land to carry out a geophysical survey over land at Forest Farm, Chippenham, Wiltshire (hereafter "the Site", centred on NGR 393950, 171700) (**Figure 1**). The survey forms part of an ongoing programme of informative archaeological evaluation in support of a future planning application for the development of the Site.

1.1.2 A Method Statement (MS) was prepared by WA (T20557.01; see **Appendix 1**) which clearly detailed the rationale and methodology of recorded scanning survey with subsequent detailed gradiometer survey. The desk-based assessment (DBA) identified a low potential for archaeological sites but qualified that this conclusion was limited by the extent and quality of existing information. Further archaeological work in the form of geophysical survey was deemed appropriate and effective in the first instance (Terence O'Rourke, 2015).

1.1.3 The initial phase of the survey comprised recorded scanning of the entire Site with a second and detailed phase of survey covering 25% of the Site and targeting anomalies of archaeological potential as well as a supposed 'blank' area identified through the initial scanning phase.

1.1.4 The aim of the geophysical survey was to establish the presence/absence, extent and character of detectable archaeological remains within the survey area.

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

1.2 Site location and topography

1.2.1 The Site is located c.1.4km south southeast of the village of Pewsham and c.2.9km southeast of Chippenham, it lies to the south of London Road (A4).

1.2.2 The Site surrounds Forest Farm and outbuildings, occupying an area of 42.9ha of agricultural land currently under mixed pasture and arable use. The Site is bounded by London Road (A4) to the north and east, Pewsham Way to the northwest and further agricultural land to the south. There is a wooded area in the west of the survey area and the Site is partially bordered in the northeast by the disused Wilts & Berks Canal which connected the River Avon to the River Marden south of Chippenham.



1.2.3 The total area of the Site is 42.9ha, and the recorded scanning survey was carried out over all available areas of the Site. This was then followed by a 25% detailed gradiometer survey in targeted regions of the Site totalling 10.8ha.

1.2.4 The centre of the Site lies at approximately 55m above Ordnance Datum (aOD) in the vicinity of Forest Farm and inclines to approximately 60m aOD towards the northwest and southeast extents of the Site.

1.3 Soils and geology

1.3.1 The solid geology comprises Mudstone, Siltstone and Sandstone of the Oxford Clay Formation and Kellaways Formation with no overlying superficial geological deposits recorded within the Site, however, in the vicinity are recorded alluvial fan deposits of clay and silt (BGS 2015).

1.3.2 The soils underlying the Site are likely to consist of Pelo-stagnogley soils of the 712b (Denchworth) association with possibly some areas to the west consisting of typical stagnogley soils of the 711g (Wickham 3) association (SSEW SE Sheet 5-2 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

1.4 Archaeological background

1.4.1 There are no World Heritage Sites, Scheduled Monuments, Registered Parks and Gardens, Conservation Areas or Historic Battlefields identified within the Site.

1.4.2 A summary of the recorded sites within the Site and a 1km radius is found below.

MonUID	Name	Summary
MWI64451	Mesolithic Arrowhead, Foxcroft Walk, Pewsham	Mesolithic Arrowhead found in the garden of 14 Foxcroft Walk, Pewsham
MWI3655	Pewsham	Assemblage of Neolithic flint tools
MWI5227	Pewsham	Two Romano-British coins
MWI5236	Pewsham Forest	A Medieval deer park
Pastscape ID1580044	Plough Headland and Ridge and Furrow	Two adjacent fields of medieval and post-medieval ridge and furrow separated by a plough headland which were seen on aerial photographs taken in 1951. The rig has since been levelled through ploughing, but the ploughing headland still survives as an earthwork bank. WITHIN THE SITE
Pastscape ID1579987	Ridge and Furrow	An area of medieval or post-medieval ridge and furrow cultivation visible on RAF aerial photographs taken in 1951, but apparently largely levelled by 2005.



		WITHIN THE SITE
Pastscape ID1579858	Ridge and Furrow	Two fields of probable post medieval ridge and furrow visible as earthworks on RAF photographs taken to the east of Pewsham House. The rig may be as a result of pasture improvement and drainage.
MWI5026	Gate Farm	Place name evidence for the Medieval forest of Pewsham
MWI5196	Hangar Park Farm	Place name evidence for the Medieval forest of Pewsham
MWI9472	Wiltshire and Berkshire Canal	The Wiltshire and Berkshire Canal was authorised in 1795 and during the 19 th century carried considerable traffic. After the arrival of the railway, canal traffic dwindled and it was finally closed in 1910.
List Entry Number: 1239933	Pewsham House	Grade II Listed Country House built in 1892

- 1.4.3 The map regression exercise (Terence O'Rourke, 2015) indicated that the Site area has been in use as pasture and/or arable fields from at least the 19th century to present, however field boundaries have changed with internal field boundaries being removed over time (Ordnance Survey 1886). Beneath what is now the wooded area was a clay extraction pit and brickworks which appears on the Ordnance Survey (OS) mapping between 1828 and 1886 along with Forest Farm itself (OS 1828; OS 1886). Bordering the southwest side of this wooded area was the route of the old canal and towpath (MWI9472 Wiltshire and Berkshire Canal).



2 METHODOLOGY

2.1 Introduction

- 2.1.1 The recorded scanning and detailed gradiometer survey were conducted using a Bartington Grad 601-2 dual fluxgate gradiometer system. The detailed gradiometer survey was conducted in accordance with English Heritage guidelines (English Heritage 2008).
- 2.1.2 The geophysical survey was undertaken by Wessex Archaeology's in-house geophysics team between the 6th and 9th July and between the 16th and 20th July 2015. Field conditions at the time of the survey were good, with mostly dry conditions throughout the period of survey. An overall coverage of approximately 40.3 ha for recorded scanning and 10.8ha for detailed gradiometer survey were achieved.

2.2 Method

Recorded Scanning Gradiometer Survey

- 2.2.1 Individual survey grid nodes were established at 30m x 20m intervals using a Leica Viva RTK GNSS system, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008). The scanning survey was conducted along transects spaced 10m apart, collecting data at 0.25m intervals.
- 2.2.2 The georeferenced scanning data was processed using MagPick with the smooth function (linear) used to correct for any variation between the two Bartington sensors used. No additional processing was applied to the scanning data.
- 2.2.3 Detailed survey was located over areas of increased response and suspected archaeology identified in the scanning data along with collecting control blocks over areas thought to be empty based on the scanning results.

Detailed Gradiometer Survey

- 2.2.4 Individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008).
- 2.2.5 The detailed 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 English Heritage guidelines (2008). Data were collected in the zigzag method.
- 2.2.6 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse function (± 5 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 throughout the survey area, with no interpolation applied.
- 2.2.7 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 2**.



3 GEOPHYSICAL SURVEY RESULTS AND INTERPRETATION

3.1 Introduction

- 3.1.1 The scanning and detailed gradiometer surveys have identified anomalies of likely, probable and possible archaeological interest across the Site, along with areas of increased magnetic response, ridge and furrow and a large amount of ferrous. Results are presented as a series of greyscale plots, XY plots and archaeological interpretations at a scale of 1:2000 (**Figures 2 to 12**). The data are 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 definite, probable and potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends. Full definitions of the interpretation terms used in this report are provided in **Appendix 3**.
- 3.1.3 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.

3.1 Scanning Survey results and interpretation: Fields 1- 8 (**Figure 3**)

- 3.1.1 The scanned survey area highlighted a number of features of potential archaeological interest. These were primarily in the form of larger linear anomalies visible across the 10m spaced scanning lines as well as discrete positive anomalies and areas of increased magnetic response not thought to be associated with modern field boundaries or the farm and its outbuildings.
- 3.1.2 A key area of interest was to the west of the site where three perpendicular positive linear anomalies (**3000**) are interpreted as possible archaeology. These have been targeted by the detailed survey and discussion of results will follow.
- 3.1.3 Areas of increased magnetic response have been highlighted as they may indicate areas of archaeological activity such as a spread of magnetically enhanced debris produced by settlement activity through to modern rubbish; **3001** and **3002** were targeted by detailed survey to gain a better understanding of their origin and extent. When investigated in detail, some of these may pertain to archaeological features, though it is also possible that some may be clusters of ferrous readings which are non-archaeological in nature.
- 3.1.4 An area of parallel regularly spaced and repeating linear anomalies at **3003** exists to the south of the survey area, and are oriented in a northwest to southeast direction. From their response and spacing they are potentially ridge and furrow which has been recorded within the Site (Pastscape ID1580044; Pastscape ID1579987). This area will be discussed in the detailed survey results, which characterises further the size, direction and extent of this activity.
- 3.1.5 Some trends to the east of the survey area could indicate field drainage systems (**3004**) and a sample area was surveyed in the full detailed survey to confirm their nature and ascertain whether they were of an archaeological nature.
- 3.1.6 Ferrous responses can be seen throughout the scanning dataset. For example, large dipolar readings can be seen across the Site such as those at **3005** and **3006**. These do not represent archaeological features and were not targeted for the detail survey as they are assumed to be modern in origin.



3.1.7 A modern service, **3007**, runs through the north of the site in a northwest to south east direction. This modern feature is dominated by ferrous readings which create a halo effect, exaggerating its size and extent. This feature was not targeted for the detail survey, as it is clear from the scanning results that it is non-archaeological.

3.1.8 Overall the scanning data has revealed several areas that required a detailed survey to ascertain if archaeological features are present; some control areas have also been targeted to check the legitimacy of the scanning method and its results.

3.2 Detailed Survey results and interpretation

3.2.1 **Area A:** This area was targeted as a supposed 'blank' area and it contains several weakly positive and parallel linear trends at **4001** in the same orientation as the current field boundary..It is likely that the majority of these trends are the result of ploughing, or other agricultural activity and are presumed to be post-medieval or modern in origin.

