HIGH SPEED RAIL (LONDON - WEST MIDLANDS)

Supplementary Environmental Statement and Additional Provision 2 Environmental Statement

Volume 5 | Technical appendices

CFA21 | Drayton Bassett, Hints and Weeford

July 2015

SES and AP2 ES 3.5.1.8

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This table shows the topics covered by the technical appendices in this volume, and the reference codes for them.

CFA name and number	Topic	Code
CFA21, Drayton Bassett, Hints and Weeford	Community	CM-001-021
	Cultural heritage	CH-001-021
		CH-002-021
		CH-003-021
		CH-004-021
	Water resources and flood risk assessment	WR-003-021

Environmental topic:	Community	CM
Appendix name:	Community assessment	001
Community forum area:	Drayton Bassett, Hints and Weeford	021

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1 Introduction

1.1.1 This appendix provides an update to the Appendix CM-001-021 Community assessment from the main Environmental Statement (ES) as a result of design change 'Drayton Bassett to Hints area amendments (AP2-021-21.1)', assessed as part of the Supplementary Environmental Statement (SES) and the Additional Provision 2 Environmental Statement (AP2ES). This update should be read in conjunction with Appendix CM-001-021 Community assessment from the main ES.

1.1.2 This appendix is structured as followed:

- Part 1: Supplementary Environmental Statement
  - Community impact assessment record sheets - construction; and
  - Community impact assessment record sheets - operation.
- Part 2: Additional Provision 2 Environmental Statement
  - Community impact assessment record sheets - construction; and
  - Community impact assessment record sheets - operation

Part 1: Supplementary Environmental Statement

2 Community impact assessment record sheets - construction

2.1.1 There are no SES changes in this CFA.

3 Community impact assessment record sheets - operation

3.1.1 There are no SES changes in this CFA.

Part 2: Additional Provision 2 Environmental Statement

4 Community impact assessment record sheets - construction

4.1 Residents of Brockhurst Lane

Table 1 - Residents of Brockhurst Lane community impact assessment record sheet

Resource name	Brockhurst Lane / Rookery Lane
Community forum area (CFA)	CFA21 - Drayton Bassett, Hints and Weeford
Resource type	Residential
Resource description/profile	Properties located along Brockhurst Lane / Rookery Lane
Assessment year	Construction Phase (2017+)
Impact: Isolation	Impact: Brockhurst Lane is crossed by the HS2 route. The AP2 revised scheme includes a new green overbridge approximately 370m south of Brockhurst Lane's current alignment, and new sections of highway that will divert Brockhurst Lane across the new overbridge. The new green overbridge and sections of highway will be built offline to ensure continuous passage during the construction period, with only an overnight or weekend closure required during the tie-in of the newly built carriageway. No congestion or disruption to journeys is predicted to affect vehicular journeys to Hints village, nearby residential properties, the church or village hall. The realignment of Brockhurst Lane will increase journey distance by approximately 300m which will make accessing these destinations by foot less convenient. Significant congestion is anticipated at the junction with the A38, the A5148 and the A5206 which will affect journeys to access facilities at Lichfield, including secondary schools. Duration of impact: Temporary (one year and four months) (based on duration of nearby construction works only). Effect: Possible delays to journeys required to access community facilities giving rise to temporary isolation effects.
Assessment of magnitude	The magnitude of the impact is classified as medium due to moderate congestion effects at the A38 junction with the A5148 and A5206 which will impact journeys to Lichfield.
Relevant receptors	Residents.
Assessment of sensitivity of receptors (s) to impact	Sensitivity rating: Low. Residents will continue to enjoy continuous passage of Brockhurst Lane (either along its current or future alignment) for access to facilities at Hints and for routes to facilities at Whittington and Lichfield. Congestion effects at the A38 junction with A5148 and A5206 will impact on journeys to Lichfield however an alternative route via Flats Lane exists where, although crossed by the HS2 route, no significant congestion is predicted to occur. This route may also be used for accessing Whittington Primary

Resource name	Brockhurst Lane / Rookery Lane
	School.
Significance rating of effect	Minor adverse - not significant. This significance is different to that reported in the main ES, which was major adverse - significant.
Proposed mitigation options for significant effects	No further mitigation identified.
Residual effects significance rating	Minor adverse - not significant. This significance is different to that reported in the main ES, which was major adverse - significant.

5 Community impact assessment record sheets - operation

5.1.1 There are no significant community impacts expected in this CFA resulting from the operation of the original scheme, AP1 scheme, or AP2 scheme.

6 References

Environmental topic:	Cultural heritage	CH
Appendix name:	Baseline report	001
Community forum area:	Drayton Bassett, Hints and Weeford	021

Contents

1 Introduction

1.1.1 This appendix provides an addendum to appendix CH-001-021 from the main Environmental Statement (ES) published in November 2013. It focuses on survey information that has been collected since the main ES that affects the baseline statements made in the corresponding main ES appendix. This appendix therefore considers only those changes brought about by the new survey information. It should be read in conjunction with appendix CH-001-021 from the main ES.

1.1.2 This appendix provides a section on specific amendments to the original Appendix CH-001-021 as well as a commentary section which sets out new information and understanding which has developed since the issue of the original ES.

1.1.3 This appendix should be read in conjunction with the SES and AP2 ES, Appendices CH-002-021, CH-003-021, CH-004-021, the Volume 5 cultural heritage map book and the original main ES with accompanying appendices and map book.

2 Specific Amendments

Introduction

2.1.1 Set out below are specific amendments and additions to cultural heritage baseline report appendix CH-001-021 which accompanied the main ES.

Section3.2 Later prehistory

2.1.2 In parapgraph 3.2.8, the sentence "Features near DHW111 identified in a geophysical survey28 could relate to this site" should be removed and replaced with the statement: geophysical investigations at CN037 have resulted in the extension of the boundaries of DHW111 (see CH-004-021).

Section 3.3 Romano-British AD43-410

2.1.3 Paragraph 3.3.6 should be amended to include: geophysical investigations near Lodge Farm (CN040, see CH-004-021) identified a dense area of potential archaeological features which have been recorded as asset DHW403. Though undated, these may relate to prehistoric or Romano-British use of the area.

Section 6.2 Historic Landscape Characterisation

2.1.4 Paragraph 6.2.3 should be amended to include the statement: A small parcel of woodland between Loddy Wood and Drayton Lane exhibits characteristics of ancient woodland and, like the other nearby ancient woodlands, a remnant of an earlier woodland or wood-pasture landscape.

3 Commentary on New Understanding of the Evidence Base and Analysis and Research Potential

3.1.1 The research objectives set out in appendix CH-001-021 accompanying the main ES included research questions relating to the the prehistoric and Romano-British settlement of the region. It is thought that the identification of DHW403 and the expansion of DHW111 contribute to the understanding of these research questions and their potential has been sufficiently addressed in the main ES. No further research objectives are proposed.

Environmental topic:	Cultural heritage	CH
Appendix name:	Gazetteer of heritage assets	002
Community forum area:	Drayton Bassett, Hints and Weeford	021

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1 Introduction

1.1.1 This appendix provides an update to Appendix CH-002-021 Cultural heritage gazetteer of heritage assets to the main Environmental Statement (ES) as a result of design changes, assessed as part of the Supplementary Environmental Statement (SES) and the Additional Provision 2 Environmental Statement (AP2ES). This update should be read in conjunction with Appendix CH-002-021Cultural heritage gazetteer of heritage assets from the main ES.

2 Gazetteer

Table 1 – Gazetteer of heritage assets for CFA21

Unique ID	Map reference	Asset type	Name	Description	Period	Designation	Grade	Significance/value	NHL reference	HER reference
DHW401		Archaeology	Archaeology at Drayton Lane near Stone House	Possible archaeology in the form of very dispersed features such as ditches and some limited areas of disturbance (perhaps modern) identified through geophysical survey CN036 (WSI-CFA21-005; Appendix CH-004-021).	Undated	None	None	Not significant	None	n/a
DHW402		Archaeology	Archaeology east of Bucks Head Farm	Dispersed features such as ditches and pits identified through geophysical survey CN039 (WSI-CFA21-005; Appendix CH-004-021).	Undated	None	None	Low	None	n/a
DHW403	CH-01-118	Archaeology	Archaeology at The Lodge	Dense area of potential archaeology including clusters of pits and other negative features as well as two curvilinear ditches, identified through geophysical survey CN040 (WSI-CFA21-005; Appendix CH-004-021.	Undated, possibly prehistoric or Roman	None	None	Moderate	None	n/a
DHW404		Archaeology	Archaeology at Freeford Home Farm	Possible archaeology in the form of dispersed features, mainly pits, identified through geophysical survey CN043 (WSI-CFA21-005; Appendix CH-004-021).	Undated	None	None	Low	None	None
DHW405		Ancient Woodland	Woodland parcel off Drayton Lane	The parcel of woodland off Drayton Lane is likely to be ancient woodland, based on documentary and historic landscape characterisation.	n/a	None	n/a	High	n/a	n/a
DHW102	CH-01-59	Archaeology	Cropmarks near Gallows Brook	Possible archaeology south of Gallows Brook in the form of dispersed features such as pits and postholes identified through geophysical survey CN035 (WSI-CFA21-005; Appendix CH-004-021). Also, an L shaped linear feature visible in aerial photographs, not picked up through geophysics.	Iron age?	None	None	Low	None	n/a

DHW111	CH-01-59	Archaeology	Field system at Hill Farm	Extensive undated cropmarks forming adjoining enclosures with a possible ditched roadway, evident as cropmarks to the south of Hill Farm on aerial photos. Also possible lynchets to the north and linear earthworks visible on LiDAR. Features nearby identified in a geophysical survey (Wessex Archaeology 23 May 2013) could relate to this site. Features include field boundaries and possible post medieval enclosures, north of Barn Cottage. Survey reference CN037 (WSI-CFA21-005; Appendix CH-004-021).	Iron age?	None	None	Low	None	3629
DHW141	CH-01-61	Archaeology	Pit alignment and enclosure	Pit alignment evident as cropmarks. Suggested to be of probable Bronze Age to Romano-British date (CUCAP ADR19-20, BQV71-3, BTO61-4). Additional archaeology in the form of dispersed features, including curvilinear ditches, pits and post holes just north of the A5 and a possible palaeo channel. (No evidence of pit alignment identified through geophysical survey) CN041 (WSI-CFA21-005; Appendix CH-004-021).	Bronze age?	None	None	Moderate	None	2064

Environmental topic:	Cultural heritage	CH
Appendix name:	Impact assessment table	003
Community forum area:	Drayton Bassett, Hints and Weeford	021

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1 Introduction

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2 Impact assessment

Table 1 - Impact assessment for CFA21

Unique identification	Name	Designation(s)	Value	Construction impact			Operation impact			New or different environmental effect from that reported in the main ES or the Additional Provision (AP1) ES
				Nature of impact including mitigation	Scale of impact	Effect	Nature of impact including mitigation	Scale of impact	Effect	
DHW403	Archaeology at The Lodge	None	Moderate	Construction of the mainline of the AP2 revised scheme will remove most of the archaeological features identified through geophysical survey and remove the context of remaining features.	Permanent High adverse	Permanent major adverse	No impact on significance	No change	Neutral	This is a new effect.
DHW166	Enclosure at Roundhill	None	Low	The AP2 revised scheme embankment construction and landscaping will result in the total loss of below ground features.	High adverse	Moderate adverse	No impact on significance.	No Change	Neutral	No change to the magnitude of effect reported in the main ES

Unique identification	Name	Designation(s)	Value	Construction impact			Operation impact			New or different environmental effect from that reported in the main ES or the Additional Provision (AP1) ES
				Nature of impact including mitigation	Scale of impact	Effect	Nature of impact including mitigation	Scale of impact	Effect	
DHW119	Roundhill Wood ancient woodland	Ancient woodland	High	The AP2 revised scheme will require partial removal of the woodland.	High adverse	Major adverse	There will be an increase in noise audible from within the south western part of the wood (SV-02-60). This will result in a low adverse impact. There will be high adverse permanent construction impact as a result of changes to the asset. The combined permanent construction and operational impacts will result in a high adverse impact.	High adverse	Major adverse	No change to the magnitude of effect reported in the main ES
DHW123	Rookery ancient woodland	Ancient woodland	High	The AP2 revised scheme will require partial removal of the woodland.	High adverse	Major adverse	There will be an increase in noise audible from within the wood (SV-02-60). This will result in a low adverse impact.	High adverse	Major adverse	No change to the magnitude of effect reported in the main ES

Unique identification	Name	Designation(s)	Value	Construction impact			Operation impact			New or different environmental effect from that reported in the main ES or the Additional Provision (AP1) ES
				Nature of impact including mitigation	Scale of impact	Effect	Nature of impact including mitigation	Scale of impact	Effect	
							There will be high adverse permanent construction impact as a result of changes to the asset. The combined permanent construction and operational impacts will result in a high adverse impact.			
DHW360	Hints village	Listed buildings, Conservation area	Moderate	There will be an impact of construction on views of the village from the north and east and there may be an increase in noise. Medium adverse temporary impact. The AP2 revised scheme will pass 200m from the historic core of the village which is	Medium adverse	Moderate adverse	There will be long views of the trains from key viewpoints north of the village. There will be an increase in noise closer to the Bourne Brook, up to 5dB 9SV-02-60). This will result in a low adverse impact. There will also be a low adverse permanent	Mediu m adverse	Moderate adverse	No change to the magnitude of effect reported in the main ES

Unique identification	Name	Designation(s)	Value	Construction impact			Operation impact			New or different environmental effect from that reported in the main ES or the Additional Provision (AP1) ES
				Nature of impact including mitigation	Scale of impact	Effect	Nature of impact including mitigation	Scale of impact	Effect	
				screened from it by woodland and intervening topography. The core of the village is not in the ZTV. The AP2 revised scheme will sever the village from its local historic landscape and create notable change to the character of its setting.			construction impact as a result of changes to the setting of the asset. The combined permanent construction and operational impacts will adversely alter key characteristics of the setting of this asset, resulting in a medium adverse impact.			
DHW141	Pit alignment and enclosure	None	Moderate	The AP2 revised scheme will traverse this asset resulting in significant loss of the below ground features and loss of context for remaining features	High adverse	Major adverse	No impact on significance.	No Change	Neutral	No change to the magnitude of effect reported in the main ES
DHW125	Roman field system	None	Moderate	The AP2 revised scheme will traverse this asset resulting in almost total loss of	High adverse	Major adverse	No impact on significance.	No Change	Neutral	No change to the magnitude of effect reported in the main ES

Unique identification	Name	Designation(s)	Value	Construction impact			Operation impact			New or different environmental effect from that reported in the main ES or the Additional Provision (AP1) ES
				Nature of impact including mitigation	Scale of impact	Effect	Nature of impact including mitigation	Scale of impact	Effect	
				the below ground features.						

Environmental topic:	Cultural heritage	CH
Appendix name:	Survey reports	004
Community forum area:	Drayton Basset, Hints and Weeford	021

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1 Introduction

1.1.1 This appendix provides an update to Appendix CH-004-021 Cultural heritage survey reports to the main Environmental Statement (ES) as a result of changes assessed as part of the Supplementary Environmental Statement (SES) and the Additional Provision 2 Environmental Statement (AP2 ES). This update should be read in conjunction with Appendix CH-004-021 Cultural heritage survey reports from the main ES.

2 Geophysical surveys

2.1 CN035 Land off Coppice Lane

Introduction

2.1.1 Survey Parcel CN035 was not reported in the main ES due to access being unavailable at the time.

Project background

2.1.2 Wessex Archaeology was commissioned HS2 to carry out a geophysical survey of area CN035 off Coppice Lane, near Drayton Bassett, Staffordshire (Figure 1), hereafter "the Site" (centred on NGR 417985 299244). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

2.1.3 The geophysical survey undertaken here has been preceded by desk-based research[1] and remote sensing survey comprising LiDAR and hyperspectral survey and analysis[2]. Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

2.1.4 This site, CN035, was selected for geophysical survey as it is considered to be an area at with elevated archaeological potential due to its topographic location on gravels.

Site details

2.1.5 The Site comprises one large field in an area of arable land to the north-east of Coppice Lane approximately 1.9km south-east of the centre of Drayton Bassett and 0.9km to the north-east of the centre of Middleton. The limits of the geophysical survey area are defined by hedgerow field boundaries for the entire site. To the north of the Site is an unnamed brook, to the west and east are hedgerow field boundaries and to the south is Gallows Brook. There is also a large pond in the north-east corner of the site and two smaller tree-lined ponds within the western area of the Site. The gradiometer survey covered 20.1ha

2.1.6 The Site lies on a slight hill or 'island' which is on a lower-lying area between two brooks. The centre of the Site lies at a height a little over 85m aOD (above Ordnance Datum) and falls from this height to less than 77m aOD at the very south-eastern limit of the Site adjacent to Gallows Brook.

2.1.7 The solid geology is recorded as Mercia Mudstone (Triassic) formation across the whole site[3]. Superficial deposits record an "island" of river terrace deposits of sands and gravels; this coincides with the topographic "island" mentioned above[4]. The soils underlying the site are likely to comprise the typical stagnogley soils of the 711f (Wickham 2) association across the central and south-western survey area and the 711n (Clifton) association to the north-east[5]. Soils in such geological settings have been demonstrated to produce magnetic contrasts suitable for the detection of anomalies through gradiometer survey.

Archaeological background

2.1.8 For a detailed assessment of the known archaeology of the site and surrounding area the relevant baseline report should be consulted[6]. A summary of relevant sites within 1km of the survey area are summarised below and have been included to provide context and inform the geophysical interpretation. Sites referred to can be found either within the gazetteer for CFA 21 in the main Environmental Statement[7] (DHW numbers) in the supplementary survey works (WA numbers) or in the Staffordshire or Warwickshire SMRs (MST numbers and MWA numbers respectively).

2.1.9 The current landscape is characterised as post-1880s large rectilinear fields reorganised from small irregular fields .

2.1.10 Available OS mapping shows that the survey area was formerly divided into seven smaller fields[8]. Gallows Brook, which defines the western and southern boundaries of the site, also defines the historic county boundary between Staffordshire and Warwickshire and both the presence of gravels and the topography of the site (being a raised area between two brooks or watercourses) gives increased potential especially for prehistoric exploitation of the area[9].

2.1.11 Remote sensing revealed two irregular hollows within the survey area, probably the remains of quarries or pond and found on the edges of modern fields (WA20.53).

2.1.12 The site lies in arable land between the medieval settlements of Drayton Basset (Staffordshire) to the north-east and Middleton to the south-west (Warwickshire). The medieval manor and deer park of Middleton Hall is approximately 1.5km to the south-east; most of the HER data in the vicinity relates to the medieval period.

2.1.13 The site has particular potential for the prehistoric period and in the surrounding area a Lower Palaeolithic stone handaxe was recorded as a findspot in the village of Middleton to the south of the Site and there is a Bronze Age Axe findspot, south of Brook Farm which is 500m to the north-east of the Site (DHW167).

2.1.14 In Middleton village a Roman figurine mount was also found whilst metal detecting (MWA12358) and Romano-British pottery (MWA10352).

[1] CH-001-021, HS2 Environmental Statement, 2013
[2] CH-004-021, HS2 Environmental Statement, 2013
[3] Ordnance Survey, 1954
[4] Ordnance Survey 1977
[5] Soil Survey of England and Wales, 1983
[6] CH-001-021, HS2 Environmental Statement, 2013
[7] CH-002-021, HS2 Environmental Statement, 2013
[8] Ordnance Survey, 1884
[9] CH-001-021, HS Environmental Statement, 2013

2.1.15 To the south-west of the site is Upper House Farm, an historic farmstead dating to before the 1880's (MWA4247) with an area of ridge and furrow to the north (MWA4275) and a Marl pit east of Upper House Farm (MWA6267) dating to the post-medieval period.

2.1.16 The probable extent of the medieval settlement of Middleton village is based on the OS map of 1887 and is approximately 750m to the south of the Site (MWA9527).

2.1.17 A large area over and around the village of Middleton is the site of a post-medieval ironworks but the exact location is unknown (MWA4198).

Survey objectives

2.1.18 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed[10]. The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site;
- to determine the general nature of the remains present.
- to combine the results of the geophysical surveys with data from other archaeological assessments carried out as part of the project in order to analyse the archaeological potential of the survey locations

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

Methods

Survey dates

2.1.20 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team on 1-3 and 7 October 2014.

Grid location

2.1.21 The 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 Historic England (HE) recommendations[11].

2.1.22 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments used and survey method

2.1.23 The magnetometer 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 HE guidelines[12].

2.1.24 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data processing

2.1.25 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.

2.1.26 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.

Data presentation

2.1.27 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then used to produce the final figures in GIS (ESRI ArcMap 10).

2.1.28 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

2.1.29 The gradiometer survey has been successful in identifying anomalies of possible archaeological interest, along with numerous trends. The results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figures 2 to 7).

2.1.30 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figures 4 and 7). Full definitions of the interpretation terms used in this report are provided in Annex 2.

2.1.31 Ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: archaeology

[10] Wessex Archaeology, 2014
[11] English Heritage, 2008
[12] ibid

2.1.32 A number of features of possible archaeology or possible archaeology (very weak response) have been recorded within the site (see Figures 4 and 7).

2.1.33 The area at 4000 (Figure 4) has been highlighted due to the presence of a number of possible and weakly contrasting possible archaeological anomalies of interest. A linear weakly positive anomaly aligned north-west to south-east may represent a ditch with clusters of pit-type anomalies to the west and south-west. The magnetic strength of the linear anomaly is below ±1nT and it is not possible to confidently extrapolate the feature beyond this area.

2.1.34 The circular and sub-oval anomalies may represent pits of various sizes but could also represent natural features or relate to changes in the natural geology. The irregular shaped weakly shaped positive anomaly is difficult to interpret, it is a large, broad area of weakly positive magnetic strength but there are no other anomalies similar to this present within the survey area and it has been interpreted as possible archaeology (very weak response). The anomaly could equally represent a natural variation in the background soil matrix.

2.1.35 At 4001 in the south-east corner of the site adjacent to Gallow's Brook is a concentration of sub-oval anomalies and a linear shaped positive anomaly (Figure 7). These may relate to cut features such as pits, postholes and sections of ditch. They form no discernible pattern and there is a possibility that they are natural in origin.

2.1.36 A number of pit-like anomalies have been identified at 4002 and 4003 (Figure 7); they are weakly contrasting and are potentially natural in origin either in response to natural variations in the superficial deposits or representative of features such as tree throws.

2.1.37 At 4004 is a curvilinear positive anomaly flanked by negative 'haloes', it is oriented approximately east-west and is classed as a ferrous response. It corresponds with the line of a former field boundary marked on available OS mapping[13] and due to its magnetic strength in excess of ±5nT it is likely a ditch with a large amount of ferrous or enhanced magnetic material within it. There are no physical obstructions above ground.

2.1.38 In the north-west region of the site are several linear repeating bipolar anomalies (4005, 4006 and 4009), relatively evenly spaced and oriented in discrete groups of north-south and east-west alignments. They are interpreted as ceramic field drains in low-lying areas of land adjacent to the brooks.

2.1.39 Ploughing trends are visible across the site, they are weak but narrow linear responses usually regularly spaced and following the same orientation. Concentrations of ploughing trends can be seen around 4004 and 4008 and the predominant direction of ploughing follows a north-west to south-east orientation.

2.1.40 In the south-eastern corner of the site, to the east of 4001, is an area of increased magnetic response. A group of medium to large dipolar anomalies coincides with an area of disturbed and waterlogged ground on available satellite mapping. The anomalies may represent dumped material at the edge of the field or naturally occuring geological responses.

2.1.41 A modern service runs approximately north-west to south-east across the site at 4007, it has a large amount of ferrous debris either side of the core area and this will mask potential anomalies of a weaker response.

2.1.42 There are a number of weakly contrasting and indistinct linear and curvilinear trends present across the site, interpreted as trends of uncertain origin as their form or concentration are not sufficiently defined for further interpretation.

Interpretation: modern services

2.1.43 There is one modern service identified within the site , oriented north-west to south-east, continuing beyond the survey area boundaries.

2.1.44 Gradiometer data will not be able to 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 should be used to confirm the location of buried services before any trenches are opened on site.

Conclusion

2.1.45 The detailed gradiometer survey has been successful in detecting anomalies of possible archaeological interest within the site, in addition to regions of increased magnetic response and trends of uncertain origin.

Discussion

2.1.46 There are several anomalies of possible archaeological interest across the site with some concentrations apparent. The two areas with a concentration of possible archaeological features, around 4000 and 4001 are coincidentally in the same locations as the highest and the lowest-lying areas of the site (see Figure 8). The site as a whole was given increased archaeological potential due to its topographic position and its location as an "island" of superficial deposits of sands and gravels.

2.1.47 It is not possible to date these potential features from the gradiometer survey but locating early prehistoric archaeology with geophysics has been demonstrated on other sites where such features were suspected. The types of features identified through gradiometer survey and that were subsequently excavated and dated to the Mesolithic included pits, postholes, hearths and scoops, their topographic location was also a factor in their identification and interpretation (Biggins 2007).

2.1.48 An area of ceramic field drains around 4004-4006 in the northern part of the site is in a low-lying area adjacent to the brook. The density of drains in this area will obscure the weaker responses generated by possible archaeological features.

2.1.49 Numerous linear and curving trends have been noted within the survey area, in addition to ferrous responses and magnetic disturbance associated with the existing boundaries. Whilst it is possible that some of these trends may be of archaeological interest, it is considered more likely that they relate to ploughing and near-surface geological changes.

2.1.50 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 encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

[13] Ordnance Survey, 1884

References

Biggins, A., 2007 "Geophysical Survey" in C. Waddington (ed), 'Mesolithic Settlement in the North Sea Basin: A Case Study from Howick, North-East England' 9-16, Oxbow Books: Oxford

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Ordnance Survey, 1977. Quaternary Map of the United Kingdom: South. Ordnance Survey. Southampton

Soil Survey of England and Wales, 1983. Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

Wessex Archaeology, 2014. HS2: Geophysical Survey Written Scheme of Investigation: Staffordshire. Report Reference: 86257.01.

HER records consulted

HST5762 - Other large rectilinear fields, post-1880s reorganised fields
HWA4274 - Upper House Farm; pre-1880s historic farmstead
HWA4275 - area of ridge and furrow north of Upper House farm
MST3408 - Bronze Age Axe findspot, south of Brook Farm
MWA111 - Findspot of Lower Palaeolithic stone handaxe, Middleton
MWA4198 - Site of post-medieval ironworks at Middleton
MWA6267 - Marl pit east of Upper House Farm
MWA9527 - probable extent of the medieval settlement of Middleton village
MWA10352 - Findspot of Romano-British pottery found in Middleton
MWA12358 - Findspot of Roman figurine mount through metal detecting, Middleton

2.2 Figures

Figure 1 - CN035 site location

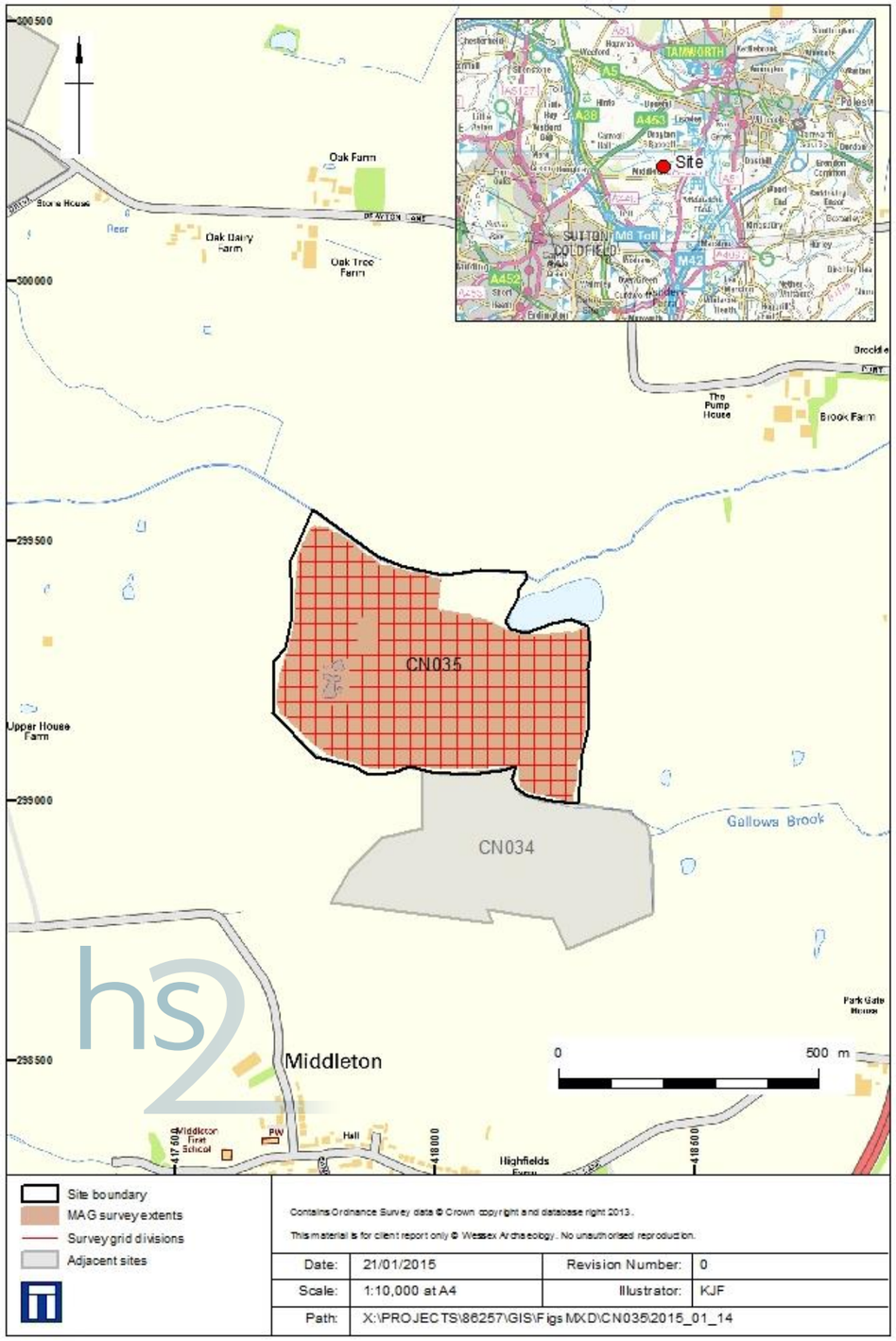
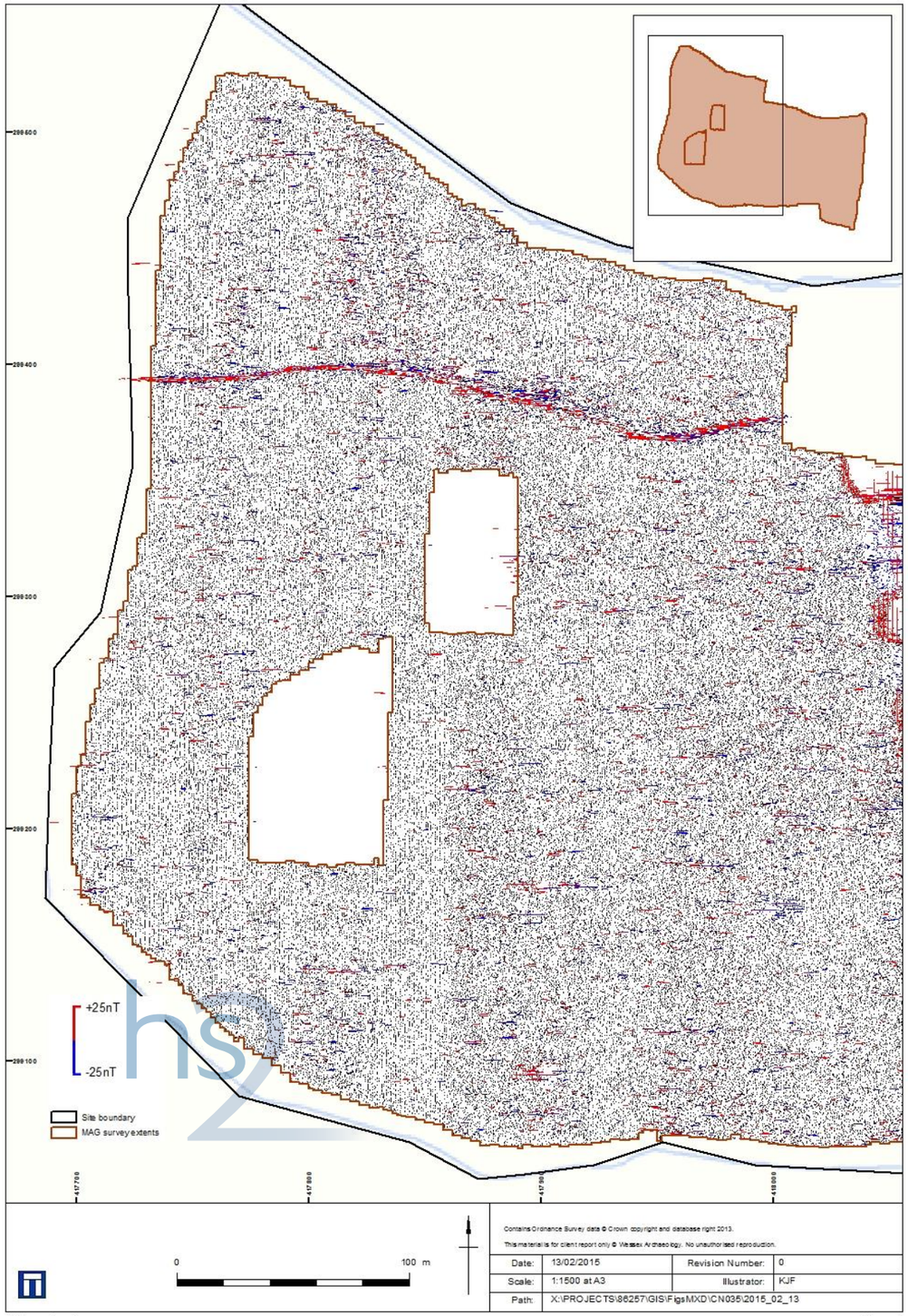


Figure 2 - CN035 greyscale plot (west)

Greyscale (west)

Figure 2

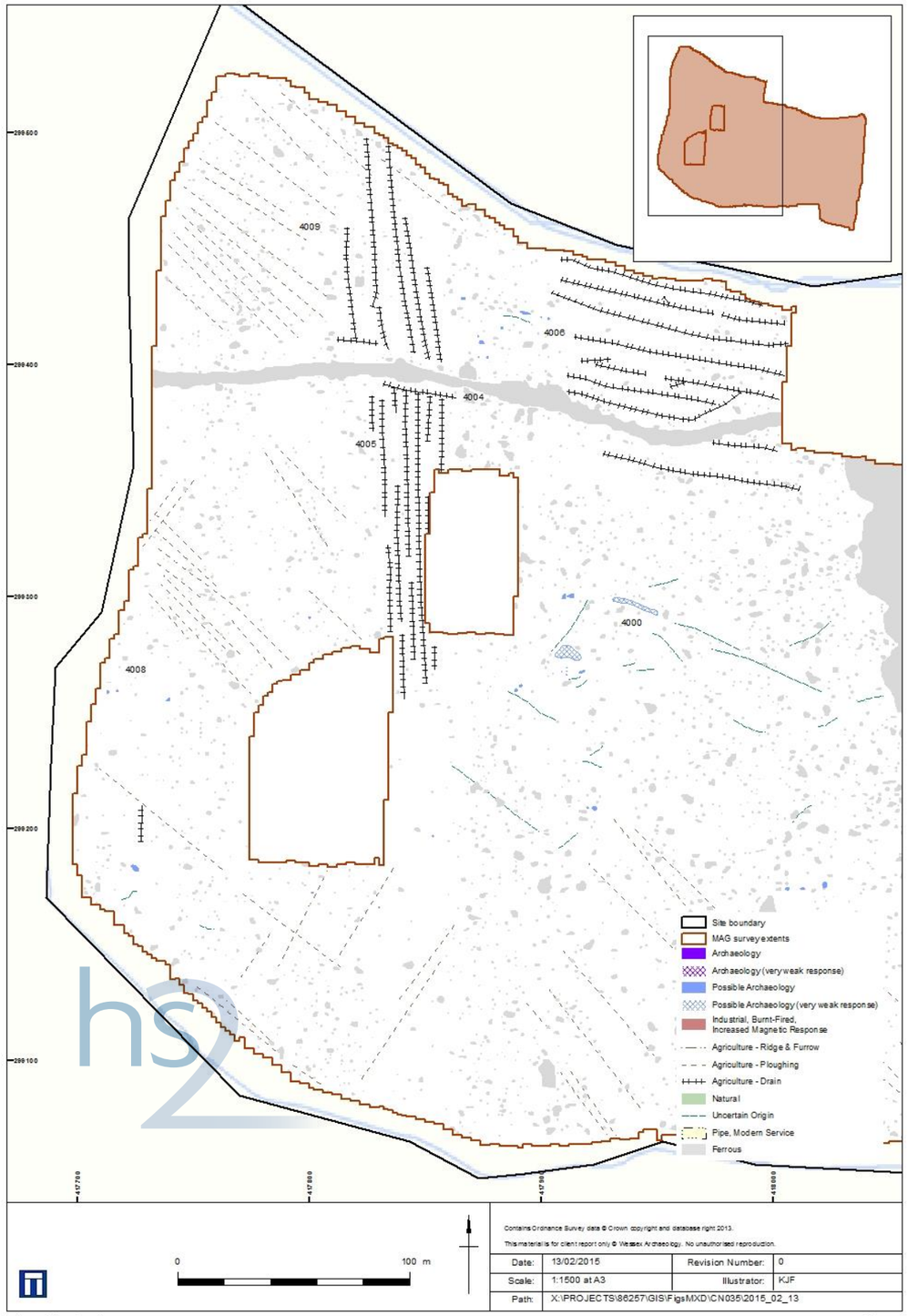
Figure 3 - CN035 XY trace (west)



