

pre-construct geophysics

archaeological surveys

GEOPHYSICAL (GRADIOMETER) SURVEY

BARNSELY WEST, BARNSELY, SOUTH YORKSHIRE

NGR SE 3162 0697

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ON BEHALF OF PROSPECT ARCHAEOLOGY

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Non-technical summary

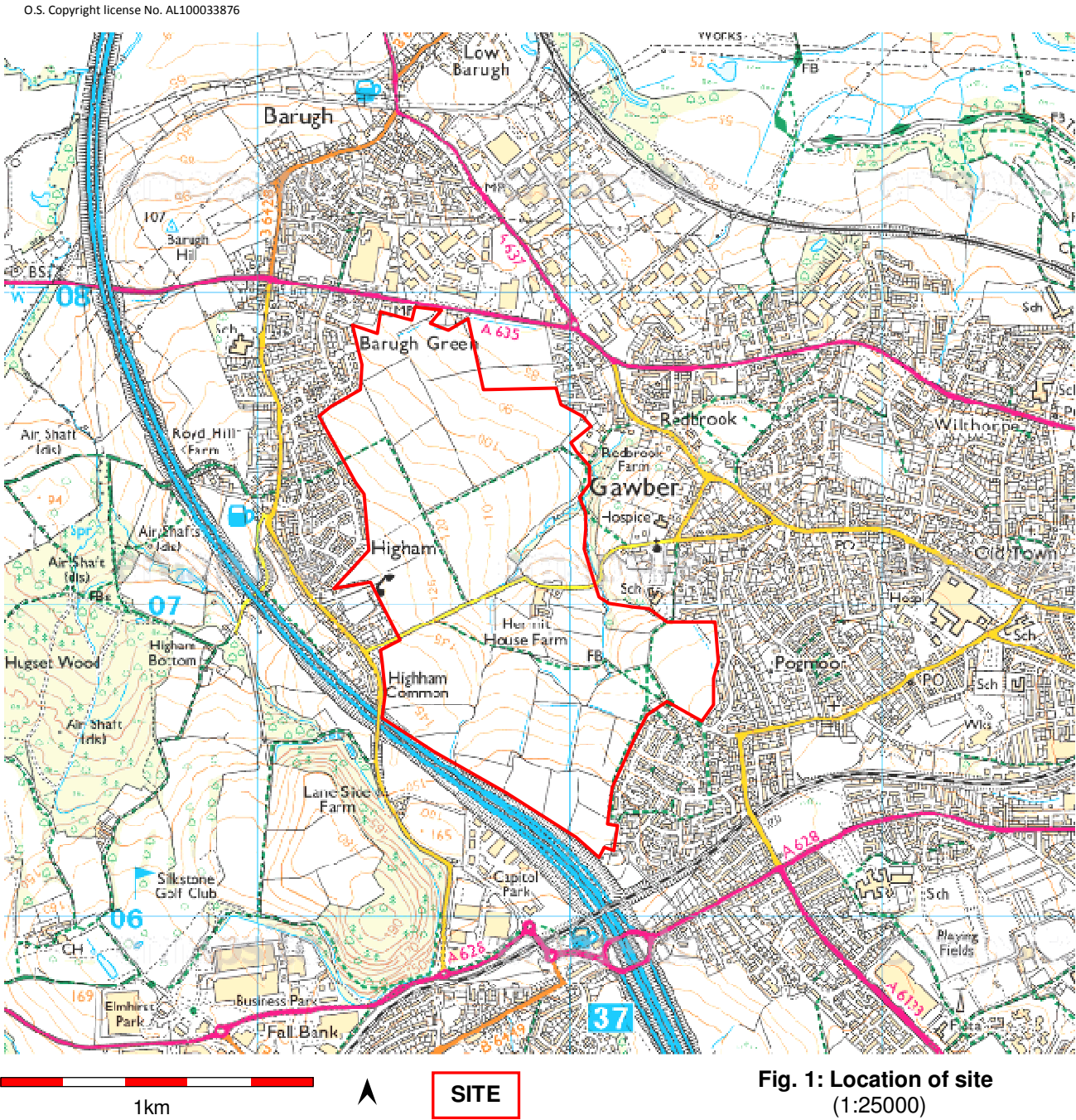
The survey has recorded a limited number of magnetic anomalies that could be attributed to buried archaeological remains. These comprise potential in situ remains associated with former Hermit Cottage in the central region (A21) and some possible isolated ditches in the southern part of the site.

Little of potential archaeological significance was detected on purportedly non-mined ground situated to the north of Hermit Lane, though arrays of parallel linear anomalies might signify relict ridge and furrow cultivation. Other linear responses to the north of Hermit lane include land drains and traces of modern/recent field boundaries.

An extensive zone of relatively strong variation recorded on land in the eastern part of site probably reflects ferrous-rich spoil associated with the construction of the M1 motorway. It is speculated that linear trends on land to the immediate south of this area might relate to vehicular traffic access from the motorway. With that in mind, an archaeological origin of two parallel linear anomalies recorded in this locality should not be discounted.

The survey results appear to concur with cartographic evidence that a strip of land in the northern region has not been subject to open cast mining. However, there is no clearly defined evidence of the interface of mined and non mined areas in the north-western part of A1, at the edges of A4 – A6 or in the central part of A7. The lack of magnetic contrast might imply that most of the un-mined areas contain near surface deposits associated with mining activity and/or post mining landscaping.