3.2.2 **Area B:** There is a pit-like anomaly located near the centre of this area **4002**; the form and size suggest that it is of some archaeological interest. It is possible, however, that this anomaly is of natural or geological origins such as a tree-throw and has therefore been characterised as Possible Archaeology.

3.2.3 Area B contains numerous positive linear trends and areas of increased magnetic responses. It is likely that the majority of these are the result of ploughing, or other agricultural activity, and these extend predominately northwest to southeast.

3.2.4 **Area C:** Extending across this area, four strongly positive linear anomalies **4003** are clearly visible forming a zig-zag pattern from northwest to southeast. It is considered likely that these linear anomalies form part of a land drainage system and was targeted by the scanning survey **3004** to confirm their nature.

3.2.5 Area C contains numerous linear and curvilinear trends **4004** and it is likely that the majority of these are the result of ploughing, or other agricultural activity, and these extend predominately NNE to SSW. There are also several positive circular and oval-shaped anomalies located predominately to the southwest of this area; their form and size suggest that they are of some archaeological interest and potentially pit-type features. It is also possible, however, that these anomalies are of natural or geological origins such as a tree-throw or a change in the superficial geology.

3.2.6 **Area D:** In this area a strong positive linear anomaly **4006** is clearly visible extending ENE to WSW and it is considered likely that this linear anomaly forms part of a land drainage system as it is similar to anomalies **4003** which are directly to the north of **4006**. There is a pit-like anomaly located near the northern edge of this area and to the south of anomaly **4006**; the form and size suggest that it is of some archaeological interest and is similar to other anomalies to the north in Area C.

3.2.7 **Area E:** An area of increased magnetic response is visible across the western half with the most significant anomaly at **4007** of a short, L-shaped positive anomaly possibly representing a surviving section of ditch. There are several small positive oval shaped anomalies to the south of **4007** that are interpreted as Possible Archaeology and potentially pit-type features. They do not form a significant concentration or distribution and could also be natural in origin. Several linear and curvilinear trends have been identified that are weak responses that do not appear to form clear archaeological features. It is possible that the majority of the trends are the result of ploughing or other agricultural activity. Ploughing trends to the east of this area extend either northwest to



southeast or northeast to southwest and are presumed to be post-medieval or modern in origin.

- 3.2.8 **Area F:** A discrete area at **4008** contains short sections of ditch-type features in an approximately L-shaped layout. They are wider in plan and stronger in response than the ridge and furrow identified immediately to the northwest and corresponds to a similar ditch feature at **4028** found in Area K. At **4009** are two short parallel ditch-type features that are on a different alignment to the surrounding ridge and furrow and possibly represent a surviving feature of archaeological interest within this area.
- 3.2.9 A concentration of linear trends was detected in the scanning survey **3003** and is visible across the northern half of Area F around **4009** as parallel, regular linear anomalies. They have been interpreted as ridge and furrow due to their form and spacing. The ridge and furrow anomalies are oriented NNW to SSE and terminate in a curvilinear boundary to the south at **4011** but continue over a ditch type feature to the north at **4010**. It is potentially the remains of a former field boundary although the relative phasing cannot be ascertained from the geophysics alone. This area of ridge and furrow corresponds to the recorded location of two adjacent fields of ridge and furrow identified from aerial photography (Pastscape ID1580044). To the south of the ridge and furrow are narrower spaced linear trends extending southwest to northeast and these have been interpreted as ploughing trends so as to distinguish them from the area of ridge and furrow.
- 3.2.10 Extending across the southeast corner of this area is a discrete large curvilinear anomaly **4012** composed of a large amount of dipolar anomalies indicating that it contains a concentration of ferrous and/or ceramic material. Extending from the southern end of anomaly **4012** is a further curvilinear area of ferrous and increased magnetic response at **4013** which continues on a similar alignment as **4012**. These anomalies correspond to the route of disused Wiltshire and Berkshire canal channel and an associated towing path, likely to be in the area around **4013**. The extremely high magnetic response of **4012** and **4013** is probably representative of the ferrous and ceramic debris material used to backfill the canal channel when it was no longer in use.
- 3.2.11 There are several pit-like anomalies located predominately around **4013**; the form and size suggest that they could be of archaeological interest and they have been characterised as Possible Archaeology. They form however, a concentration in the vicinity of the route of the disused canal and are possibly associated. They could also be natural or geological in origin.
- 3.2.12 **Area G:** A series of connecting positive linear anomalies in a 'ladder' or 'H' shaped layout has been identified at **4014** and interpreted as a ditch. The magnetic strength of the response varies along its length and is strongest in the vicinity of the former canal towpath and weakens to the south. A similar type of feature but larger is located to the northwest at **4019-4021** in Area J and they are potentially a form of drainage feature. At **4015** is a second smaller and weak ditch and possible oval shaped pit which is on a different alignment to **4014** and likely represents a different phase and feature.
- 3.2.13 A concentration of large dipolar ferrous anomalies is seen around **4016** as well as several weaker but positive linear ditch-type anomalies that are possibly associated. These correspond to the location of the towing path from Area F seen at **4013** and also partially identified from a large amount of ferrous. It is also possible to trace the extents of this feature further to the west as it can be seen in the scanning data at **3006** and is therefore unlikely to be associated with modern ferrous material as originally thought.



- 3.2.14 **Areas H:** This area around **4017** has numerous positive, parallel and regularly spaced linear trends and it is likely that the majority of these are ridge and furrow. The ridge and furrow is oriented northeast to southwest and represents a second area of ridge and furrow identified within the Site, it is likely to be associated with the recorded ridge and furrow in Area F (Pastscape ID1580044).
- 3.2.15 **Area I:** There are three weakly positive linear anomalies at **4018** that have been interpreted as Possible Archaeology and could represent ditch-type anomalies. The northwest to southeast linear which is parallel to the current field boundary is potentially a continuation of the ditch feature above at **4021** whereas the other two southwest to northeast oriented anomalies are weaker and more intermittent, therefore it is more difficult to interpret if they could be associated and form part of a 'ladder' feature as well.
- 3.2.16 **Area J:** This area was targeted as a key area of interest by the scanning survey **3000** as several linear anomalies were identified across adjacent scan lines. The detailed survey has identified a series of interconnecting positive linear anomalies at **4019** which have been characterised as Archaeology and form a larger 'ladder' shaped feature. Two further ditch type anomalies adjoining **4019** are visible at **4020** and **4021** and are weaker in response therefore have been characterised as Possible Archaeology. There could potentially be further ditch sections of this overall 'ladder' feature but this is difficult to distinguish as the southwest to northeast oriented ditches are in the same direction as the surrounding ridge and furrow trends. The overall feature **4019-4021** is orientated northwest to southeast and is similar in its morphology to the feature at **4014** in Area G. Around and across the 'ladder' feature of **4019-4021** are numerous parallel and regularly spaced positive linear anomalies that have been interpreted as ridge and furrow. This area corresponds to an area of recorded ridge and furrow identified from aerial photography (Pastscape ID1579987).
- 3.2.17 **Area K:** Several anomalies of archaeological interest have been identified in this area suggesting more than one phase of occupation. A large curvilinear positive anomaly extending from **4022** to **4023** is representation of an enclosure ditch approximately 60 x 40m. A second narrow linear pair of ditches at **4024** crosses the southwest of the curvilinear enclosure ditch. There is a break in each ditch at **4024** both at a similar place possibly suggesting truncation but it could be deliberate and indicative of an entrance. To the south of this area are a series of further linear, curvilinear and rectilinear enclosure ditches all smaller in size. They have been characterised as Archaeology or Possible Archaeology based on their magnetic strength and response. Anomalies **4024 - 4027** are potentially associated as part of the same rectangular enclosure with the pair of ditches at **4024** representing a narrow corridor or driveway at one end of the enclosure. The phasing of these ditch-type anomalies cannot be ascertained from the geophysics alone but there are two areas where the large circular and the rectangular enclosure cross. Within the rectangular and curvilinear enclosure at **4029** and **4030** are several very weak positive linear and curvilinear anomalies which possible represent internal ditch type features but it cannot be identified which enclosure or even if they are associated with either enclosure.
- 3.2.18 **Area L:** This area contains few linear trends **4036** and it is likely that these are the result of ploughing, or other agricultural activity, and they extend predominately northwest to southeast.



3.3 Modern Services

- 3.3.1 There is at least one modern service at **3007/4005** running through three of the northern most fields of the Site. The service appears to be ferrous pipe and is oriented roughly WNW to ESE. Both ends of the **3007/4005** anomaly continue beyond the limits of the geophysical survey area.
- 3.3.2 It is not clear from the geophysical data whether the service identified is in active use. The gradiometer data cannot locate and identify 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 CONCLUSION

- 4.1.1 The recorded scanning and detailed gradiometer surveys have been successful in detecting anomalies of definite, probable and possible archaeological interest within the Site. In addition to these, anomalies interpreted as ploughing trends, areas of increased magnetic response and a former canal channel and associated towpath have also been identified.
- 4.1.2 The scanning survey has successfully defined areas with definite and probable anomalies of archaeological interest that were subsequently targeted by detailed survey. There have however been instances where the scanning results have suggested the presence of archaeological remains but detailed survey have shown these areas to be dominated by geological or ferrous responses; areas C, D and E are good examples of this. It would appear that the scanning survey has revealed the largest and strongest anomalies associated with large ditches and extended areas of human activity but it should be noted that small, isolated and very ephemeral remains such as those from structures built from small timber posts cannot be discerned from scanning data.
- 4.1.3 The anomalies of archaeological interest are primarily in areas F to K in the south and southwest of the Site with the supposed 'blank' areas showing mainly ploughing trends and isolated ferrous anomalies. The two areas of recorded ridge and furrow have been identified in the gradiometer survey in Areas F and J with a third area potentially added to the known locations in Area H (Pastscape ID1580044; 1579987). Areas G and J contained two areas of distinct interconnecting ditches described as 'ladder' features at **4014** and **4019-4021** which, interestingly at **4019-4021** are in the same orientation as the ridge and furrow and possibly suggests an association. These features could be related to improving drainage or for agricultural purposes but cannot be dated from the geophysics.
- 4.1.4 Area K contained a number of ditch type features from **4022-4033** potentially indicating different phases of settlement with a curvilinear and a rectangular enclosure and several further linear and curvilinear ditches within the enclosed areas. Also in this area is a strongly enhance ditch feature at **4028** which is set apart from the enclosures area and possibly represents a different phase and archaeological feature.
- 4.1.5 Anomalies **4012, 4013 and 4016** in Areas F and G correspond to the location of the disused Wiltshire and Berkshire canal channel and towing path and can be seen on historic mapping from the first edition Ordnance Survey dated 1885. The geophysical response suggests that these areas have been backfilled with enhanced debris containing ferrous and ceramic material.
- 4.1.6 Frequent ploughing trends are visible across the Site on differing alignments. This is likely due to variable boundaries and different farming processes but these are likely to be post-medieval and modern in provenance.
- 4.1.7 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.



