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West Midlands Interchange Staffordshire

Outline Written Scheme of Investigation for a Programme of Archaeological
Evaluation

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West Midlands Interchange Staffordshire

Outline Written Scheme of Investigation for a Programme of Archaeological Evaluation

1 INTRODUCTION

1.1 Project and planning background

- 1.1.1 Wessex Archaeology has been commissioned by Four Ashes Limited ('the client'), to produce an outline written scheme of investigation (WSI) for a programme of archaeological evaluation of land at Four Ashes, Staffordshire ('the Site', **Figure 1**), centred on National Grid Reference (NGR) 391856, 309745. This document will support an application for a Development Consent Order (DCO), to be submitted to the Secretary of State (SoS) via the Planning Inspectorate (PINS).
- 1.1.2 A Historic Environment Desk-based Assessment (Wessex 2017a) and a LiDAR Assessment (Wessex 2017b) has been undertaken of the Site, along with geophysical survey of priority areas (Wessex 2017c). These surveys were produced to support an Environmental Impact Assessment.
- 1.1.3 Following information gathered from these previous archaeological investigations, the Site has been split into zones based upon potential for known and currently unknown archaeological remains.
- 1.1.4 The proposed programme of archaeological evaluation will comprise additional geophysical survey, trial trench evaluation and archaeological watching brief during site investigation works (i.e. intrusive geotechnical surveys).
- 1.1.5 The scope of this WSI takes account of comments from Staffordshire County Council (SCC) in a Stage 2 Consultation Document and provides an overview of the full programme of archaeological evaluation required to fully appreciate the archaeological potential of the Site and outline the process of liaison between all interested parties, including the SCC Principal Archaeologist, the Local Planning Authority (LPA), Historic England and the conservation officer.

1.2 Scope of document

- 1.2.1 This WSI provides the overall scope for further archaeological investigations within the Site. Detailed WSIs for work within specific development areas will be produced based on detailed design plans, where they are located within the Archaeological Potential Zones (see Section 3) and in consultation with the SCC Principal Archaeologist.
- 1.2.2 The specific aims of the evaluation, and the methods and standards that will be employed are set out below. In format and content, it conforms to current best practice, as well as to the guidance in *Management of Research Projects in the Historic Environment* (MoRPHE, Historic England 2015a) and the Chartered Institute for Archaeologists' (CIfA) standards (CIfA 2014a to c).



- 1.2.3 This document will be submitted to the SCC Principal Archaeologist, the archaeological advisor to the Local Planning Authority (LPA), for approval, prior to the start of the evaluation.

1.3 Location, topography and geology

- 1.3.1 The Site comprises five parcels of land comprising a total of approximately 300 hectares (ha) located immediately to the north of Four Ashes industrial estate, approximately 1.6 km north-east of the village of Coven and approximately 5 km west of Cannock, Staffordshire.
- 1.3.2 The Site is currently primarily under arable cultivation in the north and pasture in the south and consists of numerous fields enclosed by hedgerows. An area totalling approximately 20 ha is covered by woodland which encompasses the eastern half of a wood named on Ordnance Survey maps as 'Calf Heath Wood', and approximately 19 hectares comprises the site of a quarry. The route of the Staffordshire and Worcestershire canal and the Wrinchill to Wolverhampton railway line run through the Site, although neither are included within any of the land parcels.
- 1.3.3 The Site is broadly bounded on four sides by roads, the A449 along the western edge, the A5 along the northern edge, the M6 along the north-eastern edge and Straight Mile along the southern edge. A further land parcel is located to the south of Straight Mile and bounded to the south by the Staffordshire and Worcestershire canal. The Four Ashes industrial estate is located immediately to the south of the Site. Beyond the immediate boundaries of the Site its environs are characterised by agricultural land with farmsteads, residential properties and scattered settlements.
- 1.3.4 The Site is situated within a relatively flat area of land at an elevation of approximately 16-18m above Ordnance Datum (aOD). Local topography falls gently to the south towards the valley of the River Stour.
- 1.3.5 The underlying bedrock geology throughout the Site is mapped as sandstone of the Wildmoor Sandstone Formation and the Bromsgrove Sandstone Formation. A large area of Glaciofluvial Deposits of Sand and Gravel from the Devensian period, or latest ice age, is present within the Site either side of the Staffordshire and Worcestershire Canal with smaller areas of Alluvium (British Geological Survey).

2 ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

2.1 Introduction

- 2.1.1 The archaeological and historical background was assessed in a prior desk-based assessment (Wessex 2017a), which considered the recorded historic environment resource within a 1 km study area of the proposed development. A summary of the results is presented below, with relevant entry numbers from the Staffordshire Historic Environment Record (HER) and the National Heritage List for England (NHLE) included. Additional sources of information are referenced, as appropriate.

2.2 Previous investigations related to the proposed development

LiDAR Assessment (2017)

- 2.2.1 Wessex Archaeology was commissioned to undertake a Light Detection and Ranging (LiDAR) assessment of the Site. The study will form a technical appendix for the Environmental Statement (ES). This resulted in the identification of a number of features of archaeological potential across the Site, except for Calf Heath Wood where understorey

and leaf litter may be masking the ground surface and in the Woodside Farm House area, where quarrying has appeared to remove any traces of possible archaeological activity.

- 2.2.2 A number of these features appear to represent the possible remains of ridge and furrow and other agricultural activity. Earlier land division, in the form of former field boundaries, is also a common feature across the Site. The cropmark features recorded in the Staffordshire Historic Environment Record are not visible in the LiDAR data, suggesting that subsequent agricultural activity in the area of the Site has removed any clear above-ground evidence.

Geophysical Survey (2017)

- 2.2.3 Wessex Archaeology was commissioned to undertake a detailed gradiometer survey of areas identified in the DBA as having to have the highest potential for the presence of buried archaeological remains. The survey will form a technical appendix for the ES chapter.
- 2.2.4 Six areas were surveyed, totalling an area of 37 ha. The anomalies identified as being of archaeological interest are primarily pit and ditch-like features. However, a possible ring-ditch and two probable former field boundaries have also been identified. These features are predominantly located directly south of the Roman road known as Watling Street, which is adjacent to the northern boundary of the site along the current route of the A5. Evidence for historic Ridge and Furrow ploughing has been clearly identified in two areas.

Trial Trench Evaluation (2016)

- 2.2.5 In 2016, Oxford Archaeology South undertook an archaeological evaluation of the proposed new warehouse at the former chemical works site, located adjacent to the Site. A total of 15 trenches were excavated across undisturbed areas of the site, all measuring 50 m by 2 m. No significant archaeological remains were identified (OAS 2016).

2.3 Archaeological and historical context

Neolithic, Bronze Age and Iron Age (4000 BC – AD 43)

- 2.3.1 The earliest archaeological evidence is located within the Site. Cropmarks identified from aerial photographs indicate the presence of a ring ditch and linear feature (SHER No. MST1789) which have been dated to the Neolithic period, while a possible ring ditch (SHER MST4205), also identified in aerial photographs, is recorded as being of Bronze Age date. Additionally, two barrows (SHER MST1075), located approximately 400 m south of the Site, were noted by antiquarians in the 17th and 18th centuries. However, gravel quarrying in the area appears to have removed any remains.
- 2.3.2 Cropmarks identified from aerial photographs approximately 660 m north-west of the Site (SHER MST1790) comprise two contemporary enclosures, one of which is noted by the SHER as being an irregular enclosure containing two sub-circular enclosures and linear features. The SHER records these features as dating to the Iron Age.