The surveyed areas to the south of Hermit lane appear to largely lie beyond the presumed extents of opencast mining.



1.0 Introduction

Acting for Sterling PLC & Strata Homes, Prospect Archaeology commissioned a fluxgate gradiometer survey of land to west of Barnsley, South Yorkshire (centred at NGR SE 3162 0697).

The objective of geophysical survey is to provide information relating to potential archaeological resources within a site, forming part of an archaeological assessment or evaluation, designed to inform a planning application for development of the site.

This report contains extracts of a Desk-Based Heritage Assessment prepared by Prospect Archaeology (Bonnor, 2018).

2.0 Site Description (Fig. 1)

The site, designated as '*Barnsley West*', encompasses approximately 117 hectares of agricultural land and is situated between the settlements of Gawber, Pogmoor and Barnsley to the east, Barugh Green to the north, Higham to the west and the M1 motorway to the south. Hermit Lane runs northeast-southwest across the central part of the site. The area to the north of Hermit lane is principally arable, with the farmyard of Redbrook farm on the eastern boundary. To the south of Hermit Lane the site is predominantly pasture with some arable close to the M1. Hermit House Farm lies just south of the lane in the central region.

A stream, flows along the eastern side of the site, fed by watercourses, rising within the site and converging north of Hermit Lane.

Survey of a number of areas was requested, predominantly situated to the south of Hermit Lane, within part of the site that are presumed to have been less impacted by open cast mining (Fig. 2 & 3: Survey Areas 1 – 27). However, with that in mind, there is bolehole and test pit evidence of recent ground disturbance and colliery waste within areas hitherto thought to have been minimally affected by mining-related activities, particularly in the south-eastern region (J Bonnor, *pers. comm.*).

3.0 Geology and topography

The solid geology of the area comprises Pennine Middle Coal Measures Formation – (Mudstone, Siltstone and Sandstone) - sedimentary bedrock formed approximately 310 to 318 million years ago during the Carboniferous Period in a local environment previously dominated by swamps, estuaries and deltas (BGS, 2021). There are no recorded superficial deposits. However, most of the northern area and some of the southern region have been mined, thus negating current BGS data.

The northern part of the site occupies a generally north-east facing slope, descending from c.138m AOD in the west to c.83m AOD at the eastern boundary.

The ground is gently undulated to the south of Hermit Lane, cut by watercourses/drains, generally falling from c.155m AOD in the southeast to c.105m AOD at Hermit lane.

4.0 Archaeological Context (Fig. 3)

Extract from Desk-Based Heritage Assessment (Bonnor, 2018):

The evidence for early prehistoric activity is restricted to a few possible early flints from the edge of the study area. The composition of the finds is not clear and there is no indication they represent a significant asset. Evidence for later prehistoric and Roman activity takes the form of cropmark/excavated enclosures. The land use of the site will not have been conducive to cropmark formation or artefact recovery that would reveal settlements, enclosures and field systems as found at Capitol Park and Low Barugh and so the potential is deemed Moderate to High for remains of the later prehistoric or Roman periods, which, based upon other local examples could be of up to Regional significance.

The site avoids settlement centres of surrounding villages and, therefore, medieval settlement cores. The phenomenon of assarting and establishment of dispersed farmsteads during this period,

especially in Dodworth, means that there is the potential for medieval settlement remains beyond village cores. The landscape around Hermit House is described in the Historic Landscape Characterisation as assarts and may have medieval, perhaps monastic, origins. The demolition and new construction over and around Hermit House will have significantly impacted on any remains relating to this asset. Brick and concrete structures to the southwest of Hermit House Farm (Area C, Figure 3) are probably related to agricultural or mining activity of the 19th or 20th century. It is possible that remains of the neighbouring cottage remain, though this is more likely of later date. Such remains would be of Local significance. The exposed wall and stonework at the junction of footpaths west of Pogmoor (Area F, Fig. 3*) could represent another isolated farmstead – though could conceivably be of Roman or, less likely, Post-medieval date, and on this basis there is a Moderate-High potential for medieval remains of up to Regional significance.*

There is evidence for management of the streams from at least the early post-medieval period in relation to the Redbrook Mill and Bleaching Works (Area H1, Fig.3). One artificial pond was observed and there is a Moderate potential for other water management remains along the valley. Their significance is likely to be Local.*

During the post medieval period enclosure was completed and the area was largely agricultural, probably pasture, with a good proportion of woodland. The stone kerbed track (Area G, Fig.3) must date to this period and is pre-mining. It follows an ancient boundary and forms an access roughly east-west to the former Drury Spring. There is a suggestion of a track on the 1855 OS map on this alignment. If the track extends as far as it seems, this evidence appears to conflict with the Coal Authority data on the mining of this area. As can be seen from Figure 3*, large parts of the site have been opencast mined, though the track and boundary appear to cross the area of opencast. The track is probably of Local significance.*

The mining has impacted on a substantial area north of Hermit Lane and the general potential of the area is, therefore, limited to area A, east of Higham. The area B (Fig. 3) north of Hermit House is not recorded by the Coal Authority as having been worked though is labelled opencast on the 1960s OS mapping. South of the Lane, the extent of opencast mining is not clear. There are areas shown green on Figure 3* that do not appear to have been disturbed (Areas A, D & E), however the extent of disturbance in the Area of G does not appear to be resolved on the basis of the conflicting evidence.*

* DBA figure 14

5.0 Methodology

The survey methodology was prepared with reference to relevant heritage industry guidance and best practice advice, including the *EAC Guidelines for the use of Geophysics in Archaeology* (Schmidt et al. 2016), and the 'Standard and Guidance for Archaeological Geophysical Survey' (Chartered Institute for Archaeologists, 2014).

