

ARCHAEOLOGICAL
SERVICES
DURHAM UNIVERSITY

for
Mr Don Mason
on behalf of
The Friends of Longovicium

Longovicium Roman Fort and Environs
Lanchester
County Durham

geophysical survey

report 4980
April 2019



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1. Summary

The project

- 1.1 This report presents the results of further geophysical surveys conducted within the Roman fort of *Longovicium*, and in the fields to the immediate north and east. The fort is located on high ground to the south-west of Lanchester in County Durham. The works comprised geomagnetic survey of three areas totalling 6.6ha.
- 1.2 The works were commissioned by Mr Don Mason, on behalf of The Friends of *Longovicium*, and conducted by Archaeological Services Durham University.

Results

- 1.3 Many of the linear anomalies within the fort are associated with the remains of stone building walls. Identified buildings here include the headquarters building, the commandant's house, two granaries and several barrack blocks. Additional buildings could be workshops, stores or a hospital. Two rows of four barracks have been detected in the east of the fort; the barracks in the west are not so readily identified but traces of them have been detected.
- 1.4 Anomalies detected within part of the commandant's house probably indicate the presence of a hypocaust heating system.
- 1.5 Buildings identified in the survey may represent more than one phase of the fort's history.
- 1.6 Many densely packed buildings were detected outside the eastern gate of the fort and along Dere Street. The nature of the anomalies associated with these buildings may indicate that the buildings in this area were consumed by fire.
- 1.7 In the field to the north-west of the fort, many more anomalies reflect the changing land use there. A series of ditches in the east of that survey appear to form contiguous enclosures, traces of which were also detected in an earlier survey of the field to the east. These enclosures appear to be associated with the civilian settlement along Dere Street north of the fort. Further probable enclosures were detected in the west of the survey. Additional features detected in this area include a probable former stream, or possible outflow drainage channel, a former field boundary, traces of ridge and furrow cultivation, a series of lynchets, some of which are still evident in the field today, and a probable former building.

2. Project background

Location (Figures 1 & 2)

- 2.1 The survey area comprised the interior of the Roman fort of *Longovicium*, 0.8km south-west of Lanchester in County Durham (NGR fort centre: NZ 15945 46890), together with land to the immediate north and east of the fort. The fort and its surroundings are a Scheduled Ancient Monument (SAM, Asset UID 100236).
- 2.2 The present surveys covered approximately 6.6ha across three areas.
- 2.3 Several geophysical surveys have been undertaken within and adjacent to the scheduled area in recent years. The locations and results of the current surveys are presented together with those of previous Archaeological Services surveys undertaken between 2008 and 2017 (Figures 7 & 8).

Objective

- 2.4 The aims of the present surveys were to re-survey the interior of the fort and the small area to the immediate east with state-of-the-art instruments, and to extend the survey programme into the field to the north to assess the nature and extent of any sub-surface features of potential archaeological significance in that area.
- 2.5 The regional research framework *Shared Visions: The North-East Regional Research Framework for the Historic Environment* (Petts & Gerrard 2006) contains an agenda for archaeological research in the region. In this instance, the scheme of works was designed to address the following research priorities: Roman Rii. Roads and communication, Riii. The Roman military presence, Riv. Native and civilian life, Rvi. Trade and industry, Rvii. Religion, Rviii. Burial and Rix. Landscape and environment.

Methods statement

- 2.6 The surveys have been undertaken in accordance with instructions from the client, with survey proposals and a methods statement prepared by Archaeological Services Durham University and with national standards and guidance (see para. 5.1 below).
- 2.7 Since the survey areas all lie within the scheduled monument the surveys were undertaken in accordance with a licence granted by Historic England under Section 42 of the Ancient Monuments and Areas Act 1979 (as amended by the National Heritage Act 1983). A Historic England Geophysical Survey Database Questionnaire is included as an Appendix to this report.

Dates

- 2.8 Fieldwork was undertaken on the 15th and 17th January 2019. This report was prepared for April 2019.

Personnel

- 2.9 Fieldwork and data processing were conducted by Duncan Hale and Mark Woolston-Houshold. This report was prepared by Duncan Hale, with illustrations by Janine Watson and Hannah Woodrow. The Project Manager was Duncan Hale.

Archive/OASIS

- 2.10 The site code is **LAN19**, for **LAN**chester 2019. The survey archive will be retained at Archaeological Services Durham University and a copy supplied on CD to the client for deposition with the project archive in due course. Archaeological Services

Durham University is registered with the **Online Access** to the **Index of archaeological investigations** project (**OASIS**). The OASIS ID number for this project is **archaeol3-348307**.

Acknowledgements

- 2.11 Archaeological Services is particularly grateful to the landowners Mr Nicholas Greenwell, Greenwell Farm, and the Austin family, Upper Houses Farm, and to Mr Don Mason of The Friends of Longovicium for facilitating this research.