Romano-British (AD 43 – 410)

- 2.3.3 The Study Area contains evidence for significant occupation during the Romano-British period which includes four Scheduled Monuments (NHLE Nos 1006097, 1006098, 1006104 and 1006121). The activity during this period is mainly clustered approximately 750 m north-west of the Site where the assets in this area are described within the NHLE listing as occupying a 'strategic location and a nodal point in the Roman road system, with roads leaving Watling Street for Chester, Wroxeter, Greensforge, and perhaps Metchley'.
- 2.3.4 Watling Street (SHER MST1138) ran from the east coast of England, through the major settlements at London (*Londinium*) and St Albans (*Verulaium*), along the northern edge of

the Site to the settlement at Water Eaton (*Pennocrucium*) and on towards the major town at Wroxeter (*Viroconium Cornoviorum*). Three subsidiary roads are recorded within the immediate area comprising the road from Crateford to Standeford Green (SHER MST6022), the road from *Pennocrucium* to Kingswood (SHER MST1889) and the road from *Pennocrucium* to Greensford (SHER MST12107).

- 2.3.5 Three of the Scheduled Monuments relate to camps or forts constructed by the Roman military. Two camps north of Water Eaton (NHLE No. 1006097) survive as buried archaeological remains. The camps comprise rectangular or sub-rectangular enclosures which were used by Roman soldiers when on campaign or as practice camps and as such were likely only used temporarily.
- 2.3.6 A vexillation fort (NHLE No. 1006104) is likely to represent the first semi-permanent structure the Roman army constructed within the Study Area (roman-britain.co.uk 2016). The fort was discovered via aerial photo reconnaissance in 1946 by Dr. J.K. St Joseph who subsequently excavated two sections across the western defences. Subsequent excavations in the early 1970s identified the earliest fort was constructed c. AD 50 with occupation continuing until the early Flavian period (AD 69- 96). The fort was reduced in size later in its occupational lifespan with approximately 120 m removed from its eastern defences.
- 2.3.7 A second fort (NHLE No. 1006098) is located west of Eaton House, approximately 600 m west of the Site. The fort measures approximately 2 ha in size with two external ditches on the eastern and northern sides. Daub and gravel from the interior of the fort were turned up during ploughing in the 1960s while the pottery scatter recovered from the area included rusticated ware, an amphora neck, mortaria fragments and Samian Ware. The fort is overlain by earthworks relating to later ridge and furrow agriculture with no trace of the fort visible on recent aerial photographs.
- 2.3.8 In addition to the Roman military installations to the north-west of the Site are the Scheduled remains of the Roman settlement of *Pennocrucium* (NHLE No. 100612). Excavations following its discovery uncovered a rectangular enclosure adjacent to Watling Street with timber buildings fronting on to the road. The excavations identified two possible occupation phases with the pottery assemblage suggesting the settlement flourished from the late 1st to late 3rd century AD.
- 2.3.9 Aside from the Scheduled Monuments and roads, the area around the site has yielded Roman pottery and coins, including a complete silver Roman republican denarius minted in 82 BC found within the Site (SHER MST15931).

Anglo-Saxon and medieval (AD 410 – 1500)

- 2.3.10 Two settlements are recorded within the area as tracing their origins to the Anglo-Saxon period. Gailey, or Gragelie, (SHER MST2456) located within the Site is recorded as having one villager in the Domesday Survey on 1086 while the settlement at Rodbaston, or Redbaldeson, (SHER MST1226), located approximately 540 m north of the Site, comprised four smallholders at the time of the survey following the Norman Conquest of 1066. At Rodbaston the earthwork remains of at least three house platforms have been identified. The settlement at Water Eaton is recorded in the Domesday Survey of 1086 as settlement as containing ten households suggesting its establishment during the Anglo-Saxon period.
- 2.3.11 Other finds from the Anglo-Saxon period within the area include two copper alloy strap ends (SHER MST12107) found approximately 250 m north of the Site while a copper alloy strap

end and stirrup strap mount with an animal's head (SHER MST16617) were recovered within the Site.

- 2.3.12 A series of upstanding earthworks (SHER MST4933) located approximately 300 m south of the Site have been interpreted as the possible remains of a medieval moat while a rectangular feature interpreted as a ploughed-out moat (SHER MST2715) is located approximately 1 km north-west of the Site. The SHER notes latter of these may in fact relate to the significant Roman occupation of this area noted above.

Post-medieval, 19th century and modern (AD 1500 – present day)

- 2.3.13 Evidence suggests the rural character of the landscape surrounding the Site changed little between the end of the medieval period and the beginning of the post-medieval period. Two post-medieval mills are recorded in the area. Deepmore Mill (SHER MST2257) is an 18th century mill located approximately 500 m south of the Site. The former course of the mill stream (SHER MST18843) is still visible as a cropmark although some remains of the mill are still visible including a dry pond and a stone and brick revetment. The second mill, Standeford Mill (SHER MST2266), is located approximately 800 m south of the Site and initially operated as a watermill, although it is recorded as a corn mill in the late 19th century.
- 2.3.14 Somerford Park (SHER MST6192) is located approximately 220 m south-west of the Site and was likely laid out in the mid-18th century. The layout of the park is almost identical to the park at Prestwood Hall which was designed by the famed landscape architect Humphrey Repton, although there is no documentary evidence to suggest Repton was involved.
- 2.3.15 The most significant change in the landscape was the introduction of the Staffordshire and Worcestershire Canal (SHER MST1229) in 1772. The canal was designed by James Brindley, the engineer responsible for the Trent and Mersey Canal, as part of his wider plan to link the cities of Hull, Bristol and Liverpool with waterways (gracesguide.co.uk 2016). Several features associated with the canal are also present, mainly comprise locks and lock keeper's cottages including the Grade II Listed 18th century Round House (NHLE No. 1188285) located between two of the land parcels west of Gailey along the northern edge of the Site. Adjacent to the Round House, Gailey Wharf (SHER MST1237) is a Grade A locally listed building which includes a restored 18th century revolving crane. Within the south of the Study Area is a canal aqueduct (SHER MST1256) and the Grade A locally listed Deepmore Bridge (SHER MST2772).
- 2.3.16 Little about the character of Site and the Study Area changes in the 19th century as the area remaining broadly rural. The Grade II Listed Wharf Cottage (NHLE No. 1039205) is another within the group of buildings associated with the canal located between two of the land parcels east of Gailey along the northern edge of the Site, adjacent to the Round House and Gailey Wharf. The Hatherton Branch of the canal (NHLE No. MST2201) was built in 1860 to connect the Staffordshire and Worcestershire canal (SHER MST1229) to the Wyrley and Essington Canal. Archaeological excavations during the construction of the M6 toll at Great Wyrley uncovered remains connected with the canal including railway tracks, a wharf and an aqueduct.
- 2.3.17 The route of the Grand Junction Railway runs through the Site. Gailey Railway Station (SHER MST1270) is located between two of the land parcels west of Gailey along the northern edge of the Site. It was built in 1837 along the Grand Junction Railway line which runs through the Site, although is not located within any of the constituent parcels. The railway was constructed in 1833 and ran between Newton Junction near Warrington to Birmingham (gracesguide.co.uk 2016).



- 2.3.18 Other assets from the 19th century within the Study Area include a group of cottages (SHER MST1259) approximately 100 m south of the Site, and several farmsteads including Model Farm (SHER MST13237), Lowlands Farm (SHER MST21772) and Stable Farm (SHER MST22578). The local listed (Grade B) Heath Farm (SHER MST22071) is located within the southern portion of the Site.

3 ARCHAEOLOGICAL POTENTIAL: ZONING

- 3.1.1 Based on current knowledge, the Site has been divided into four zones of archaeological potential (Figure 3):

- High: Areas which are known to contain, or are located adjacent to, known archaeological remains including the Roman Road, Watling Street, and features visible such as cropmarks on aerial photographs;
- Moderate: Areas located close to known archaeological remains or are located within an area where evidence indicates the potential for significant archaeological remains;
- Low: Areas located away from known archaeological remains or are located within an area where evidence indicates little potential for significant archaeological remains; and
- None: Areas which have previously been disturbed and are unlikely to contain any remaining archaeological features.