Fluxgate Gradiometry is a non-intrusive scientific prospecting tool that is used to determine the presence/absence of some classes of sub-surface archaeological features (e.g. pits, ditches, kilns, and occasionally stone walls).

Gradiometry should help to establish the presence/absence of buried magnetic anomalies, which may indicate sub-surface archaeological features, and may therefore form a basis for subsequent archaeological trenching, where required.

The use of magnetic surveys to locate sub-surface ceramic materials and areas of burning, as well as magnetically weaker features is well established, particularly on large greenfield sites. The detection of anomalies requires the use of highly sensitive instruments; in this instance the Bartington 601 Dual Fluxgate Gradiometer, calibrated to the mean magnetic value of the survey area. Sensors mounted vertically and separated by 1m, measure slight, localised distortions of the earth's magnetic field, which are recorded by a data logger.

The fieldwork was undertaken on and between 10th May and 25th May 2021. The zigzag traverse method was used, with readings taken at 0.25m intervals along 1.0m wide traverses.

The survey grid was established by Global Positioning Satellite to an accuracy of +/- 0.1m using a Leica CS15 RTK with Leica SmartWorx Viva software.

The data were processed using *Terrasurveyor V3*.

The greyscales of the unprocessed data are presented on Figs. 4, 7 & 10.

A 'Despike' function was applied to reduce the effect of extreme readings induced by metal objects, and 'Destripe' to eliminate striping introduced by zigzag traversing. The processed data are presented as greyscale images on Figs. 2, 5, 8 & 11.

Anomalies in excess of +/-10nT are highlighted pink and blue on the interpretive images (Figs. 6, 9 & 12). These are characterised magnetically as dipolar 'iron spikes', often displaying strong positive and/or negative responses, which reflect ferrous-rich objects. Examples include those forming/deposited along current or former boundaries (e.g. wire fencing), services and random scatters of horseshoes, ploughshares etc across open areas. Fired (ferro-enhanced) material, such as brick/tile fragments (often where the latter are introduced during manuring or land drain construction) usually induce a similar though predominately weaker response, closer to c+/-5nT (highlighted in pink/blue on interpretive images). Collectively, concentrations of such anomalies indicate probable rubble spreads, such as backfilled ponds/ditches and demolished buildings. On a cautionary note, fired clay associated with early activity has the same magnetic characteristics as modern brick/tile rubble. As such, the interpretation of such variation must consider the context in which it occurs. It should also be noted that this technique only records magnetic variation (relative to natural background levels). As such, the magnetic response of archaeological remains will vary according to geology/pedology. Additionally, remains may be buried beyond the effective 1 - 2m range of the instrumentation.

The interpretation of geophysical survey results should only be regarded as an aid to establishing the nature and origin of buried features. This can only be fully achieved by intrusive investigation.

A digital archive of the survey data will be retained by PCG.

6.0 Results and discussion (Figs. 2 - 12)

6.1 Areas 1 - 7 (Figs. 2 – 6)

These areas lie north of Hermit Lane, where the site has been heavily impacted by open cast mining.

Only a narrow strip of non-opencast mined land was identified, extending approximately east-west across the central part of the northern area as depicted on the O.S. maps dated between 1960-1966¹ (Fig. 6: dotted yellow lines). This is also shown on the drawing of opencast areas (Fig. 3).

While the area is shown as un-worked on Fig.3, preliminary geo-environmental ground investigations undertaken in July 2019 by JPG recorded reworked topsoil/made ground over reworked natural to a depth of 0.7m (ref 4848-JPG-SW-XX-RP-G-0603-S2-P01). As such, it is likely that elements of recorded magnetic variation reflect this ground disturbance.

Magnetically weak linear anomalies in Area 7 are conceivably associated with cultivation (possibly ridge and furrow: orange lines) and land drains (purple lines). Further probable land drains were detected in A5, within an area designated as un-worked, with a small number of possible land drains in the southern parts of A1 and A3. These appear to have been laid after the mining period, not least given their respect to modern field boundaries.

Zones of strong variation, particularly widespread in the central part of A7, are probably indicative of ferrous-rich materials contained within near surface deposits associated with reinstatement following cessation of mining activity or, possibly, deposited in purported non-mined areas adjacent to the workings (pink and blue). The survey also recorded the abrupt interface of mined and un-worked areas at the northern edge of A7.

An approximately northwest - southeast aligned magnetically strong linear that extends across the northern part of A7 possibly reflects a modern buried ditch/drain containing miscellaneous debris (dotted purple line).

Evidence of a recently removed boundary was recorded in the central part of A1 (yellow line). This boundary formed part of the post mining agricultural landscape.

There is no geophysical evidence of the western edge of opencast mining in the north-western part of A1 or its western extent in A7. Similarly, there are no clear indications of any potential interface of mined and non-mined areas in A4 – A6.