5 REFERENCES

5.1 Bibliography

English Heritage, 2008, *Geophysical Survey in Archaeological Field Evaluation. Research and Professional Service Guideline No 1*, 2nd edition.

Terence O'Rourke, 2015 *Land at Forest Farm, Chippenham: Desk-Based Heritage Assessment* Unpublished Client Report ref: 227610

Wessex Archaeology, 2015. *Method Statement for Recorded Scanning and Detailed Gradiometer Survey: Land at Forest Farm, Chippenham*. Unpublished Client Report ref: T20557.01

5.2 Cartographic and documentary sources

1828 First Edition Ordnance Survey 6 inch map / 1:10,560 (Sheet 34)

1886 Ordnance Survey 25 inch map / 1:2,500 (Sheet LXXXV.10)

1889 Ordnance Survey 25 inch map / 1:10,560 (Sheet LXXXV.10)

1899 Ordnance Survey 6 inch map / 1:10,560 (Sheet 26)

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

5.3 Online resources

British Geological Survey, <http://www.bgs.ac.uk> [accessed July 2015]



APPENDIX 1:

Forest Farm, Chippenham

Method Statement for Recorded Scanning and Detailed Gradiometer Survey

1 INTRODUCTION

1.1 Project Background

- 1.1.1 This document is produced to give method statement for the proposed geophysical survey by Wessex Archaeology's in-house geophysics team, as presented in **Table 1**.

Table 1 Project specific details

Client Details	John Trehay Terence O'Rourke Everdene House, Deansleigh Road, Bournemouth. BH7 7DU Tel: 0771 7571968		
Site Name	Forest Farm	Site NGR	393843, 171581
Survey Dates	06/07/2015 to 17/07/2015	Project Manager	Lucy Learmonth
Survey Area (ha)	42.9 – Scanning 10.7 - Detail (25%)	On Site Personnel	Jen Smith Alistair Black
Current Land Use	Farm land. Both pasture and arable crop.	Geology & Soils	Oxford Clay formation (Mudstone) and kellaways Formation (sandstone, Siltstone and Mudstone). No superficial deposits recorded.



1.2 Project Team

- 1.2.1 The work will be undertaken by Wessex Archaeology's in-house geophysics team. Dr Paul Baggaley as Director of GeoServices at Wessex will be responsible for the work and Paul is, in turn, responsible to the Chief Executive. The Chief Executive has ultimate responsibility for the maintenance of quality standards for all work within Wessex Archaeology.
- 1.2.2 Lucy Learmonth as Terrestrial Geophysics Manager will be responsible for the day to day running of the geophysical survey work from fieldwork through data processing, interpretation and reporting. Lucy is also the nominated Project Manager for these works.
- 1.2.3 Fieldwork will be undertaken by suitably qualified and experienced members of Wessex Archaeology's in-house geophysics team.
- 1.2.4 All nominated Wessex Archaeology staff are appropriately qualified and experienced for their project role. Wessex Archaeology reserves the right to vary project staff according to the operational demands of its overall programme. Career profiles can be provided on request.

1.3 Project Aim

- 1.3.1 The aim of the geophysical survey is to conduct a recorded gradiometer scanning survey to identify possible areas of archaeological interest, and to establish the presence/absence, extent and character of detectable archaeological remains through detailed gradiometer survey.
- 1.3.2 This document presents a brief description of the standard methodology to be followed and the form that the archaeological interpretation and reporting of the geophysical survey will take.

1.4 Scope of Document

- 1.4.1 This method statement sets out the strategy and methodology by which Wessex Archaeology will implement the geophysical survey. In format and content it conforms with current best practice and to the guidance outlined in Management of Research Projects in the Historic Environment ('MoRPHE') (Historic England 2015), the Chartered Institute for Archaeologists' Standards and Guidance for archaeological geophysical survey (2014) and English Heritage's Guidelines Geophysical Survey in Archaeological Field Evaluation (2008) and Thesauri (2013).

2 METHODOLOGY

2.1 Survey Area

- 2.1.1 Recorded scanning and detailed gradiometer survey has been considered to be the most appropriate technique in the first instance. Gradiometer survey detects anomalies produced by a wider range of archaeological features than other techniques such as resistivity survey and, although other techniques may be justifiable depending upon the results of the gradiometer survey, they should be considered supplementary to gradiometry.



- 2.1.2 It is proposed that the entire survey area is subject to recorded scanning and 25% of the survey area is targeted for detailed gradiometer survey. For the total size of the proposed survey area see **Table 1**. As much as possible of the survey area will be surveyed but artificial obstructions, such as overgrown vegetation, trees, crops, pylons, hedgerows, drains, road, farming equipment etc. may prevent the total area being surveyed.
- 2.1.3 Stakeout data will be prepared in British National Grid coordinates prior to survey using AutoCAD, and survey data will be georeferenced accordingly. For the recorded scanning survey, Individual survey grid nodes will be established at 30m x 20m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008).
- 2.1.4 For the detailed gradiometer survey, Individual survey grid nodes will be established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (2008).
- 2.1.5 The surveyed areas will be tied into the National Grid using GPS survey equipment to enable the surveyed area to be independently relocated by a third party.
- 2.1.6 Digital mapping and archaeological information gathered during previous work conducted by Wessex Archaeology on the Site will be used to support the interpretation of the geophysical data where available.

2.2 Instrument specification

- 2.2.1 The recorded scanning and detailed gradiometer survey will be conducted using an upgraded Bartington Grad601-2 dual fluxgate gradiometer system, which has a vertical separation of 1m between sensors and with an effective sensitivity of 0.03nT.

2.3 Survey specification

- 2.3.1 For the recorded scanning survey, data will be collected at 0.25m intervals along traverses spaced 10m apart with an effective sensitivity of 0.1nT, in accordance with EH guidelines (2008).
- 2.3.2 For the detailed gradiometer survey, data will be collected at 0.25m intervals along transects spaced 1m apart, in accordance with English Heritage guidelines (2008). Data will be collected in the zigzag method.
- 2.3.3 Data from the survey will be subject to minimal data correction processes. These would typically comprise a zero mean traverse function ($\pm 5\text{nT}$ thresholds) to correct for variations in the calibration 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 are generally applied to all survey areas, with no further filtering or interpolation.



- 2.3.4 The data will be processed using commercially available and in-house software which allows greyscale and trace plots to be produced. Minimal processing will be applied to the data and typically includes bounded zero mean traverse and destagger functions.
- 2.3.5 An interpretation of the geophysical anomalies will also be presented identifying likely, probable and possible archaeological features along with linear trends and areas of increased magnetic response. Data from the recorded scanning survey will also provide targeted areas of possible interest for the detailed gradiometer survey.
- 2.3.6 Further details of the geophysical and survey equipment, methods and processing are described in **Appendix 2** of this report.

3 REPORTING

- 3.1.1 Unless otherwise specified, upon completion of the fieldwork results of the recorded scanning and detailed gradiometer surveys will be compiled into an illustrated report in Wessex Archaeology's house style describing the survey results and interpretation only.
- 3.1.2 The report will include the following elements:
- The name(s) of the investigators/contractors, title, date, report reference number and client details;
 - A non-technical summary including the basis for the survey, its aims and results;
 - Introduction including site location plan, planning reference numbers & SMR casework number, Site history, National Grid Reference, Site description;
 - An account of the background to the project and circumstances of work;
 - The aims and objectives of the survey; and
 - The methodology used.
- 3.1.3 The results of the survey will include:
- Plans at appropriate scales to include, raw data, greyscale plot, XY trace plot and interpretative plot. Each illustration will contain a scale bar and north arrow;
 - A figure and text to demonstrate that the survey has been accurately geo-located;
 - Detailed survey results and interpretation;
 - An assessment of the importance of sites and features within the study area against a background of national, regional or local importance;
 - References to all primary and secondary sources consulted; and



- An appendices to include details of the geophysical and survey equipment, methods and processing undertaken and full definitions of the interpretation terms used in the report.

- 3.1.4 The report will usually be prepared within two weeks of completion of all fieldwork, and submitted to the Client for approval. If required an interim report, in the form of a preliminary greyscale, can be completed following fieldwork.
- 3.1.5 Once approved, a PDF copy of the report will be supplied to the Client. Digital copies of the raw data, report text, figures and electronic drawings will be made available upon request. Additionally, hard copies of the report can be issued to the Client and to the relevant County Council HER (if required) in their preferred format.

