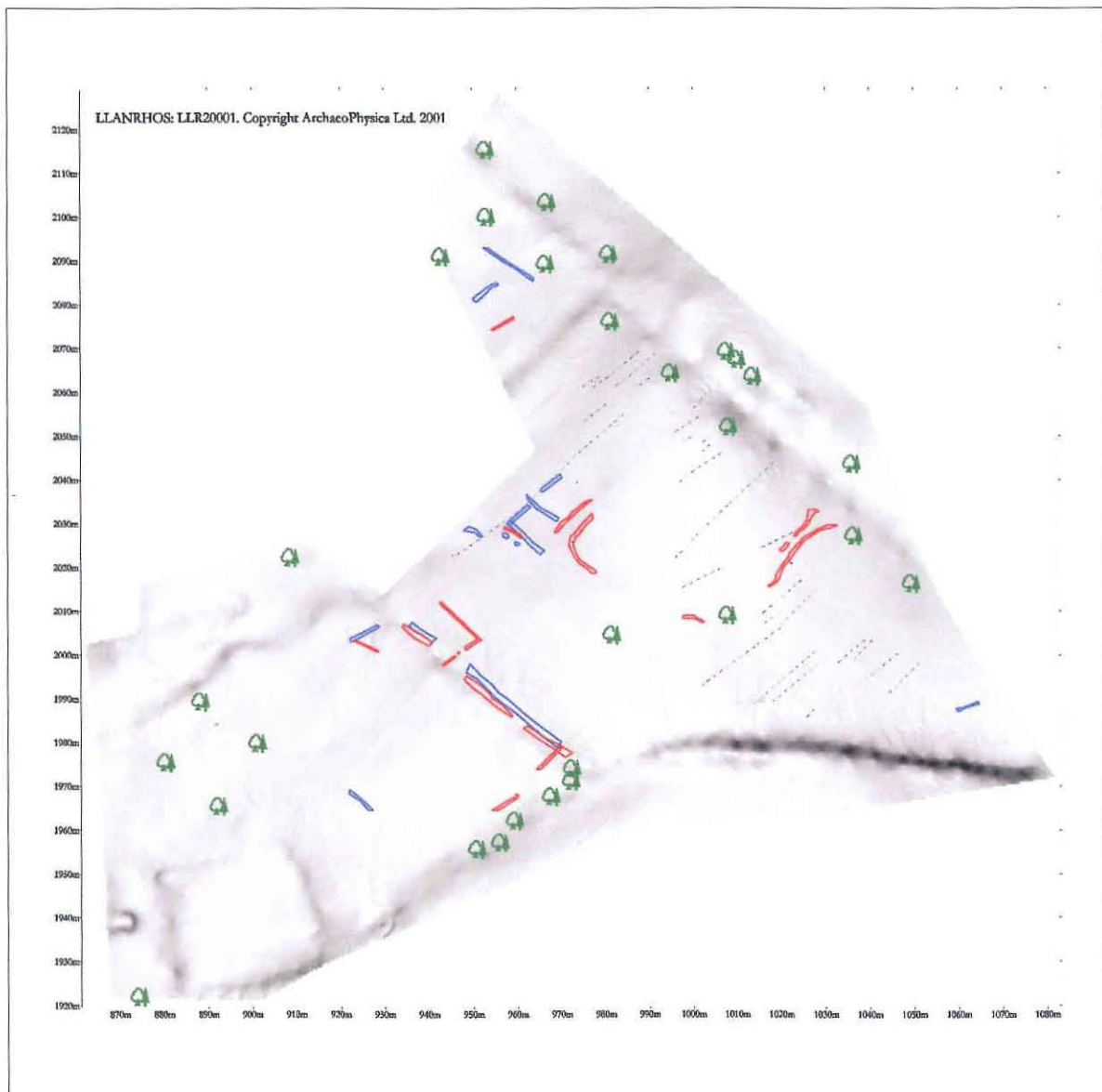


Proposed extension to Llanrhos cemetery, Conwy

ARCHAEOLOGICAL ASSESSMENT



CPAT Report No 406.1

**Proposed extension to Llanrhos cemetery,
Conwy
ARCHAEOLOGICAL ASSESSMENT**

**N W Jones, R J Silvester,
A and M Roseveare
February 2001**

Report for Conwy County Borough Council

The Clwyd-Powys Archaeological Trust
7a Church Street, Welshpool, Powys, SY21 7DL
tel (01938) 553670, fax (01938) 552179
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prepared by	R J Silvester	<i>R.J.S.</i>	13/02/01
	N W Jones	<i>N.W.Jones</i>	13/02/01
	A Roseveare	<i>A.Roseveare</i>	13/02/01
	M Roseveare	<i>M.Roseveare</i>	13/02/01
checked by	R.J. Silvester	<i>R.J.S.</i>	13/02/01
approved by	R.J. Silvester	<i>R.J.S.</i>	13/02/01

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Internal memo

The Clwyd-Powys Archaeological Trust

7a Church Street Welshpool Powys SY21 7DL

tel (01938) 553670, fax 552179

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**PROPOSED EXTENSION TO LLANRHOS CEMETERY, CONWY:
ARCHAEOLOGICAL ASSESSMENT**

SUMMARY

The assessment has identified a number of features of known or potential archaeological significance which are likely to be affected by the proposed development. In addition there may be further potentially significant buried features or artefacts which have not been detected by any of the methods used in the survey.

The geophysical survey has identified a possible structure immediately to the south-east of the present churchyard, and a second just beyond the south-west boundary of the development area, although possibly with associated features extending into the area. There is no surface evidence in the form of earthworks and the remains are therefore likely to consist of buried features such as ditches, pits etc., cut into the subsoil. If the data do represent archaeological features they are likely to be fairly slight and thus easily damaged by ground disturbance.

Two possible tracks have been identified, one associated with a low earthwork bank to the north-east of the churchyard, and the other identified only by the geophysical survey and which may have flanking ditches.

The former Estate Drive runs north-west to south-east, close to the north-east boundary of the area. Surviving as an earthwork with tarmac surface and flanked by the remains of an avenue of trees the drive is a significant landscape feature. The likely effect of the proposed cemetery extension on the drive is not known.

With the exception of the former drive, further investigation would be required in order to determine the nature, condition and significance of all features which have been identified.

1 INTRODUCTION

- 1.1 Conwy County Borough Council are proposing to extend the cemetery attached to Llanrhos church near Llandudno, and due to the perceived significance of the church the Gwynedd Archaeological Planning Service, in their capacity as archaeological curators for the area, recommended that an evaluation be undertaken in advance of any works in order to establish the potential impact of the proposal.
- 1.2 In June 2000, the Contracts Section of the Clwyd-Powys Archaeological Trust, hereafter CPAT Contracting, were invited to submit a tender for the assessment, based on a brief prepared by the Gwynedd Archaeological Planning Service (brief D440br; undated) for the Highways and Technical Services Division of the County Borough Council. The tender was accepted by the Council on 10 October 2000, and elements of the desk-top assessment were commenced during that month, continuing into November. The other elements of the evaluation - measured survey and geophysical survey - were undertaken by A and M Roseveare of ArchaeoPhysica¹ in November 2000 and January 2001 respectively.
- 1.3 A list of the repositories and sources used during the desk-top assessment are provided in Appendix 2.

2 LOCATION and TOPOGRAPHY

- 2.1 The church of St Mary at Llanrhos (previously Eglwys-rhos; PRN 4596; SH 79338032) lies a little less than 2km to the south-east of the heart of the town of Llandudno and about 1.5km north-east from Deganwy, where the land begins to narrow between the north coast and Afon Conwy which runs into Conwy Bay. The proposed cemetery extension occupies land to the east of the present churchyard, encompassing an area of 1.11ha (Fig. 1). The original proposal on which the brief was based included an area which extended further to the south encompassing 2.027ha, and the desk-top study and total station survey both encompass this wider area. Following consultation with Gwynedd Archaeological Planning Service it was agreed that the geophysical survey should concentrate on the revised area likely to be affected by the proposed development.
- 2.2 The church and its churchyard occupy flattish ground at 30m (100') above sea level. About 300m to the north-east the ground ascends rapidly to Bryn Maelgwyn while in the opposite direction but rather further away the hill supporting Deganwy Castle looms over the Conwy Estuary. With high ground also to the north Llanrhos is effectively set in a basin open only to the south.
- 2.3 In recent times the church has acquired a housing estate for a neighbour on the south, but retains some of its rural identity, set as it close to parkland associated with Gloddaeth, a former home of the Mostyn family which lies one kilometre to the north-east.
- 2.4 The name Eglwys-rhos has been superseded by Llanrhos during the last century or so. E. H. Hall at the beginning of the 19th century referred to both terms as though they were interchangeable. During the 19th century the ecclesiastical parish was known as Eglwys-rhos (or Eglwysrhos) but there was a small village within it called Llanrhos. With the administrative change from parish to community, Llanrhos has been favoured, thus confirming a trend already evident at the beginning of the 20th century.
- 2.5 The drift geology consists of clays and gravels with thin topsoil. The area is now pasture with short grass cover which at the time of the geophysical survey was badly waterlogged with large areas of severely poached bare soil.

3 THE SITE: ITS HISTORY, ARCHAEOLOGY and LANDSCAPE

Early Medieval

- 3.1 The importance of the church at Eglwys-rhos in early times should not be underestimated. Roberts in 1992 speculated that this might be a particularly early site. Its proximity to the important secular

¹ 77 High Street, Newport, Shropshire

centre of Deganwy and the suggestion that 'eglwys' names (borrowed from Latin 'ecclesia' for church) appear only singly in commotes might indicate an early origin, as perhaps, unusually, does its combination with the name of the cantref of Rhos. As such it might represent the earliest church site in the cantref.

- 3.2 The church also has a strong traditional link with the 6th-century prince, Maelgwn Gwynedd. He is supposed to have taken refuge in the church to avoid the yellow plague, but a prophecy about his death was fulfilled and he died and was buried there. Other writers claimed that he was responsible for the erection of the first church at Eglwys-rhos, though an alternative view sees the church as having been founded by St Eleri of Gwytherin. Whatever the true origins of the church, the underlying strength of these traditions cannot be dismissed. They were repeated consistently by later 18th and 19th-century travellers and clearly had a much longer currency, and in this context it might be noted that Sian Mostyn, buried in the church in 1571, was reputedly interred in the grave of Maelgwn Gwynedd. While the details cannot now be verified they highlight the likely importance of the church at Eglwys-rhos in early times.
- 3.3 The fabric of the church contains nothing from such an early period - it would be an extremely rare survival if it did for it can be generally assumed that early churches were of timber. A 5th-century stone in the church was brought from Tyddyn Holland, some little distance away, to secure its safety and is thus not a legitimate indicator of early activity.
- 3.4 There is, however, some other evidence that could conceivably have a bearing on this early period. West of the road (the modern B5115) and about 250m from the church is a curving field boundary, in itself not an unusual feature in the local landscape. However, taken in conjunction with a further length of boundary, now gone, on the east side of the road, where it edged the Mostyn Arms (see the 1889 Ordnance Survey map: Fig. 4), it is possible to define about half the boundary of a large sub-circular enclosure with the church set eccentrically within it. It is tempting to compare the features at Eglwys-rhos with the early church sites and their large enclosures reported in Carmarthenshire and Pembrokeshire by T James. It should be stressed, however, that this can only be a tentative hypothesis, based on what may be a fortuitous configuration of boundaries. Nevertheless it should be considered in the light of the proposed graveyard extension which would almost certainly cut across the projected line of such an enclosure boundary. It is also interesting to note that there appears to be a local tradition that burials have been noted in the field to the west of the road (Fig. 1, PRN 12998). There is also a tradition that a burial, reputedly of Early Christian date, was found during alterations to the road (Fig. 1, PRN 12999).

