



Parc Pelenna Holiday Resort

Phase 1 Ground Conditions Desk Study

For Trivselhus UK

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Executive summary

Site information and setting	
Objectives	The objectives of the Phase 1 Ground Conditions Desk Study are to formulate a preliminary Ground Model and an initial Conceptual Site Model (CSM) of the site to identify and make a preliminary assessment of any potential geo-environmental and geotechnical risks to the proposed development.
Client	Trivselhus UK.
Site name and location	Parc Pelenna Holiday Resort. The site is situated to the northeast of Neath, Swansea with the nearest postcode being SA11 4ET.
Proposed development	The site development proposals are understood to comprise of 120 single-storey/split level lodges spread across the western half of the site within five clusters. Within this area there will be a single-storey community hub with amenities and an access road leading in from the north.
Site description	The site is situated on the north face of a hill meaning almost everywhere on-site slopes towards the north at varying angles. It is almost entirely vegetated with sections of forest, scrubland and managed lawns with some superficial and bedrock exposures. In the central area of the site lies a farm house, a farm building and a vacant holiday house with some small areas used for material storage. The site is bound by pastoral lands and forest on all sides with notable features being the River Neath 585m northwest, the Pelenna Forest abutting the southern boundary, and a gas distribution facility 55m west. The site is approximately 43.8Ha in area with an irregular rectangular shape.
Desk study summary	
Topography	The elevation across the site varies substantially due to it being situated on the side of a hill where the surface broadly slopes towards the north into the Vale of Neath. The elevation ranges from 250m Above Ordnance Datum (AOD) in the southwest of the site to 134m AOD in the north. However, on a smaller scale the topography varies across the site with areas of steep slopes, flat plateaus, track cuttings and terraced gardens.
Hydrology	Many drain systems lie on all sides of the site between 11m and 240m away. Other notable features include the Neath Canal 365m northwest and the River Neath 585m northwest.
Site History	The site comprised pastoral and forest land in the 1800s with some minor quarrying activities. In the first half of the 20 th century the site was heavily mined for coal with the Cefn-mawr Colliery present in the northwest and many adits present in the east. By 1965 coal mining activities had ceased and the site has since been used for forestry.
Geology	Superficial: Peat Solid: Hughes Member and Brithdir Member
Natural geological hazards	» Organic matter (Peat) is expected to be present in the west of the site and possibly elsewhere.
Anthropomorphic geotechnical hazards	» Legacy issues pertaining quarrying and mining activities in the north of the site.

	» Tracks have been cut into the site for access and has resulted in many superficial and bedrock exposures across the site. » Areas around farm house, farm building and storage area may have Made Ground and buried objects beneath.
Hydrogeology	Superficial: Peat – unproductive. Solid: Hughes Member and Brithdir Member – Secondary A aquifer.
UXO risk	A non-specialist UXO assessment indicates a low bomb risk.

Preliminary conceptual site model based on desk study

Potential contaminant sources	» Made Ground, associated with the Cefn-mawr Colliery activities, possibly including elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials, PAHs, petroleum hydrocarbons, lubricants and solvents (S01). » Made Ground at the entrances of coal mine adits and used for backfilling, potentially containing metals and metalloids, asbestos fibres, asbestos containing materials, PAHs and petroleum hydrocarbons (S02). » Burnt fly tipped waste near the former quarry in the centre of the site including paint cans, plastics and metals, possibly a source of metals, metalloids, PAHs and petroleum hydrocarbons (S03). » Ground gases (methane and carbon dioxide) from organic materials in Made Ground / Peat / superficial weathered bedrock and worked coal seams (S04). » Farm building in the centre of the site which has an asbestos tile roof and contains an Above Ground Storage Tank, and the storage area in the southwest, possibly a source of petroleum hydrocarbons, PAHs, VOCs, asbestos fibres and Asbestos Containing Materials (S05). » Workshop near the house in the centre of the site, possibly a source of elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials, PAHs, petroleum hydrocarbons, lubricants and solvents (S06). » Naturally elevated concentrations of arsenic within the natural soils across the site (S07). » Radon (S08).
Potential contaminant linkages (for receptors for which there is or will be a pathway)	» People. » Development end use. » Groundwater. » Surface waters.

