

HIGH SPEED RAIL (LONDON - WEST MIDLANDS)

Supplementary Environmental Statement and
Additional Provision 2 Environmental Statement

Volume 5 | Technical appendices

CFA20 | Curdworth to Middleton

July 2015

SES and AP2 ES 3.5.1.7

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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
CFA20, Curdworth to Middleton	Community	CM-001-020
	Cultural heritage	CH-002-020
		CH-003-020
		CH-004-020
	Sound, noise and vibration	SV-004-020 (operational)
	Water resources and flood risk assessment	WR-003-020

SES and AP2 ES Appendix CM-001-020

Environmental topic:	Community	CM
Appendix name:	Community assessment	001
Community forum area:	Curdworth to Middleton	020

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1 Introduction

- 1.1.1 This appendix provides an update to the Appendix CM-001-020 Community assessment from the main Environmental Statement (ES) as a result of design changes including the Middleton area amendments (AP2-020-007), 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-001-020 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 resources affected by the SES.

3 Community impact assessment record sheets - operation

3.1.1 There are no resources affected by the SES.

Part 2: Additional Provision 2

Environmental Statement

4 Community impact assessment record sheets - construction

4.1 Five residential properties along Church Lane and Crowberry Lane, Middleton

Table 1 - Five residential properties along Church Lane and Crowberry Lane - Middleton community impact assessment record sheet

Resource name	Five residential properties along Church Lane and Crowberry Lane, Middleton
Community forum area (CFA)	CFA20 Curdworth to Middleton
Resource type	Residential
Resource description/profile	Five residential properties at Church Lane and Crowberry Lane, Middleton. These are Ashley, Woodard, Priors Revel and the Spinney at Church Lane together with Horse Shoes on Crowberry Lane.
Assessment year	Construction phase (2017+)
Impact: Amenity effect during construction period	No significant effects
Assessment of magnitude	N/A
Relevant receptors	Residential occupiers of 5 properties at along Church Lane and Crowberry Lane, Middleton
Assessment of sensitivity of receptors (s) to impact	Residential dwellings therefore sensitivity rating is high
Significance rating of effect	No significant effects
Proposed mitigation options for significant effects	No further mitigation identified.
Residual effects significance rating	No significant effects. 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 resources affected by the design changes during operation.

6 References

6.1.1 N/A

Environmental topic:	Cultural heritage	CH
Appendix name:	Gazetteer of heritage assets	002
Community forum area:	Curdworth to Middleton	020

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1 Introduction

- 1.1.1 This appendix provides an update to Appendix CH-002-020 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-002-020 Cultural heritage gazetteer of heritage assets from the main ES.

2 Gazetteer

Table 1 – Gazetteer of heritage assets for CFA20

Unique ID	Map reference	Asset type	Name	Description	Period	Designation	Grade	Significance/value	NHL reference	HER reference
CWM001	CH-01-114b	Archaeology	Possible enclosure	Possible rectilinear enclosure identified as cropmarks on aerial photographs. Geophysical survey (CNo27; WSI-CFA20-001) does not support the presence of a substantial enclosure. Magnetised debris may, however, have obscured potential weaker archaeological anomalies.	Undated	None	None	Low	N/A	N/A
CWM014	CH-01-114b and CH-01-115	Archaeology	Possible deserted settlement	Possible deserted medieval settlement north of Dunton Island and northeast of Curdworth indicated by cropmarks visible on aerial photographs. Including ridge-and-furrow in Lea Marston Parish, identified on aerial photographs of 1948, but not identified through LiDAR and	Medieval	None	None	Low	N/A	MWA9146; MWA12037

SES AP2 ES Appendix CH-002-020

				<p>possibly removed.</p> <p>Geophysical Survey (CNo30; WSI CFA20-004) identified ferrous anomalies across the area surveyed indicating a spread of ceramic or ferrous debris, possibly associated with the construction of the M42. Curvilinear and linear anomalies of uncertain origin were also identified.</p>						
CWM149		Ancient Woodland	Walker's Spinney	An area of ancient woodland 1.2ha in extent to the east of the village of Middleton. Forms part of a dispersed network of ancient woodland located close to small watercourses in the vicinity of Middleton.	Post-medieval	Likely to be added to the ancient woodland inventory	N/A	High	N/A	N/A
CWM150	CH-01-114b	Archaeology	Possible ditches and pits, south of Faraday Avenue	Geophysical survey (CNo27; WSI-CFA20-001; Appendix CH-004-020) has identified a number of potential archaeological features including a possible ditch and an	Undated	None	None	Low	N/A	N/A

SES AP2 ES Appendix CH-002-020

				intermittent ditch which are unknown in date. These anomalies do not align with more recent field boundaries and are therefore considered to be of possible archaeological interest. Several pit-like anomalies have also been identified which may be of archaeological interest.						
CWM151	CH-01-114b	Archaeology	Possible pits, between the M42 and Lichfield Road (A446)	Geophysical Survey (CNo28; WSI-CFA20-002; Appendix CH-004-020). A small number of pit-like anomalies have been identified which may be archaeological in origin. Areas of ferrous responses may mask any other potential weak archaeological anomalies.	Undated	None	None	Low	N/A	N/A
CWM152			Possible pits and ditches north of Middleton	Geophysical survey (CNo34; WSI-CFA20-008; Appendix CH-004-020) has identified groups of pit and short ditch-	Undated	None	None	Low	N/A	N/A

				like anomalies.						
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Environmental topic:	Cultural heritage	CH
Appendix name:	Impact assessment table	003
Community forum area:	Curdworth to Middleton	020

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1 Introduction

- 1.1.1 This appendix provides an update to Appendix CH-003-020 Cultural heritage impact assessment 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-003-020 Cultural heritage impact assessment from the main ES.

2 Impact assessment

Table 1 – Impact assessment for CFA2o

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	
CWMo01	Possible enclosure	None	Low	Construction of the main line will remove the asset	High adverse	Moderate adverse	No impact on significance	No change	Neutral	There is a change in the magnitude of effect reported in the main ES, from a permanent major adverse effect to a permanent moderate adverse effect. There is a change in value from moderate to low.
CWMo14	Possible deserted settlement	None	Low	Removal of possible Deserted medieval settlement near Curdworth. Cropmarks have indicated a possible deserted medieval settlement. The asset is located within areas of permanent and temporary land required for construction, including a proposed temporary construction compound.	High adverse	Moderate adverse	No impact on significance	No change	Neutral	There is a change in the magnitude of effect reported in the main ES, from a permanent major adverse effect to a permanent moderate adverse effect. There is a change in value from moderate to low.
CWMo84	Primrose Cottage, Bodymoor Heath Road	None	Low	The realigned Bodymoor Heath Lane will be situated on embankments in the vicinity of the asset. This and presence of the Proposed Scheme to the south and south-west will considerably alter the generally open rural setting of this agricultural cottage. This will affect its significance.	Medium adverse	Minor adverse	Trains will be visible from the asset and there will be a 6 to 10db increase in noise. Planting to the south-west of Primrose Cottage would reduce visibility of the Proposed Scheme This will result in a low adverse impact. There will also be medium adverse permanent construction impacts as a result of changes to the setting of the asset. The combined permanent constructional and operational impacts will adversely alter	Low adverse	Minor adverse	There is a change in the magnitude of effect for Operation reported in the main ES, from a permanent medium adverse effect to a permanent low adverse effect.

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	
							characteristics of the setting of this asset, resulting in a medium adverse impact.			
CWM149	Walker's Spinney	Likely to be added to the ancient woodland inventory	High	Asset lies partly within land required for the construction of the Church Lane embankment.	Low	Moderate adverse	There will be an increase in noise in the eastern part of the woodland. This will alter the character and significance of the asset	Minimal adverse	Minor adverse	This is a new effect not reported in the main ES
CWM150	Possible ditches and pits, south of Faraday Avenue	None	Low	Construction of the main line will remove the asset	High adverse	Moderate adverse	No impact on significance	No change	Neutral	This is a new effect not reported in the main ES
CWM152	Possible pits and ditches north of Middleton	None	Low	The asset is partly within the land required for the construction of the Proposed Scheme.	High adverse	Moderate adverse	No impact on significance	No change	Neutral	This is a new effect not reported in the main ES

Environmental topic:	Cultural heritage	CH
Appendix name:	Survey reports	004
Community forum area:	Curdworth to Middleton	020

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1 Introduction

1.1.1 This appendix provides an update to Appendix CH-004-020 Cultural heritage survey reports from 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 (AP2 ES). This update should be read in conjunction with Appendix CH-004-020 Cultural heritage survey reports from the main ES.

2 Geophysical surveys

2.1 CNo27 Land off Faraday Avenue
Introduction

- 2.1.1 Wessex Archaeology was commissioned by HS2 to carry out a geophysical survey of area CNo27 off Faraday Avenue, to the south-east of Curdworth, Warwickshire (Figure 1), hereafter “the site” (centred on NGR 419004 292004). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.
- 2.1.2 The geophysical survey undertaken here has been preceded by desk-based research¹ and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis². Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.
- 2.1.3 This site, CNo27, was selected for geophysical survey as it is considered to be an area at high risk with known cropmarks and is the possible site of a rail head.
- Site details
- 2.1.4 The site is comprised of three arable fields with wide vegetation boundaries and an area of pasture to the south-west, approximately 1.2km south-east of Curdworth, Warwickshire.
- 2.1.5 Due to agricultural constraints the north-western part of the site, totalling 5.7ha, was surveyed in May 2013 and the remaining 6.9ha, in October 2014.
- 2.1.6 The site is bounded to the north by Faraday Avenue, to the west by Lichfield Avenue (A446), to the east by a live railway line and adjacent industrial compound and to the south by a man-made watercourse which flows into the River Tame.
- 2.1.7 The site occupies a gentle south-west facing slope , falling from a height of approximately 80m aOD (above Ordnance Datum) in the north-east to 75m aOD at the south-western corner of the site.
- 2.1.8 The solid geology is recorded as Keuper marl (Triassic)³, overlain in places by superficial river terrace deposits, alluvium and glacial deposits⁴. The soils underlying most of the site are likely to be gleyic brown earths of the 543 (Arrow) association⁵. The eastern edge of the site was not

surveyed by the Soil Survey as it was considered to be largely urban or industrial. 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

- 2.1.9 For a detailed assessment of the known archaeology of the site and surrounding area the relevant baseline report should be consulted⁶. 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 20 in the ES⁷ (CWM/COL numbers) in the supplementary survey works (WA numbers) or in the Warwickshire SMR (MWA/HWA numbers).
- 2.1.10 The current landscape is characterised as very large irregular post-war fields (HWA3377). Remote sensing revealed a former field boundary in the northern half of the site⁸ (WA5.3).
- 2.1.11 There is one undated site to the north of the survey area which is very close; it is a group of cropmarks observed on Aerial Photographs (APs) including a ring ditch and linear features (CWM006). The ring ditch is recorded as oval in shape and fairly faint and the northern linear is thought to look geological.
- 2.1.12 The only prehistoric records in the vicinity date to the Bronze Age and include a find of an Early Bronze Age finished axe (EH332058) and a Middle Bronze Age palstave (EH332068), both found to the north of Curdworth (northwest of the survey area). Another palstave axe (bronze) was found to the west of the survey area and is recorded as unlooped with a shield pattern, the location for this findspot is uncertain (MWA47).
- 2.1.13 A single sherd of Romano-British mortarium was discovered to the northwest of the site when the M42 was constructed (MWA4882). There are no post-Roman or Anglo-Saxon records within 1km of the survey area.
- 2.1.14 The medieval records are concentrated in and around Curdworth. The village is listed in Domesday in the Coleshill Hundred. First edition maps suggest that the village may have shrunk in the medieval period with empty plots recorded (CWM005). The church of St. Peter and St. Nicholas in Curdworth has its origins in the medieval period with parts of the building dating to the 11th century. Other parts of the building were restored in the 19th century. A record of a possible medieval cross is situated 20m south of the church; it was thought to have been brought in from elsewhere and was not local. It was destroyed by vandalism during the Second World War (CWM057).
- 2.1.15 Immediately to the northeast of Curdworth are the remains of a moated site thought to date to the medieval period. Three arms of the moat are visible although it is now dry; this moat is considered to represent the site of a manor house although no trace has been found within (CWM007). There are two records of possible ridge and furrow around Curdworth (MWA9098 and MWA12047).
- 2.1.16 The post-medieval and modern periods are represented by areas of industrial activity or parkland and agriculture. The area to the east of the site was occupied by the park and

¹ CH-001-020, HS2 Environmental Statement, 2013
² CH-004-020, HS2 Environmental Statement, 2013
³ Ordnance Survey, 1957
⁴ Ordnance Survey, 1977
⁵ Soile Survey of England and Wales, 1983

⁶ CH-001-020, HS2 Environmental Statement, 2013
⁷ CH-002-020, HS2 Environmental Statement, 2013
⁸ CH-004-020, HS2 Environmental Statement, 2013

gardens of Ham Hall; the original house was re-built c.1768 but the site is thought to date to the earlier post-medieval period. The gardens and hall were demolished in 1920 and the area became the site of a power station (CWM113). Records of two bridges are located to the southwest of the survey area; both are known as Curdworth Bridge. The earlier bridge dates to the 16th century and lies upstream of the current bridge although no trace of it can be seen today. The current bridge was erected in the 19th century about 50 yards from the earlier one upstream (COL102).

2.1.17 To the north of the survey area is a windpump that is recorded on the ordnance survey map of 1901 (MWA6610). Dunton Hall lies further north and dates to the late 17th century, a barn and a dovecote (late 17th or early 18th century) are also associated with the hall and all are Grade II listed (CWM059). To the east of Dunton Hall are the remains of a number of charcoal manufacturing sites that appear as roughly circular soil marks on APs (CWM013).

2.1.18 An undated pit was discovered east of Curdworth during construction of the Birmingham Northern Relief Road; it contained a few flecks of charcoal but no finds (MWA9099).

Survey objectives

2.1.19 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed⁹. 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

2.1.20 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

2.1.21 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team. The northern half of the site was surveyed previously¹⁰ and the southern half of the site was surveyed on 18 September and between 10 and 13 October 2014.

Grid location

2.1.22 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 Historic England (HE) recommendations¹¹ (English Heritage 2008).

2.1.23 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

2.1.24 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 EH guidelines.

2.1.25 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

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

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

Data presentation

2.1.28 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 used to produce the final figures in GIS (ESRI ArcMap 10).

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

Results

2.1.30 The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends and two modern services. 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).

2.1.31 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.

⁹ Wessex Archaeology, 2014

¹⁰ CH-004-020, HS2 Environmental Statement, 2013

¹¹ English Heritage, 2008

- 2.1.32 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

Northern field

- 2.1.33 A small number of anomalies of archaeological interest have been recorded within the survey area. The linear positive anomalies at 4000 and 4001 form the clearest features with magnetic values over +2nT; there are also weaker linear features such as at 4002 with values less than +2nT. These features are considered to represent ditches and appear to partly define a former field boundary visible on early Ordnance Survey (OS) maps. This field boundary was removed between 1967 and 1982¹².
- 2.1.34 The only other anomaly of likely archaeological interest is located at 4003; this feature is sub-oval in plan, measures 3.2m in length and has magnetic values over +3nT. This anomaly is considered likely to represent a cut feature such as a pit.
- 2.1.35 There are numerous agricultural features visible in the data including ploughing trends at 4004 and ceramic field drains at 4005. The remaining trends are considered to be of uncertain origin as they are set at different alignments to the ploughing and have differing forms.
- 2.1.36 The curving trend at 4006 may prove to be archaeological but could also be a turn in the ploughing direction. There are two parallel linear trends at 4007 that are not related to modern ploughing although their identity is unclear from the geophysical data. Both of these have been classified as trends of uncertain origin.
- 2.1.37 The remaining anomalies of possible archaeological interest are numerous small sub-oval positive responses such as those close to the west of 4008. They typically have values over +1.5nT and are considered to either represent cut features such as small pits and postholes or naturally occurring geological features. Further interpretation of these features is not possible as there is no significant patterning in their spatial distribution.
- 2.1.38 There are concentrations of ferrous responses accompanied by spreads of increased magnetic response in the data, as at 4009. These spreads are likely formed of relatively modern metallic and ceramic debris that has been dumped or deliberately spread during agricultural activity.
- 2.1.39 There are two modern services visible in the data at 4010 and 4017; these features are discussed in more detail below.
- 2.1.40 The remaining anomalies are broad, weakly positive regions with very diffuse edges such as at 4011; given their form these features are considered to be geological and have been classified as natural.

Southern field

- 2.1.41 There are several anomalies of archaeological and possible archaeological interest. At 4012 a short linear positive anomaly extends from the current field boundary approximately south-west to north-east and may represent a cut feature such as a ditch. A second, weaker, positive anomaly at 4013 runs parallel to the south-eastern field boundary and may also represent an

earlier ditch. A linear feature has been identified at 4014 consisting of intermittent oval and sub-oval positive anomalies oriented approximately north-west to south-east. The anomalies may represent surviving sections of a linear cut feature such as an enclosure ditch or former field boundary.

- 2.1.42 Two linear but weakly positive anomalies aligned roughly north-south at 4015 are intermittent with linear sections of ferrous anomalies. This feature may continue north, visible as a weak linear trend, to join with the former field boundaries identified at 4000 to 4002.
- 2.1.43 The features at 4015 appear to partly define a former field boundary visible on early OS maps. This field boundary was removed between 1904 and 1925 when the railway line bounding the site was under construction but then reappears in the 1957 edition before finally disappearing by 1982¹³.
- 2.1.44 Around 4014 and 4016 and at 4019 are several oval and sub-oval shaped positive anomalies of varying size with magnetic values below +2nT. They have been identified and characterised as possible archaeology and possible archaeology (very weak response) and if archaeological are considered to represent cut features such as pits. Some broad, very weak, positive irregular shaped anomalies have been identified as natural or geological in origin, such as at 4020, whilst those around 4014 are stronger in magnetic response.
- 2.1.45 There are several concentrations of ferrous material around the modern services and to the north of 4019. These spreads are not considered to be archaeological and are likely to be formed of relatively modern metallic and ceramic debris that has been dumped or deliberately spread during agricultural activity.
- 2.1.46 The remaining anomalies relate to agricultural activity including ceramic field drains around 4018 and 4019 and ploughing trends are visible across the site predominantly in a north-east to south-west orientation.

Interpretation: modern services

- 2.1.47 Two modern services have been identified in the data close to 4010 and 4017; these services appear to be metallic/ceramic pipes and are possibly interconnecting. The modern service at 4010 runs roughly north-south through the south-west corner of the field and the second, at 4017, which extends perpendicular from 4008 heads south-east into the middle of the field. Both services run beyond the extents of the survey area.
- 2.1.48 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

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

Discussion

¹² Ordnance Survey, 1967 and 1982

¹³ Ordnance Survey 1904, 1924, 1957, 1982

- 2.1.50 The data contains a number of archaeological anomalies relating to 19th century and modern field boundaries visible on OS mapping. However a pit-like response was identified at 4003, a small section of ditch-like anomaly at 4012 and an intermittent linear anomaly at 4014 which have not been identified from OS mapping and are unknown in date. Moreover they are on a different alignment to the field boundaries at 4000 to 4002 and 4015 with the latter field boundary truncating the feature at 4014. Also in this area are several possible archaeological pit-like responses.
- 2.1.51 The site contains large amounts of strongly magnetised debris with magnetic values high enough to mask the weaker responses expected from archaeological features. This has reduced the area in which archaeological features are visible, especially around services and field edges. It may be that more archaeological features are present than were detected in the geophysical data presented in this report.
- 2.1.52 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 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 though.

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Ordnance Survey, 1904-5. OS County Series: Warwickshire 1:10,560

Ordnance Survey, 1924. OS County Series: Warwickshire 1:2,500

Ordnance Survey, 1957. OS Plan: Warwickshire 1:2,500

Ordnance Survey, 1982. OS Plan: Warwickshire 1:10,000

Wessex Archaeology, 2014. HS2: Geophysical Survey Written Scheme of Investigation: Warwickshire Report Reference: 86257.02.