XY trace (west)

Figure 3

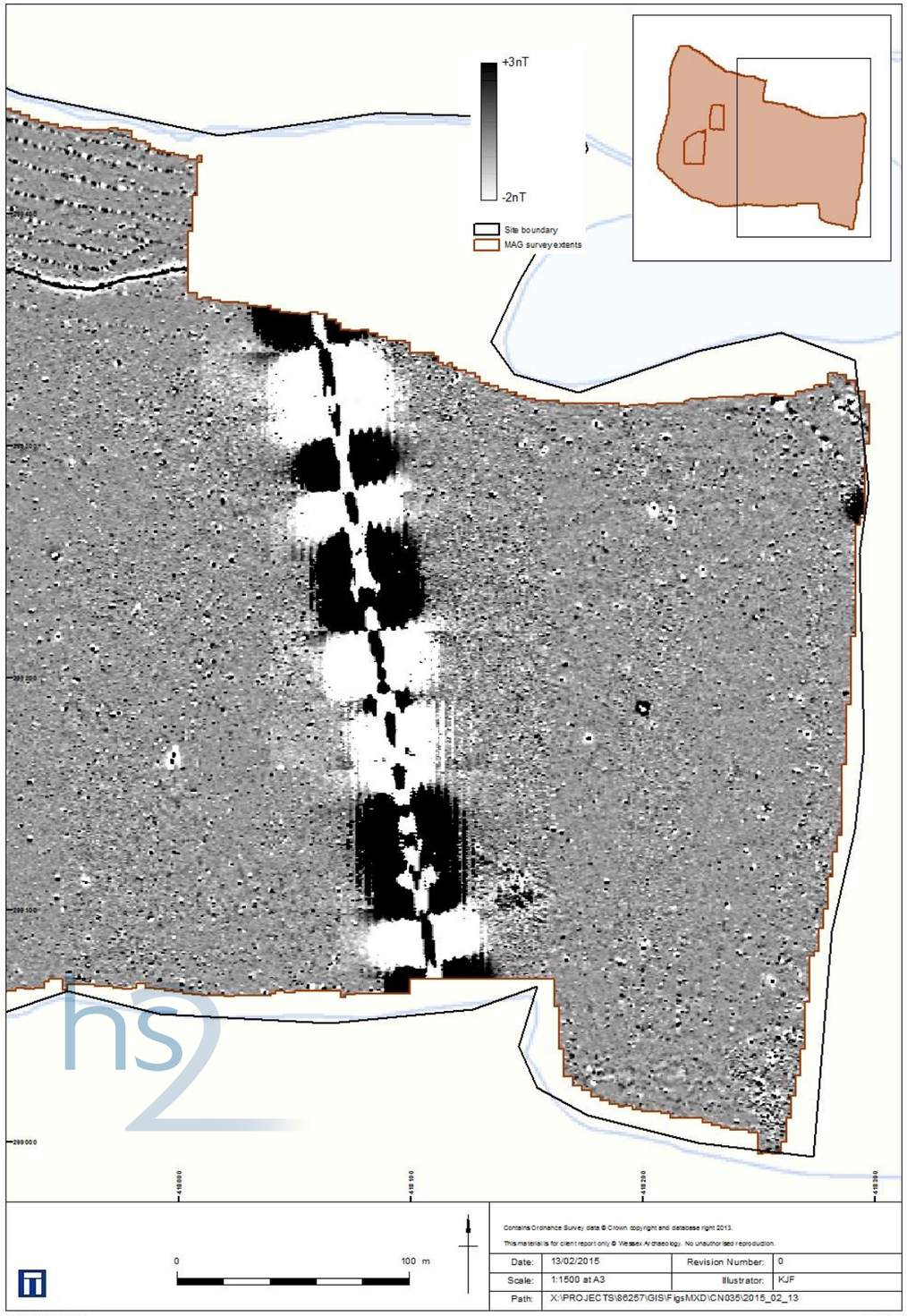
Figure 4 - CN035 interpretation (west)



Interpretation (west)

Figure 4

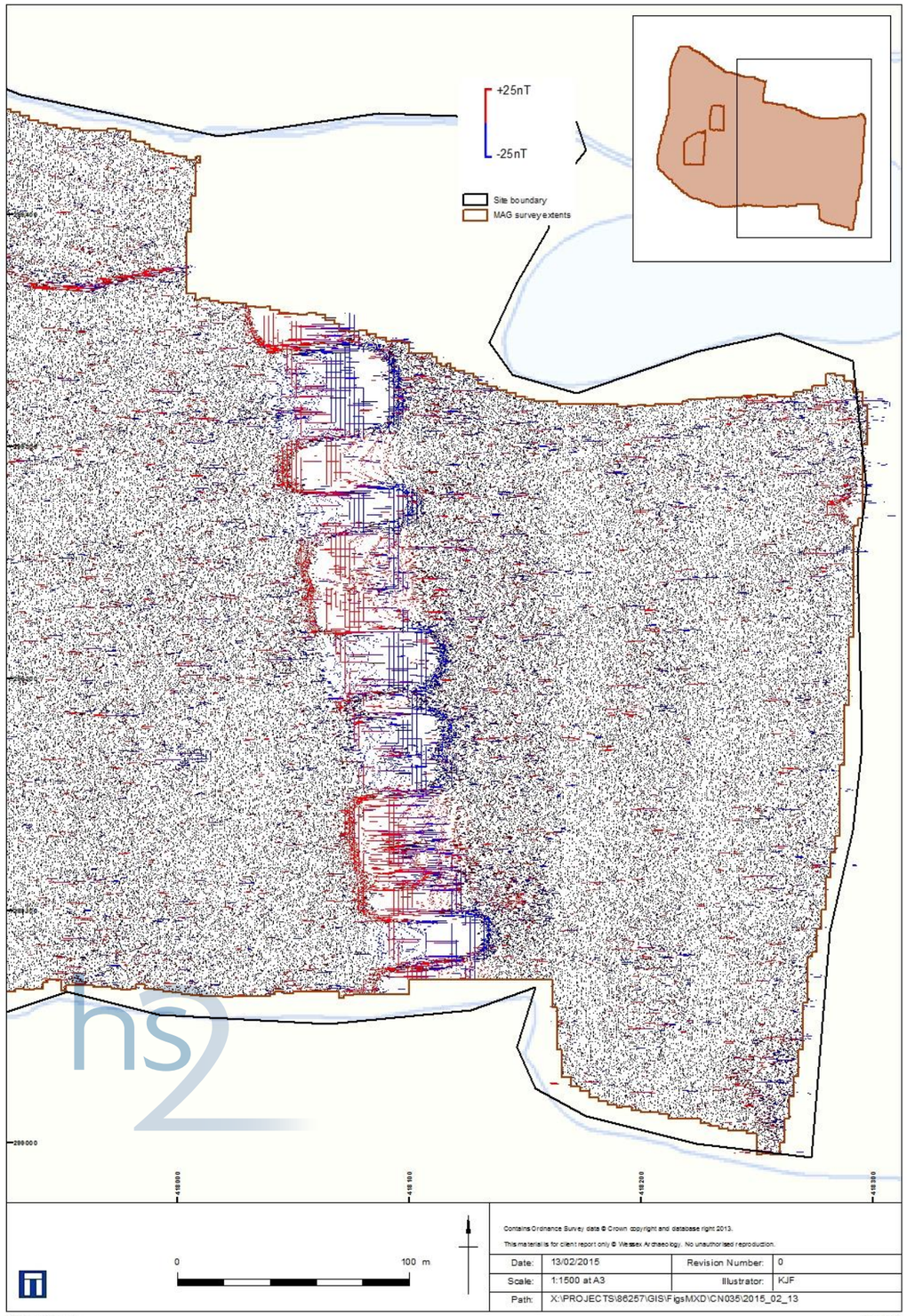
Figure 5 - CN035 greyscale plot (east)



Greyscale (east)

Figure 5

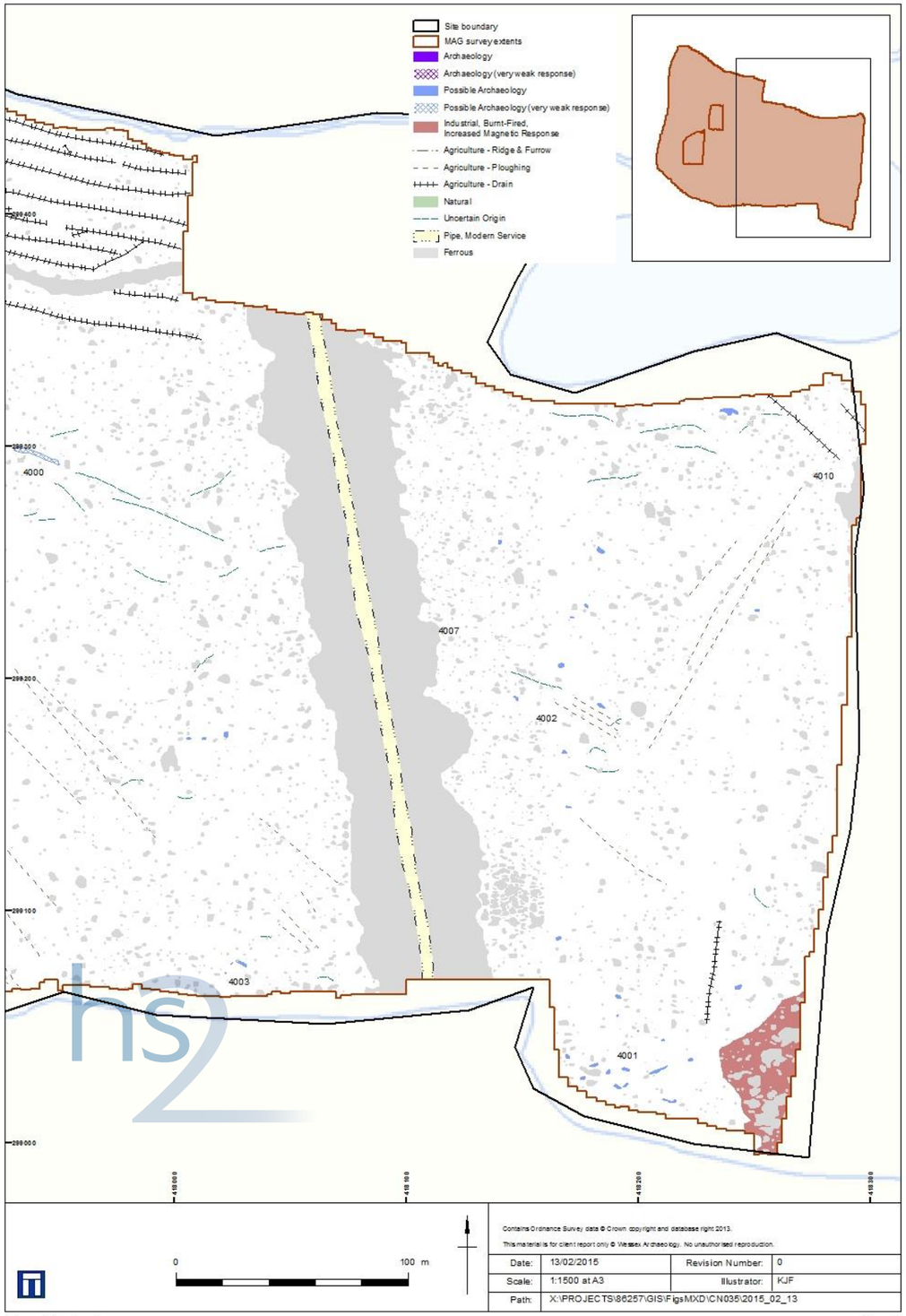
Figure 6 - CN035 XY trace (east)



XY trace (east)

Figure 6

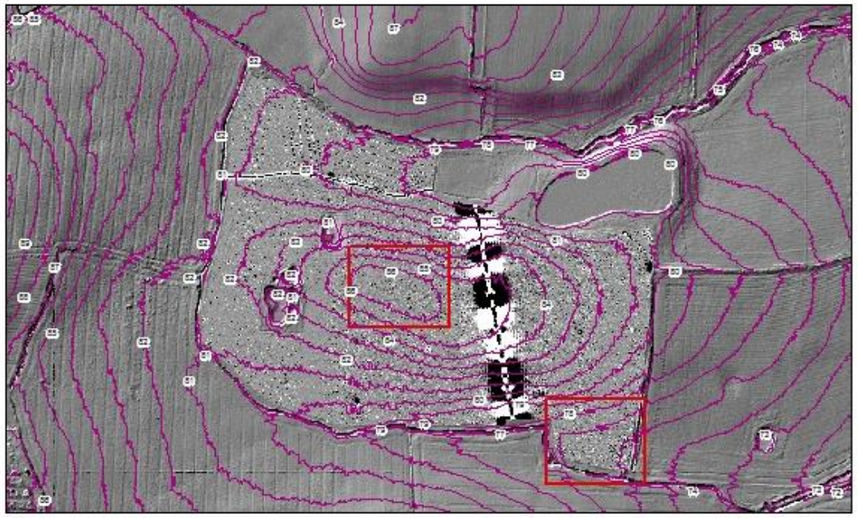
Figure 7 - CN045 interpretation (east)



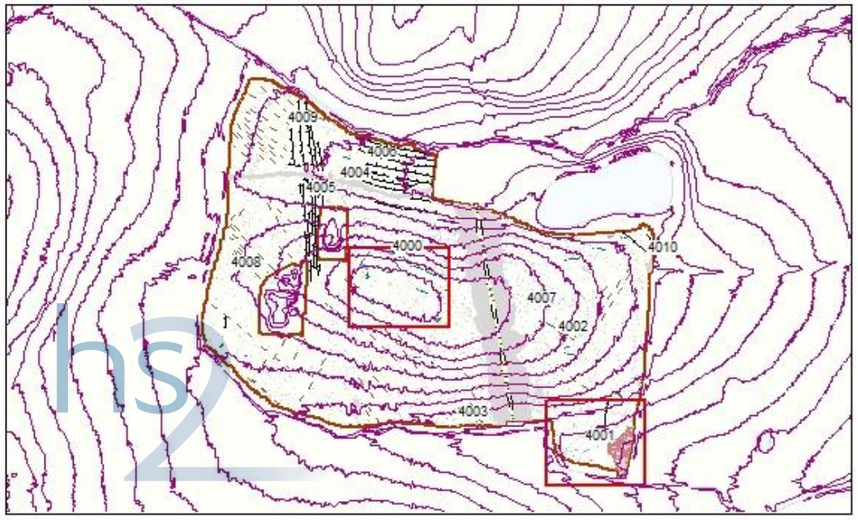
Interpretation (east)

Figure 7

Figure 8 - CN035 anomalies in association with DEM generated 1m contours



LiDAR data of hillshade raster with DEM generated 1m contours



Geophysical interpretation with DEM generated 1m contours

Areas containing possible archaeological anomalies

Date:	17/02/2015	Revision Number:	0
Scale:	NTS	Illustrator:	RAM
Path:	X:\PROJECTS\86257\GIS\Figs MXD\CN035\2015_01_21		

Anomalies in association with DEM generated 1m contours

Figure 8

2.3 CN036 Land off Shirrall Drive

Introduction

2.3.1 Wessex Archaeology was commissioned by HS2 to carry out a geophysical survey of area CN036 off Shirrall Drive, near Drayton Bassett, Staffordshire (Figure 9), hereafter "the site" (centred on NGR 417113 300237). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

2.3.2 The geophysical survey undertaken here has been preceded by desk-based research[14] and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis[15]. Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

2.3.3 This site, CN035, was selected for geophysical survey as it is considered to be a known area of medium to high risk with known archaeology in the wider landscape.

The site

2.3.4 The site is comprised of one arable field located approximately 2.1km west of Drayton Bassett, Staffordshire. The site is bounded to the north by Drayton Lane, to the south-east by Shirrall Drive and to the south-west and north-west by hedgerow and tree field boundaries. The gradiometer survey has fully covered the 4.2ha site.

2.3.5 The site lies on a south-west facing slope at a height of 102m aOD (above Ordnance Datum) and falls from this height to less than 95m aOD.

2.3.6 The solid geology is recorded as Mercia Mudstone Formation (Triassic)[16]. There are superficial deposits recorded on site are recorded as Mid Pleistocene till - diamicton[17]. The soils underlying the site are likely to be typical stagnogley soils of either the 711n (Clifton) or 711f (Wickham 2) association[18]. Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological background

2.3.7 For a detailed assessment of the known archaeology of the site and surrounding area the relevant baseline report should be consulted[19]. A summary of relevant sites within 1km of the survey area are summarised below and have been included to provide context and inform the geophysical interpretation. Sites referred to can be found either within the gazetteer for CFA 21 in the main ES (DHW numbers)[20] in the supplementary survey works[21] (WA numbers) or in the Staffordshire HER (MST numbers).

2.3.8 The current landscape is characterised as a former deer park and then early small rectilinear field (post-medieval) and 18th/19th century planned.

2.3.9 Remote sensing revealed man-made features within the site[22]. Within the site is an approximately circular large hollow, possibly a former pond or quarry (WA21.9). Bordering the north-west field boundary are two ponds, probably man-made and dating to the post-medieval or modern period (WA21.11) and to the south-east is a large irregular hollow of uncertain origin adjacent to the road (WA21.10).

2.3.10 Prehistoric activity seems to be concentrated to the north-east of the site within the area of Drayton Deer Park but this could also be a reflection of the amount of fieldwalking that has been undertaken in the area (MST2258-2266). A possible Bronze Age burnt mound in Alder Wood (MST3781) and four separate locations of flint scatters and pottery findspots are recorded but of unknown date (DHW128; MST6142; MST1846; MST6140).

2.3.11 Two Roman and medieval pottery sherd findspots are recorded within Drayton Deer Park (MST6141; MST6139) and an undated field system (MST3403), all to the north-east of the site. There is one located findspot of medieval pottery to the west of the Site (MST6135).

2.3.12 The site lies within the former boundary of the medieval Drayton Deer Park (DHW105) and adjacent to its boundary are two others of Shirral Deer Park (DHW106) and Bangley Deer Park (DHW114).

2.3.13 Within Shirral Deer Park in an area named Shirral Coppice are three earthwork features of a dam, a boundary bank and a field boundary (DHW107), they are undated but could be associated with the coppice and possibly plantation earthworks, the locations of these earthworks are not covered by LiDAR survey.

2.3.14 Within the wider landscape, the site lies approximately 1.5km to the south-west of Bourne Brook where undated enclosures, linear features, a bloomery and charcoal burning sites are recorded.

Survey Objectives

2.3.15 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed[23]. The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site;
- to determine the general nature of the remains present.
- to combine the results of the geophysical surveys with data from other archaeological assessments carried out as part of the project in order to analyse the archaeological potential of the survey locations

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

[14] CH-001-021, HS2 Environmental Statement, 2013
[15] CH-004-021, HS2 Environmental Statement, 2013
[16] Ordnance Survey, 1957
[17] Orndance Survey, 1977
[18] Soil Survey of England and Wales, 1983
[19] CH-001-021, HS2 Environmental Statement, 2013
[20] CH-002-021, HS2 Environmental Statement, 2013
[21] CH-004-021, HS2 Environmental Statement, 2013
[22] ibid
[23] Wessex Archaeology, 2014

Methods

Survey dates

2.3.17 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between the 29-30 September and the 10-18 November 2014.

Grid location

2.3.18 The 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 HE recommendations[24].

2.3.19 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments used and survey method

2.3.20 The magnetometer 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 HE guidelines[25].

2.3.21 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data processing

2.3.22 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.

2.3.23 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.

Data presentation

2.3.24 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then used to produce the final figures in GIS (ESRI ArcMap 10).

2.3.25 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

2.3.26 The gradiometer survey has been successful in identifying anomalies of possible archaeological interest, along with numerous trends. The results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figures 10 to 12).

2.3.27 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 12). Full definitions of the interpretation terms used in this report are provided in Annex 2.

2.3.28 Ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: archaeology

2.3.29 A small number of anomalies of possible archaeological interest have been identified within the site. To the north west of 4000 is an elongated weakly positive anomaly emerging from the current field boundary, to the east of 4000 are a series of elongated oval shaped positive anomalies in a linear orientation also emerging from the current field boundary ono a broadly north-west to south east alignment. These may represent the line of former fitches, but are on a different orientation to and do not relate to modern field boundaries.

2.3.30 At 4001 are three approximately oval shaped positive anomalies. They are in a linear series and are on the same orientation as a ceramic field drain and possibly associated. As a direct association is not visible between the possible features at 4001 and the ceramic field drain, they are interpreted as possible archaeology and could be discrete pits or sections of ditch.

2.3.31 At 4002 are two small, positive anomalies grouped together, they are possibly pit-type features but could also potentially be natural in origin. They have been identified as possible archaeology as they are weaker and their profile more rounded than dipolar ferrous responses in the vicinity.

2.3.32 There is one further possible pit-like feature at 4003 close to the modern field boundary bordering Drayton Lane.

2.3.33 An irregular area of increased magnetic response at 4004 lies close to the north-west field boundary and possibly represents a larger pit or area of debris or burning.

2.3.34 Ploughing trends orientated broadly north-west to south-east are visible throughout the survey area. A series of repeating bipolar anomalies at 4006 and 4007 most likely represent ceramic field drains.

Interpretation: modern services

2.3.35 No modern services have been identified within the survey area.

2.3.36 It should be noted that gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole

[24] English Heritage, 2008

[25] ibid

source for service locations and appropriate equipment should be used to confirm the location of buried services before any trenches are opened on site.

Conclusion

2.3.37 The detailed gradiometer survey has been successful in detecting anomalies of possible archaeological interest within the site, an area of increased magnetic response, ploughing trends, trends of uncertain origin and two ceramic field drains.

Discussion

2.3.38 The anomalies of possible interest are centred around 4000 to 4003, with possible ditches at 4000 and potential pits at 4001 to 4003. The pit-type anomalies at 4001 are aligned upon the same orientation as a potential ceramic field drain at 4006 and could possibly be associated. There are no internal field boundaries visible on the earliest available OS mapping[26] to suggest they are associated with a former field boundary.

2.3.39 The ploughing trends recorded are aligned north-west to south-east, in the same orientation as the current field boundaries and are probably post-medieval or modern in origin.

2.3.40 The area of increased magnetic response at 4004 is more difficult to define, while it could represent an area of former burning or containing debris and therefore potentially of archaeological interest it could also be natural in origin and represent a change in the near surface geology.

2.3.41 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 encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

References

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Soil Survey of England and Wales, 1983. Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

Wessex Archaeology, 2014. HS2: Geophysical Survey Written Scheme of Investigation: Staffordshire. Report Reference: 86257.01.

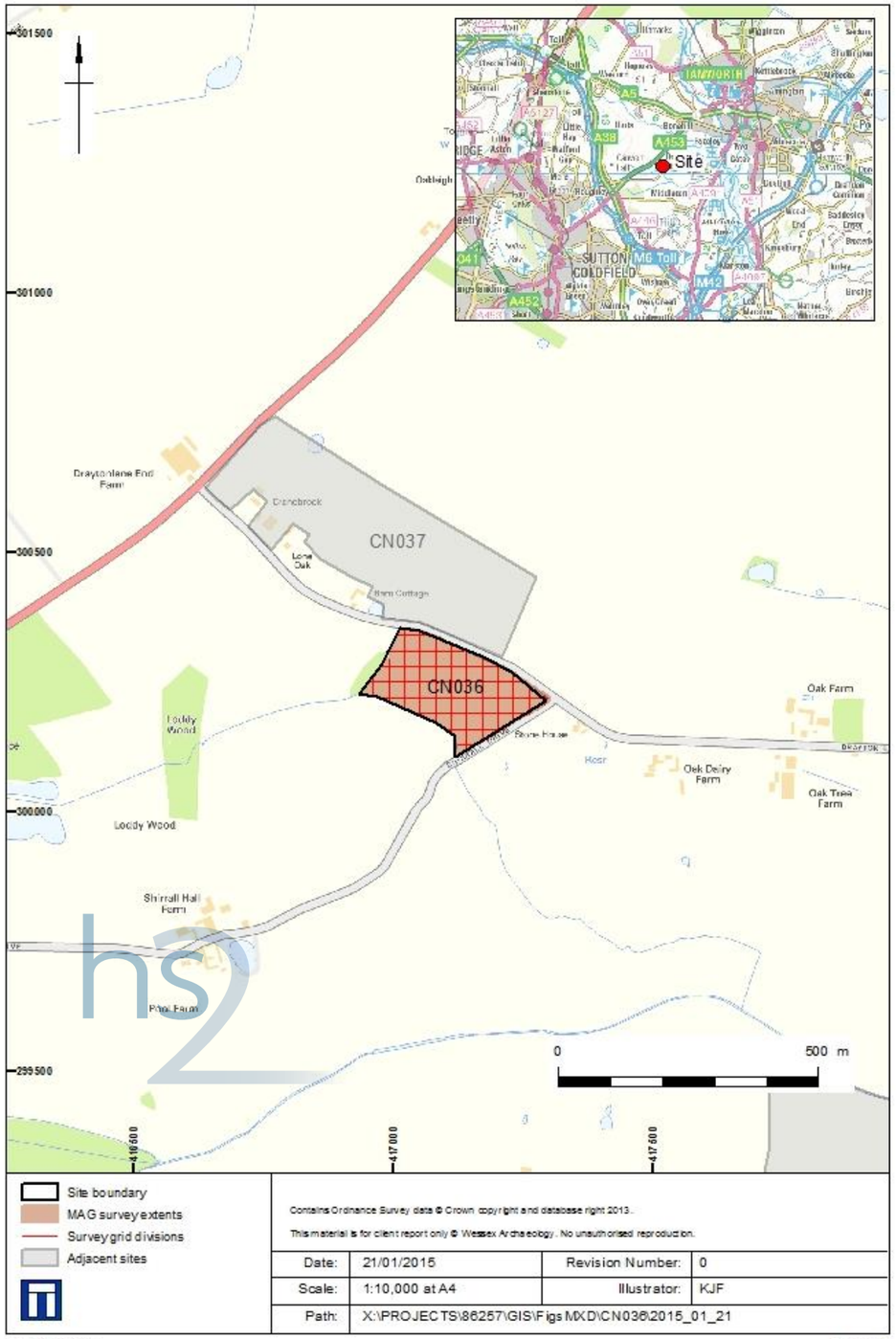
HER Records Consulted

EST2258-2266 - Field walking at Drayton Park, 1981
HST5763 - 18th/19th century planned enclosure
HST6576 - 18th/19th century semi-planned enclosure of other small rectilinear fields
MST1846 - Flint and pottery finds, Drayton Park, Drayton Bassett
MST3403 - Undated Field system, South of Hill Farm, Drayton Bassett
MST4004 - Drayton Deer Park
MST4005 - Bangley Park Deer Park
MST4006 - Shirral Park Deer Park
MST6134 - Dam, Shirral Park, Drayton Bassett
MST6135 - Medieval pottery findspot, Drayton Bassett
MST6138 - Flint scatter and pottery finds, Alder Wood, Drayton Park, Drayton Bassett
MST6139 - Findspot of Roman pottery, Hill Farm, Drayton Park, Drayton Bassett
MST6140 - Flint and pottery finds, near Hill Farm, Drayton

[26] Ordnance Survey, 1884

Figures

Figure 9 - CN036 site location



Site location

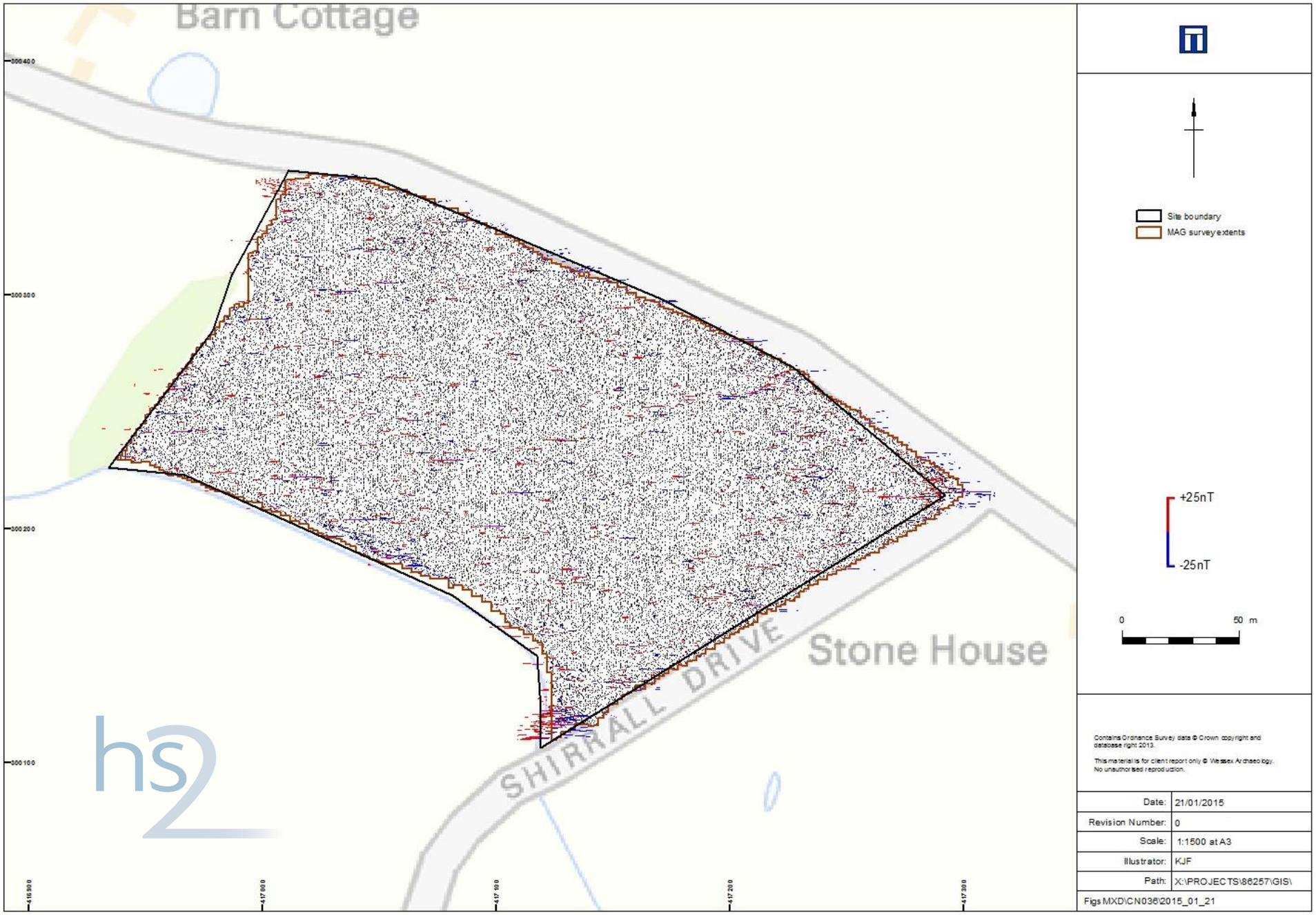
Figure 9

Figure 10 - CN036 greyscale plot

Greyscale plot

Figure 10

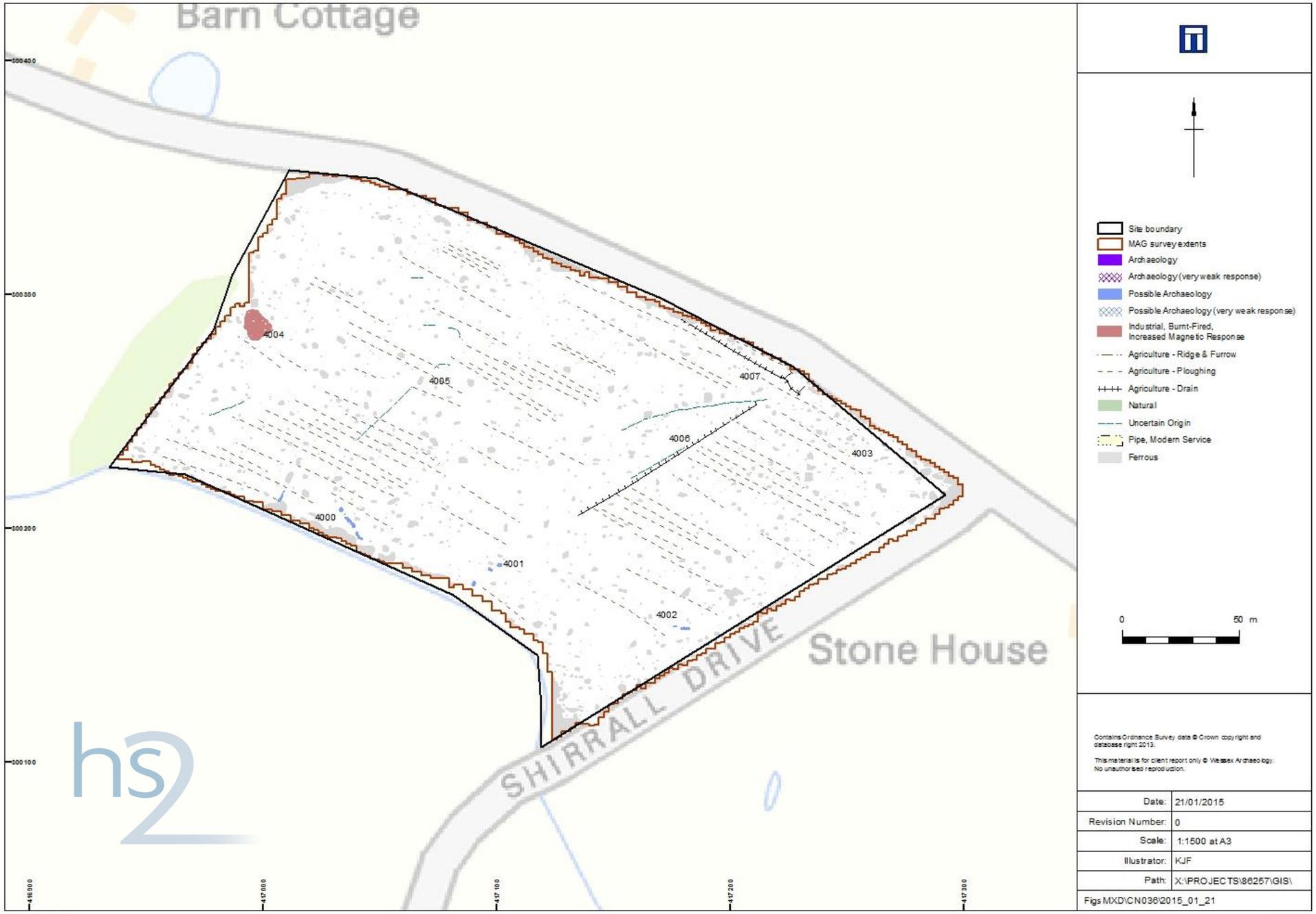
Figure 11 - CN036 XY trace



XY trace

Figure 11

Figure 12 - CN036 interpretation



Interpretation

Figure 12

2.4 CN037 Land off Drayton Lane

Introduction

2.4.1 Survey parcel CN037 was not reported in the main ES due to access being unavailable at the time.

Project background

2.4.2 Wessex Archaeology was by HS2 to carry out a geophysical survey of area CN037 off Drayton Lane, near Drayton Bassett, Staffordshire (Figure 13), hereafter "the site" (centred on NGR 416981 300530). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

2.4.3 The geophysical survey undertaken here has been preceded by desk-based research[27] and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis[28]. Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

2.4.4 This site, CN037, was selected for geophysical survey as it is considered to be an area of high risk with known archaeology in the area.