4 HEALTH AND SAFETY

- 4.1.1 Health and safety considerations will be of paramount importance in conducting all fieldwork. Safe working practises will override archaeological considerations at all times.
- 4.1.2 All work will be carried out in accordance with the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety Regulations 1992, and all other relevant Health and Safety legislation, regulations and codes of practice in force at the time.
- 4.1.3 Wessex Archaeology will supply a copy of their Health and Safety Policy and a Risk Assessment to the Client before the commencement of any fieldwork. The Risk Assessment will have been read and understood by all staff attending the Site before any groundwork commences.
- 4.1.4 Wessex Archaeology has both public liability (£10,000,000) and professional indemnity insurance (£5,000,000).
- 4.1.5 The geophysical survey will be logged on a pro forma log sheet, which will include a checklist of safe working practices, safety equipment, emergency procedures and specific information relating to environmental conditions likely during fieldwork. Members of the survey teams will remain in visual contact at all times.

5 STANDARDS

5.1 Quality and Code of Practice

- 5.1.1 Wessex Archaeology is an archaeological organisation registered with the Chartered Institute for Archaeologists.
- 5.1.2 Wessex Archaeology endorses the Code of Practice and the Code of Approved Practice for the Regulation of Contractual Arrangements in Field Archaeology of the Chartered Institute for Archaeologists.
- 5.1.3 All core staff would be of a standard approved by Wessex Archaeology, be employed in line with The Chartered Institute for Archaeologists Codes of Practice



and be members of the Chartered Institute for Archaeologists or be appropriately qualified.

- 5.1.4 Wessex Archaeology operates a Project Management System. All projects are undertaken under the direction of the Project Manager who is responsible to a Section Head, who ensures the maintenance of quality standards within the organisation. The Chief Executive has ultimate responsibility for all of the Company's work.

6 REFERENCES

6.1 Bibliography

Chartered Institute for Archaeologists, 2014. Standard and Guidance for archaeological geophysical survey.

English Heritage, 2013. *English Heritage Thesauri*, [Online], Available: <http://thesaurus.english-heritage.org.uk/frequentuser.htm> [7th April 2015].

English Heritage, 2008. *Geophysical Survey in Archaeological Field Evaluation. Research and Professional Service Guideline No 1, 2nd edition*. Swindon: English Heritage.

Historic England, 2015. *Management of Research Projects in the Historic Environment: The MoRPHE Project Manager's Guide*. Version 1.1. Swindon: Historic England.



APPENDIX 2: 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 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 magnetometer;
- 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 3: 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.
- 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 modern category is used for anomalies that are presumed to be relatively modern in date:

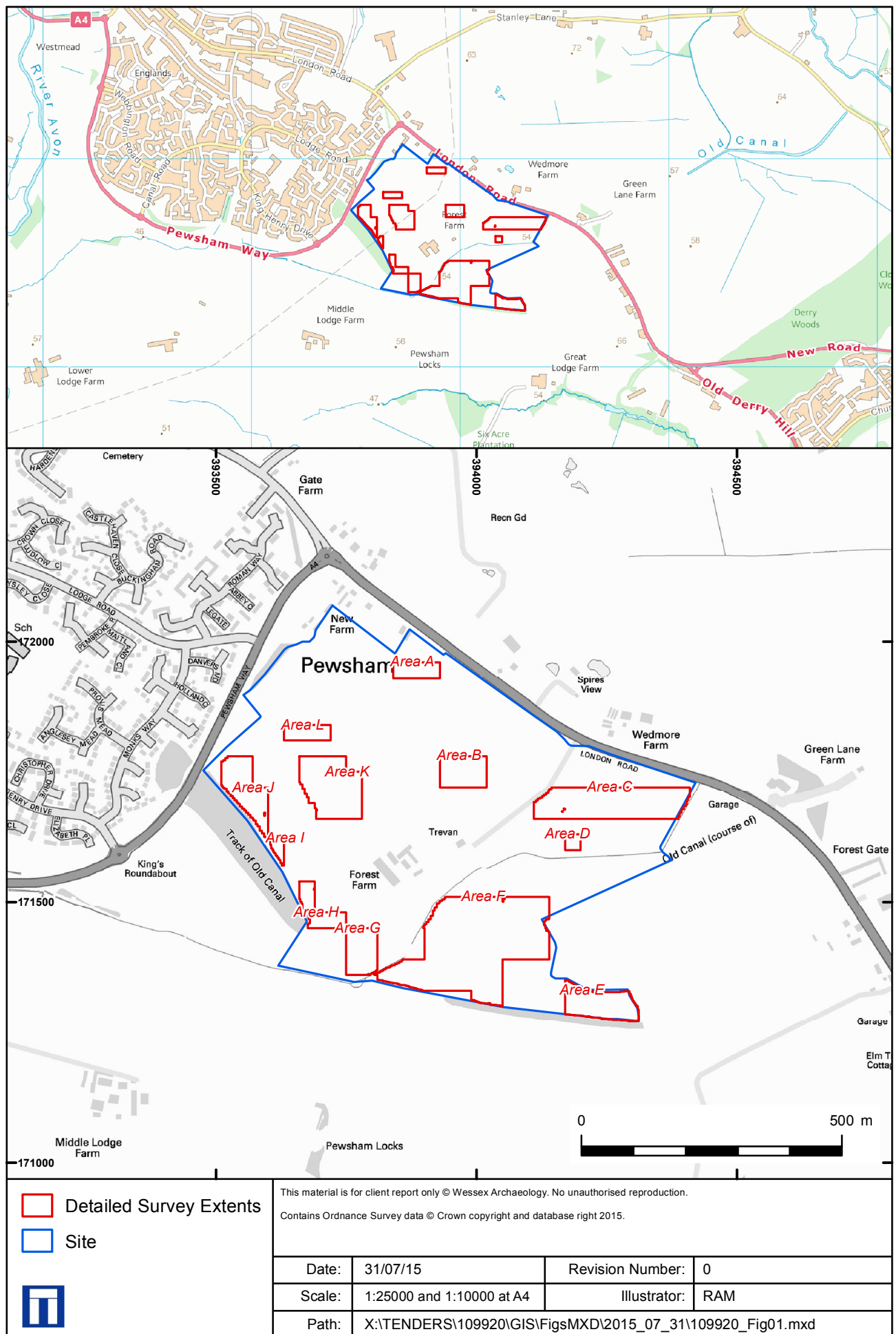
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be 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.
- Agricultural ditches – used for ditch sections that are aligned parallel to existing boundaries and former field boundaries that are not considered to be of archaeological significance.
- 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.

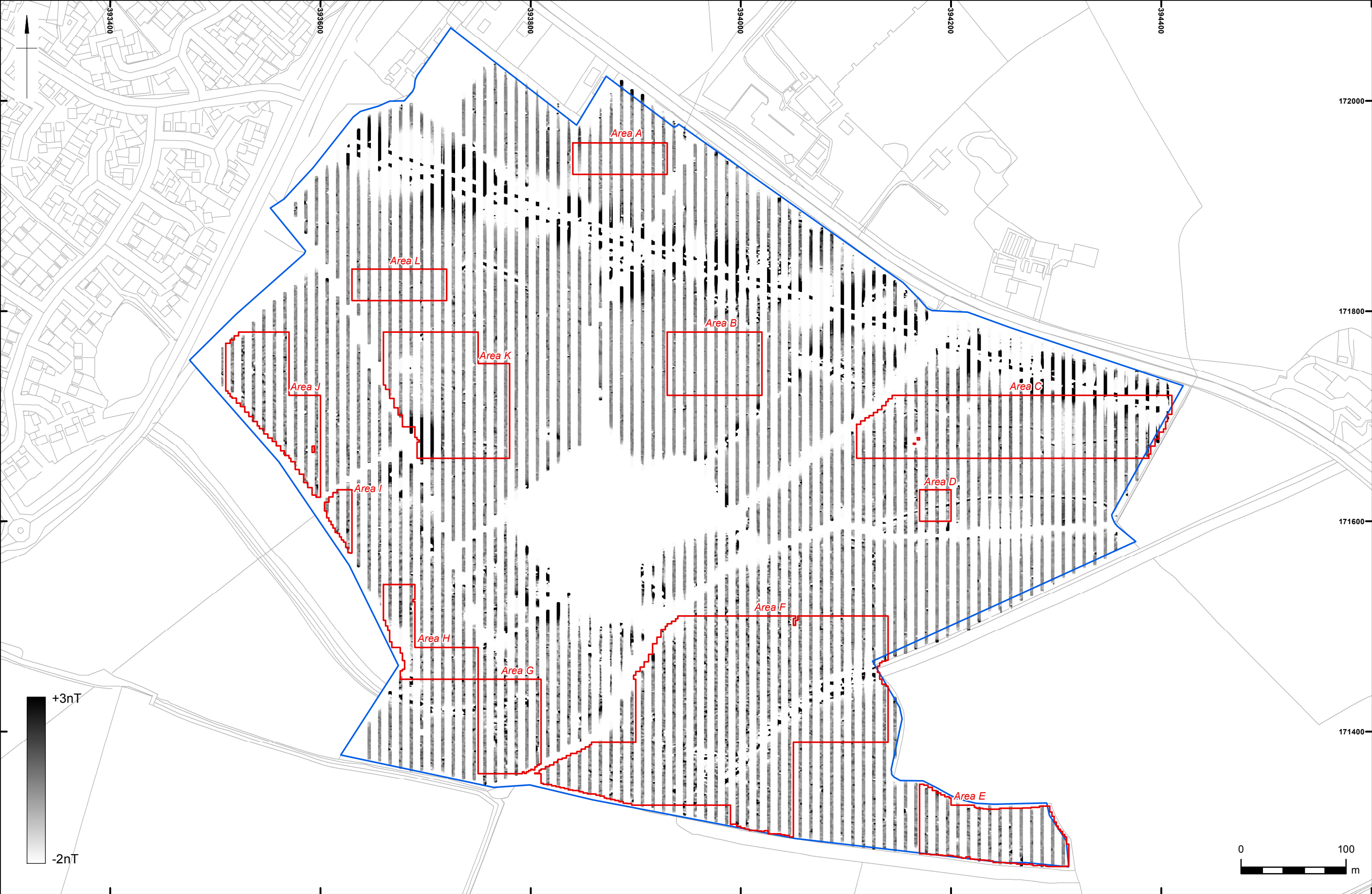
The uncertain origin/geological category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

- 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.