- 3.1.2 The scale of archaeological work required for each phase/section of the proposed development will be determined by detailed design plans, their location within one of these zones and consultation with the Principal Archaeologist for SCC but are likely comprise one or more of the techniques detailed below to a higher or lower degree.

- 3.1.3 Where appropriate, in areas of soft landscaping where the ground will not be disturbed, further archaeological investigations may not be necessary. The requirement for investigations will be determined based on final designs and in consultation with the Principal Archaeologist for SCC.

4 AIMS AND OBJECTIVES

4.1 General objectives

- 4.1.1 Following consideration of the archaeological potential of the Site and results of the current assessment work, the objectives of the archaeological works are:

- To examine the potential for the presence of prehistoric features in the Site as indicated by aerial photographs;
- To examine the potential for evidence of Iron Age and Roman settlement activity;
- To examine the potential for Anglo-Saxon settlement activity; and
- To examine evidence for remains of medieval/post-medieval ridge and furrow (known from historic maps) and assess if this has impacted on any earlier remains.

4.2 Aims of geophysical survey

- 4.2.1 The aims (or purpose) of the geophysical survey, in compliance with the ClfA' *Standards and guidance for archaeological geophysical survey* (ClfA 2014a), are:



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

4.3 Objectives of geophysical survey

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

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

4.4 Aims of trial trench evaluation

4.4.1 The general aims (or purpose) of the evaluation, in compliance with the ClfA' *Standard and guidance for archaeological field evaluation* (ClfA 2014b), are:

- To provide information about the archaeological potential of the site; and
- To inform either the scope and nature of any further archaeological work that may be required; or the formation of a mitigation strategy (to offset the impact of the development on the archaeological resource); or a management strategy.

4.5 Objectives of trial trench evaluation

4.5.1 In order to achieve the above aims, the general objectives of the evaluation are:

- To determine the presence or absence of archaeological features, deposits, structures, artefacts or ecofacts within the specified area;
- To establish, within the constraints of the evaluation, the extent, character, date, condition and quality of any surviving archaeological remains;
- To place any identified archaeological remains within a wider historical and archaeological context in order to assess their significance; and
- To make available information about the archaeological resource within the site by reporting on the results of the evaluation.

4.6 Aims of archaeological watching brief

4.6.1 The aims (or purpose) of the watching brief, as defined in the ClfA' *Standard and guidance for an archaeological watching brief* (ClfA 2014c) are:

- To allow, within the resources available, the preservation by record of archaeological deposits, the presence and nature of which could not be established (or established with sufficient accuracy) in advance of the development or other works;
- To provide an opportunity, if needed, for the watching archaeologist to signal to all interested parties, before the destruction of the material in question, that an archaeological find has been made for which the resources allocated to the



watching brief itself are not sufficient to support treatment to a satisfactory and proper standard; and

- To guide, not replace, any requirement for contingent excavation or preservation of possible deposits.

4.7 Objectives of archaeological watching brief

4.7.1 In order to achieve the above aims, the objectives of the watching brief are:

- To determine the presence or absence of archaeological features, deposits, structures, artefacts or ecofacts within the specified works area;
- To record and establish, within the constraints of the works, the extent, character, date, condition and quality of any surviving archaeological remains (a preservation by record);
- To place any identified archaeological remains within a wider historical and archaeological context in order to assess their significance; and
- To make available information about the archaeological resource on the site by preparing a report on the results of the watching brief.

5 GEOPHYSICAL SURVEY METHODS

5.1 Introduction

5.1.1 All works will be undertaken in accordance with the detailed methods set out within this WSI. Any significant variations to these methods will be agreed in writing with the SCC Principal Archaeologist and the client, prior to being implemented.

5.1.2 For the geophysical survey, the Site has been divided into 13 areas (**Figure 2**). Areas A to E and Area I(a) have been subject to geophysical survey (Wessex 2017c) and no further survey is proposed in these areas. Areas which are obviously unsuitable for survey have been excluded from the scope of works.

5.1.3 Two significant areas of increased magnetic response were identified in Area A which likely relate to the use of green waste as a fertiliser. The presence of this material has the potential to impact on the reliability of the geophysical survey results as it can mask buried archaeological anomalies. It is recommended that no further geophysical survey is carried out within Area A where green waste is known to be present (or within other areas if it is definitely confirmed that green waste is present).

5.2 Service location and other constraints

5.2.1 The client has information regarding the presence of any below/above-ground services, and any ecological, environmental or other constraints which will be provided in advance of planning further surveys and/or interpreting survey results.

5.3 Survey specification

5.3.1 Stakeout data will be prepared in Ordnance Survey (OS) National Grid coordinates prior to survey using AutoCAD, and survey data will be georeferenced accordingly. Individual survey grid nodes will be established at 30 m x 30 m intervals using a Leica Viva RTK GNSS instrument. The full extent of the surveyed areas will be located using a Leica Viva RTK GNSS instrument. This allows for the surveyed area to be independently relocated by a third party, if ever required.



- 5.3.2 All survey data will be recorded in OS National Grid coordinates and heights above OD (Newlyn), as defined by OSGM15 and OSTN15, with a three-dimensional accuracy of at least 50 mm.
- 5.3.3 Digital mapping and archaeological information gathered during any previous work by Wessex Archaeology on the site will be used to support the interpretation of the geophysical data.
- 5.3.4 An interpretation of the geophysical anomalies will be presented identifying likely and possible archaeological features, along with linear trends and areas of increased magnetic response.
- 5.3.5 Further details of the geophysical and survey equipment, methods, processing and interpretation are described in **Appendix 1** and **2**.

5.4 Gradiometer survey specification

- 5.4.1 The detailed gradiometer survey will be conducted using Bartington Grad-01-1000L gradiometers mounted at 1 m intervals on either a non-magnetic cart or on a hand-held frame with an effective sensitivity of 0.03 nT.
- 5.4.2 Data will be collected at 0.25 m intervals along transects spaced 1 m apart, in accordance with Historic England guidelines (English Heritage 2008). Data will be collected in the zigzag method.
- 5.4.3 Data from the survey will be subject to minimal data correction processes. These would typically comprise a zero mean traverse function (± 5 nT thresholds) to correct for variations in the calibration between the Bartington sensors used and, for hand-held collected data, a de-step function to account for variations in traverse position due to varying ground cover and topography. These two steps are generally applied to all survey areas, with no further filtering. The data will be processed using commercially available and in-house software which allows greyscale and trace plots to be produced.

6 TRIAL TRENCH EVALUATION METHODS

6.1 Introduction

- 6.1.1 All works will be undertaken in accordance with the detailed methods set out within this WSI. Any significant variations to these methods will be agreed in writing with the SCC Principal Archaeologist and the client, prior to being implemented.
- 6.1.2 The evaluation will comprise the excavation, investigation and recording of a series of linear trial trenches measuring between 10 m and 50 m in length by 2 m. The number of trenches and their position will be agreed in consultation with the SCC Principal Archaeologist and will be determined by the results of the geophysical survey.

6.2 Setting out of the trenches

- 6.2.1 All trenches will be set out using GNSS. Minor adjustments to the layout may be required to take account of any on-site constraints such as vegetation or located services, and to allow for machine manoeuvring. The trench locations will be tied in to the Ordnance Survey (OS) National Grid and Ordnance Datum (OD) (Newlyn), as defined by OSGM15 and OSTN15.



6.3 Service location and other constraints

- 6.3.1 The client will provide information regarding the presence of any below/above-ground services, and any ecological, environmental or other constraints.
- 6.3.2 Before excavation begins, the evaluation area will be walked over and visually inspected to identify, where possible, the location of any below/above-ground services. All trial trench locations will be scanned before and during excavation with a Cable Avoidance Tool (CAT) in order to verify the absence of any live underground services.