HER Records Consulted

COL102 - Curdworth Bridge

CWM005 - Curdworth Medieval Settlement

CWM006 - Ring ditch and linear features in Curdworth Parish

CWM007 - Moat at Curdworth Hall Farm and site of manor house at Curdworth Hall Farm

CWM013 - Charcoal manufacturing sites in Curdworth Parish

CWM057 - Church of St. Peter and St. Nicholas, Curdworth with site of possible medieval cross adjacent

CWM059 - Dunton Hall and Dovecote, Curdworth

CWM113 - Hams Hall Park and Garden

HWA3377 - Very large irregular post-war fields

MWA47 - Findspot, Bronze Age axehead in the parish of Curdworth

MWA4882 - Findspot, Roman pottery sherd

MWA6610 - Site of windpump south of Dunton Hall

MWA9098 - Linear features, east of Curdworth Hall Farm, Curdworth, Warwickshire

MWA9099 - Pit, east of Curdworth Hall Farm, Curdworth, Warwickshire

MWA12047 - Ridge and furrow in Curdworth Parish

[English Heritage PastScape Records](#)

Monument No. 332058 - Findspot, Early Bronze Age finished axe (EH332058)

Monument No. 332068 - Findspot, Middle Bronze Age palstave (EH332068)

Figures

Figure 1 – CN027 site location

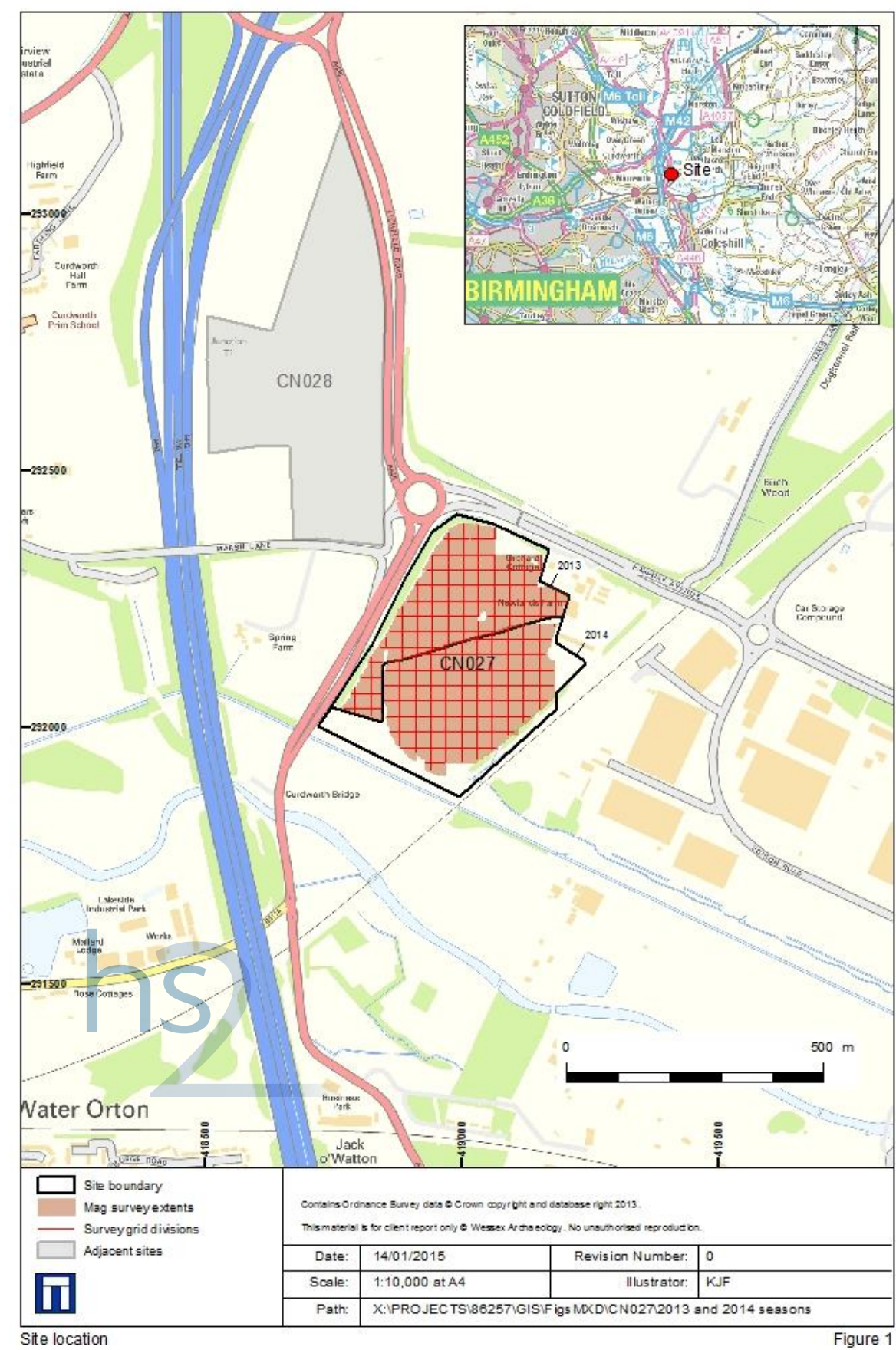


Figure 1

Figure 2 – CNo27 greyscale plot (north)

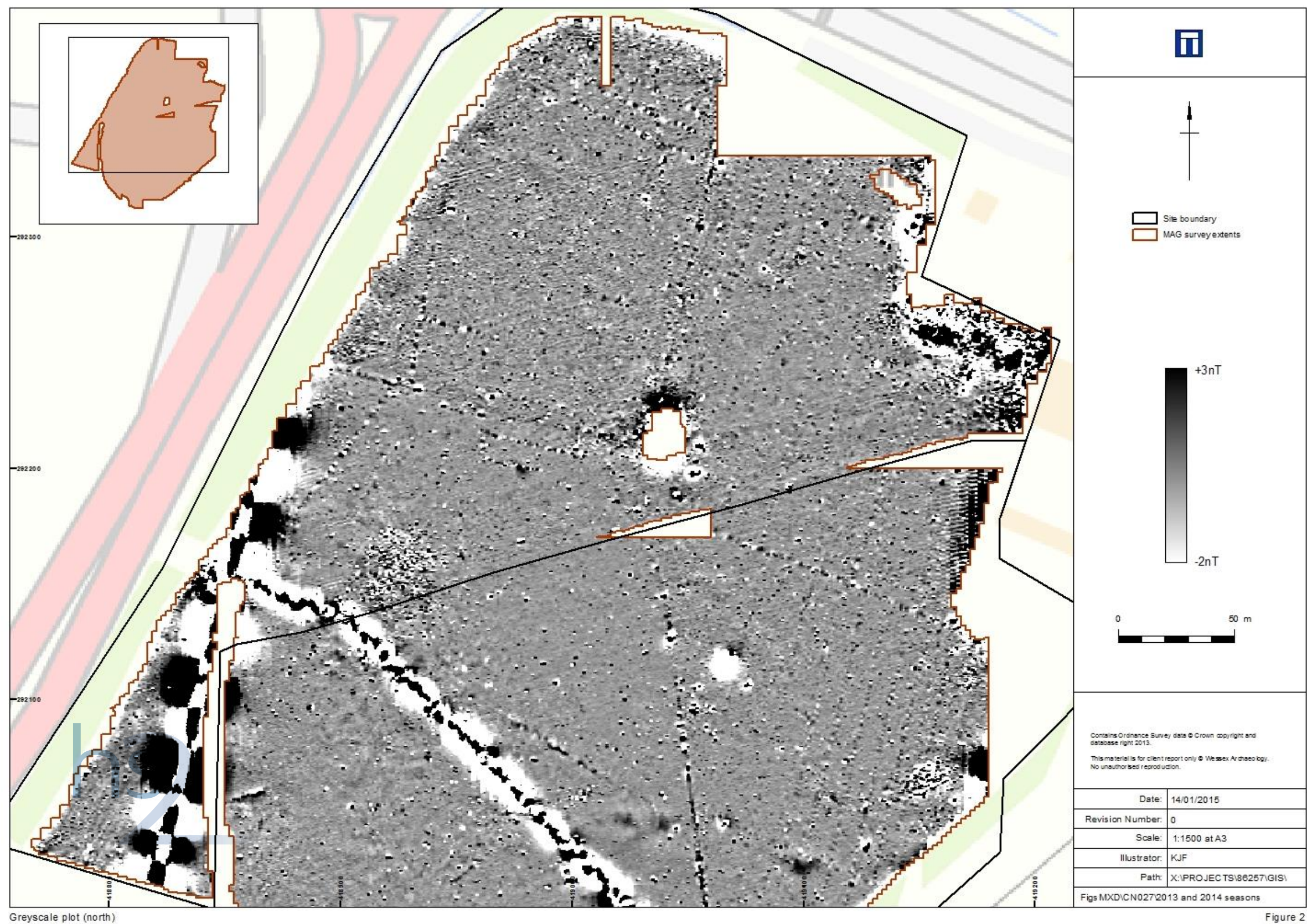


Figure 3 – CNo27 XY trace (north)

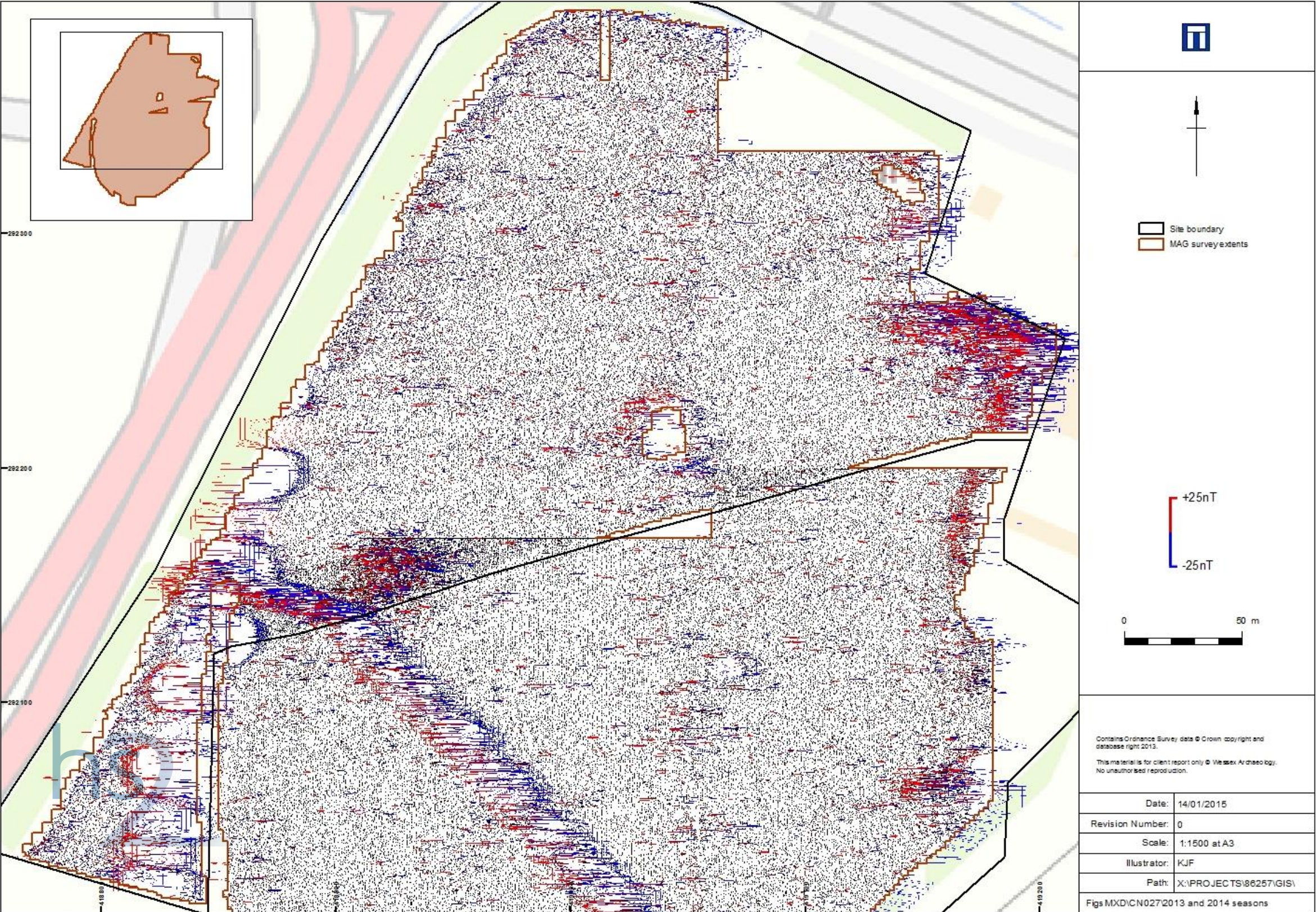


Figure 3

Figure 4 – CN027 interpretation (north)

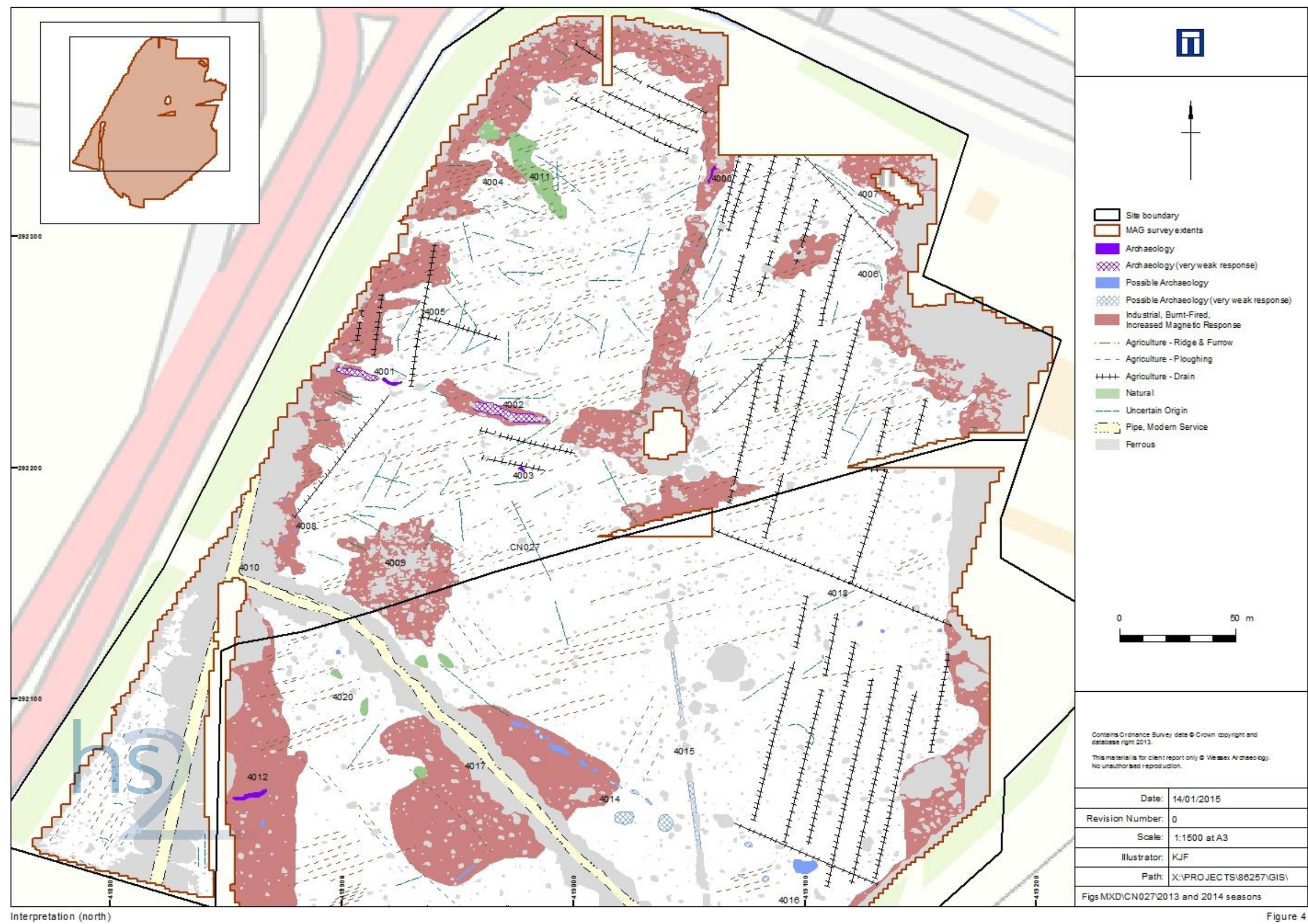


Figure 4

Figure 5 – CN027 greyscale plot (south)

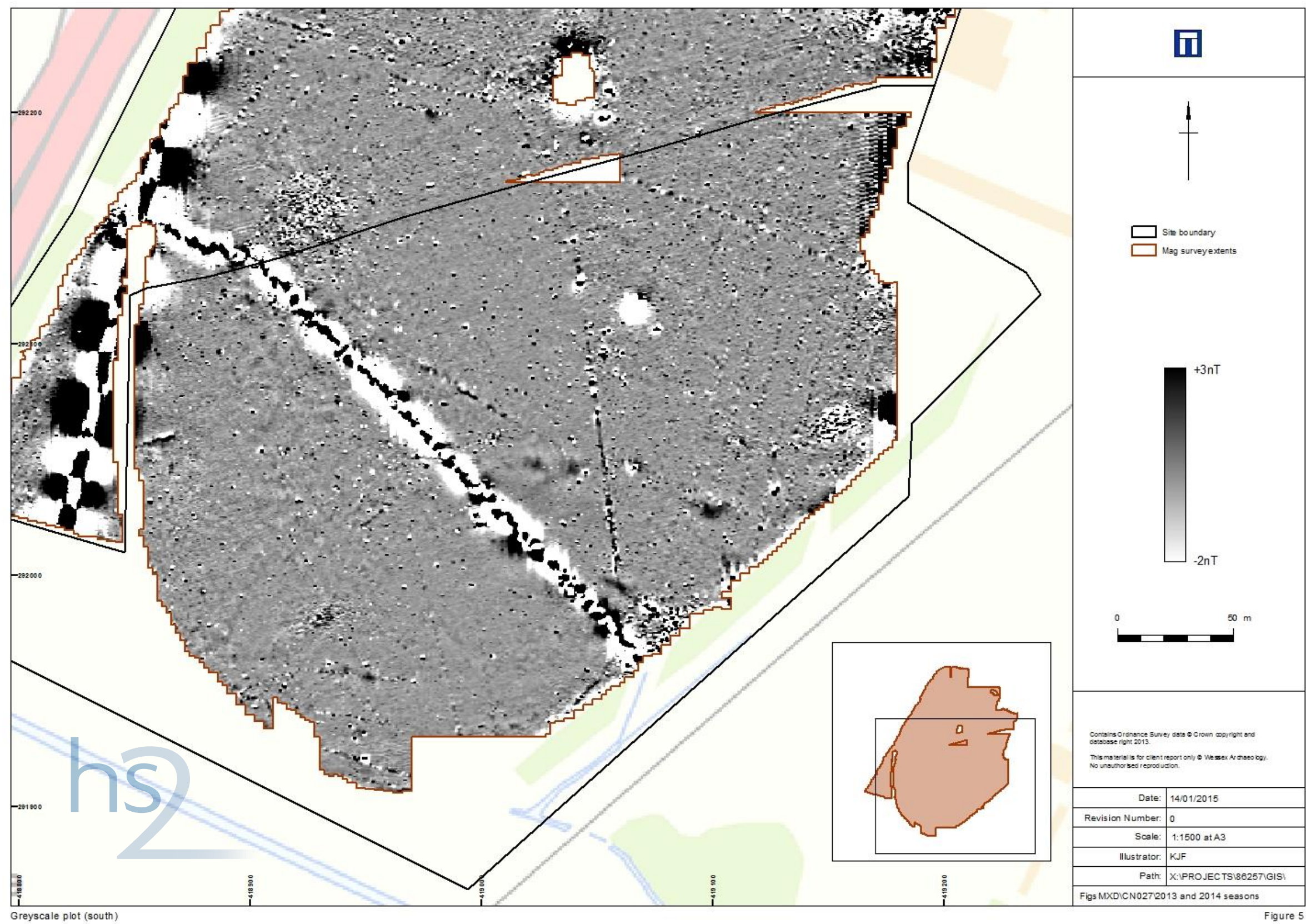


Figure 6 – CNo27 XY trace (south)

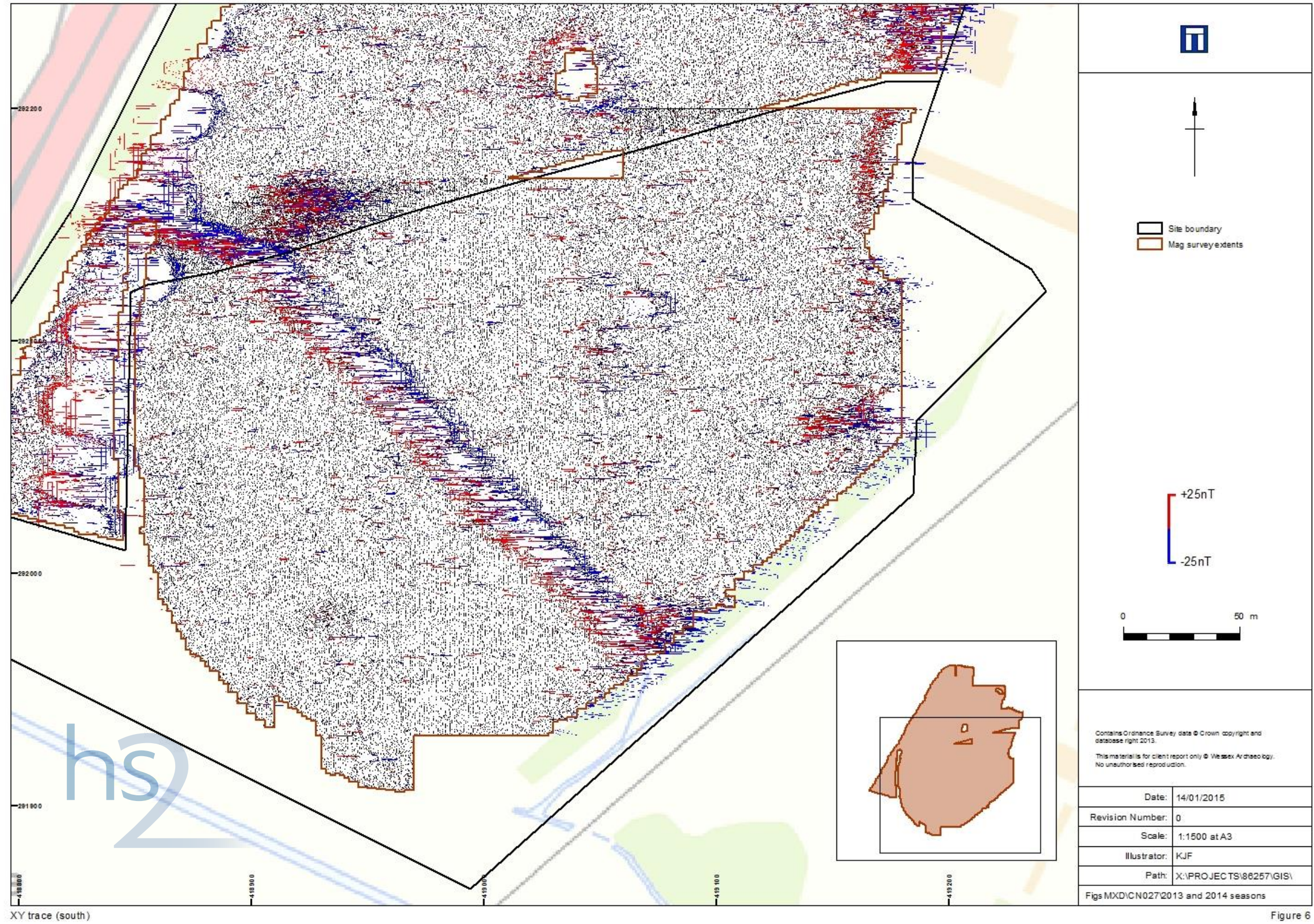


Figure 7 – CN027 interpretation (south)

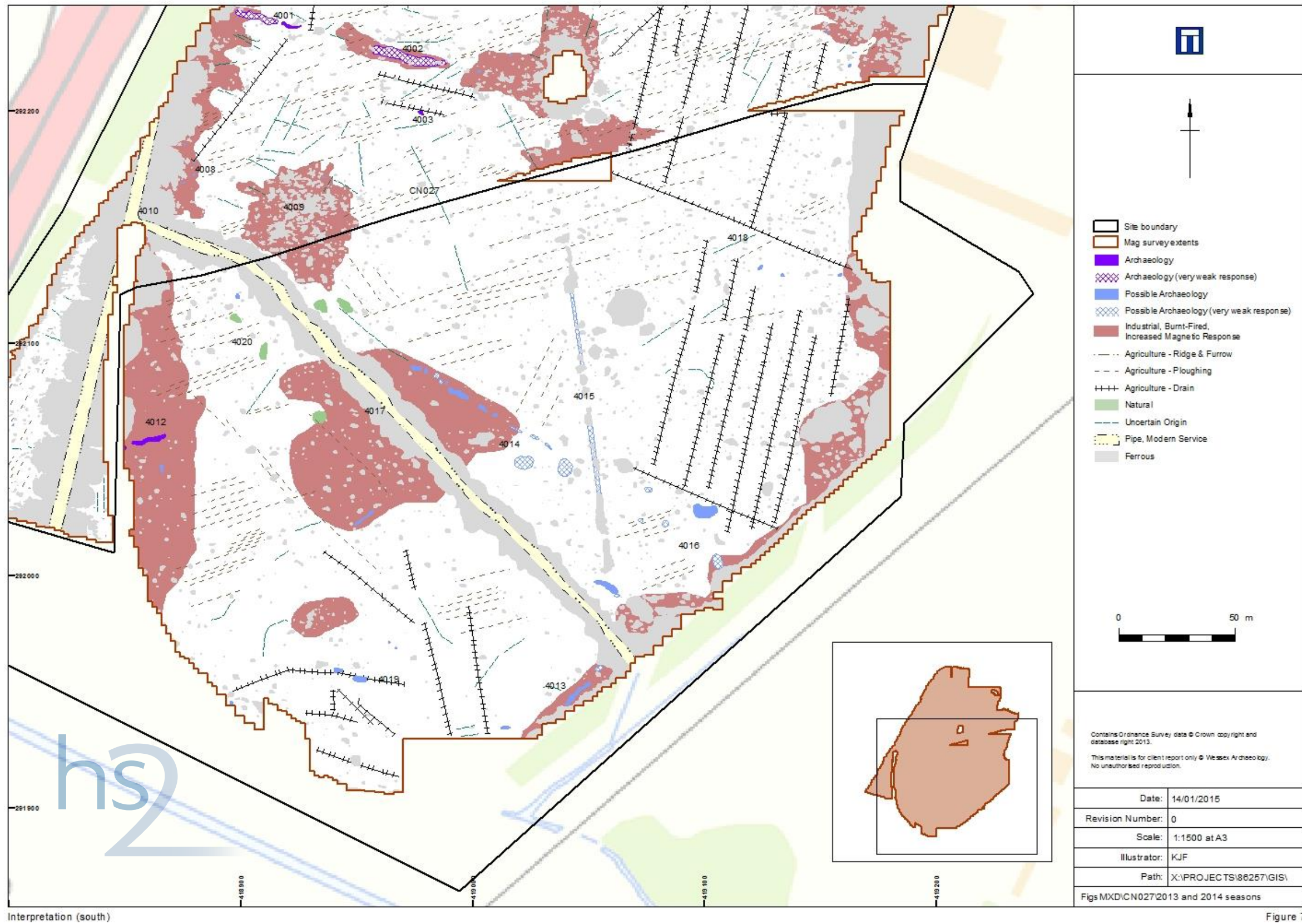


Figure 7

2.2 Site: CNo30

Introduction

2.2.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CNo30 off Kingsbury Road, near Curdworth, Warwickshire (Figure 8), hereafter “the site” (centred on NGR 419105 293899). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

2.2.2 The geophysical survey undertaken here has been preceded by a Desk-Based Assessment (DBA) (HS2 Environmental Statement 2013) and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis (Wessex Archaeology 2013). Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

2.2.3 This Site, CNo30, was selected for geophysical survey as it is considered to be in an area of medium to high risk .