Medieval

- 3.5 In the medieval period Eglwys-rhos lay within the medieval commote of Creuddyn and the cantref of Rhos.
- 3.6 The church was first recorded in the Norwich Taxation of 1254. In 1350 it was acquired from King Edward III by the abbey of Aberconwy in exchange for the grange of Ffriwlwyd which lay on the southern coast of the Llyn Peninsula. It is claimed that the church was then rebuilt by the monks and re-dedicated to St Mary. Now a cruciform church, it has some medieval fabric remaining in its walls but was heavily restored in 1820 and again in 1865. The only other medieval survivals are the timbers from the late medieval arch-braced roof, the font, and from a later period, an 18th-century cupboard and some 17th and 18th-century memorials.
- 3.7 The churchyard was formerly small and rectangular and appeared so on the Tithe Map of 1840 (Fig. 2). A medieval origin seems likely and the lack of any degree of curvilinearity is interesting though not necessarily of any great significance. At some point in the next fifty years it was extended eastwards, more than doubling its area.

Post-medieval

- 3.8 Thomas Badeslade's plan of the estate of Gloddaeth was drawn in 1742, one of a number of such maps produced for the Mostyn family around this time (not reproducible in this report because it is a rolled manuscript map which cannot be readily copied). It offers the first cartographic representation of the church and its environs, though in the mid-18th century the land immediately around the churchyard was in the ownership of Sir Robert Williams and continued with the same family for another century. Badeslade's plan shows the church in its rectangular churchyard, a building, probably a cottage, on its northern edge, presumably to be equated with Llanbach (see section 3.10 below), the dwelling or farm later to be called Glebe House (see section 3.11 below) together with outbuildings against the churchyard wall on the south side of the church, and two small buildings which may also

have been cottages to the west of the churchyard, one projecting from the churchyard wall and the other on the opposite side of the road. Neither of these buildings appears to have survived into the 19th century. Fields and enclosures were shown to the north, east and south of the churchyard but it has to be born in mind that this land did not form part of the Gloddaeth estate and may not have been accurately portrayed.

- 3.9 South of the field within which was Glebe House and was later to house the Mostyn Arms (see below) was the 15-acre field of Cae'r Llan. Though beyond the proposal area, it is significant for the landscape elements that were depicted by Badeslade. It contained three ponds or lakes, all controlled by dams, two of them in line towards the western side of the field and the third fed by a second stream or spring further to the east. Whether these resulted from the enhancement of the Gloddaeth landscape in the post-medieval era or were related to the much earlier activities of the Aberconwy monks cannot be established (see Atkinson 1999). Certainly by 1854 there was only one pond remaining.
- 3.10 19th-century maps (Figs 2-5) show a scatter of buildings around the churchyard: the Mostyn Arms (PRN 12992) about 120m south of the church, and cottages known as Llanbach (subsequently the Queen's Head) on the northern edge. Both of these were in place by the time of the Tithe Survey (1840), but have now gone, the latter by 1913 (Fig. 6) though their earthworks were still faintly visible on aerial photographs in 1947. Neither, however, lay within the area of the proposed churchyard extension. On the opposite side of the road to the church were the Post Office and the School, the latter established soon after 1822, the former, of course, rather later.
- 3.11 South and south-east of the church were a series of small bounded enclosures, though these had been largely removed by 1889 leaving only the Mostyn Arms. The earlier Tithe Map, however, points to further buildings close to the churchyard wall, though the associated Apportionment (which was compiled six years after the map was drawn) is silent; and their presence is confirmed by an estate map of early 19th-century date which shows Glebe House (PRN 12991), associated outbuildings, a yard and gardens, and a track running along the east side of the garden area and then eastwards along the southern edge of the adjacent field. This map carries an appended date of 1858 but was certainly drawn at the beginning of the 19th century before either the Mostyn Arms or the school were erected. From this it can be assumed that the area immediately to the south of the churchyard was heavily occupied from the early 19th or perhaps the late 18th century.
- 3.12 The land around the church to the east of the road was integrated into the grounds of Gloddaeth Hall by Lady Augusta Mostyn after 1861. New lodges were built, that to the north of the church dated to 1881, and new drives from these ran eastwards to the hall itself. In 1840 some of the land including the field to the north-east of the church, a small part of which falls within the proposal area, and another smaller one to the east, had been under arable cultivation, the rest down to permanent pasture. By 1889 the new drives had been created with their avenues of trees, that from the lodge north of the church still surviving today though now terminating at the new road (see below). The land adjacent to the drives was probably all turned over to pasture and a circular conifer plantation established a few hundred metres to the south of the church.
- 3.13 The immediately post-war aerial photographs hint at cultivation ridges (or perhaps drainage gullies) in the land immediately to the south of the proposal area (comparable perhaps with ridging closer to Gloddaeth Hall). These are too faint to be accurately defined but do not appear to impinge on the proposal area.
- Modern*
- 3.14 In recent years, the A470 (Wormhout Way) has been introduced into the landscape, no more than 200m away from the church and defining the eastern boundary of the proposal area.

4 TOPOGRAPHICAL AND EARTHWORK SURVEY by A and M Roseveare

- 4.1 The topographical survey was conducted by ArchaeoPhysica using a Nikon DTM730 total station and downloaded in ENZ format before being separated into spot-heights and map data. Data were collected across two days, from two stations related to OS datum which were set up in the east and west parts of the survey area to guarantee coverage. The two stations have been left in situ but are marked with temporary wooden grid pegs only. Profiles were surveyed across all earthworks as appropriate and the data form part of the digital archive. All features identified were photographed in 35mm format black and white and colour print and colour slide, each view including a photographic scale.
- 4.2 The results from the survey are presented in two forms: a contour survey (Fig. 7) at 100mm intervals related to Ordnance Datum, and a false relief plot (Fig. 8) which is particularly interesting as it identifies a number of features not evident from the contour plot.

Glebe House earthworks (PRN 12991)

- 4.3 A confused set of earthworks mark the site of buildings immediately to the south of the present churchyard, presumably associated with the site of Glebe House and associated structures (see section 3.11), although it is difficult to identify individual buildings. There is, however, a broad platform standing 0.3m to 0.4m above the land to the south and extending as far as the churchyard to the north. Various small earthworks exist on this platform, notably a low (0.15m) and approximately circular mound, and there is also a suggestion that the platform may have been subdivided, as indicated by two broad indentations in the southern edge of the platform. Other small and less well-defined earthworks are assumed to be elements of a number of structures together with boundaries and a track which are depicted on the Tithe Map (Fig. 2). It is possible that the surviving earthworks may also relate in part to earlier settlement predating the Tithe Map, although this cannot be demonstrated.

Mostyn Arms earthworks (PRN 12992)

- 4.4 The Tithe Map and Ordnance Survey 1st edition (Figs 2 and 4) show two buildings forming the Mostyn Arms. From the surviving earthworks it is clear that the modern road has encroached on the western side of the site destroying part of the southern building and at least the west wall of the other. There is some exposed masonry concentrated towards the south-east corner of the complex, which seems to be a stub of stone wall, perhaps a jamb or corner. There are also fragments of brick visible in the turf but it is difficult to determine whether these are part of the public house or not as there are some firmly embedded fragments of concrete towards the south-east corner which may indicate that materials from elsewhere have been dumped on the site. The adjoining yard or enclosure to the east is well-defined and although the interior is featureless its appearance suggests that a yard surface may survive below the topsoil. The Ordnance Survey of 1889 (Fig. 4) shows two small structures at the south-east corner of the enclosure, and although these could not be identified as earthworks, some brick and rubble was visible.

Gloddaeth Estate drive (PRN 12993)

- 4.5 This feature is known to have been created by Lady Augusta Mostyn during the second half of the 19th century. The drive, which has a tarmac surface a little over 3m wide, was originally flanked by an avenue of trees, many of which are now missing. Aligned north-west to south-east the drive is scarped into the slope by approximately 0.3m at the north-west end but raised on an embankment as the ground falls to the south and east. The embankment profile is asymmetrical with a longer and steeper fall to the south-west, reflecting the topography. Beyond the survey area the drive has been lost beneath the new A470.

Field boundaries

- 4.6 To the north-east of the churchyard a slight earthwork (PRN 12994) aligned north-east to south-west appears to predate the present churchyard, and may be overlain by the Estate Drive, although it could not be traced on the north-east side of the drive. The earthwork takes the form of a indistinct bench cut across the slope, with a shallow non-revetted slope 0.3m high against the higher ground to the north. It is likely that this is an former field boundary and track shown on the Tithe Map (Fig. 2) in approximately this position.
- 4.7 Two other former field boundaries survive as earthworks, both of which appear on the Tithe Map. A low but well-defined earthwork (PRN 12995) runs south-east from the corner of the churchyard. The feature is up to 0.2m high and 2m wide at the south-east end, although less well-defined at the north-

west end. There are traces of a wide silted ditch, which although indistinct, appeared to be approximately 2m across along the south-west side at the south-east end. At the south-east end there is a suggestion that the boundary may turn to the east for a short distance, leaving a gap or entrance between it and a curving lynchet (PRN 12996). This feature is well-defined along its eastern section, surviving to 1.3m high with a silted ditch 0.3m deep and up to 3m wide on the south side, but much lower (up to 1m) to the west, lacking any revetment or ditch. It is possible that the two sections of earthwork are actually separate features and not a continuous boundary, although it is difficult to be certain. The top of a stone revetment appears to be eroding out of the lynchet along the eastern section and is visible as a line of fairly large stones close to the edge.

Ridge and furrow

- 4.8 A substantial area of fairly ridge and furrow (PRN 12997) exists along the southern edge of the survey, to the south of the lynchet (PRN 12996), and apparently contemporary with it. The ridge and furrow is aligned approximately north to south, with 3-4m between furrows and the ridges standing to only 0.1m in height, having been much reduced by ploughing.

Other features

- 4.9 There are a few other features within the development area that are worth noting. The retaining wall of the churchyard has been repaired many times in differing styles and some of it is now unstable but retains character. The remains of a steel 'kissing-gate' can be found near where the Estate drive is truncated by the new A470; it is not thought to have been situated within a solid boundary here and has perhaps been moved from somewhere else on the estate. At least three short concrete posts survive which apparently mark the lines of footpaths on the estate.

5 GEOPHYSICAL SURVEY by A and M Roseveare

Methodology

- 5.1 The curatorial brief stipulated the use of fluxgate gradiometry as the preferred option for geophysical survey, although following discussions with the curator, Neil Johnstone, it was agreed that the superior caesium vapour technology would be used as it has demonstrable benefits for archaeology. The survey was undertaken by ArchaeoPhysica using a Geometrics G858 caesium vapour magnetic vertical gradiometer. The primary advantages of this for routine survey are speed, sensitivity and invulnerability to thermal drift, the latter a particular problem for fluxgate gradiometers. The Geoscan Research FM36 fluxgate gradiometer used frequently in archaeology is not a true gradiometer which has repercussions when comparing data across sites. It is a vertical component differential magnetometer and produces data that should be converted to true gradient before comparison with the caesium vapour gradiometers. All magnetic gradiometry data in this report represents non-directional magnetic gradient expressed as nano-Tesla per metre (nT/m). In approximate terms only (ignoring factors of directional dependency) 10nT/m in this report would be comparable with 5nT for a FM36 instrument.
- 5.2 Following discussions with the curator, it was decided that the magnetic line scanning would not be undertaken. The use of this survey methodology does not provide an adequate representation of the magnetic variability of the subsurface, especially for small areas over potentially variable geology or low magnetic susceptibility deposits, such as glacial moraine deposits. This is because the variation in magnetic field strength resulting from geological differences in these deposits can be as large as the anomalies of small but significant archaeological features, e.g. drainage gullies and without a lateral spread of data these features could not be detected. Reduced-field strength anomalies, often caused by non-magnetic stone structures intruding into more magnetic soil, can be lost completely.
- 5.3 The methodology adopted was for a medium resolution (e.g. 1m x 0.25m) survey of approximately 1.1 ha within the eastern half of the field (Fig. 2). This area was reduced slightly in practice but took longer to complete than expected due to extremely soft and wet ground conditions. Medium-resolution survey is usually adequate for the accurate detection and location of archaeological features, including most of those to be found on medieval and post-medieval sites although the smaller elements of the prehistoric landscape and other fine detail are definitely better resolved at higher resolutions, e.g. 0.5 x 0.25m.
- 5.4 The survey was aligned on magnetic north to provide maximum resolution along the axis of any anomalies and lines were carried as close to the edges of the field as possible. Fiducial markers were

at 2m intervals along east to west lines, a maximum of 40m apart. The survey grid was located relative to the topographical survey by total station.