3. Historical and archaeological background

- 3.1 The Roman fort of *Longovicium* was built in around AD150 and covers an area of about 2.3ha. There has been very limited excavation at the site and its history is not clear. It is believed to have been rebuilt around AD230 and again in the early 4th century. The fort was a later addition to a chain of defensive forts along the Roman road of Dere Street. Detailed background information is presented elsewhere (for example, Casey *et al.* 1992; The Friends of *Longovicium* 2007 & 2011).
- 3.2 Previous work has suggested that the interior of the fort could have held up to 1,000 soldiers and included barracks, granaries and a *praetorium* or commandant's house, and that there were aqueducts and a cemetery to the west and south-west of the fort (for example, Casey *et al.* 1992; Turner 1990). Elsewhere outside the fort geophysical surveys have shown that there was an extensive *vicus* to the north, east and south-east, along the line of Dere Street (Archaeological Services 2008a, 2008b, 2009, 2013; Cousins 1990; Noel *et al.* 1991; Payne 1991); that the remains of a probable industrial area (including ditched enclosures, roads, pits, reservoirs and fired features) survived to the west and south of the fort (Archaeological Services 2014, 2017), and that buildings in the field immediately south of the fort probably included a bath-house and Mithraeum (Archaeological Services 2017; Cousins 1990; Noel *et al.* 1991).
- 3.3 In addition to the above, several small geophysical surveys were undertaken by Durham University students in the 1990s, with mixed results, in the fields immediately east and south of the fort.
- 3.4 Geophysical instrumentation and software have developed considerably since the first geophysical surveys at *Longovicium* in the early 1990s. Advances in technology now enable very high density datasets to be collected rapidly with great sensitivity and precision using multi-sensor arrays. In addition, global navigation satellite systems with real-time kinematic correction can now be integrated with these multi-sensor magnetometer arrays to enable positional data of 5-10mm accuracy to be logged simultaneously with the magnetic gradient data.
- 3.5 Although the early surveys demonstrated the efficacy of both geomagnetic and earth resistance techniques at the site (with excellent gradiometer results over the fort and two adjacent areas, in particular), much of the data from those surveys are lost or were stored in formats that are now obsolete. This, together with recent advances in survey technology, supports the case for re-surveying some of those areas when opportunities arise. With the kind permission of Mr Greenwell, and under the licence provided by Historic England, it was possible to include the fort interior and land to the immediate east in the present survey programme.

4. Landuse, topography and geology

- 4.1 At the time of survey, all three areas were in pasture.
- 4.2 The fort, *vicus* and associated features occupy high ground at the eastern end of a ridge, with extensive views in each direction. The land drops away north down to Alderdene Burn, east down to Lanchester and south down to the River Browney.
- 4.3 Area 1 occupied the eastern (scheduled) part of a field on the north-facing slope, with elevations between approximately 183m OD at the survey's south-western corner and 160m OD near its north-eastern corner. Area 2, the fort interior, occupied a raised platform with elevations between approximately 180-183m OD. Area 3 was near the top of the east-facing slope, with elevations between almost 179m OD in the west and 170m OD in the east.
- 4.4 The underlying solid geology comprises strata of the Pennine Lower Coal Measures Formation, including mudstone, siltstone and sandstone, with coal seams. In the southern parts of Areas 2 and 3 these strata were overlain by Devensian till.

5. Geophysical survey

Standards

- 5.1 The surveys and reporting were conducted in accordance with Historic England guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Chartered Institute for Archaeologists (CIfA) *Standard and Guidance for archaeological geophysical survey* (2014); the CIfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service & Digital Antiquity *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2013).

Technique selection

- 5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.
- 5.3 In this instance, based on previous work, it was known that cut features such as ditches and pits would be present on the site, and that other types of feature such as wall foundations, fired structures (for example kilns and hearths) and roads would also be present.
- 5.4 Given the anticipated depth of targets and the non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting the types of feature mentioned above. This technique involves the use of magnetometers to detect and record anomalies in the vertical component of the Earth's magnetic field caused by variations in soil magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

Field methods

- 5.5 Measurements of vertical geomagnetic field gradient were determined using a Sensys Magneto MX V3 multi-sensor magnetometer survey system towed by a quad-bike. Eight FGM650/3 fluxgate gradiometer sensors were mounted on a frame at 0.5m intervals, logging gradient data at less than 0.08m intervals along traverses, providing high density data collection.
- 5.6 Data collection point locations were recorded in relation to the Ordnance Survey (OS) National Grid using an integrated global navigation satellite system (GNSS) with real-time kinematic (RTK) correction typically providing 5-10mm accuracy.
- 5.7 Data were downloaded on site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

- 5.8 Sensys MonMX, DLMGPS and MagnetoARCH software were used to record and display gradient and positional data and to create greyscale images of gridded values at 0.2m by 0.2m intervals. TerraSurveyor software was then used to produce continuous tone greyscale images and trace plots of the raw (minimally processed) data and greyscale images of filtered data. The greyscale images and trace plots are presented in Figures 2-4; the interpretations are presented in Figures 5-6. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. Palette bars relate the greyscale intensities to anomaly values in nanoTesla.
- 5.9 The following basic processing functions have been applied to each dataset:

<i>clip</i>	clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic
<i>de-spike</i>	locates and suppresses iron spikes in gradiometer data
<i>interpolate</i>	increases the number of data points in a survey to match sample and traverse intervals; in this instance the data have been interpolated to 0.1m x 0.1m intervals

- 5.10 The following filter has been applied to the magnetic data (Figure 3):

<i>low pass filter</i>	(applied with Gaussian weighting) to remove high frequency, small-scale spatial detail; for enhancing larger weak features and smoothing data
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Interpretation: anomaly types

- 5.11 A colour-coded geophysical interpretation plan is provided. Three types of magnetic anomaly have been distinguished in the data:

<i>positive magnetic</i>	regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic susceptibility soil-filled structures such as pits and ditches
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negative magnetic regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids

dipolar magnetic paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths

Interpretation: features

General comments

- 5.12 A colour-coded archaeological interpretation plan is provided (Figure 6). For ease of reference, anomaly numbers shown bold in the text below (eg **1a**, **1b**, etc) are also shown on the archaeological interpretation plan. The locations and results of the current surveys are also presented together with those of previous Archaeological Services surveys (Figures 7 & 8).
- 5.13 Except where stated otherwise in the text below, the weaker positive magnetic anomalies are taken to reflect slight increases in relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning. Many such linear positive magnetic anomalies have been detected across the surveys.
- 5.14 In this instance, additionally, many stronger positive magnetic anomalies have also been detected, which may reflect concentrations of burnt or fired materials. The vast majority of these stronger anomalies (with values over +15nT) have been detected within buildings and could reflect concentrations of occupation debris, burnt material, rammed earth floors or possibly fired tiles, used either in hypocausts, floors or roofs. These are discussed further below.
- 5.15 Series of parallel, weak, positive magnetic anomalies have been detected across Area 1 and parts of Area 3. These anomalies almost certainly reflect traces of former ridge and furrow cultivation. Several broader parallel positive magnetic anomalies, aligned east-west in Area 1, correspond to terraces or strip lynchets (eg **1a**) noted on the ground during survey. The ridge and furrow and lynchets remains are also evident in the Environment Agency (EA) LiDAR survey of the area. A linear anomaly between these two sets of features is presumed to represent a former field boundary.
- 5.16 Small, discrete dipolar magnetic anomalies have been detected across each survey area. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as chainlinks, nails and brick/tile fragments. Low concentrations of such anomalies are detected in most magnetic surveys, and in most cases they will have little or no archaeological significance. However, in this instance, it is likely that these anomalies reflect a mixture of both ancient and modern objects. Some the larger discrete dipolar and positive magnetic anomalies could reflect ovens and hearths.

Area 1

- 5.17 In addition to the former ridge and furrow and lynchets mentioned above, many other straight and narrow positive magnetic anomalies have also been detected in

this area to the north of the fort. These anomalies are concentrated in the east, towards Dere Street, though others were also detected in the west of this area. The anomalies probably reflect soil-filled ditches and appear to form a series of contiguous enclosures (**1b**) in the east and discrete enclosures in the west.

- 5.18 Some of the lynchets and enclosure ditches were previously detected in the field to the east in 2008 (Archaeological Services 2008a), though the data are not so clear in that area. For the earlier survey, the data were collected by volunteers and Archaeological Services personnel with hand-held instruments, at coarser sampling intervals, and also processed with different software to the current surveys. It is likely that further features would be detected if the 2008 survey were to be repeated with the current instrumentation and software. Nevertheless, the probable enclosures do appear to continue eastwards and may be associated with the *vicus* settlement along Dere Street. These features are almost certainly earlier than the lynchets. Indeed, the lynchets are the predominant topographic features in the LiDAR survey of Area 1 and the field to the east, with virtually no traces of Dere Street or the *vicus* surviving topographically in those fields.
- 5.19 Several curvilinear positive magnetic anomalies have also been detected here (eg **1c**); three such features have been detected in the south-eastern corner of the field, though all are generally within the same area as the probable enclosures. This could indicate that these ditches are not contemporary with the enclosures and they represent additional phases of activity.
- 5.20 A strong sinuous positive magnetic anomaly has been detected crossing this area broadly north-south (**1d**). The nature of this anomaly is typical of a former stream channel. It leaves the field at the field's lowest point, on its northern edge, and appears to head down to join the Alderdene Burn. In 1893 a Roman altar was found just west of the northern end of the anomaly; if this was a stream channel then it is possible there may have been a ritual association between the two features. A relatively strong L-shaped anomaly (**1e**) was detected at the higher, southern, end of the possible stream; this could reflect the remains of a small enclosure or, given its location, possibly a tank, with the 'stream' being an outflow channel.
- 5.21 A cluster of strong magnetic anomalies detected near the centre of this survey area (**1f**) almost certainly reflects a buried deposit of ferrous and/or fired materials.
- 5.22 A small group of rectilinear positive and negative magnetic anomalies was detected in the south-west corner of this survey area (**1g**). The smaller negative rectangle almost certainly reflects footings for a former building, measuring approximately 9m by 5m, however, the age and function of the building are unknown.
- 5.23 A line of discrete, intense, dipolar magnetic anomalies was detected across the area aligned north-west/south-east. These anomalies correspond to the locations of former telegraph poles, also shown on aerial photographs from 1949 and 1953.