Site details

2.4.5 The site comprises three arable fields located approximately 2.2km west of Drayton Basset, Staffordshire. The site is bounded to the north-west by Sutton Road, to the south-west by Drayton Lane and to the north-east and south-east by agricultural fields. The gradiometer survey covered 10.4ha.

2.4.6 The Site lies on a south-east facing slope at a height of 112m aOD (above Ordnance Datum) and falling to less than 102m aOD.

2.4.7 The solid geology is recorded as Mercia Mudstone Formation (Triassic)[29]. Superficial deposits of Mid Pleistocene till (Diamicton) are recorded on site[30].

2.4.8 The soils underlying the site are likely to be typical stagnogley soils of either the 711b (Brockhurst 1) or 711n (Clifton) association[31]. Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological background

2.4.9 For a detailed assessment of the known archaeology of the site and surrounding area the relevant baseline report should be consulted[32]. Relevant sites within 1km of the survey area are summarised below and have been included to provide context and inform the geophysical interpretation. Sites referred to can be found either within the gazetteer for CFA 21 in the ES[33] (DHW numbers) in the supplementary survey works[34] (WA numbers) or in the Staffordshire HER (MST numbers).The current landscape is characterised as a former deer park and 18th/19th century planned enclosures.

2.4.10 Remote sensing revealed man-made features within the site[35] of two ponds on the current field boundaries (WA21.10 and 21.11) and a low linear earthwork aligned broadly NE-SW, possibly a former field boundary dating to the post-medieval or modern period (WA21.12).

2.4.11 To the south of Hill Farm, Drayton Bassett, there is an undated trackway and field system recorded over a large area that includes the two larger fields of the site. There are no further details as to the form or layout of the field system and its date range is unknown but it is described as a Celtic field system (MST3403).

2.4.12 Prehistoric activity seems to be concentrated to the north-east of the site within the area of Drayton Deer Park but this could also be a reflection of the amount of fieldwalking that has been undertaken in the area (MST2258-2266). A possible Bronze Age burnt mound in Alder Wood (MST3781) and four separate locations of flint scatters and pottery findspots are recorded but of unknown date (DHW128; MST6142; MST1846; MST6140).

2.4.13 Two Roman and medieval pottery sherd findspots are recorded within Drayton Deer Park (MST6141; MST6139) and an undated field system (MST3403), all to the north-east of the site. There is one located findspot of medieval pottery to the west of the Site (MST6135).

2.4.14 The site lies within the former boundary of the medieval Drayton Deer Park (DHW105) and adjacent to its boundary are two others of Shirral Deer Park (DHW106) and Bangley Deer Park (DHW114).

2.4.15 Within Shirral Deer Park in an area named Shirral Coppice are three earthwork features of a dam, a boundary bank and a field boundary (DHW107), they are undated but could be associated with the coppice and possibly plantation earthworks, the locations of these earthworks are not covered by LiDAR survey.

2.4.16 Within the wider landscape, the site lies approximately 1.5km to the south-west of Bourne Brook where undated enclosures, linear features, a bloomery and charcoal burning sites are recorded.

Survey Objectives

2.4.17 A WSI was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed[36]. The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site;
- to determine the general nature of the remains present.
- to combine the results of the geophysical surveys with data from other archaeological

[27] CH-001-021, HS2 Environmental Statement, 2013.
[28] CH-004-021, HS2 Environmental Statement, 2013.
[29] Ordnance Survey, 1957
[30] Ordnance Survey, 1977
[31] Soil Survey of England and Wales, 1983
[32] CH-001-021, HS2 Environmental Statement, 2013
[33] CH-002-021, HS2 Environmental Statement, 2013
[34] CH-004-021, HS2 Environmental Statement, 2013
[35] ibid
[36] Wessex Archaeology, 2014

assessments carried out as part of the project in order to analyse the archaeological potential of the survey locations

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

Methodology

Survey dates

2.4.19 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between the 28-31 October 2014.

Grid Location

2.4.20 The 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 HE recommendations[37].

2.4.21 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments used and survey method

2.4.22 The magnetometer 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 HE guidelines[38].

2.4.23 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data processing

2.4.24 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.

2.4.25 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.

Data presentation

2.4.26 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then used to produce the final figures in GIS (ESRI ArcMap 10).

2.4.27 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

2.4.28 The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends. The results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figures 14 to 19).

2.4.29 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Anomalies 4000-4009 in Figure 16; anomalies 4010-4019 in Figure 19). Full definitions of the interpretation terms used in this report are provided in Annex 2.

2.4.30 Ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: archaeology

2.4.31 A former field boundary aligned southeast-northwest has been identified at 4000, this is also likely present returning to the north-east at 4001. These have been interpreted as archaeology and archaeology (very weak response) with a magnetic strength of ±2-3nT. This feature is not marked on available OS mapping but is on the same alignment as the current field system.

2.4.32 Some possible oval shaped, positive, pit-type anomalies have been identified at 4002 with some weaker but similar oval anomalies around 4003. While classified as possible archaeology they are scattered and weak and could equally be in response to natural features such as tree throws or variations in the superficial geology.

2.4.33 There a number of features relating to agricultural activity across the Site such as ploughing trends oriented north-west to south-east at 4004 and ceramic field drains.

2.4.34 Ceramic field drains are present in the form of a linear series of bipolar responses at 4006, aligned north-west to south-east with a second set aligned south-west to north-east. Within this L-shaped area bounded by ceramic field drains is an area of increased magnetic response at 4005. It is possibly a spread of debris containing ferrous or ceramic debris material but it is unclear whether there is archaeological potential associated with it. The presence of ceramic field drains in the vicinity and a large amount of ferrous anomalies suggests that there has been modern disturbance in this field.

2.4.35 Strong negative and positive anomalies at 4007 are consistent in alignment with a modern track way evident at the time of survey and in aerial imagery. The response is likely caused by materials such as hard-core used to strengthen the surface.

[37] English Heritage, 2008

[38] ibid

2.4.36 There are a large amount of ferrous responses around the current field boundaries which are presumed to be result of metal fencing and buildings bordering the Site such as at 4008 and 4009.

2.4.37 There are several linear and curvilinear weak trends of uncertain origin across the Site for example between 4001 and 4009, from their magnetic strength and shape and layout they could not be characterised further.

2.4.38 In the south-eastern field around 4010-4014 an area of irregular anomalies has been identified that could indicate possible enclosures; these are several weak negative and also positive magnetic responses forming rectilinear patterns. At 4010 and 4011 the negative rectilinear anomalies predominate with areas of oval shaped positive anomalies within them. At 4012 to 4014 there are weakly positive oval and curvilinear anomalies that are more typical of ditch and pit-like anomalies. The nature of these responses overall and their association with each other is unclear as they could be consistent with former earthwork features now ploughed out but also ditches filled with sterile soil thereby exhibiting as a weakly negative feature. Only one anomaly at 4010 is more clearly visible in form and layout, measuring approximately 16 x 20m. Anomalies around 4013 to the north-west suggest a possible continuation of these features into the adjacent field.

2.4.39 At 4010 have also been identified several linear weakly negative anomalies, regularly spaced approximately 10m apart and not quite parallel in alignment but slightly radiating. They have been identified as possible archaeology (very weak response) but as with the anomalies at 4010 to 4014 it is difficult to distinguish whether this is in response to a former earthwork feature or cut feature.

2.4.40 A section of ceramic field drain is visible just to the north-east of 4011, Between 4011 and 4012 an anomaly of possible archaeological potential has been identified. Therefore it should not be ruled out that these several possible archaeological features could be associated, as some of the weakly positive pit-type anomalies continue in approximately the same linear alignment as the field drain.

2.4.41 Elsewhere in this field are ploughing trends can be seen in two different alignments, north-west to south-east and north-east to south-west. They are presumed to be post-medieval or modern in date.

2.4.42 A large area of increased magnetic response around 4015 and 4016 also contains field drains and numerous ferrous anomalies. This area borders the farm buildings and is likely to be the result of debris containing ferrous and ceramic material and is most probably of modern date.

Interpretation: modern services

2.4.43 One modern service 4019 has been identified in the geophysical survey bisecting the south-eastern field oriented on an east-west alignment.

2.4.44 Gradiometer data will not be able to 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 should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

2.4.45 The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the site in particular an area of possible enclosures and pits. Additionally anomalies were also identified that are probably natural in origin along with areas of increased magnetic response ploughing trends, trends of uncertain origin and a modern service.

Discussion

2.4.46 A series of possible archaeological features around 4002 and 4004 have been identified within the HER area of cropmarks identified as an undated field system (MST3403). These are not wholly aligned on the same axis as the current field boundaries but are of similar orientation. These features are concentrated in the eastern area of the Site and no similar anomalies are visible elsewhere. The negative anomalies could be in response to areas of sterile or less magnetically enhanced soil, which can be attributed to ditches as well as former banks.

2.4.47 The field boundary at 4000 and 4001 is not visible on earliest available OS mapping (Ordnance Survey 1889) but it is on the same NW-SE alignment as the current field system and as such is likely to represent post-medieval or 19th century enclosure.

2.4.48 A possible linear earthwork boundary was identified in the LiDAR data (WA6.12) and its location coincides with a ceramic field drain therefore the linear earthwork is possibly associated with its construction.

2.4.49 There is a large amount of ferrous disturbance in the south-west area of the site especially around the farms and outbuildings of Cranebrook, Lone Oak and Barn Cottage. This is assumed to be modern in origin but the halo around these areas will mask weakly magnetised features.

2.4.50 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 encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

References

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

HS2 Ltd, 2013. London-West Midlands Environmental Statement, Volume 5: Technical Appendices: CFA21

Ordnance Survey, 1884. OS County Series: Staffordshire 1:2500

Ordnance Survey 1957. Sheet 2, Geological Map of Great Britain: England and Wales. Ordnance Survey: Chessington

Ordnance Survey, 1977. Quaternary Map of the United Kingdom: South. Ordnance Survey. Southampton

Soil Survey of England and Wales, 1983. Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

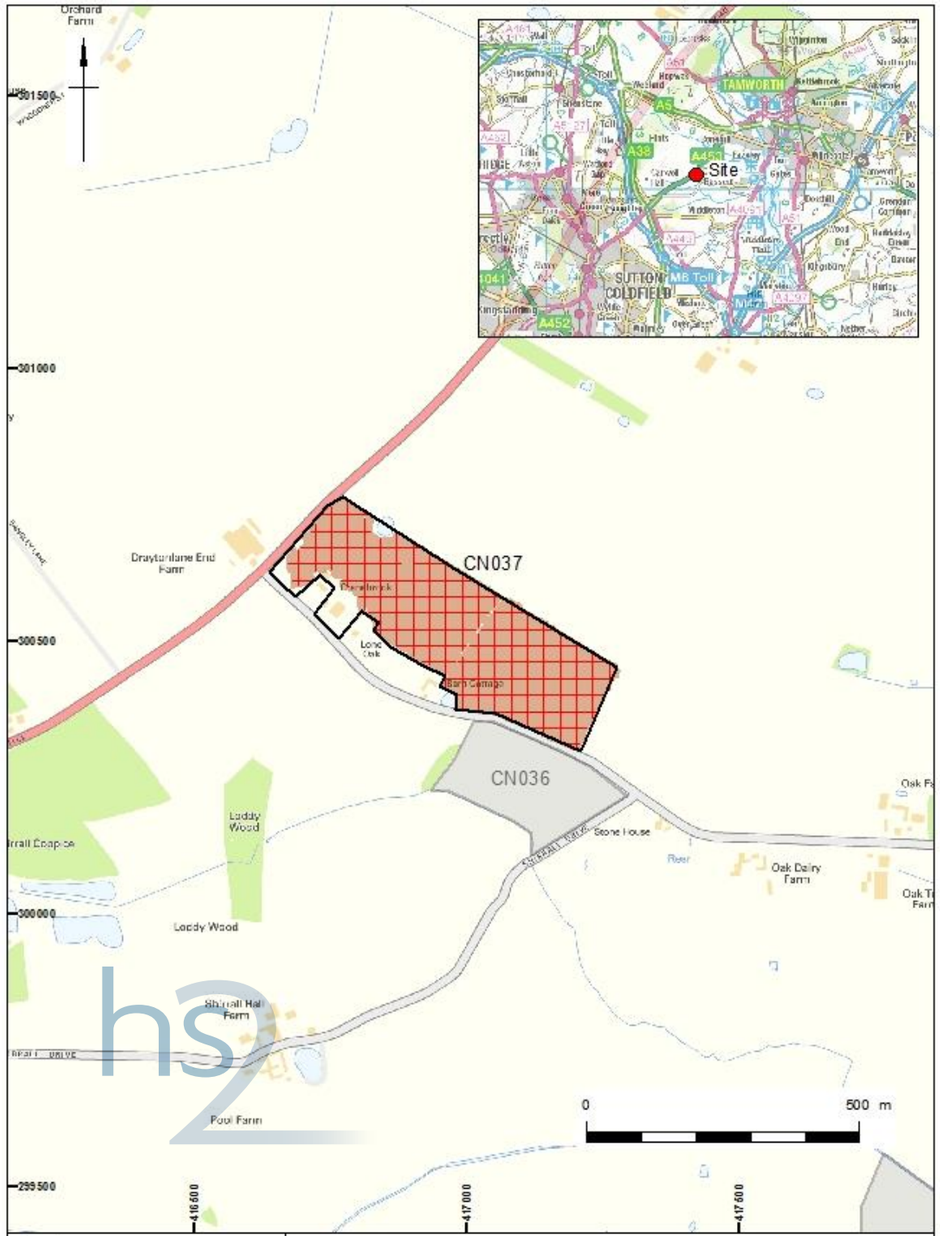
Wessex Archaeology, 2014. HS2: Geophysical Survey Written Scheme of Investigation: Staffordshire. Report Reference: 86257.01.

HER Records Consulted

EST2258-2266 - Field walking at Drayton Park, 1981
HST5763 - 18th/19th century planned enclosure
MST1846 - Flint and pottery finds, Drayton Park, Drayton Bassett
MST3403 - Undated Field system, South of Hill Farm, Drayton Bassett
MST4004 - Drayton Deer Park
MST4005 - Bangley Park Deer Park
MST4006 - Shirral Park Deer Park
MST6134 - Dam, Shirral Park, Drayton Bassett
MST6135 - Medieval pottery findspot, Drayton Bassett
MST6138 - Flint scatter and pottery finds, Alder Wood, Drayton Park, Drayton Bassett
MST6139 - Findspot of Roman pottery, Hill Farm, Drayton Park, Drayton Bassett
MST6140 - Flint and pottery finds, near Hill Farm, Drayton
MST6141 - Findspot of Roman and medieval pottery, Drayton Park, Drayton Bassett
MST6142 - Flint and pottery findspot, Drayton Park, Drayton Bassett
MST6147 - Field boundary, Shirral Coppice
MST6148 - Boundary bank, Shirral Coppice

Figures

Figure 13 - CN037 site location



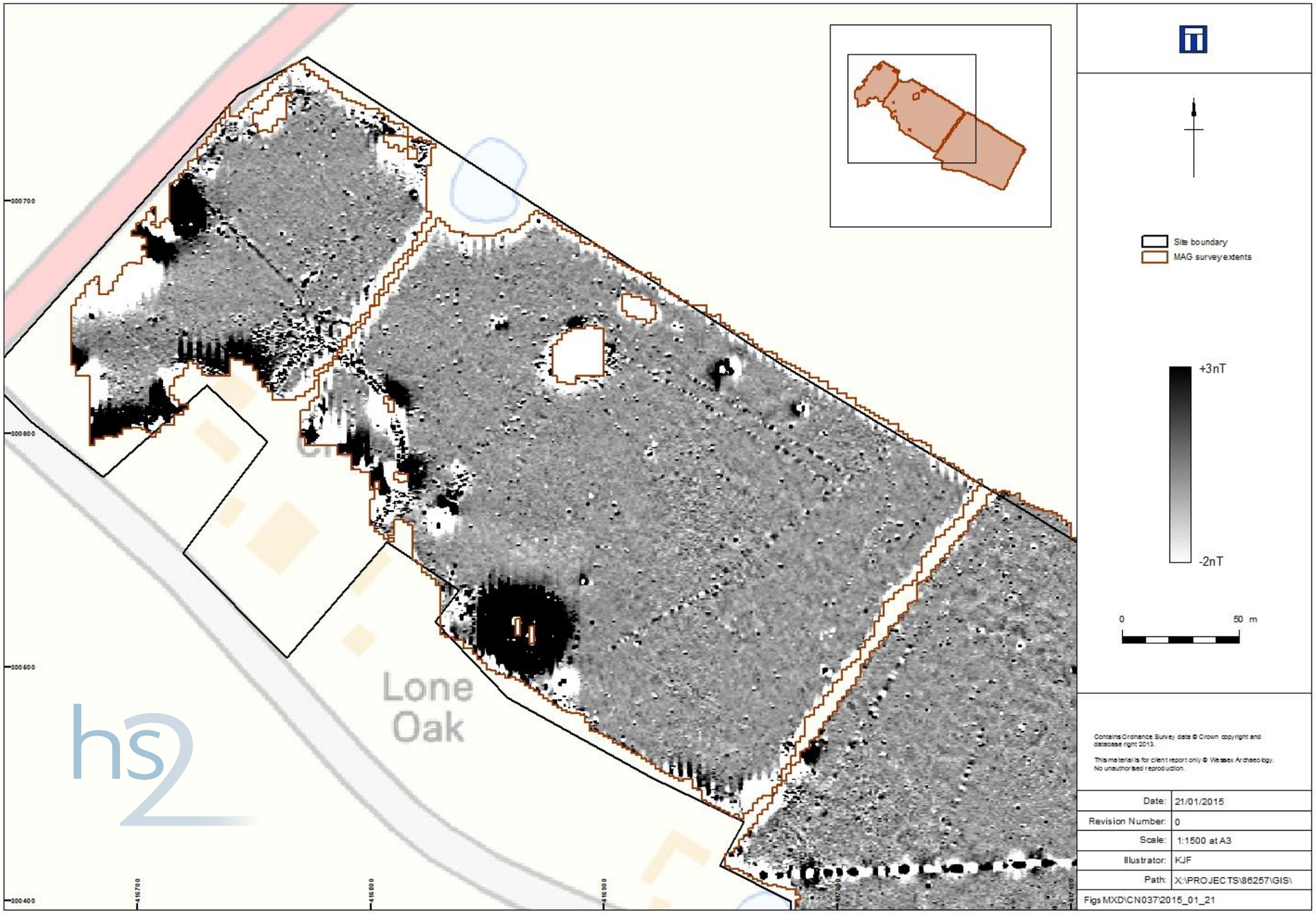
Site boundary
MAG survey extents
Survey grid divisions
Adjacent sites

Date:	21/01/2015	Revision Number:	0
Scale:	1:10,000 at A4	Illustrator:	KJF
Path:	X:\PROJECTS\86257\GIS\Figs MXD\CN037\2015_01_21		

Site location

Figure 13

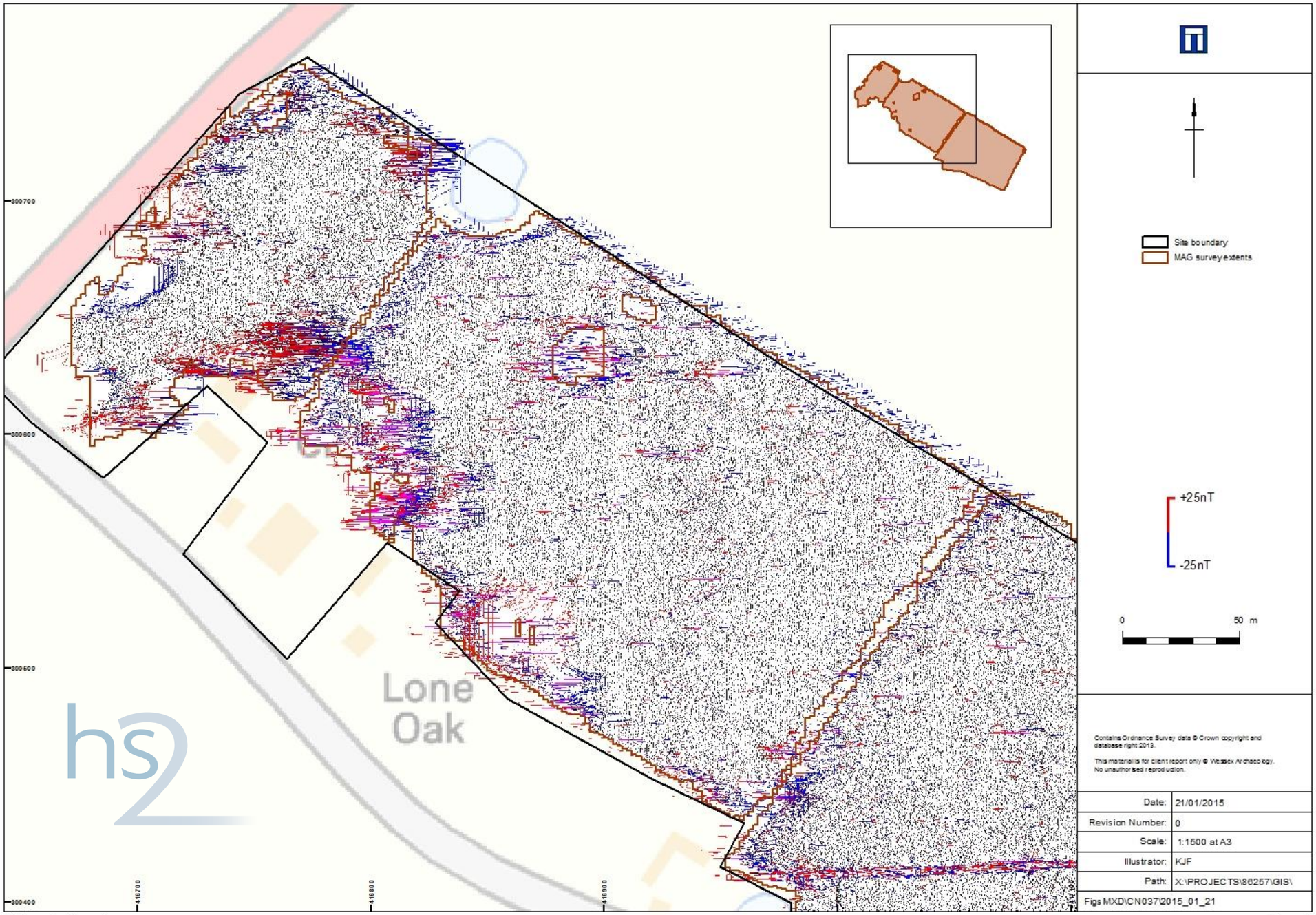
Figure 14 - CN037 greyscale plot (north-west)



Greyscale plot (north-west)

Figure 14

Figure 15 - CN037 XY trace (north-west)



XY trace (north-west)

Figure 15

Figure 16 - CN037 interpretation (north-west)

Interpretation (north-west)

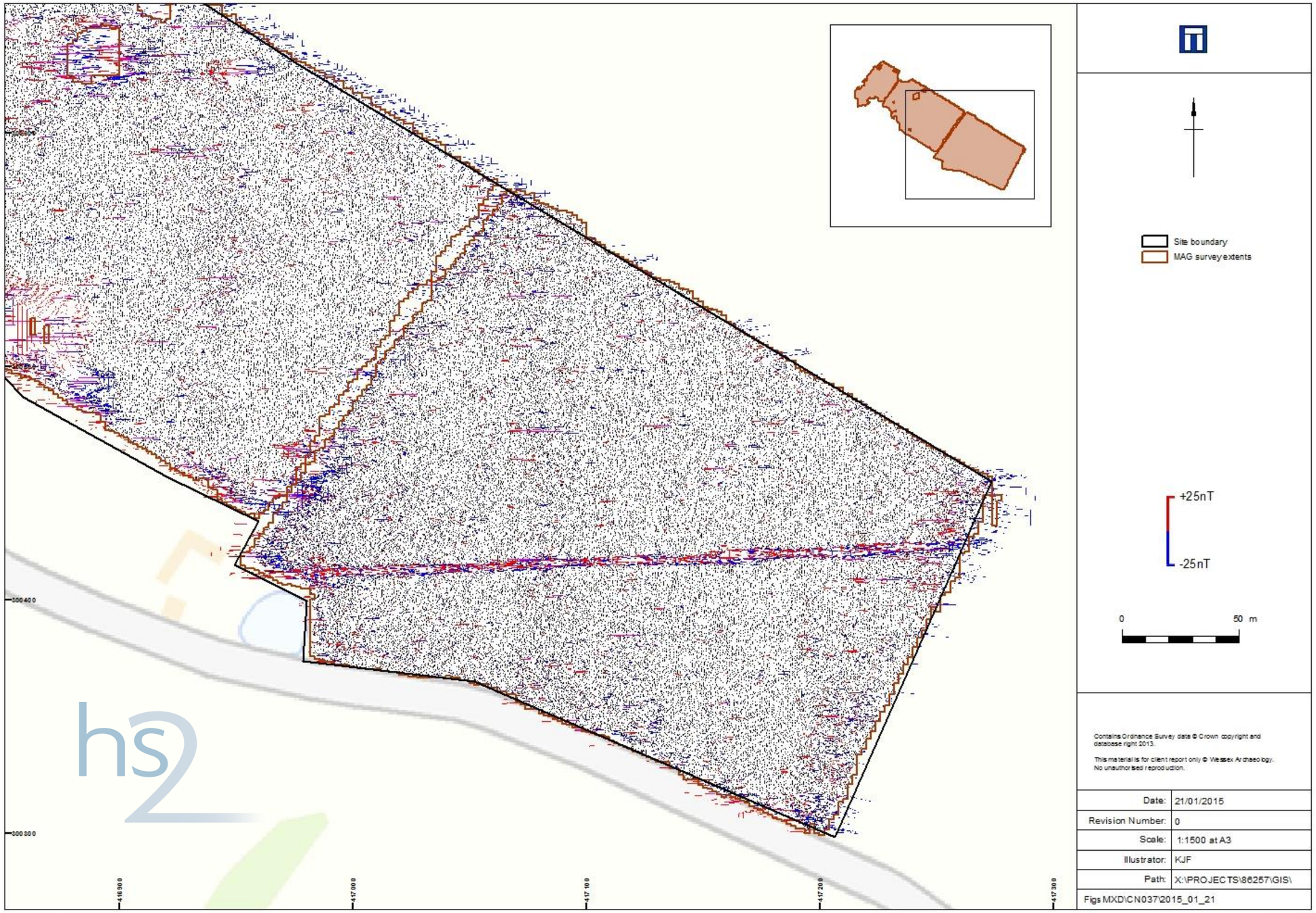
Figure 16

Figure 17 - CN037 greyscale plot (south-east)

Greyscale plot (south-east)

Figure 17

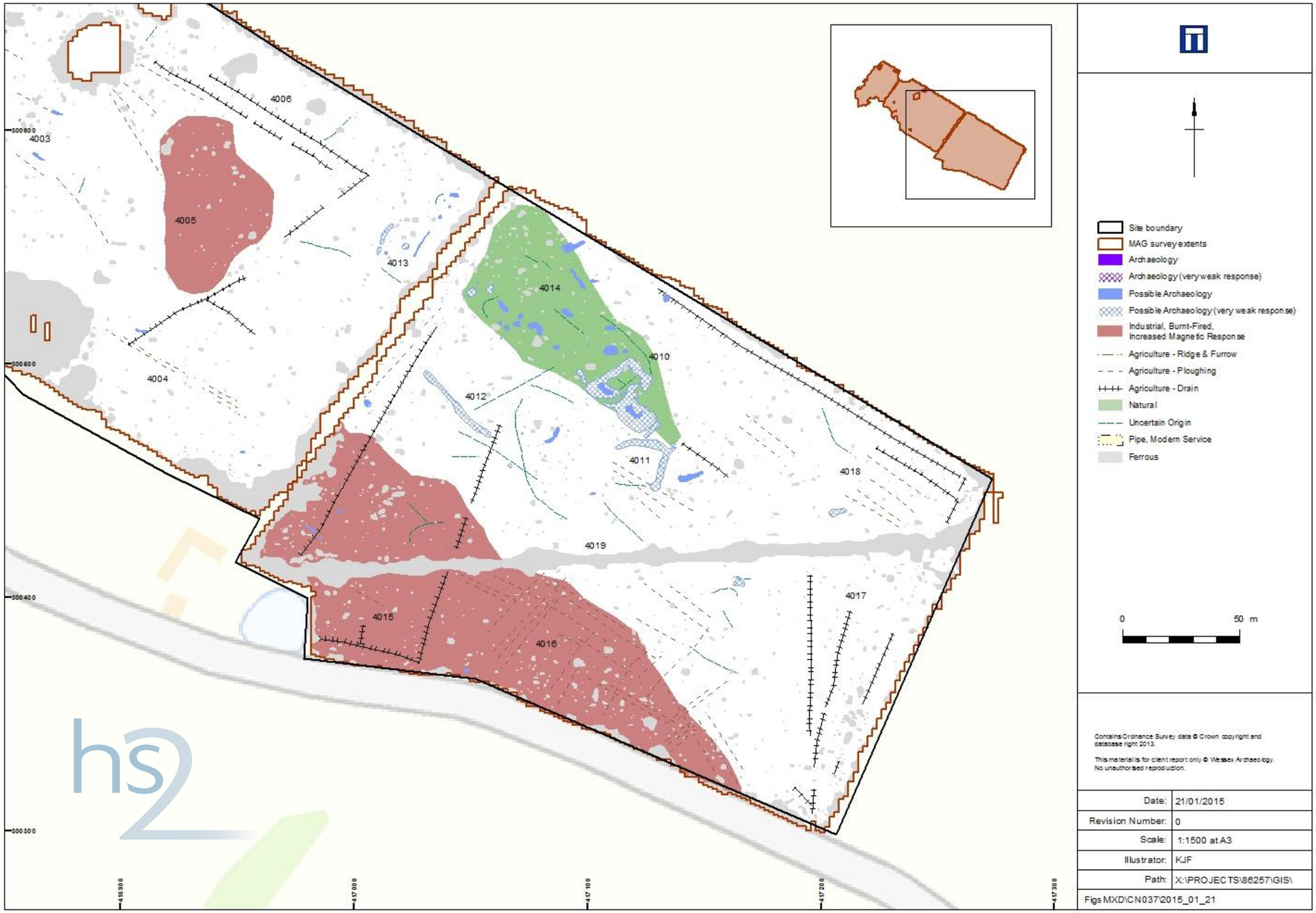
Figure 18 - CN037 XY trace (south-east)



XY trace (south-east)

Figure 18

Figure 19 - CN037 interpretation (south-east)



Interpretation (south-east)

Figure 19

2.5 CN039 Land off Roman Road

Introduction

2.5.1 Survey parcel CN039 was not reported in the main ES due to access being unavailable at the time.

Project Background

2.5.2 Wessex Archaeology was commissioned by HS2 to carry out a geophysical survey of area CN039 off Roman Road, near Weeford, Staffordshire (Figure 20), hereafter "the site" (centred on NGR 415081, 303791). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

2.5.3 The geophysical survey undertaken here has been preceded by desk-based research[39] and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis[40]. Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

2.5.4 This site, CN039, was selected for geophysical survey as it is considered to be a known area of medium to high risk with known archaeology in the wider landscape , in particular related to Watling Street Roman road which runs along the south-western boundary.

The Site

2.5.5 The site is comprised of one arable field located immediately north of Roman Road and lies approximately 1km east of Weeford, Staffordshire. The site is bounded to the north by the A5, to the south by Roman Road, to the west by farm buildings and to the east by a hedgerow and tree field boundary. The gradiometer survey covered 4.4ha and has covered all accessible areas of the Site.

2.5.6 The Site lies on a gentle south-east facing slope at a height of 95m aOD and falls from this height to 89m aOD.

2.5.7 The solid geology is recorded as primarily Kidderminster Sandstone Formation (Triassic) with a possible change to Bromsgrove sandstone formations along the north-eastern boundary. There are no superficial deposits recorded on site.

2.5.8 The soils underlying the Site are likely to comprise the humo-ferric podzols of the 631e (Goldstone) with possibility of the typical brown sands of the 551a (Bridgnorth) association[41]. Soils in such geological settings have been demonstrated to produce magnetic contrasts suitable for the detection of anomalies through gradiometer survey.

Archaeological background

2.5.9 For a detailed assessment of the known archaeology of the Site and surrounding area the relevant baseline report should be consulted[42]. A summary of relevant sites within 1km of the survey area are summarised below and have been included to provide context and inform the geophysical interpretation. Sites referred to can be found either within the gazetteer for CFA 21 in the main ES[43] (STN numbers) in the supplementary survey works[44] (WA numbers) or in the Staffordshire HER (MST numbers).

2.5.10 Watling Street lies immediately south of the site and is a route or trackway from Dover to Wroxeter that has been in use since the Iron Age. The area on either side of Watling Street and Bourne Brook valley is considered as having the highest archaeological potential within CFA 21 due to the number of cropmarks recorded in the area and the retrieval of artefacts from the southern end of the CFA[45].

2.5.11 The majority of archaeological finds and sites within the vicinity of CN039 have been identified by works relating to Hints Quarry approximately 1km to the east or excavation works for the A5 road scheme which is immediately north of the site.

2.5.12 Evidence along the route of the A5 includes sites dating from the Bronze Age to the Romano-British periods indicating continued prehistoric settlement and activity contemporary with the ancient route of Watling Street. Possible contemporary field systems were uncovered during excavation (MST11442; MST11445). Other evidence includes a cropmark ditch and pit dated to the Bronze Age (MST11444), an Iron Age enclosure with pit alignment (MST2056) and other undated cropmark features showing pits and ditches (MST11443). Post holes which could have formed a structure (MST11441) and a farmstead (MST11439) also highlight further prehistoric settlement.

2.5.13 Three sets of pit alignments have been identified in the area: two Iron Age pit alignments and an enclosure where discovered during excavations to the west of the site between Watling Street and the A5 (MST2054; MST2055; DHW139). A further alignment dated to the Iron Age and Romano-British has been identified on aerial photographs at Flats Lane (MST2055).

2.5.14 Regular works at Hints Quarry have uncovered a flint findspot (MST1306), a middle Bronze Age cremation, a lead pig dated to AD 69 - AD79 and other prehistoric features including a pit cluster (EST2191).

2.5.15 Further cropmarks between the site and Hints Quarry include an undated linear (MST1545), an enclosure (MST1406) and a ring ditch (MST1408). Unfortunately these features fall just outside the LiDAR survey extents but contours suggest that this falls on a higher level.

2.5.16 The site lies approximately 0.9km to the north-east of Weeford, a settlement possibly originating in the early medieval period (DHW137), which is home to several Grade II Listed Buildings including St Mary's Church and the outbuildings of Weeford House Farm.

2.5.17 To the south-west of the site lies Slitting Mill, Bourne House (MST2076), a post-medieval mill on Bourne Brook, the pond and leat identified in the LiDAR data (WA21.28) are probably associated with this structure.