Preliminary geotechnical hazards

Groundwork	» Uncontrolled Made Ground (variable strength and compressibility). » Soft / loose compressible ground (low strength and high settlement potential). » Variable lateral and vertical changes in ground conditions. » Attack of buried concrete by aggressive ground conditions. » Obstructions. » Existing below ground structures to remain (onsite tunnels). » Shallow groundwater.
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- » Changing groundwater conditions.
- » Loose Made Ground, leading to difficulty with excavation and collapse of side walls.
- » Slope stability issues – general slopes.
- » Mining.
- » Relict slip surfaces.

Future considerations

Further work	Following the ground investigation works undertaken to date, the following further works will be required: » Intrusive investigation to confirm the presence, depth and composition of Made Ground across the site at development locations; » Intrusive investigation to determine depth and distribution of mine workings beneath the site at development locations; » Foundation assessment at proposed development locations; » Slope stability assessment at proposed development locations; » Vegetation clearance and additional site walkovers to determine distribution of mine adits on site. » Assess trench stability, over break potential and 'diggability'; » Determine CBRs to assist with road pavement design; » Obtain information on soil sulphate conditions in terms of Aggressive Chemical Environment for Concrete Class (ACEC); » Determine depth to groundwater below the site; » Soil sampling for chemical and geotechnical laboratory testing; » Undertake ground gas monitoring and assessment; and » Complete a demolition / refurbishment asbestos survey of the existing buildings on site.
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This Executive Summary forms part of Hydrock Consultants Limited report number 16044-HYD-XX-XX-RP-GE-1000 and should not be used as a separate document.

1. Introduction

1.1 Terms of reference

In October 2023, Hydrock Consultants Limited (Hydrock) was commissioned by Trivselhus UK (the Client) to complete a Phase 1 Desk Study at Parc Pelenna. The site is located to the northeast of Neath, Swansea with the nearest postcode being SA11 4ET.

The study area discussed within this report comprises the proposed development site, a wider area of the same ownership proposed for ecological enhancement, and a wider study area of option land, herein referred to as 'the site'. Where figures and third party reports indicate a boundary, this relates to 'the site' as a whole/combined, as outlined above.

The site is situated 5.2km northeast of Neath town centre roughly 760m southeast of the A465 highway on the north-facing slope of a hill side. The site is almost entirely vegetated with sections of forest, scrubland and managed lawns. In the central area of the site lies a farm house, a farm building and a vacant holiday house with some small areas used for material storage. The site is bound by pastoral lands and forest on all sides with notable features being the River Neath 585m to the northwest, the Pelenna Forest abutting the southern boundary and a gas distribution facility 55m to the west.

Hydrock understands that the proposed development layout has yet to be finalised, however it is expected to consist of 120 single-storey/split level lodges spread across the western half of the site within five clusters. Within this area there will be a single-storey community hub with amenities and an access road from the north. Much of the existing vegetation is likely to be retained and enhanced. The current development proposal for the site that this report has been based upon (Concept Masterplan: Parc Pelenna, 2304/SK001) is presented in Appendix A.

These Phase 1 works have been undertaken in accordance with Hydrock's proposal referenced (Ref: 16044-Parc Pelenna, dated 2 October 2023) and the Client's instructions to proceed (email from the Client 4th October 2023).

1.2 Objectives

The works have been commissioned to support the planning application and to assist with the design of the development.

The objectives of the Phase 1 Desk Study are to formulate a preliminary Ground Model and an Initial Conceptual Site Model (CSM) of the site to identify and make a preliminary assessment of any potential geo-environmental and geotechnical risks to the proposed development.

1.3 Scope

The site investigation includes a Phase 1 Desk Study and a Phase 2 Ground Investigation.

The scope of the Phase 1 Desk Study comprises:

- » a field reconnaissance (walkover) to determine the nature of the site and its surroundings including current and former land uses, topography and hydrology;
- » the acquisition and review of:
 - » historical Ordnance Survey maps, to identify any; former potentially contaminative uses shown at the site and immediately surrounding it, and an assessment of the associated contamination risks;
 - » a third-party environmental report to identify any; flooding warning areas, local landfills, pollution incidents, abstractions, environmental permits etc. All of which may have had the potential to have environmental impact on the site;

- » topographical, geological and hydrogeological maps;
- » British Geological Survey (BGS) archive records;
- » Zetica unexploded ordnance (UXO) maps;
- » a site-specific Coal Authority 'Consultants Coal Mining Report';
- » the Coal Authority's Interactive Viewer;
- » a site-specific BGS Radon report and Infiltration SuDS report;
- » development of a preliminary Ground Model representing ground conditions at the site;
- » development of an initial CSM, including identification of potential contaminant linkages;
- » a qualitative assessment of any geo-environmental risks identified; and
- » identification of any plausible geotechnical hazards.