Area 2

- 5.24 As expected, the survey of the fort interior has detected a great many anomalies. Also as expected, the map of anomalies is generally similar to that recorded in 1991 (Casey *et al.* 1992), for which the data are no longer available.

- 5.25 In this instance, the linear negative magnetic anomalies almost certainly indicate the presence of stone. The majority of the narrow linear anomalies are likely to reflect wall footings for a range of buildings, many of which can be identified with confidence. However, a series of longer negative anomalies, extending right across the interior, reflect stone land drains. The locations of some of these drains are evident on the surface, and they are very clear in the EA LiDAR data. Other than their length, the nature of these anomalies is almost identical to that of the wall footings. The orientation of the drains is also parallel to many of the building remains in the fort and in places this has hindered the identification and interpretation of some anomalies. Many weaker, orthogonal, magnetic striations have also been detected across this area, associated with former ploughing episodes, which have similarly impacted on the interpretation of some anomalies.
- 5.26 The large *Principia* (headquarters building, **2a**) is clearly defined in the centre of the fort, measuring approximately 29m square. Within the building are traces of the courtyard and cross-hall, with the well-defined *sacellum* at the rear flanked by two additional smaller rooms on each side. The *Principia* appears to have been extended on the south side, across what would typically be a road between the *Principia* and the *Praetorium* (commandant's house).
- 5.27 The extent of the *Praetorium* (commandant's house, **2b**), to the south of the headquarters, is not clear though some of the complex is well-defined. At least one building in the south of the range contains a concentration of strong magnetic anomalies; since these anomalies are confined to the interior of the building, and distributed across almost the entirety of the floor area, it is likely that they could reflect a significant quantity of fired clay tile associated with a hypocaust. An alternative interpretation, though perhaps less likely, might be an inwardly collapsed tile roof. One of the small strong anomalies close to this building could have been a furnace for the hypocaust.
- 5.28 To the north of the headquarters building are the clear remains of two granaries (**2c**). These are readily identified by the stone buttresses detected along their sides, in this case eight buttresses along each long side. The granaries measure approximately 25m by 9m. It is likely that one of the strong discrete anomalies near the granaries will reflect a corn-drying kiln.
- 5.29 There are the remains of another building (**2d**) between the granaries and the headquarters building. This building is roughly the same size as a granary but slightly offset and possibly protruding slightly onto the *via principalis*. The function of this building is unknown, but it may have been a workshop or stores, or possibly a small hospital. The building is evident in the survey in part as wall remains and in part by a pattern of strong anomalies, each of which appears to sit within one regularly sized room in the building. This pattern of anomalies is typical of many of the buildings within the fort. The strong internal anomalies could reflect concentrations of occupation debris, burnt material, rammed earth floors or possibly fired clay tiles. The nature of these anomalies is, however, rather different to those within part of the commandant's house, which are interpreted as reflecting a hypocaust.
- 5.30 The majority of the remainder of buildings identified within the fort are barrack blocks. Two rows of four barrack blocks were detected in the east of the fort, with one row to either side of the *via praetoria*. Further barrack blocks were partially

detected in the west of the fort. In some barracks, the outer walls and internal divisions are apparent as narrow negative magnetic anomalies, indicating wall footings, while others are less well defined. The rooms are arranged in pairs, each pair forming (or accommodating) a *contubernium* of eight soldiers. Ten *contubernia* can be identified in some of the blocks. Together with two ‘servants’ per *contubernia* this would form century unit of 100 men commanded by a centurion. Different configurations may have been used when cavalry were housed at *Longovicium*. In places, the internal barrack walls were not readily detectable, but their former presence can be inferred by the pattern of strong anomalies within the rooms, as noted above. Similarly, the typical extended centurions’ quarters at the ends of the blocks are not clear. There are, however, clear indications of rooms or buildings (**2e**) at the northern end of the barrack blocks in the north-east of the fort. Although aligned with the barracks, it is possible that these are separate buildings, possibly from a later re-modelling of the fort.

- 5.31 The detection and identification of barrack blocks, particularly in the west of the fort, has been hindered by the presence of the stone land drains and a magnetic texture left by former ploughing, perhaps as the land was prepared for pasture.
- 5.32 Many strong anomalies were detected close to the inner faces of the fort walls. Some of these will be associated with the remains of interval towers and gatehouses, while other very strong discrete anomalies will almost certainly reflect the remains of bread ovens and similar fired structures (eg **2f**).
- 5.33 A chain of intense dipolar magnetic anomalies has been detected just outside the fort’s west wall, indicating the presence of a ferrous pipe.