6.2 Areas 8 - 20 (Figs. 2, 3, 7 - 9)

Whilst Area 8 is depicted on Figure 3 as lying outside the extents of open cast mining, historic O.S. Maps indicate open cast mining in the south-western part of the field¹. The survey results do not confirm either scenario, though seemingly random variation across this locality might signify some form of near surface backfill or, indeed, colliery waste. An array of linear anomalies in the northern part of the field appears to be of agricultural origin, possibly relict ridge and furrow (orange lines). Perhaps of note, there are no clearly-defined indications that these continue into the southern half of the field region.

Two east-west aligned parallel linear features extend across the mid eastern region of A8 (yellow lines). Whilst an archaeological origin cannot be discounted, these might merely be associated with a field boundary depicted on O.S. Maps dated 1907 - 1969, implying this part of the field has also remained relatively undisturbed.

A small number of linear anomalies recorded in A10, A15, A16 & A20 have been highlighted as possible indicators of buried ditches, albeit of uncertain origin (red lines). Other linear trends might reflect cultivation (orange lines).

Most surveyed areas are magnetically 'busy', with widespread scatters of discrete anomalies and more extensive zones of variation. Whilst it seems likely that most magnetically weak discrete anomalies have little or no archaeological value, it has not been possible to confidently distinguish natural/modern responses and those induced by potential archaeological pits.

Bolehole and test pit data (albeit limited) in the mid part of this survey block confirm that land that lies in proximity to Hermit House Farm may be largely unaffected by direct mining activity, thus implying that random magnetic variation signifies variations in the natural.

Zones of stronger magnetic variation (pink and blue) were recorded along the eastern side of A15, in the locality of a mine access and along the north-eastern edge of A17 where variation probably signifies some form of activity associated with an area of former open cast mining to its immediate east (Fig. 3). Additionally, a band of strong variation at the western side of A18 and south-west corner of A17 corresponds to the eastern extent of open cast mining. It should be noted the mined area extends eastward though only partially beyond both the historic and current western boundary of A18, which appears to be unchanged. This suggests that some field boundaries were maintained during the period of mining. Indeed, the modern eastern and south-eastern boundaries of former Drury Spring Wood, which lay to the west within a large zone of mining, also remain unchanged.

A buried service extends across A17 (blue line). A weak linear anomaly to the west of this in A16 is similarly orientated, thus possibly related though an apparent association might be incidental (yellow line). In any event, this is considered more likely to be of recent rather than archaeological origin.

The results in A18 are characterised by widespread and perpendicular arrays of linear anomalies, probably some form of cultivation (orange lines). A test pit in the south-west corner of the field identified near surface made ground, reworked top soil and colliery waste. However, given the limited ground investigations in this field, the extent of disturbance across a wider area within A18 cannot be determined by non intrusive investigation. It is therefore unclear if the cultivation is associated with natural soils or imported materials.

Open cast mining is mapped as having extended into the southern edges Areas 19 & 20 (Fig.3). Clearly, however, this does not include the boundary with A18 that is followed by a kerbed track (Bonnor, 2018).

Potential ditches were recorded in A20 (red lines). There is no geophysical evidence that the east-west aligned example at the southern side of the field extends westward into A19. It is possible that any such former continuation west might have been eradicated at the edge of open cast mining (or ancillary activity).

6.3 Areas 21 - 27 (Figs. 2, 3, 10 - 12)

A zone of stronger magnetic variation in the north-western corner of A21 conceivably represents a spread of demolition material associated with former Hermit Cottage (Fig.11: circled yellow). A number of linear anomalies were also recorded within and adjacent to the remains of the cottage, some corresponding to recent boundaries¹ (solid yellow lines), with others of uncertain origin and possibly of archaeological value (red lines). One example lies in close proximity to, and is parallel with, a known boundary, thus implying a contemporaneous relationship (dotted yellow line). For the most part, other strongest responses are clearly associated with current boundaries and the western edge of Hermit House Farm buildings.

Traces of potential cultivation were recorded in A23 (orange lines). Stronger variation almost certainly relates to mining activity. It should be noted that the central region is mapped as having been subject to open cast extraction and a mine access point though the survey has not identified any transition between work and un-worked areas (Fig. 3).

Widespread strong magnetic variation was recorded across almost the entire surveyed area in A24 (Fig. 11: pink and blue). This area was utilised for spoil deposition during the construction of the M1 motorway (JPG geotechnical report) - borehole and test pit investigation in the mid western part of the area has established that the depth of made ground over the natural exceeds 3.5m where sampled. Linear features in the magnetically quieter north-eastern region possibly signify cultivation (orange lines).

Two approximately north-south aligned parallel potential ditches were detected in the western part of A25 (red lines). However, whilst clearly of anthropogenic origin, it is possible that these might be vehicle access tracks associated with the construction of the motorway. Indeed, further linear trends in this area and in A26 are more likely to relate to the motorway construction than earlier archaeological remains (dotted yellow lines). Stronger variation, particularly along the western edge probably reflects materials potentially associated with the construction of the motorway.

Nothing of potential interest was recorded in A27, the results suggesting that variation largely reflects probable made ground situated on the western edge of an area of open cast mining (Fig 3).

7.0 Conclusions

The survey has recorded a limited number of magnetic anomalies that could be attributed to buried archaeological remains. These comprise potential in situ remains associated with former Hermit Cottage in the central region (A21) and some possible isolated ditches in the southern part of the site.