Survey Objectives

2.5.18 A WSI was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed[46]. The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible,

[39] CH-001-021, HS2 Environmental Statement, 2013
[40] CH-004-021, HS2 Environmental Statement, 2013
[41][41] Soil Survey of England and Wales, 1983
[42] CH-001-021, HS2 Environmental Statement, 2013
[43] CH-002-021, HS2 Environmental Statement, 2013
[44] CH-004-021, HS2 Environmental Statement, 2013
[45] CH-001-021, HS2 Environmental Statement, 2013
[46] Wessex Archaeology, 2014

allowing for artificial obstructions;

- to clarify the presence/absence and extent of any buried archaeological remains within the site;
- to determine the general nature of the remains present.
- to combine the results of the geophysical surveys with data from other archaeological assessments carried out as part of the project in order to analyse the archaeological potential of the survey locations

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

Methods

Survey Dates

2.5.20 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between the 25-26 September 2014.

Grid location

2.5.21 The 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 HE recommendations[47].

2.5.22 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments used and survey method

2.5.23 The magnetometer 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 HE guidelines[48].

2.5.24 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data processing

2.5.25 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.

2.5.26 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.

Data presentation

2.5.27 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then use to produce the final figures in GIS (ESRI ArcMap 10).

2.5.28 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

2.5.29 The gradiometer survey has been successful in identifying anomalies of possible archaeological interest, along with numerous trends. The results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figures 21 to 23).

2.5.30 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 23). Full definitions of the interpretation terms used in this report are provided in Annex 2.

2.5.31 Ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: archaeology

2.5.32 There were no anomalies of clear archaeological potential identified across the site. Areas of possible archaeology however have been identified.

2.5.33 South of 4000 is a weak (±1-2nT) series of anomalies which are present as short linear features aligned west by north-west to east by south-east and east by north-east to west by south-west; which may represent ditches. These features are considered to be of possible archaeological interest.

2.5.34 Groups of positive (±3nT) anomalies forming clusters of pit-like features can be seen at 4001 and 4003.These anomalies are classed as possible archaeology.

2.5.35 At 4002 and 4004 short sections of linear anomalies are visible as weak positive magnetic responses (±1nT). These anomalies may represent ditches aligned roughly south-west to north-east and are identified as possible archaeology.

2.5.36 Large areas of superficial geological responses have been identified at 4005 and 4007 with similar, smaller areas at 4008 and 4009.

2.5.37 The area around 4006 shows a large area of increased magnetic response. It is unclear whether these responses relate to concentrations of modern magnetically enhanced material or date to an earlier period.

[47] English Heritage, 2008

[48] ibid

2.5.38 Agricultural activity is evident within the data and can be seen across the site, following north-east to south-west and north-west to south-east alignments. In the south-eastern corner of the Site area small series of north by north-west to south by south-east ploughing trends.

Interpretation: modern services

2.5.39 No modern services have been identified within the survey area.

2.5.40 Gradiometer data will not be able to 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 should be used to confirm the location of buried services before any trenches are opened on site.

Conclusion

2.5.41 The detailed gradiometer survey has been successful in detecting anomalies of possible archaeological interest within the site, an area of increased magnetic response and superficial geology. The anomalies of possible archaeological interest include possible ditch-like features and pits.

Discussion

2.5.42 The anomalies of archaeological interest are centred around 4000, 4001, 4002, 4003 and 4004 with possible ditches at 4000 and 4002 and potential pits at 4001 and 4003. The anomalies at 4004 represent a number of features and it is unclear if these connect to form a ditch or are a line of pits.

2.5.43 The ploughing trends aligned with, and at right angles to, the current field boundaries are likely to be post-medieval or modern in origin. Those aligned north by north-west to south by south-east are of an unknown date.

2.5.44 The area of increased magnetic response at 4006 is difficult to define. It may represent an area of former burning or containing debris and therefore potentially of archaeological interest, but it could also be modern or natural in origin and represent a change in the near surface geology.

2.5.45 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 encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

References

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

HS2 Ltd, 2013. London-West Midlands Environmental Statement, Volume 5: Technical Appendices: CFA21

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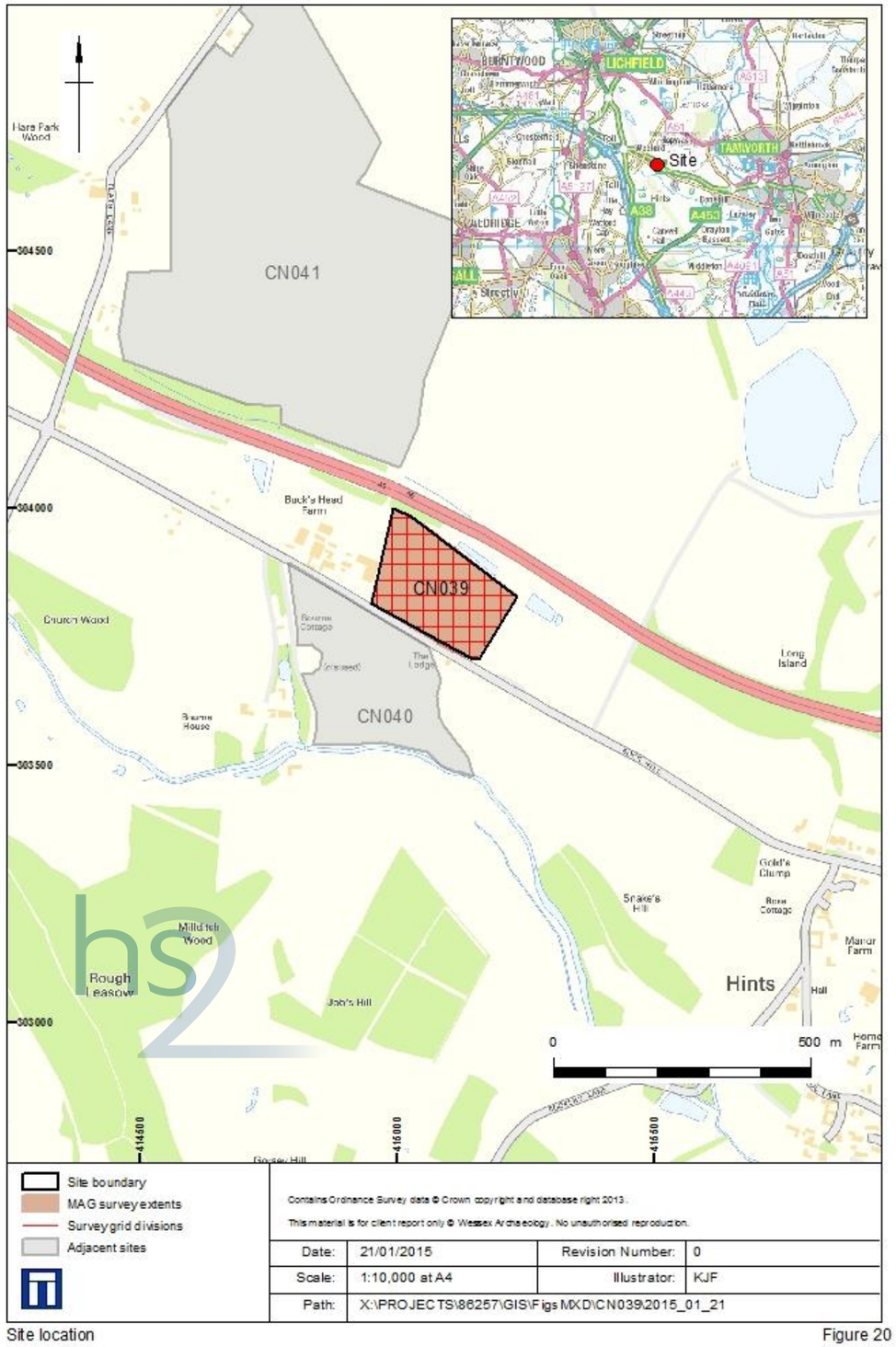
Wessex Archaeology, 2014. HS2: Geophysical Survey Written Scheme of Investigation: Staffordshire. Report Reference: 86257.01.

HER Records Consulted

EST 2191 – Excavation of a middle Bronze Age Cremation and other Prehistoric Features at Hints Quarry, Staffordshire
MST 1406 - Cropmark Enclosure, Buck's Head Cottage
MST 1407 - Buck's Head Cottage Cropmark
MST 1408 - Buck's Head Cottage Cropmark
MST 1545 - Knox's Grave Lane Cropmarks
MST 2054 - Pit Alignment, Watling Street, Weeford
MST 2055 - Flats Lane Cropmark
MST 2056 - Enclosure, Watling Street, Weeford
MST 2076 - Slitting Mill, Bourne House, Weeford
MST 2583/DHW137 - Weeford/Weforde Settlement
MST 11438 - Cropmarks, Watling Street, Weeford
MST 11439 - Farmstead, Watling Street, Weeford
MST 11140 - Cropmarks, Watling Street, Weeford
MST 11441 - Post Holes, Watling Street, Weeford
MST 11442 - Field System, Watling Street, Weeford
MST 11443 - Buck's Head Farm Cropmark
MST 11444 - Buck's Head Farm Cropmark
MST 11445 - Field System, Watling Street, Weeford

Figures

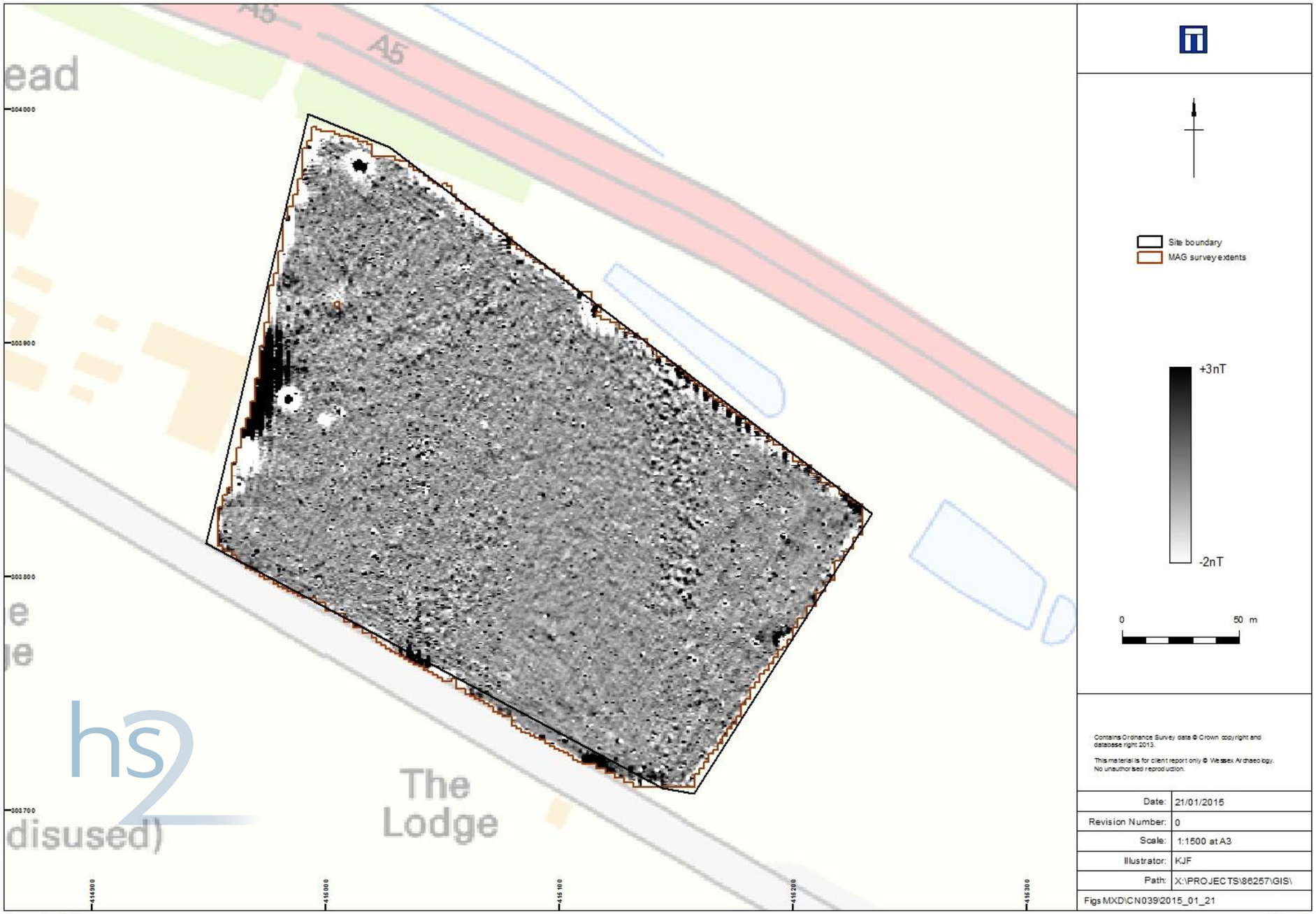
Figure 20 - CN039 site location



Site location

Figure 20

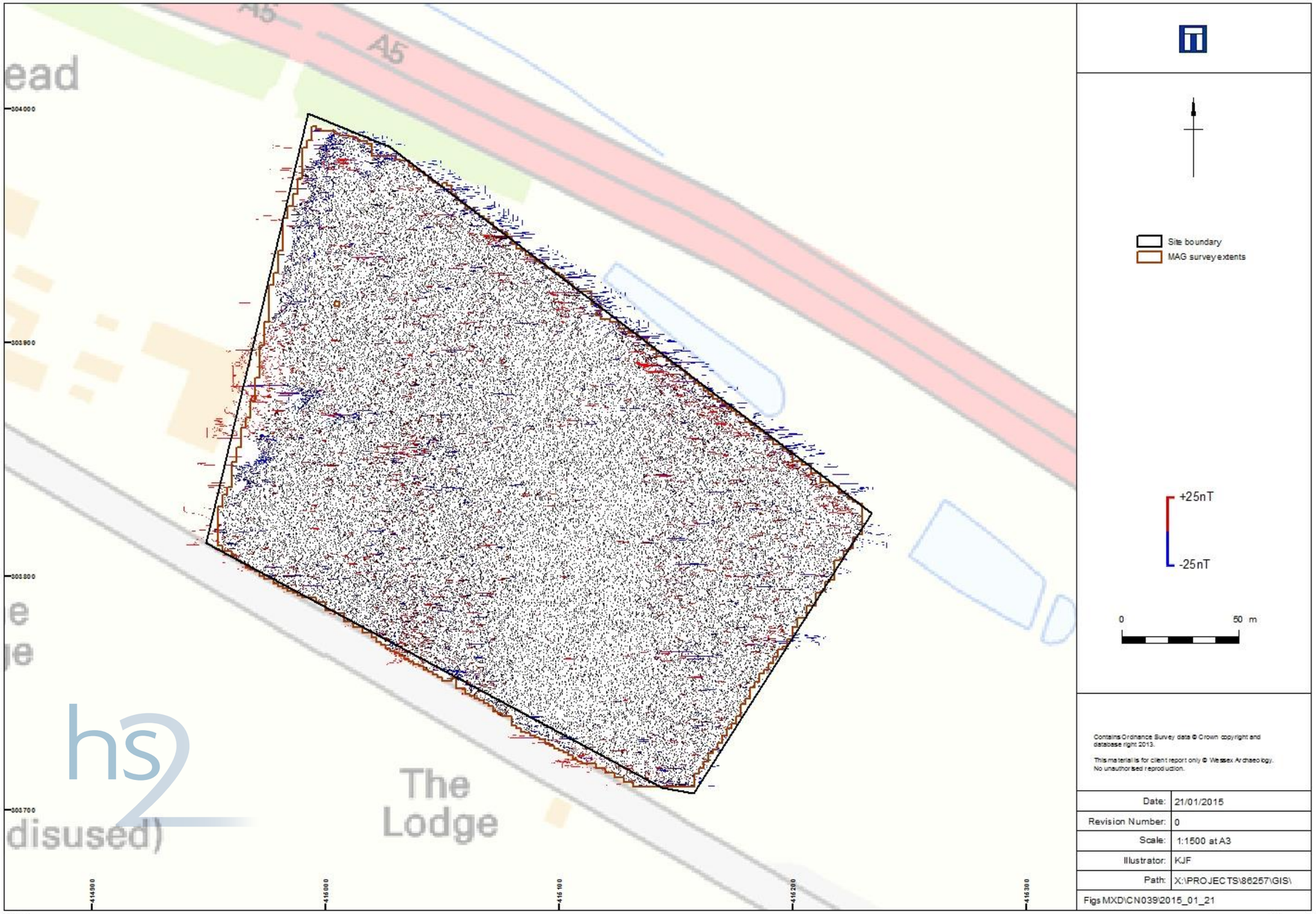
Figure 21 - CN039 greyscale plot



Greyscale plot

Figure 21

Figure 22 - CN039 XY trace



XY trace

Figure 22

Figure 23 - CN039 interpretation

Interpretation

Figure 23

2.6 CN040 Land south of Rock Hill Road

Introduction

2.6.1 Survey parcel CN040 was not reported in the main ES due to access being unavailable at the time.

Project background

2.6.2 Wessex Archaeology was commissioned by HS2 to carry out a geophysical survey of area CN040 off the Roman Road, near Weeford, Staffordshire (Figure 24), hereafter "the site" (centred on NGR 414970 303680). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

2.6.3 The geophysical survey undertaken here has been preceded by desk-based research[49] and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis[50]. Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

2.6.4 This site, CN040, was selected for geophysical survey as it is considered to be an area at medium to high risk with known remains in the vicinity including a Roman road and cropmarks.

Site details

2.6.5 The site is comprised of seven fields immediately south of the Roman Road of Watling Street and lies approximately 0.8km east of the centre of Weeford. The limits of the geophysical survey area are defined by modern field boundaries for the entire site. To the north of the survey area lies the Roman road, to the west is a track and to the south is Black Brook. There is also a disused gravel pit on the western boundary of the site.

2.6.6 The northern half of the site lies on an area of higher ground gently sloping towards the southern area adjacent to Black Brook. The northern part of the survey area lies at a height a little over 95m aOD and falls from this height to less than 80m aOD at the southern limit of the site.

2.6.7 The gradiometer survey covered 1.2ha in total with 5.4 ha having previously been surveyed in 2013[51]. A triangular area at the eastern edge of the site initially proposed for survey was not surveyed because it comprised a private landscaped garden.

2.6.8 The solid geology is recorded as soft sandstone with pebble beds with grey marls with fine clays and sandstones along the bank of Black Brook[52]. The soils underlying the site are likely to comprise the typical brown sands of the 551a (Bridgnorth) association and the humo-ferric podzols of the 631e (Goldstone) association closer to the brook[53]. Soils in such geological settings have been demonstrated to produce magnetic contrasts suitable for the detection of anomalies through gradiometer survey.

Archaeological background

2.6.9 For a detailed assessment of the known archaeology of the site and surrounding area the relevant baseline study should be consulted[54]. A summary of relevant sites within 1km of the survey area are summarised below and have been included to provide context and inform the geophysical interpretation. Sites referred to can be found either within the gazetteer for CFA 21 in the ES[55] (DHW numbers) in the supplementary survey works (WA numbers) or in the Staffordshire HER (MST numbers).

2.6.10 The current landscape is characterised as 18th to 19th century semi-planned enclosures (HST6554). Watling Street lies immediately north of the site and is a route or trackway from Dover to Wroxeter in use from the Iron Age. The area on either side of Watling Street and Bourne Brook valley is considered as having the highest archaeological potential within CFA 21 due to the number of cropmarks recorded in the area and the retrieval of artefacts from the southern end of the CFA[56].

2.6.11 Remote sensing revealed man-made and geomorphological features in the vicinity of the site associated with Black Brook, a tributary of the River Tame, which lies directly to the south of the site (Figure 24)[57]. The features identified were a pond and leat that shows the use of the brook as a power source in the medieval and post medieval periods as well as two former channels associated with the brook. These palaeochannels might have acted as foci for human activity especially in the prehistoric period of which there are sites recorded in the area.

2.6.12 Most archaeological finds and sites in the vicinity of CN040 have been identified by archaeological works relating to Hints Quarry approximately 1km to the north-east or excavation for the road improvement scheme for the A5 which is 250m to the north of the site.

2.6.13 Along the route of the A5 to the north of CN040 are sites dating from the Bronze Age to the Romano-British periods indicating prehistoric settlement in the area and activity contemporary with the ancient route of Watling Street. Excavation uncovered field systems (DHW125) which would have possibly been contemporary with Roman Watling Street (DHW138), an Iron Age enclosure and pit alignment (DHW141), a cropmark of a ditch and pit dated to the Bronze Age (MST11444) and a second undated cropmark identified as a ditch, pit and post hole (MST11443). Post holes which would have formed a structure (MST11441) and a farmstead (MST11439) also indicate further prehistoric settlement in the area.

2.6.14 There are three pit alignments in the vicinity; Flats Lane Cropmark (MST2055) is a pit alignment dated to the Iron Age and Romano-British periods and discovered from aerial photographs. Two further Iron Age pit alignments and an enclosure were discovered by excavation to the north-west of the site between Watling Street and the A5 (MST2054; MST2055; MST2056).

2.6.15 Archaeological work at Hints Quarry has uncovered a flint findspot (MST1306), a middle Bronze Age cremation and other prehistoric features such including a pit cluster (EST2191) and a lead pig dated to between AD 69 - AD79.

[49] CH-001-021, HS2 Environmental Statement, 2013
[50] CH-004-021, HS2 Environmental Statement, 2013
[51] ibid
[52] Ordnance Survey, 1954
[53] Soil Survey of England and Wales, 1983
[54] CH-001-021, HS2 Environmental Statement, 2013
[55] CH-002-021, HS2 Environmental Statement, 2013
[56] CH-001-021, HS2 Environmental Statement, 2013
[57] CH-004-021, HS2 Environmental Statement, 2013

2.6.16 There are further cropmarks to the east and north-east between the Site and Hints Quarry, they are a ring ditch (MST1408), an enclosure (MST1406) and an undated linear feature (MST1545). These fall just outside of the LiDAR survey area but contours adjacent to the ring ditch cropmark location show that it is probably on a higher, level area approximately 103m aOD.

2.6.17 The site is approximately 0.9km to the north-east of the village of Weeford, a settlement possibly originating in the early medieval period, which has several Grade II Listed Buildings including St Mary's Church and the outbuildings of Weeford House Farm.

2.6.18 Finally the south-west corner of the site overlaps with Slitting Mill, Bourne House (MST2076), a post-medieval mill sited on Black Brook, the pond and leat identified in the LiDAR data (WA6.28) are probably associated with this post-medieval structure.

Survey objectives

2.6.19 A WSI was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed[58]. The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site;
- to determine the general nature of the remains present.
- to combine the results of the geophysical surveys with data from other archaeological assessments carried out as part of the project in order to analyse the archaeological potential of the survey locations

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

Methods

Survey dates

2.6.21 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team on 12-13, 16 and 29 August 2013 and on 26 September 2014.

Grid location

2.6.22 The 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 HE recommendations[59].

2.6.23 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments used and survey method

2.6.24 The magnetometer 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 HE guidelines[60].

2.6.25 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data processing

2.6.26 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.

2.6.27 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.

Data presentation

2.6.28 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then use to produce the final figures in GIS (ESRI ArcMap 10).

2.6.29 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

2.6.30 The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends. The results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figures 25 to 27).

2.6.31 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 27). Full definitions of the interpretation terms used in this report are provided in Annex 2.

2.6.32 Ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: archaeology

[58] Wessex Archaeology, 2014
[59] English Heritage, 2008
[60] ibid

2.6.33 Near the northern extent of the site a region of increased magnetic response 4000 lies adjacent to the Roman road and, although the responses are not characteristically archaeological in origin, it is possible that it is associated with archaeological deposits. However, magnetic disturbance nearby is assumed to be modern in origin, and it is therefore possible that the increased responses relate to the construction of the road or later dumping.

2.6.34 A region of increased magnetic response 4001 extends NW-SE, parallel with the northern boundary and the Roman road. Given the presence of ploughing trends on the same orientation, it is possible that it relates to magnetic deposits being ploughed to the surface, or is perhaps a former subdivision or ploughing headland.

2.6.35 Clusters of pit-like anomalies 4002, 4003, 4004 and 4005 lie within the northern portion of the northernmost field. These groups have been interpreted as being of possible archaeological interest given the size of some of the individual anomalies and the relative density of their distribution. However, the pit-like responses are unenclosed and their relationships with one another are uncertain.

2.6.36 Towards the southern extent of the northern field, numerous ferrous responses 4006 lie close to strong magnetic disturbance associated with fencing. Several isolated pit-like anomalies are visible, which are considered to be of possible archaeological interest.

2.6.37 In the southern part of the site, curvilinear ditch-like anomaly 4007 extends approximately E-W across the centre of the field, with a weaker band of increased response immediately to the north, demarked by a pair of trends. It is unclear whether this anomaly relates to a ditch or an agricultural feature, and has consequently been interpreted as being of possible archaeological interest.

2.6.38 At the centre of the southern fields, anomalies 4008 appear in close proximity to regions of magnetic disturbance. The extent of ferrous responses associated with the fencing and other sources of disturbance have reduced the confidence with which these anomalies can be interpreted, although they are considered to be of possible archaeological interest.

2.6.39 Immediately to the east, a profusion of sub-linear and pit-like anomalies 4009 lies within an extended region of increased magnetic response. These anomalies are considered to only be of possible archaeological interest, as there is a general lack of coherency of form. Their proximity to regions of magnetic disturbance further hampers conclusive interpretation.

2.6.40 Towards the south-eastern extent of the survey area, a series of short linear anomalies 4010 is oriented north-south and is consistent with the remnants of a ditch or former boundary. Given the fragmentary nature of these anomalies, it is difficult to ascertain whether they are archaeological in origin, or represent a more recent temporary boundary. To the east, a similar band of anomalies 4011 is oriented NNE-SSW and is similar in character; this cluster is also considered to be of possible archaeological interest.

2.6.41 At the south-easternmost extent of the site, strong linear anomaly 4012 is oriented NNW-SSE and has been interpreted as being of possible archaeological interest. This is tempered by the presence of magnetic disturbance flanking the anomaly and, whilst 4012 is consistent with a ditch, the strength of its response suggests that it may be modern in origin although it lacks the characteristics typical of a service. However, an archaeological interpretation cannot be excluded entirely.

2.6.42 The field in the southwest corner of the site at 4014 to 4015 is dominated by an area of irregular shaped and approximately linear features of strong bipolar responses interpreted as ferrous and trends of uncertain origin. There could have been ploughing in the field which has had a dump of debris containing magnetically enhanced material and ferrous or magnetic material mixed in. It is considered unlikely to be natural in origin as the area of anomalies stops short of the current field boundaries.

2.6.43 In the north-eastern corner of this field at 4013 are two curvilinear positive anomalies of a similar response to those around 4014 and 4015 but as they are on a different orientation to these and modern ploughing trends they have been interpreted as possible archaeology.

2.6.44 Within the northern portion of the survey area, ploughing trends oriented parallel with the Roman road are visible, although there is little indication of former field boundaries. Other trends on different orientations are visible throughout the dataset, although it is difficult to ascertain their archaeological potential.

Interpretation: modern services

2.6.45 There are no modern services identified in the survey area.

2.6.46 Gradiometer data will not be able to 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 should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

2.6.47 The detailed gradiometer survey has been successful in detecting anomalies of possible archaeological interest within the site, in addition to regions of increased magnetic response and numerous trends of uncertain origin.

Discussion

2.6.48 Near the northern extent of the survey area, regions of increased magnetic response and clusters of pit-like anomalies lie in close proximity to the Roman road. Whilst it is not possible to demonstrate a relationship between the pit-like responses and the road, it is possible that they represent contemporary activity.

2.6.49 The densest concentration of anomalies of possible archaeological interest lies near the centre of the southern fields within the survey area. These appear as fragmentary linear and pit-like anomalies within a region of increased magnetic response. The confidence with which they can be interpreted is reduced by the presence of magnetic disturbance nearby, the result of the existing fencing. However, it is possible that these anomalies are archaeological in origin and may extend further to the west. The anomalies interpreted as possible archaeology between 4008 and 4009 are similar in character to the anomalies at 4013 to 4015, interpreted as ferrous or potentially natural features; it is possible that the features between 4008 and 4009 also have a similar origin.

2.6.50 At the south-eastern corner of the survey area a possible ditch was identified, although its response suggests that it may be modern in origin. The LiDAR data shows a break in the bank of Bourne Brook in the same location as the terminus of the ditch anomaly at 4012, suggesting that the anomaly may be associated with a modern drainage or outlet pipe.

2.6.51 Elsewhere within the survey area, numerous linear and curving trends can be seen along with ferrous responses and magnetic disturbance associated with the existing boundaries. Whilst it

is possible that some of these trends may be of archaeological interest, it is considered that it is more likely that they relate to ploughing and near-surface geological changes.

2.6.52 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 encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

References

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HS2 Ltd, 2013. London-West Midlands Environmental Statement, Volume 5: Technical Appendices: CFA21

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Ordnance Survey 1957. Sheet 2, Geological Map of Great Britain: England and Wales. Ordnance Survey: Chessington

Ordnance Survey, 1977. Quaternary Map of the United Kingdom: South. Ordnance Survey. Southampton

Soil Survey of England and Wales, 1983. Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

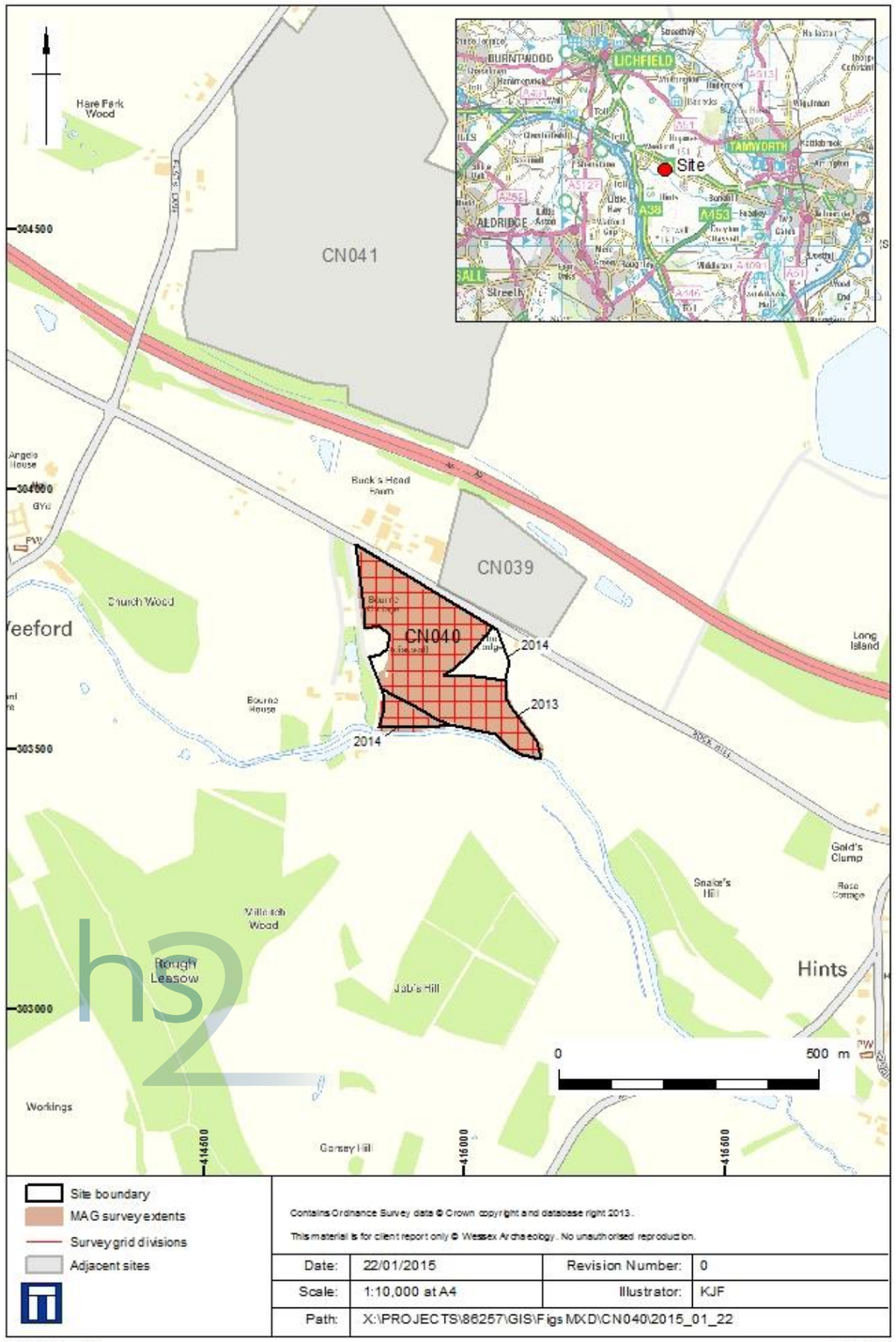
Wessex Archaeology, 2014. HS2: Geophysical Survey Written Scheme of Investigation: Staffordshire. Report Reference: 86257.01.