Site location and survey extents

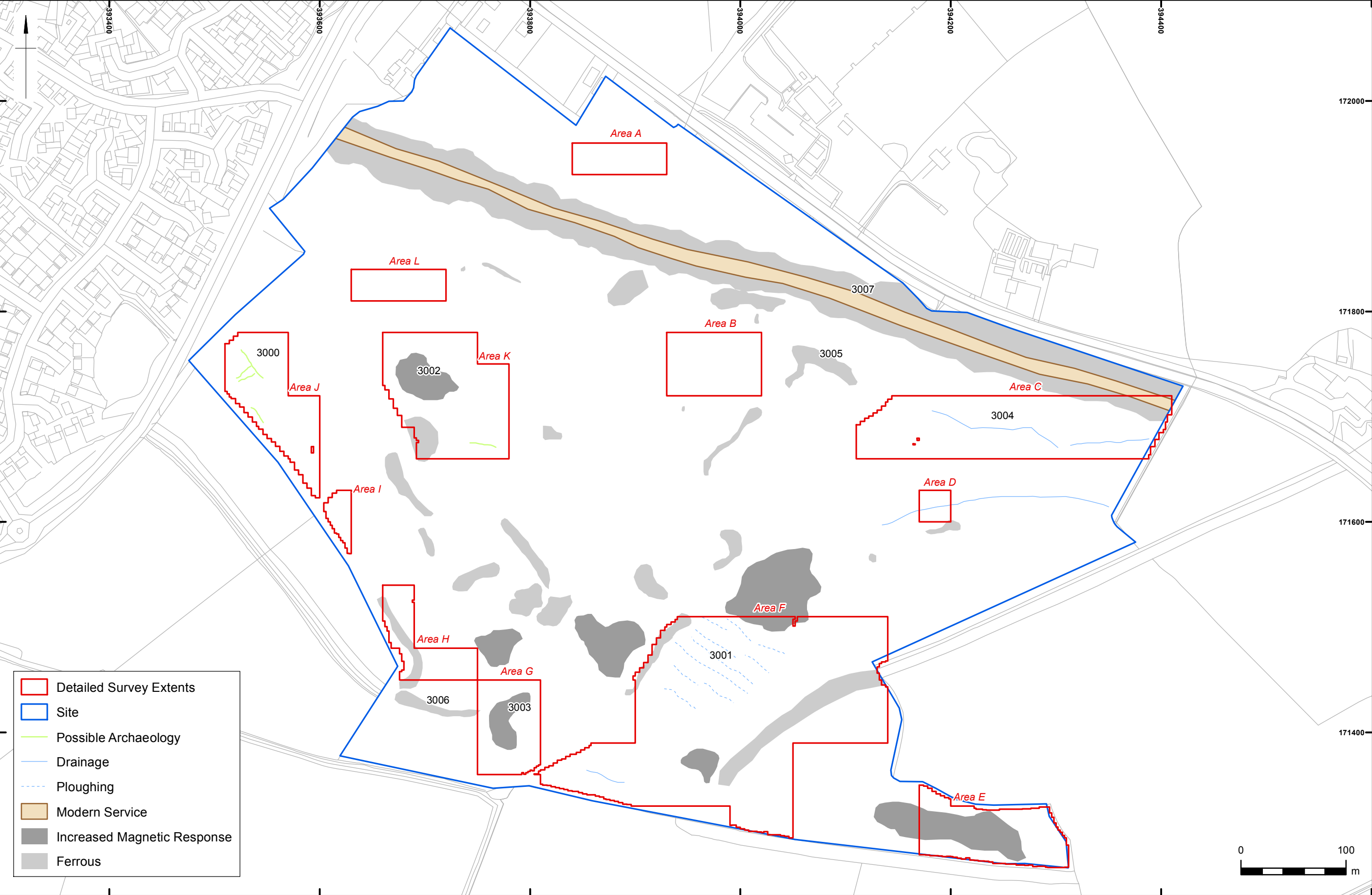
Figure 1



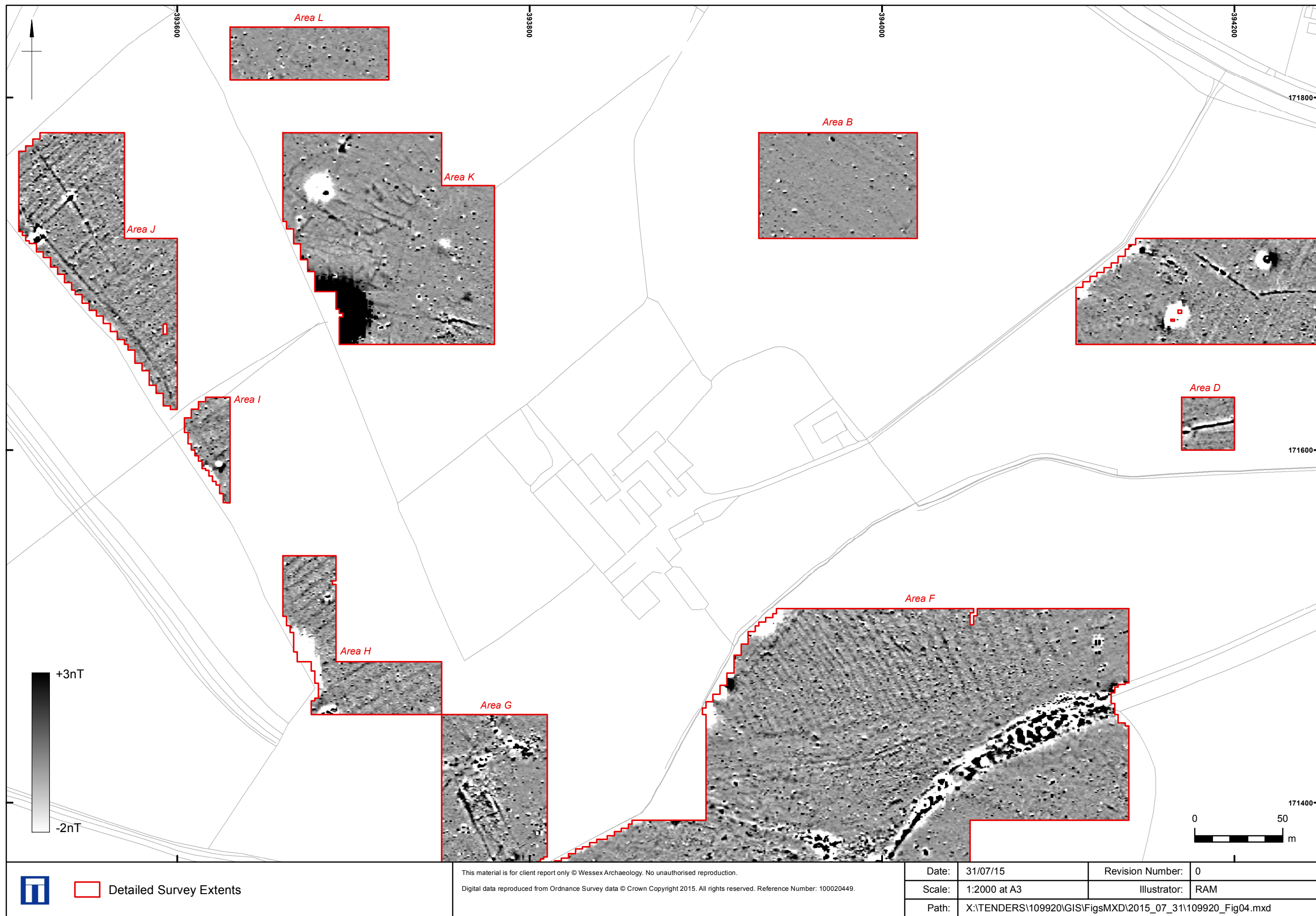
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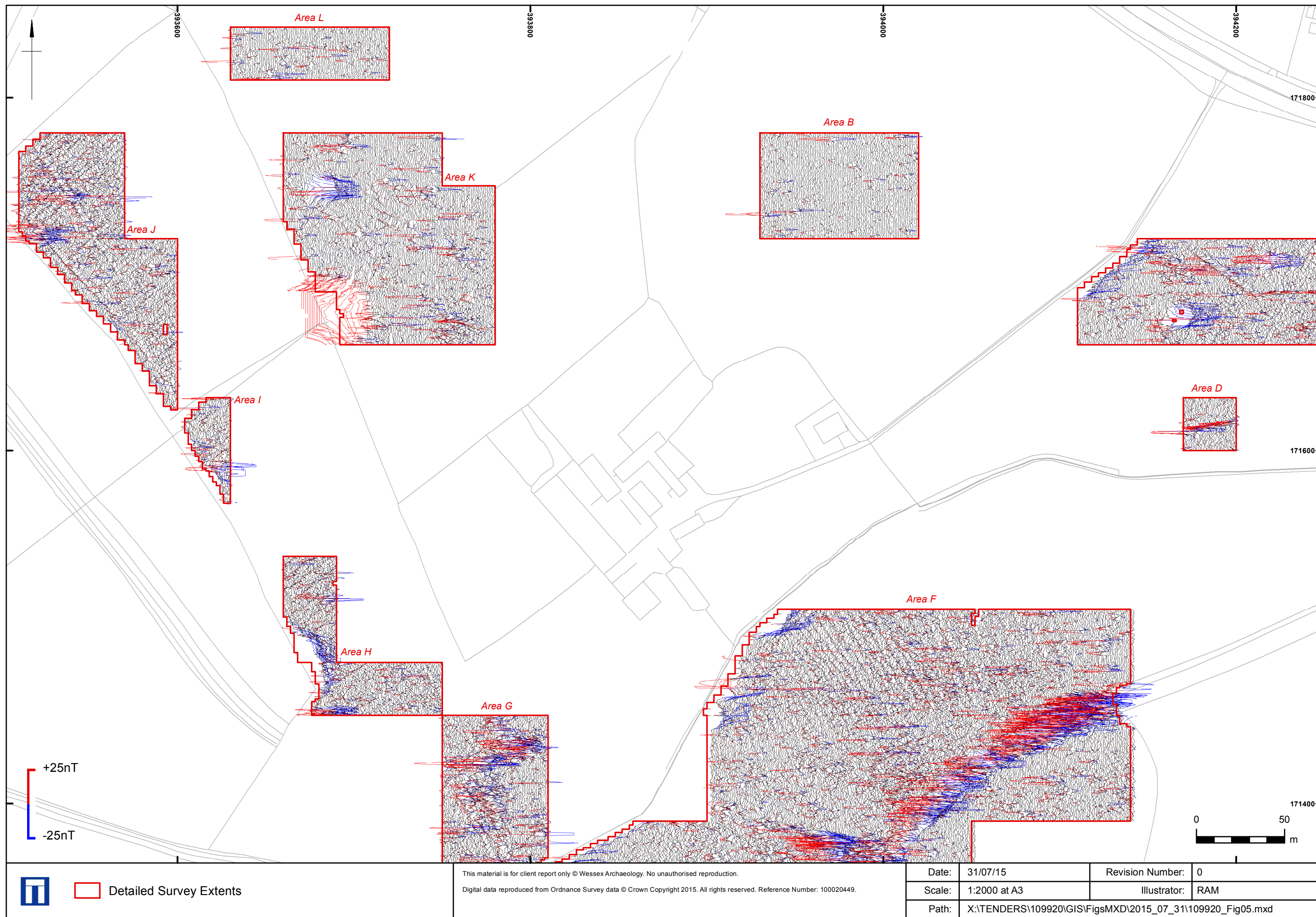
Scanning survey results