1.4 Available information

The following documents, reports etc have been provided to Hydrock by the Client for use in the preparation of this report:

- » Ross Peedle Architecture (RPA), n.d. 'Parc Pelenna: Concept masterplan'. Ref: 2304/SK001 (RPA, n.d); and
- » Hywel John Surveys Ltd, October 2023. 'Parc Pelenna, Neath: Topographical Survey 1:1,500'. Ref: 4223 (Hywel John Surveys, 2023). It should be understood that the extent of the topographical survey at the time of writing did not cover the entire site.

It is understood that the Client defined in Section 1.1 commissioned assignment of the above documents and Hydrock has assumed that full reliance can be placed upon their contents. Should this not be the case, Hydrock should be informed at the earliest opportunity.

1.5 Regulatory context and guidance

The investigation work has been carried out in general compliance with recognised best practice, including (but not limited to) BS 5930:2015, BS 10175:2011+A2:2017 and the AGS (2006) 'Good Practice Guidelines for Site Investigations'.

The geo-environmental section of this report is written in broad accordance with BS 10175:2011+A2:2017, EA LCRM (2023) and the AGS (2006) 'Good Practice Guidelines for Site Investigations'.

The methods used follow a risk-based approach, the first stage of which is a Phase 1 Desk Study and field reconnaissance, with any potential geo-environmental risks assessed qualitatively. This is done using the 'source-pathway-receptor contaminant linkage' concept to assess risk as introduced in the Environmental Protection Act 1990 (EPA, 1990). Any potential geotechnical risks are also assessed from the Phase 1 desk study and site reconnaissance stage.

Professional judgement is then used to evaluate the findings of the risk assessments and to provide recommendations for the development.

The geo-environmental and geotechnical aspects are discussed in separate sections. Throughout the report the term 'geotechnical' is used to describe aspects relating to the physical nature of the site (such as foundation requirements). The term 'geo-environmental' is used to describe aspects relating to ground-related environmental issues (such as potential contamination). However, it should be appreciated that this is an integrated investigation and these two main aspects are inter-related. Designers should take all aspects of the investigation into account.

Remaining uncertainties and recommendations for further work are listed in Section 6 and Section 7.

2. Desk study (and field reconnaissance)

2.1 Data

A number of desk study sources have been used to assemble the following information. These are presented in Appendix C and Appendix D and include:

- » Third-party environmental report (Groundsure report, Ref: GS-5IU-EWQ-VUE-VXL) (Appendix D);
- » Historical Ordnance Survey mapping (Appendix C);
- » BGS Archive Records (Appendix D);
- » Zetica UXO Risk Map (<https://zeticauxo.com/downloads-and-resources/risk-maps/>) (Appendix D);
- » Coal Authority 'Consultants Coal Mining Report' (Ref: 51003388903001) (Appendix D);
- » Coal Authority's Interactive Viewer (<http://mapapps2.bgs.ac.uk/coalauthority/home.html>);
- » BGS Radon report (Ref: BGS_335835/50064) (Appendix D); and
- » BGS Infiltration SuDS report (Ref: BGS_335835/50063) (Appendix D).

2.2 Site referencing

Table 2.1: Site referencing information

Item	Brief Description
Site name	Parc Pelenna Holiday Resort.
Site address	The nearest postcode is SA11 4ET.
Site location and grid reference	The site is located 5.2km northeast of Neath town centre approximately 760m southeast of the A465 highway on the north-facing slope of a hill side. The National Grid Reference (NGR) of the approximate centre of the site is 280319E, 199507N. The site is approximately 43.8Ha in area with an irregular rectangular shape.
Site boundaries	The site is bound on all sides by pastoral land and forests with notable features including the River Neath 585m northwest, the Pelenna Forest abutting the southern boundary, and a gas distribution facility 55m west. Across the site the boundary varies from dry stone walls, metal livestock fencing and dense vegetation.