HER Records Consulted

HST5750 - 18th/19th century semi-planned enclosures
MST1058 - Bucks Head Farm Outbuildings
MST1106 - Gorsey Hill Mound, Hints
MST1119 - Gold's Clump, Hints
MST1120 - Hints Mill, Hints
DHW125/MST1144 - Watling Street Field System and Buck's Head Farm Cropmark
MST1266 - Milepost, Rock Hill, north-west of Hints
MST1306 - Pottery findspot, A5, Weeford to Fazeley
MST1670 - Key findspot, Weeford
MS1691 - Forge, Rookery Lane, Hints
DHW134/MST2076 - Slitting Mill, Bourne House, Weeford
DHW137/MST2583 - Medieval settlement of Weeford/Weforde
DHW136/MST3105 - Weeford Hall Moated Site, Weeford
DHW138 - Watling Street, approximate alignment of Roman road

Figures

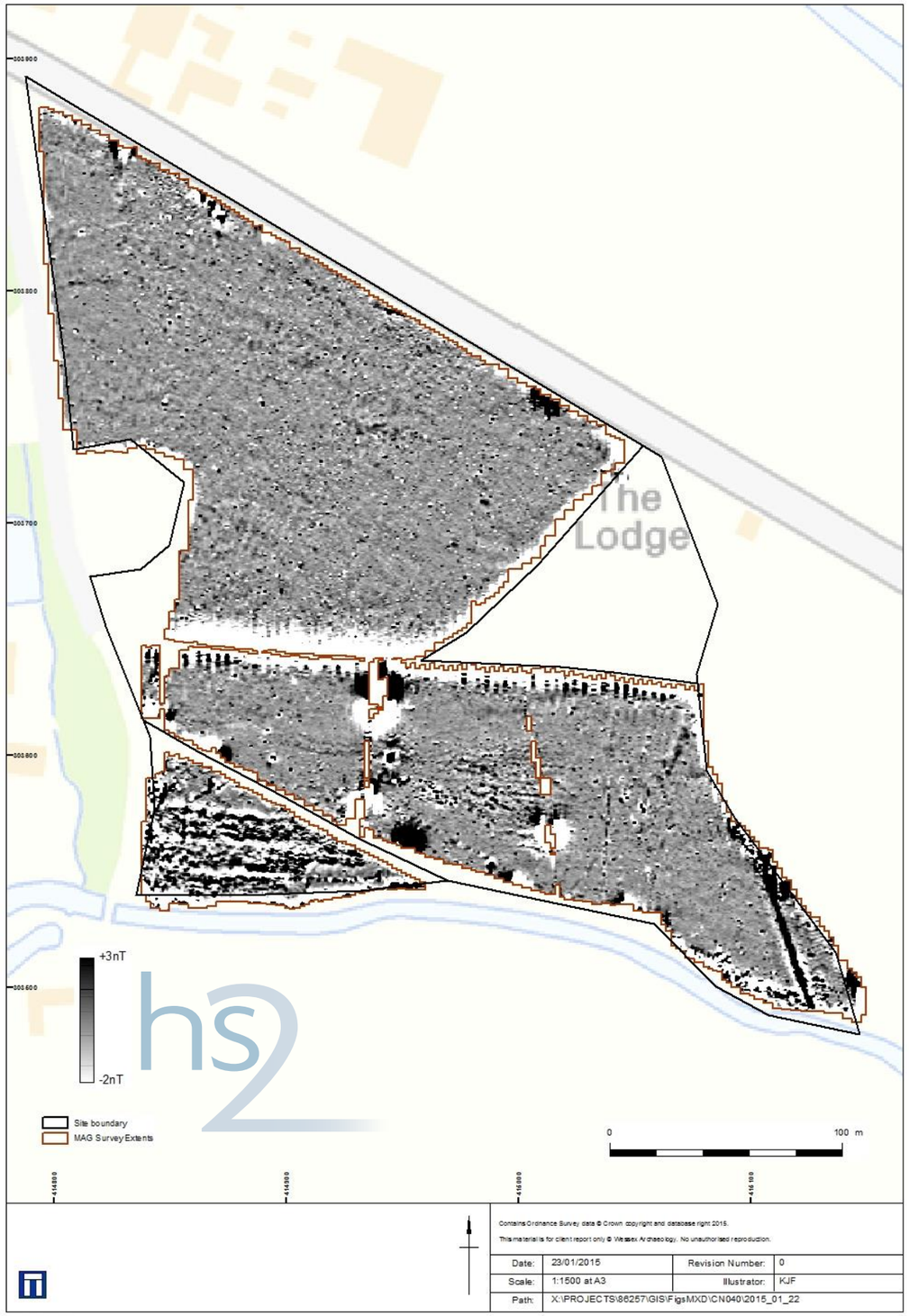
Figure 24 - CN040 site location



Site location

Figure 24

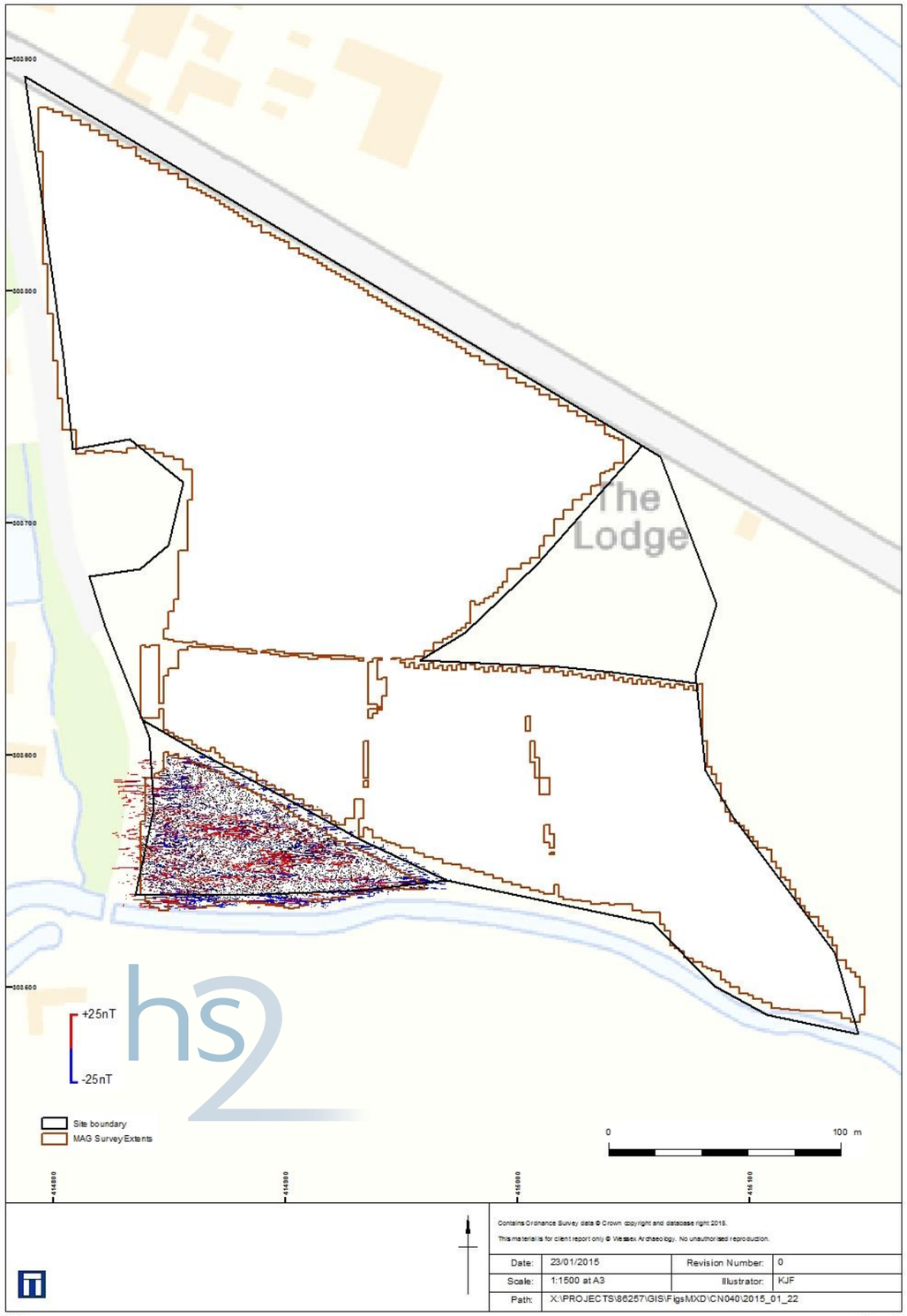
Figure 25 - CN040 greyscale plot



Greyscale plot

Figure 25

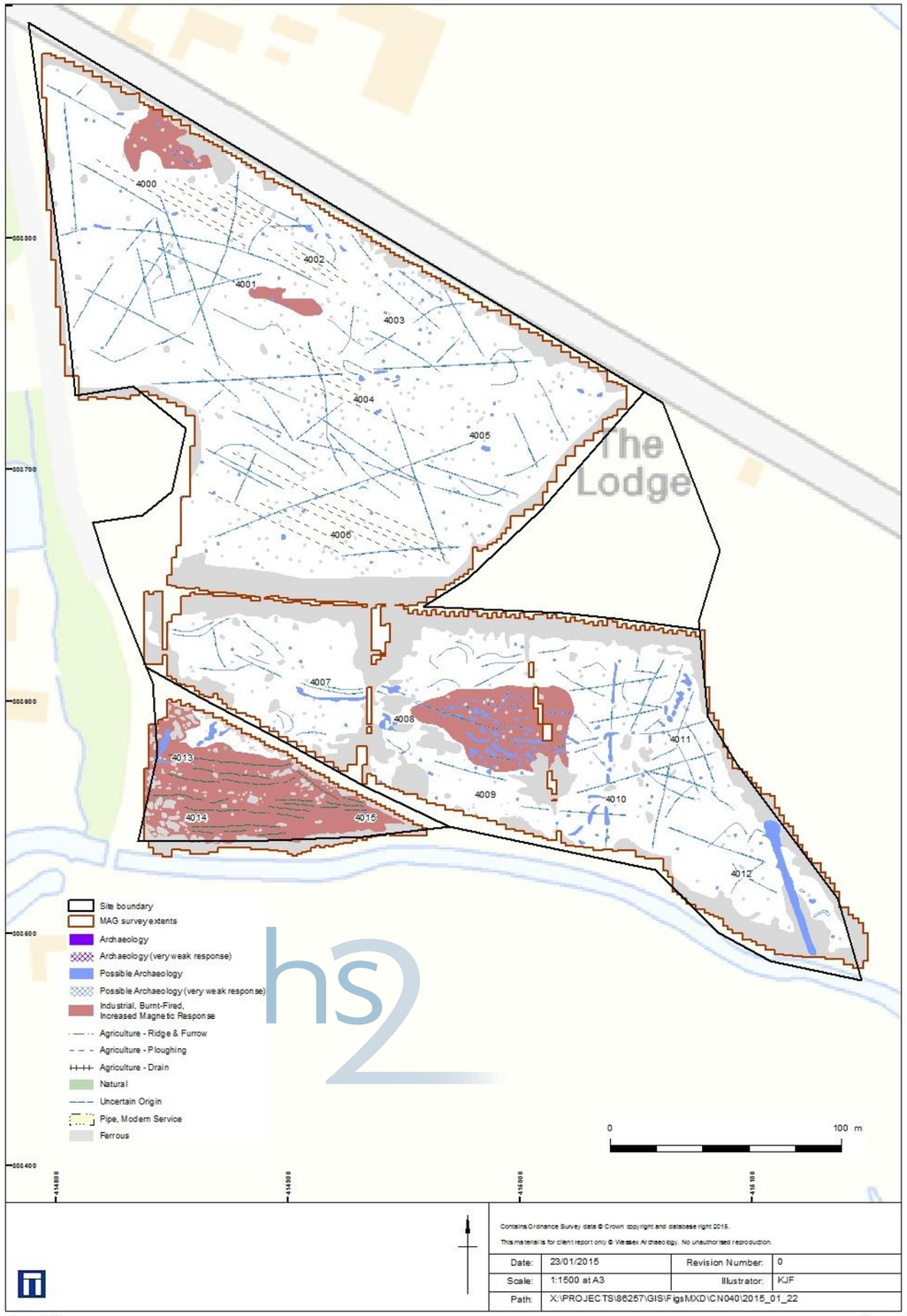
Figure 26 - CN040 XY trace



XY trace

Figure 26

Figure 27 - CN040 interpretation



Interpretation

Figure 27

2.7 CN041 Land off Flats Lane

Introduction

2.7.1 Survey parcel CN041 was not reported in the main ES due to access being unavailable at the time.

Project background

2.7.2 Wessex Archaeology was commissioned HS2 to carry out a geophysical survey of area CN041 off Flats Lane, near Weeford, Staffordshire (Figure 28), hereafter "the site" (centred on NGR 414799 304508). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

2.7.3 The geophysical survey undertaken here has been preceded by desk-based research[61] and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis[62]. Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

2.7.4 The site, CN041, was selected for geophysical survey as it is considered to be an area at high risk with known remains in the vicinity including Watling Street Roman road and cropmarks.

Site details

2.7.5 The site is comprised of three fields located 0.9km north-east of Weeford, Staffordshire. The site is bounded by hedgerow field boundaries, to the west by Flats Lane, to the north-east and east by hedgerow field boundaries and to the south by a narrow strip of woodland screening the field from the A5 (Weeford to Fazeley). The gradiometer survey covered 30.1ha out of a proposed survey area of 37ha with one field unable to be surveyed due to being under crop.

2.7.6 The site lies on an area of gently sloping land that falls away towards the south. The north-east region of the survey area lies at a height of 103m aOD and falls from this height to less than 91m aOD at the south of the Site.

2.7.7 The solid geology is recorded as Bromsgrove Sandstone Formation (Triassic)[63]. There are no superficial deposits recorded on site but close by are river terrace deposits of alluvium and sand and gravel extraction has been undertaken on adjacent land to the north-east at Hints Quarry[64]. The soils underlying the Site are likely to be typical brown sands of the 551a (Bridgnorth) association[65]. Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological background

2.7.8 For a detailed assessment of the known archaeology of the site and surrounding area the relevant baseline report should be consulted[66]. A summary of relevant sites within 1km of the survey area is provided below and has been included to provide context and to inform the geophysical interpretation. Sites referred to can be found either within the gazetteer for CFA 21 in the ES[67] (DHW numbers) or in the Staffordshire HER (MST numbers).

2.7.9 The current landscape is characterised as 18th to 19th century semi-planned enclosures and post-war amalgamated fields. Watling Street lies approximately 200m to the south of the site and is a route or trackway from Dover to Wroxeter in use from the Iron Age. The area on either side of Watling Street and Bourne Brook valley is considered as having the highest archaeological potential within CFA21 due to the number of cropmarks recorded in the area and the retrieval of artefacts from the southern end of the CFA[68].

2.7.10 Remote sensing revealed man-made and geomorphological features in the vicinity of the site associated with Bourne Brook, a tributary of the River Tame, which lies approximately 0.9km to the south (Figure 28)[69]. The man-made features were a pond and leat which identify the use of the brook as a power source in the medieval and post medieval periods, plus two former channels associated with the brook. These palaeochannels might have acted as foci for human activity especially in the prehistoric period, supported by other evidence recorded in the area.

2.7.11 Most archaeological finds and sites in the vicinity of CN041 have been identified by archaeological works relating to Hints Quarry, approximately 0.75km to the north-east, and excavation for the road improvement scheme for the A5, which borders the southern boundary of the site.

2.7.12 Flats Lane Cropmark (MST2055) is located within the survey limits of the site, a pit alignment dated to the Iron Age and Romano-British periods and discovered from aerial photographs. Two further Iron Age pit alignments and an enclosure were discovered by excavation to the south-west of the site between Watling Street and the A5 (MST2054; MST2055; MST2056).

2.7.13 Along the route of the A5, directly to the south of CN041, are sites dating from the Bronze Age to the Romano-British periods indicating prehistoric settlement in the area and activity contemporary with the ancient route of Watling Street. Excavation uncovered field systems (DHW125) which would possibly have been contemporary with Roman Watling Street, an Iron Age enclosure and pit alignment mentioned above (MST2056), a cropmark of a ditch and pit dated to the Bronze Age (MST11444) and a second undated cropmark identified as a ditch, pit and post hole (MST11443). Post holes which would have formed a structure (MST11441) and a farmstead (MST11439) also indicate further prehistoric settlement in the area.

2.7.14 Archaeological work at Hints Quarry has uncovered a flint findspot (MST1306), a middle Bronze Age cremation and other prehistoric features such including a pit cluster (EST2191) and a lead pig dated to between AD 69 - AD79.

2.7.15 There are further cropmarks to the east and north-east between the site and Hints Quarry including a ring ditch (MST1408), an enclosure (MST1406) and an undated linear feature (MST1545). These fall just outside of the LiDAR survey area but contours adjacent to the ring ditch cropmark location show that it is probably on a higher, level area approximately 103m aOD.

[61] CH-001-021, HS2 Environmental Statement, 2013
[62] CH-004-021, HS2 Environmental Statement, 2013
[63] Ordnance Survey, 1957
[64] Ordnance Survey, 1977
[65] Soil Survey of England and Wales, 1983
[66] CH-001-021, HS2 Environmental Statement, 2013
[67] CH-002-021, HS2 Environmental Statement, 2013
[68] CH-001-021 HS2 Environmental Statement, 2013
[69] CH-004-021, HS2 Environmental Statement, 2013

2.7.16 The site is approximately 0.9km to the north-east of the village of Weeford, a settlement possibly originating in the early medieval period, which has several Grade II Listed Buildings including St Mary's Church and the outbuildings of Weeford House Farm (DHW137).

Survey objectives

2.7.17 A WSI was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed[70]. The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site;
- to determine the general nature of the remains present.
- to combine the results of the geophysical surveys with data from other archaeological assessments carried out as part of the project in order to analyse the archaeological potential of the survey locations

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

Methods

Survey dates

2.7.19 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between the 29-30 September, 11-18 November 2014 and 23 and 25 February 2015.

Grid location

2.7.20 The 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 HE recommendations[71].

2.7.21 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments used and survey method

2.7.22 The magnetometer 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 HE guidelines[72].

2.7.23 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data processing

2.7.24 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.

2.7.25 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.

Data presentation

2.7.26 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then used to produce the final figures in GIS (ESRI ArcMap 10).

2.7.27 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

2.7.28 The gradiometer survey has been successful in identifying anomalies of archaeological potential, along with numerous trends. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figures 28 to 40 progressing from the south of the site to the north).

2.7.29 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figures 31, 34, 37 and 40). Full definitions of the interpretation terms used in this report are provided in Annex 2.

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

Interpretation: archaeology

2.7.31 Across the site are numerous spreads of dipolar and bipolar anomalies which have been interpreted as natural and ferrous in origin which suggest that large areas of the fields potentially have abrupt changes in the soils. The 'noise' and numerous dipolar and bipolar anomalies could also indicate the presence of, for example, alluvial or fluvioglacial soils containing pebbles, cobbles and other material contributing to the overall magnetic response. Within these areas, however, have been identified some anomalies of archaeological potential.

[70] Wessex Archaeology, 2014
[71] English Heritage 2008
[72] ibid

2.7.32 At 4000 are a series of very weak positive curvilinear anomalies that almost disappear to become curvilinear trends. If these anomalies are proven to be archaeological, they may represent cut features such as sections of ditches. At the approximate centre of this area just below 4000 is a much smaller and weaker curvilinear positive anomaly. Altogether they are possibly an archaeological feature but their very weak magnetic response makes it difficult to determine the level of confidence to be placed in their identification.

2.7.33 At 4001 and 4002 are several small sub-oval and elongated oval positive anomalies interpreted as possible archaeology and possibly represent pits or ditches. They have been differentiated from similar anomalies interpreted as natural on the western side of the survey due to their location and their magnetic profiles. These anomalies tend to be slightly larger with positive peaks whereas surrounding anomalies interpreted as natural are bipolar or dipolar in shape with a stronger magnetic response.

2.7.34 Between 4003 and 4007, a concentration of dipolar and bipolar anomalies outlines a forked curvilinear feature between the two concentrated areas of natural anomalies. This feature may represent a possible palaeochannel.

2.7.35 At 4003 is a series of oval and sub-oval positive anomalies in a linear alignment oriented north-east to south-west terminating near a large, diffuse-edged positive anomaly. The relationship between these anomalies is currently unclear. They have been interpreted as possible archaeology as they are located within the possible palaeochannel. Although these possible features have similar magnetic responses to surrounding anomalies interpreted as natural (possibly cobbles or boulders), their overall shape and layout is different.

2.7.36 Further south-west at 4004 a rectilinear alignment of sub-oval positive anomalies and again at 4005 of a similar rectilinear alignment suggests these features are anthropogenic in origin. A potential explanation of the features at 4003, 4004 and 4005 is that they are man-made modifications to the palaeochannel, possibly lines of stones, cobbles or boulders put in place to manage the watercourse.

2.7.37 Positive and dipolar anomalies bordering the southern half of this field boundary south of 4007 have been interpreted as ferrous and associated with the current field boundary. They are not thought to be associated with the palaeochannel as they follow the north-south alignment of the current field boundary and the anomalies associated with the edges of the palaeochannel abut this area at a different angle.

2.7.38 Between 4008 and 4009 there are numerous positive but weak, elongated oval-shaped anomalies, they have been interpreted as possible archaeology and may represent cut features such as pits, postholes and ditches.

2.7.39 There are numerous ploughing trends present across the survey area oriented in several different directions. Particular concentrations are visible at 4012 to 4013 where they are oriented north-west to south-east and visible across the area containing the palaeochannel and predominantly oriented north to south around 4014 to 4016. These are assumed to be post-medieval and modern in origin and reflect the site's current use for arable farming.

2.7.40 A section of ceramic drain has been identified at 4006 and 4007 in the form of a series of bipolar anomalies.

2.7.41 A number of faint linear and curvilinear trends visible in the data which are of uncertain origin but may prove to be of archaeological significance. The most significant have been described at 4000 but some curvilinear anomalies are also visible at 4009 and 4016. These trends are categorised as uncertain origin as it is not possible to characterise them from the geophysical data alone.

2.7.42 A strip between 4010 and 4011 contains a much lower concentration of ferrous anomalies and no identified possible archaeological anomalies from the gradiometer data apart from linear ploughing trends presumed to be modern. This area coincides with an area visible in the LiDAR data and derived contour map as of sloping down towards the current field boundary and the route of the possible palaeochannel descending in height approximately 5m. It is unlikely that any archaeological anomalies are present here.

2.7.43 Numerous responses are attributed to natural and ferrous material across the northern half of the survey area (as across the southern half). There are however a few anomalies that are more distinct in response or layout and are therefore considered possible archaeology. A curvilinear series of positive anomalies at 4017 are considered of archaeological interest due to their layout and a more pronounced negative 'halo' running parallel to the positive anomalies. It is possibly a cut feature such as a ditch.

2.7.44 A weakly positive intermittent linear anomaly continues across two fields between 4018, 4019 and terminates to the west of 4021. It is on a different alignment to the trends of natural and ferrous anomalies but on a similar alignment to some of the ploughing trends across the field. This anomaly however is wider in its profile and much larger in size therefore it could possibly be the remains of a former internal field boundary ditch.

2.7.45 At 4020 is a cluster of stronger and larger irregular shaped positive anomalies. They form a discrete area but is interpreted as natural in origin and is possibly due to changes in the superficial geology (recorded as alluvium). This cluster potentially defines the eastern edge of a palaeochannel that continues into the southern field and has been interpreted and identified between 4003 and 4007.

2.7.46 There is a second area of concentration of bipolar and dipolar anomalies around 4022, 4023 and 4025 which has been interpreted as an area of natural and ferrous anomalies. This is a more discrete area and the concentration of stronger anomalies does not continue into the adjacent field to the north. These anomalies potentially indicated another area of alluvial deposits or change in the superficial geology.

2.7.47 A ceramic drain is identified to the north of 4026 and its orientation and location suggests that it is a continuation of the drain identified at 4006 to 4007.

2.7.48 A few possible linear and curvilinear trends of uncertain origin are present, such as at 4028, they are weakly contrasting and cannot be characterised further.

2.7.49 Numerous ploughing trends are visible either in a south-west to north-east direction or in an approximate north-south direction; both orientations follow current field boundaries and are presumed to be modern in origin.

2.7.50 There is a large irregular shaped spread of strong ferrous anomalies at 4029 in the vicinity of houses and farm buildings and this debris is presumed to be associated and modern in origin.

Interpretation: modern services

2.7.51 There are no modern services identified in the geophysical survey data.

2.7.52 Gradiometer data will not be able to 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 should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

2.7.53 The site is within an area identified as having high archaeological potential. The detailed gradiometer survey has been successful in detecting anomalies of archaeological interest within the site. Additionally, a palaeochannel possibly associated with Bourne Brook, numerous ploughing trends and trends of uncertain origin have been identified.

2.7.54 Although only a few possible individual anomalies of archaeological potential have been identified there is still a high archaeological potential considered for the palaeochannel. This feature was possibly a former tributary of Bourne brook and a foci for human activity and settlement.

Discussion

2.7.55 The data does shows a number of possible archaeological features however no anomalies of archaeological interest have been identified that correspond with the type of feature and location of the known cropmark of Flats Lane pit alignment (MST2055).

2.7.56 A relative concentration of anomalies of possible archaeology around 4001, 4002 and between 4008 and 4009 could represent pits and short sections of ditch. The superficial geology of the area makes it difficult to further define these potential features. Another area of interest at 4017 is a similar in that it is an area of numerous natural and ferrous responses but has been singled out due to its form and slightly different response.

2.7.57 Some anomalies around 4008 and 4009 are in the same north-west to south-east orientation as numerous ploughing trends. However, they have been increased in their potential due to the fact that prehistoric settlement was discovered in the adjacent field to the south of the site. Settlement was in the form of enclosures, field systems, pit alignments and a farmstead. Before the construction of the A5 the gently sloping topography of this area of the site would have continued between here and Watling Street therefore there is the potential for this settlement activity to also be present within the site.

2.7.58 A possible former internal field boundary is identified at 4018 and 4019; available OS mapping shows that these fields and many in the area were previously divided into smaller fields[73]. The similar orientation of the linear anomaly to current field boundaries and ploughing trends suggests it is associated.

2.7.59 The main feature identified is the large number of dipolar and bipolar anomalies across the site outlining a possible palaeochannel. The feature is across three fields at 4003 to 4007 and around 4020, 4021 and 4026. There is a second area of similar responses at 4022 to 4025 but they do not form a distinct outline and could therefore indicate a discrete deposit or change in the superficial geology.

2.7.60 Three series of linear and rectilinear positive anomalies within the areas of natural response are of particular note. These are interpreted as possible archaeology at 4003, 4004 and 4005. Due to their more regular layout and form compared to the clusters and curves of the numerous natural and ferrous anomalies in the vicinity. These may represent lines of boulders, cobbles or stones that are anthropogenic modifications to the channel, possibly to manage the watercourse.

2.7.61 Combining the LiDAR and geophysical data has allowed topographic information to be integrated with the geophysics to enhance the overall interpretation. Overlaying the geophysics on the DTM and contour map provides the possible path of the possible palaeochannel as continuing due south past Buck's Head Farm and Bourne Cottage towards Bourne Brook. Some small ponds and watercourses still survive along this route at Buck's Head Farm and are present on current OS mapping.

2.7.62 A number of streams within the Study Area flow into the River Tame and its tributaries, such as Bourne Brook. Alluvial deposits are recorded along these watercourses with the potential of deposits to preserve palaeo-environmental remains[74]. Gradiometer survey has been shown to indicate potential areas of superficial deposits, such as alluvium, that could be masking weaker and more deeply buried features of archaeological interest[75].

2.7.63 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 encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

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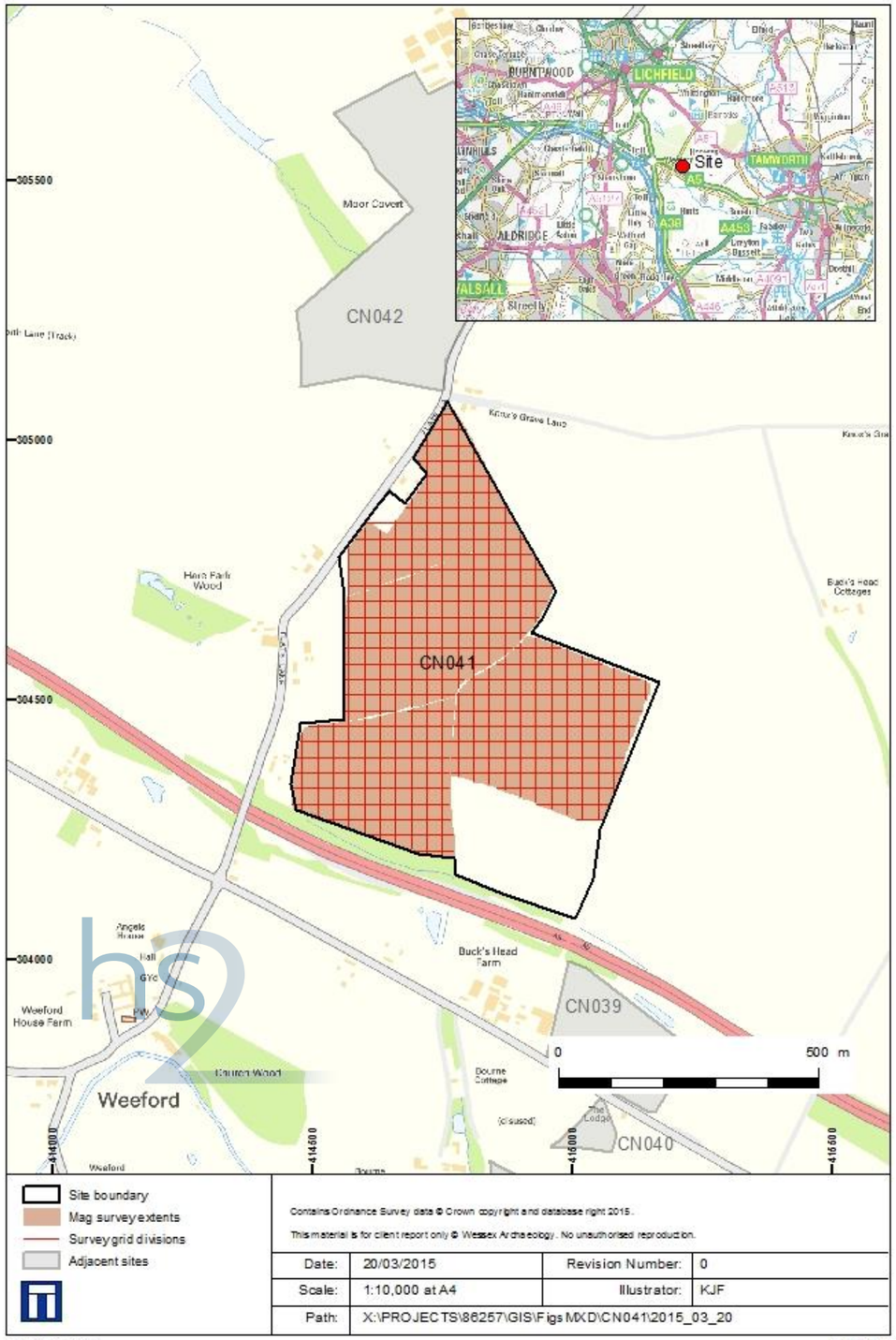
HER Records Consulted

[73] Ordnance Survey 1884
[74] CH-001-021, HS2 Environmental Statement, 2013
[75] Weston, 2001

HST5672 - Very large post-war amalgamated fields
HST6554 - 18th/19th century semi-planned enclosures; other large rectilinear fields
MST1408 - Buck's Head Cottage Cropmark
MST2054 - Pit Alignment, Watling Street
MST2055 - Flats Lane Cropmark
MST2056 - Enclosure, Watling Street
DHW137 - Medieval settlement of Weeford/Weforde
MST11439 - Farmstead, Watling Street
MST11441 - Post Holes, Watling Street
MST11443 - Buck's Head Farm Cropmark
MST11444 - Buck's Head Farm Cropmark
DHW125 - Watling Street Field System

Figures

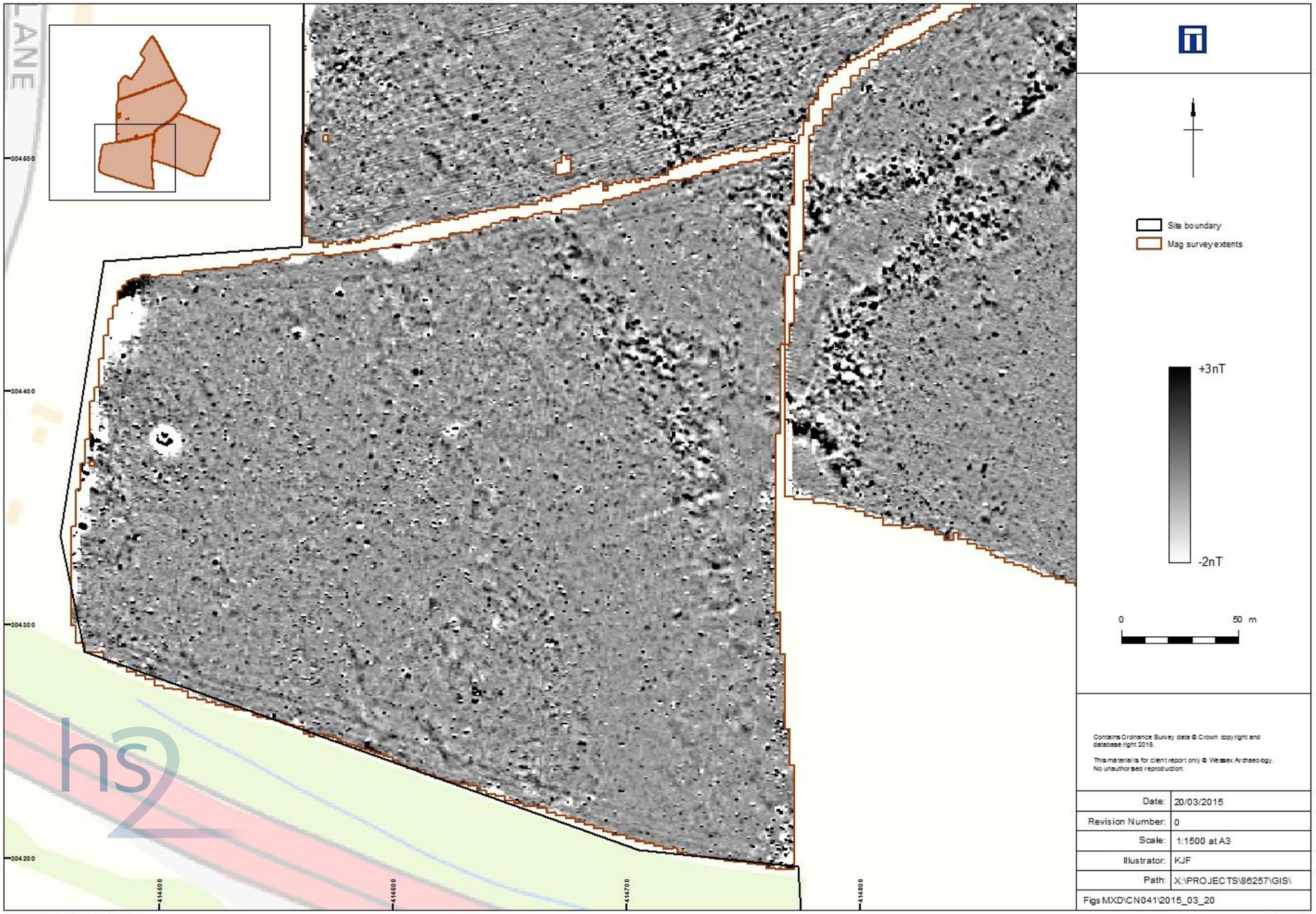
Figure 28 - CN041 site location



Site location

Figure 28

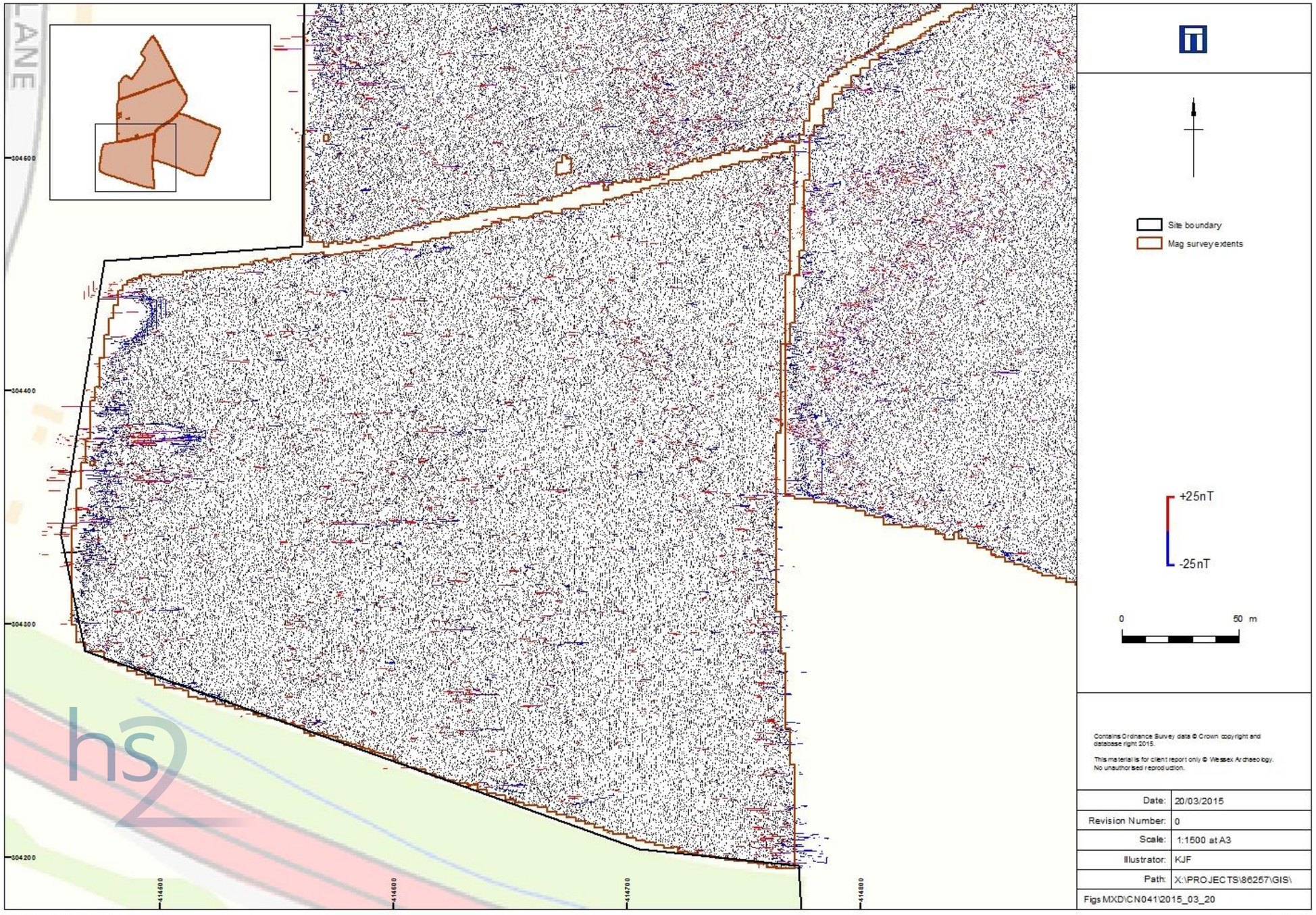
Figure 29 - CN041 greyscale plot (south-west)