6.4 Excavation methods

- 6.4.1 The trenches will be excavated using a 360° tracked excavator equipped with a toothless bucket. Machine excavation will be under the constant supervision and instruction of the monitoring archaeologist. Machine excavation will proceed in level spits of approximately 50–200 mm until either the archaeological horizon or the natural geology is exposed. Where necessary, the base of the trench/surface of archaeological deposits will be cleaned by hand.
- 6.4.2 A sample of the archaeological features and deposits identified will be hand-excavated, sufficient to address the aims of the evaluation. Spoil derived from both machine stripping and hand-excavation will be visually scanned for the purposes of finds retrieval, and where appropriate will also be metal-detected by trained archaeologists. Artefacts and other finds will be collected and bagged by context.
- 6.4.3 If an exceptional number and/or complexity of archaeological deposits are identified, sample excavation will aim to be minimally intrusive, but sufficient to resolve the principal aims of the evaluation, to a level agreed with the SCC Principal Archaeologist and the client.
- 6.4.4 If human remains are uncovered, the specific methods outlined below (section 6.9.2) will be followed.
- 6.4.5 Where complex archaeological stratification is encountered, deposits will be left *in situ* and alternative measures taken to assess their depth, as agreed with the SCC Principal Archaeologist. Where modern features are seen to truncate the archaeological stratification, these may be removed, where practicable, in a manner that does not damage the surrounding deposits in order to enable the depth of stratification to be assessed.

6.5 Recording

- 6.5.1 All exposed archaeological deposits and features will be recorded using Wessex Archaeology's pro forma recording system.
- 6.5.2 A complete drawn record of excavated archaeological features and deposits will be made. This will include plans and sections, drawn to appropriate scales (generally 1:20 or 1:50 for plans, 1:10 for sections) and tied to the OS National Grid. The OD heights of all principal features will be calculated (as defined by OSGM15 and OSTN15) and the levels added to the drawings.
- 6.5.3 A full photographic record will be made using digital cameras equipped with an image sensor of not less than 10 megapixels. This will record both the detail and the general context of the principal features and the site as a whole. Digital images will be subject to managed quality control and curation processes which will embed appropriate metadata within the image and ensure long term accessibility of the image set. Photographs will also



be taken of all areas, including access routes, to provide a record of conditions prior to and on completion of the evaluation.

6.6 Survey

- 6.6.1 The real time kinematic (RTK) survey of all trenches and features will be carried out using a Leica GNSS connected to Leica's SmartNet service. All survey data will be recorded in OS National Grid coordinates and heights above OD (Newlyn), as defined by OSGM15 and OSTN15, with a three-dimensional accuracy of at least 50 mm.

6.7 Monitoring

- 6.7.1 The client will inform the SCC Principal Archaeologist of the start of the evaluation and its progress. Reasonable access will be arranged for the SCC Principal Archaeologist to make site visits in order to inspect and monitor the progress of the evaluation. Any variations to the WSI, if required to better address the project aims, will be agreed in advance with the client and the SCC Principal Archaeologist.

6.8 Reinstatement

- 6.8.1 Trenches completed to the satisfaction of the client and the SCC Principal Archaeologist will be backfilled using excavated materials in the order in which they were excavated, and left level on completion. No other reinstatement or surface treatment will be undertaken.

6.9 Finds

General

- 6.9.1 All archaeological finds from excavated contexts will be retained, although those from features of modern date (19th century or later) may be recorded on site and not retained, depending on the site-specific objectives. Where appropriate, soil samples may be taken and sieved to aid in finds recovery. Any finds requiring conservation or specific storage conditions will be dealt with immediately in line with *First Aid for Finds* (Watkinson and Neal 1998).

Human remains

- 6.9.2 Any human remains (articulated or disarticulated, cremated or unburnt) discovered, will be left *in situ*, covered and protected. A Ministry of Justice licence will be obtained by Wessex Archaeology before any further excavation (including where remains are to be left *in situ*). Following discussions with the client and the SCC Principal Archaeologist, and with advice from Wessex Archaeology's osteoarchaeologist, the need for and appropriateness of their excavation/removal or sampling as part of the evaluation will be determined. Should human remains require excavation, they will be fully recorded, excavated and removed from the site in compliance with the terms of the Ministry of Justice licence.
- 6.9.3 Any excavation and post-excavation processing of human remains will be undertaken in accordance with Wessex Archaeology protocols, and in line with current guidance documents (see McKinley 2013) and ClfA standards (McKinley and Roberts 1993). Appropriate specialist guidance will be provided by Wessex Archaeology's osteoarchaeologist, with site visits undertaken if required. The final deposition of human remains, following analysis, will be in accordance with the terms of the Ministry of Justice licence.

Treasure

- 6.9.4 Wessex Archaeology will immediately notify the client and the SCC Principal Archaeologist on discovery of any material covered, or potentially covered, by the *Treasure Act 1996* (as



amended by *The Coroners and Justice Act 2009*). All information required by the Treasure Act (ie, finder, location, material, date, associated items etc.) will be reported to the Coroner within 14 days.

6.10 Environmental sampling

- 6.10.1 All sampling will be undertaken following Wessex Archaeology's in-house guidance, which adheres to the principles outlined in Historic England's guidance (English Heritage 2011 and Historic England 2015b).
- 6.10.2 Bulk environmental soil samples, for the recovery of plant macrofossils, wood charcoal, small animal bones and other small artefacts, will be taken as appropriate from well-sealed and dateable contexts or features. In general, features directly associated with specific activities (e.g., pits, latrines, cesspits, hearths, ovens, kilns, and corn driers) should be prioritised for sampling over features, such as ditches or postholes, which are likely to contain reworked and residual material.
- 6.10.3 If waterlogged or mineralised deposits are encountered, an environmental sampling strategy will be devised and agreed with the SCC Principal Archaeologist as appropriate. Specialist guidance will be provided by a member of Wessex Archaeology's geoarchaeological and environmental team, with site visits undertaken if required.
- 6.10.4 Any samples will be of an appropriate size – typically 40 litres for the recovery of environmental evidence from dry contexts, and 10 litres from waterlogged deposits.
- 6.10.5 Following specialist advice, other sampling methods such as monolith, Kubiena or contiguous small bulk (column) samples may be employed to enable investigation of deposits with regard to microfossils (e.g., pollen, diatoms) and macrofossils (e.g., molluscs, insects), soil micromorphological or soil chemical analyses.

7 WATCHING BRIEF FIELDWORK METHODS

7.1 Introduction

- 7.1.1 All works will be undertaken in accordance with the detailed methods set out within this WSI. Any significant variations to these methods will be agreed in writing with the SCC Principal Archaeologist and the client, prior to being implemented.
- 7.1.2 The watching brief will monitor ground investigation works being undertaken as part of environmental and geotechnical investigations in areas where there is potential to impact on the buried archaeological resource. This WSI does not address any requirement for a watching brief as part of mitigation during the construction phase.

7.2 Service location and other constraints

- 7.2.1 The client and/or their principal contactor will be responsible for the identification and protection of any above- and below-ground services within the watching brief area/s. The client and/or their principal contactor will also be responsible for informing Wessex Archaeology of, and delimiting, any other areas of environmental, ecological or other constraints.

7.3 Watching brief methods

- 7.3.1 The watching brief will be undertaken by at least one archaeologist, subject to the number of site operations being carried out at any one time. All mechanical excavation will, where



possible, be undertaken using a toothless ditching bucket, and will be constantly monitored by the watching archaeologist.