Area 3

- 5.34 Survey in this area immediately east of the fort has again detected a great many anomalies, most of which are associated with stone-founded buildings. The buildings are concentrated along two roads, here evident as broad bands of negative magnetic anomalies, which could indicate that these busy sections of road were metalled. One road (**3a**) joins the main, east, gate of the fort (*porta praetoria*) to the major road of Dere Street (**3b**), some 50m to the east.
- 5.35 The buildings along both these roads are arranged with their narrow gable ends fronting onto the street; the buildings are aligned perpendicular to the roads, along both sides of each road. These buildings are densely packed along each street frontage here, this being one of the most desirable areas of the *vicus*.
- 5.36 Each of the buildings contains very strong magnetic anomalies; the anomalies vary in strength, but they are typically much stronger than those within the buildings inside the fort. It is possible that the strong positive magnetic anomalies here are in part the result of a substantial fire, an unfortunate consequence of the buildings being so densely packed. The very strong positive magnetic anomalies within and around the wall footings almost certainly reflect burnt materials, probably including burnt daub or cob from the walls in this instance, as well as the usual hearths, ovens and possibly tiles. The anomalies associated with the buildings on Dere Street to the immediate south (Archaeological Services 2009) are similarly very strong and support the possibility that this part of the settlement was consumed by fire.

- 5.37 A broad strong positive magnetic anomaly detected at the south-western edge of this area (3c) almost certainly reflects part of the fort's ditch on this side.

6. Conclusions

- 6.1 Further high resolution magnetometer surveys have been undertaken in and around *Longovicium* Roman fort, near Lanchester, County Durham, as part of ongoing research conducted by the Friends of *Longovicium*.
- 6.2 The fort interior and the field immediately east of the fort were originally surveyed in 1991 and have been re-surveyed here with state-of-the-art instrumentation and software. The present surveys have demonstrated the advantages of current technology, enabling the rapid survey of areas with high density sampling, high resolution of anomalies, unparalleled positional accuracy and the elimination of any errors that can be associated with surveyors walking with hand-held instruments.
- 6.3 Many of the linear anomalies within the fort are associated with the remains of stone building walls. Identified buildings here include the headquarters building, the commandant's house, two granaries and several barrack blocks. Additional buildings could be workshops, stores or a hospital. Two rows of four barracks have been detected in the east of the fort; the barracks in the west are not so readily identified but traces of them have been detected.
- 6.4 Anomalies detected within part of the commandant's house probably indicate the presence of a hypocaust heating system.
- 6.5 Buildings identified in the survey may represent more than one phase of the fort's history.
- 6.6 Many densely packed buildings were detected outside the eastern gate of the fort and along Dere Street. The nature of the anomalies associated with these buildings may indicate that the buildings in this area were consumed by fire.
- 6.7 In the field to the north-west of the fort, many more anomalies reflect the changing land use there. A series of ditches in the east of that survey appear to form contiguous enclosures, traces of which were also detected in an earlier survey of the field to the east. These enclosures appear to be associated with the civilian settlement along Dere Street north of the fort. Further probable enclosures were detected in the west of the survey. Additional features detected in this area include a probable former stream, or possible outflow drainage channel, a former field boundary, traces of ridge and furrow cultivation, a series of lynchets, some of which are still evident in the field today, and a probable former building.

7. Sources

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Appendix: Geophysical Survey Database Questionnaire



Historic England

English Heritage Geophysical Survey Database Questionnaire

Survey Details

Name of Site: LONGOVICIUM ROMAN FORT AND VICUS

County: DURHAM

NGR Grid Reference: fort centre NZ 15945 46898

Start Date: 15 JANUARY 2019 **End Date:** 5 APRIL 2019

Geology at site (Drift and Solid):

The underlying solid geology comprises strata of the Pennine Lower Coal Measures Formation, including mudstone, siltstone and sandstone with coal seams. In Areas 2 and 3 these strata were partly overlain by Devensian till.

Known archaeological Sites/Monuments covered by the survey

(Scheduled Monument No. or National Archaeological Record No. if known)
LANCHESTER ROMAN FORT (LONGOVICIUM), LANCHESTER, CO DURHAM
Scheduled Ancient Monument, Asset UID 100236

Archaeological Sites/Monument types detected by survey

(Type and Period if known. "?" where any doubt).

Roman fort and ditches, roadside ditches, vicus, enclosure ditches, buildings (including headquarters building, commandant's house, granaries, barrack blocks etc inside fort), possible hypocaust, probable furnaces/ovens/hearths

Surveyor (Organisation, if applicable, otherwise individual responsible for the survey):

Duncan Hale, ARCHAEOLOGICAL SERVICES DURHAM UNIVERSITY

Name of Client, if any:

THE FRIENDS OF LONGOVICIUM

Purpose of Survey: RESEARCH

Location of:

a) Primary archive, i.e. raw data, electronic archive etc:
ARCHAEOLOGICAL SERVICES DURHAM UNIVERSITY

b) Full Report:

MR DON MASON & THE FRIENDS OF LONGOVICIUM
DURHAM COUNTY COUNCIL ARCHAEOLOGY SECTION/HER
HISTORIC ENGLAND (NORTH EAST OFFICE, NEWCASTLE)
HISTORIC ENGLAND (GEOPHYSICS SECTION, PORTSMOUTH)
OASIS ref: **archaeol3-348307**
ARCHAEOLOGICAL SERVICES DURHAM UNIVERSITY