Little of potential archaeological significance was detected on purportedly non-mined ground situated to the north of Hermit Lane, though arrays of parallel linear anomalies might signify relict ridge and furrow cultivation. Other linear responses to the north of Hermit lane include land drains and traces of modern/recent field boundaries.

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The survey results appear to concur with cartographic evidence that a strip of land in the northern region has not been subject to open cast mining. However, there is no clearly defined evidence of the interface of mined and non mined areas in the north-western part of A1, at the edges of A4 – A6 or in the central part of A7. The lack of magnetic contrast might imply that most of the un-mined areas contain near surface deposits associated with mining activity and/or post-mining landscaping.

The surveyed areas to the south of Hermit lane appear to largely lie beyond the presumed extents of opencast mining.

8.0 Acknowledgements

Pre-Construct Geophysics Ltd. wish to thank Prospect Archaeology for this commission.

9.0 References

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CIFA 2014 *Standard and Guidance for Archaeological Geophysical Survey*. Chartered Institute for Archaeologists.

Schmidt, A; Linford, Linford, P; N; David, A; Gaffney, C; Sarris, A; & Fassbinder, J; 2016. *EAC Guidelines for the use of Geophysics in Archaeology: Questions to Ask and Points to Consider. EAC Guidelines 2*. Euopae Archaeologiae Consilium.

¹<https://www.old-maps.co.uk>

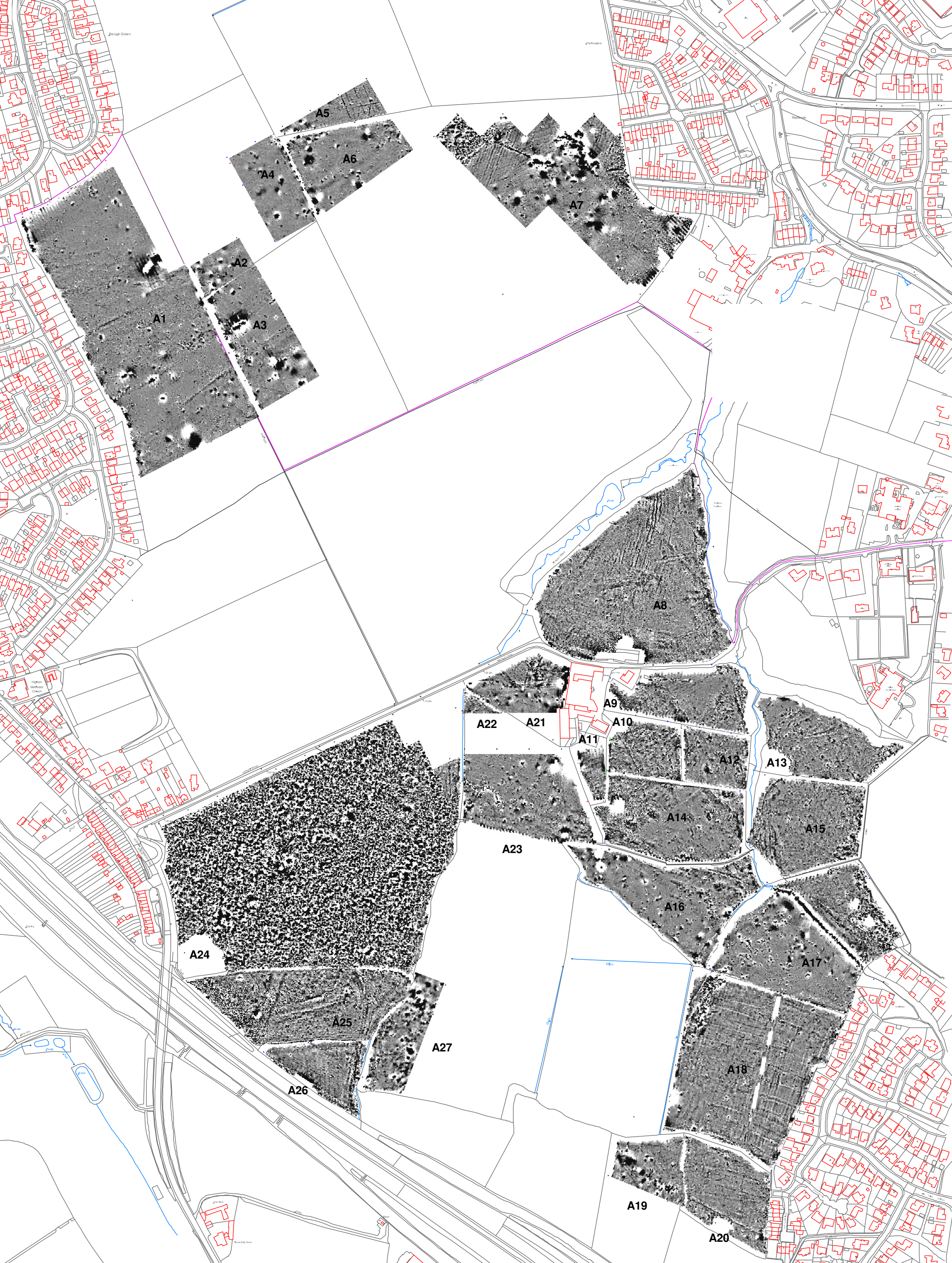


Fig 2: Greyscale images of raw data

(1:4000)