- 7.3.2 Without causing unnecessary delay to the groundwork programme, the archaeologist may ask for the groundwork to be temporarily halted whilst investigations are carried out. If appropriate, areas of archaeological interest will be defined and suitably protected in advance of their investigation and recording.
- 7.3.3 Where necessary, the surface of archaeological deposits will be cleaned by hand. A sample of the archaeological features and deposits identified will be hand-excavated and recorded, sufficient to address the aims of the watching brief. Spoil derived from both machine stripping and hand-excavation will be visually scanned for the purposes of finds retrieval, and where appropriate will also be metal-detected by trained archaeologists. Artefacts and other finds will be collected and bagged by context.
- 7.3.4 If extensive, complex or well-preserved archaeological remains are identified, for which the scope of the approved watching brief WSI is insufficient, the watching archaeologist will halt the groundwork, delimit the area of archaeological interest, and report immediately to the Wessex Archaeology project manager. Wessex Archaeology will then inform the groundwork contractor, the client and the SCC Principal Archaeologist, as a contingent excavation or revised strategy may be required. The programme, and additional resources, for any contingent excavation will be agreed with the client. Accordingly, this WSI will need revising before any further fieldwork proceeds – the revised WSI will need the approval of the SCC Principal Archaeologist, on behalf of the LPA.
- 7.3.5 If human remains are uncovered, the specific methods outlined above (section 5.9.2) will be followed.

7.4 Recording

- 7.4.1 All exposed archaeological deposits and features will be recorded using Wessex Archaeology's pro forma recording system as outlined in Section 5.5.

7.5 Survey

- 7.5.1 The real time kinematic (RTK) survey of all archaeological features will be carried out using a Leica GNSS connected to Leica's SmartNet service. All survey data will be recorded in OS National Grid coordinates and heights above OD (Newlyn), as defined by OSGM15 and OSTN15, with a three-dimensional accuracy of at least 50 mm.
- 7.5.2 If, due to unforeseen circumstances, it is not possible to survey using survey equipment prior to the destruction of the material, archaeological features will be located to either client plans that are related to OS mapping or structures/features that appear on OS mapping. This will be achieved using hand-held measuring tapes and the basic principles of triangulation.

7.6 Monitoring

- 7.6.1 The client will inform the SCC Principal Archaeologist of the start of the watching brief and its progress. Reasonable access will be arranged for the SCC Principal Archaeologist to make site visits in order to inspect and monitor the progress of the watching brief. Any variations to the WSI, if required to better address the project aims, will be agreed in advance with the client and the SCC Principal Archaeologist.



7.7 Finds and Environmental sampling

7.7.1 The procedure for Finds and Environmental sampling will follow that outlined in Section 5.9 and Section 5.10.

8 GEOPHYSICAL SURVEY REPORTING

8.1 General

8.1.1 Following completion of the fieldwork and the processing and assessment of the data, a draft report will be submitted for approval to the client, for comment. Once approved, a digital (.pdf) final version will be submitted.

8.1.2 The report will include the following elements:

- A non-technical summary;
- Introductory statements including location and NGR of surveyed area, background to the project (and any references/event numbers as supplied by the client), site description with geology, and summarised archaeological background;
- Aims and objectives;
- Methods;
- Results;
- Conclusions in relation to the project aims and objectives;
- Archive preparation and deposition arrangements;
- Appendices;
- Plans and plots (including location plan); and
- References

8.1.3 The report will be prepared within six weeks of completion of all fieldwork, and submitted to the client for approval. If required interim reporting can be completed following fieldwork, subject to variation.

8.1.4 Digital copies of the raw data, report text, figures and electronic drawings will be made available upon request (subject to copyright).

8.2 OASIS

8.2.1 An OASIS online record (<http://oasis.ac.uk/pages/wiki/Main>) will be created, with key fields completed, and a .pdf version of the final report submitted. Subject to any contractual requirements on confidentiality, copies of the OASIS record will be integrated into the relevant local and national records and published through the Archaeology Data Service (ADS) ArchSearch catalogue.

9 POST-EXCAVATION METHODS AND REPORTING

9.1 Stratigraphic evidence

9.1.1 All written and drawn records from the evaluation will be collated, checked for consistency and stratigraphic relationships. Key data will be transcribed into an Access database, which can be updated during any future analyses. Archaeological features and deposits will be



preliminary phased using stratigraphic relationships and the spot dating from finds, particularly pottery.

- 9.1.2 A written description will be made of all archaeologically significant features and deposits that were exposed and excavated, ordered either by trench or by period as appropriate. Detail of all contexts will be provided in trench tables in the appendix of the report.

9.2 Finds evidence

- 9.2.1 All retained finds will, as a minimum, be washed, weighed, counted and identified. They will then be recorded to a level appropriate to the aims and objectives of the evaluation. The report will include a table of finds by feature/context or trench.
- 9.2.2 Metalwork from stratified contexts will be X-rayed and, along with other fragile and delicate materials, stored in a stable environment. The X-raying of objects and other conservation needs will be undertaken by Wessex Archaeology in-house conservation staff, or by another approved conservation centre.
- 9.2.3 Finds will be suitably bagged and boxed in accordance with the guidance given by the relevant museum and generally in accordance with the standards of the ClfA (2014d).

9.3 Environmental evidence

- 9.3.1 Bulk environmental soil samples will be processed by standard flotation methods and scanned to assess the environmental potential of deposits. The flot will be retained on a 0.25 mm mesh, with residues fractionated into 5.6/4 mm, 2 mm, 1 mm and 0.5 mm and dried if necessary. Coarse fraction (>5.6/4 mm) will be sorted, weighed and discarded, with any finds recovered given to the appropriate specialist. Finer residues will be retained until after any analyses, and discarded following final reporting (in accordance with the Selection policy, below).
- 9.3.2 In the case of samples from cremation-related deposits the flots will be retained on a 0.25 mm mesh, with residues fractionated into 4 mm, 2 mm and 1 mm. In the case of samples from inhumation deposits, the sample will be artefact sieved through 9.5 mm and 1 mm mesh sizes. The coarse fractions (9.5 mm) will be sorted with any finds recovered given to the appropriate specialist together with the finer residues.
- 9.3.3 Any waterlogged or mineralised samples will be processed by standard waterlogged flotation methods.

9.4 Reporting

General

- 9.4.1 Following completion of the fieldwork and the evaluation of the stratigraphic, artefactual and ecofactual evidence, a draft report will be submitted for approval to the client and the SCC Principal Archaeologist, for comment. Once approved, a final version will be submitted.
- 9.4.2 The report will include the following elements:
- Non-technical summary;
 - Project background;
 - Archaeological and historical context;
 - Aims and objectives;



- Methods;
- Results – stratigraphic, finds and environmental;
- Conclusions in relation to the project aims and objectives, and discussion in relation to the wider local, regional or other archaeological contexts and research frameworks etc;
- Archive preparation and deposition arrangements;
- Appendices, including trench summary tables;
- Illustrations; and
- References.

9.4.3 A copy of the final report will be deposited with the HER, along with surveyed spatial digital data (.dxf or shapefile format) relating to evaluation.

Publication

9.4.4 If no further mitigation works are undertaken, a short report on the results of the evaluation will be prepared for publication in a suitable journal, if considered appropriate and agreed with the client and the SCC Principal Archaeologist

OASIS

9.4.5 An OASIS online record (<http://oasis.ac.uk/pages/wiki/Main>) will be created, with key fields completed, and a .pdf version of the final report submitted. Subject to any contractual requirements on confidentiality, copies of the OASIS record will be integrated into the relevant local and national records and published through the Archaeology Data Service ArchSearch catalogue.

10 ARCHIVE STORAGE AND CURATION

10.1 Geophysical Survey

10.1.1 If provision is made in the contract, the complete project archive will be prepared in accordance with *A Guide to Good Practice: Geophysical Data in Archaeology* (Schmidt *et al.* 2001) and ADS guidelines (ADS 2015), and any requirements of the relevant Historic Environment Record (HER).