- 5.5 During survey a low susceptibility contrast became evident, which results in magnetic anomalies of archaeological origin being of low amplitude. This implies a less magnetic soil than would be expected at this location and means that the survey results should be used with caution: a lack of apparent archaeological features may in part be a reflection of the lack of magnetic contrast.

Survey variables

- 5.6 Instrument: Geometrics G858 caesium vapour magnetic vertical gradiometer.
 Sampling: Survey lines 1m apart, data collected at intervals highly dependent on ground conditions and with a temporal interval of 0.1 seconds per sample:
 West part of survey: average 0.1m
 East part of survey: average 0.09m
 Central part of survey: average 0.11m
 North part of survey: average 0.07m

These are much smaller than the 0.15m average usually resulting from surveys with this instrument because ground conditions prevented a faster rate of survey

Ground and weather conditions

- 5.7 The ground and weather conditions at the time of the survey were as follows:
- Weather: Damp with the occasional light shower and gusty wind, occasionally strong.
 - Geology: Drift: clays and gravels.
 - Soils: Thin topsoil over wet clays with rounded gravels at larger depths and some isolated stones.
 - Ground cover: Badly waterlogged short grass. Large areas of severely poached bare soil.

Processing and interpretation

- 5.8 Various software packages were used during the acquisition, processing and presentation of the magnetic data. Instrument download and spatial registration were achieved using proprietary software for the magnetic gradiometer. Subsequent geophysical processing was conducted using in-house GeoGenie software before porting the data to Surfer for image production and incorporation with basemaps and digitised results, etc.
- 5.7 Processing of the data has been heavily biased towards locating low amplitude anomalies, using predominantly graphical techniques after careful preparation and removal of survey defects. The overall emphasis has been to keep processing to a minimum to avoid the introduction of artefacts in the data which is especially relevant when seeking low amplitude anomalies. Initial processing included removing most of a fairly large number of single-sample high amplitude spikes resulting from the instrument itself and balancing adjacent survey lines to the lateral median amplitude trend. This ensures that the slight amplitude offsets between adjacent lines, caused by surveying them in opposite directions, can be removed without removing long-wavelength trends in the data, perhaps resulting from geological changes. This line offset results from an effect known as 'heading error' where tiny imperfections in the magnetic symmetry of the instrument, and the presence of the operator, result in the measured field becoming a direction-dependent vector that will change amplitude depending on instrument orientation relative to magnetic north. Lines of data have been exactly interpolated to a regular spacing of 0.25m using a radial multiquadric algorithm with no anisotropy, honouring the original data. To allow different susceptibility contrasts to be sought various discrete ranges of data have been examined, first between wide limits of +/- 100nT/m to highlight the high-amplitude anomalies of ferrous debris and larger archaeological anomalies, e.g. hearths, and then across narrower ranges to pick out weaker anomalies. Particular attention has to be paid to detecting reduced-field anomalies as these are likely to indicate buried wall footings.
- 5.9 Reduction to pole phase filtering involves the reorientation of the earth's field to vertical which simplifies anomalies and provides a more direct measure of local susceptibility contrast. By removing the effect of a directional magnetic field, anomalies are realigned to directly over their sources, rather than slightly to the South. It also allows automatic discrimination between magnetically remnant and non-remnant features. This might, for example, allow a clay hearth to be distinguished from a magnetic silt in some conditions. The technique was used on selected Llanrhos data to improve the clarity of certain areas before interpretation.

- 5.10 The final result has been lightly smoothed using a simple non-weighted filter of approximately 1m diameter. This reduces the visual disruption caused by small discrete anomalies, none of which in isolation is relevant to archaeology.
- 5.11 Three images have been used to display the data: Fig. 9 shows the magnetic gradient data as a grey-scale and Fig. 10 the same data using colour imaging, while Fig. 11 shows an interpretation of significant anomalies. Magnetic north is towards the top of all images.

Survey and data quality assessment

- 5.12 The data description includes an assessment of survey quality including spatial accuracy, surveyor-induced errors, etc. and data quality which seeks to quantify the effect of weather and ground conditions.
- 5.13 Survey grids are positioned to within +/-0.05m which is adequate. Measurements are all horizontal or very nearly horizontal and 2D axes were laid out with their perpendicular angle within +/-0.25 degree which is adequate for the short line lengths used at Llanrhos. Survey was not conducted east of the former estate drive as this and its embankment would have obscured any features below it. To the east of the drive the area was either obstructed by trees or by large areas of ground too wet and unstable to survey. The survey was continued as far north as possible into unstable ground but a limit was again reached the ground became too waterlogged. To ensure adequate ground was covered the survey was continued further south and west than originally planned, which had the additional benefit of allowing a useful comparison between known structural remains in the north-west and the results from further east.
- 5.14 Data quality was reduced by the unfavourable ground conditions, primarily as a consequence of the difficulties of maintaining a stable footing while surveying. This leads to small scale local position errors and instrument dip events where a constant height of instrument sensor above the ground cannot be maintained. These latter can affect the data to varying degrees, introducing short bursts of slightly higher values as the sensor height above the surface decreases. This is a defect present in all magnetic surveys to some extent (sometimes called 'walk error') and cannot be avoided entirely unless the instrument is mounted on a wheeled carriage, which has its own problems.

Geophysical results

- 5.15 Overall, the essential objectives were achieved in that a suitably large area was surveyed and was sufficiently unaffected by ground conditions to allow a reasonable degree of analysis. The lack of magnetic contrast, presumably caused by low soil magnetic susceptibility, is unfortunate as we know that certain features, e.g. a wall right in the north-west corner of the survey, have not been detected with sufficient clarity to allow their confident detection elsewhere in the survey. The low variation of soil susceptibility may imply that there has been little in the way of anthropogenic sources of enhancement, e.g. settlement debris etc. The predominant factor though must be a poorly magnetic drift geology imparting little or no susceptible material to the topsoil.
- 5.16 There are a reasonable number of anomalies in the survey that are likely to have an archaeological origin but nearly all are weak and sometimes indistinct. They fall into two classes, discrete and textural, and at no point should either be assumed to represent the full range of archaeological features that might be present. Textural anomalies are usually a product of the combination of past and modern land use. These are sufficiently visible to suggest that there is enough magnetic material in the topsoil to reveal archaeological features; textural variations are often some of the lowest amplitude anomalies that exist. This implies that although a stone wall noted during topographical survey did not produce a pronounced magnetic contrast (so the topsoil must possess a similar magnetic susceptibility to the stone) anomalous accumulations of topsoil may be sufficiently magnetic to increase their visibility against the thinner soil elsewhere. An example of this may be the faint striation across much of the eastern half of the survey which is thought to be caused by a combination of slightly deeper topsoil in the relict furrows of ploughed-out ridge and furrow and topsoil that has silted into land drains.
- 5.17 There are seven principal groups of magnetic anomalies which have been identified, with the more significant anomalies labelled 1 to 8 (Fig. 11). The magnetic contrasts are, however, too low to allow some anomalies to be defined accurately, especially the penultimate group which tend to have amplitudes very close to the survey average and can therefore be difficult to isolate with any confidence.

Ferromagnetic anomalies

- 5.18 These consist of areas of strong magnetic gradients, usually of dipolar form, associated with ferromagnetic material. There is a pronounced linear anomaly (1) running towards the old gate into the churchyard, and marked on the surface by small concrete pillars. This appears to run along the north side of a path or track depicted on the Ordnance Survey maps of 1900 and 1912 (Figs 5-6), and may be due to a buried water pipe or electricity cable.
- 5.19 Substantial areas of interference exist along the eastern edge of the survey and against the churchyard wall to the north. This latter area was seen to be contaminated near the wall with corrugated iron that was too deeply buried to remove before survey. Two further areas of interference are within the survey, which correspond with modern wire fences around young trees. Various discrete sources of interference along the eastern edge of the survey correspond with both existing trees and tree stumps. Some trees elsewhere had the remains of railings embedded in them so presumably the magnetic trees have completely engulfed railings around their bases.

Diffuse anomalies

- 5.20 These consist of areas of less strong but more diffuse, often multipolar, anomalies from burnt soil and other debris. There are two adjacent areas of strong and amorphous anomalies. One is a uniform circular area with an enhanced susceptibility central region, weakening towards abrupt edges. This may be an archaeological feature but it is much more likely to be the site of a bonfire. The second area is 13m to the south and although a similar size to the first it has a more irregular shape and several dipole-type responses within it. This again is likely to be the site of a bonfire, though probably contaminated with steel debris.

Variations in magnetic texture

- 5.21 Magnetic texture is a complex and rather poorly understood variable but it does provide a valuable indicator of differing agricultural regimes. It is usually a compound of the magnetic anomalies resulting from agricultural processes and variations in the underlying shallow geology and deeper parts of the soil profile. In some cases it creates sharply differentiated areas within a survey and the edges of these areas can, in theory, indicate the former positions of ephemeral field boundaries, e.g. fences and shallow-rooted hedges without ditches.
- 5.22 In the south-west corner of the survey area and bounded to the north-east by a former field boundary (PRN 12995), is an area (2) where the texture is more irregular than on the north-east side of the boundary, suggesting a different agricultural regime within this former field, possibly having been created by plough action redistributing magnetic soils from areas of habitation in the vicinity of Glebe House and the Mostyn Arms.
- 5.23 Immediately south-east of the churchyard is another slightly anomalous area (3) where the susceptibility seems to be very slightly reduced, or perhaps less variable, compared with the area immediately south and east of it. No explanation can be suggested for this.
- 5.24 A small approximately rectangular area (4), measuring 6 x 3m, with an extremely smooth texture, is located immediately to the north-east of the former boundary (PRN 12995). This is unusual and seems unlikely to have an agricultural origin, possibly suggesting the existence of a small structure or building, which may be associated with a small group of adjacent high gradient anomalies suggesting an enclosure (see section 5.28), although its form is rather indistinct.
- 5.25 A much longer but very similar region (5) is evident running roughly north-east to south-west along the southern edge of the survey area with a width of c. 2.5m. This is not a natural feature and may be caused by a band of modified soil, perhaps the surface of a lane or track. A continuation of the feature to the north-east may be represented by a similar area (6) bounded on either side by two linear anomalies with enhanced magnetic gradients.

Striation

- 5.26 Thin linear striation is present in some areas with individual elements which are diffuse but evident as a coarse unidirectional texture. The striation across much of the eastern half of the survey is rather indistinct and is likely to be the result of agricultural processes. These may represent plough-eroded ridge and furrow or land drains. It may be relevant that it does not seem to continue to the west of field boundary PRN 12995.

Enhanced magnetic gradients

- 5.27 Enhanced magnetic gradient anomalies lack a significant remnant component and therefore indicate a material of enhanced susceptibility relative to its surroundings. The most prominent of these anomalies lies on the north-east side of the former boundary (PRN 12995) and is likely to indicate the presence of a fairly substantial ditch. A further group seem to flank part of the north side of the strip of anomalous texture against the southern edge of the survey and its possible extension further to the north-east (5 and 6). These are again likely to indicate a flanking ditch although they are rather less distinct than the others.
- 5.28 One anomaly that is of definite interest consists of two perpendicular anomalies defining a corner, within which is small area of anomalous texture (4). These are likely to be features of archaeological interest, perhaps part of an enclosure surrounding a possible building.
- 5.29 Two adjacent linear anomalies (7) may be related to a group of reduced gradient anomalies immediately to the north-west (8). One anomaly may just be a continuation of one striation but the other curves until it is perpendicular to the striation implying a different origin, possibly a short section of ditch or gully. The Tithe Map does indicate a field boundary in approximately this position.
- 5.30 Other enhanced gradients exist as short linear anomalies which are virtually impossible to interpret on their own. It is possible that they do not have an archaeological origin but the effect of a low susceptibility contrast must be considered. They may indicate ditch-type features with variable fills or degrees of agricultural truncation, and hence may be parts of larger non-magnetic complexes, although it is not possible to determine this from the data.