The site

2.2.4 The site comprises three arable fields located approximately 1.5km north-east of Curdworth, Warwickshire. The site lies between the M42 and Kingsbury Road (A4097) and is bounded by hedgerow field boundaries. The gradiometer survey covered 4.1ha of a proposed area of 27.1ha, and has demonstrated very few potential anomalies but a very large amount of ferrous response.

2.2.5 After the first area was surveyed and data quality assessed the decision was taken not to continue surveying as no anomalies of weaker response, therefore of potential archaeological interest, were able to be detected in the data after processing. It was assumed they would be masked by the strong ferrous response from modern debris covering the site.

2.2.6 The site slopes down from an approximate height of 98m above Ordnance Datum (aOD) in the centre to 80m aOD at the northern boundary.

2.2.7 The solid geology is recorded as sedimentary Mercia Mudstone (Triassic) with superficial deposits of galiciolacustrine clays and silts in the north-east and south-west areas of the site and a central area of glaciofluvial sands and gravels (Ordnance Survey 1954). The soils underlying the site are likely to comprise either the typical gleyic brown earths of the 543 (Arrow) association or the Stagnogley argillic brown earths of the 572f (Whimble) association (SSEW 1983). Soils in such geological settings have been demonstrated to produce magnetic contrasts suitable for the detection of anomalies through gradiometer survey.

Summary Archaeological and Historic Background

2.2.8 For a detailed assessment of the known archaeology of the site and surrounding area the relevant DBA should be consulted (HS2 Environmental Statement 2013). A summary of relevant sites within 1km of the survey area is provided below and has been included to provide context and inform the geophysical interpretation. Sites referred to can be found either within the gazetteer for CFA 20 in the Environmental Statement (CWM/COL numbers)

in the supplementary survey works (WA numbers) or in the Warwickshire SMR (MWA/HWA numbers).

2.2.9 The current landscape is characterised as very large, irregular, post-war fields (HWA3360). Remote sensing detected several features of interest around the site. To the east and south-east of the site are several post-medieval and modern features. These are an oval pond (WA5.14), a sub-oval hollow interpreted as probably a former quarry/pond (WA5.13), two further ponds at Lee Marston Golf Club (WA5.17) and two ornamental ponds at Mullensgrove Farm (WA5.18). To the west of the site on the opposite side of the M42 is the Birmingham and Fazeley Canal (WA5.28).

2.2.10 All the sites within 1km of CNo30 date to the medieval and post-medieval periods. The south-west area of the site is the recorded location of cropmarks identified from aerial photographs that may represent the remains of a deserted medieval settlement (CWM014). In the north-east of the site is an area of ridge and furrow (CWM014) which is not visible in the LiDAR data and has possibly since been removed.

2.2.11 Slightly further approximately 600m to the east of this is another area where ridge and furrow was recorded during an archaeological evaluation for Lea Marston Hotel and Leisure Complex. Adjacent is a possible moated site consisting of two oblong water filled hollows 150m east of Blackgreaves Farm with another area of ridge and furrow identified in the LiDAR data (CWM016).

2.2.12 Approximately 1.7 km to the south-west of the site is the historic core of Curdworth medieval settlement (CWM005), the extent of it is based on the first edition Ordnance Survey map and the village is listed in the Domesday Book of 1086.

2.2.13 Immediately to the south of the site is the post-medieval Dunton Hall and Dunton Hall Garden (CWM060). Between Dunton Hall and Dunton Wood to the north-east are a number of charcoal manufacturing sites that appear in aerial photographs as dark, roughly circular, soil marks (CWM013).

2.2.14 The section of the Birmingham and Fazeley Canal to the west of the site is the location of Dunton Wharf and former lime kilns of 18th and 19th century date (CWM118).

Survey Objectives

2.2.15 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 (Wessex Archaeology 2014). 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

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

Survey Dates

- 2.2.17 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between the 17th and 18th and the 22nd to 25th September 2014.

Grid Location

- 2.2.18 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 English Heritage recommendations (English Heritage 2008).
- 2.2.19 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

- 2.2.20 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 EH guidelines (English Heritage 2008).
- 2.2.21 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

- 2.2.22 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (± 5 nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps were applied to all survey data, with no interpolation applied.
- 2.2.23 Further details of the geophysical and survey equipment, methods and processing are described in Annex 1.

Data Presentation

- 2.2.24 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 passed to our graphics team who produced the final figures in GIS (ESRI ArcMap 10).
- 2.2.25 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ± 25 nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

Introduction

- 2.2.26 The gradiometer survey has successfully identified few anomalies of potential archaeological interest. However, ploughing trends, some possible trends of uncertain origin are visible with the majority of the survey area covered in ferrous anomalies. The results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figures 9 to 11).
- 2.2.27 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 11). Full definitions of the interpretation terms used in this report are provided in Annex 2.
- 2.2.28 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

- 2.2.29 The only possible anomalies identified in this dataset are a pair of curvilinear positive anomalies at 4000 and several positive linears around 4001. They are interpreted as trends of uncertain origin and are not able to be characterised further due to the strong ferrous response present across the site.
- 2.2.30 Some ploughing trends are visible oriented north-east to south-west and they are parallel to current field boundaries and are presumed to be modern in origin.

Interpretation: Modern Services

- 2.2.31 There are no modern services identified on this Site.
- 2.2.32 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 (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

Introduction

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

Discussion

- 2.2.34 The few possible curvilinear and linear trends of uncertain origin at 4000 and 4001 are ephemeral and interpreted as of uncertain origin due to the very strong ferrous responses seen in the data.
- 2.2.35 It is not possible to identify any further possible anomalies of archaeological interest that could be related to the possible deserted medieval settlement recorded here and any potential anomalies would be masked by the ferrous debris response. It is assumed that debris

or waste containing a large amount of ceramic and ferrous debris and modern in origin has been spread over this field possibly associated with the period of construction of the M42.

2.3 References

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

HS2 Environmental Statement, 2013. London-West Midlands Environmental Statement, Volume 5: Technical Appendices: CFA20: Curdworth to Middleton Baseline Report: Cultural Heritage. Report Reference: CH-001-020

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 2013. HS2 Community Forum Area 20 (Curdworth to Middleton): Hyperspectral and LiDAR Analysis Report Reference: 86252.01

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

2.4 HER Records Consulted

HWA3377 - Historic Landscape Characterisation of very large, irregular, post-war fields

CWM005 - Curdworth Medieval Settlement

CWM013 - Charcoal manufacturing sites in Curdworth Parish

CWM014 - Possible deserted settlement north of Dunton Island and northeast of Curdworth

CWM016 - Possible moat east of Blackgreaves Farm

CWM060 - Dunton Hall garden, Dunton Hall

CWM118 - Dunton Wharf and former lime kilns

HWA3360 - Historic Landscape Characterisation: Very large, irregular, post-war fields

2.5 Figures

Figure 8: Site location

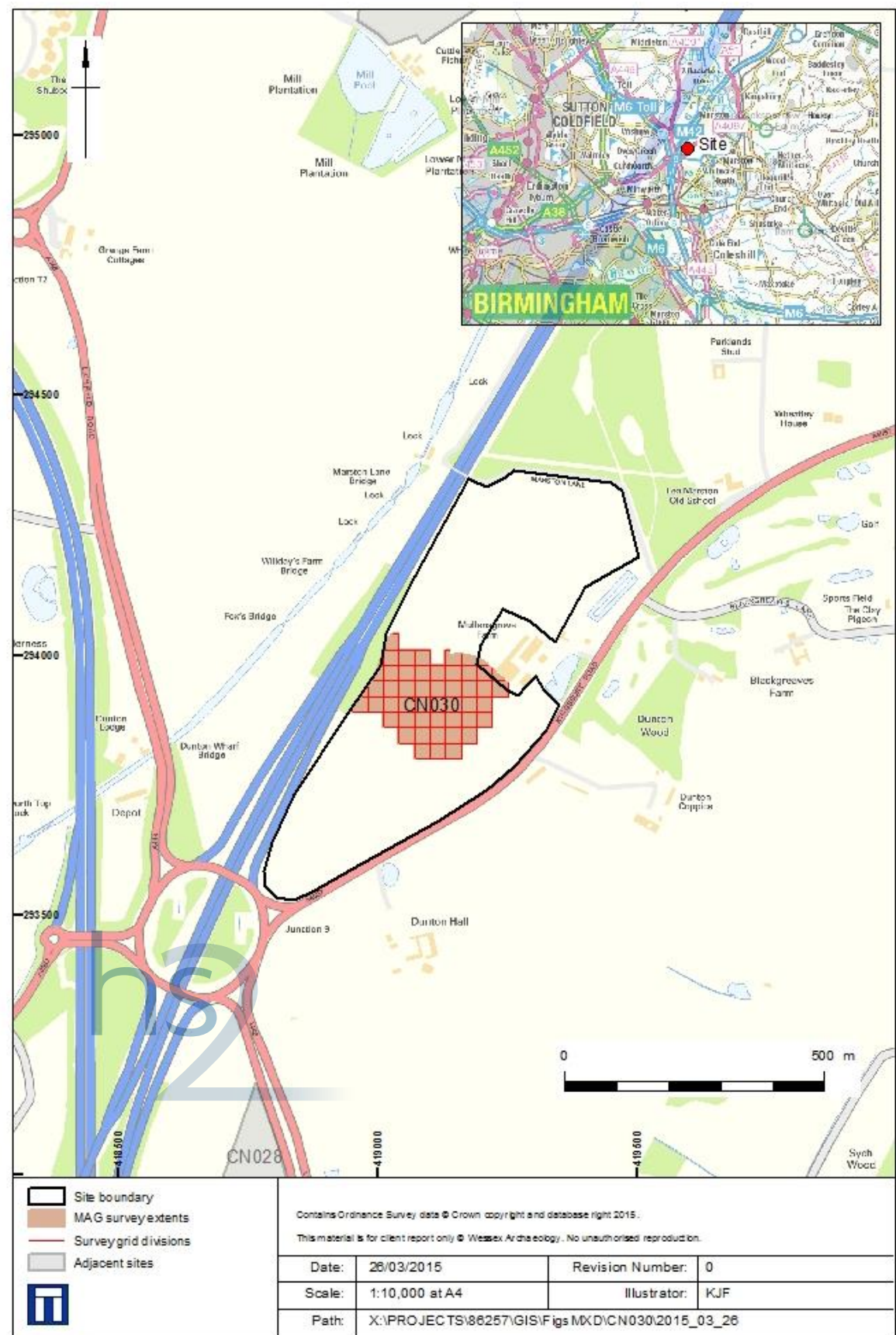


Figure 15

Figure 9: Greyscale

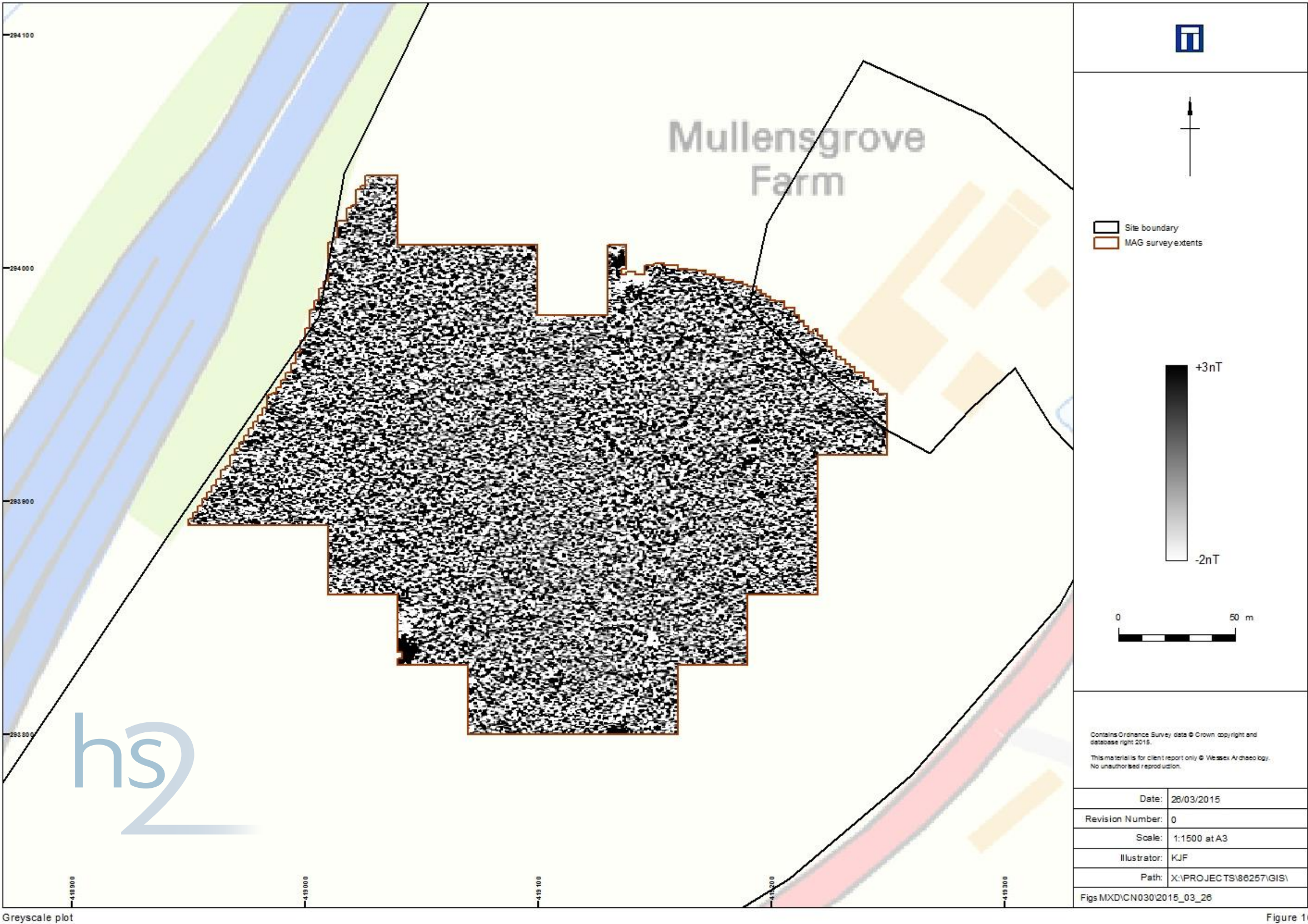


Figure 16

Figure 10: XY trace

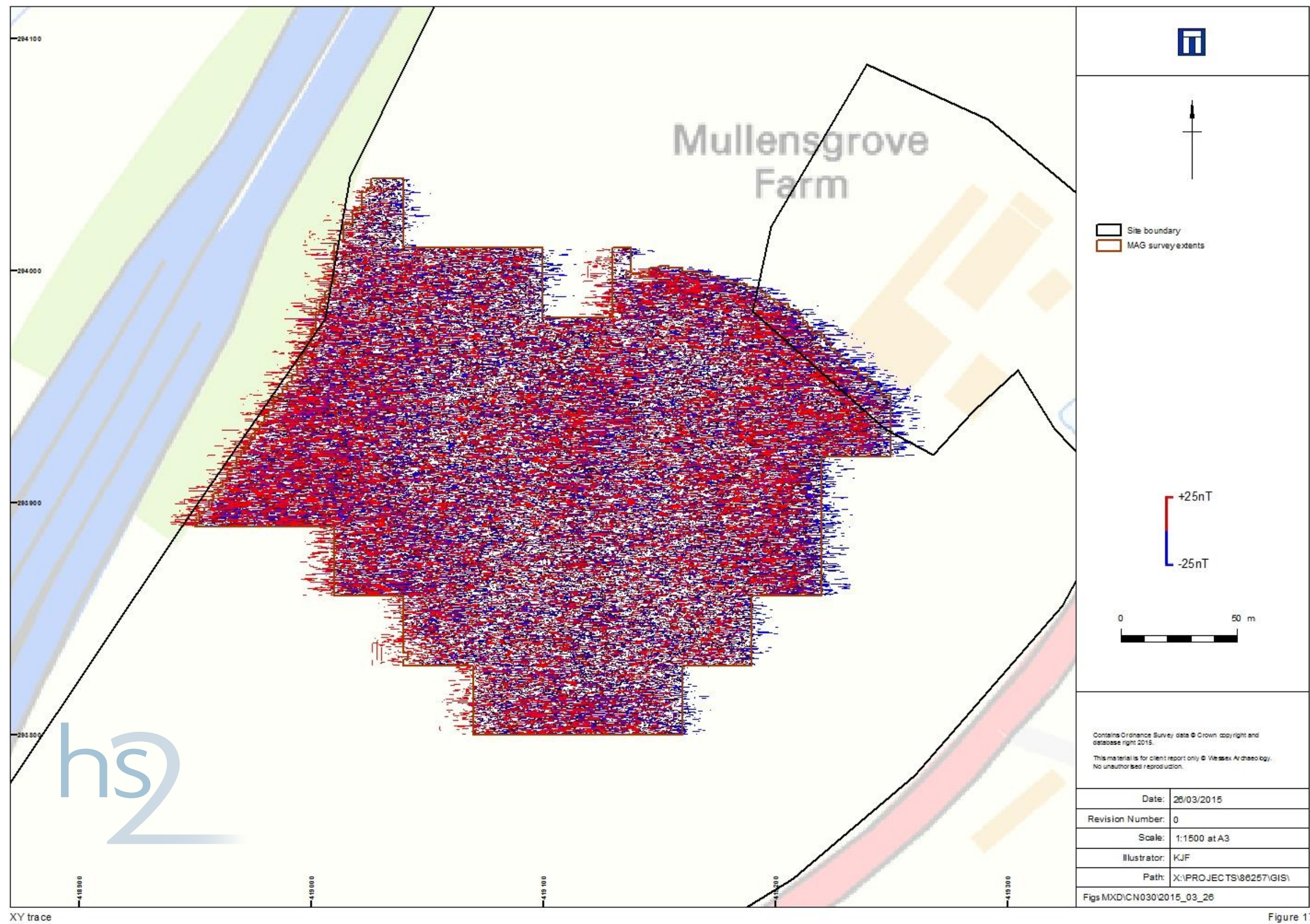
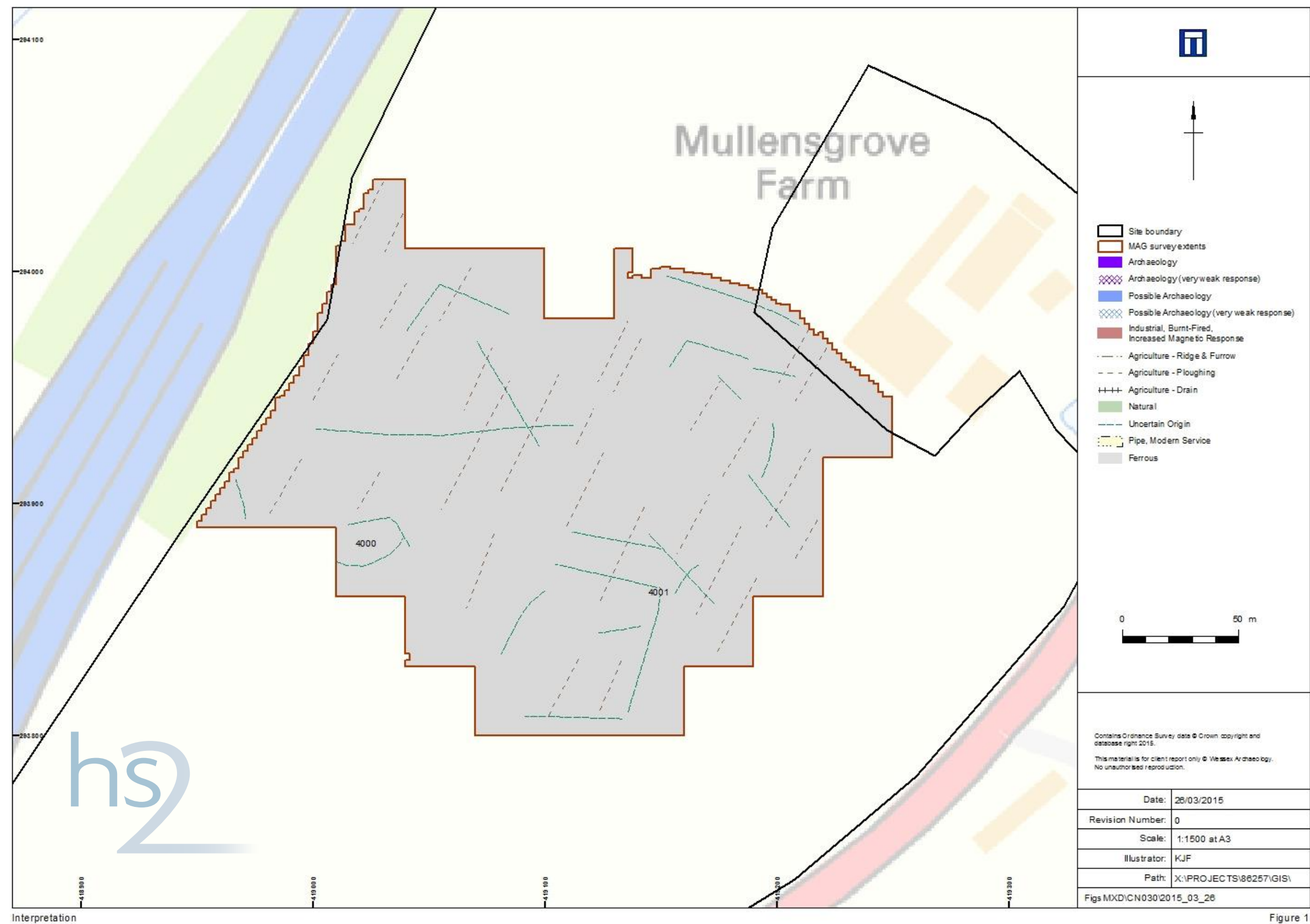


Figure 17

Figure 11: Interpretation



2.6 Site: CNo34

Introduction

2.6.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CNo34 off Coppice Lane, near Drayton Bassett, Staffordshire (Figure 12), hereafter "the site" (centred on NGR 418154 298887). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

2.6.2 The geophysical survey undertaken here has been preceded by a Desk-Based Assessment (DBA) (HS2 Environmental Statement 2013.) and a remote sensing survey comprising LiDAR and hyperspectral survey and analysis (Wessex Archaeology 2013). Geophysical survey areas have been identified based on the archaeological potential and conclusions identified in these reports.