Figure 2.1: Site location

(Reproduced with permission from Groundsure)

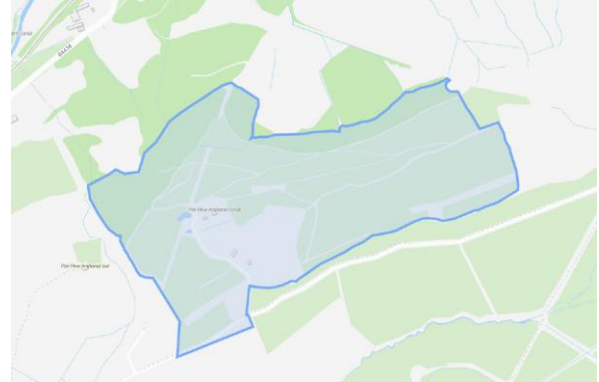


Figure 2.2: Extract from the Ordnance Survey Map.

(OS licence 100023353).

A Site Location Plan (Ref: 16044-HYD-XX-XX-DR-GE-1000) is presented in Appendix A.

2.3 Site description and field reconnaissance survey

A field reconnaissance survey was undertaken on the 14 and 15 November 2023 to visually identify assess potential geotechnical hazards, contaminant sources for future investigation and identification of possible source-pathway-receptor linkages. The weather during the field reconnaissance survey was mostly dry with slippery ground conditions.

Selected photographs are presented as Figure 2.3 to Figure 2.6. Additional photographs are presented in Appendix B.

Table 2.2: Site description

Item	Brief Description
Site access	The site was accessed from the southwest via Fairyland Road.
Site area	The site has an irregular rectangular shape and has an area of approximately 43.8Ha.
Elevation, topography and any geomorphic features	The elevation across the site varies substantially due to it being situated on the side of a hill where the surface broadly slopes towards the north into the Vale of Neath. The elevation ranges from 250m Above Ordnance Datum (AOD) in the southwest of the site to 134m AOD in the north. The surface topography does vary across the site. In the eastern half of the site a flat trackway close to the southern boundary runs east to west and begins to dip steeply towards the north. The slope is densely forested with soft hummocky ground conditions. At the base of the forest is a trackway running east to west before transitioning into another steep slope. At the base of the second steep slope there is evidence of instability in the slope toe and a bricked-up coal mining adit was observed. In the western area of the site the southern portion is generally flat as this is part of the crest of the hill. From here the ground gradually slopes towards the north. In the far west of the site lies a forest with extremely boggy ground conditions, while in the central area there are no forests with several properties and managed lawns. The ground in the central area is terraced in places

	providing flat areas for some of the properties. In the far northwest of the site the slope becomes slightly less steep as it transitions to the valley floor. Across the site there are pathways cut into the slope which in some instances have created sub-vertical to vertical walls of superficial and bedrock material. Some of these reached over 4m tall and appeared to be unstable. Two former quarries exist across the west of the site and in one instance there are 10 to 15m high bedrock exposures.
Site boundaries and surrounding land	The northern boundary is demarcated by metal livestock fencing and vegetation with forests and some pastoral land immediately north of this. Beginning 330m northwest lies a railway line, Neath Canal (365m), River Neath (585m) and the A465 highway (760m). The eastern boundary is similarly demarcated by a metal livestock fence and immediately adjacent is an oak grove in the northeast while in the southeast lies pastoral land. The southern boundary is marked by a dry-stone wall and beyond the majority of this boundary lies the Pelenna Forest. In the southwest the site bounds pastoral land. The western boundary is marked by metal livestock fencing and immediately adjacent is pastoral land. A gas distribution facility is situated off site 55m from the western boundary.
Present land use	The land is mostly unoccupied and comprises mixed native and foreign plantation forest with areas of scrubland and managed lawns. The eastern half of the site is partly comprised of forest while the northeastern area appears to have been partially logged. The western half of the site is mostly comprised of forest with some areas of managed lawn, properties, material storage and beekeeping.
Vegetation	Dense forest consisting of coniferous and deciduous trees cover the majority of the site. Scrubland is scattered between the forests and consist of ferns, short shrubs and tree saplings. In the central area of the site the grounds are managed and currently consist of managed lawns.
General site sensitivity	The site is within a generally rural area with extensive ancient woodland to the west, north and east.