Reduced magnetic gradients

- 5.31 Reduced magnetic gradient anomalies lack a significant remnant component and therefore indicate a material of reduced susceptibility relative to its surroundings. In general these anomalies are concentrated close to the churchyard.
- 5.32 A group of anomalies (8) suggest a possible rectangular structure measuring c. 12 x 8m, perhaps in association with the enhanced magnetic gradient anomalies (7) to the south-east.
- 5.33 The former field boundary (PRN 12995) has, for much of its length, a low gradient anomaly paired with an enhanced gradient anomaly along its south-west side. This is undoubtedly a typical bank and ditch pairing with the ditch on the south-west side (supported by topographical evidence). Another possible bank is just visible in the south-west corner of the survey as a slightly less well defined low gradient anomaly.

Amorphous anomalies

- 5.34 There are a number of areas of amorphous field gradients, often highly variable and frequently poorly defined, which are difficult to describe and are likely to have several origins. Of these, a series of the amorphous spreads of variable magnetic gradient are clearly associated with the former field boundary (PRN 12995), situated either in or adjacent to the ditch thought to exist there. Two similar anomalies may represent dumped burnt material, although the latter could possibly have a metallic source as a suitable anomaly exists within the wider area of disruption.

Archaeological interpretation

- 5.35 The survey has detected a number of small anomalies that may represent archaeological features that are difficult, if not impossible, to interpret. The rectilinear pattern of both high and low gradient anomalies would, however, appear to reflect the alignment of extant field banks to the south and east of the churchyard, implying that these anomalies may be contemporary features, some of which may be related to boundaries depicted on the Tithe Map, although agricultural activity such as ploughing could also be responsible for creating similarly aligned anomalies. In particular, two anomalies (4 and 8) suggest possible buildings, while a third (5 and 6) may represent a track with flanking ditches. The pattern of striations may be suggestive of ploughed-out ridge and furrow.
- 5.36 Some evidence of differential use is provided by the difference in magnetic texture to the south-west of the relict boundary (PRN 12995). It may be coincidental that there is no sign of ridge and furrow at this location, although this may be evidence for some temporal overlap between the boundary and the medieval agricultural regime. The topographical survey also supports this.

6 ARCHAEOLOGY OF THE DEVELOPMENT AREA

6.1 The results from the earthwork and geophysical surveys have been combined to identify those features of potential archaeological significance which are depicted in Fig. 12. Each site has been classified according to its perceived significance. The categories are those given in the Cadw: Welsh Historic Monuments draft Archaeology and the Trunk Road Programme in Wales: a Manual of Best Practice.

Category A sites of National importance. It is presumed that sites in this category will be preserved and protected in situ.

Category B sites of regional or county importance which are of particular importance within the region. Preservation in situ is the preferred option for these sites, but if loss or damage is unavoidable, appropriate detailed recording should be undertaken.

Category C sites of district or local importance which are not of sufficient importance to justify preservation if threatened, but which merit adequate recording in advance of loss or damage.

Category D minor and damaged sites which not merit inclusion in a higher category, and for which rapid recording should be sufficient.

Category E sites whose importance could not be fully determined as a result of the assessment and may warrant further evaluation.

PRN 12991 **Name:** Glebe House earthworks **NGR:** SH79348028
Type: Platform **Period:** Post medieval? **Form:** Earthwork **Condition:** Damaged
Source: Tithe Map 1840
 Earthwork survey
Dimensions: c. 60m long x 23m wide x 0.4m high
Description: Earthwork remains of Glebe House and associated buildings, consisting of a raised platform with low earthworks suggesting several buildings.
Category: C

PRN 12992 **Name:** Mostyn Arms earthworks **NGR:** SH79338020
Type: Platform **Period:** Post medieval? **Form:** Earthwork **Condition:** Damaged
Source: Tithe Map 1840
 OS 1st edition 1889
 Earthwork survey
Dimensions: c. 31m long x 14m wide x 0.4m high
Description: Earthwork remains of two buildings forming the Mostyn Arms public house, together with adjacent enclosure or yard measuring 34 x 31m, defined by banks 0.4m wide and 0.4m across.
Category: C

PRN 12993 **Name:** Gloddaeth Estate drive **NGR:** SH79458034
Type: Drive **Period:** 19th Century **Form:** Earthwork **Condition:** Damaged
Source: OS 1st edition 1889
 Earthwork survey
Dimensions: c. 3m wide x 0.3m high
Description: Former drive and avenue of trees associated with Gloddaeth Estate.
Category: C

PRN 12994 **Name:** Llanrhos boundary I **NGR:** SH79418034
Type: Field boundary **Period:** Medieval? **Form:** Earthwork **Condition:** Damaged
Source: Tithe Map 1840
 Earthwork survey
Dimensions: c. 0.3m high
Description: Slight earthwork bank with possible track alongside
Category: C

PRN 12995 **Name:** Llanrhos boundary II **NGR:** SH79408027
Type: Field boundary **Period:** Medieval ? **Form:** Earthwork **Condition:** Damaged
Source: Tithe Map 1840
 OS 1st edition 1889
 Earthwork and geophysical surveys
Dimensions: c. 2m wide x 0.2m high
Description: Slight earthwork bank with possible ditch alongside
Category: C

PRN 12996 **Name:** Llanrhos boundary III **NGR:** SH79448025
Type: Field boundary **Period:** Medieval ? **Form:** Earthwork **Condition:** Damaged
Source: Tithe Map 1840
 OS 1st edition 1889
 Earthwork survey
Dimensions: up to 1.3m high
Description: Earthwork lynchet with possible ditch along S side and suggestion of revetment wall along eastern section.
Category: C

PRN 12997 **Name:** Llanrhos ridge and furrow **NGR:** SH79458025
Type: Ridge and furrow **Period:** Medieval ? **Form:** Earthwork **Condition:** Damaged
Source: Earthwork survey
Description: Slight ridge and furrow aligned N-S, c. 3-4m apart and 0.1m high.
Category: D

PRN 12998 **Name:** Llanrhos burial I **NGR:** SH79258030
Type: Inhumation ? **Period:** Medieval ? **Form:** Folklore **Condition:** Unknown
Source: Folklore
Description: There is a local tradition that burials have been noted in the field to the west of the road, opposite the church. Exact location unknown.
Category: E

PRN 12999 **Name:** Llanrhos burial II **NGR:** SH79308027
Type: Inhumation ? **Period:** Medieval ? **Form:** Folklore **Condition:** Unknown
Source: Folklore
Description: There is a local tradition that a burial, apparently of Early Christian date, was found during alterations to the road close to the church. Exact location unknown.
Category: E

SITE 1 **Name:** Llanrhos structure I **NGR:** SH79398028
Type: Structure ? **Period:** Unknown? **Form:** Unknown **Condition:** Unknown
Source: Geophysical survey
Dimensions: c. 6 x 3m
Description: Possible rectangular structure 6 x 3m within ditched enclosure
Category: E

SITE 2 **Name:** Llanrhos structure II **NGR:** SH79418031
Type: Structure ? **Period:** Unknown? **Form:** Unknown **Condition:** Unknown
Source: Geophysical survey
Dimensions: c. 12 x 8m
Description: Possible rectangular structure 12 x 8m
Category: E

SITE 3 **Name:** Llanrhos trackway ? **NGR:** SH79448078
Type: Track ? **Period:** Unknown? **Form:** Unknown **Condition:** Unknown
Source: Geophysical survey
Dimensions: c. 2.5m wide
Description: Possible trackway with flanking ditches identified by geophysical survey
Category: E

- 6.2 In addition to those sites noted above, the geophysical survey also identified possible ridge and furrow and a number of anomalies which may also be of archaeological significance, consisting of possible ditches, but their interpretation was less certain.

7 CONCLUSIONS

- 7.1 Documentary evidence and historical associations would suggest that there may have been a settlement and church at Llanrhos from at least the 6th century, although the earliest documentary evidence for the church dates back only to 1254. It is likely that any early settlement would have developed around the church. Although the original extent of the churchyard is not known, it is clear that in its present form it has been extended to the south-east, encroaching upon the original area of the field within which the proposed development lies. This extension may have impacted upon archaeological features surrounding the original churchyard and the evaluation has demonstrated that several features beyond the present boundary must have originally extended into the area beneath the extension. Consequently, the interpretation of features adjacent to the present boundary is made more difficult as we may now only be seeing a part of their original extent.
- 7.2 The assessment has identified a number of earthworks which relate to former buildings and field boundaries, the majority of which lie outside the area of the proposed development. In particular, the survey has identified a series of earthworks associated with Glebe House (PRN 12991) and the Mostyn Arms public house (PRN 12992) to the south of the church.
- 7.3 Elements of earlier land division and agriculture, possibly of medieval origin, are evident, consisting of a number of former field boundaries, surviving as banks or lynchets, together with an area of ridge and furrow cultivation to the south of the development area. The geophysical survey has provided evidence for a number of slight linear anomalies which may represent the buried remains of further boundaries and a possible track which respect the same general alignments suggesting a contemporary origin. There is also some evidence from the geophysical survey for possible ridge and furrow within the development area, although there is no surface trace.
- 7.4 The geophysical survey has revealed two areas in particular which may contain evidence for some form of structure, although one (Site 1) lies just outside the development area. The other (Site 2) suggests a possible rectangular structure measuring c. 12 x 8m, although the interpretation is far from certain.
- 7.5 The area was in the later 19th century incorporated into the landscaped grounds surrounding Gloddaeth, and the former drive (PRN 12993) survives, flanked by the remains of an avenue of trees.

8 REFERENCES

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APPENDIX 1

PROPOSED EXTENSION TO LLANRHOS CEMETERY, CONWY SPECIFICATION FOR AN ARCHAEOLOGICAL EVALUATION BY CLWYD-POWYS ARCHAEOLOGICAL TRUST

1 Introduction

- 1.1 The proposed development (planning application 0/23257) involves an extension to the cemetery at Llanrhos Church, Llandudno, Conwy (SH79338032).
- 1.2 The area in question occupies 2.027ha to the south and east of the present cemetery. The church is believed to be one of the more important ecclesiastical sites within the medieval kingdom of Gwynedd and an archaeological assessment of the proposed extension area has been recommended by the Gwynedd Archaeological Planning Service (GAPS). Accordingly, the Technical Services Department of Conwy County Borough Council requested that GAPS prepare a brief for the archaeological works.

2 Objectives

- 2.1 The objectives of the evaluation are:
 - 2.1.1 to locate and describe all archaeological features within the development area by means of a combination of desk-based assessment, ground survey and geophysical survey, in so far as these aims are possible;
 - 2.1.2 to prepare a report outlining the results of the field evaluation and incorporating sufficient information on the archaeological resource for a reasonable planning decision to be taken regarding the archaeological provision for the area affected by the proposed development;
- 2.2 The early medieval history is likely to form the main archaeological interest in the development area, although the post medieval landscape, particularly in association with Gloddaeth estate, is more likely to be represented by sites which may be identified on the ground or as a result of the desk-based study. The geophysical survey may therefore play an important role in determining the earlier history of the site.

3 Methods

- 3.1 Stage one of the evaluation will involve the examination of all the readily available primary and secondary documentary, cartographic, pictorial, photographic, aerial photographic and oral sources. Repositories consulted will include the following: County SMR, GAT, Bangor; the National Monuments Record, RCAHMW, Aberystwyth; the National Library of Wales, Aberystwyth; County Records Office, Caernarfon; University College, Bangor.
- 3.2 Stage two will take the form of a detailed total survey of the entire development area, undertaken using a Wild TC500 EDM in conjunction with Penmap survey software. The survey will be related to OS datum, the OS national grid and local fixed topographical features. Plans will be produced as appropriate to include archaeological features, contour details, etc. All features identified will be photographed in 35mm format black and white and colour print and colour slide, each view including a photographic scale.
- 3.3 The third stage will involve a geophysical survey. The brief suggests an initial magnetic scan over the entire area, the results from which, together with the results from the previous two stages, will be used to determine a programme of more detailed geophysical survey. The nature and extent of the geophysical survey will be discussed in advance with GAPS, and three options have been costed for: caesium vapour magnetic gradiometry scanning of 2ha and detailed survey of 1ha; caesium vapour

magnetic gradiometry detailed survey of 2ha; caesium vapour magnetic gradiometry scanning of 2ha and detailed caesium vapour magnetic gradiometry and electrical resistance detailed survey of 1ha.