2.6.3 This Site, CNo34, was selected for geophysical survey as it is considered to be an area with elevated archaeological potential due to its topographic location on gravels and it will be the location of large extents of mitigation earthworks.

The site

2.6.4 The site comprises one large field in an area of arable land to the north-east of Coppice Lane approximately 0.9km to the north-east of the centre of Middleton, Warwickshire and 1.6km south-west of the centre of Drayton Bassett, Staffordshire. The limits of the geophysical survey area are defined by hedgerow field boundaries to the east, west and southern extents of the site and to the north of the site is Gallows Brook. The gradiometer survey covered an area of approximately 13.2ha

2.6.5 The site lies on a north-east facing area of land which gently slopes down to Gallows Brook. The south-west region of the site lies at a height a little over 86m aOD (above Ordnance Datum) and falls from this height to less than 74m aOD at the very eastern limit of the site adjacent to Gallows Brook.

2.6.6 The solid geology is recorded as Mercia Mudstone (Triassic) formation across the whole Site (Ordnance Survey 1954). Superficial deposits record an "island" of river terrace deposits of sands and gravels (Ordnance Survey 1977). 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 (SSEW 1983). Soils in such geological settings have been demonstrated to produce magnetic contrasts suitable for the detection of anomalies through gradiometer survey.

Summary Archaeological and Historic Background

2.6.7 For a detailed assessment of the known archaeology of the site and surrounding area the relevant DBA should be consulted (HS2 Environmental Statement 2013). A summary of relevant sites within 1km of the survey area are provided 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 20 in the Environmental Statement (CWM numbers) in the supplementary survey works (WA numbers) or in the Warwickshire and Staffordshire SMR (MWA/HWA and MST/HST numbers).

2.6.8 The current landscape is characterised as post-1880s large rectilinear fields reorganised from small irregular fields (HST5762).

2.6.9 Available Ordnance Survey mapping shows that the survey area was formerly divided into seven smaller fields (Ordnance Survey 1884). 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) give increased potential especially for prehistoric exploitation of the area (HS2 Environmental Statement 2013.)

2.6.10 Remote sensing has identified several features within the site. A series of linear earthworks interpreted as probable former field boundaries or drainage ditches are oriented approximately north-south (WA5.45). In the south-west and highest corner of the site is a large oval hollow probably a former quarry or pond (WA5.50) and to the east is a former watercourse one section of which is still intact and it runs approximately north-east to south-west across this area of the site (WA5.49).

2.6.11 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) (CWMo48). The medieval manor and deer park of Middleton Hall is approximately 1.5km to the south-east (CWMo99 and CWM100); most of the known sites and findspots in the vicinity relate to the medieval period.

2.6.12 The site has particular potential for the prehistoric period due to its topographic location and in the surrounding area some prehistoric finds are recorded. A Lower Palaeolithic stone handaxe was recorded as a findspot in the village of Middleton to the south of the site (MWA111) and there is a Bronze Age Axe findspot, south of Brook Farm which is 500m to the north-east of the site (MST3408).

2.6.13 In Middleton village a Roman figurine mount was discovered whilst metal detecting (MWA12358) and sherds of Romano-British pottery (MWA10352).

2.6.14 To the south-west of the site is Upper House Farm, a pre-1880s historic farmstead (CWM105) with an area of ridge and furrow to the north (CWMo49) and a marl pit east of Upper House Farm (MWA6267) dating to the post-medieval period.

2.6.15 The probable extent of the medieval settlement of Middleton village is based on the Ordnance survey map of 1887 and is approximately 500m to the south of the site (CWMo48).

2.6.16 A large area over and around the village of Middleton is the possible site of a post-medieval ironworks but the exact location is unknown (CWMo47).

Survey Objectives

2.6.17 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 (Wessex Archaeology 2014). 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

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

Survey Dates

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

Grid Location

2.6.20 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 English Heritage recommendations (English Heritage 2008).

2.6.21 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

2.6.22 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 EH guidelines (English Heritage 2008).

2.6.23 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

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

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

Data Presentation

2.6.26 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 passed to our graphics team who produced the final figures in GIS (ESRI ArcMap 10).

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

Results

Introduction

2.6.28 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 13 to 19).

2.6.29 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figures 15 and 18). Full definitions of the interpretation terms used in this report are provided in Annex 2.

2.6.30 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

2.6.31 Two large approximately circular positive anomalies at 4000 and 4001 in the north-west low-lying area of the site are interpreted as Archaeology and are characteristic of a cut feature. In this instance and due to their shape they are possibly large circular pits.

2.6.32 At 4002 immediately below the pit type responses, is an irregular shaped area of increased magnetic response which is possibly in response to debris containing ferrous or ceramic material, amongst the small positive anomalies are several dipolar anomalies randomly dispersed suggesting this.

2.6.33 A small number of oval-shaped positive anomalies at 4003 are interpreted as Possible Archaeology; they are located near the modern service. They are possibly pit type features but could equally be due to natural variations in the superficial geology.

2.6.34 An approximately elongated and weakly positive oval shaped anomaly at 4004 is oriented east to west and interpreted as Archaeology (very weak response) due to its weak magnetic strength of less than +1nT. It is possibly a short section of ditch due to its shape and orientation.

2.6.35 An area at 4005 contains two small positive circular anomalies and two linear positive anomalies at different orientations to each other. They are interpreted as Possible Archaeology as they form linears and discrete shapes compared to the wider area of increased magnetic response surrounding them between 4010 and 4011.

2.6.36 A series of positive linear and oval shaped anomalies are identified from 4006 to 4007. Together they form an overall curvilinear feature interpreted as Archaeology and is typical in response to a ditch. The feature is in an approximately north-south orientation and in a similar orientation to modern field boundaries; it is possibly a former field boundary.

2.6.37 There is one rectilinear and several discrete oval ferrous or strongly positive anomalies overall forming an L-shaped feature. The anomaly nearest to 4009 has a strong negative halo

- indicating its ferrous origin and due to this it has been interpreted as Ferrous and possibly in response to a ferrous pipe.
- 2.6.38 The area of increased magnetic response around 4010 and 4011 is an irregular dispersed area spreading from the current western field boundary. It contains numerous bipolar and dipolar anomalies possibly indicating a spread of ferrous, stone and ceramic debris.
- 2.6.39 In the north-west lowest lying area of the site around 4012 and 4013 are several interconnecting linear series of bipolar anomalies typical of the response from ceramic field drains.
- 2.6.40 Ploughing trends, such as around 4014 and 4015, are in the form of weakly positive linear anomalies oriented east to west across the site and are assumed to be modern in origin.
- 2.6.41 Finally there are a number of weakly contrasting and indistinct linear and curvilinear trends present across the site, such as around 4015 and 4017; they are interpreted as trends of uncertain origin as their form or concentration are not sufficiently defined for further interpretation.

Interpretation: Modern Services

- 2.6.42 There is one modern service identified within the site at 4018 oriented north-west to south-east, it continues to the north into survey area CNo35 and potentially also continues south beyond the site boundary.
- 2.6.43 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 (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

Introduction

- 2.6.44 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, trends of uncertain origin and of ploughing and a modern service.

Discussion

- 2.6.45 There are several anomalies of possible archaeological interest across the site with some concentrations apparent. One area with a concentration of possible archaeological features is in the lowest-lying areas of the site (see Figure 19) where there are two large oval pits at 4000 and 4001 and an area of increased magnetic response at 4002 surrounded by a network of ceramic field drains around 4012 and 4013. The association of the large pit type features with the construction of the field drains cannot be ruled out. Their relationship to each other is not able to be identified from the gradiometer data only that the locations of the ceramic drains do not appear to truncate the pits.
- 2.6.46 The ditch type anomaly between 4006 and 4007 is oriented on a similar alignment to the current field boundaries and it is visible as a slight earthwork in the LiDAR data and is identifiable in available Ordnance Survey mapping (Ordnance Survey 1884). It is assumed to be a former field boundary.

- 2.6.47 The large irregular spreading area of debris around 4010 and 4011 appears to extend approximately east to west and is possibly associated with the weak ditch type feature at 4003 being along a similar orientation. A former field boundary is identified at this location and in this orientation on available Ordnance Survey mapping (Ordnance Survey 1899) and it is assumed that these anomalies are the remains of the ploughed out and dispersed former field boundary.
- 2.6.48 The ferrous L-shaped anomaly at 4009 is not visible on available Ordnance Survey mapping (Ordnance Survey 1884, 1889, 1903a, 1903b, 1924a, 1924b, 1955-1957, 1961-1976) but it is located in a hollow platform area visible in the LiDAR data and interpreted as a former quarry or pond. One possibility due to its ferrous response and layout is that it is a pipe related to a former pond.
- 2.6.49 The modern service at 4018 continues north and is visible in the gradiometer data for site CNo35, is it assumed to continue south beyond the site boundary.
- 2.6.50 Numerous linear and curving trends have been noted within the survey area some of which follow the modern field 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.
- 2.6.51 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. The superficial geology of the site being sands and gravels means that it can be difficult for weaker contrasting anomalies of archaeological interest to be identified.

2.7 References

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

Ordnance Survey, 1889. OS County Series: Warwickshire 1:2500

Ordnance Survey, 1903a. OS County Series: Staffordshire 1:2500

Ordnance Survey, 1903b. OS County Series: Warwickshire 1:2500

Ordnance Survey, 1924a. OS County Series: Staffordshire (partial) 1:2500

Ordnance Survey, 1924b. OS County Series: Warwickshire (partial) 1:2500

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

Ordnance Survey, 1961-1976. OS Plan (partial) 1:2,500

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 2013. HS2 Community Forum Area 20 (Curdworth to Middleton): Hyperspectral and LiDAR Analysis Report Reference 86252.01

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

2.8 HER Records Consulted

CWM047 - Site of post-medieval ironworks at Middleton

CWM048 - probable extent of the medieval settlement of Middleton village

CWM049 - Ridge and Furrown north of Middleton

CWM099 - Middleton Deer Park

CWM100 - Middleton Hall Historic Building Complex

CWM105 - Upper House Farm; pre-1880s historic farmstead

HST5762 - Historic Landscape Characterisation: Other large rectilinear fields, post-1880s reorganised fields

MST3408 - Bronze Age Axe findspot, south of Brook Farm

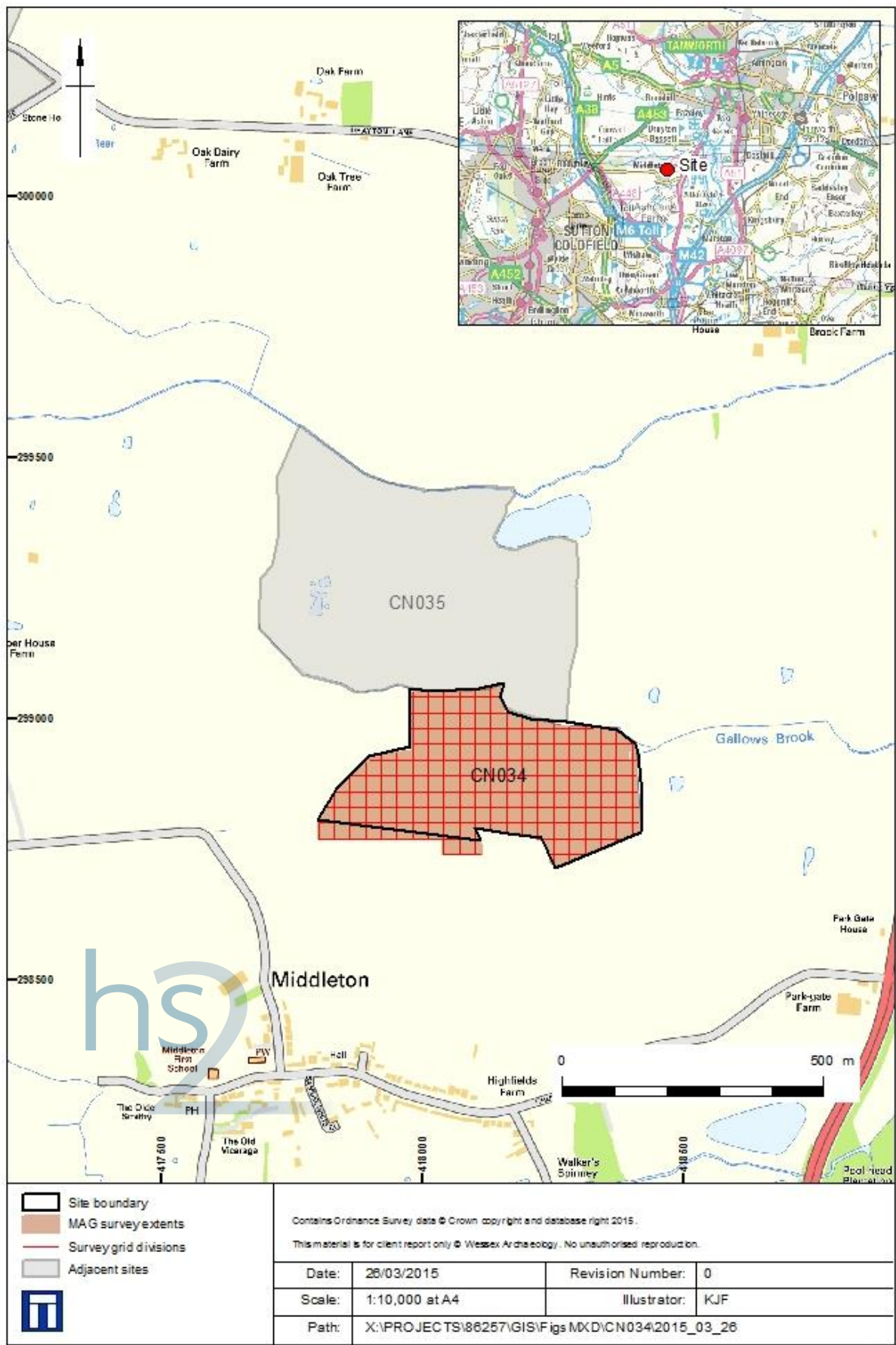
MWA111 - Findspot of Lower Palaeolithic stone handaxe, Middleton

MWA6267 - Marl pit east of Upper House Farm

MWA10352 - Findspot of Romano-British pottery found in Middleton

MWA12358 - Findspot of Roman figurine mount through metal detecting, Middleton

Figure 12: Site location



Site location

Figure 19

Figure 13: Greyscale (west)

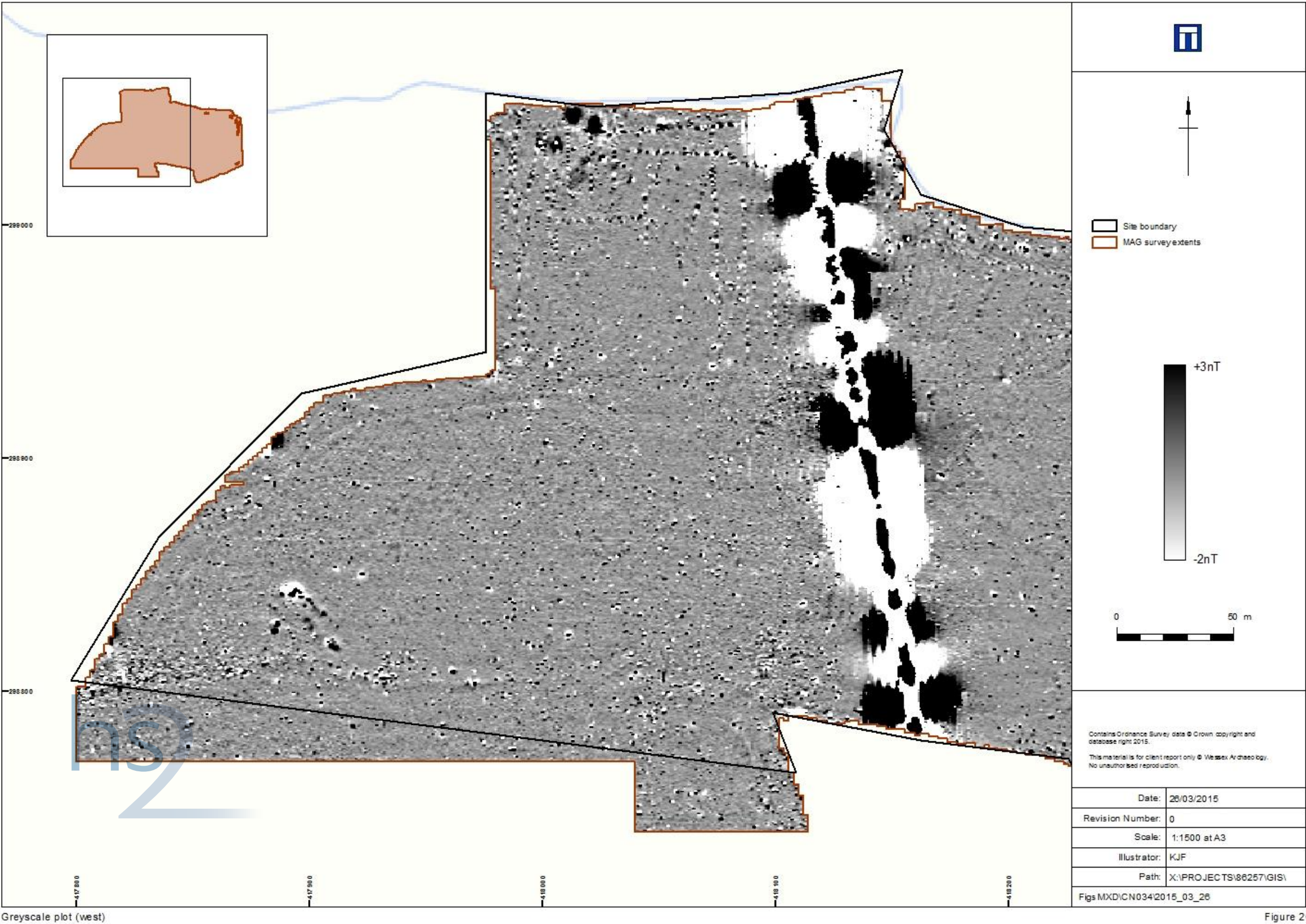


Figure 14: XY trace (west)

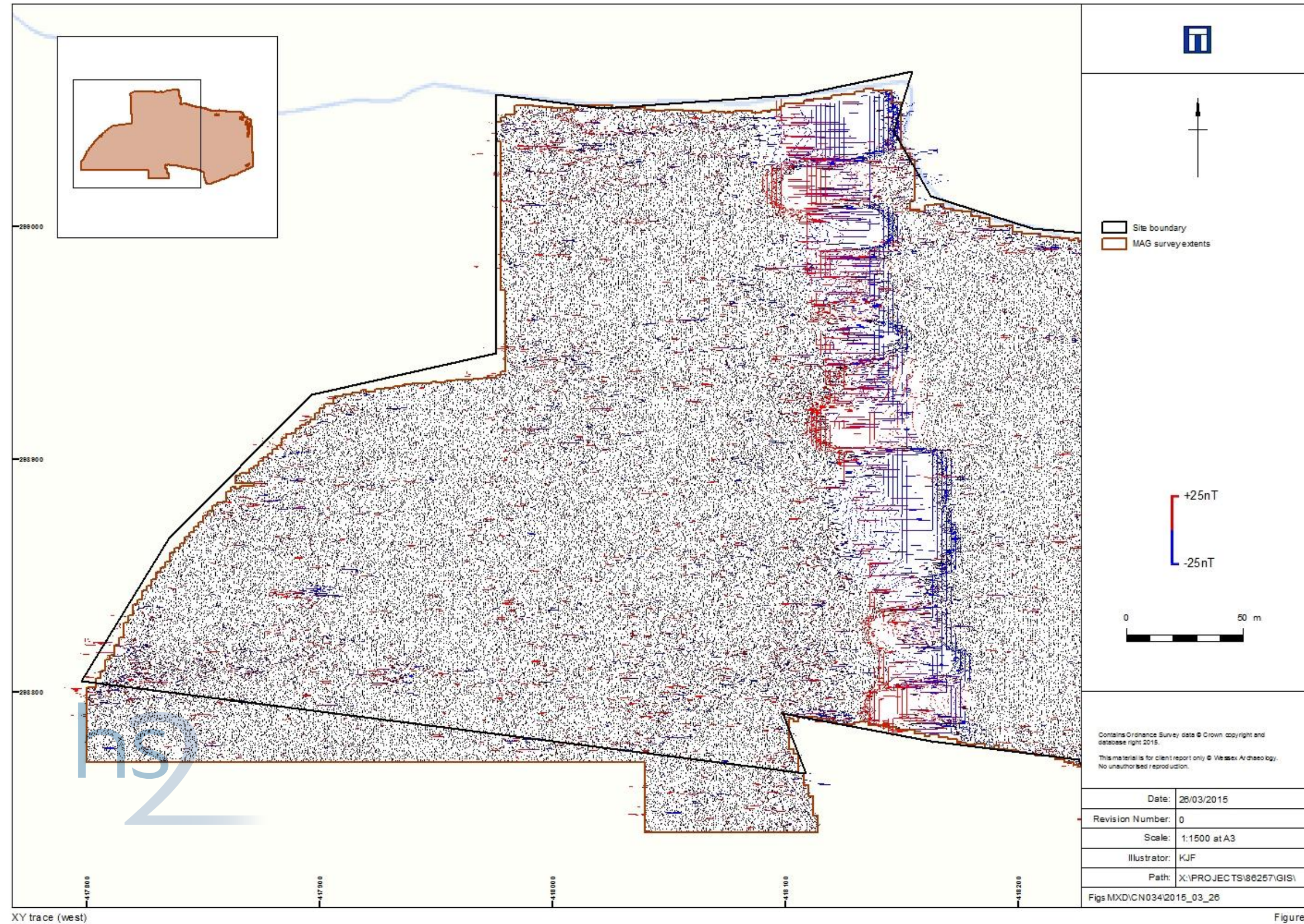


Figure 21

Figure 15: Interpretation (west)