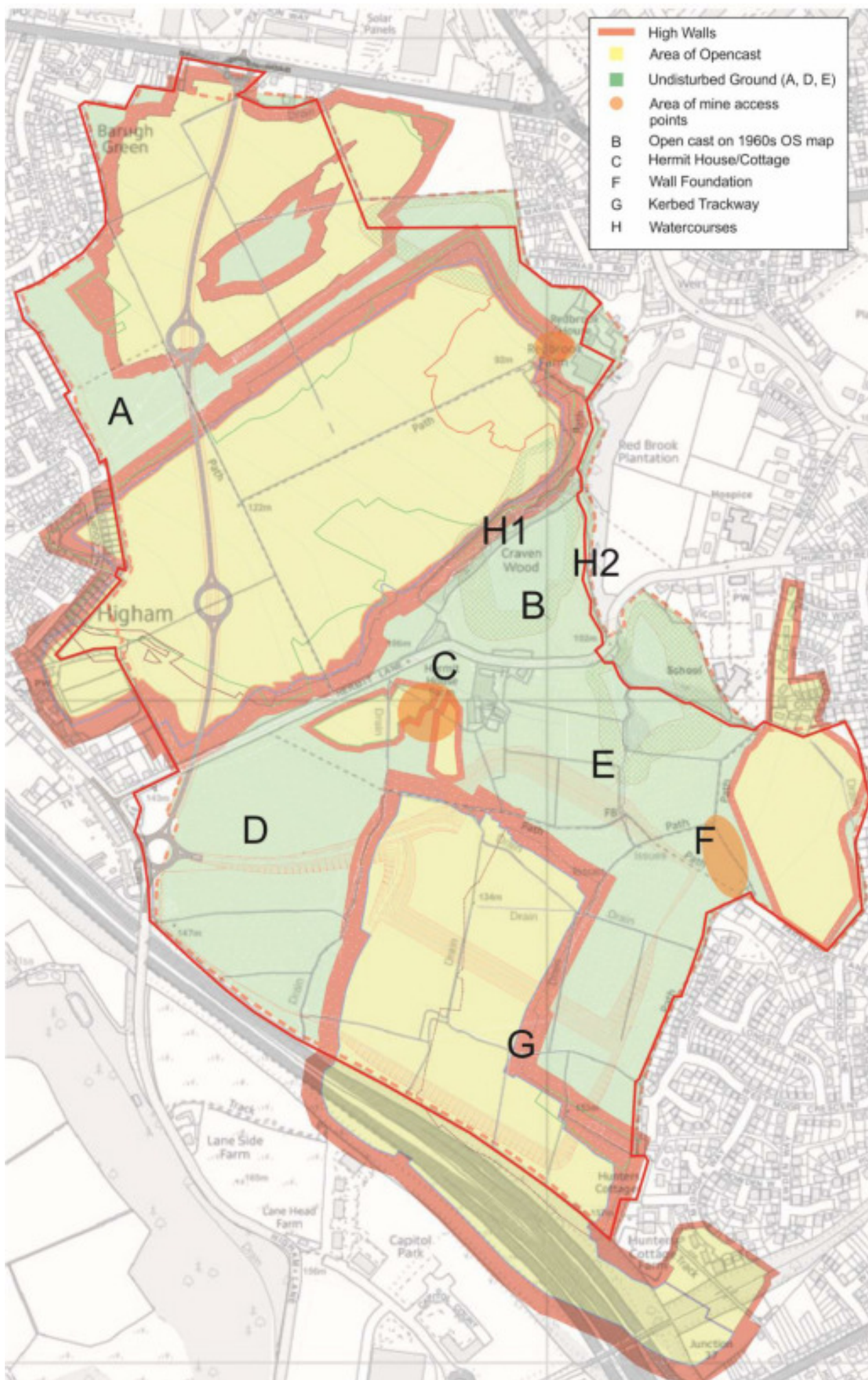
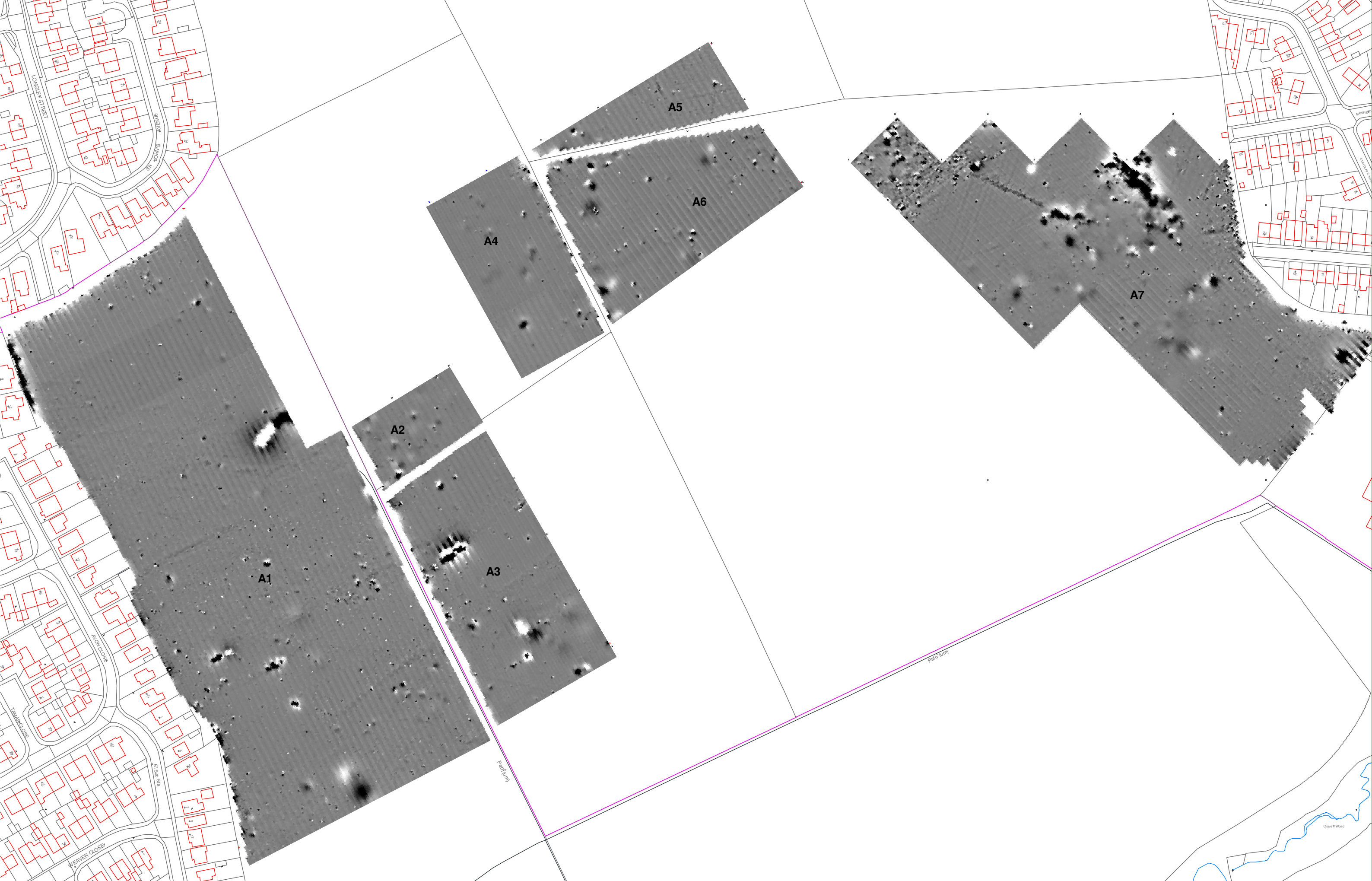