Technical Details

(Please fill out a separate sheet for each survey technique used)

Type of Survey (Use term from attached list or specify other):
MAGNETOMETRY

Area Surveyed, if applicable (In hectares to one decimal place): 6.6HA

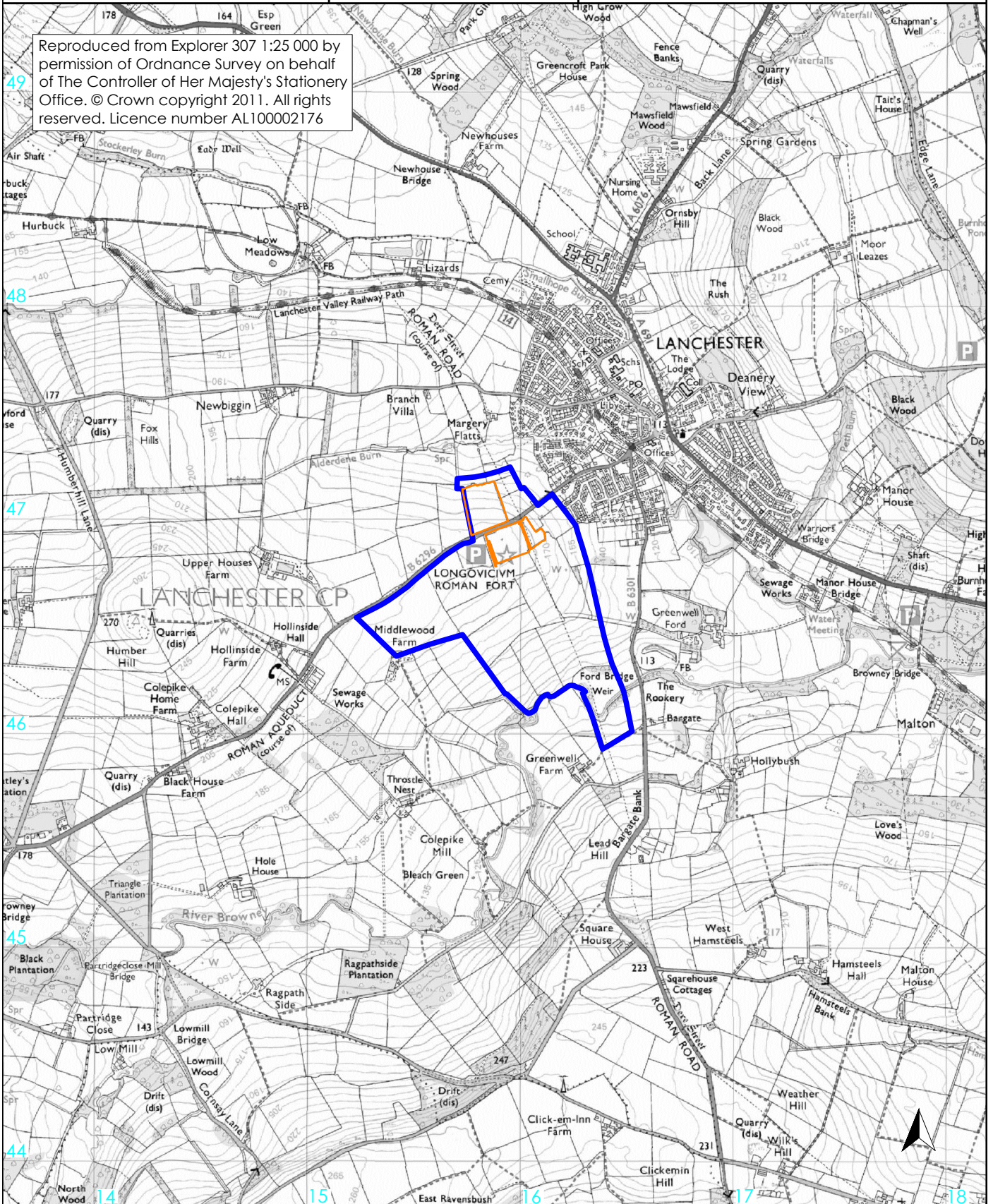
Traverse Separation, if regular: 0.5m **Reading/Sample Interval:** 0.1m

Type, Make and model of Instrumentation:
SENSYS MAGNETO MX V3 MULTI-SENSOR MAGNETOMETER ARRAY

Land use at the time of the survey (Use term/terms from the attached list or specify other):
AREAS 1-3: GRASSLAND

Additional Remarks (Please mention any other technical aspects of the survey that have not been covered by the above questions such as sampling strategy, non standard technique, problems with equipment etc.):