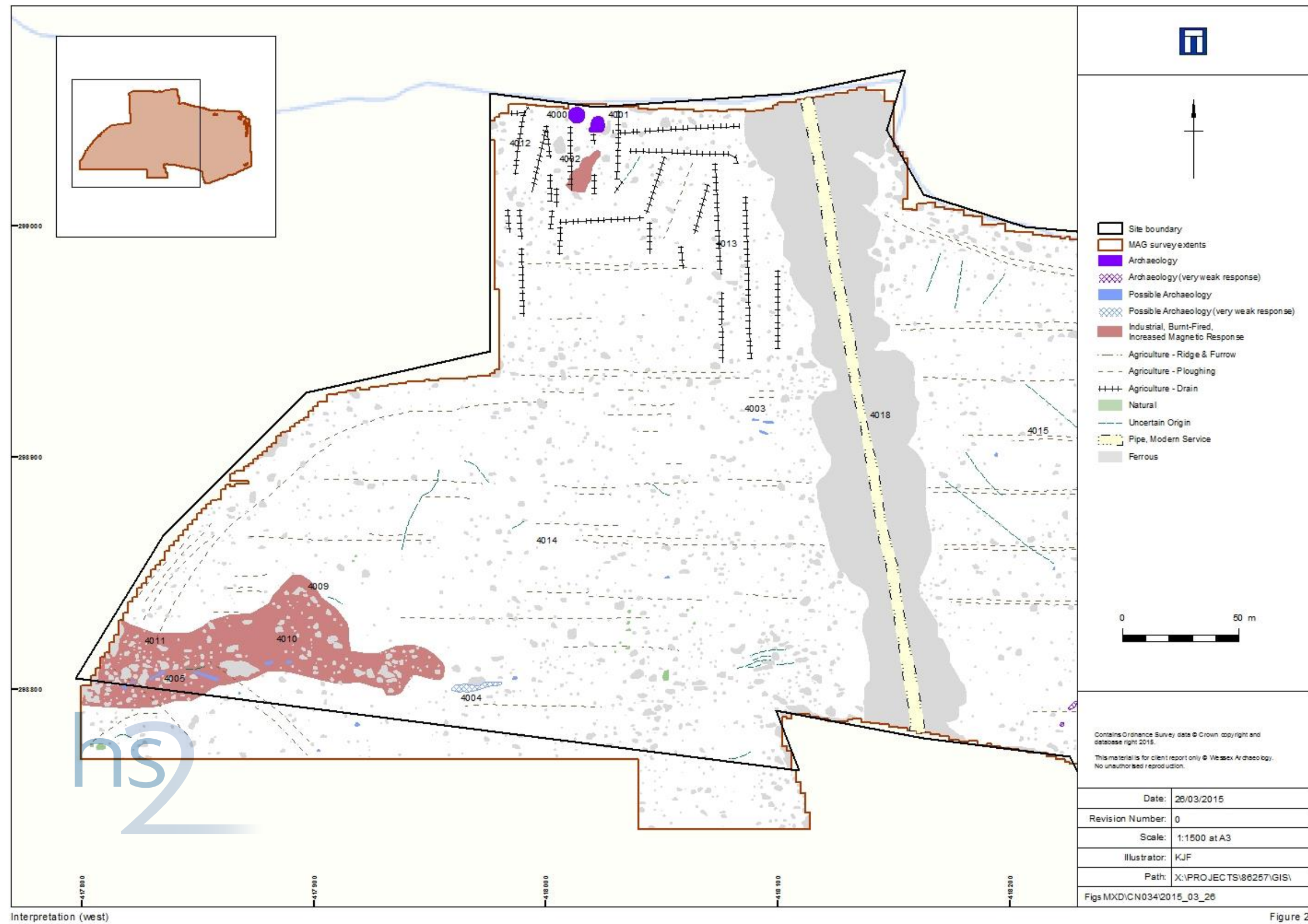


Figure 22

Figure 16: Greyscale (east)

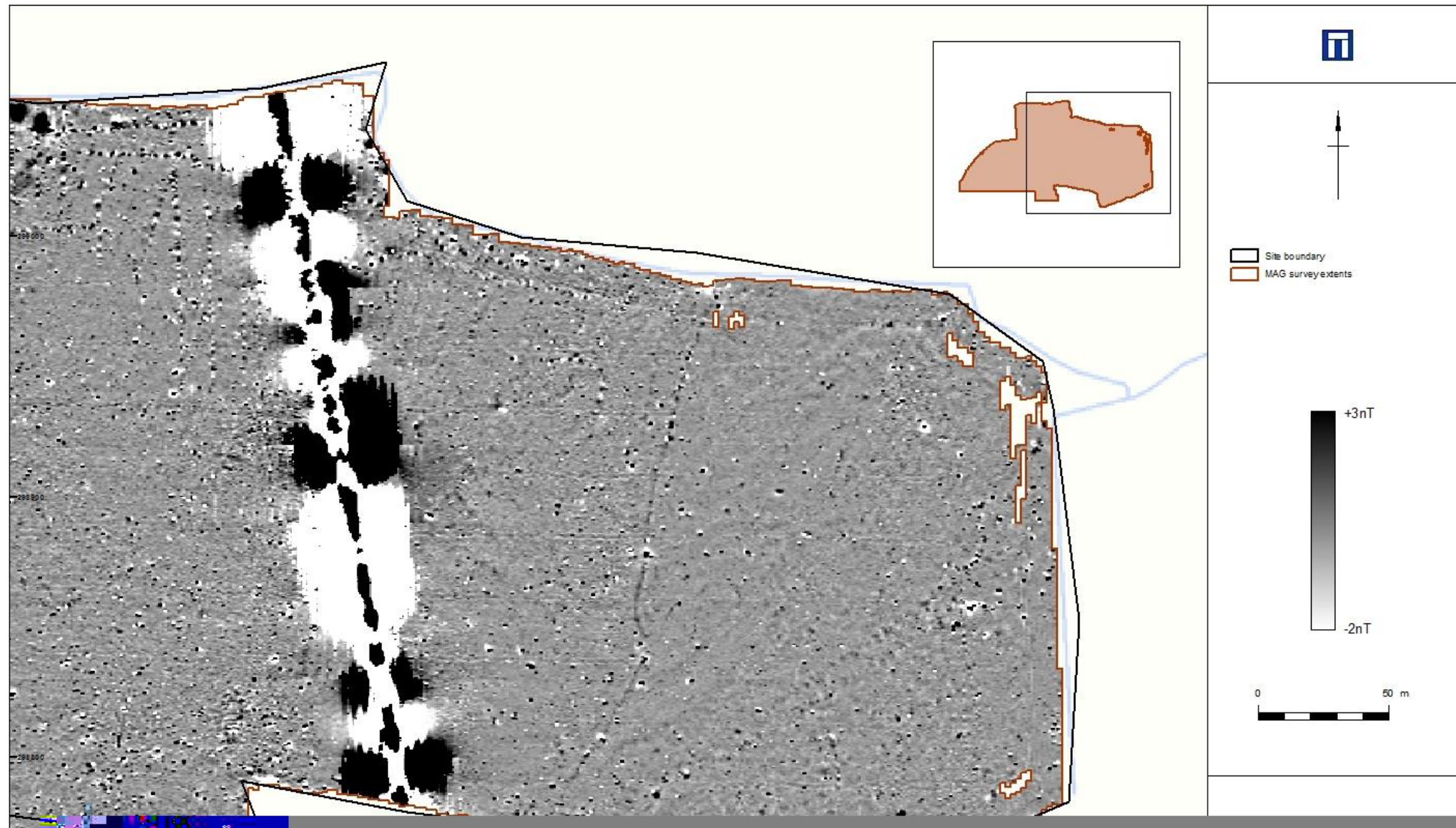


Figure 17: XY trace (east)

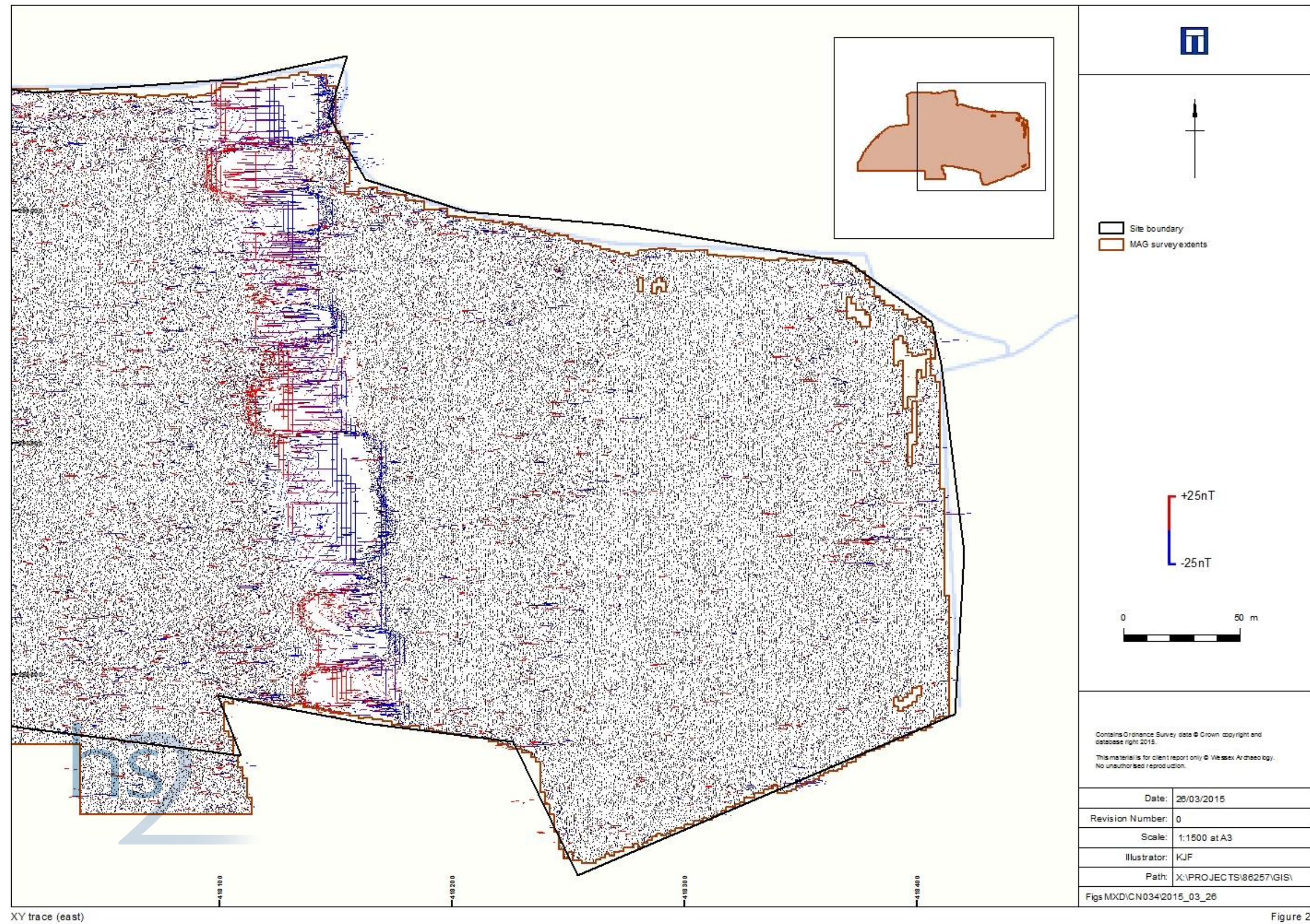
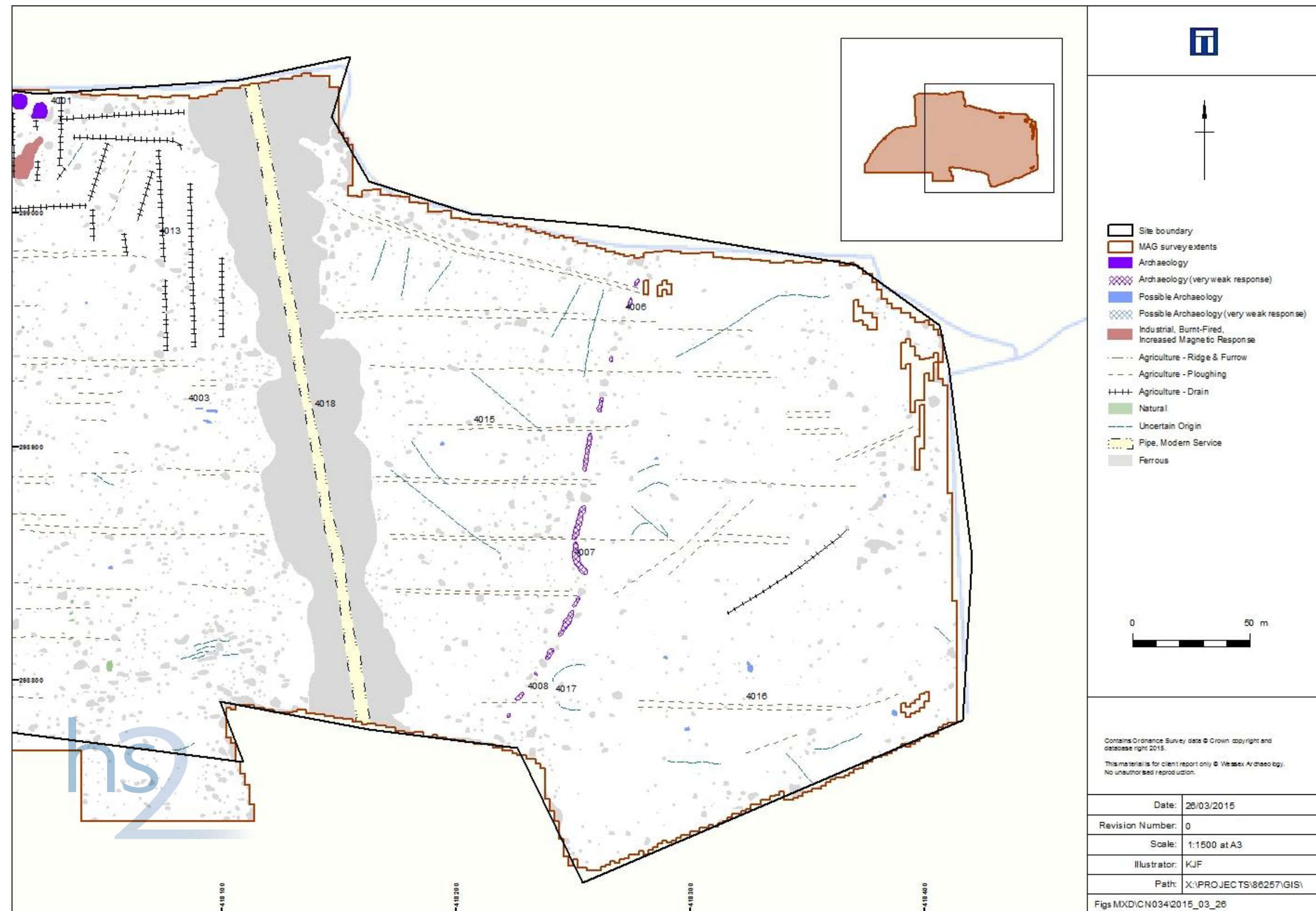


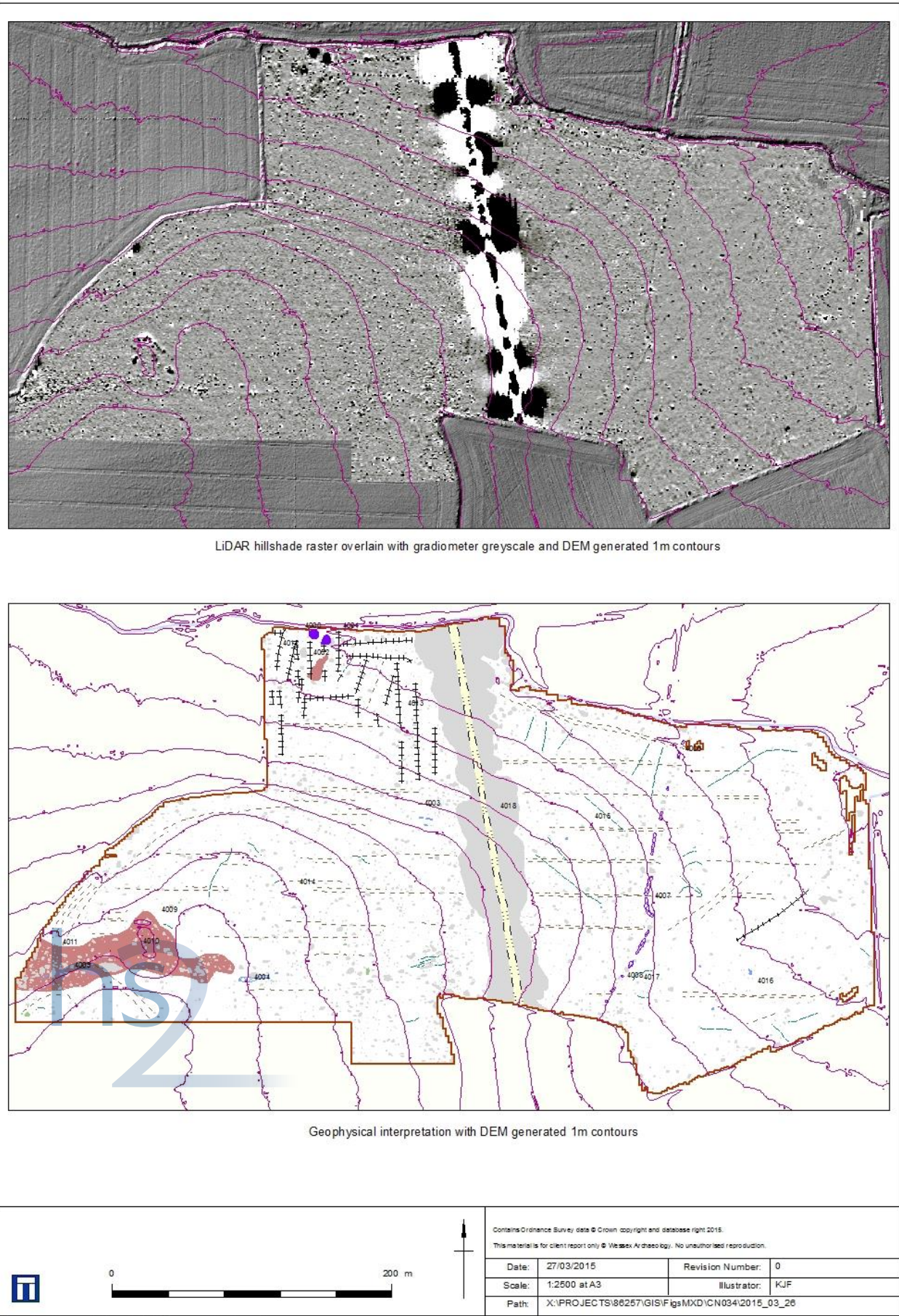
Figure 18: Interpretation (east)



Interpretation (east)

Figure 25

Figure 19: Anomalies in association with DEM generated 1m contours



Anomalies in association with DEM generated 1m contours

Figure 26

2.9 Annex 1: Survey Equipment and Data Processing

Survey Methods and Equipment

- 2.9.1 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.
- 2.9.2 The gradiometers have an effective resolution of 0.03nT over a ± 100 nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.
- 2.9.3 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.
- 2.9.4 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 (EH 2008).
- 2.9.5 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 English Heritage (2008) for characterisation surveys.

Post-Processing

- 2.9.6 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.
- 2.9.7 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.
- 2.9.8 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.

2.9.9 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.

2.10 Annex 2: Geophysical Interpretation

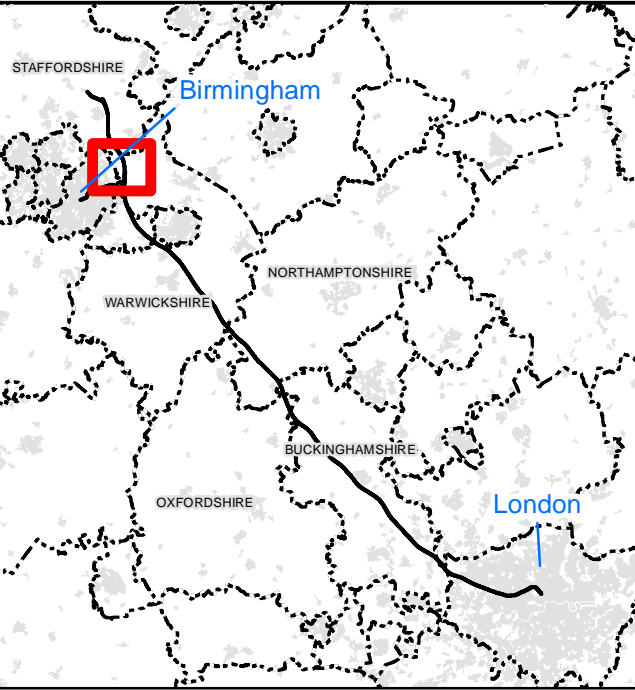
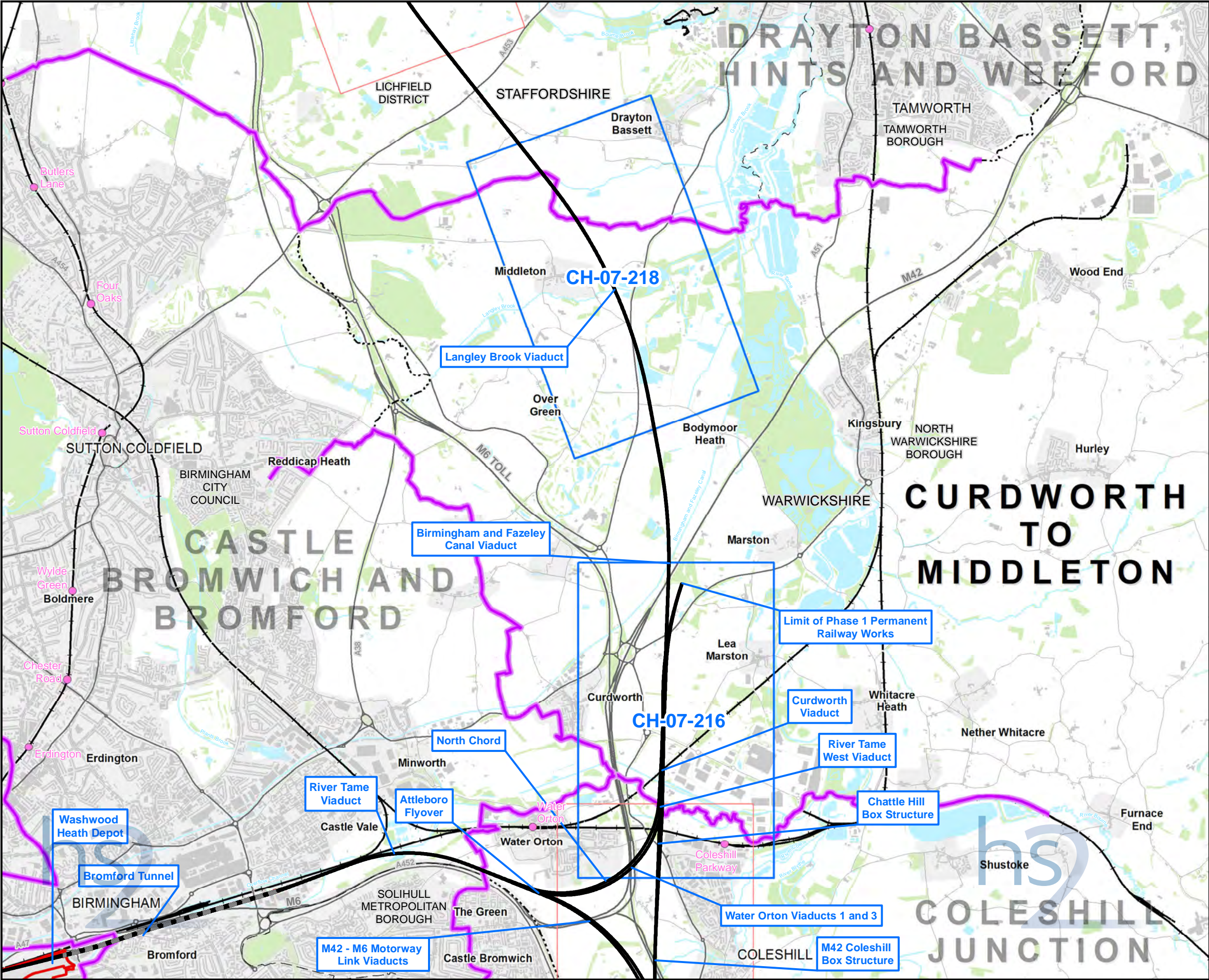
Interpretation Categories

- 2.10.1 The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.
- 2.10.2 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.
- 1.1.1.1 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:
- 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.