Figure 2



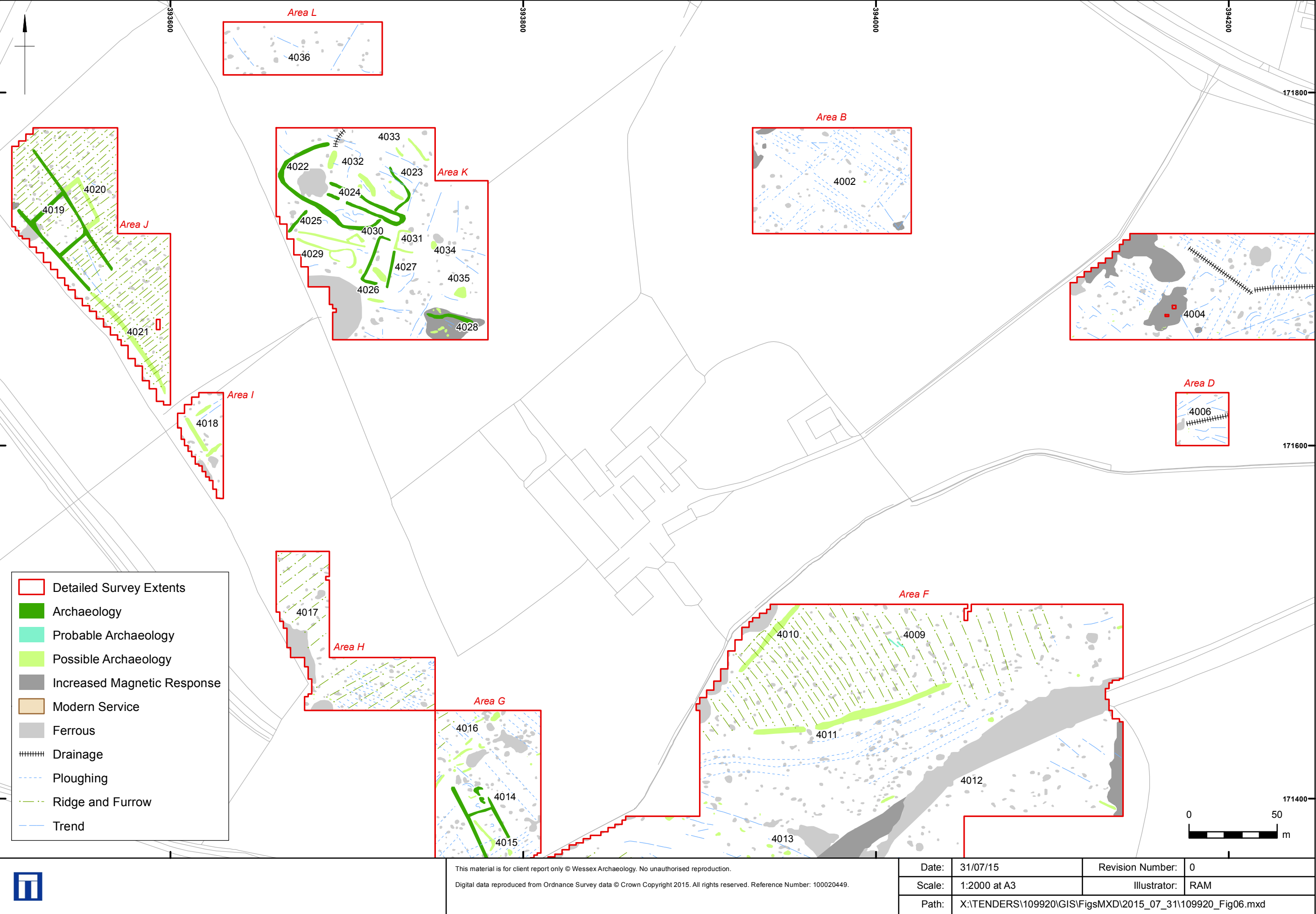
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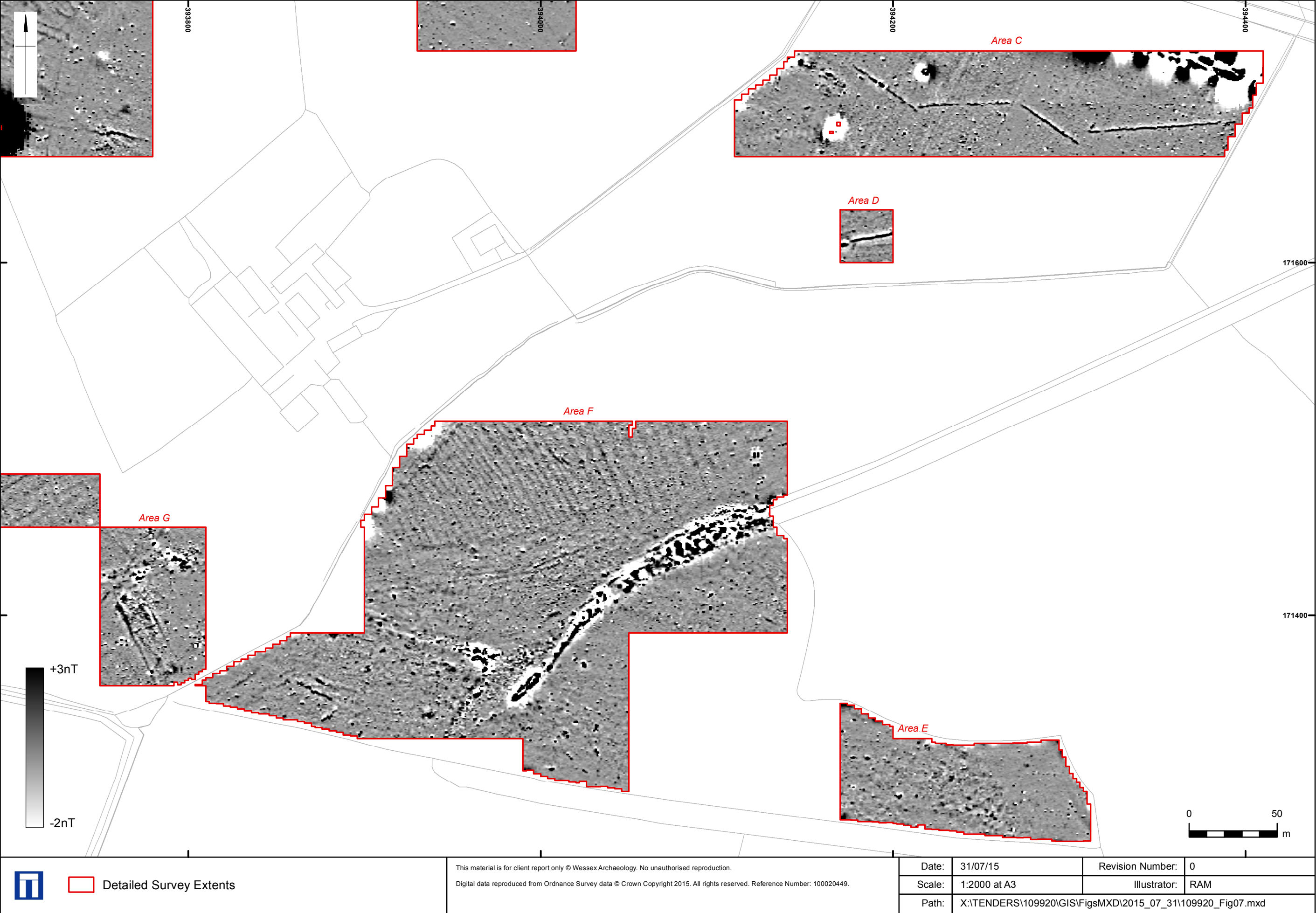
XY trace (north-west)