- 3.4 Following the on-site work an illustrated and bound report will be prepared according to the principles laid out in the Curatorial Brief (section 10). This will be in A4 format and contain conventional sections on: Site location, Topography and Geology; Historic Background; Total Station Survey; Geophysical Survey; Conclusions and Recommendations and References, together with appropriate appendices on archives and finds. A gazetteer will be included of all sites identified.
- 3.5 The site archive will be prepared to specifications laid out in Appendix 3 in the Management of Archaeological Projects (English Heritage, 1991). The archive will be deposited at an appropriate repository following consultation with the archaeological curator, within six months of the completion of the project.

4 Resources and Programming

- 4.1 Project Director: Nigel Jones AIFA, Project Officer, CPAT (cv enclosed)
Project Assistant: Wendy Owen, Senior Project Assistant, CPAT (cv enclosed)
- 4.2 The geophysical survey will be undertaken by ArchaeoPhysica of Newport, Shropshire. Overall supervision will be by Mr RJ Silvester, a senior member of CPAT's staff who is also a member of the Institute of Field Archaeologists.
- 4.3 All report preparation will be completed by or with the assistance of the same field archaeologists who conducted the evaluation.
- 4.4 The following timings are anticipated: desk-based study, 5 days; total station survey, 1 day; geophysical survey, 2 days; report, 4 days. The report would be prepared immediately on completion of the fieldwork, dependent on the client's instructions and the arrangement of a suitable timetable. The date of commencement, at the time of writing, has yet to be agreed with the client, and will be dependent on the state of the site negotiated access. At present, CPAT would be unable to commence fieldwork before August 2000 due to existing commitments, although the desk-top study could be completed during July. The archaeological curator will be informed of the detailed timetable and staffing levels when agreement has been reached with the client.
- 4.5 Requirements relating to Health and Safety regulations will be adhered to by CPAT and its staff.
- 4.6 CPAT is covered by appropriate Public and Employer's Liability insurance.

N.W.Jones
29th June 2000

APPENDIX 2

Archives

The following archives were consulted in order to inform the desk-top assessment:

Denbighshire Record Office (Ruthin)
Flintshire Record Office (Hawarden)
Gwynedd Archives Service, Caernarfon Record Office (Caernarfon)
National Library of Wales (Aberystwyth)
National Monument Record, RCAHMW (Aberystwyth)
Regional SMR held by the Gwynedd Archaeological Trust (Bangor)
University of Wales Bangor, Department of Manuscripts (Bangor)

Sources: Aerial Photographs

RAF/CPE/UK/1939/4224 approx 1:10560 19/01/1947 (NMR)
RAF/541/38/4006 approx 1:10560 21/05/1948 (NMR)
58/RAF/2196/0203 1:15650 14/06/1957 (NMR)

Sources: Maps

1742 Survey of the Gloddaeth Estate by Thomas Badeslade (Flintshire Record Office: Mostyn D/M/6411)
1742? Map of the Gloddaith Estate, unsigned but by Thomas Badeslade (Caernarfon Record Office M/680/5).
Early 19th-century (but carries appended date of 1858) Survey of Glebe House, Llanrhos (Caernarfon Record Office M/680/5).
1840 Tithe Map for Eglwys-rhos (apportionment from 1846)
1854 Plan of the Estate at Gloddaeth (Flintshire Record Office: Mostyn D/M/6412)
1889 Ordnance Survey 1:2500 1st Edition Caernarvonshire 5.5
1900 Ordnance Survey 1:2500 2nd Edition Caernarvonshire 5.5
1913 Ordnance Survey 1:2500 3rd Edition Caernarvonshire 5.5

Sources: Documents

1822 Lease of land for schoolroom (NLW WCC 1947 Deposit no.111)

(It should be noted here that there are considerable quantities of 19th and 20th-century documents relating to Gloddaeth and its environs in the Flintshire Record Office which appear to have been overlooked when the report was prepared for the Historic Gardens Register (Cadw 1998). These documents were not examined in detail for this report as it was considered that because of their date little of relevance would be garnered from them).

Sources: Secondary Material

Archaeologia Cambrensis
Church leaflet (c.1989) (NMR)
Transactions of the Caernarvonshire Historical Society