2.10.3 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-CFA20

Map Name Index Map of:
Archaeological Geophysical Survey -
Location
SES and AP2 ES
Community Forum Area CFA20:
Curdworth to Middleton

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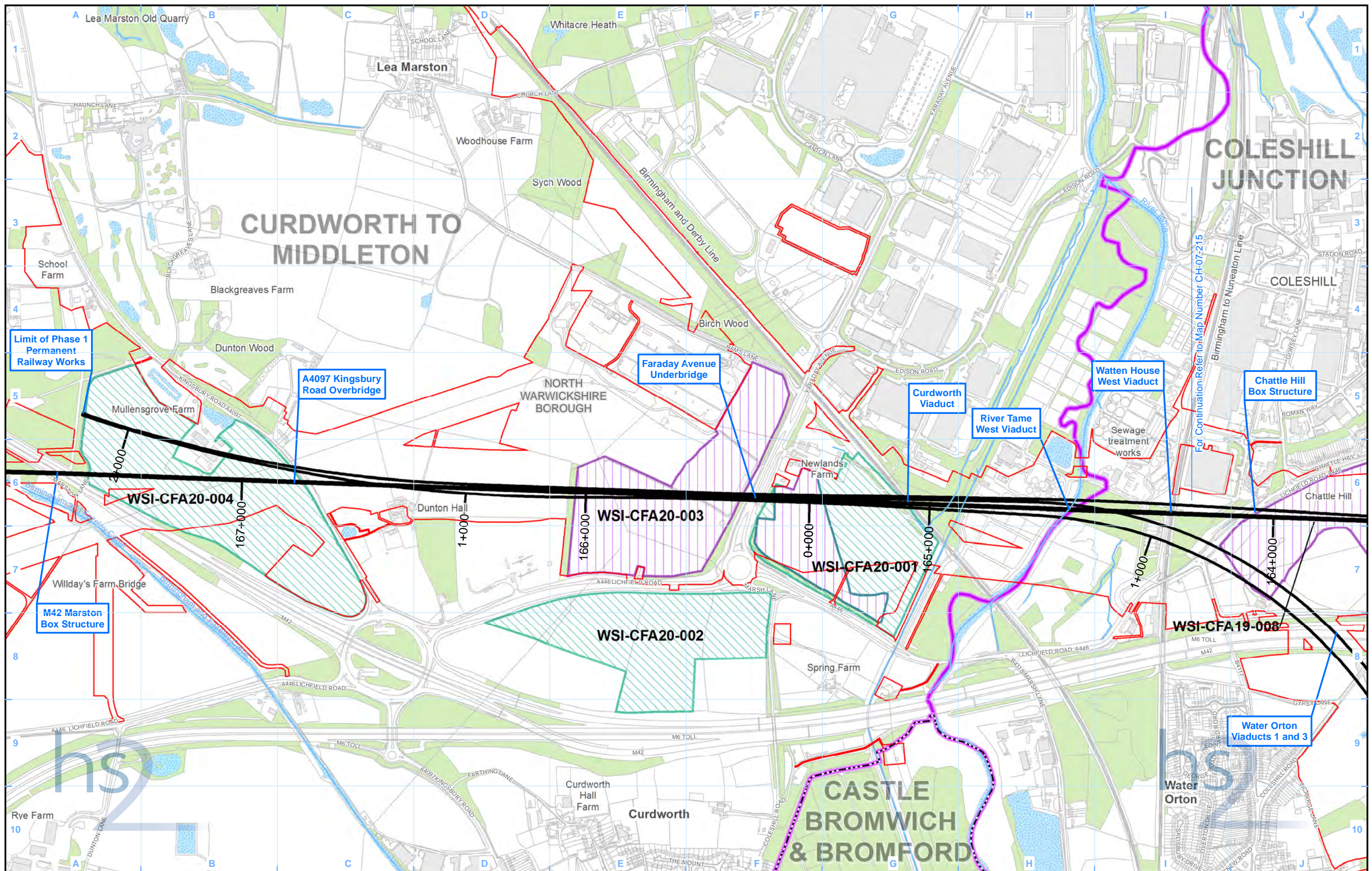
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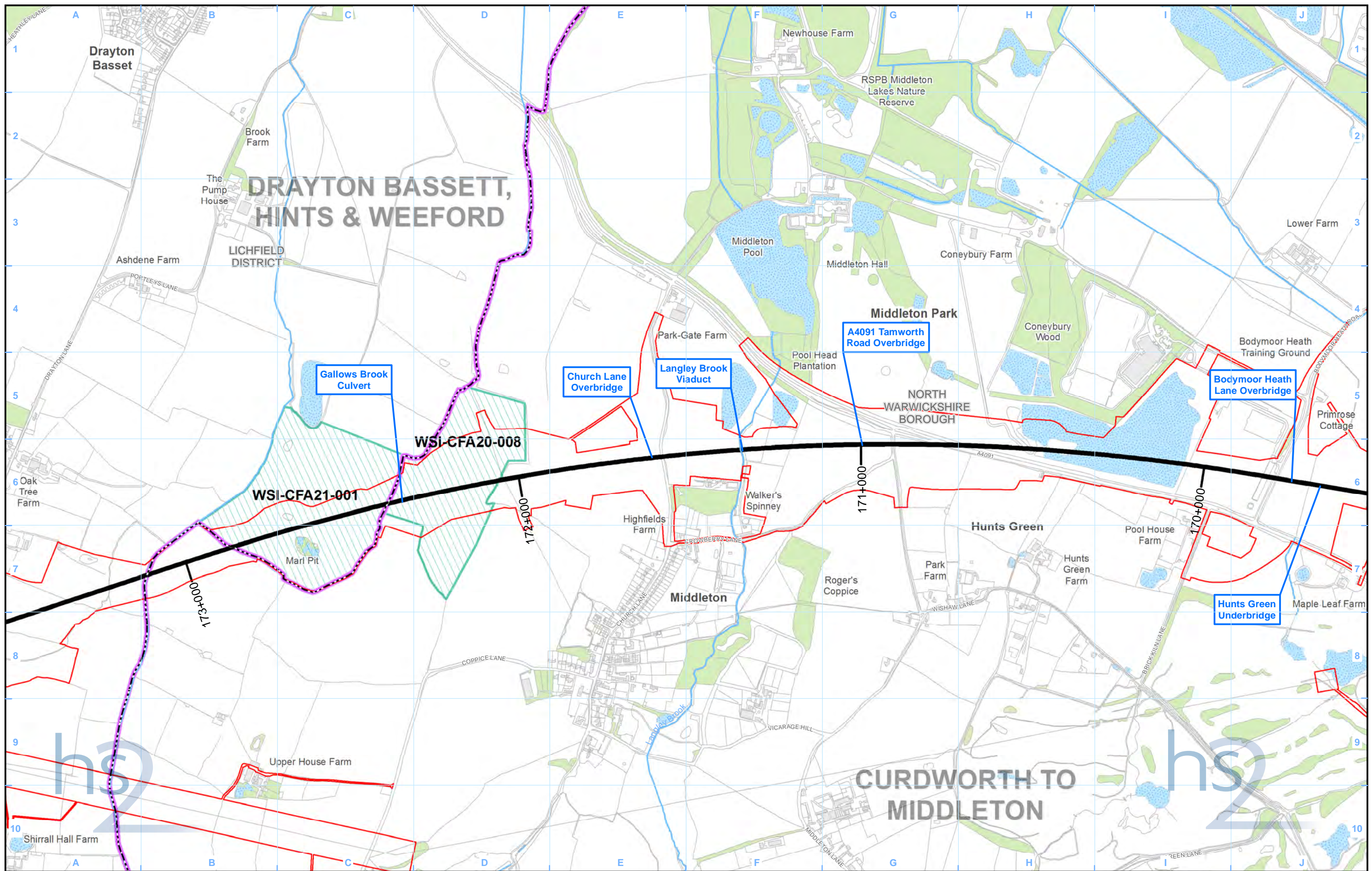
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Doc Number: C253-ATK-EV-MAP-030-001854-AP02-P01

Date: 10/06/15



Legend <ul style="list-style-type: none">Route in tunnelRoute on surfaceDepot, station, headhouse or portal buildingLand potentially required during constructionCommunity forum boundaryCounty boundaryDistrict/Borough boundaryWatercourseWater bodyWoodlandArea identified for survey 2014Geophysical and Fieldwalking surveysGeophysical surveysFieldwalking surveys completedGeophysical surveys completed	<p>Map Number: CH-07-216</p> <p>Map Name: Archaeological Geophysical Survey - Location SES and AP2 ES</p> <p>Community Forum Area CFA20: Curdworth to Middleton</p>	<p>hs2</p> <p>HS2 Ltd accept no responsibility for any circumstances, which arise from the reproduction of this map after alteration, amendment or abbreviation or if it is issued in part or issued incomplete in any way.</p> <p>Registered in England. Registration number 06791686. Registered office: One Canada Square, London, E14 5AB.</p> <p>© Crown copyright and database rights 2015. Ordnance Survey Licence Number 100049190.</p> <p>Doc Number: C253-ATK-EV-MAP-030-001797-AP02-P01</p> <p>Date: 08/06/15</p> <p>Scale at A3: 1:10,000</p> <p>0 100 200 300 400 Metres</p>
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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-07-218

Map Name

Archaeological Geophysical Survey - Location SES and AP2 ES

Community Forum Area CFA20: Curdworth to Middleton

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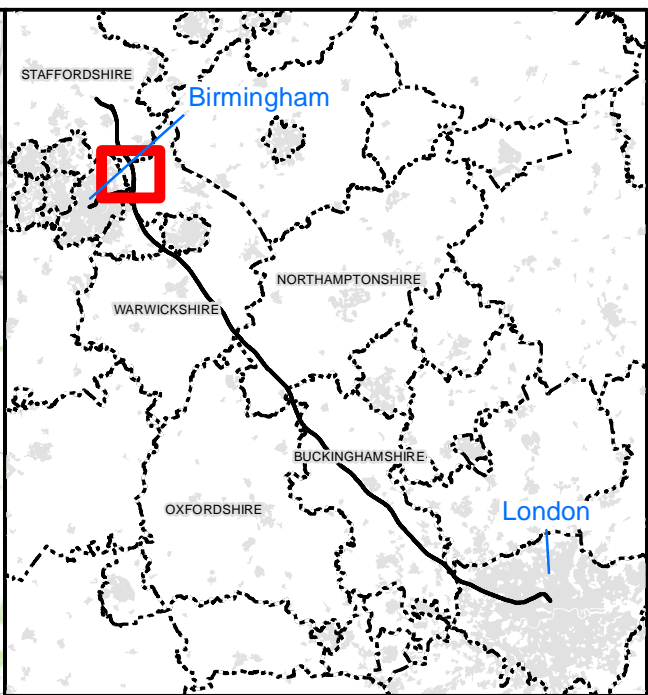
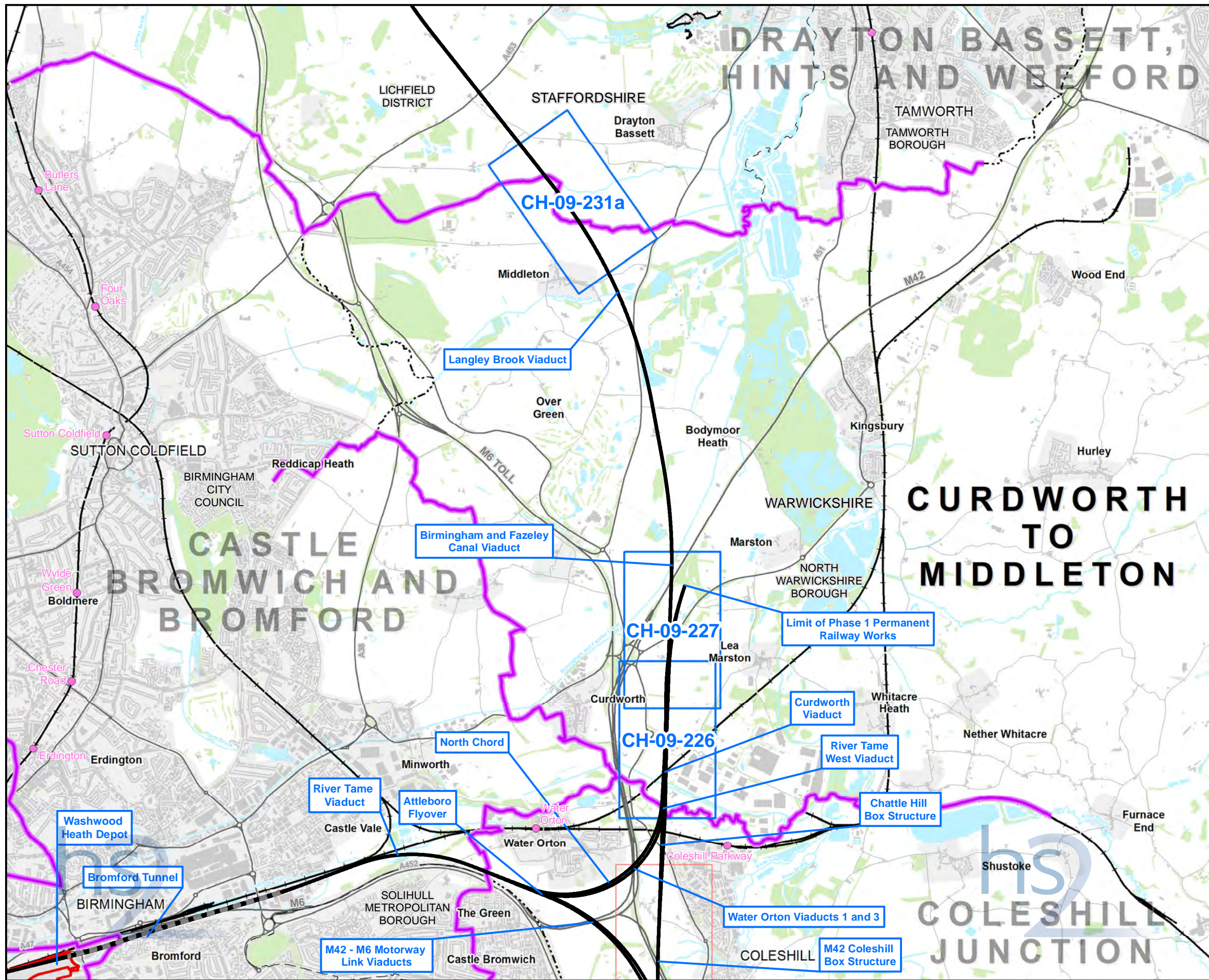
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Scale at A3: 1:10,000

Date: 08/06/15



Map Series Information:

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

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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-CFA20

Map Name

Index Map of:
Archaeological Geophysical
Survey - Magnetometer Data Plot
SES and AP2 ES
Community Forum Area CFA20:
Curdworth to Middleton

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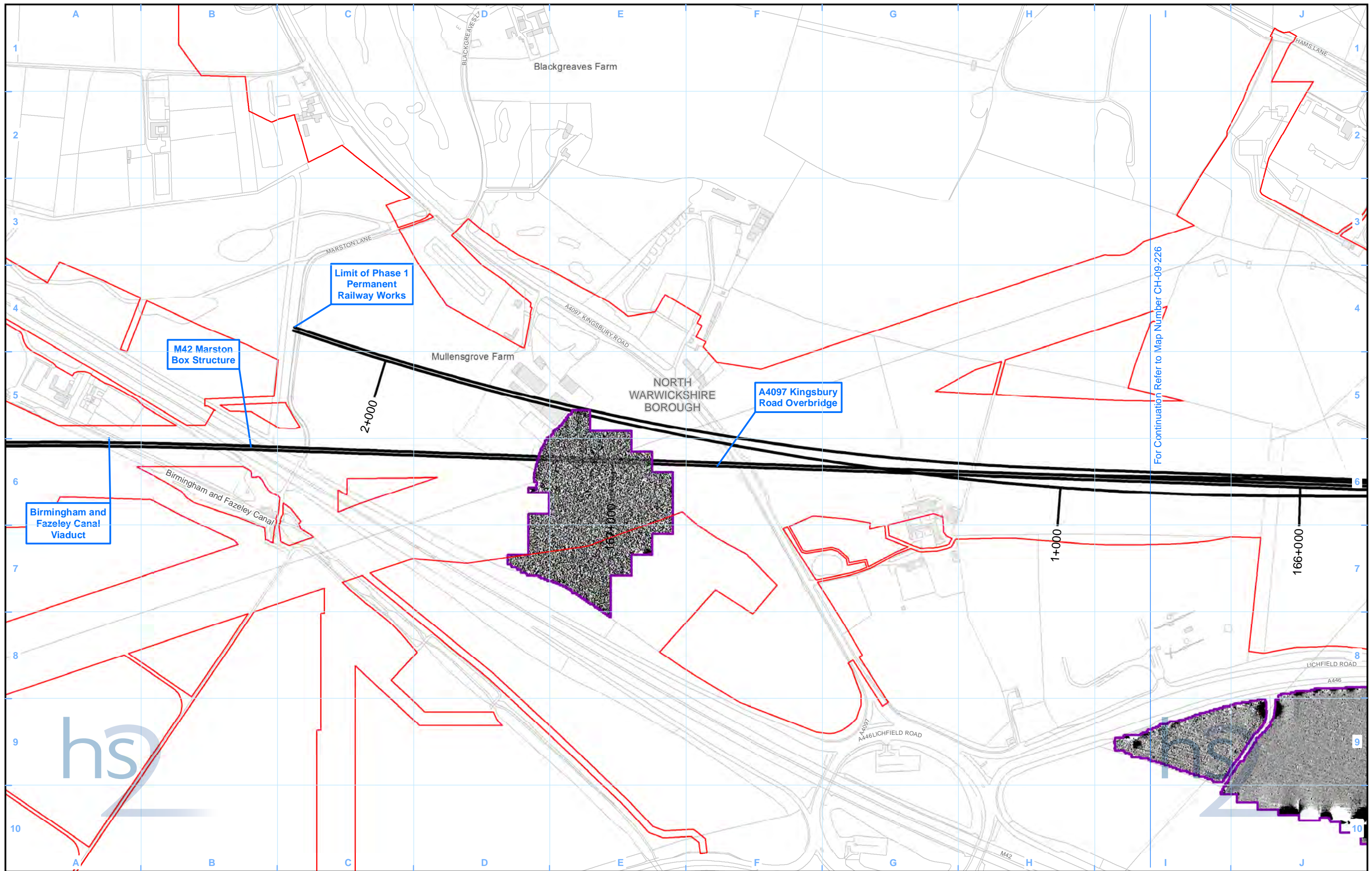
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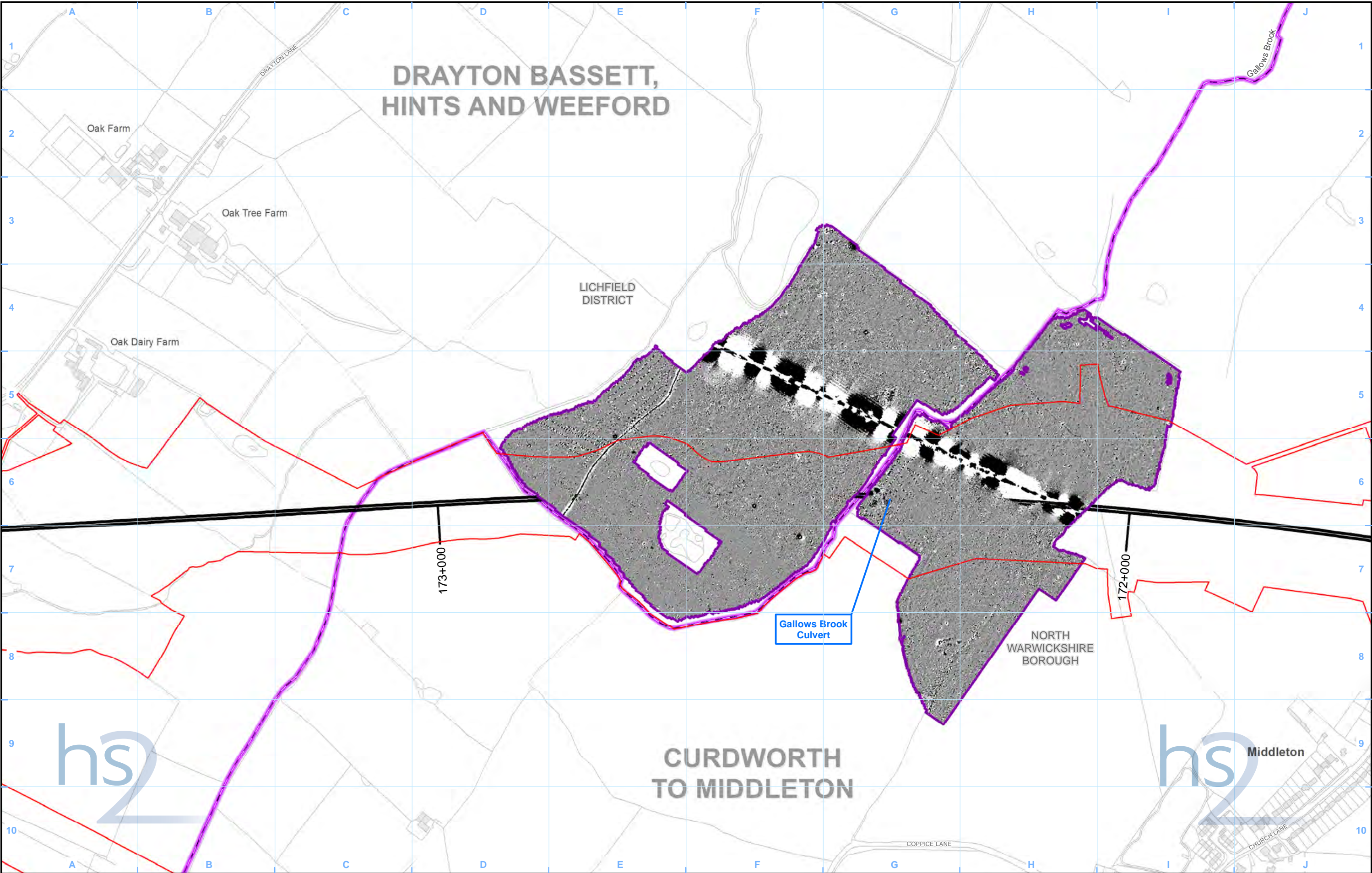
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Legend <ul style="list-style-type: none">Route in tunnelRoute on surfaceDepot, station, headhouse or portal buildingLand potentially required during constructionCommunity forum boundaryDistrict/Borough boundaryEdge of geophysical survey	Map Number CH-09-226	<p>HS2 Ltd accept no responsibility for any circumstances, which arise from the reproduction of this map after alteration, amendment or abbreviation or if it is issued in part or issued incomplete in any way.</p> <p>Registered in England. Registration number 06791686. Registered office: One Canada Square, London, E14 5AB.</p> <p>© Crown copyright and database rights 2015. Ordnance Survey Licence Number 100049190.</p> <p>Scale at A3: 1:5,000</p> <p>0 50 100 150 200 Metres</p> <p>Doc Number: C253-ATK-EV-MAP-030-001818-AP02-P01 Date: 08/06/15</p>
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	Community Forum Area CFA20: Curdworth to Middleton	