A Site Walkover Plan (Ref: 16044-HYD-XX-XX-DR-GE-1001) is presented in Appendix A.



Figure 2.3: Above ground fuel storage tank in the farm building in the south-central area of the site.



Figure 2.4: Sandstone bedrock exposure in the northwest of the site.



Figure 2.5: Site of the historical Cefn-mawr Colliery.



Figure 2.6: Mine adit in the north of the site.

2.4 Site history

A study of historical Ordnance Survey maps (Appendix D) has been undertaken to identify any former land uses at the site and surrounding areas which may have geotechnical or geo-environmental implications for the proposed development. The key findings are summarised in Table 2.3.

Table 2.3: Site history review

Reference	Key features on site	Key features off-site
OS Map ¹ 1877: 1:10,560	The site mostly comprises open pastoral land with some forests in the northeast and along the northwest boundary. A farm lies roughly central in the site with a spring and quarry located to the slightly north of the farm. A tunnel connects to the quarry which run	100m west – Penrhiw Angharad Isaf farm with several buildings. 100m northeast – Engine house and air shaft associated with coal mining. 200m northeast – Small quarry. 330m northwest – Railway.

¹ Ordnance Survey Historical Map Information provided by Groundsure.

	offsite towards the west and links up with the railway. Two small quarries are present in the northeast of the site with a linear feature (likely a track) leading away from these towards the eastern boundary. Overall, the site is split into over 25 parcels of land, likely separated by drystone walls, ditches or fencing.	350m and 500m northeast – Tramways trending northwest to southeast connect to the railway. 365m northwest – Neath Canal. 585m northwest – River Neath. 750m north – Clyne Colliery.
OS Map 1877 1:2,500	'Old Drum' marked in the northwest of the site near the quarry and spring.	Tramway and interchange trending northwest to southeast immediately northeast of the site with two engine houses, an air shaft and old coal drift. 100m west – Old quarry next to the site of the farm. 200m northeast – area marked as old coal level next to the small quarry.
OS Map 1897 1:10,560	The main farm area has shifted 100m east from the positions seen in 1877. Mapping appears to show the two quarries in the northeast have combined into one and the linear feature next to this is now marked as a footpath and extends further into the site.	350m and 500m northeast – Tramways now marked as 'old tramways'. 450m north – Old coal pit. 750m north – Clyne Colliery has been renamed as the Resolven Tin Plate Works and has expanded.
OS Map 1899 1:2,500	No significant changes noted onsite.	Tramway interchange immediately northeast now remodelled into on continuous track and the two engine houses and air shaft are no longer marked.
OS Map 1919 1:2,500	The quarry in the northwest of the site is now marked as the Cefn-mawr Colliery with a tramway trending northeast to southwest passing from here to the north. A 'supply pipe' passes through the northern edge of the site generally trending southwest to northeast. Air valves are periodically marked above this feature. Two coal mining adits along the north of the site along the footpath and marked on the map as 'old coal level'. One adit lies where one of the quarries was. Possibility for a third adit based on the presence of a sluice valve coming from the area.	Three sluice valves noted coming from the northern boundary of the site and heading north (downhill). Tramway immediately northeast now marked as 'Old Tramway'.