Figure 5



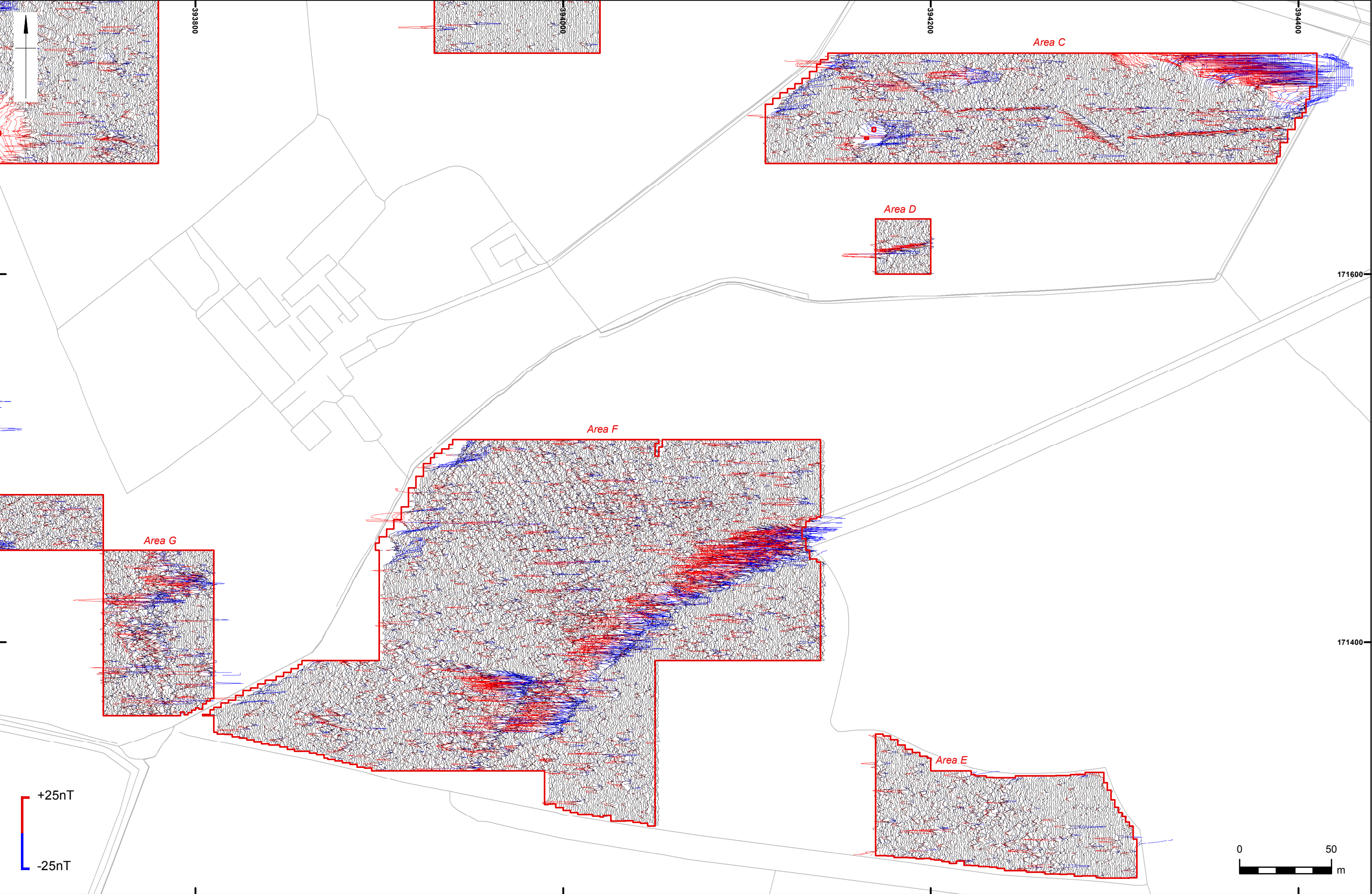
Interpretation (north-west)

Figure 6

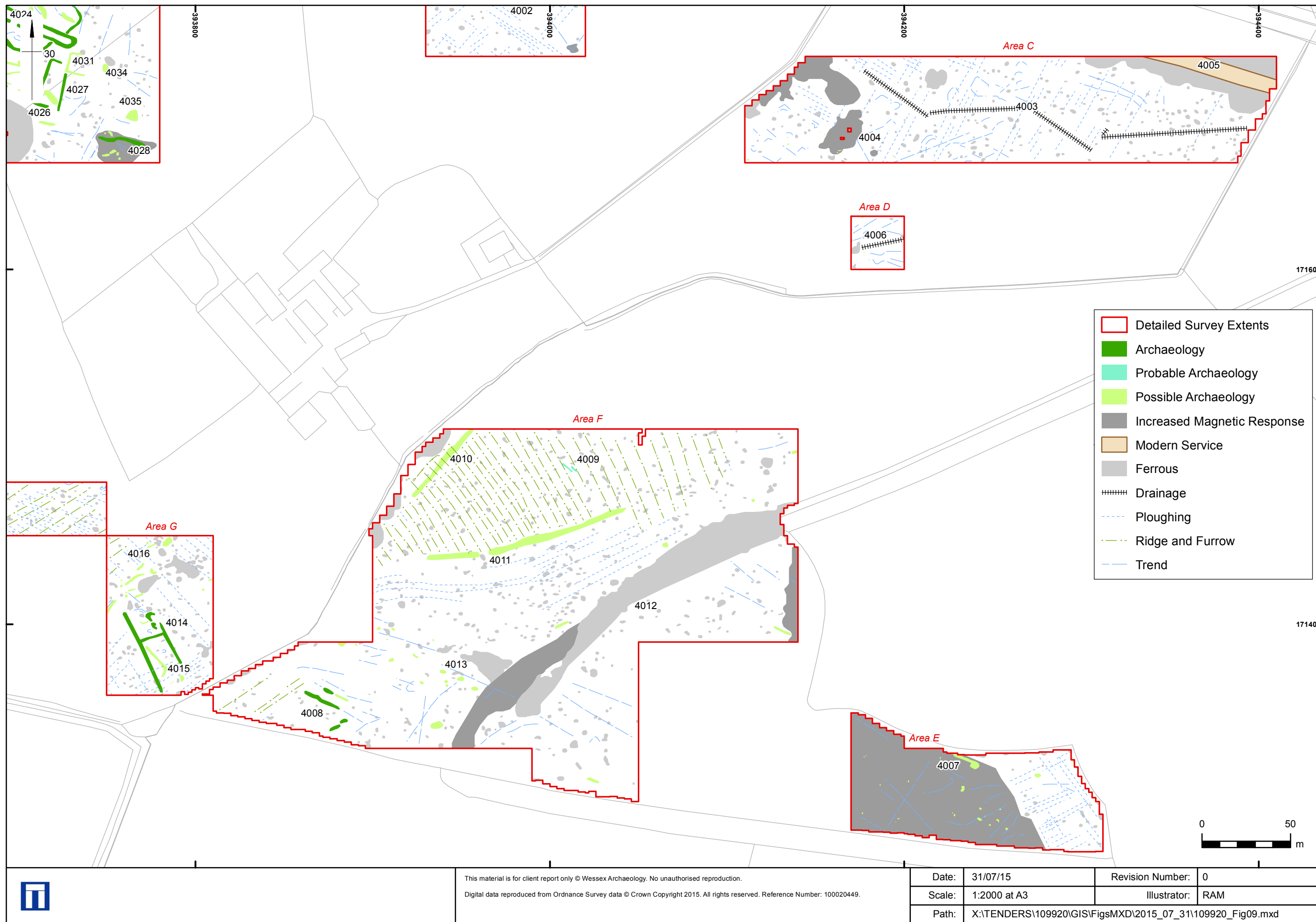


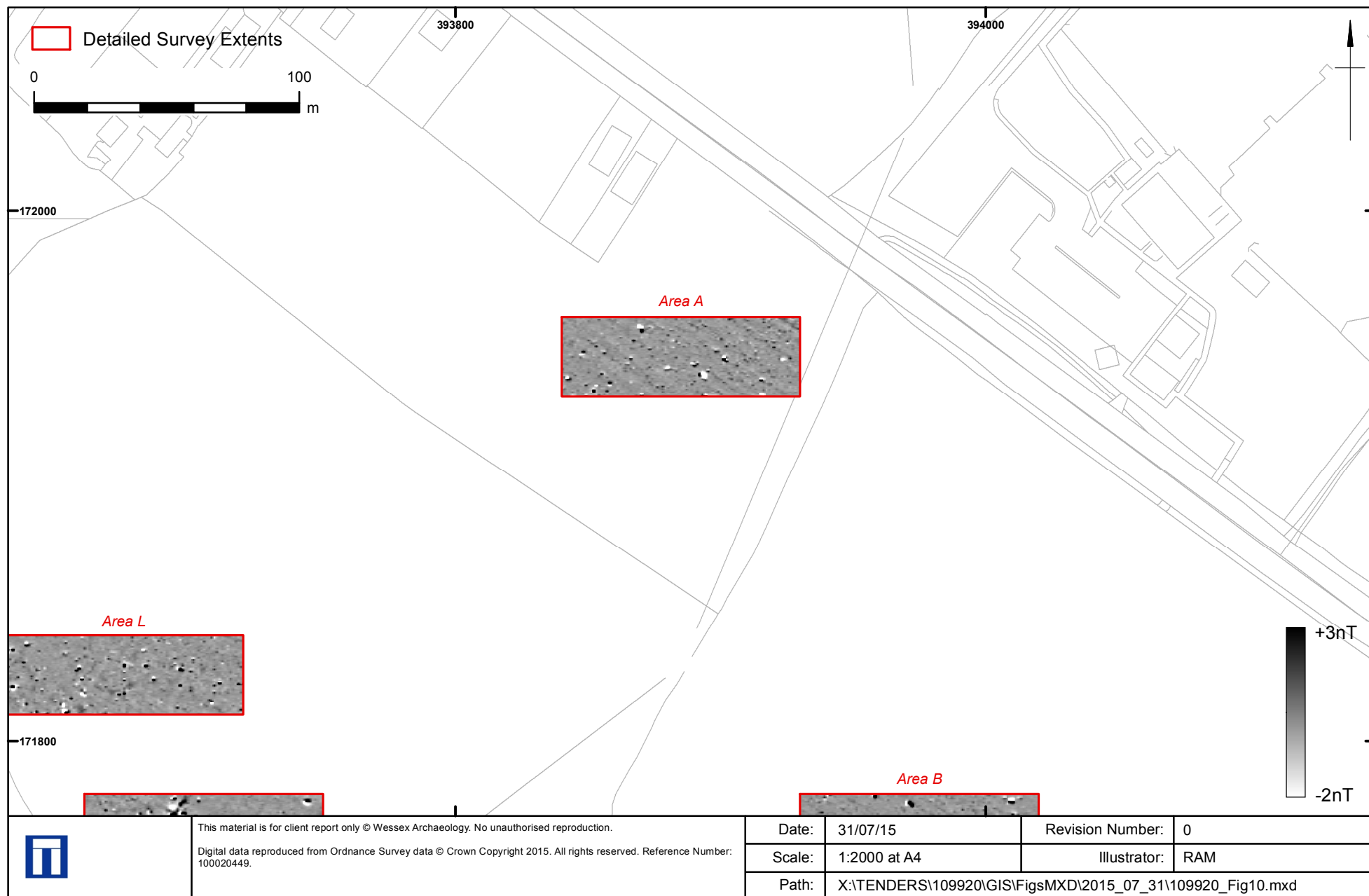
Greyscale (south-east)