Legend <ul style="list-style-type: none">Route in tunnelRoute on surfaceDepot, station, headhouse or portal buildingLand potentially required during constructionCommunity forum boundaryDistrict/Borough boundaryEdge of geophysical survey	Map Number CH-09-227	<p>HS2 Ltd accept no responsibility for any circumstances, which arise from the reproduction of this map after alteration, amendment or abbreviation or if it is issued in part or issued incomplete in any way.</p> <p>Registered in England. Registration number 06791686. Registered office: One Canada Square, London, E14 5AB.</p> <p>© Crown copyright and database rights 2015. Ordnance Survey Licence Number 100049190.</p> <p>Scale at A3: 1:5,000</p> <p>0 50 100 150 200 Metres</p> <p>Doc Number: C253-ATK-EV-MAP-030-001820-AP02-P01 Date: 08/06/15</p>
	Map Name Archaeological Geophysical Survey - Magnetometer Data Plot SES and AP2 ES	
	Community Forum Area CFA20: Curdworth to Middleton	



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-09-231a

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

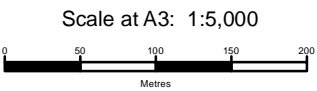
Community Forum Area CFA20:
Curdworth to Middleton



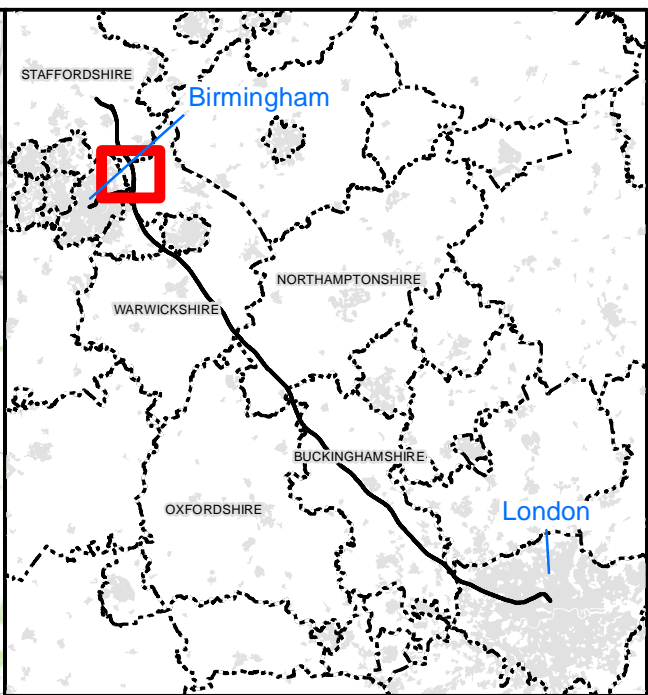
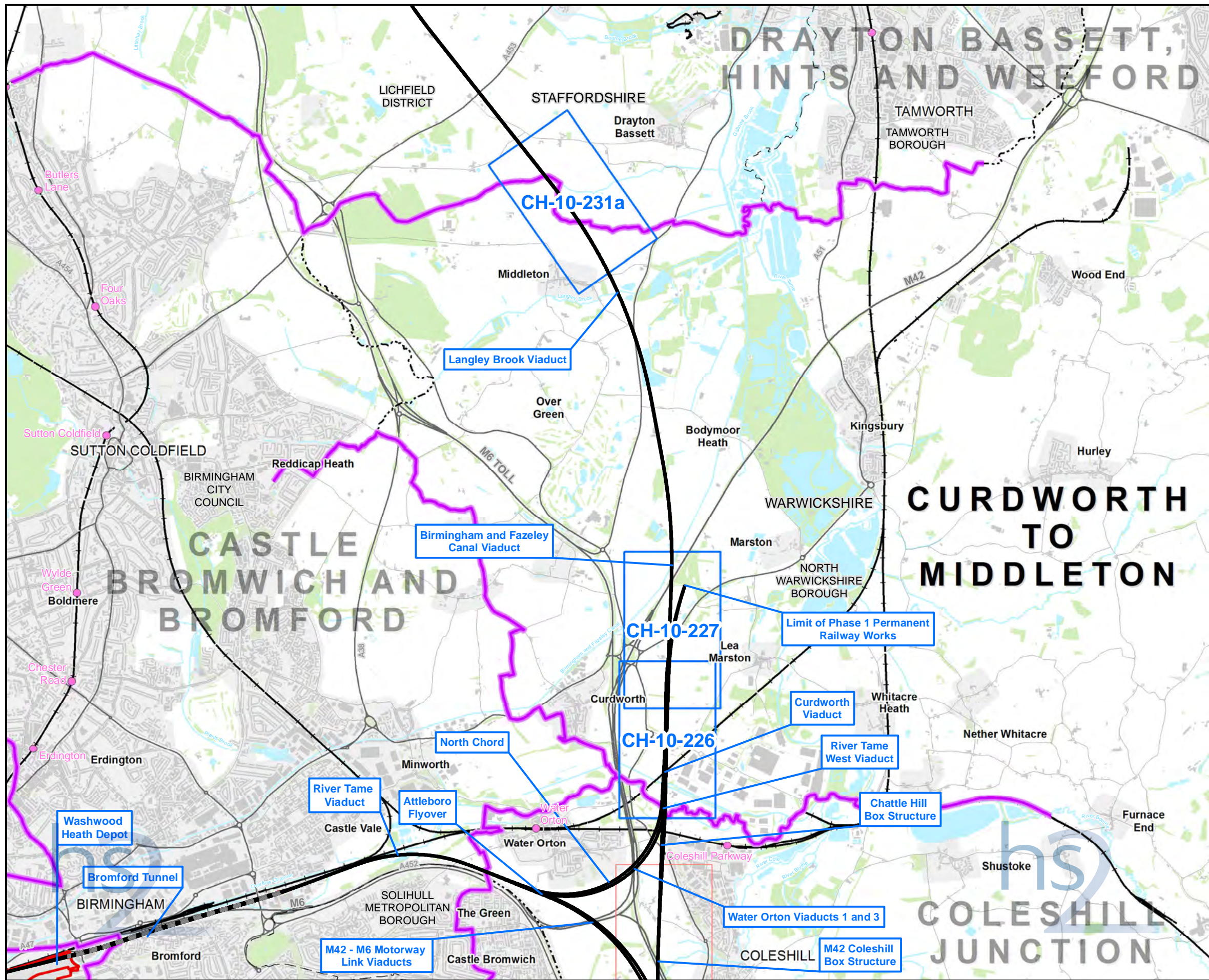
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Note: Not all data layers in the legend are represented on every map.

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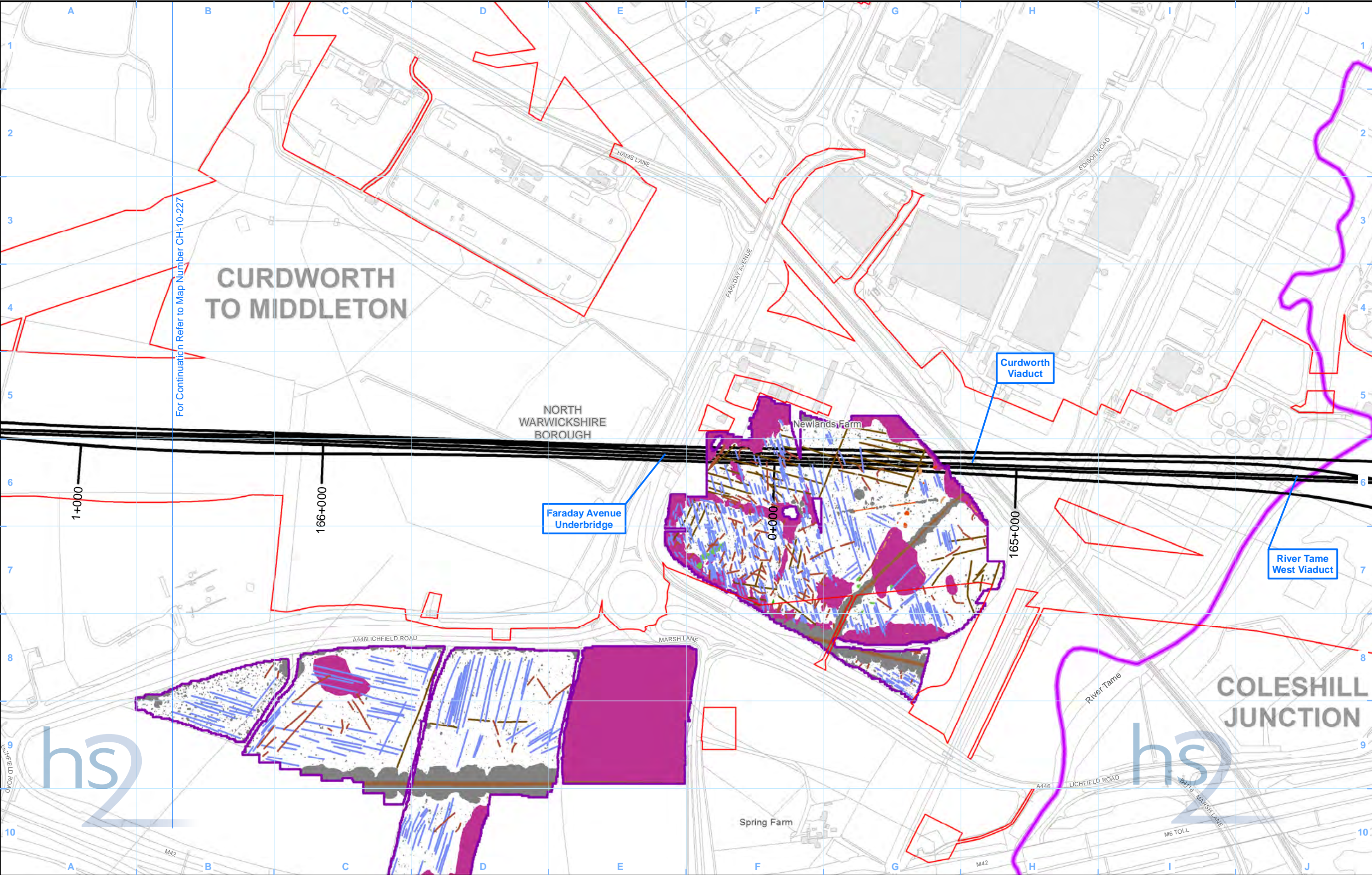
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Metres

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-10-226
Map Name	Archaeological Geophysical Survey - Interpretation Plot SES and AP2 ES Community Forum Area CFA20: Curdworth to Middleton

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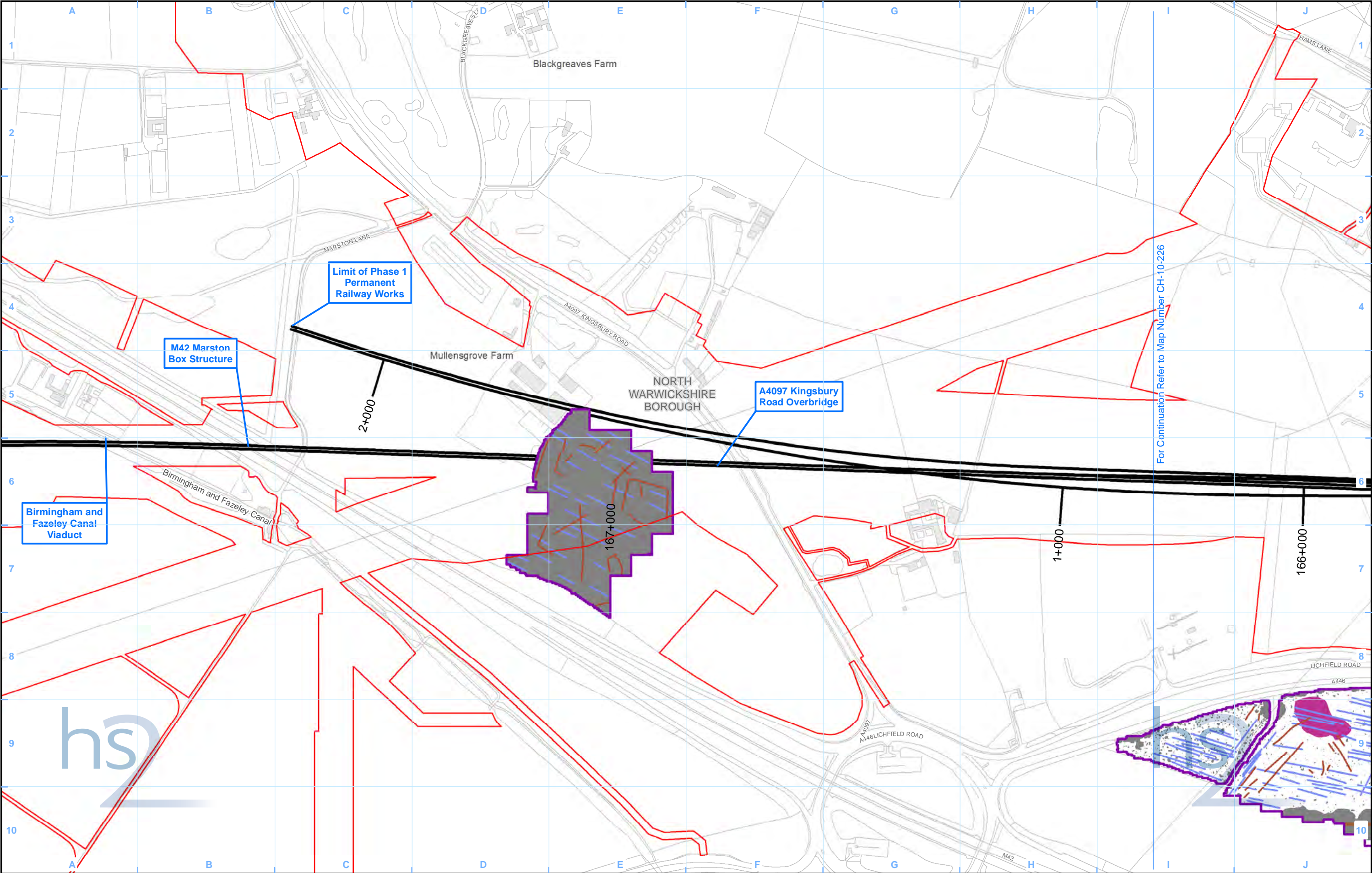
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Metres

Doc Number: C253-ATK-EV-MAP-030-001839-AP02-P01

Date: 08/06/15



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-10-227

Map Name

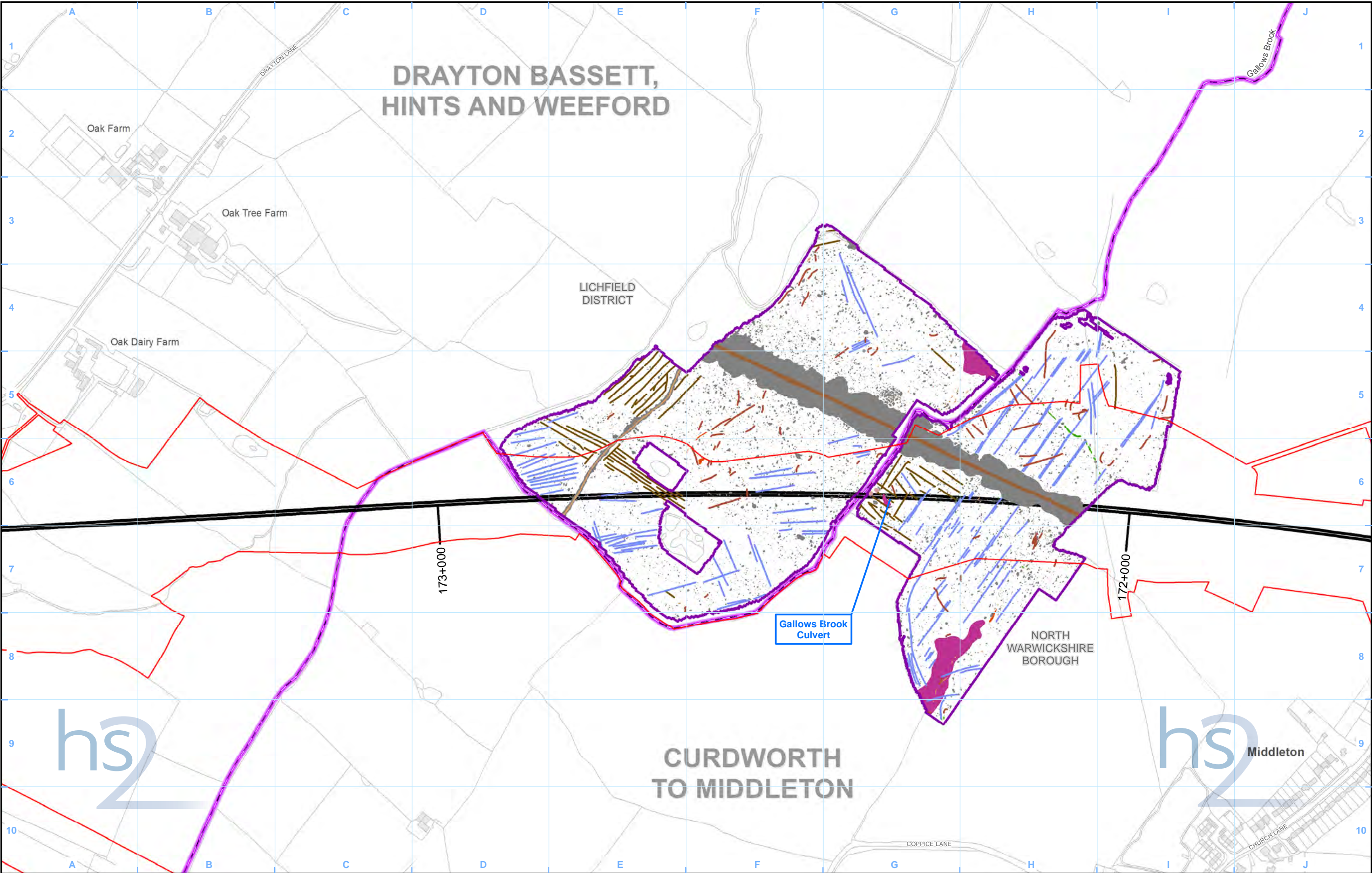
Archaeological Geophysical Survey - Interpretation Plot
SES and AP2 ES
Community Forum Area CFA20:
Curdworth to Middleton

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Doc Number: C253-ATK-EV-MAP-030-001841-AP02-P01

Date: 08/06/15



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)
- 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-10-231a

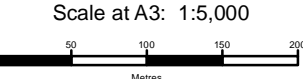
Map Name: Archaeological Geophysical Survey - Interpretation Plot SES and AP2 ES

Community Forum Area CFA20: Curdworth to Middleton



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Environmental topic:	Sound, noise and vibration	SV
Appendix name:	Operational assessment report	004
Community forum area:	Curdworth to Middleton	020

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Table 3 - Summary of operational airborne sound impacts (main ES and AP2 ES)	17

1 Introduction

- 1.1.1 This appendix provides an update to Appendix SV-004-020 Operational assessment report for community forum area (CFA) Curdworth to Middleton from the main Environmental Statement (ES) as a result of ES corrections and design changes in AP2 Group 20.2, 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 SV-004-020 Operational assessment report from the main ES.

2 Scope, assumptions and limitations

2.1 Changes of relevance to this assessment

ES correction

- 2.1.1 The dwelling at Cuttle Mill Fishery was omitted from the operational sound, noise and vibration assessment.

Supplementary Environmental Statement (SES)

- 2.1.2 Operational sound, noise and vibration assessments have been undertaken for Middleton area amendments (AP2 Group 20.2), lowering of the HS2 route northwards of Middleton.

3 Effects arising during operation

3.1 Avoidance and mitigation measures

- 3.1.1 These are set out in main ES, CFA20, Volume 2, Section 11 and additionally by this SES.

3.2 Quantitative identification of impacts and effects

Groundborne sound and vibration

- 3.2.1 The amendments does not alter the assessment of operational groundborne sound and vibration identified in main ES Appendix SV-004-020. Cuttle Mill Fishery is located outside of the scoping distance for the operational groundborne sound and vibration identified in main ES Appendix SV-001-000.

Airborne sound: direct impacts and effects

- 3.2.2 The direct effects from the operation of the scheme as well as any new, amended or altered roads or railway lines, which are identified as part of the scheme, are presented in Table 1 for those locations in the vicinity of the amendments.
- 3.2.3 The assessment information, impact criteria and significance criteria for the assessment of the incorporated mitigation case at residential and non-

residential receptors are presented in Table 1 and 2. The results should be considered in conjunction with the information contained in main ES map series Sv-02 in the CFA11 Volume 5 sound, noise and vibration map book.

- 3.2.4 Explanation of the Table 3 information is provided in main ES, Volume 5: Appendix SV-001-000 and Appendix Sv-004-011.
- 3.2.5 Table 1 presents the operational sound levels for Cuttle Mill Fishery based upon the main ES scheme, Table 2 presents the operational sound levels as a result of the amendment.