Greyscale plot (south-west)

Figure 29

Figure 30 - CN041 XY trace (south-west)



XY trace (south-west)

Figure 30

Figure 31 - CN041 interpretation (south-west)

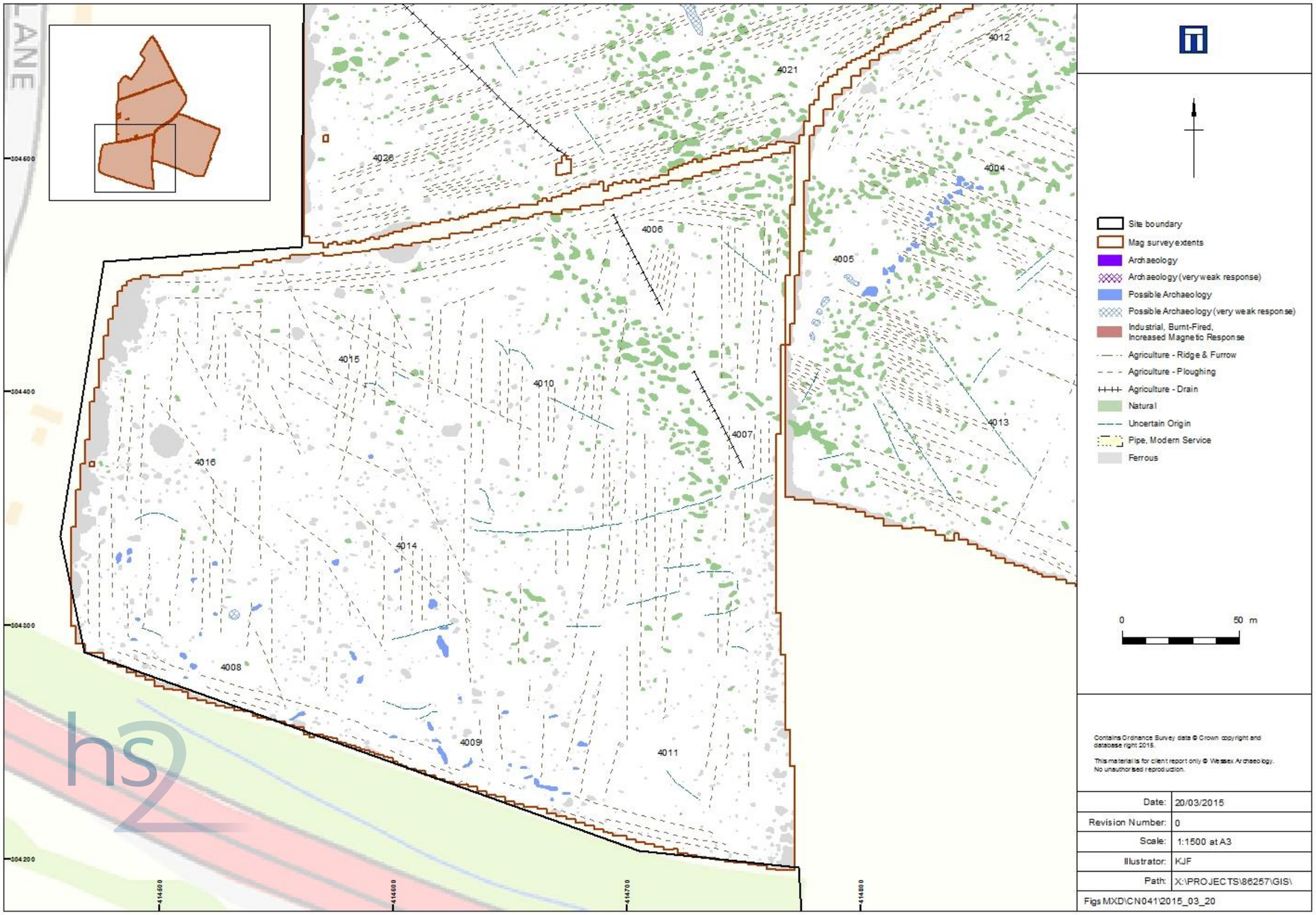
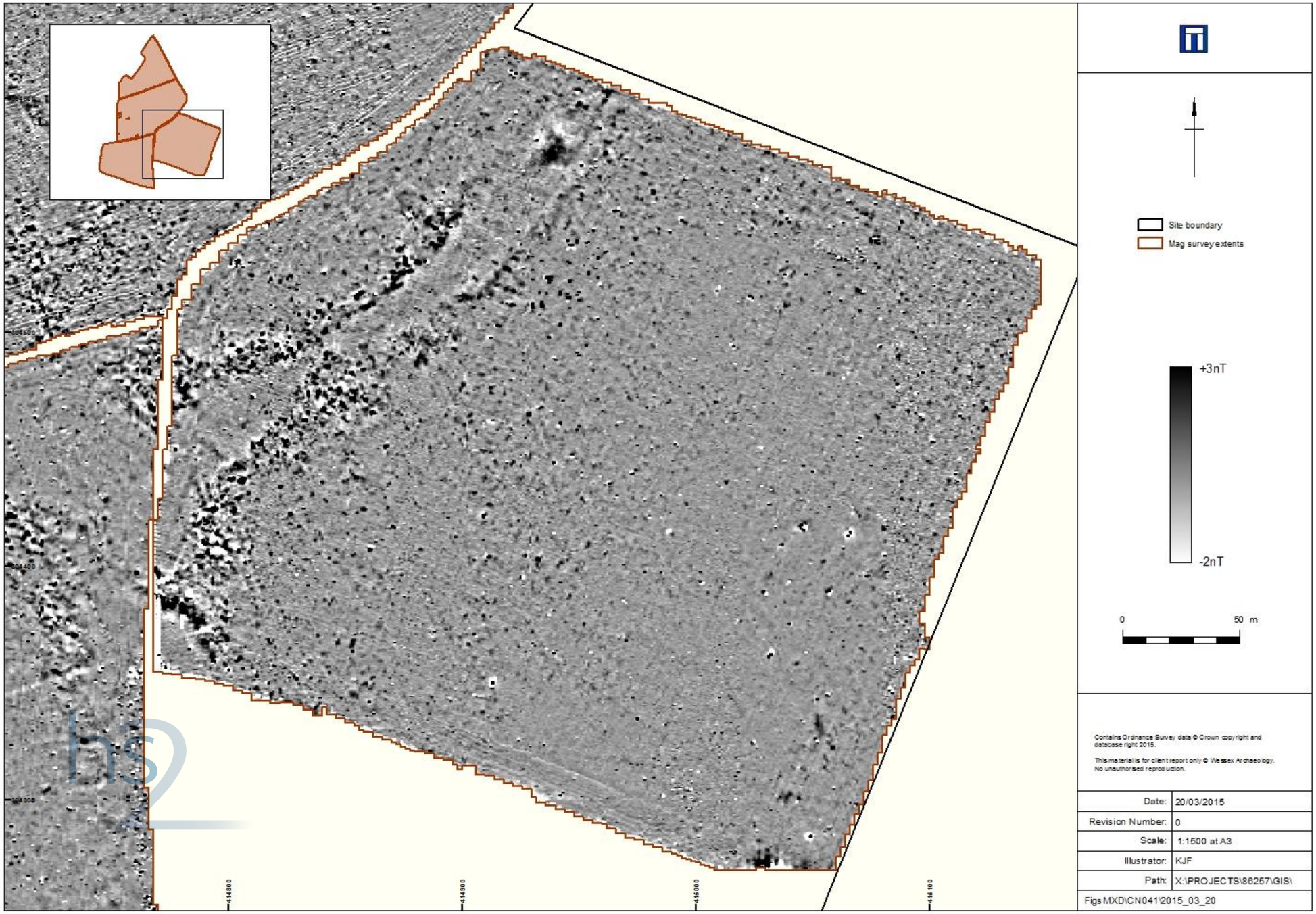


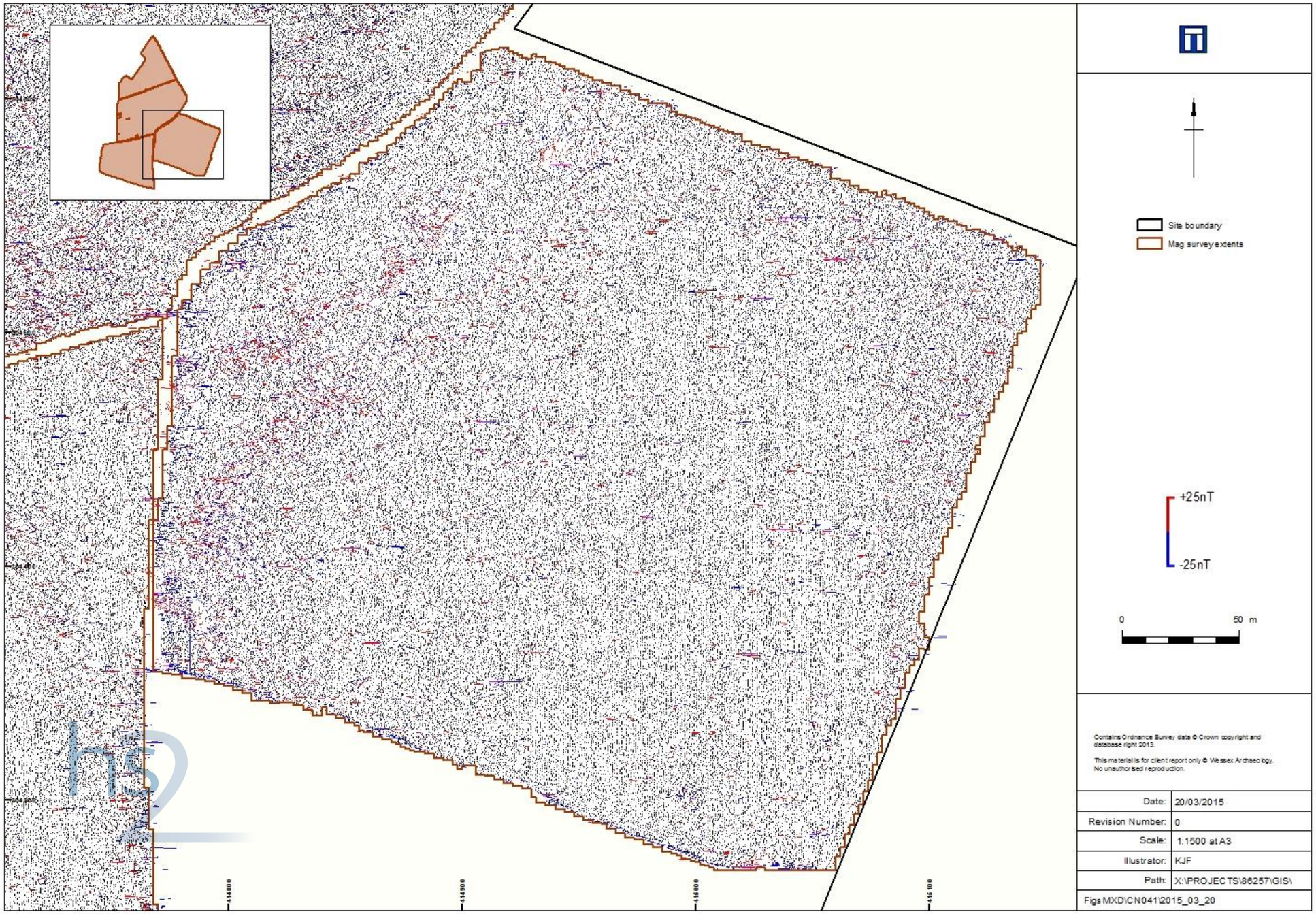
Figure 32 - CN041 greyscale plot (south-east)



Greyscale plot (south-east)

Figure 32

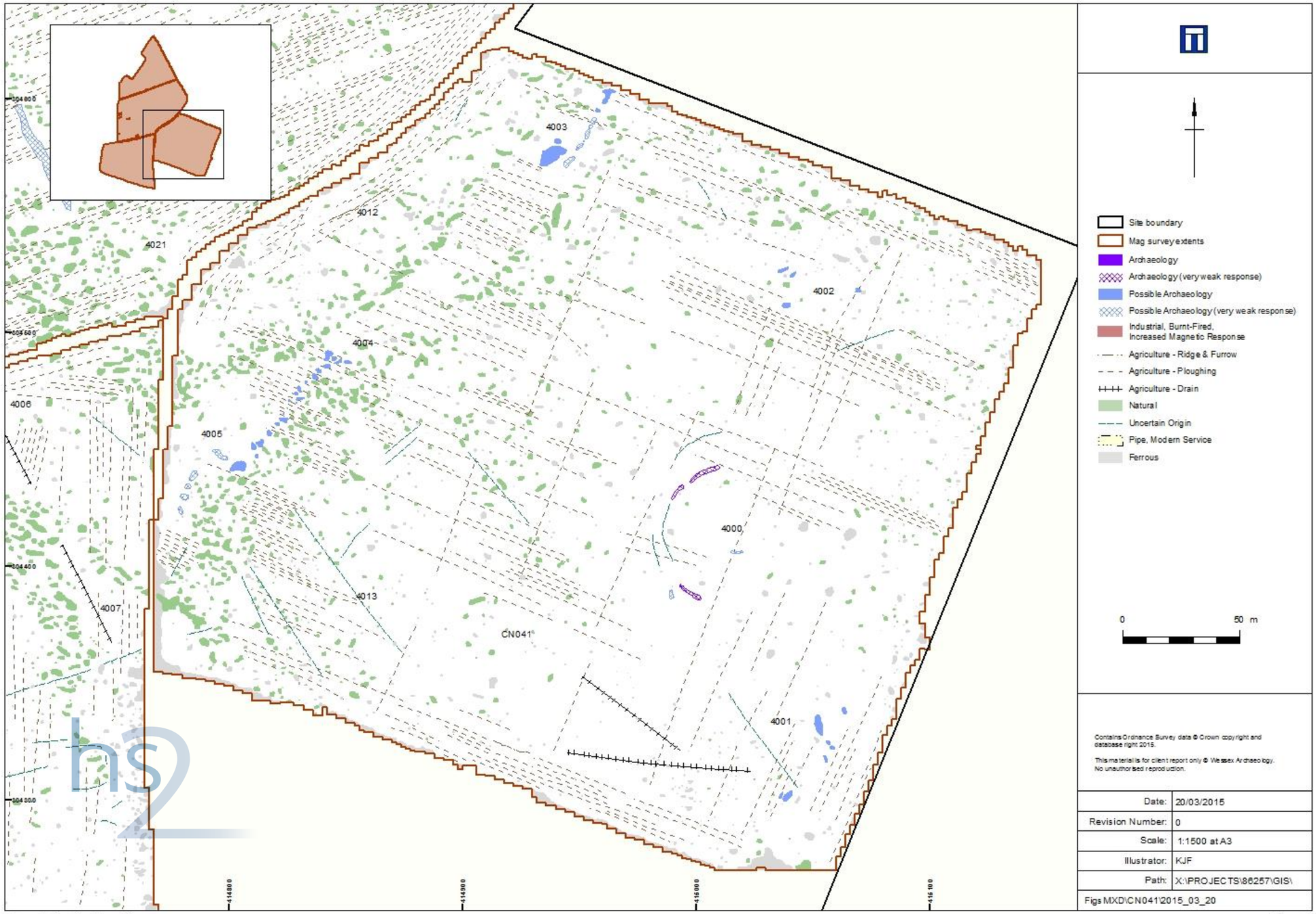
Figure 33 - CN041 XY trace (south-east)



XY trace (south-east)

Figure 33

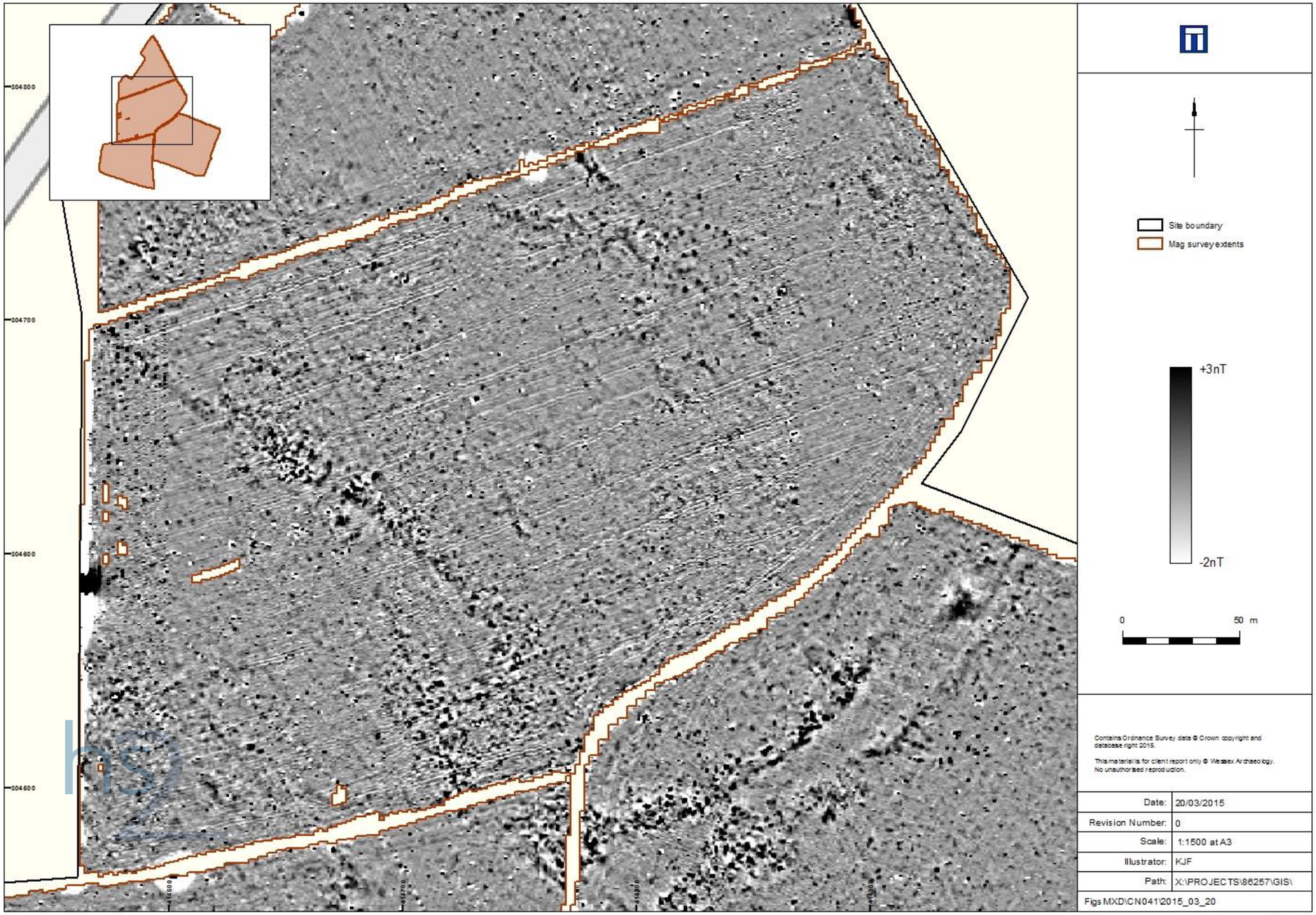
Figure 34 - CN041 interpretation (south-east)



Interpretation (south-east)

Figure 34

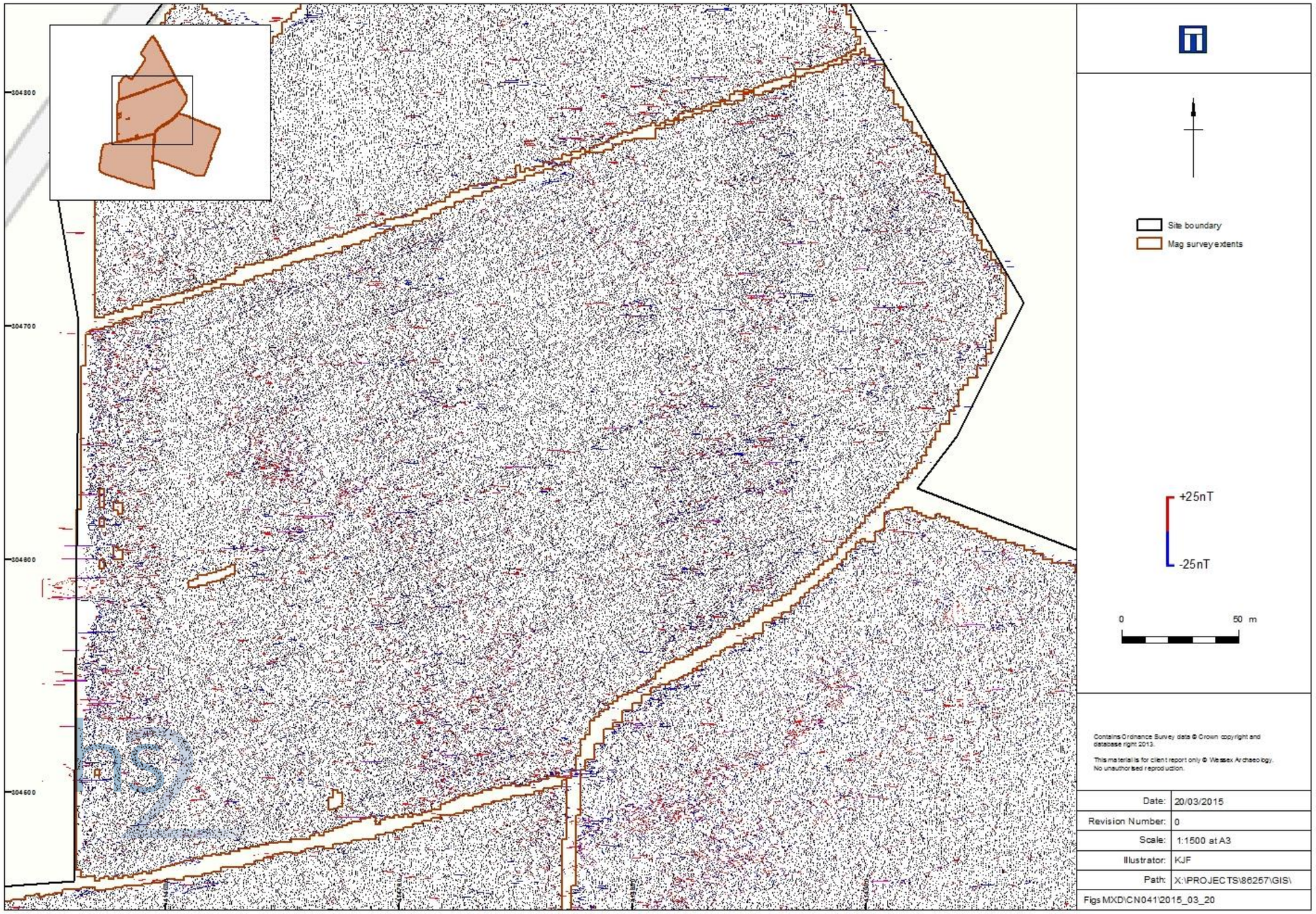
Figure 35 - CN041 greyscale plot (central)



Greyscale plot (central)

Figure 35

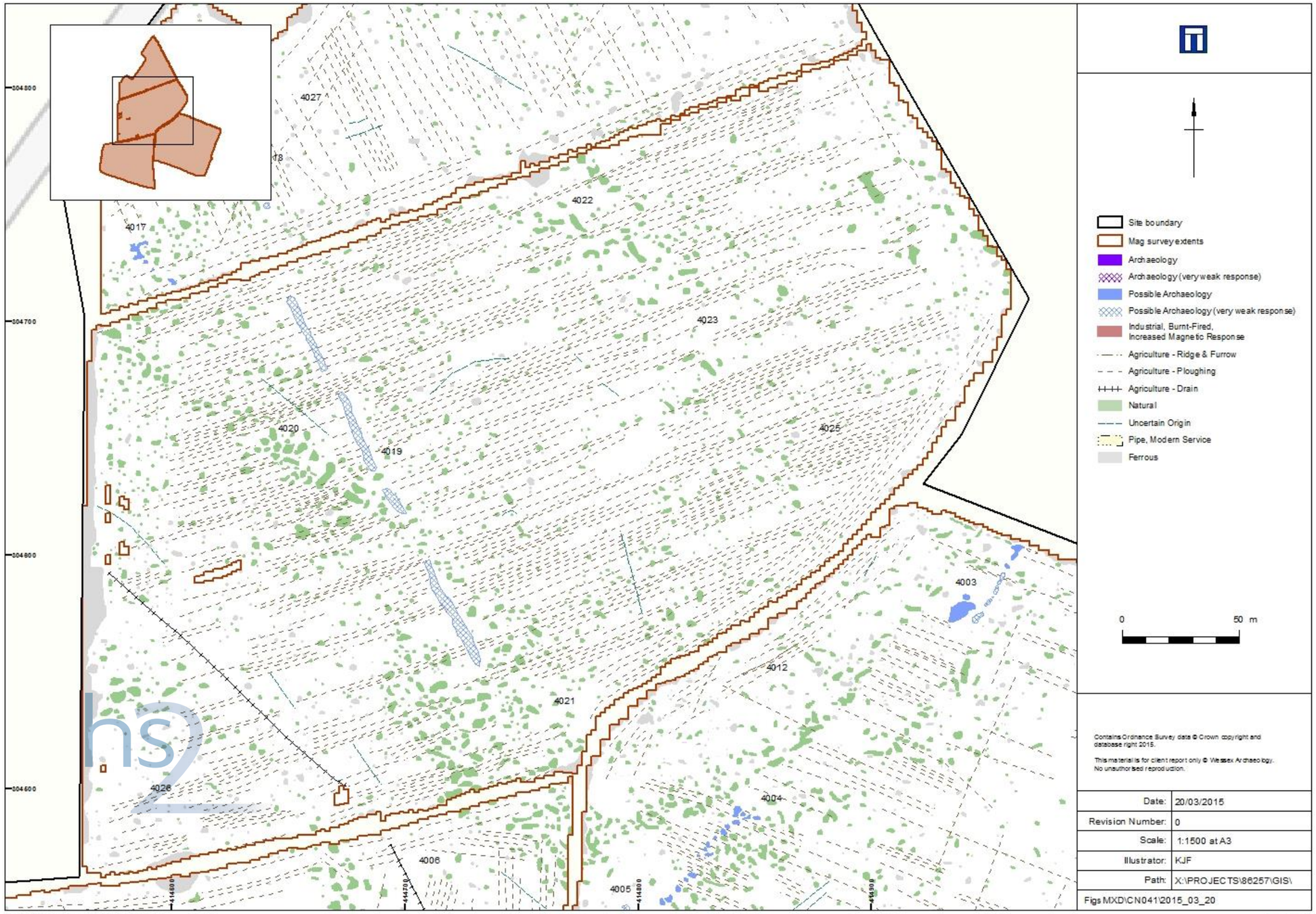
Figure 36 - CN041 XY Trace (central)



XY trace (central)

Figure 36

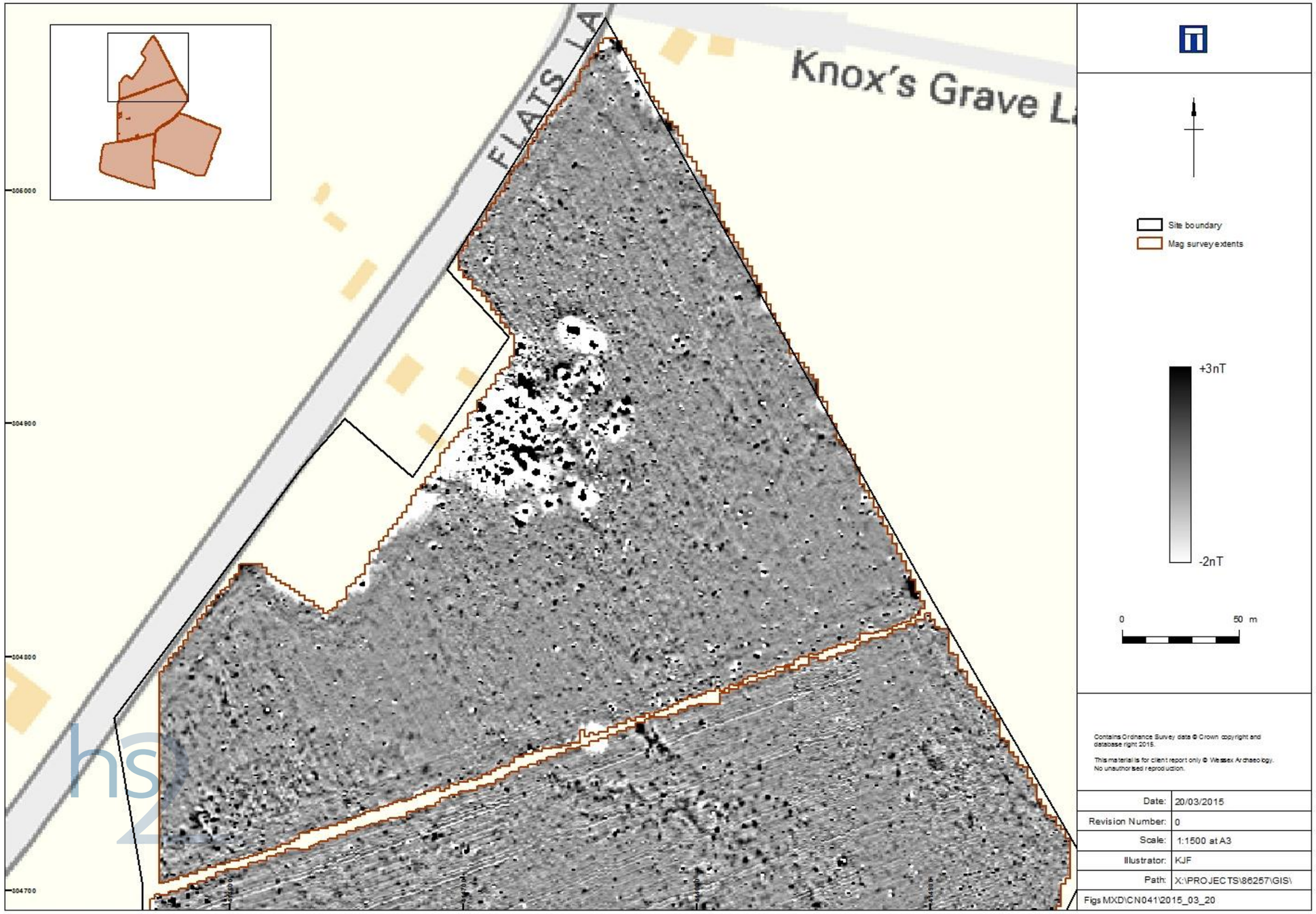
Figure 37 - CN041 interpretation (central)



Interpretation (central)

Figure 37

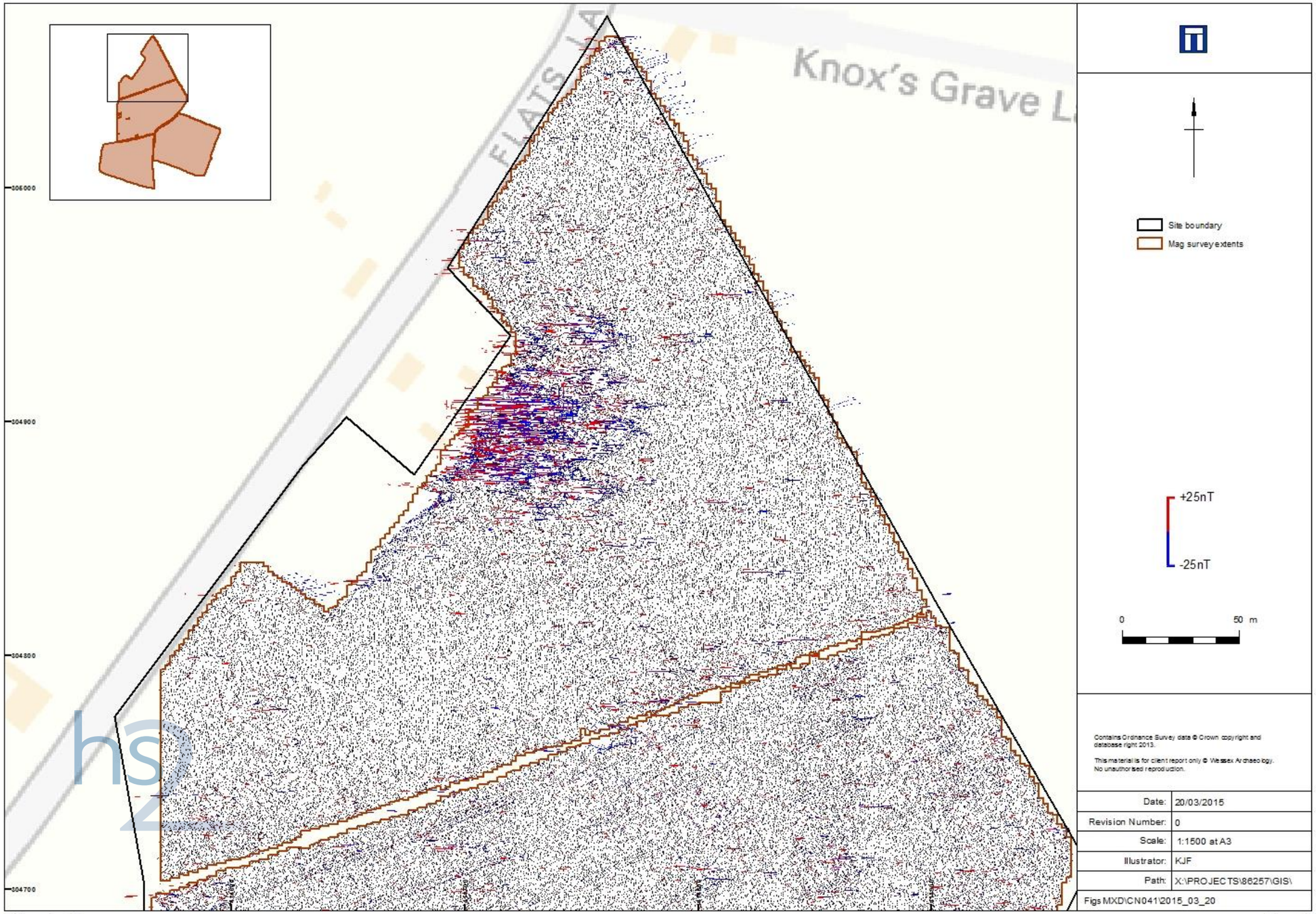
Figure 38 - CN041 greyscale plot (north)



Greyscale plot (north)

Figure 38

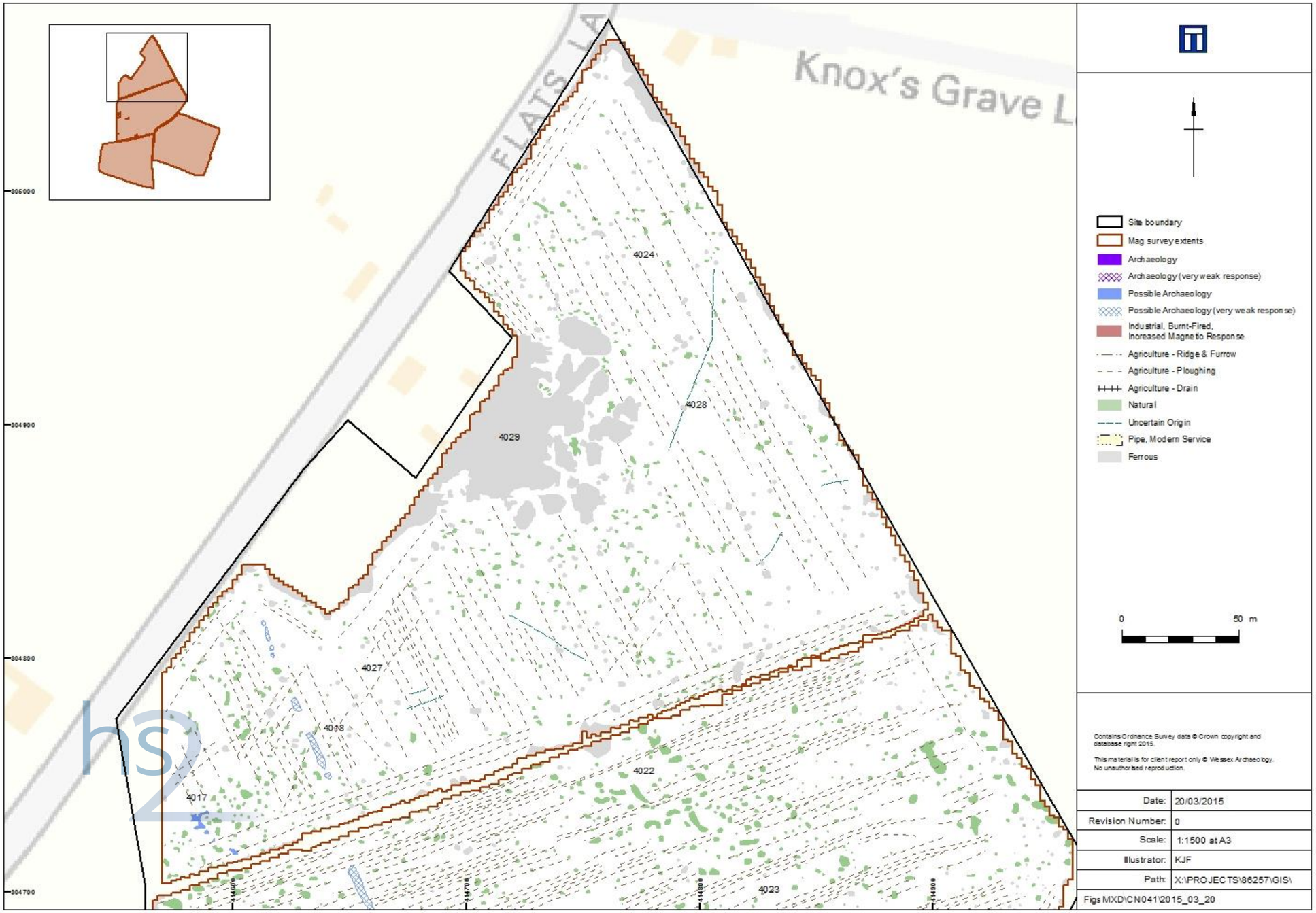
Figure 39 - CN041 XY Trace (north)



XY trace (north)

Figure 39

Figure 40 - CN041 interpretation (north)



Interpretation (north)

Figure 40

2.8 CN043 Land off Tamworth Road

Introduction

2.8.1 Survey parcel CN043 was not reported in the main ES due to access being unavailable at the time.

Project background

2.8.2 Wessex Archaeology was commissioned by HS2 to carry out a geophysical survey of area CN043 off Tamworth Road (A51), near Lichfield, Staffordshire (Figure 41), hereafter "the site" (centred on NGR 414600, 307050). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

2.8.3 The geophysical survey undertaken here has been preceded by desk-based research[76] and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis[77]. Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

2.8.4 This site, CN043, was selected for geophysical survey as it is considered to be a known area of medium risk with known archaeology in the area.