OS Map 1921 1:10,560	Three 'rises' are marked in the north of the site with the sluice valves coming from these and heading north (downhill).	Forest land immediately northwest of the northwest boundary has been deforested. 10m northeast – Tramway now marked as 'Old Tramway'. 500 to 600m north – Two quarries and one old quarry now present along a stream.
OS Map 1948 1:10,560	No major changes noted other than some minor deforestation in the northeast and an electrical powerline now runs through the northwest of the site trending northeast to southwest. Tramway leading from the Cefn-mawr Colliery is not marked anymore.	The tunnel leading from the Cefn-mawr Colliery towards the northwest is no longer recorded.
OS Map 1962 - 1965 1:10,560	The Cefn-mawr Colliery is now marked as 'mine' while in the northeast the quarry is marked as disused. Some afforestation in the east of the site. 'Cairns' now present in the southwest of the site.	Large forest (Cwm Gwenffrwd) is now present immediately south and southeast of the site. 490m southwest – Roman Camp now marked. 750m north - Resolven Tin Plate Works no longer marked. Appears the main building has been demolished.
OS Map 1962 - 1964 1:2,500	Site of the Cefn-mawr Colliery now marked as a disused tip. Possibly two more coal mining adits present in the north of the site to the west of the previously mentioned ones. One of the adits in the far northeast now marked as disused and the sluice valves on site are marked as having 'issues'.	100m west – Sheep wash now marked next to the farm. 210m northwest – New road (B4434) constructed northeast to southwest.
OS Map 1973 1:10,560	Mine in the northwest of the site is now marked as disused. The land in the west of the site has become forested with plantation trees.	No significant changes noted. No map coverage for lands east of the site.
OS Map 1982 - 1987 1:10,560	Tip now present in the northwest of the site next to the disused mine. Unmarked tramway leading from the Mine is now marked as dismantled tramway.	No significant changes noted offsite. No map coverage for lands east of the site.
OS Map 1988 - 1991 1:10,560	No significant changes noted onsite.	No significant changes noted offsite.
OS Map 1993 1:2,500	No significant changes noted onsite.	Linear feature noted along the northwest boundary of the site leading

		northwest towards the Neath Canal. Possible utility. 100m west – Sheep wash no longer marked next to the farm.
OS Map 2001 1:10,560	Building or structure noted in the south-central area of the site.	760m northwest - A465 high now present.
Google Earth© Imagery 2006 ² .	Most of the site except for the central area (area of the farm building which is grassland) is forested with footpaths and/or vehicle tracks crossing the site. Two ponds are now present near the farm house in the centre of the site and a possible quarry has opened up northeast of the farm house. A second building is noted in the south-central area of the site.	50m west – hardstanding pad with an access road leading up to it. Large areas of the forest to the south and southeast have been cut down.
OS Map 2010 1:10,000	Tip is no longer marked in the northwest and two more ponds are marked in the south.	No significant changes noted offsite.
Google Earth© Imagery 2013	Large strip of forest has been cut down along the north of the site with some minor cutting done across the site. A small compound is present in the southwest of the site with a possible storage container and an earth bund.	No significant changes noted offsite.
Google Earth© Imagery 2021	Large swathes of forest have been cut down in the east, north and northwest. Possible quarry northeast of the farm house does not appear active and is overgrown with trees.	No significant changes noted offsite.
OS Map 2023 1:10,000	No significant changes noted onsite.	No significant changes noted offsite.

The site comprised both pastoral and forest land in the 1800s with some minor quarrying activities. In the first half of the 20th century the site was heavily mined for coal with the Cefn-mawr Colliery present in the northwest and several adits present in the east. By 1965 coal mining activities had ceased and the area of the colliery was labelled as a tip. Mining and quarry activities largely ceased on site after this and the site has since been used for forestry.

² ©Infoterra Ltd & Bluesky, image date: 1/1/2006; ©Digital Globe, image date: 12/7/2013; ©Digital Globe, image date: 23/4/2013.

2.5 Geology

The geology of the site area is shown on the British Geological Survey (BGS) 1:50,000 geological map of Pontypridd (Sheet 248) map extract reproduced as part of the Groundsure report and is summarised below. Paper copies of the 1:10,560 geological mapping do not cover the entire site and only cover the western portion of the site. The geology for the western portion of the site is shown on the BGS 1:10,560 geological map SS79NE. Hydrock drawing 16044-HYD-XX-XX-DR-GE-1002 outlines the geological features on site including the inferred coal seams.

Table 2.4: Geology

Ref. for Figures	Location	Stratigraphic Name	Description
Superficial Deposits (Figure 2.7)			
1	On site (west).	Peat	Partially decomposed mass of semi-carbonised vegetation.
Solid Geology (Figure 2.8)			
8	On site.	Hughes Member	Green-grey 'Pennant sandstones' with thin mudstones/siltstone, seatearth interbeds and thin coals.
6	On site.	Brithdir Member	Green-grey 'Pennant sandstones' with thin mudstones/siltstone, seatearth interbeds and thin coals.



Figure 2.7: Superficial deposits.