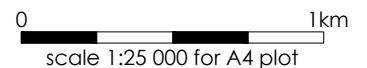
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scheduled ancient monument




geophysical survey



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 scheduled ancient monument




 2019 magnetic survey

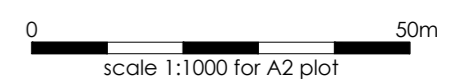
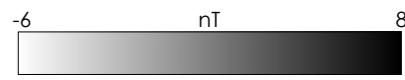
 previous survey

0  100m
scale 1:2500 for A4 plot

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-  scheduled ancient monument
-  2019 magnetic survey
-  previous survey



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Figure 3: Magnetometer survey (2019 data filtered)



Area 1

Area 3

Area 2

40.00nT/cm

0 50m
scale 1:1000 for A2 plot

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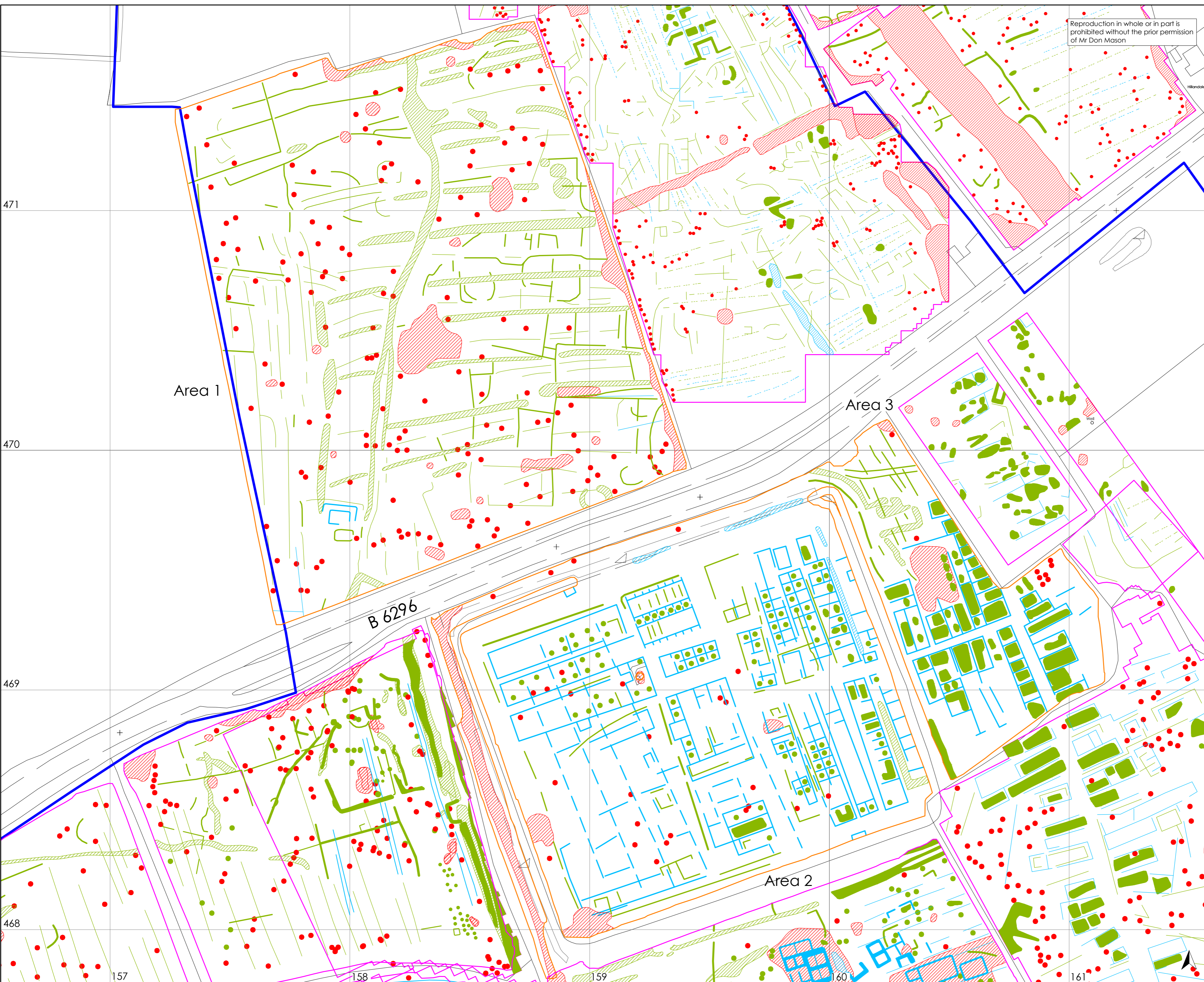
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



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Figure 4: Trace plots of magnetometer
data



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-  scheduled ancient monument
-  2019 magnetic survey
-  previous survey
-  dipolar magnetic anomaly
-  positive magnetic anomaly
-  negative magnetic anomaly