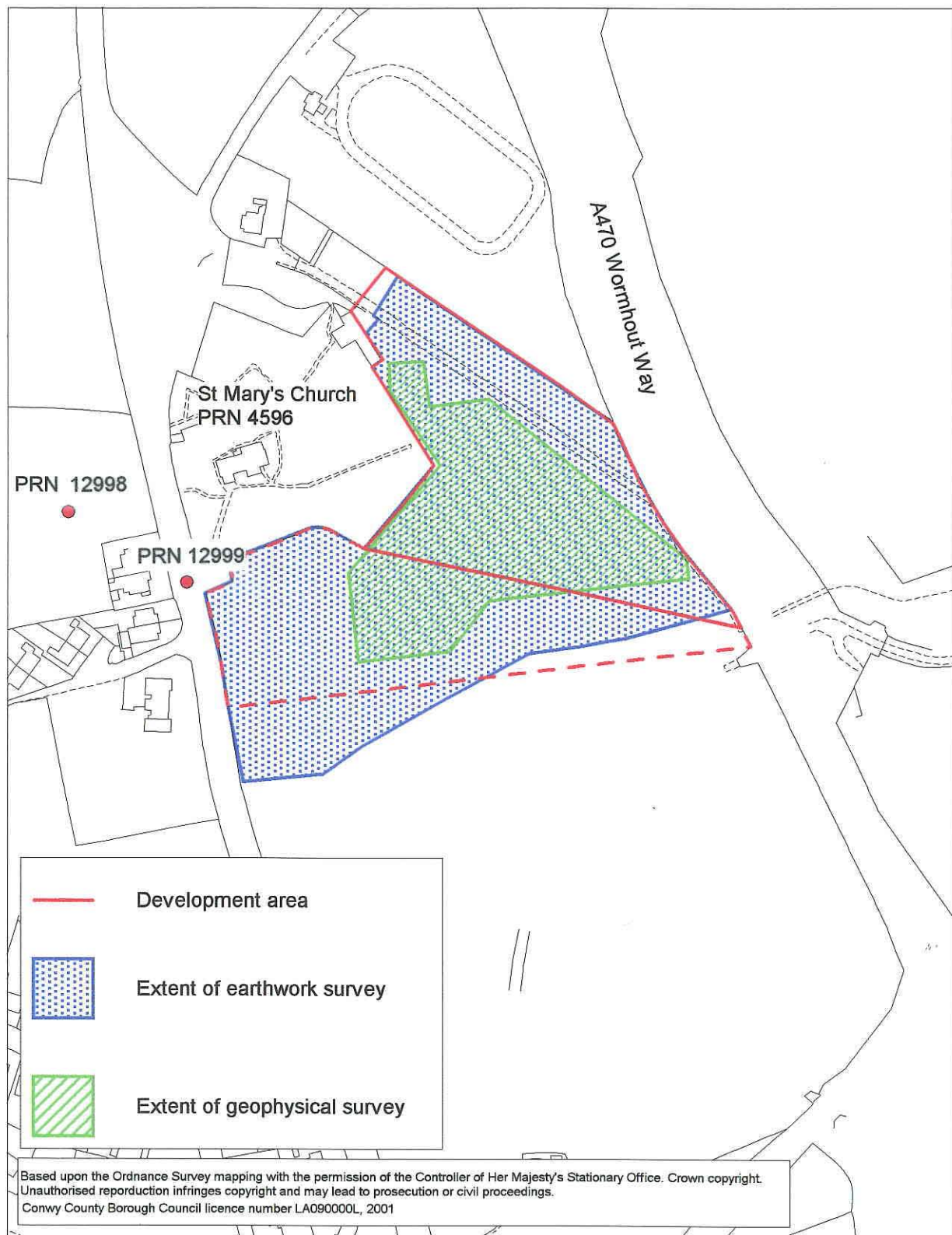


Fig. 1 Development area location, 1:2,500

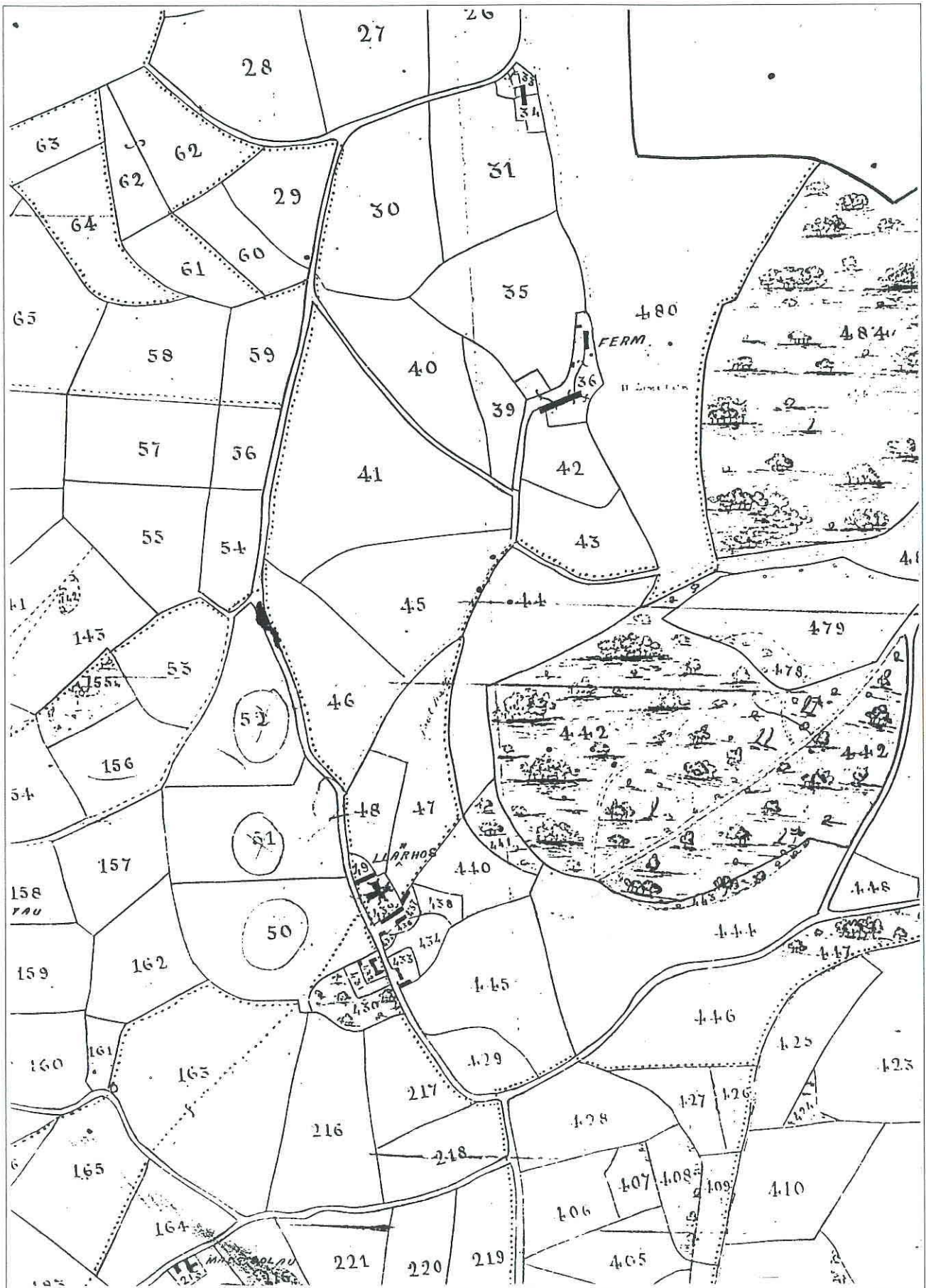


Fig. 2 1840 Tithe Map for Eglwys-rhos

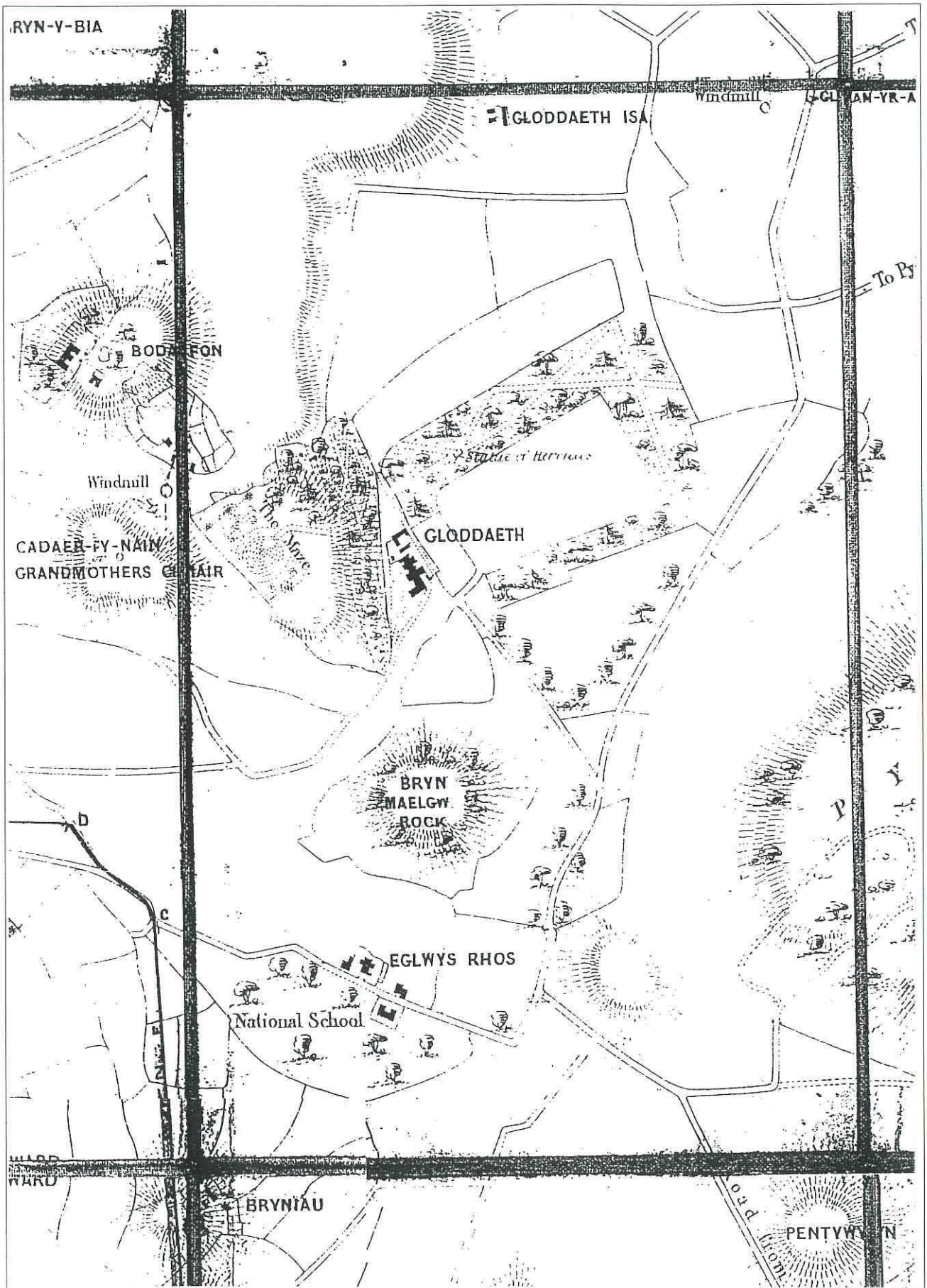


Fig. 3 1854 Plan of the Estate at Gloddaeth

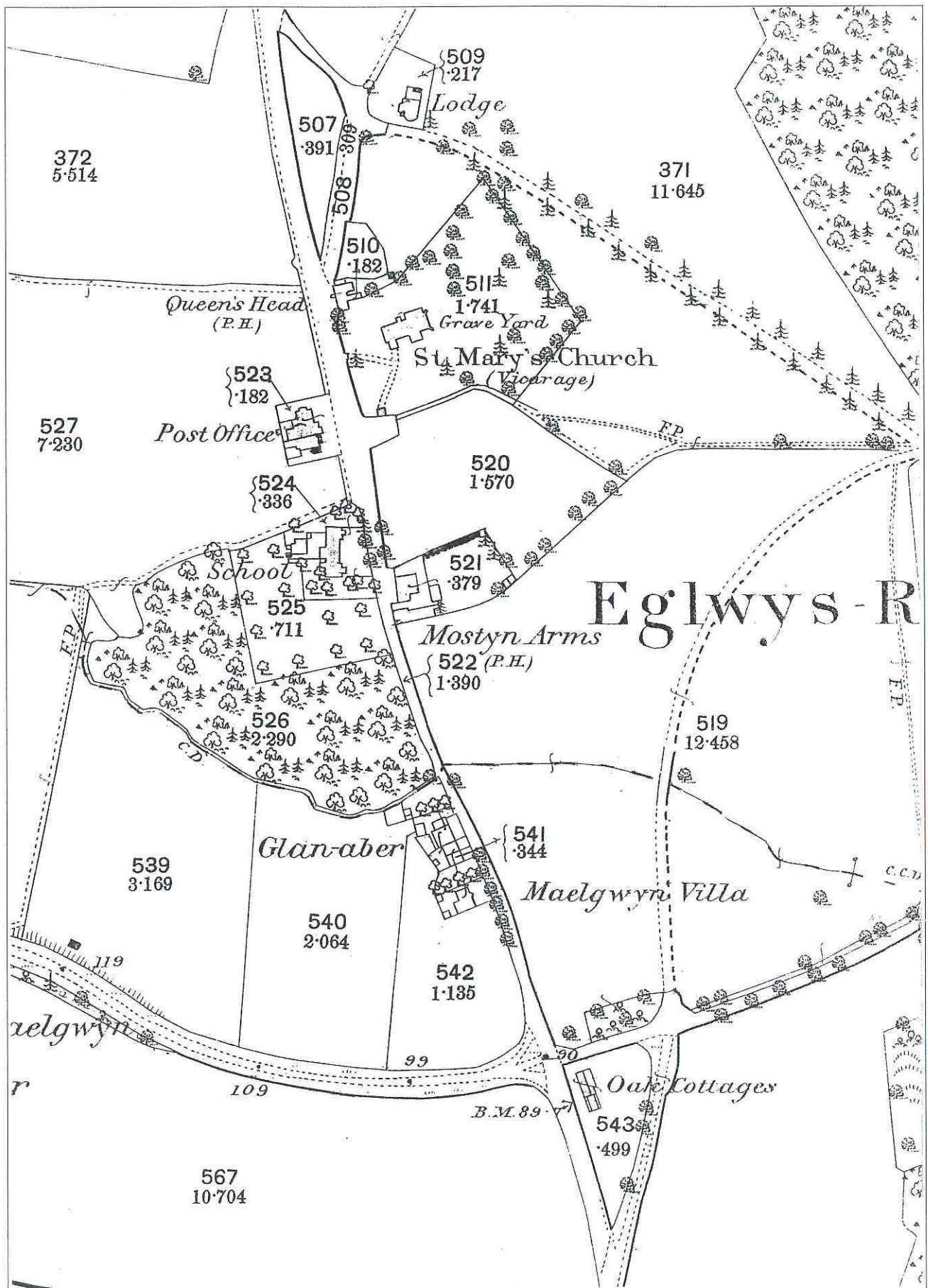


Fig. 4 Ordnance Survey 1st edition 1:2,500, Caernarvonshire 5.5, 1889

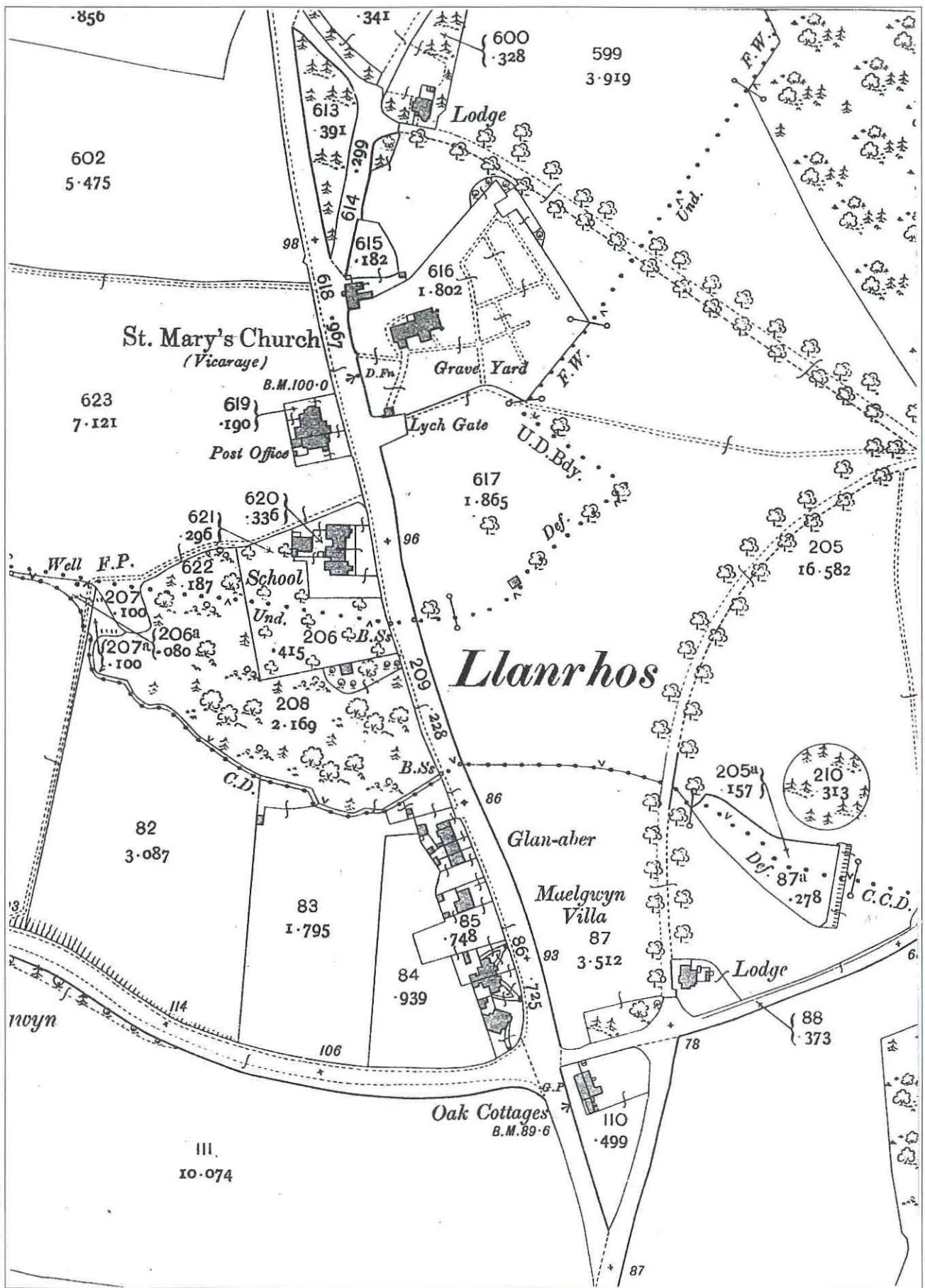


Fig. 5 Ordnance Survey 2nd edition 1:2,500, Caernarvonshire 5.5, 1900

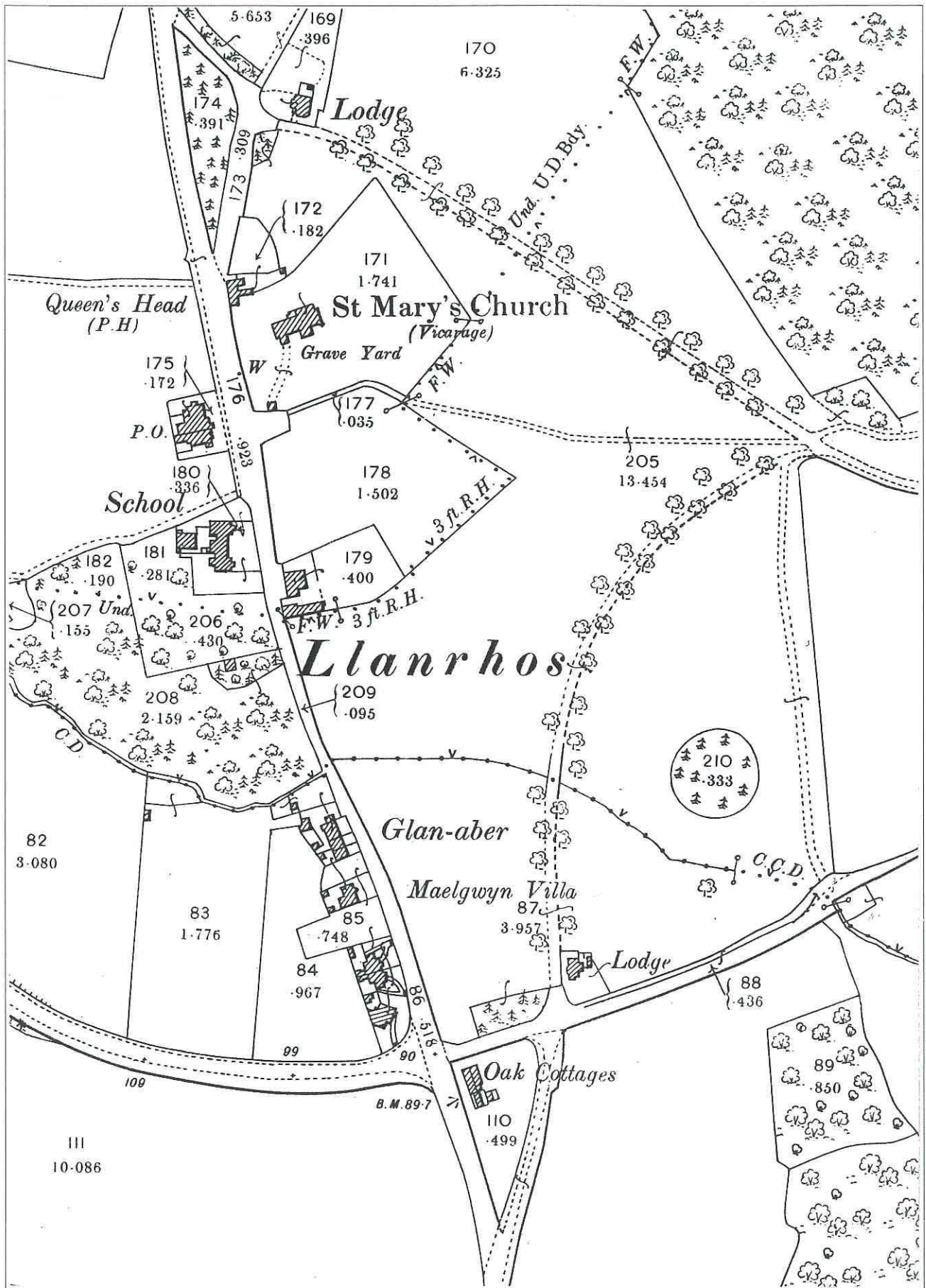


Fig. 7 Ordnance Survey 3rd edition 1:2,500, Caernarvonshire 5.5, 1913