Figure 7



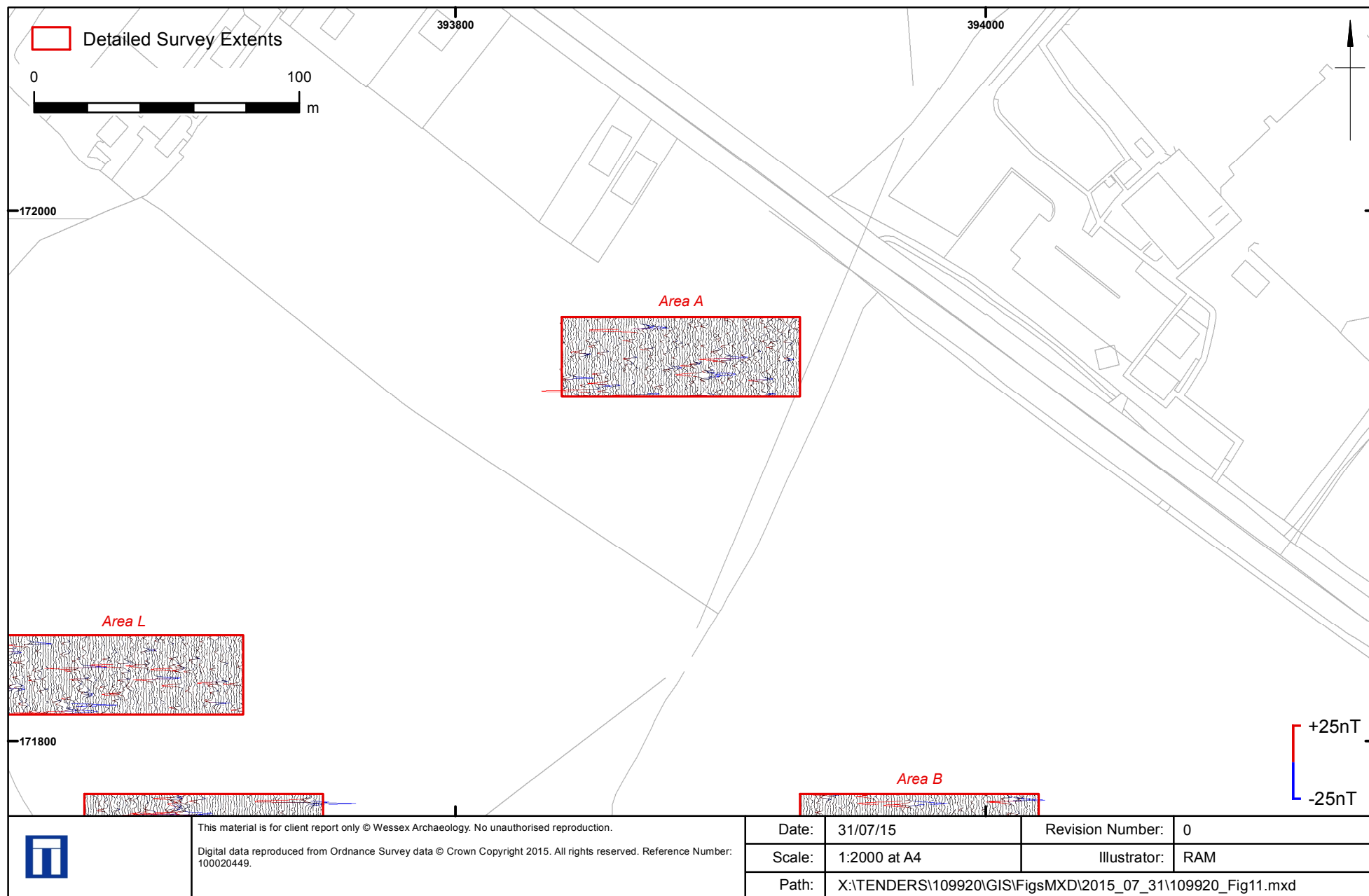
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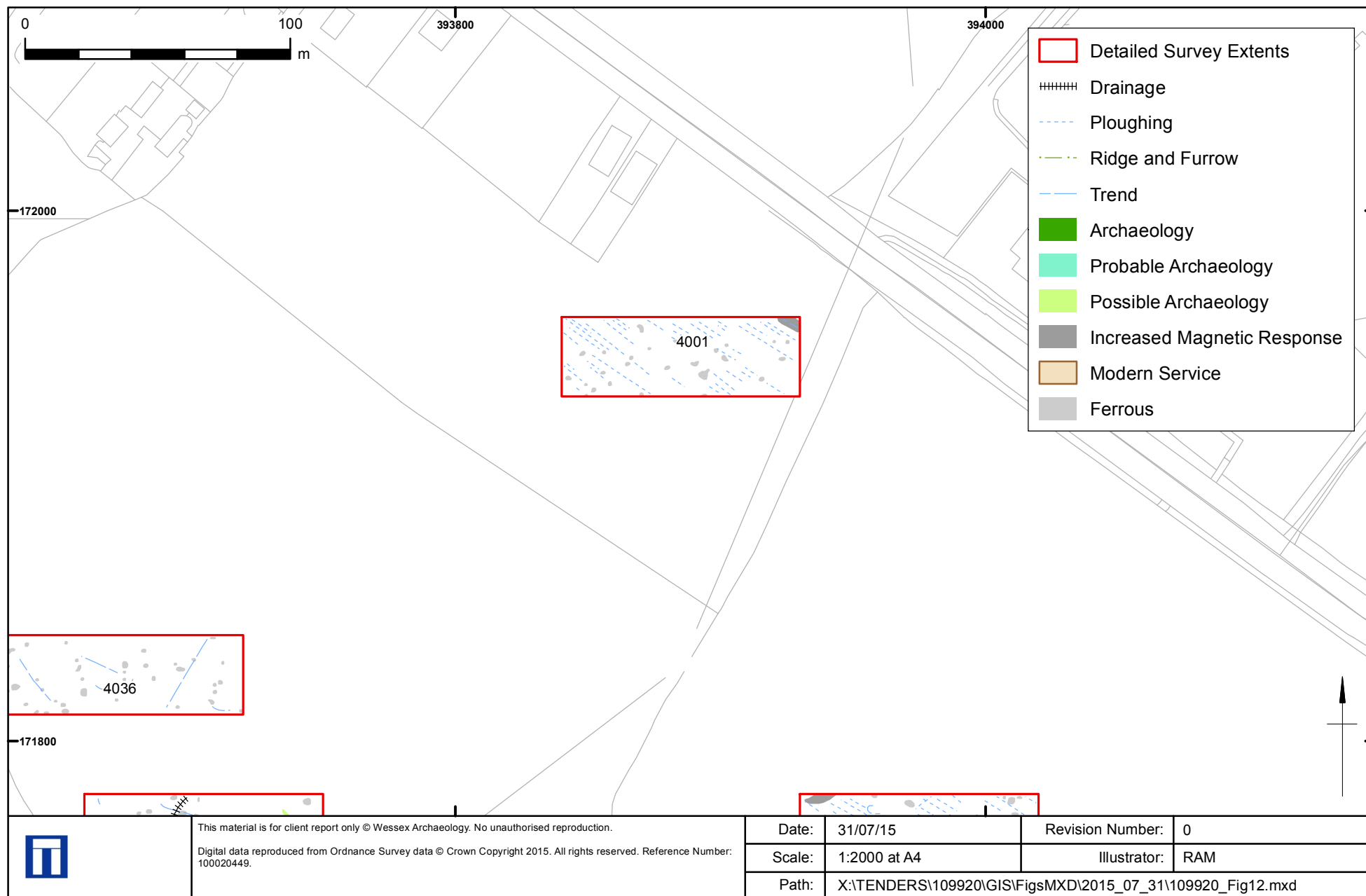
Greyscale (north)

Figure 10



XY trace (north)

Figure 11



Interpretation (north)

Figure 12



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