Fig. 3: Map showing former mining and areas of archaeological potential



100m



< -40 nT >40



Fig 4: Areas 1 – 7, Greyscale images of raw data

(1:2000)

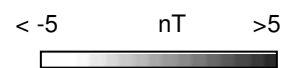
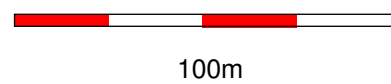
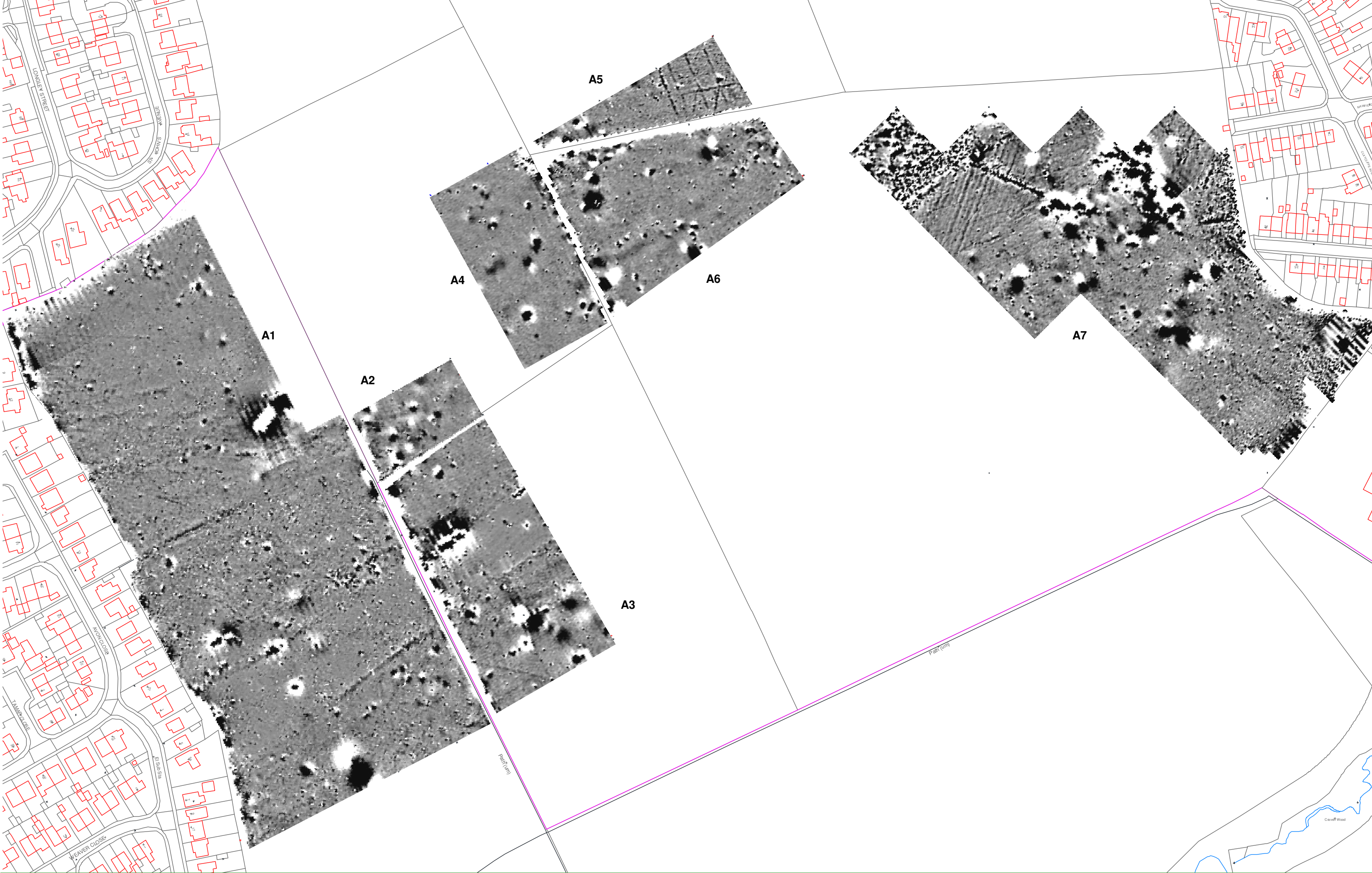