10.1.2 A high quality geo-rectified TIFF will be produced from the processed data, with the raw data stored as Geoplot compatible pre-processed composite files. The archive will usually be deposited within 6–12 months of the project's completion.

10.2 Trial trench evaluation and watching brief

Museum

10.2.1 It is recommended that the project archive resulting from the evaluation be deposited with the Potteries Museum and Art Gallery. Provision must be made for the cost of long-term storage in the post-fieldwork costs. The museum will receive notification of the project prior to fieldwork commencing, and an accession number will be obtained.

Transfer of title

10.2.2 On completion of the evaluation (or extended fieldwork programme), every effort will be made to persuade the legal owner of any finds recovered (ie, the landowner), with the exception of human remains and any objects covered by the *Treasure Act 1996* (as

amended by the Coroners and Justice Act 2009), to transfer their ownership to the museum in a written agreement.

Preparation of archive

- 10.2.3 The complete project archive, which may include paper records, graphics, artefacts, ecofacts and digital data, will be prepared following the standard conditions for the acceptance of excavated archaeological material by Potteries Museum and Art Gallery, and in general following nationally recommended guidelines (SMA 1995; ClfA 2014e; Brown 2011; ADS 2013). The archive will usually be deposited within one year of the completion of the project, with the agreement of the client.

Selection policy

- 10.2.4 Wessex Archaeology follows national guidelines on selection and retention (SMA 1993; Brown 2011, section 4). In accordance with these, and any specific guidance prepared by the museum, a process of selection and retention will be followed so that only those artefacts or ecofacts that are considered to have potential for future study will be retained. The selection policy will be agreed with the museum, and fully documented in the project archive. Material not selected for retention may be used for teaching or reference collections by the museum, or by Wessex Archaeology.

Security copy

- 10.2.5 In line with current best practice (e.g., Brown 2011), on completion of the project a security copy of the written records will be prepared in the form of a digital PDF/A file. PDF/A is an ISO-standardised version of the Portable Document Format (PDF) designed for the digital preservation of electronic documents through omission of features ill-suited to long-term archiving.

11 PUBLIC ENGAGEMENT

- 11.1.1 In accordance with the ClfA standards (ClfA 2017b and ClfA 2017c), and in line with its own charitable aims, Wessex Archaeology will, where possible and in consultation with the client, seek opportunities to disseminate the results of the archaeological evaluation and engage with the local community. This can be achieved through a variety of methods, including social media, press releases, open days and volunteer involvement, while taking into account issues such as Health & Safety, confidentiality and vandalism.

12 COPYRIGHT

12.1 Archive and report copyright

- 12.1.1 The full copyright of the written/illustrative/digital archive relating to the project will be retained by Wessex Archaeology under the *Copyright, Designs and Patents Act 1988* with all rights reserved. The client will be licenced to use each report for the purposes that it was produced in relation to the project as described in the specification. The museum, however, will be granted an exclusive licence for the use of the archive for educational purposes, including academic research, providing that such use conforms to the *Copyright and Related Rights Regulations 2003*. In some instances, certain regional museums may require absolute transfer of copyright, rather than a licence; this should be dealt with on a case-by-case basis.
- 12.1.2 Information relating to the project will be deposited with the Historic Environment Record (HER) where it can be freely copied without reference to Wessex Archaeology for the purposes of archaeological research, or development control within the planning process.

12.2 Third party data copyright

- 12.2.1 This document, the evaluation report and the project archive may contain material that is non-Wessex Archaeology copyright (e.g., Ordnance Survey, British Geological Survey, Crown Copyright), or the intellectual property of third parties, which Wessex Archaeology are able to provide for limited reproduction under the terms of our own copyright licences, but for which copyright itself is non-transferable by Wessex Archaeology. Users remain bound by the conditions of the *Copyright, Designs and Patents Act 1988* with regard to multiple copying and electronic dissemination of such material.

13 WESSEX ARCHAEOLOGY PROCEDURES

13.1 External quality standards

- 13.1.1 Wessex Archaeology is registered as an archaeological organisation with the Chartered Institute for Archaeologists (CIfA) and fully endorses its *Code of conduct* (CIfA 2014f) and *Regulations for professional conduct* (CIfA 2014g). All staff directly employed or subcontracted by Wessex Archaeology will be of a standard approved by Wessex Archaeology, and archaeological staff will be employed in line with the CIfA codes of practice, and will normally be members of the CIfA.

13.2 Personnel

- 13.2.1 The fieldwork will be directed and supervised by an experienced archaeologist from Wessex Archaeology's core staff, who will be on site at all times for the length of archaeological fieldwork as required. The overall responsibility for the conduct and management of the project will be held by one of Wessex Archaeology's project managers, who will visit the fieldwork as appropriate to monitor progress and to ensure that the scope of works is adhered to. Where required, monitoring visits may also be undertaken by Wessex Archaeology's Health and Safety manager. The appointed project manager and fieldwork director will be involved in all phases of the investigation through to its completion.
- 13.2.2 The analysis of any finds and environmental data will be undertaken by Wessex Archaeology core staff or external specialists, using Wessex Archaeology's standard methods, under the supervision of the departmental managers and the overall direction of the project manager. A complete list of finds and environmental specialists can be provided on request.
- 13.2.3 The following key staff are proposed:
- Project Manager Mark Turner
 - Geophysical Survey technical lead Lucy Learmonth
- 13.2.4 Wessex Archaeology reserves the right, due to unforeseen circumstances (e.g., annual leave, sick leave, maternity, retirement etc) to replace nominated personnel with alternative members of staff of comparable expertise and experience.

13.3 Internal quality standards

- 13.3.1 Wessex Archaeology is an ISO 9001 accredited organisation (certificate number FS 606559), confirming the operation of a Quality Management System which complies with the requirements of ISO 9001:2008 – covering professional archaeological and heritage advice and services. The award of the ISO 9001 certificate, independently audited by the British Standards Institution (BSI), demonstrates Wessex Archaeology's commitment to providing quality heritage services to our clients. ISO (the International Organisation for



Standardisation) is the most recognised standards body in the world, helping to drive excellence and continuous improvement within businesses.

- 13.3.2 Wessex Archaeology operates a computer-assisted project management system. Projects are assigned to individual project managers who are responsible for the successful completion of all aspects of the project. This includes monitoring project progress and quality; controlling the project budget from inception to completion; and all aspects of Health and Safety for the project. At all stages, the project manager will carefully assess and monitor performance of staff and adherence to objectives, timetables and budgets, while the manager's performance is monitored in turn by the team leader or regional director.
- 13.3.3 All work is monitored and checked whilst in progress on a regular basis by the project manager, and all reports and other documents are checked (where applicable) by the team leader/technical manager, or regional director, before being issued. A series of guideline documents or manuals form the basis for all work. The technical managers in the Graphics, Finds & Analysis, GeoServices and IT sections provide additional assistance and advice.
- 13.3.4 All staff are responsible for following Wessex Archaeology's quality standards but the overall adherence to and setting of these standards is the responsibility of the senior management team in consultation with the team leaders/regional directors who also ensure projects are adequately programmed and resourced within Wessex Archaeology's portfolio of project commitments.

13.4 Health and Safety

- 13.4.1 Health and Safety considerations will be of paramount importance in conducting all fieldwork. Safe working practices will override archaeological considerations at all times. Wessex Archaeology will supply trained, competent and suitably qualified staff to perform the tasks and operate the equipment used on site. All work will be carried out in accordance with the *Health and Safety at Work Act 1974* and the *Management of Health and Safety at Work Regulations 1999*, and all other applicable Health and Safety legislation, regulations and codes of practice in force at the time.
- 13.4.2 Wessex Archaeology will supply a copy of the company's Health and Safety Policy and a Risk Assessment to the client before the commencement of the evaluation. The Risk Assessment will have been read, understood and signed by all staff attending the site before any fieldwork commences. Wessex Archaeology staff will comply with the Personal Protective Equipment (PPE) requirements for working on the site, and any other specific additional requirements of the principal contractor.
- 13.4.3 All fieldwork staff are certified through the Construction Skills Certification Scheme (CSCS) or UK equivalent and have had UKATA Asbestos Awareness Training. Key staff also have qualifications in the use of CAT and Genny equipment and as banksmen/Plant Machinery Marshalls through the National Plant Operators Recognitions Scheme (NPORS).