Fig. 7 Contour survey, scale 1:1,500

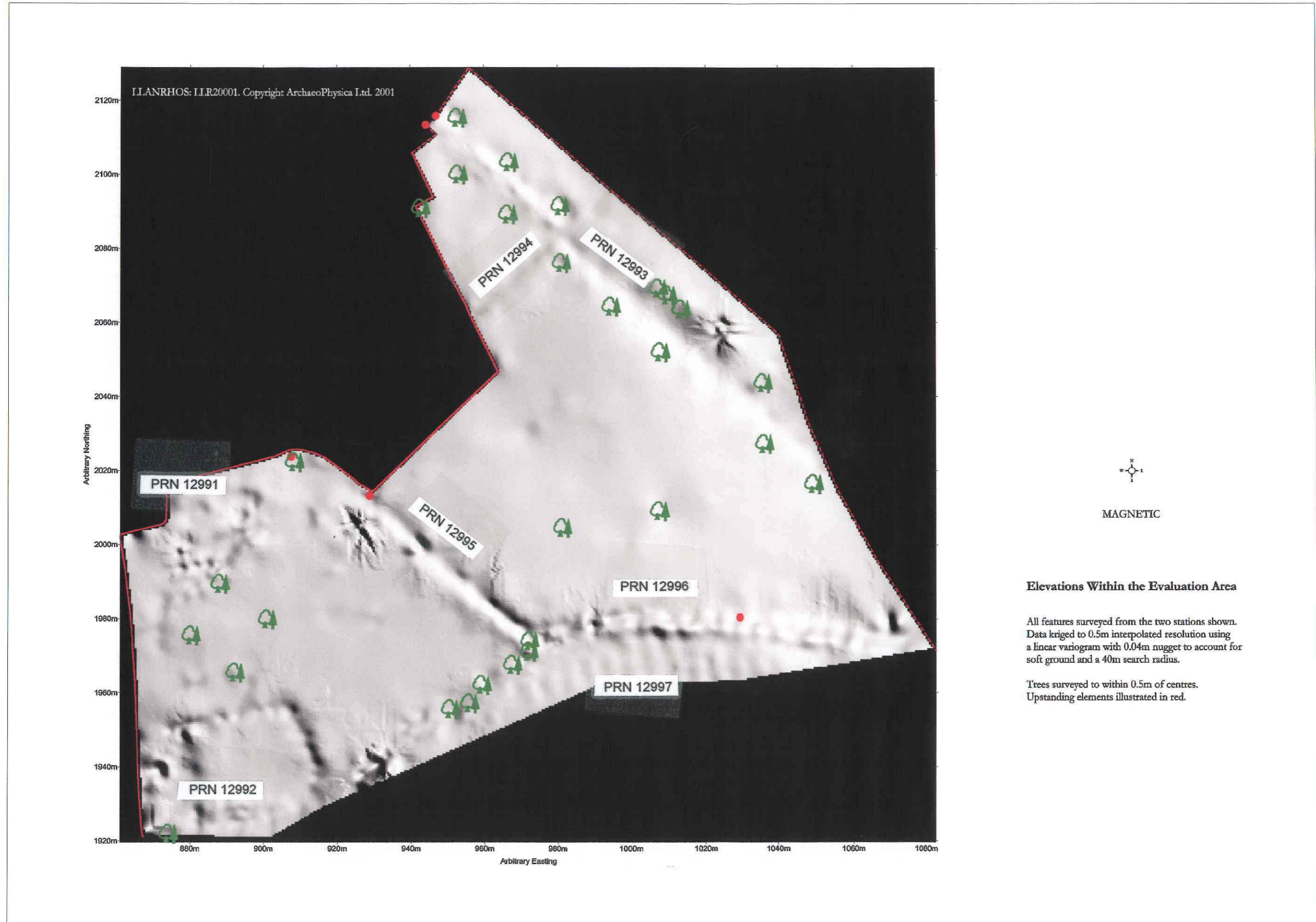


Fig. 8 Topographical and earthwork survey: false relief plot

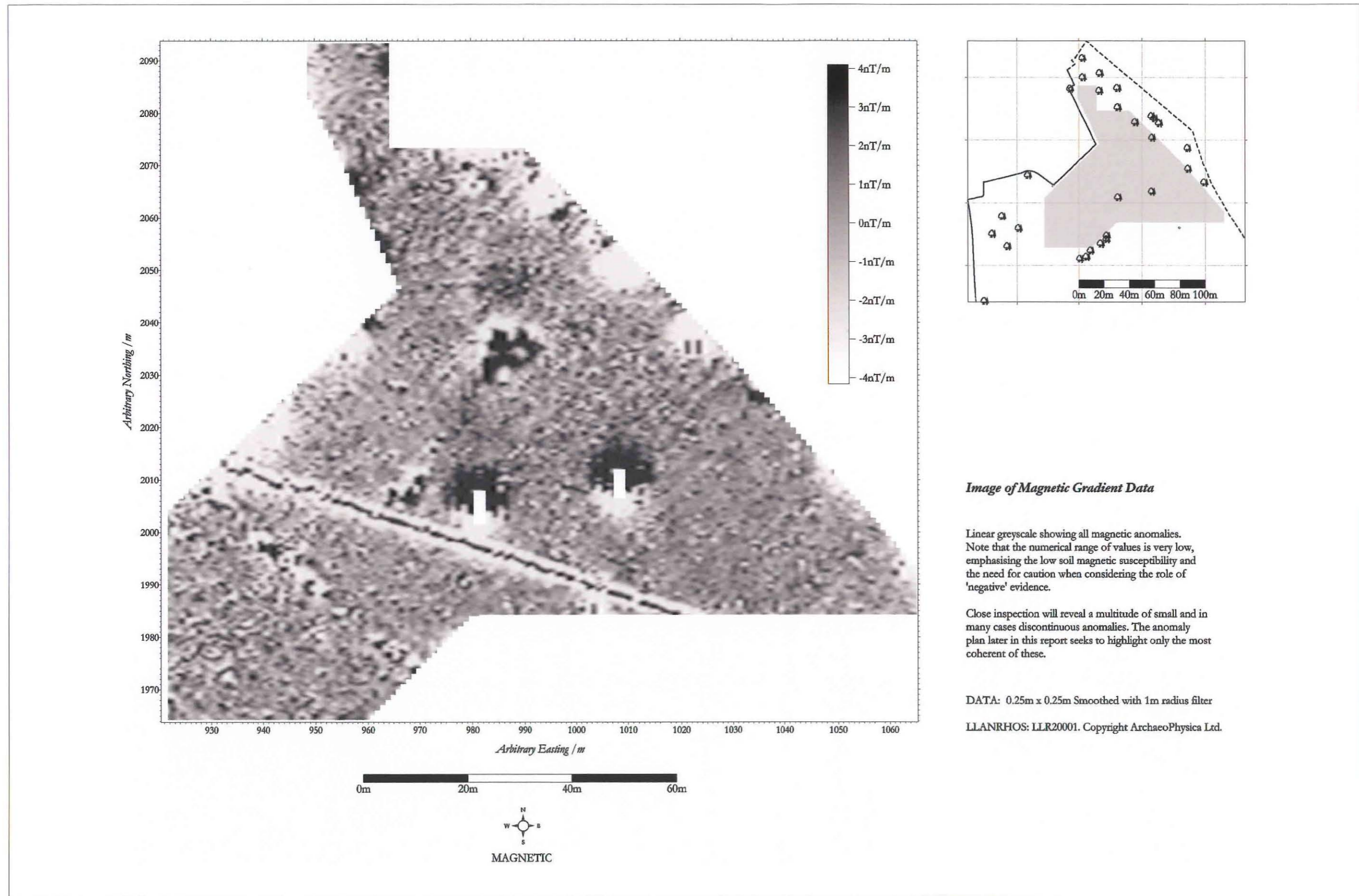


Image of Magnetic Gradient Data

Linear greyscale showing all magnetic anomalies. Note that the numerical range of values is very low, emphasising the low soil magnetic susceptibility and the need for caution when considering the role of 'negative' evidence.

Close inspection will reveal a multitude of small and in many cases discontinuous anomalies. The anomaly plan later in this report seeks to highlight only the most coherent of these.