(Reproduced with permission from Groundsure)

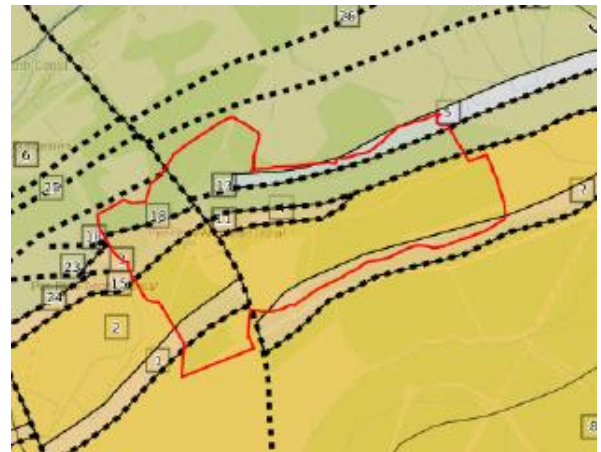


Figure 2.8: Solid geology.

(Reproduced with permission from Groundsure)

A fault, trending approximately northwest to south, with a downthrow to the west, passes through the western half of the site. The Ton-y Grugos Fault, trending parallel with this fault, with a downthrow to the west, is located 440m to the west of the site.

Three outcropping coal seams are present on site; (beginning in the south and moving north) these are the Mountain (also known as the Darren Ddu), Wenallt (also known as the Hughes) and Glyngwilym seams. The Mountain seam is approximately 1 to 5 ft thick with an unknown dip angle. The Wenallt seam is approximately 3 to 4 ft thick and roughly dips at 0.7° to 7.8°. The Glyngwilym

seam is approximately 2ft thick and has an unknown dip angle. It is likely that the Mountain and Glyngwilym seam dip angles are roughly the same as the Wenallt seam. These outcrops are roughly parallel and trend northeast to southwest with the seams dipping toward the south and southeast. The fault passing through the site displaces these outcrops. Furthermore, there are several other coal seams outcropping to the northwest of the site and these are likely to pass beneath the site at significant depth including the Brithdir Rider, Graig and the No.1 Rhondda.

BGS 1:10,000 mapping indicates a landslide occurred in the northwest of the site. It is unclear if any other landslips or types of mass movement have occurred on site due to limited coverage by the maps.

A number of borehole logs from the BGS archive have been reviewed. Selected records are summarised below:

- » SN80SW2, located 430m to the north of the site at Clyne Pit (280720E, 200250N), drilled to a depth of 191.41m and recorded:
 - » 0.00m to 4.57m walling (brick-lined pit wall).
 - » 4.57m to 39.24m Coal Measures: rock with thin beds of clift (blocky or silty mudstone).
 - » 39.24m to 39.50m coal seam (possible Brithdir).
 - » 39.50m to 42.21m fireclay, rock and clift.
 - » 42.21m to 42.24m coal seam.
 - » 42.24m to 45.90m fireclay, rock and clift.
 - » 45.90m to 53.34m white rock
 - » 53.34m to 56.29m sequences of clift and coal.
 - » 56.29m to 63.02m shale, fireclay and clift mixed with rock.
 - » 63.02m to 190.55m rock, with thin beds of clift and discontinuous streaks of coal.
 - » 190.55m to 191.62m No. 1 Rhondda coal seams.

The term 'clift' has been directly transcribed from the BGS borehole log, and it is believed to be 'blocky mudstone or silty mudstone'.

2.6 Hydrogeology

2.6.1 Aquifer designations

Based on the inferred geological sequence presented in Section 2.5 and the Natural Resources Wales (NRW) interactive aquifer designation map, the aquifer system presented in Table 2.5 applies.

Table 2.5: Aquifer system

Superficial Deposits		
Peat	Unproductive	Comprised of partially decomposed semi-carbonised vegetation. Permeability will likely be moderate to low and water is likely to follow heterogenous preferential pathways.
Solid Geology		

Hughes and Brithdir Members (Coal Measures)	Secondary A	Both these deposits are similar and form part of the Pennant Sandstone Formation. These are likely dominated by moderate primary permeability sandstone which is interbedded with low permeability layers of mudstone, seatearths and coal seams. Potentially faulted and fractured, with high secondary permeability. Coal workings are likely to have created a significant secondary porosity and permeability and large volumes of groundwater can be present in abandoned workings, with associated potentially high rates of flow.
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2.6.2 Groundwater abstraction

There are no active licensed groundwater abstractions within 1000m of the site.