13.5 Insurance

- 13.5.1 Wessex Archaeology has both Public Liability (£10,000,000) and Professional Indemnity Insurance (£5,000,000).

REFERENCES

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- Wessex Archaeology 2017b. West Midlands Interchange Staffordshire LiDAR Data Assessment
- Wessex Archaeology 2017c. West Midlands Interchange Staffordshire Detailed Gradiometer Survey

Online References

- roman-britain.co.uk 2016
- gracesguide.co.uk 2016



APPENDICES

Appendix 1: Survey equipment and data processing

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 1 m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1 m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

The gradiometers have an effective resolution of 0.03nT over a ± 100 nT range, and measurements from each sensor are logged at intervals of 0.25 m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

Wessex Archaeology undertakes two types of magnetic surveys: scanning and detail. Both types depend upon the establishment of an accurate 20 m or 30 m 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 0.02 m in real-time and therefore exceed the level of accuracy recommended by Historic England (English Heritage 2008) for geophysical surveys.

Scanning surveys consist of recording data at 0.25 m intervals along transects spaced 10 m apart, acquiring a minimum of 80 data points per transect. Due to the relatively coarse transect interval, scanning surveys should only be expected to detect extended regions of archaeological anomalies, when there is a greater likelihood of distinguishing such responses from the background magnetic field.

The detailed surveys consist of 20 m x 20 m or 30 m x 30 m 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 (English Heritage 2008).

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

Post-processing

The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

Typical data and image processing steps may include:



- Destripe – Applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- Destagger – Shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- Despike – Filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data).

Typical displays of the data used during processing and analysis:

- XY Plot – Presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies.
- Greyscale – Presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.



Appendix 2: Geophysical interpretation

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

The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- Archaeology – used when there is a clear geophysical response and anthropogenic pattern.
- Possible archaeology – used for features which give a response but which form no discernible pattern or trend.

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

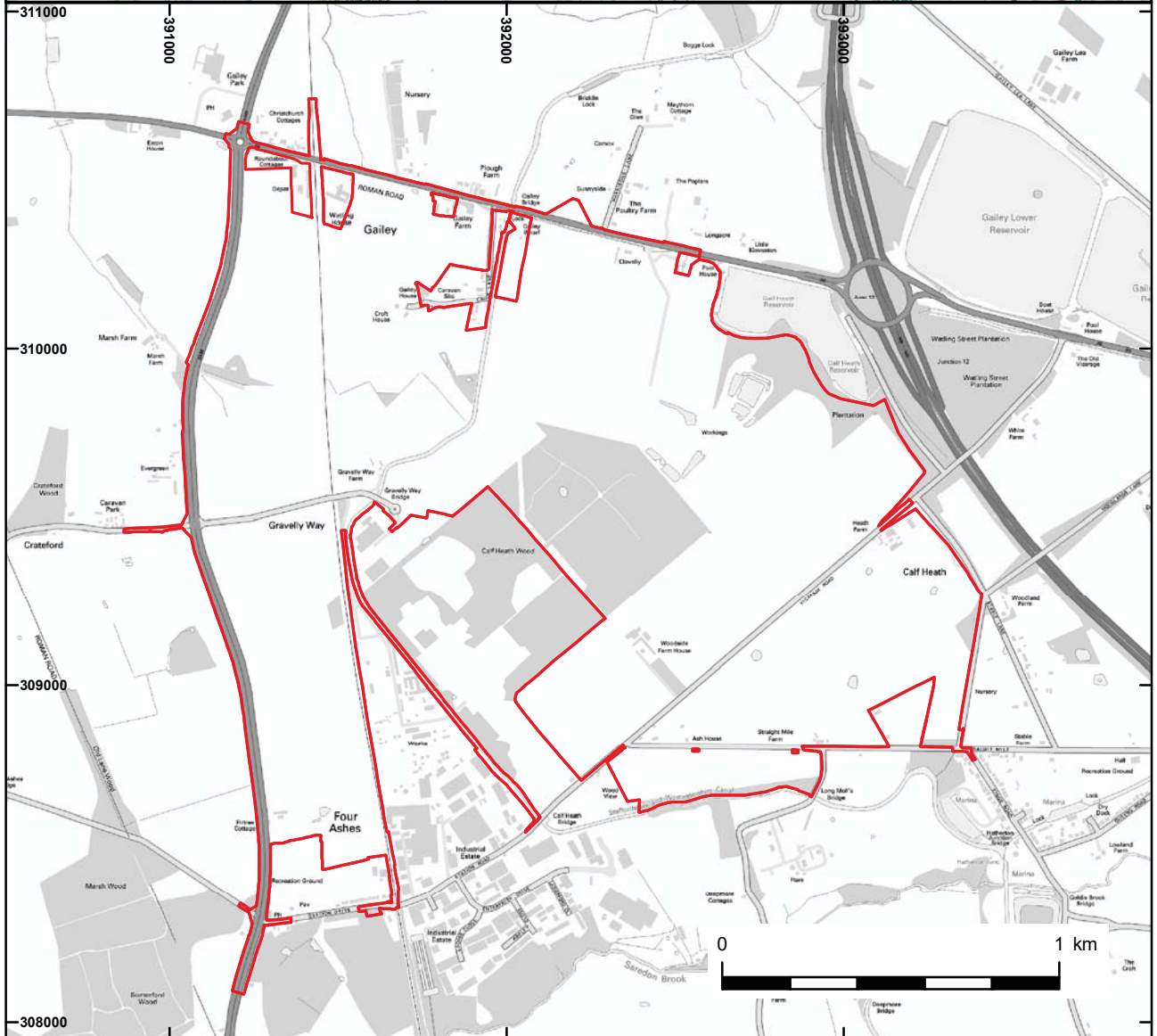
- Ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin.
- Modern service – used for responses considered relating to cables and pipes; most are composed of ferrous/ceramic material although services made from non-magnetic material can sometimes be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


The agricultural category is used for the following:

- Former field boundaries – used for ditch sections that correspond to the position of boundaries marked on earlier mapping.
- Agricultural ditches – used for ditch sections that are aligned parallel to existing boundaries and former field boundaries that are not considered to be of archaeological significance.
- Ridge and furrow – used for broad and diffuse linear anomalies that are considered to indicate areas of former ridge and furrow.
- Ploughing – used for well-defined narrow linear responses, usually aligned parallel to existing field boundaries.
- Drainage – used to define the course of ceramic field drains that are visible in the data as a series of repeating bipolar (black and white) responses.