Site details

2.8.5 The site comprised a single arable field located approximately 3.8km southeast of the centre of Lichfield, opposite Whittington Heath Golf Course. The site is bounded to the northeast by the A51 Tamworth Road, to the south-east, southwest and north-west by agricultural fields. To the northwest of the site is Freeford Home Farm, while Ingleyhill Farm lies just to the south-west. The gradiometer survey covered 14.8ha with all proposed areas surveyed.

2.8.6 The site lies on an area of very gently sloping land that falls away towards the southwest; where it then slopes downwards more steeply. The majority of the survey area to the northeast lies at a height of around 100m aOD and falling to around 95m aOD in the southwest corner. The site occupies one of the highest areas of a ridge running northwest to southeast; the highest point of which is located at the nearby Whittington Barracks (107m aOD). Several watercourses define this ridge of land; the River Tame to the east (roughly aligned north to south), a small unnamed brook that flows towards the north to the west and Brook Leasow to the southeast of the site, which flows northeast to the River Tame.

2.8.7 The solid geology is recorded as Keuper Sandstone (Triassic) within the south-western half of the Site and Bunter Sandstone (Triassic) under the north-eastern half of the site[78]. There is also a very small area of superficial geology composed of Diamicton Till recorded on the site[79].

2.8.8 The soils underlying the site are likely to be typical brown sands of the 551a (Bridgnorth) association. There are other soil types nearby with typical brown earths of the 541r (Wick 1) association to the north and typical humic-sandy gley soils of the 861b (Isleham 2) association to the west of the site[80]. Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological background

2.8.9 For a detailed assessment of the known archaeology of the Site and surrounding area the relevant baseline study should be consulted[81]. A summary of relevant sites within 1km of the survey area are summarised below and have been included to provide context and inform the geophysical interpretation. There are ten Grade II listed buildings within this area but no other designations. Sites referred to can be found either within the gazetteer for CFA 21 in the ES[82] (DHW numbers) or in the Staffordshire HER (MST numbers).

2.8.10 There are no records of Palaeolithic, Mesolithic or Iron Age sites or findspots within 1km of the survey area. A Bronze Age flanged axe was located at Whittington Heath golf club, to the northeast of the Site (MST6317).

2.8.11 Approximately 1km northwest of the site is the location of Freeford deserted medieval settlement (MST5230) which has been identified from pottery finds dating from 12th-16th century and documentary evidence from 1334 and 1377. Freeford Hall (MST 1093) is located on the same site and is a Grade II listed country house, built on the site of a medieval manor house. A pool is also recorded on the site which is believed to be related to a former medieval mill at the location.

2.8.12 Grade II post-medieval farm buildings are recorded 350m south at Ingley Hill Farm (DHW042) and 650 m south at Horsley Brook Farm, consisting of a farmhouse, barn, granary and cart shed and blacksmiths workshop and stables (DHW045).

2.8.13 Whittington Barracks lies approximately 1km southeast of the site and is the location of four Grade II listed properties. The keep (MST 14727), the garrison church (MST14728) and North and South Staffordshire World War I memorials (MST 17883 and MST 17884).

Survey objectives

2.8.14 A WSI was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed[83]. The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site;
- to determine the general nature of the remains present.
- to combine the results of the geophysical surveys with data from other archaeological assessments carried out as part of the project in order to analyse the archaeological potential of the survey locations

[76] CH-001-021, HS2 Environmental Statement, 2013.
[77] CH-004-021, HS2 Environmental Statement, 2013
[78] Ordnance Survey 1957
[79] Ordnance Survey 1977
[80] Soil Survey of England and Wales, 1983
[81] CH-001-021, HS2 Environmental Statement, 2013
[82] CH-002-021, HS2 Environmental Statement, 2013
[83] Wessex Archaeology, 2014

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

Methods

Survey dates

2.8.16 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between 16-19 January 2015.

Grid location

2.8.17 The 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 HE recommendations[84].

2.8.18 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments used and survey method

2.8.19 The magnetometer 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 HE guidelines[85].

2.8.20 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data processing

2.8.21 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (±5nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.

2.8.22 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.

Data presentation

2.8.23 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then used to produce the final figures in GIS (ESRI ArcMap 10).

2.8.24 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

2.8.25 The gradiometer survey has been successful in identifying anomalies of possible archaeological interest, along with numerous trends. The results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figures 42 to 47).

2.8.26 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figures 44 and 47). Full definitions of the interpretation terms used in this report are provided in Annex 2.

2.8.27 Ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: archaeology

2.8.28 The greatest concentration of anomalies of possible archaeological interest lies in the southwest corner of the site (see Figures 44 and 47). While the wider area around these anomalies has been interpreted as natural geology due to the wide spread of weak bipolar responses there are several discrete positive anomalies are much stronger with magnetic values exceeding +3nT. Although most of these anomalies have an irregular shape in plan, a few are more regular with squared and L-shaped anomalies observed around 4000 and 4001 in particular. Due to the apparent spread of natural features within the vicinity and the irregularity in form of some of these positive anomalies they have all been classified as possible archaeology. If archaeological, these features are considered to represent cut features such as pits.

2.8.29 To the northwest of this area is a similar feature at 4002, made up of two positive anomalies that appear to form a short north-west to south-east linear feature measuring approximately 7m in length. There are two other similarly aligned short linear features located approximately 50m to the east of this one. These features may prove to be cut features such as short sections of ditch but could just as easily represent strong ploughing features.

2.8.30 Across the site are further isolated sub-oval positive anomalies with magnetic values between +2nT and +4nT possibly representing small pit-type features. The features at 4003 and 4006 represent two of the more densely concentrated examples but there are a great many similar anomalies located across the site.

2.8.31 There are a few groups of positive anomalies that appear to form significant patterns in their spatial distribution; these will be discussed below.

2.8.32 A number of elongated oval and sub-oval positive anomalies at 4004 form an intermittent linear feature approximately parallel to the current field boundary. It is weakly contrasting and could be related to agricultural activity, such as a former field boundary ditch, and has been classed as possible archaeology (very weak response). A line of north-west to south-east

[84] English Heritage, 2008

[85] ibid

discrete sub-oval shaped positive anomalies visible at 4005may also be the remains of a cut feature such as a ditch. A group or apparent concentration of oval positive anomalies is present around 4006 and 4003 including a number of apparently large features up to 3m in length.

2.8.33 However, not all of these positive responses are considered to be archaeological in nature as many are likely to be natural features resulting from variations in the superficial geology or discrete features such as tree throws. Nevertheless, due to the uncertainty in interpretation a precautionary approach has been adopted and all of these positive anomalies have been classified as possible archaeology or possible archaeology (very weak response).

2.8.34 Agricultural activity is visible across the Site with ploughing trends especially evident at 4008 and 4009. The north-east to south-west orientation of these trends is similar to the current field alignment and presumed to be modern in date.

2.8.35 Weak positive and negative linear trends have been identified across the entire site however they do not form any regular patterns or distributions in relation to themselves or other anomalies and as such and given their strength it is not possible to accurately identify their origin.

2.8.36 Along with the numerous small positive anomalies present across the site are a number of linear and curvilinear trends classed as uncertain origin. Many of these trends may prove to be related to modern ploughing or a coincidental arrangement of unrelated anomalies but some may prove to be of archaeological significance. There are a group of small positive anomalies at 4006 that form a slightly irregular arc. Similarly there are regular trends that form right-angles and curved arcs around 4007 and 4008. The majority of the trends observed were fairly straight and were aligned parallel to the present field boundaries such as can be seen around 4008. These have been classed as ploughing trends and are considered to be relatively modern.

2.8.37 There are two spreads of dipolar and bipolar anomalies at 4005 and 4010; these have been classed as industrial, burnt-fired, increased magnetic response. Given their magnetic values and their close proximity to modern services it is considered that these spreads represent a concentration of relatively modern ferrous and ceramic debris.

2.8.38 The remaining features present on site are broad, irregular shaped spreads of weak bipolar anomalies. These spreads, such as 4012, are not consistent with a spread of magnetised anthropogenic material (ferrous/ceramic). These spreads are considered to be natural and related to variations in the underlying geology.

Interpretation: modern services

2.8.39 Four modern services have been identified in the data at 4010 to 4013; of which the service at 4010 appears to be discontinuous. 4010 and 4011 are considered to represent metallic/ceramic pipes.

2.8.40 The services at 4012 and 4013 both run parallel to the current field boundaries. Anomaly 4012, a north-northwest to south-southwest aligned linear feature, presents as a series of repeating dipolar anomalies; this is consistent with responses from a ceramic field drain.

2.8.41 The service at 4013 shows another linear of strong dipolar anomalies aligned northwest to southeast. This is much has a much larger area of magnetic response and is likely to be a modern service.

2.8.42 Gradiometer data will not be able to 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 should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

2.8.43 The detailed gradiometer survey has been successful in detecting anomalies of possible archaeological interest within the site, including a number of possible pit clusters. Additionally ploughing trends, areas of increased magnetic response and superficial geology have also been identified.

Discussion

2.8.44 The anomalies of possible interest are centred around 4000, 4001 and 4002, with possible ditches at 4000 and potential pits at 4001 and 4002. There are no internal field divisions visible on the earliest available OS mapping[86] at this location to which they might relate.

2.8.45 There are numerous possible archaeological anomalies across the site with particular concentrations at 4003 and 4006 and linear alignments at 4004 and 4005. Whilst these have all been classed as possible archaeology or possible archaeology (very weak response) there is also the possibility that they are natural in origin. The site is located between water courses and there are also glacial till deposits recorded in the survey area. Changes and variation in the superficial geology could be responsible for the large number of positive and bipolar anomalies across the site, also contributing to the large number of trends of uncertain origin.

2.8.46 The ploughing trends, such as are visible around 4008 and 4009, are aligned northwest to southeast along the same orientation as the current field boundaries and are probably post-medieval or modern in date.

2.8.47 The areas of increased magnetic response at 4007 and 4010 are more difficult to define, while they could represent an area of burning or debris and may therefore potentially be of archaeological interest they are also located near modern services and could therefore be associated with their construction.

2.8.48 No features of definite archaeological interest have been identified in the geophysical data as there were no groups of anomalies that produced a significant enough pattern in their spatial distribution to warrant this classification. However there are some areas of the dataset that may prove to be of higher potential such as around 4000 and 4001 where high concentrations of positive magnetic anomalies were detected. Additionally, some of the trends and small positive anomalies such as 4003 and 4006 may prove to be more significant.

2.8.49 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; it is assumed

[86] Ordnance Survey, 1884

that the centreline of services is coincident with the centreline of their anomalies. It is difficult to estimate the depth of burial of the services through gradiometer survey.

2.8.50 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 encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

References

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

HS2 Ltd, 2013. London-West Midlands Environmental Statement, Volume 5: Technical Appendices: CFA21

Ordnance Survey, 1884. OS County Series: Staffordshire 1:2500

Ordnance Survey 1957. Sheet 2, Geological Map of Great Britain: England and Wales. Ordnance Survey: Chessington

Ordnance Survey, 1977. Quaternary Map of the United Kingdom: South. Ordnance Survey. Southampton

Soil Survey of England and Wales, 1983. Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

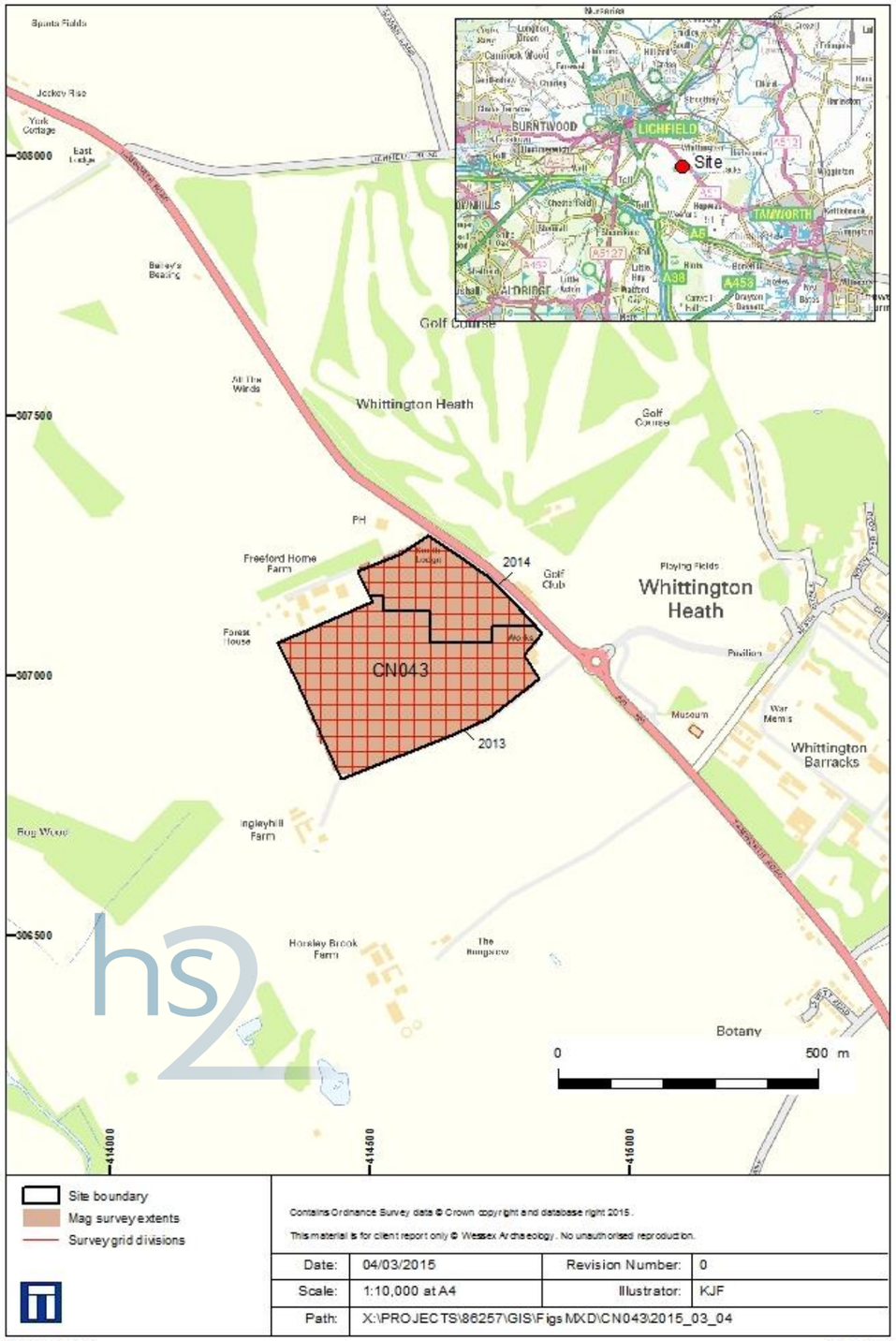
Wessex Archaeology, 2014. HS2: Geophysical Survey Written Scheme of Investigation: Staffordshire. Report Reference: 86257.01.

HER Records Consulted

DHW042 – Ingley Hill Farmhouse and Barn
DHW045 - Horsley Brook Farm; House; Barn; Stable; Smithy
MST 1093 - Freeford Hall
MST5230 - Freeford deserted medieval settlement
MST6317 - Bronze Age flanged axe
MST 14727 – Keep at Whittington Barracks
MST 14728 – Garrison church at Whittington Barracks
MST 17883 - North Staffordshire Regimental war memorial
MST 17884 - South Staffordshire Regimental war memorial

Figures

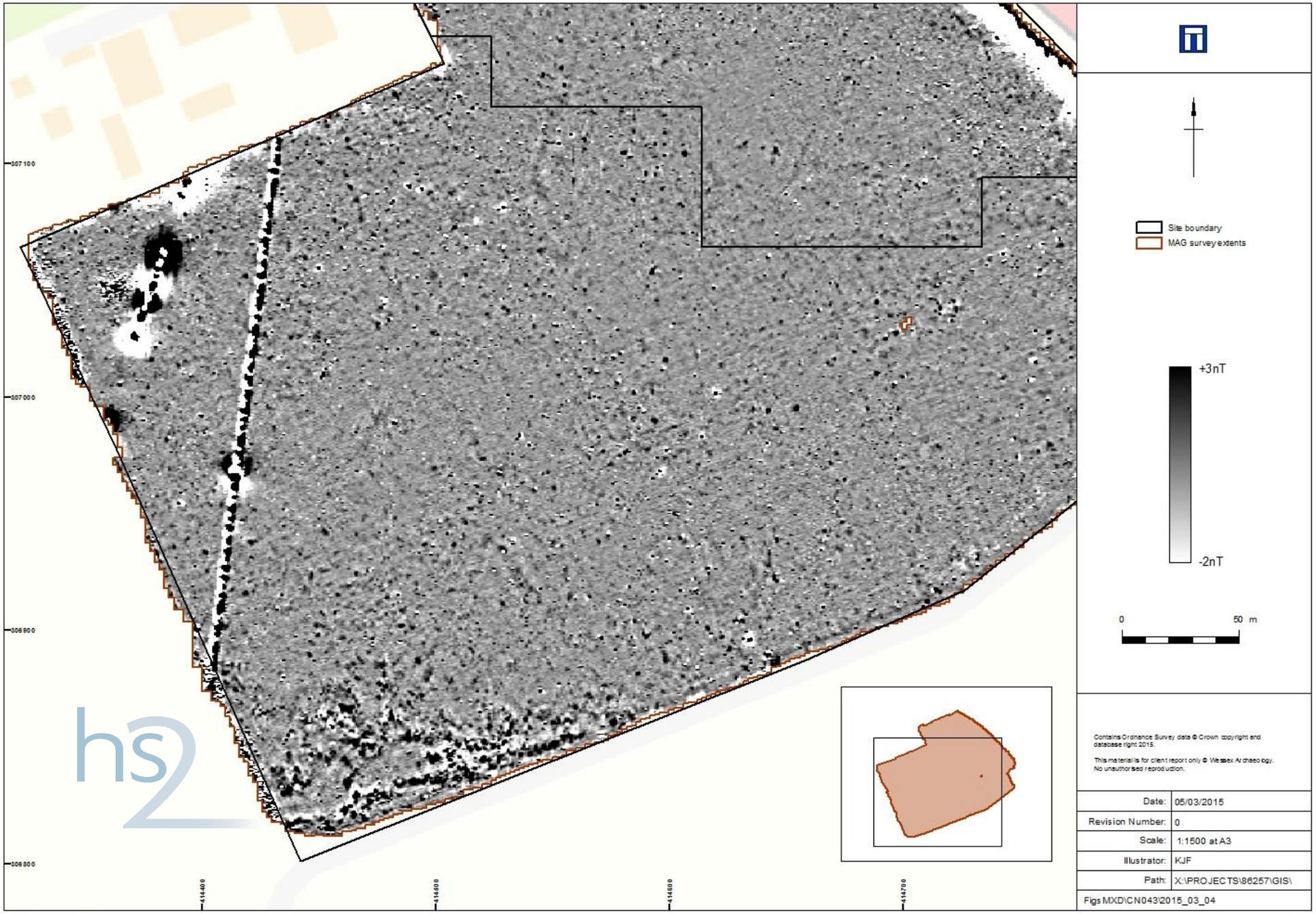
Figure 41 – CN043 site location



Site location

Figure 41

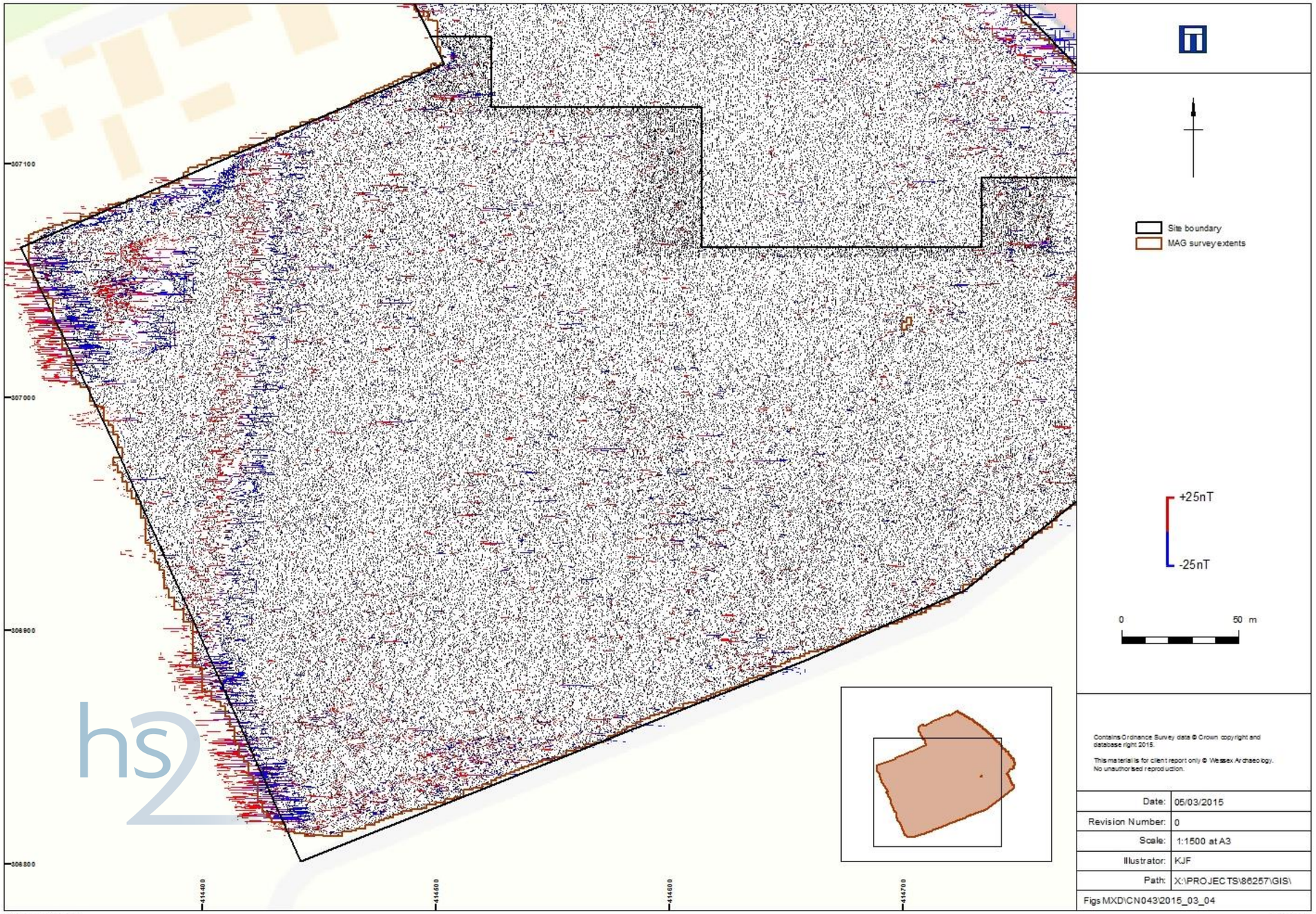
Figure 42 – CN-43 greyscale plot (west)



Greyscale plot (west)

Figure 42

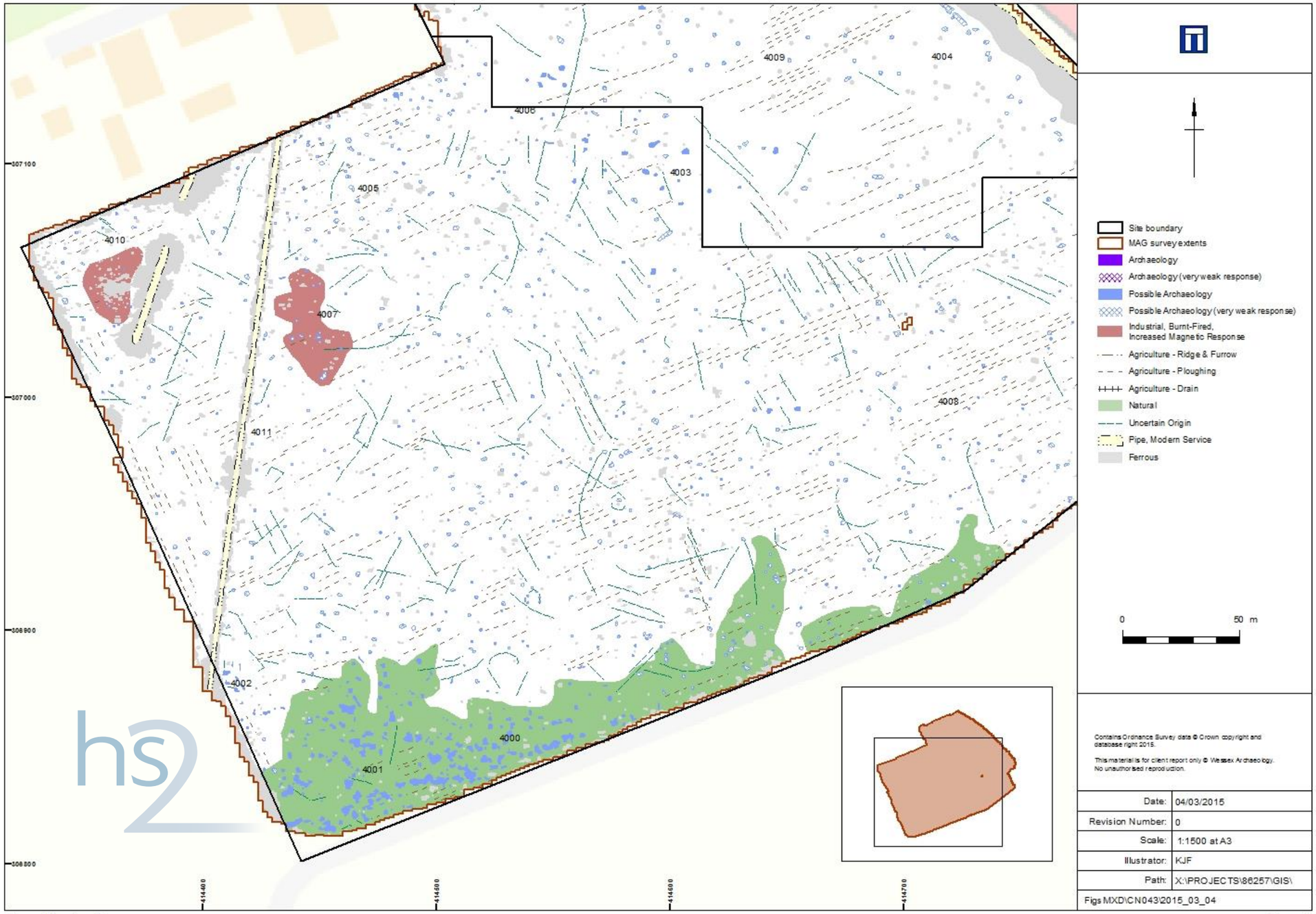
Figure 43 – CN043 XY trace (west)



XY trace (west)

Figure 43

Figure 44 – CN043 interpretation (west)



Interpretation (west)

Figure 44

Figure 45 – CN043 greyscale plot (east)

Greyscale plot (east)

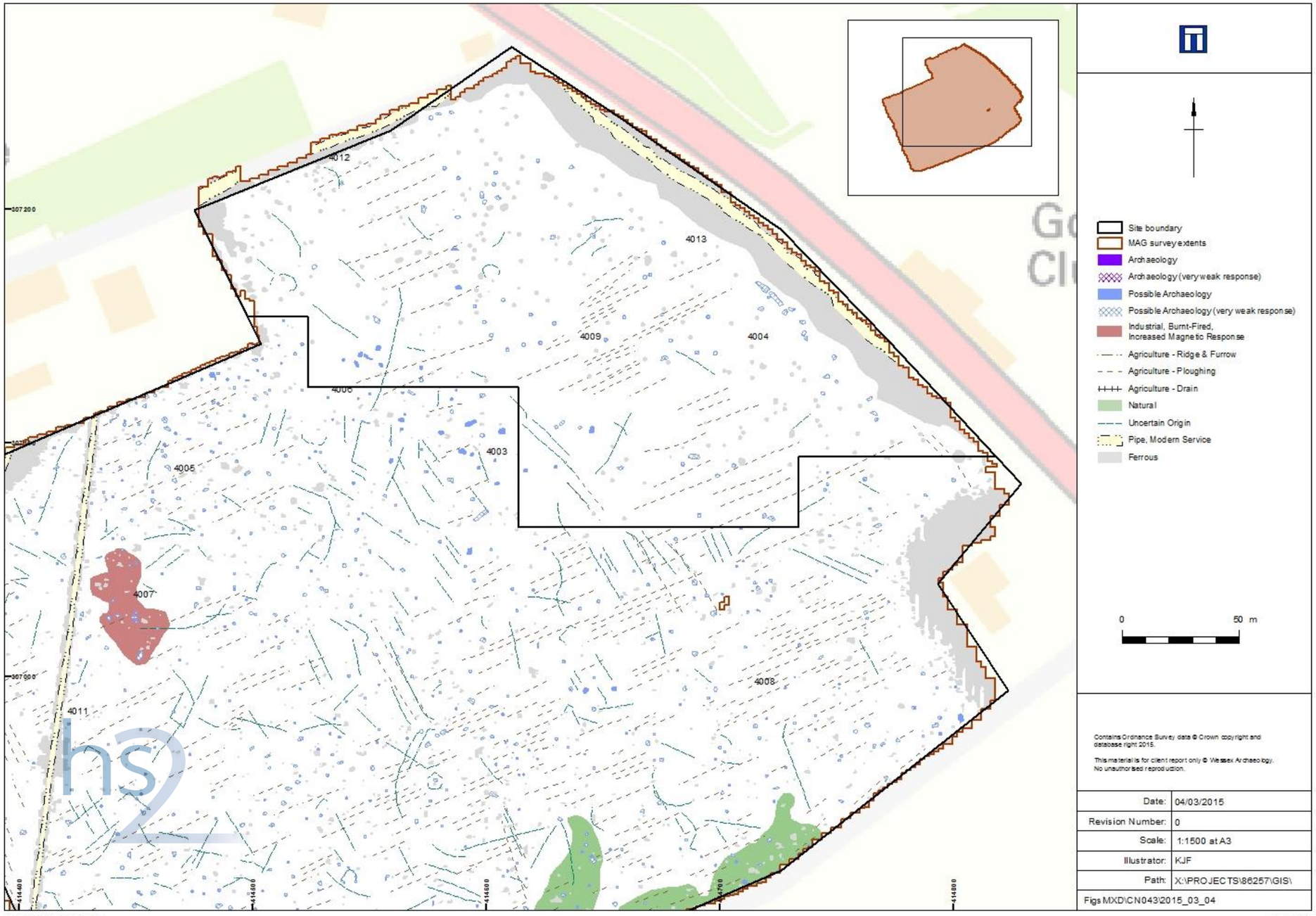
Figure 45

Figure 46 – CN043 XY trace (east)

XY trace (east)

Figure 46

Figure 47 – CN043 interpretation (east)



Interpretation (east)

Figure 47

3 Annex 1: Survey Equipment and Data Processing

Survey methods and equipment

3.1.1 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.

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

3.1.3 Wessex Archaeology conducts detailed gradiometer surveys using 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.

3.1.4 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[87].

3.1.5 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 HE[88] for characterisation surveys.

Post-Processing

3.1.6 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.

3.1.7 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.

3.1.8 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);
- deslope - this function is used to remove a linear trend within a data set. It is most commonly used to remove grid edge discontinuities that can result from applying zero mean traverse to a data set.
- multiply - the multiply function multiplies the data by a negative or positive constant value. It has a variety of functions but its typical use is to normalise data that has been collected with sensors at different heights from the ground.

3.1.9 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.

4 Annex 2: Geophysical Interpretation

Interpretation categories

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

4.1.2 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.