Fig 5: Areas 1 – 7, Greyscale images of processed data

(1:2000)

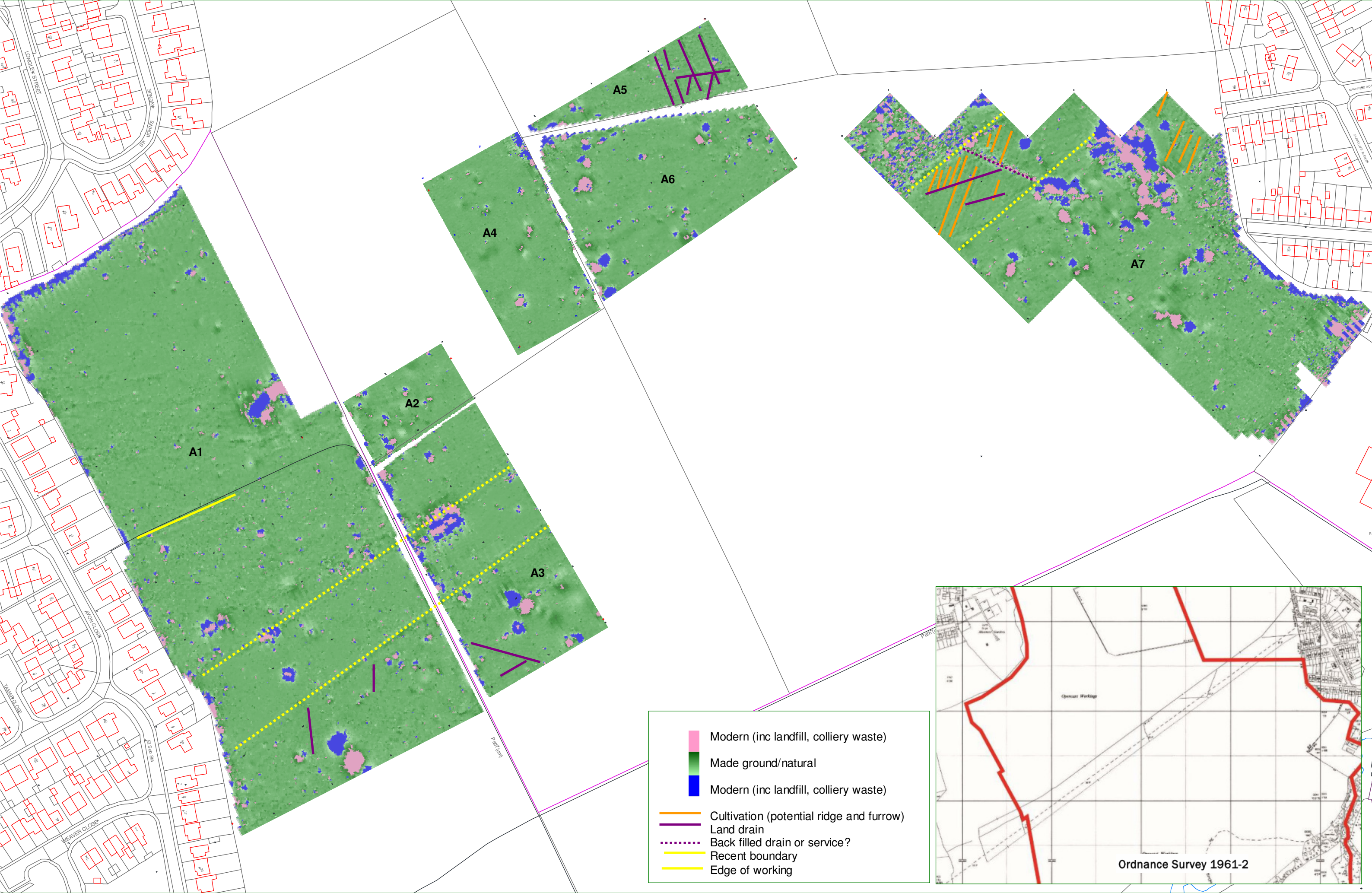


Fig 6: Areas 1 – 7, Interpretation

(1:2000)