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

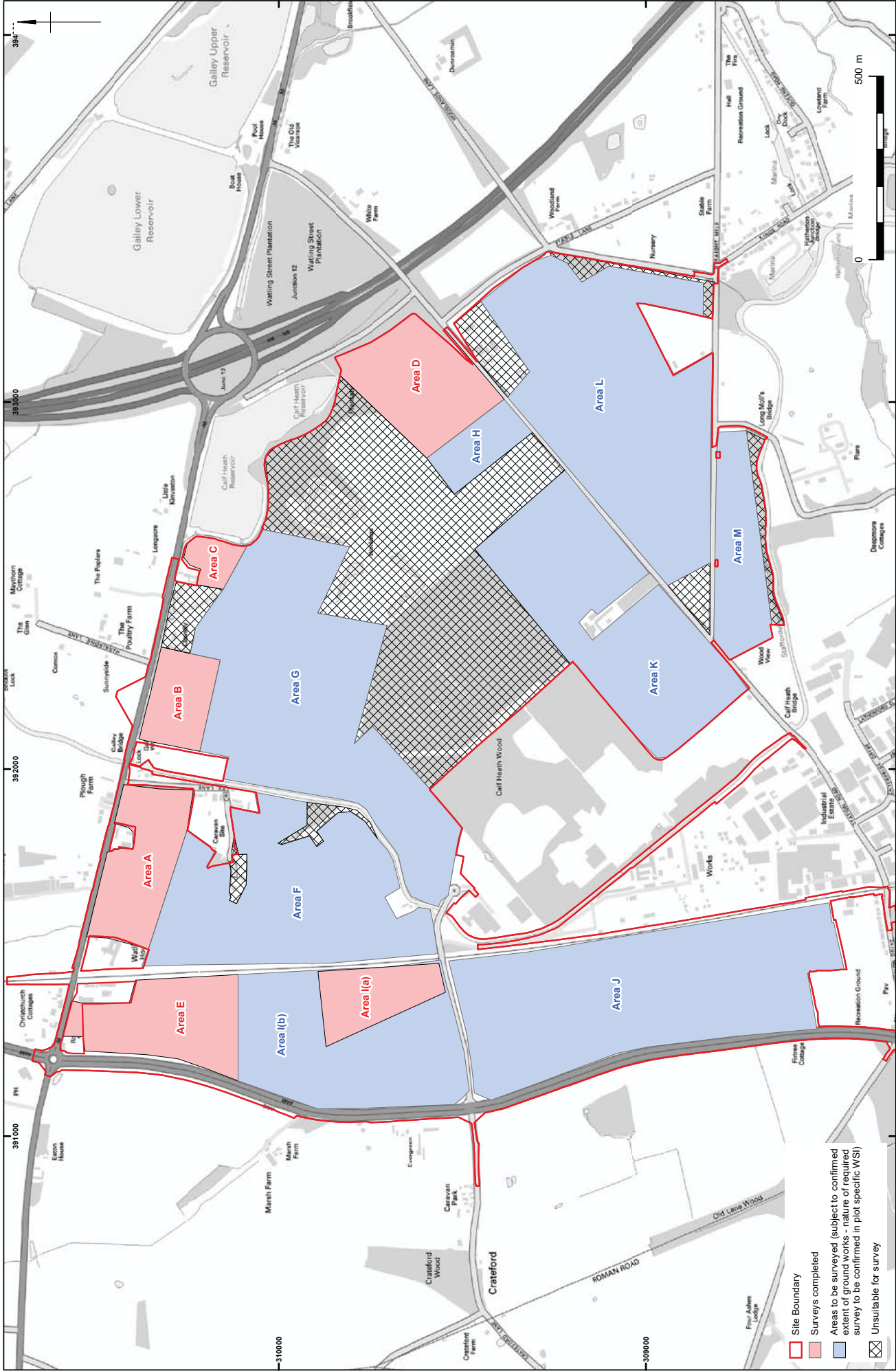
- Increased magnetic response – used for areas dominated by indistinct anomalies which may have some archaeological potential.
- Trend – used for low amplitude or indistinct linear anomalies.
- Superficial geology – used for diffuse edged spreads considered to relate to shallow geological deposits. They can be distinguished as areas of positive, negative or broad bipolar (positive and negative) anomalies.



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	Scale:	1:50000 & 1:20000 @ A4	Illustrator:	ND/IA
	Path:	Y:\PROJECTS\112700 Sheffield\GIS\FigsMXD\2017_10_09		

Site location plan

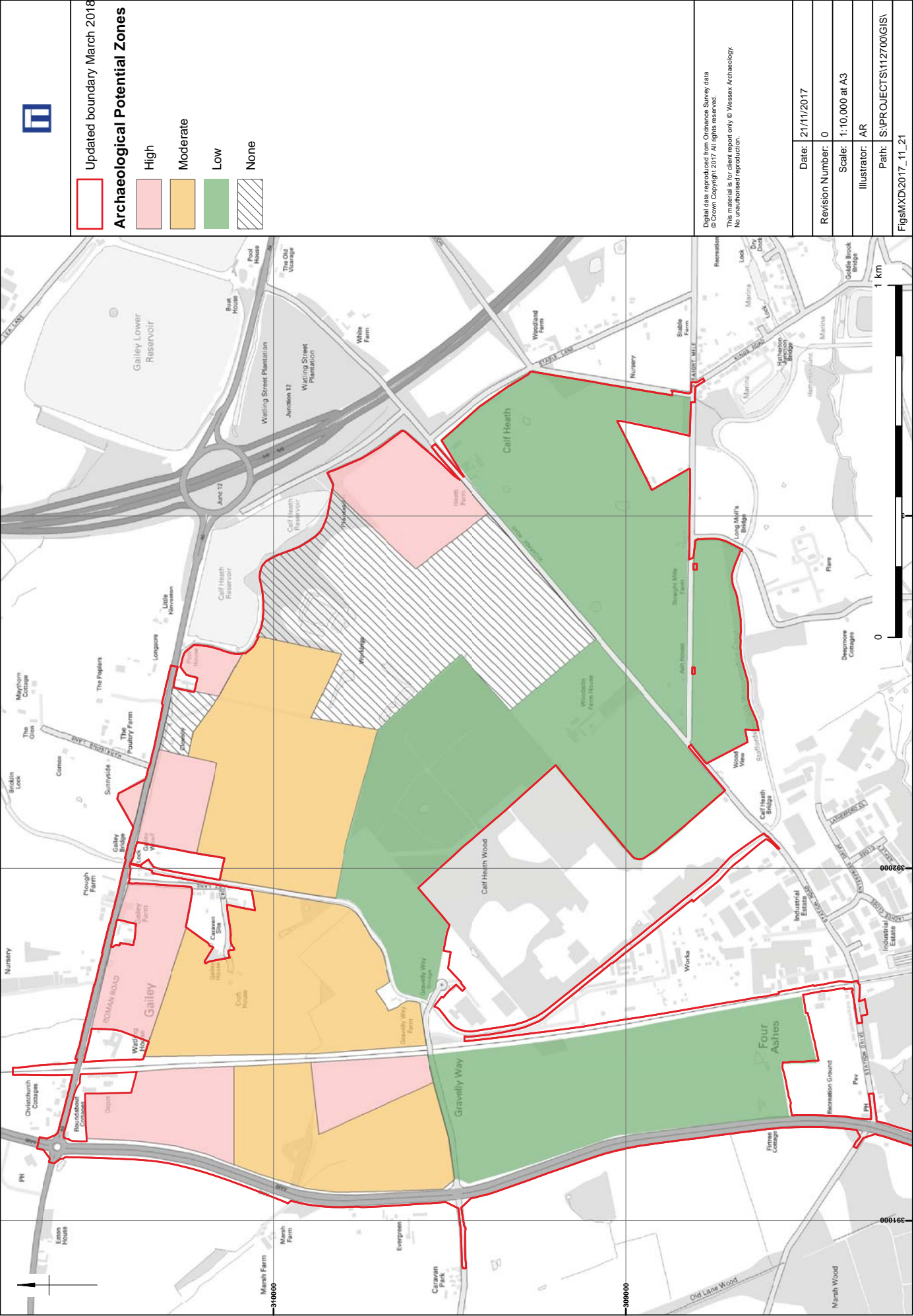
Figure 1



- ▭ Site Boundary
- ▭ Surveys completed
- ▭ Areas to be surveyed (subject to confirmed extent of ground works - nature of required survey to be confirmed in plot specific WSI)
- Unsuitable for survey

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Archaeological Potential Zones for further investigations Figure 3



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