SES and AP2 ES Appendix SV-004-020

Table 1 - Operational noise – detailed results (AP2 ES correction)

Assessment Location		Impact criteria										Significance criteria								Significant effect
ID	Area represented	HS2 only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	
		Day *	Night **	Max ***	Day *	Night **	Max ***	Day *	Night **	Day *	Night **									
157992	Cuttle Mill Lane, Wilshaw	60	51	82/85	50	52	60	60	55	10	3	S	1	R	T	-	-	-	-	OSV20-Do6

SES and AP2 ES Appendix SV-004-020

Table 2 - Operational noise – detailed results (AP2 Amendment)

Assessment Location		Impact criteria										Significance criteria								Significant effect
ID	Area represented	HS2 only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	
		Day *	Night **	Max ***	Day *	Night **	Max ***	Day *	Night **	Day *	Night **									
131149	Canalside, Curdworth	42	34	55/58	54	53	55	54	53	0	0	NA	2	R	T	-	-	-	-	
131403	Farthing Lane, Curdworth	45	36	61/64	59	57	62	59	57	0	0	NA	1	R	T	H	-	-	-	
131532	Marston Lane, Curdworth	64	54	86/89	69	61	71	70	62	1	2	S	1	R	T	H	-	-	NI	OSV20-Do3
148264	Farthing Lane, Curdworth	41	32	56/58	59	57	62	59	57	0	0	NA	8	R	T	H	-	-	-	
148284	Farthing Lane, Curdworth	43	33	61/64	59	57	62	59	57	0	0	NA	7	R	T	H	-	-	-	
148328	Farthing Lane, Curdworth	44	35	61/64	59	57	62	59	57	0	0	NA	8	R	T	H	-	-	-	
148810	Coleshill Road, Curdworth	45	36	60/63	58	55	69	58	55	0	0	NA	1	R	T	H	-	-	-	
148843	Marsh Lane, Curdworth	50	41	65/68	63	60	74	63	60	0	0	NA	2	R	T	H	-	-	-	
148867	Marsh Lane, Curdworth	53	44	70/72	63	60	74	63	60	0	0	NA	1	R	T	H	-	-	-	

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Assessment Location		Impact criteria										Significance criteria								Significant effect
ID	Area represented	HS2 only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	
		Day *	Night **	Max ***	Day *	Night **	Max ***	Day *	Night **	Day *	Night **									
148957	Farthing Lane, Curdworth	43	34	60/63	55	54	56	55	54	0	0	NA	1	R	T	-	-	-	-	
149112	Lichfield Road, Curdworth	50	42	66/69	63	60	74	63	60	0	0	NA	1	R	T	H	-	-	-	
149175	Tamworth Road, Wishaw	47	37	66/69	65	57	61	65	57	0	0	NA	3	R	T	H	-	-	-	
153252	Newlands Lane, Curdworth	72	63	89/92	60	57	64	72	63	12	6	S	2	R	T	H	-	Y	NI	OSV20-Do1
153646	Kingsbury Road, Curdworth	63	53	92/94	58	54	64	64	57	6	2	S	1	R	T	-	-	-	NI	OSV20-Do2
153754	Kingsbury Road, Curdworth	54	45	66/69	53	53	60	55	53	2	0	NA	1	R	T	-	-	-	-	
153809	Blackgreaves Lane, Lea Marston	51	43	68/71	53	53	60	55	53	1	0	NA	8	R	T	-	-	-	-	
153857	Kingsbury Road, Marston	50	41	70/73	64	59	79	64	59	0	0	NA	1	R	T	H	-	-	-	

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Assessment Location		Impact criteria										Significance criteria								Significant effect
ID	Area represented	HS2 only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	
		Day *	Night **	Max ***	Day *	Night **	Max ***	Day *	Night **	Day *	Night **									
153874	Kingsbury Road, Marston	55	45	74/77	67	62	85	67	62	0	0	NA	3	R	T	H	-	-	-	
153895	Lock House Lane, Curdworth	63	54	84/87	72	64	71	72	64	1	0	S	1	R	T	H	-	-	NI	OSV20-Do5
154354	Church Lane, Middleton	43	35	58/61	50	49	51	51	49	1	0	NA	8	R	T	-	-	-	-	
154882	Bodymoor Heath Lane, Bodymoor Heath	53	44	70/73	60	52	71	61	53	1	1	NA	3	R	T	-	-	-	-	
156042	Vicarage Hill, Middleton	42	35	60/62	38	34	38	42	35	4	3	NA	3	R	T	L	-	-	-	#
156159	Church Lane, Middleton	45	37	61/64	57	44	47	60	44	2	1	NA	4	R	T	-	-	-	-	
156221	Church Lane, Middleton	44	36	60/62	52	47	49	53	47	0	0	NA	8	R	T	-	-	-	-	
156249	Church Lane, Middleton	45	37	59/62	44	40	44	46	40	2	1	NA	1	R	T	-	-	-	-	
156460	Coppice Lane, Middleton	42	33	58/61	52	47	49	53	47	0	0	NA	8	R	T	-	-	-	-	

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Assessment Location		Impact criteria										Significance criteria								Significant effect
ID	Area represented	HS2 only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	
		Day *	Night **	Max ***	Day *	Night **	Max ***	Day *	Night **	Day *	Night **									
156490	Coppice Lane, Middleton	45	36	62/65	52	47	49	53	47	1	0	NA	8	R	T	-	-	-	-	
156581	Simmons Close, Middleton	44	35	61/64	52	47	49	60	45	8	-2	NA	14	R	T	-	-	-	-	#
156612	Church Lane, Middleton	45	36	61/64	49	44	49	60	44	10	1	NA	3	R	T	-	-	-	-	#
156642	Church Lane, Middleton	44	36	57/60	50	49	51	51	49	1	0	NA	5	R	T	-	-	-	-	
156675	Church Lane, Middleton	44	36	61/64	52	47	49	53	47	0	0	NA	3	R	T	-	-	-	-	
156682	Church Lane, Middleton	46	38	62/64	60	47	47	60	48	0	1	NA	3	R	T	-	-	-	-	
156781	Coppice Lane, Middleton	49	40	66/68	43	32	49	50	40	7	8	A	1	R	T	L	-	-	-	~
157025	Tamworth Road, Wishaw	50	41	66/69	67	63	82	67	63	0	0	NA	3	R	T	H	-	-	-	
157038	The Belfry, Lichfield Road, Wishaw, (Office)	47	37	65/68	67	63	82	67	63	0	0	NA	1	R	T	H	-	-	-	

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Assessment Location		Impact criteria										Significance criteria								Significant effect
ID	Area represented	HS2 only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	
		Day *	Night **	Max ***	Day *	Night **	Max ***	Day *	Night **	Day *	Night **									
157129	Wishaw Lane, Middleton	48	40	60/63	50	42	50	51	42	1	0	NA	3	R	T	-	-	-	-	
157219	Brick Kiln Lane, Middleton	56	47	71/74	67	63	82	67	62	0	0	NA	1	R	T	H	-	-	-	
157233	Tamworth Road, Middleton	60	51	77/80	72	68	87	72	68	0	0	NA	1	R	T	H	-	-	-	
157272	Wishaw Lane, Middleton	49	41	60/63	48	40	46	49	41	1	1	NA	1	R	T	-	-	-	-	
157376	Wishaw Lane, Middleton	52	44	66/68	52	44	54	54	45	2	1	NA	1	R	T	-	-	-	-	
157403	Wishaw Lane, Middleton	50	42	62/65	50	42	50	50	42	0	0	NA	4	R	T	-	-	-	-	
157437	Wishaw Lane, Middleton	47	39	60/63	45	37	45	47	39	2	2	NA	1	R	T	-	-	-	-	
157444	Wishaw Lane, Middleton	51	43	62/65	50	42	50	51	43	1	1	NA	3	R	T	-	-	-	-	
157480	Church Lane, Middleton	48	39	62/65	49	44	49	60	45	11	1	NA	8	R	T	-	-	-	-	#

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Assessment Location		Impact criteria										Significance criteria								Significant effect
ID	Area represented	HS2 only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	
		Day *	Night **	Max ***	Day *	Night **	Max ***	Day *	Night **	Day *	Night **									
157513	Church Lane, Middleton	50	42	65/68	60	47	47	63	48	2	1	NA	4	R	T	-	-	-	-	
157552	Church Lane, Middleton	48	39	64/66	60	47	47	63	47	2	0	NA	8	R	T	-	-	-	-	
157573	Church Lane, Middleton	51	43	65/68	60	47	47	63	48	2	1	NA	7	R	T	-	-	-	-	
157603	Church Lane, Middleton	50	41	67/70	50	47	47	53	47	3	0	A	5	R	T	-	-	-	-	~
157635	Tamworth Road, Middleton	50	42	67/70	64	60	62	64	60	0	0	NA	2	R	T	H	-	-	-	
157725	Crowberry Lane, Middleton	49	41	67/70	41	37	44	49	41	9	5	A	1	R	T	L	-	-	-	~
157992	Cuttle Mill Lane, Wilshaw	59	50	83/86	50	52	60	60	54	10	2	S	1	R	T	-	-	-	-	OSV20-Do6
158064	Bodymoor Heath Lane, Bodymoor Heath	50	41	67/70	60	52	71	60	53	0	0	NA	1	R	T	-	-	-	-	

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Assessment Location		Impact criteria										Significance criteria								Significant effect
ID	Area represented	HS2 only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	
		Day *	Night **	Max ***	Day *	Night **	Max ***	Day *	Night **	Day *	Night **									
158102	Bodymoor Heath Lane, Bodymoor Heath	50	40	66/69	62	54	70	62	55	0	0	A	4	R	T	-	-	-	-	
158180	Bodymoor Heath Lane, Bodymoor Heath	52	43	69/71	50	52	73	54	53	4	1	A	2	R	T	-	-	-	-	~
158206	Bodymoor Heath Lane, Bodymoor Heath	47	38	65/67	65	57	76	65	57	0	0	A	4	R	T	H	-	-	-	
158314	Bodymoor Heath Lane, Kingsbury	51	41	68/71	54	56	77	56	56	2	0	A	5	R	T	H	-	-	-	
158349	Bodymoor Heath Lane, Middleton	62	53	79/82	57	53	72	63	55	6	3	A	1	R	T	-	-	-	-	~
158471	Middleton, Tamworth	51	43	62/65	54	50	52	55	51	1	0	A	2	R	T	-	-	-	-	
190438	Hams Lane, Lea Marston	42	34	51/54	56	56	62	56	56	0	0	A	2	R	T	H	-	-	-	
191067	Haunch Lane, Lea Marston	44	36	60/62	53	53	60	54	53	0	0	A	4	R	T	-	-	-	-	

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Assessment Location		Impact criteria										Significance criteria								Significant effect
ID	Area represented	HS2 only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	
		Day *	Night **	Max ***	Day *	Night **	Max ***	Day *	Night **	Day *	Night **									
700645	Church Lane, Middleton	41	33	57/60	50	49	51	50	49	0	0	A	1	R	T	-	-	-	-	
711045	Kingsbury Road, Curdworth	61	51	77/80	58	54	64	63	56	5	2	A	1	R	T	-	-	-	-	~
711047	Middleton House Farm	65	55	86/89	57	53	72	66	57	9	4	S	1	R	T	-	-	-	NI	OSV20-Do4
131403	Curdworth Primary School, (Primary School)	45	36	61/64	59	57	62	59	57	0	0	B	1	G4	T	H	-	-	-	
131532	Dunton Stables (Stables)	64	54	86/89	69	61	71	70	62	1	2	B	1	G5	T	H	-	-	-	
149112	Dunton Wharf, Lichfield Road, (General Commercial)	50	42	66/69	63	60	74	63	60	0	0	B	1	G5	T	H	-	-	-	
149112	Wishaw Lane, Curdworth, (General Commercial)	50	42	66/69	63	60	74	63	60	0	0	B	1	G5	T	H	-	-	-	

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Assessment Location		Impact criteria										Significance criteria								Significant effect
ID	Area represented	HS2 only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	
		Day *	Night **	Max ***	Day *	Night **	Max ***	Day *	Night **	Day *	Night **									
152897	Hams Hall National Distribution Park, Canton Lane (General Commercial)	51	42	64/67	69	66	85	69	66	0	0	B	7	G5	T	H	-	-	-	
153153	Edison Road, Hams Hall (General Commercial)	56	47	74/77	59	56	60	60	56	2	0	B	1	G5	T	H	-	-	-	
153646	Dunton Hall, Kingsbury Road, (Veterinary Clinic)	63	53	92/94	58	54	64	64	57	6	2	B	1	G5	T	-	-	-	-	OSV20-No1
153754	Kingsbury Road, Curdworth, (General Commercial)	54	45	66/69	53	53	60	55	53	2	0	B	1	G5	T	-	-	-	-	
154354	Church Lane, Middleton, (Shopping)	43	35	58/61	50	49	51	51	49	1	0	B	1	G5	T	-	-	-	-	
156042	Vicarage Hill Farm, Vicarage Hill (Equestrian Training)	42	35	60/62	38	34	38	42	35	4	3	B	1	G4	T	L	-	-	-	\$

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Assessment Location		Impact criteria										Significance criteria								Significant effect
ID	Area represented	HS2 only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect	
		Day *	Night **	Max ***	Day *	Night **	Max ***	Day *	Night **	Day *	Night **									
156675	Middleton Recreation Room, Church Lane, Middleton, (Hall)	44	36	61/64	52	47	49	53	47	0	0	B	1	G3	T	-	-	-	-	
156781	Upper House Farm, Coppice Lane, Middleton, (Office)	49	40	66/68	43	32	49	50	40	7	8	B	1	G5	T	L	-	-	-	\$
157038	The Belfry, Lichfield Road, Wishaw (Office)	47	37	65/68	67	63	82	67	63	0	0	B	2	G5	T	H	-	-	-	
158003	Marston Farm Hotel, Dog Lane, Bodymoor Heath (Hotel)	54	45	68/71	61	63	85	62	63	1	0	B	1	G4	T	H	-	-	-	
158471	Middleton (Office)	51	43	62/65	54	50	52	55	51	1	0	B	1	G5	T	-	-	-	-	
191067	Haunch Lane, Lea Marston, (Hotel)	44	36	57/60	53	53	60	54	53	0	0	B	1	G4	T	-	-	-	-	

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Assessment Location		Impact criteria										Significance criteria									
ID	Area represented	HS2 only (Year 15 traffic)			Do nothing (Opening year baseline)			Do something (Opening year baseline + Year 15 traffic) ****		Change		Type of effect	Number of impacts	Type of receptor	Receptor design	Existing environment	Unique feature	Combined impact	Mitigation of effect		Significant effect
		Day *	Night **	Max ***	Day *	Night **	Max ***	Day *	Night **	Day *	Night **										
700643	St. John The Baptist Church, Middleton (Church)	45	36	58/60	52	47	49	53	47	1	0	B	1	G3	T	-	-	-	-		
700645	Green Man Inn, Church Lane, Middleton (Inn)	42	34	55/58	50	49	51	51	49	1	0	B	1	G5	T	-	-	-	-		

Direct impact - Summary

- 3.2.7 The operational airborne noise impacts identified in Table 1 are summarised in Table 2, including those included in Appendix 5, SV-004-020 Table 4.

Table 2: Summary of operational airborne sound impacts (main ES and AP2 ES)

Receptor	Number of Impacts		
	Minor	Moderate	Major
Residential properties	7	6	3
Non-residential properties	0	1	0
Quiet Areas	None	None	None

3.3 Assessment of significance of effects

Residential receptors: direct effects- individual dwellings

- 3.3.1 Taking account of the avoidance and mitigation measures incorporated into the scheme, the main ES assessment identified a number of residential dwellings, close to the scheme, where noise would exceed the daytime trigger threshold set forth in the Regulations. It is therefore estimated that these buildings are likely to qualify for noise insulation under the Regulations. These dwellings include the following and are indicated on Volume 5: Map Book – Sound, noise and vibration, Map series SV-02:
- Orchard Bungalow and Newlands Farm, Newlands Lane, Curdworth, receptor reference 153252 (marked as OSV20-Do1 in Table 1); and
 - The Bungalow, Middleton Farm, Tamworth Road, Middleton, receptor reference 711047 (marked as OSV20-Do4 in Table 1).
- 3.3.2 The main ES assessment also identified three additional residential buildings close to the scheme, Dunton Hall and Dunton Stables off Kingsbury Road, Curdworth, and 254 Lock House Lane, Curdworth, represented by receptors 153252, 153646 and 153895 (marked as OSV20-Do2, OSV20-Do3 and OSV20-Do5 in Table 1); where the daytime forecast noise level does not exceed the threshold set in the Regulations but the forecast night-time noise level would exceed the World Health Organization's Interim Target of 55dB₁, or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion². It is estimated that these buildings will also be offered noise insulation as described previously in the Avoidance and mitigation measures section. These are also identified as being likely to qualify for noise insulation as a consequence of construction noise as described earlier in this

¹ World Health Organization (2010), *Night-time Noise Guidelines for Europe*.

² During the night (2300-0700) a significant effect is also identified where the scheme results in a maximum sound level at the façade of a building at or above: 85dB L_{pAFmax} (where the number of train pass-bys exceeding this value is less than or equal to 20); or 80dB L_{pAFmax} (where the number of train pass-bys exceeding this value is greater than 20).

section. These buildings are indicated on main ES Volume 5: Map Book - Sound, noise and vibration, Map series SV-02.

- 3.3.3 Additionally, as result of the ES correction, Cuttle Mill Fishery, represented by receptor 157992 (marked as OSV20-Do6 in Table 1); where the daytime forecast noise level does not exceed the threshold set in the Regulations but the forecast night-time noise level would exceed the World Health Organization's Interim Target of 55dB₃, or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion⁴. It is estimated that these buildings will also be offered noise insulation as described previously in the Avoidance and mitigation measures section. These are also identified as being likely to qualify for noise insulation as a consequence of construction noise as described earlier in this section. These buildings are indicated on AP2 ES Volume 5: Map Book - Sound, noise and vibration, Map series SV-02. The significant operational noise effect at this property remains when considering AP2 Group 20.2.
- 3.3.4 The mitigation measures, including noise insulation, will reduce noise inside all dwellings such that it will not reach a level where it would significantly affect residents.

Residential receptors: direct effects- communities

- 3.3.5 No change from main ES.

Residential receptors: indirect effects

- 3.3.6 No change from main ES.

Non-residential receptors: direct effects

- 3.3.7 No change from main ES.

Non-residential receptors: indirect effects

- 3.3.8 No change from main ES.

Cumulative effects

- 3.3.9 No change from main ES.

³ World Health Organization (2010), *Night-time Noise Guidelines for Europe*.

⁴ During the night (2300-0700) a significant effect is also identified where the scheme results in a maximum sound level at the façade of a building at or above: 85dB L_{pAFmax} (where the number of train pass-bys exceeding this value is less than or equal to 20); or 80dB L_{pAFmax} (where the number of train pass-bys exceeding this value is greater than 20).

Environmental topic:	Water resources and flood risk assessment	WR
Appendix name:	Flood risk assessment	003
Community forum area:	Curdworth to Middleton	020

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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-003-20 Flood risk assessment from the main ES (Volume 5). This update should be read in conjunction with Appendix WR-003-20 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-003-020 within the main ES.

2 Summary of changes outside the existing limits of the Bill

2.1 Proposed development

- 2.1.1 The Bill provides for the route between Park Lane, Middleton and Drayton Bassett to alternate between cutting and embankment. Planting and landscape earthworks will be undertaken throughout this section of the route. At the northern end of this section the route meets the CFA21 (Drayton Bassett, Hints and Weeford) boundary. A key feature of this section of the route that relates to the this amendment and flood risk is a viaduct with five spans approximately 90m long over Langley Brook (Langley Brook viaduct) with a 3m noise barrier on the west side of the viaduct.

Local flood risk receptors

- 2.1.2 Towards the northern extent of the Curdworth to Middleton CFA, Langley Brook flows from west to east. The catchment area draining to this location is 16.5km² and the width of the 1 in 100 (1%), floodplain at the proposed crossing is 167m allowing for climate change. There are no residential properties within the floodplain near to the route. The land use within the floodplain between Crowberry Lane and the HS2 route

includes a sewage treatment works and equine facilities, which is categorised as less vulnerable (moderate value receptor).

- 2.1.3 There are no residential properties affected that are located within the modelled 1 in 100 (1%) plus climate change floodplain. The flood risk assessment (FRA) in Volume 5: Appendix WR-003-020 provides further details of receptors within the Flood Zones and their vulnerability.

Description of AP2 amendments relevant to flood risk

- 2.1.4 The revision of the Langley Brook structure, reducing the width of the viaduct has the potential to affect flood conveyance along the Langley Brook. As the structure crosses the river and encroaches into the floodplain the amendments are in a location of high flood risk.

2.2 Existing flood risk

Risk of flooding from rivers

Langley Brook

- 2.2.1 The Environment Agency Flood Zone mapping indicates that the area surrounding the proposed Langley Brook viaduct (main ES Volume 5: CFA20 Map Book, Map WR-01-034, D5) 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 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 20 (5%) annual probability event. Flood levels were also determined for the 1 in 1000 (0.1%) annual probability event to ensure that the proposed track will not be at risk during this event. The flood extents and levels as determined through hydraulic modelling are detailed in the river modelling report of the main ES (WR-004-013).
- 2.2.4 The vulnerability classification has been taken from the NPPF and relates to the vulnerability of existing development in areas currently at risk from river flooding. Upstream of the Langley Brook viaduct is a sewage treatment works which is adjacent to the flood extent. This sewage treatment works is one of a number of specified land uses considered 'less vulnerable' to the risk of river flooding, as described within the NPPF.

Summary of baseline flood risk

- 2.2.5 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	Langley Brook	High Risk	Langley Brook viaduct	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

Langley Brook viaduct

- 2.3.1 Hydraulic modelling at this location showed that the original scheme would result in an increase in flood levels upstream of the proposed mitigation area during the 1 in 100 (1%) annual probability event with an allowance for climate change. This effect would have been reduced through the provision of replacement floodplain storage.

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

Langley Brook viaduct

- 2.4.2 The revised crossing consists of a 40m long viaduct structure of with two piers crossing Langley Brook, SWC-CFA20-013 (Map WR-05-058, F6, Volume 5: CFA20 Map Book). The proposed embankment will encroach onto approximately 110m of existing floodplain to the south of the crossing and approximately 10m to the north of the crossing.
- 2.4.3 The existing floodplain is mostly agricultural land and a minor road crossing approximately 300m upstream. A sewage treatment works is located 100m to the west of the crossing which could potentially be impacted by any changes to the floodplain.
- 2.4.4 The proposed embankment and viaduct piers will reduce the volume of the floodplain and constrict flows at the crossing location, potentially increasing flood risk in the area.
- 2.4.5 The hydraulic modelling at the Langley Brook viaduct carried out to assess this amendment indicates that the Proposed Scheme would have a minor impact on flood levels during the 1 in 100 (1%) annual probability event with an allowance for climate change. However hydraulic modelling has indicated that replacement floodplain

storage can be provided upstream of this crossing to reduce change to a negligible impact.

- 2.4.6 The hydraulic modelling for works at Langley Brook assumes that the A4091 Tamworth Road culvert (located approximately 200m downstream of the Langley Brook viaduct) will act as a constriction to flow. There will be a negligible increase of 2mm on flood levels during the 1 in 100 (1%) annual probability event with an allowance for climate change and a negligible impact of 3mm on flood levels during the 1 in 1000 (0.1%) annual probability event raising levels to 72.829mAOD. Therefore the road embankment works at this location will have a negligible impact on river flood risk.
- 2.4.7 There will be a small reach 150m long where increases in flood levels will be higher than 10mm. This reach is restricted to the area adjacent to the proposed crossing and the proposed mitigation area.

Summary of potential impacts and effects on flood risk

Receptor	Vulnerability classification	Pathway	AP2 amendment leading to impact	Effects
Agricultural Land	Less vulnerable	Fluvial	Langley Brook Viaduct	Negligible upstream of mitigation area
Sewage Treatment Works	Essential infrastructure	Fluvial	Langley Brook Viaduct	Negligible upstream of mitigation area

Residual flood risk

Langley Brook viaduct

- 2.4.8 Failure of the proposed Langley Brook viaduct is unlikely to significantly impact flood risk in the area, therefore there are minimal residual risks at this crossing location.

Compliance with local planning policy

Langley Brook

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