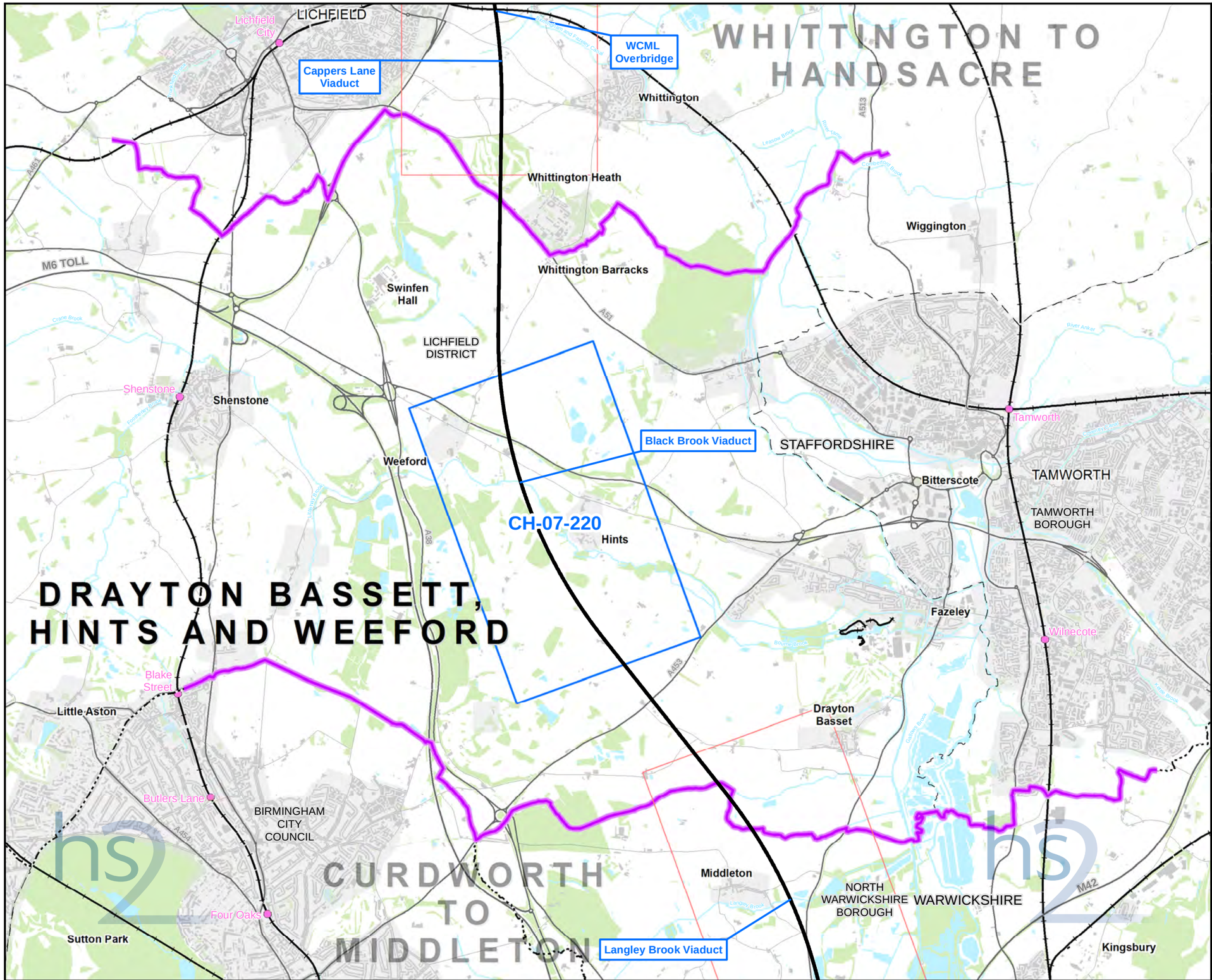
4.1.3 The unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:

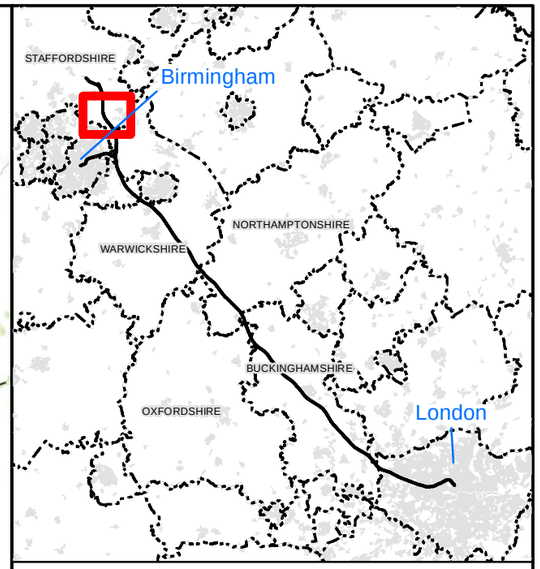
[87] English Heritage 2008

[88] ibid

- industrial, burnt-fired, increased magnetic response - used for areas dominated by bipolar and dipolar anomalies which may have some archaeological potential.
- uncertain origin - used for low amplitude or indistinct linear anomalies.
- ferrous - used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- agricultural - used for linear trends that can be shown to relate to agricultural activity including ridge and furrow, drainage and ploughing scars.
- natural - used for spreads of anomalies that are considered to be geological or more discrete anomalies considered to be natural.

4.1.4 Finally, services such as water pipes are marked where they have been identified along with ceramic field drains.





Map Series Information:

This map series shows archaeological geophysical survey locations within the land required for the construction of the Proposed Scheme

Note: Not all data layers in the legend are represented on every map.

Main Map Legend

- Route in tunnel
- Route on surface
- Depot, station, headhouse or portal building
- Community forum boundary
- Existing railway station
- County boundary
- District/Borough boundary
- Map sheets included in this community forum with amendment
- Map sheets not included in this community forum

Map Number: CH-07-INDEX-CFA21

Map Name: Index Map of: Archaeological Geophysical Survey - Location SES and AP2 ES

Community Forum Area CFA21: Drayton Bassett, Hints and Weeford

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Scale at A3: 1:50,000

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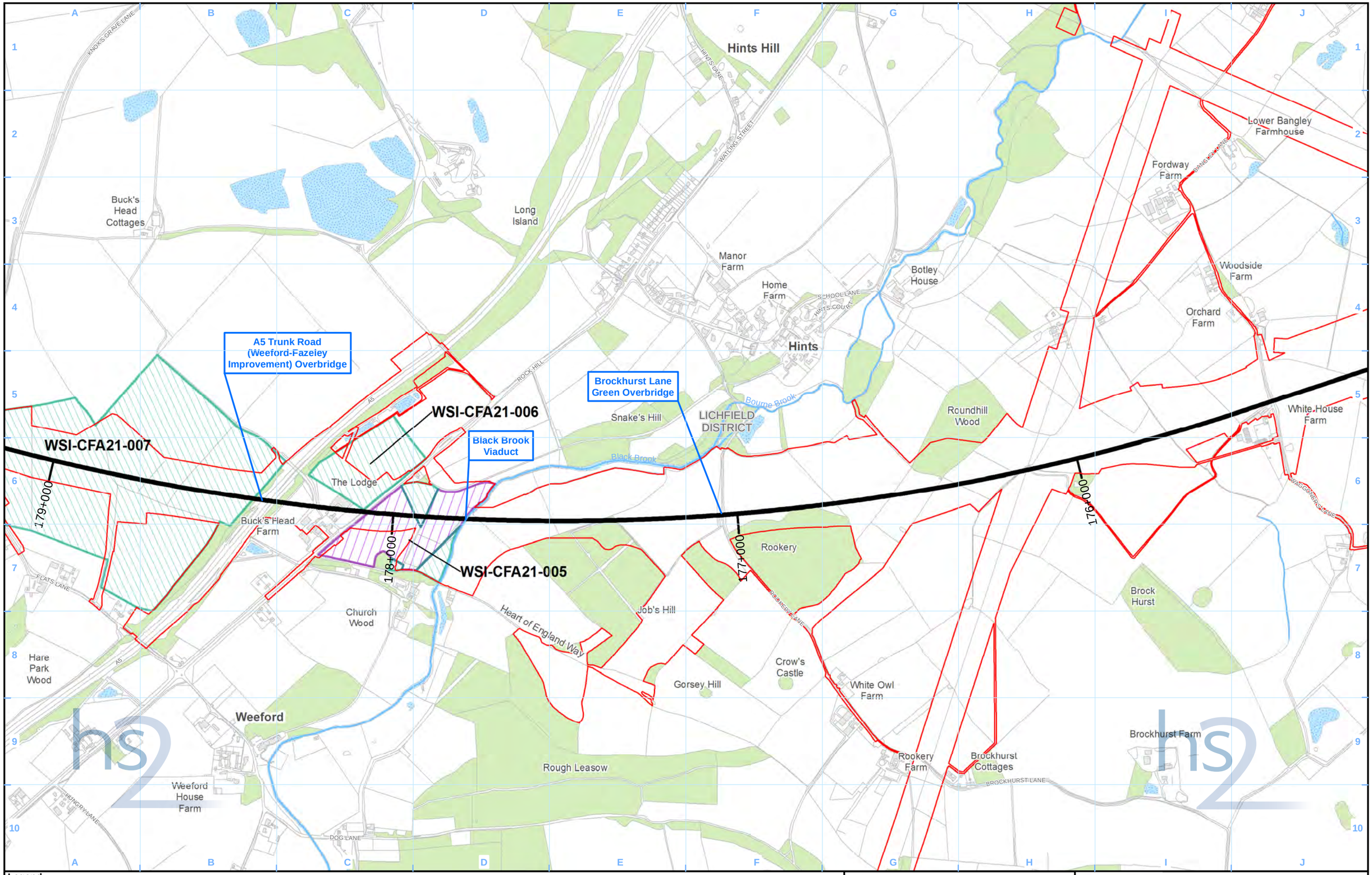
Doc Number: C253-ATK-EV-MAP-030-001855-AP02-P01

Date: 10/06/15



Legend

- Route in tunnel
- Route on surface
- Depot, station, headhouse or portal building
- Land potentially required during construction
- Community forum boundary
- County boundary
- District/Borough boundary
- Watercourse
- Water body
- Woodland

Area identified for survey 2014

- Geophysical and Fieldwalking surveys
- Geophysical surveys

Areas surveyed in 2013

- Fieldwalking surveys completed
- Geophysical surveys completed

Map Number

CH-07-220

Map Name

Archaeological Geophysical Survey - Location SES and AP2 ES

Community Forum Area CFA21: Drayton Bassett, Hints and Weeford

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Scale at A3: 1:10,000

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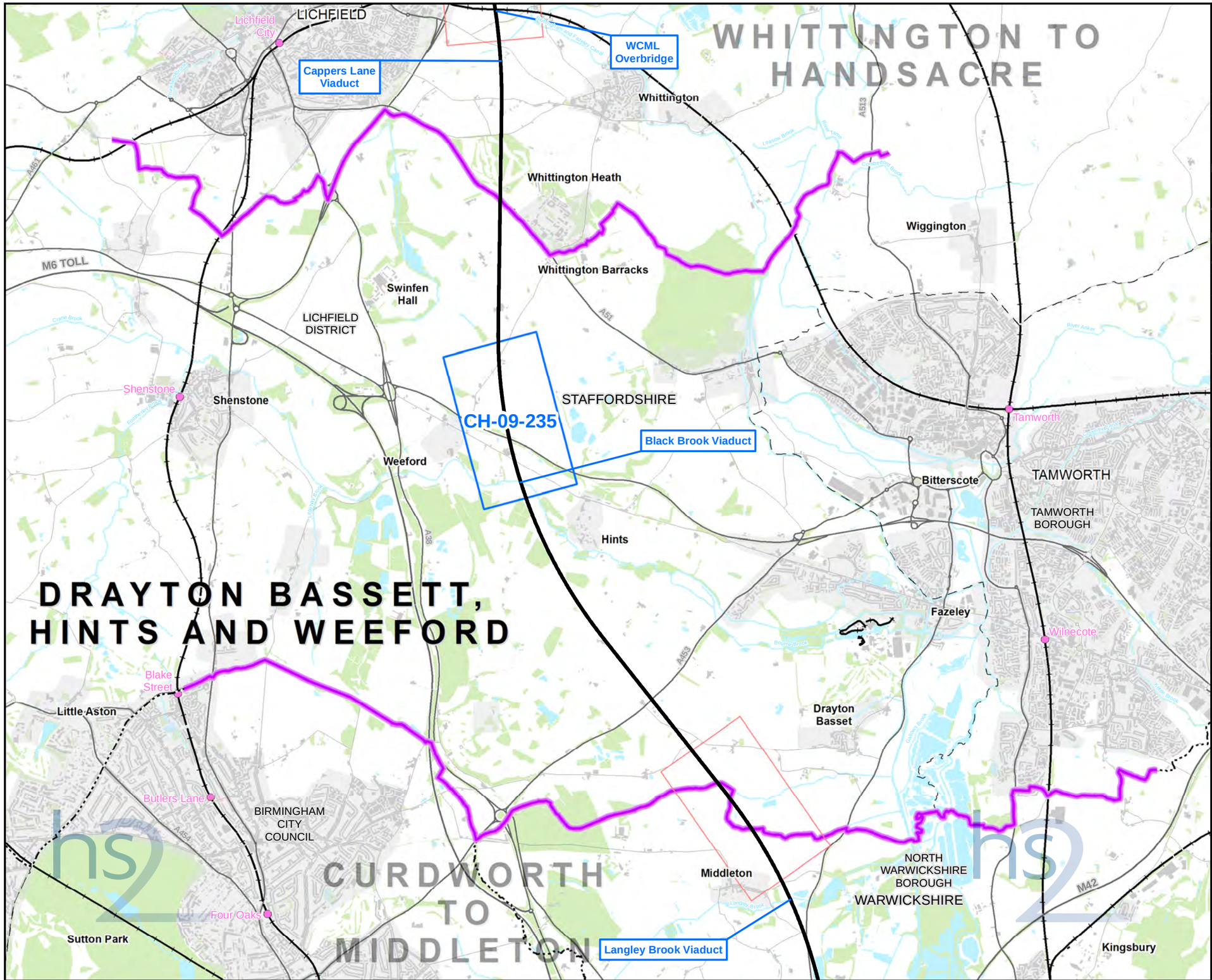
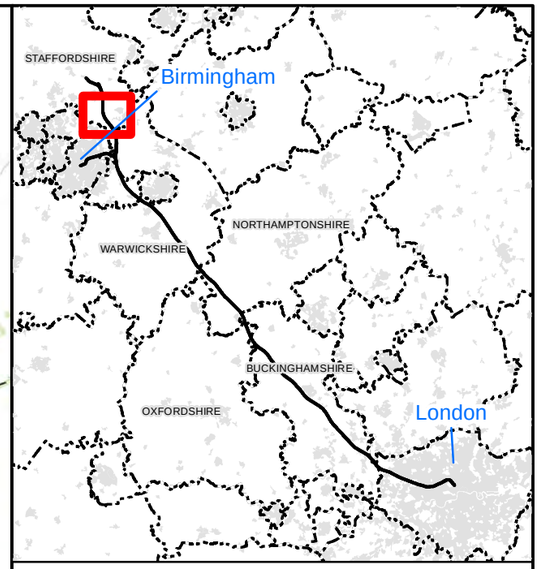
Date: 10/06/15





Map Series Information:

This map series shows magnetometer survey results within the land required for the construction of the Proposed Scheme

Note: Not all data layers in the legend are represented on every map.

Main Map Legend

- Route in tunnel
- Route on surface
- Depot, station, headhouse or portal building
- Community forum boundary
- Existing railway station
- County boundary
- District/Borough boundary
- Map sheets included in this community forum with amendment
- Map sheets not included in this community forum

Map Number: CH-09-INDEX-CFA21

Map Name: Index Map of: Archaeological Geophysical Survey - Magnetometer Data Plot SES and AP2 ES

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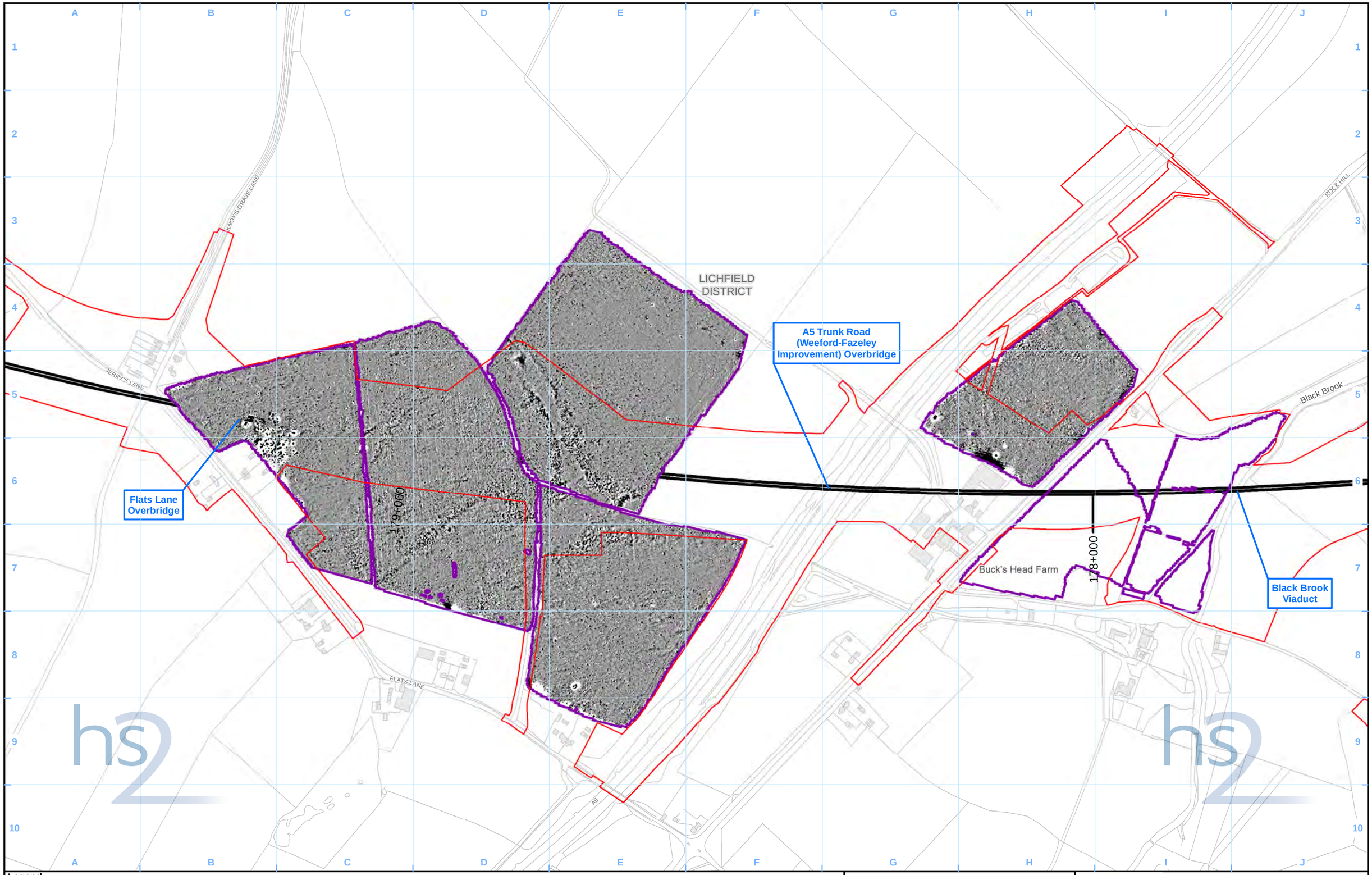
Date: 10/06/15



Legend

- Route in tunnel
- Route on surface
- Depot, station, headhouse or portal building
- Land potentially required during construction
- Community forum boundary
- District/Borough boundary
- Edge of geophysical survey

Map Number
CH-09-235

Map Name
Archaeological Geophysical Survey - Magnetometer Data Plot SES and AP2 ES

Community Forum Area CFA21:
Drayton Bassett, Hints and Weeford

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

Scale at A3: 1:5,000

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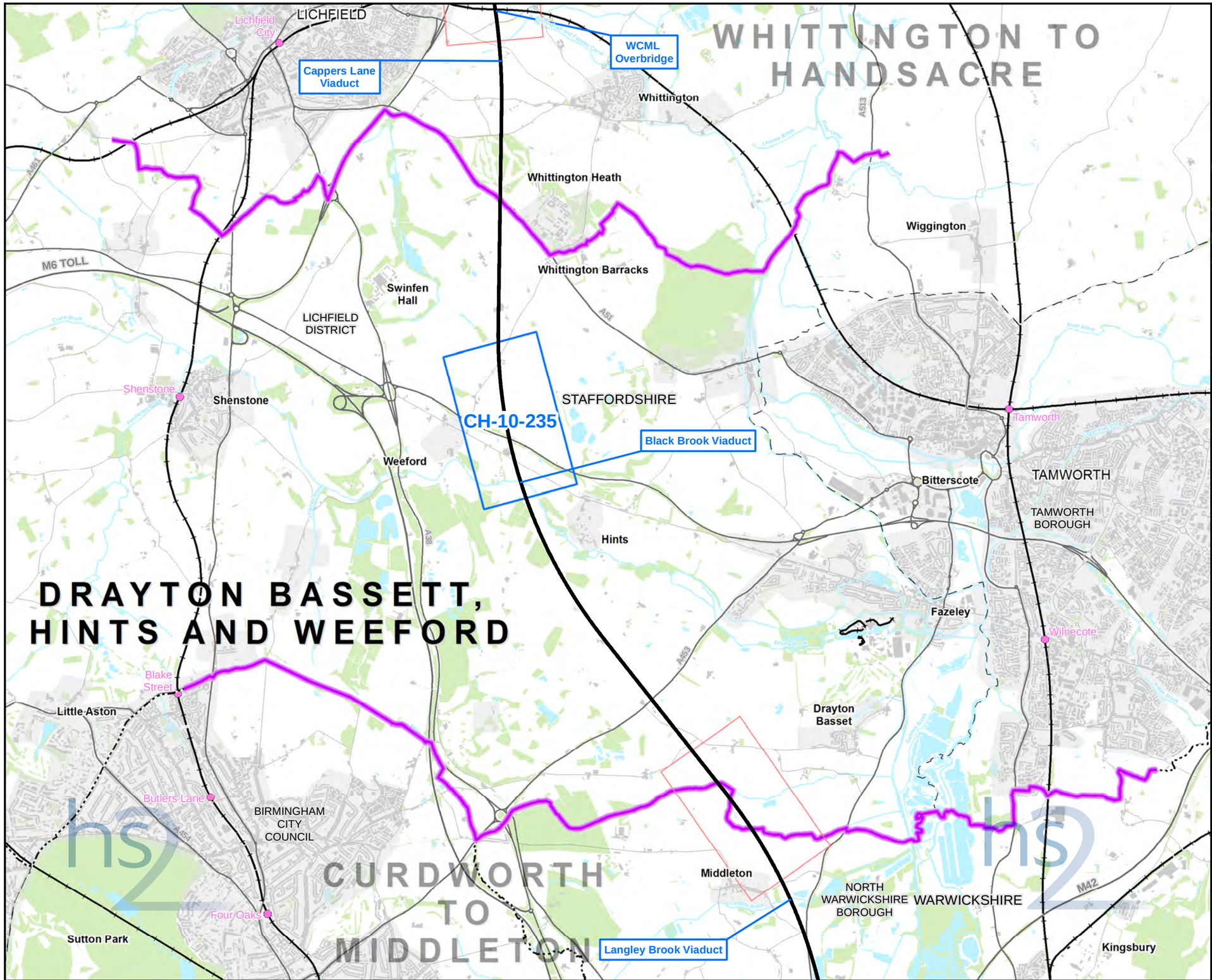
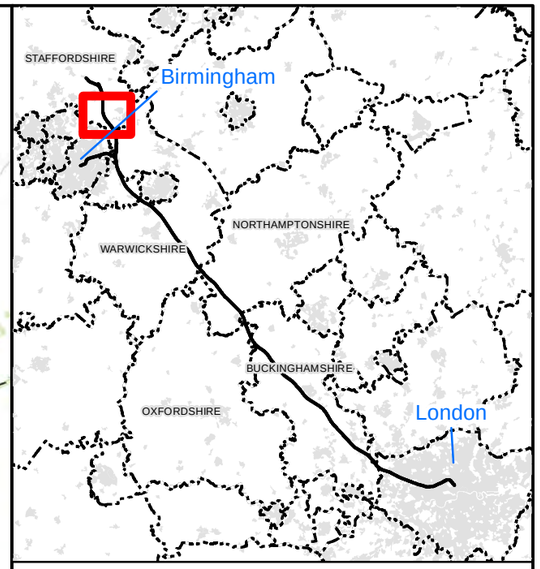
Metres

Doc Number: C253-ATK-EV-MAP-030-001822-AP02-P01

Date: 10/06/15





Map Series Information:

This map series shows interpretation of magnetometer survey results within the land required for the construction of the Proposed Scheme

Note: Not all data layers in the legend are represented on every map.

Main Map Legend

- Route in tunnel
- Route on surface
- Depot, station, headhouse or portal building
- Community forum boundary
- Existing railway station
- County boundary
- District/Borough boundary
- Map sheets included in this community forum with amendment
- Map sheets not included in this community forum

Map Number: CH-10-INDEX-CFA21

Map Name: Index Map of: Archaeological Geophysical Survey - Interpretation Plot SES and AP2 ES

Community Forum Area CFA21: Drayton Bassett, Hints and Weeford

Registered in England. Registration number 06791686.
Registered office: One Canada Square, London, E14 5AB.

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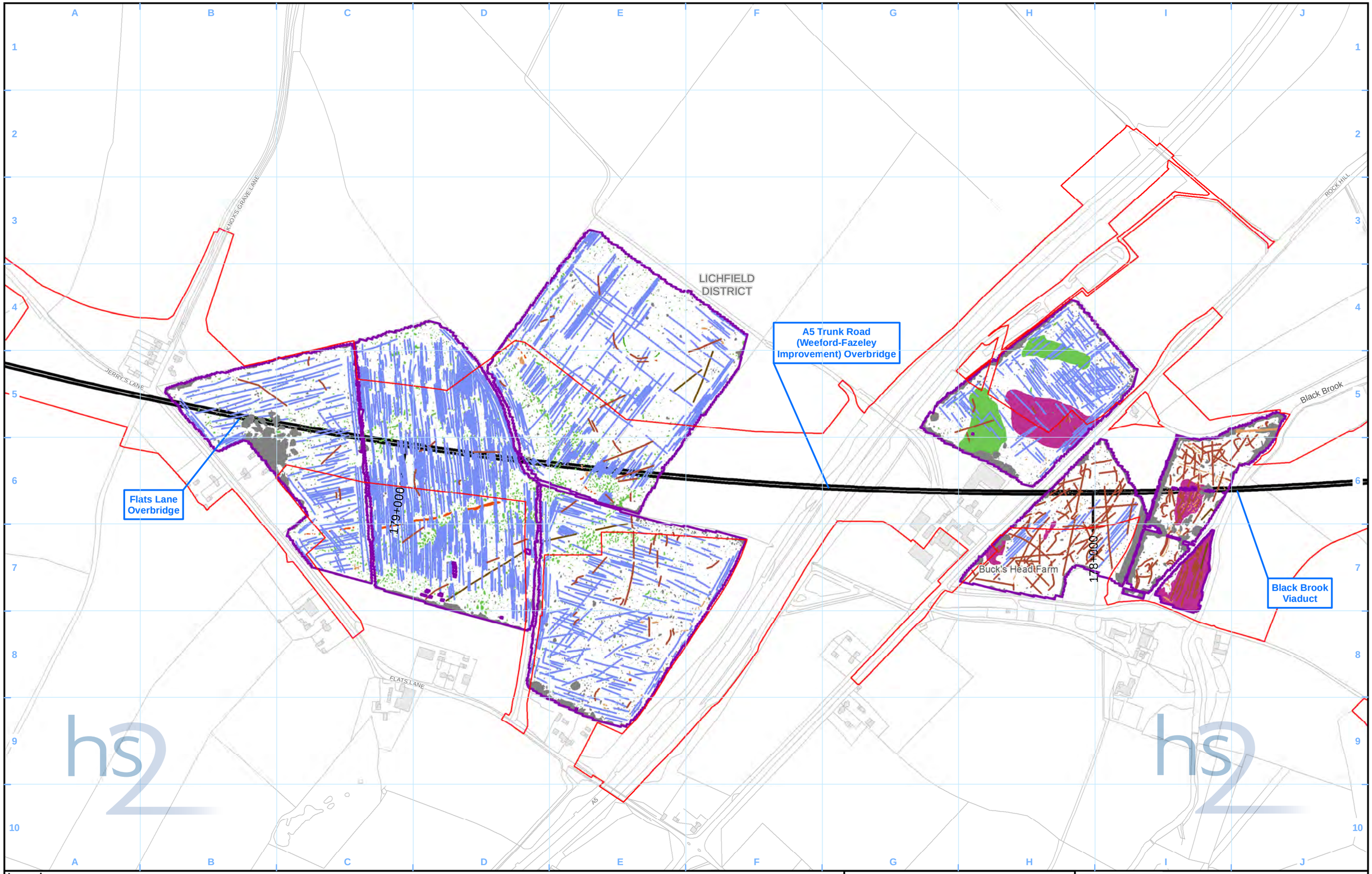
Date: 10/06/15



Legend

- Route in tunnel
- Route on surface
- Depot, station, headhouse or portal building
- Land potentially required during construction
- Community forum boundary
- District/Borough boundary
- Edge of geophysical survey

Geophysical survey results

- Possible archaeology (VWR)
- Drain
- Pipe
- Plough
- Ridge and furrow
- Trend
- Uncertain origin
- Archaeology (discrete)
- Archaeology (zone)
- Archaeology (VWR)
- Possible archaeology (VWR)
- Possible archaeology
- Ferrous
- Old field boundary
- Increased magnetic response
- Industrial burnt fired
- Modern service
- Natural
- Pipe, modern service
- Plough
- Ridge and furrow
- Uncertain

Map Number

CH-10-235

Map Name

Archaeological Geophysical Survey - Interpretation Plot SES and AP2 ES

Community Forum Area CFA21: Drayton Bassett, Hints and Weeford

Scale at A3: 1:5,000

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Doc Number: C253-ATK-EV-MAP-030-001843-AP02-P01

Date: 10/06/15

Environmental topic:	Water resources and flood risk assessment	WR
Appendix name:	Flood risk assessment	003
Community forum area:	Drayton Bassett, Hints and Weeford	021

Contents

List of tables

1 Introduction

1.1 Structure of the water resources and flood risk assessment appendices

1.1.1 This appendix provides an update to Appendix WR-003-021Flood risk assessment from the main ES (Volume 5). This update should be read in conjunction with Appendix WR-003-021 Flood risk assessment from the main ES.

1.1.2 Maps referred to throughout the water resources and flood risk assessment appendices are contained in the Volume 5 water resources map book, within the main ES.

1.2 Scope of this assessment

1.2.1 This FRA considers changes to flood risk as a result of design changes outside the existing limits of the Bill (Part 2 of this appendix).

1.2.2 The assessments reported within this FRA have been carried out in accordance with the requirements of the National Planning Policy Framework (NPPF). The NPPF aims to prevent inappropriate development in areas at risk of flooding and to ensure that, where development is necessary in areas at risk of flooding, it is safe to do so without increasing flood risk elsewhere.

Methodology, data sources and design criteria

1.2.3 This FRA has used the same methodology, design criteria and data sources as reported in sections 2,3 and 4 of Appendix WR-003-021 within the main ES.

2 Summary of changes outside the existing limits of the Bill

2.1 Proposed development

2.1.1 Since submission of the Bill, it is proposed to reduce the elevation of the route at Gallows Brook. In order to achieve this, a revised design replaces the Drayton Bassett viaduct and its approaches as proposed in the original scheme with a single embankment approximately 155m in length and approximately 2.5m lower than the original scheme.

2.1.2 Two underbridges, each spanning 10 metres, will pass through the embankment, allowing the existing watercourses and any associated flood water to pass beneath the route. The southern underbridge will provide similar headroom to the viaduct proposal, maintaining the ability to move cattle under the route.

Local flood risk receptors

2.1.3 Two un-named tributaries of the River Tame are potentially affected by the AP2 amendments.

2.1.4 The two un-named tributaries of the River Tame are minor tributaries of the River Tame with a combined catchment area of 5km^2. The width of the modelled 1 in 100 (1%) annual probability event floodplain, allowing for climate change, is approximately 140m. In the vicinity of the scheme the land use within the 1 in 100 (1%) annual probability event floodplain is agricultural and therefore less vulnerable (moderate value receptor).

Description of AP2 amendments relevant to flood risk

2.1.5 The AP2 amendments will replace the Drayton Bassett viaduct with two underbridges, therefore the structure will encroach into the floodplain rather than spanning the floodplain. This change has the potential to affect flood conveyance and floodplain connectivity.

2.2 Existing flood risk

Risk of flooding from rivers

Drayton Bassett

2.2.1 The Environment Agency Flood Zone mapping indicates the area surrounding Drayton Bassett viaduct (Volume 5: CFA20 Map Book, MapWR-01-034, B6) is at risk of flooding.

2.2.2 The crossing location has been identified to fall within Flood Zone 3, however given that the route will cross the watercourse, it will also be located within Flood Zone 3b (very high risk).

2.2.3 Hydraulic modelling was carried out to provide a more accurate representation of river flood risk along the route, specifically at locations where the route will cross a watercourse. The Drayton Bassett viaduct was to have crossed two watercourses,

CFA21-SWC-002 and 003, and hence these watercourses were assessed in one model and referred to as one crossing. The modelling provided flood extents for the 1 in 100 (1%) annual probability event with a 20% allowance for climate change and for the 1 in 1000 (0.1%) annual probability event to ensure that the proposed track would not be at risk during this event. The flood extents and levels as determined through hydraulic modelling were further detailed in the hydraulic modelling report within the main ES (Volume 5, WR-004-014).

2.2.4 The hydraulic modelling redefined the Flood Zones at the location of the Drayton Bassett viaduct (map WR-01-035 , G5, Volume 5, CFA21, Map Book). As a result the watercourses crossed by the viaduct were identified to be within Flood Zone 3b and hence classed as at a very high risk. It was necessary to remodel the flooding extents of this watercourse to provide a more accurate extent of the river flood risk posed to the route.

2.2.5 The vulnerability classification was taken from the NPPF and relates to the vulnerability of existing development in areas currently at risk from river flooding. At Drayton Bassett a less vulnerable classification has been assigned because the land use is agricultural.

Summary of baseline flood risk

2.2.6 Table 1 provides a summary of the baseline flood risk relevant to the AP2 amendment.

Table 1 Summary of baseline flood risk

Source of flooding	Location of flooding source	Flood risk category	AP2 amendment at risk	Assessment of risk	Potential impact to water resource	New risk or change in risk to main ES
River	Two un-named watercourses at Drayton Bassett	High Risk	Drayton Bassett Underbridges	Updated hydraulic models with amended proposals	Loss of floodplain and reduced flow conveyance	None

2.3 Flood risk management measures

Risk of flooding from rivers

Drayton Bassett

2.3.1 The hydraulic modelling showed that the original scheme would have a negligible impact on river flood risk. Areas of land have been identified as suitable to provide replacement floodplain storage, therefore reducing the impact. Any replacement floodplain storage at the locations of negligible impact was likely to provide betterment.

2.4 Post-design change flood risk assessment

2.4.1 There is the potential for the AP2 revised scheme to change the baseline risk of flooding described in Section 2.2 of this appendix. Though designed such that the probability of the scheme flooding in any given year is less than 1 in 1,000, any change

to the baseline risk of flooding could impact on the assessment of flood risk to the scheme.

Impact on risk of flooding from rivers

Drayton Bassett

2.4.2 This revised crossing consists of two 10m wide underbridges which will convey two ordinary watercourses SWC-CFA21-002 and SWC-CFA21-003 (map WR-01-035, G5, Volume 5, CFA21, Map Book) through the proposed embankment. The watercourses flow from west of the crossing and combine into one watercourse which continues east.

2.4.3 The existing floodplain is entirely agricultural land. There are no structures at increased risk of fluvial flooding in the area.

2.4.4 The proposed embankment will reduce the volume of the floodplain at the crossing location and restrict the conveyance of floodwaters from west to east. The new embankment will pass through approximately 150m of existing floodplain in the 1 in 100 with climate change annual probability event.

2.4.5 The reduction in the width of opening over the tributaries of the River Tame as a result of the change from a viaduct to two 10m-wide underbridges could increase flood risk by changing the flow characteristics of the channels and the associated flood plains. The effect of this change has been assessed using flood modelling which indicates an increase on flood levels, without mitigation, upstream of the underbridges of 21mm (compared to the baseline flood levels). This is a minor impact on flood risk and the agricultural land affected is "less vulnerable" and therefore of moderate value. The significance is therefore slight (not significant). The 1 in 1000 (0.1%) annual probability event water level post construction is 85.87mAOD.

2.4.6 An area for floodplain compensation has been identified which will likely provide betterment in the area.

Residual flood risk

Drayton Bassett

2.4.7 Any failure of the two proposed culverts at Drayton Bassett could potentially cause a significant increase in flood levels at the location of the AP2 revised scheme by blocking the only flow routes through the embankment.

Compliance with local planning policy

Drayton Bassett

2.4.8 There will be no changes in compliance with local planning policy due to the AP2 amendments proposed at the Langley Brook crossing.

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