0 50m
scale 1:1000 for A2 plot

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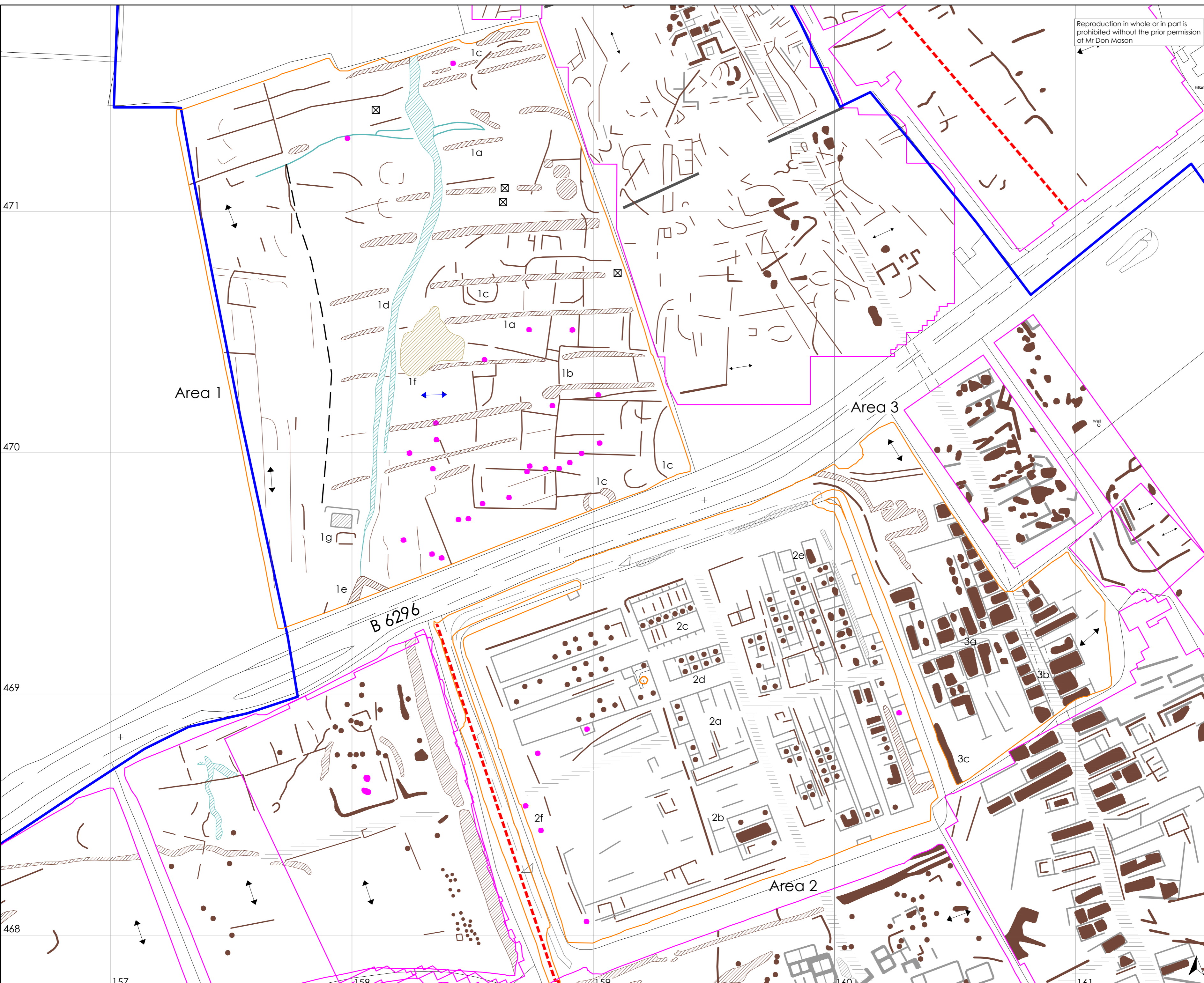
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









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Figure 5: Geophysical interpretation

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-  scheduled ancient monument
-  2019 magnetic survey
-  previous survey
-  soil-filled feature
-  former building
-  possible pit/ hearth/ oven
-  former roads / tracks
-  former ploughing
-  ridge and furrow
-  former field boundary
-  former telegraph pole
-  disturbed ground
-  former stream channel
-  service pipes

0 50m
scale 1:1000 for A2 plot

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

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Figure 6: Archaeological interpretation



 scheduled ancient monument
 2019 magnetic survey
 previous survey
 0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 m

0 10 20 30 40 50 60 70 80 90 100 m
scale 1:1000 for A3 plot

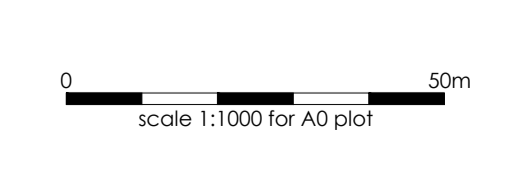
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Figure 7: Magnetometer surveys
2008-2019



- scheduled ancient monument
- 2019 magnetic survey
- previous survey
- soil-filled feature
- former building
- industrial debris
- former stream channel
- presumed Roman reservoir
- former roads / tracks
- former ploughing
- ridge and furrow
- service pipes
- former field boundary
- possible pit/ hearth/ oven / kiln or furnace
- former telegraph pole



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Figure 8: Archaeological interpretation 2008-2019