DATA: 0.25m x 0.25m Smoothed with 1m radius filter

LLANRHOS: LLR20001. Copyright ArchaeoPhysica Ltd.

Fig. 9 Geophysical survey: magnetic gradient data grey-scale image

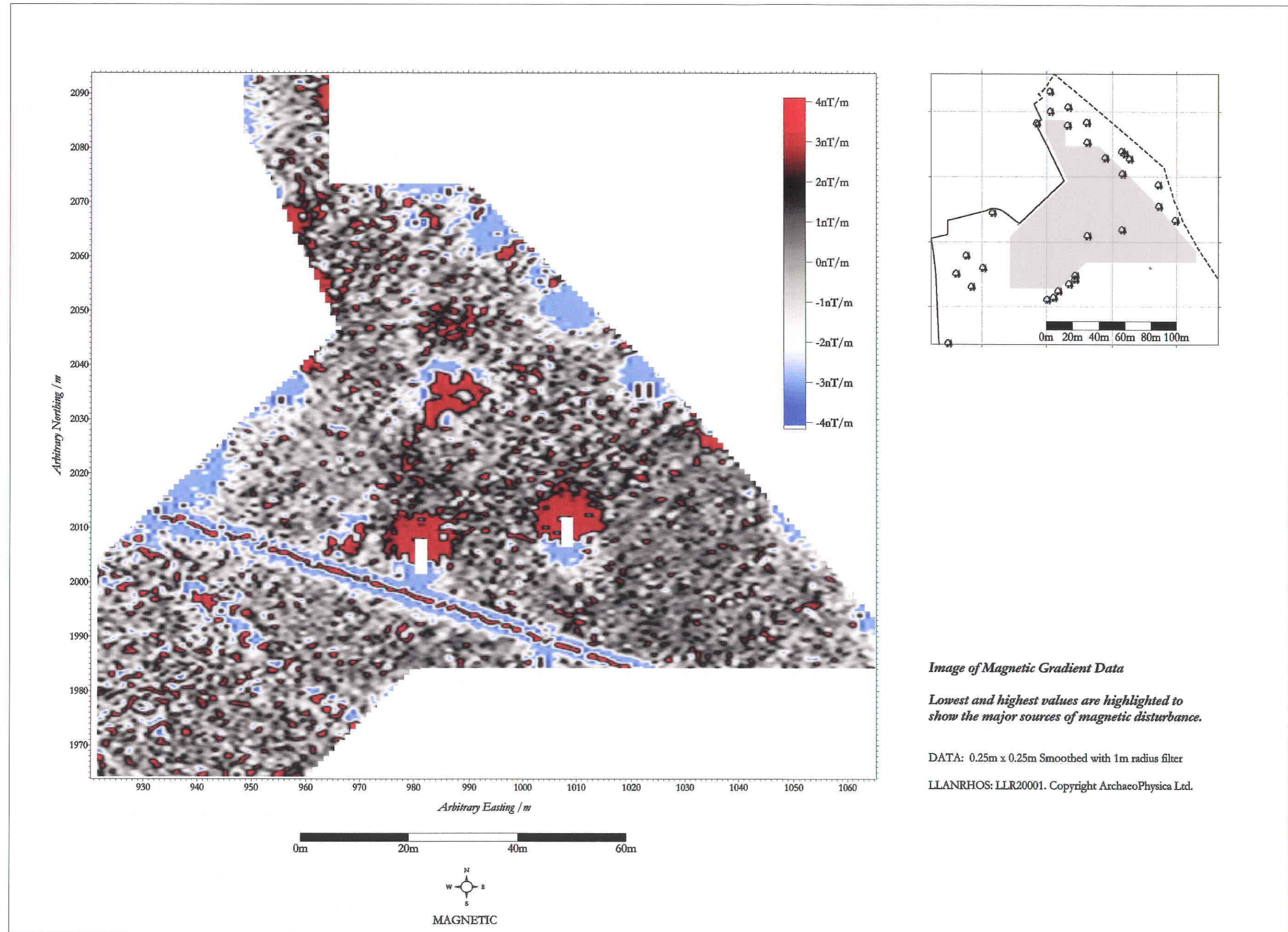
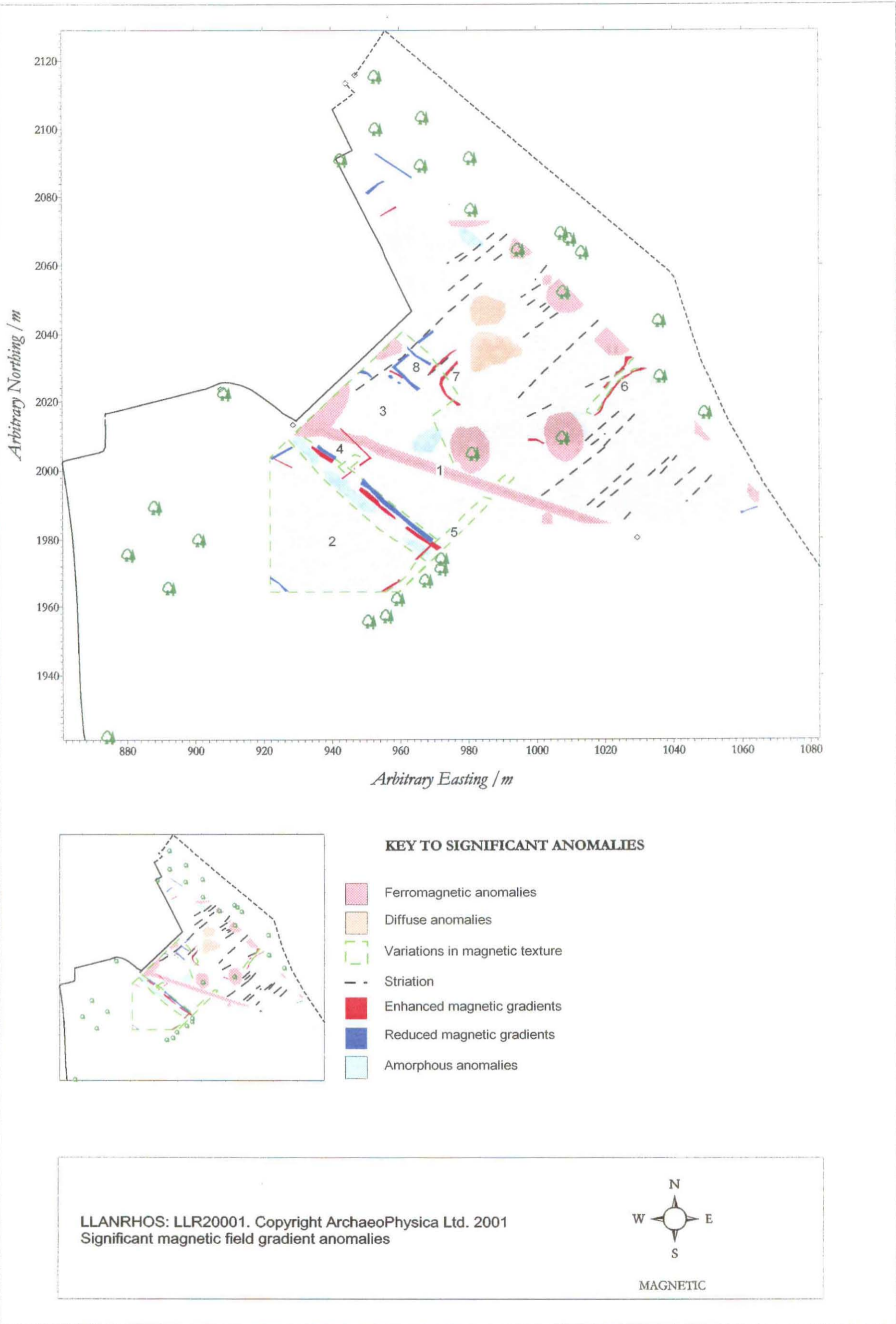


Fig. 10 Geophysical Survey: magnetic gradient data colour image

Fig. 11 Geophysical Survey: significant anomalies



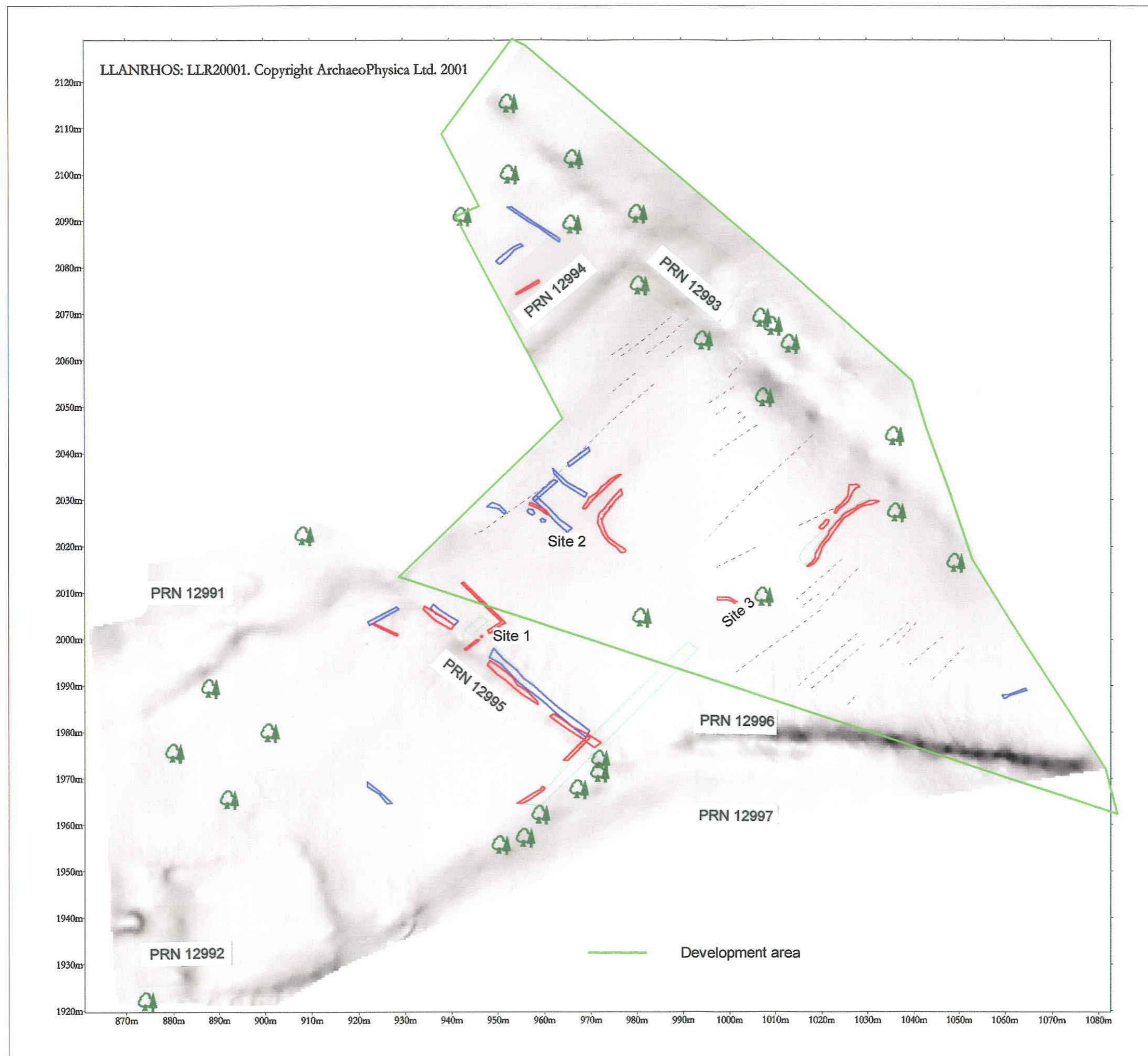


Fig. 12 Features of potential archaeological significance



Plate 1 Earthwork remains of Glebe House PRN 12991



Plate 2 Earthwork remains of Mostyn Arms, PRN 12992



Plate 3 Former Estate Drive, PRN 12993



Plate 4 Earthwork remains of former field boundary, PRN 12996