2.6.3 Groundwater source protection zones and groundwater vulnerability

The site is not within a groundwater Source Protection Zone (SPZ).

2.6.4 Groundwater levels, recharge, and flow

There is limited information available regarding groundwater depth as there were no historical boreholes located on or close to the site which mentioned the depth to groundwater. Nevertheless, looking at the historical maps it can be inferred that groundwater is likely to be close to the surface in the north of the site due to the presence of a spring in the northwest and the presence of sluice valves leaving the coal mining adits. The BGS Infiltration SuDS report indicates that ground water is likely to be more than 5m below ground level (bgl) throughout the year across much of the site, however in the north the report states groundwater will be less than 3m bgl for at least part of the year. Overall, groundwater is expected to be shallow in the north and at depth in the south.

Superficial deposits are generally absent across the site except for a pocket of Peat in the west. These deposits are likely to act as sponge for surface water and gradually release it into the surrounding ground. The BGS Infiltration SuDS report supports this and shows the mapped superficial deposits to be poorly draining.

The Hughes and Brithdir Members are likely to exhibit heterogenous flow as these deposits are comprised of varying layers of sandstone, mudstone, seatearths and coal seams where intergranular permeability is expected to differ. A high secondary permeability via faulting and fracturing is likely to be present across both these Members. Historical coal workings are expected to be present beneath the site which will also lead to a significant secondary permeability and porosity. Due to the heterogenous spread of these features, it is likely that flows through the bedrock will be heterogeneous.

Recharge into the bedrock is expected to take place mainly via infiltration as the site surface is almost entirely exposed with only small areas of hardstanding. A degree of horizontal recharge is likely to take place in the south of the site where the ground slopes generally toward the north.

The site is generally located within one catchment which is expected to direct groundwater flows toward the north (downhill) into the Vale of Neath valley.

2.6.5 Groundwater quality

The groundwater body beneath the site (Swansea Carboniferous Coal Measures) is currently (2021 Cycle 3) classified under the Water Framework Directive as 'poor'.

The water body is currently provided a 'poor' status due to 'chemical dependant surface water body' conditions.

2.6.6 Groundwater flooding

The environmental data report indicates a negligible risk of groundwater flooding. The BGS Infiltration SuDS report indicates the site is within an area underlain by variably draining Hughes and Brithdir Member bedrock, however much of it is marked as being free draining. This is likely to enable moderate to high groundwater flows which should help to transport excess water off site. The site also slopes steeply towards the north which will help to drive surface water off-site. Finally, the SuDS report indicates groundwater across most of the site will be more than 5m bgl throughout the year which should provide a large area of unsaturated ground where water can be stored resulting in a lower likelihood of groundwater flooding.

2.7 Hydrology

2.7.1 Surface water system and drainage

The surface water features in the vicinity of the site are listed in Table 2.6 and, where appropriate, are marked on the Site Walkover Plan (Ref: 16044-HYD-XX-XX-DR-GE-1001) in Appendix A.

Table 2.6: Surface water features

Feature	Location Relative to Site Area
Drain system (leading to Twrch Brook)	11m northeast
Drain system	44m north
Drain system	61m northwest
Drain system	143m east
Drain system	183m northwest
Drain system	220m north
Drain system (Gwenffrwd)	238m south
Drain system	240m west
Neath Canal	365m northwest
River Neath	585m northwest

2.7.2 Surface water abstractions and discharges

There are no active surface water abstractions or discharges within 1km of the site.

2.7.3 Surface water quality

Reference to the third-party environmental report shows the site is almost entirely within one catchment, except for a small sliver in the southwest. The main catchment is called the 'Neath –

conf with Nedd Fechan and Mellte to TL'. The current (2021 cycle 3) overall status under the Water Framework Directive is described as 'moderate'.

The overall reason for the waterbody currently having a 'moderate' status is due to the plant life. The map also indicates the chemical condition of the catchment as 'high' and the driving contaminants are pH, arsenic, copper, iron, manganese, cadmium, lead, nickel and several PAHs.

2.7.4 Surface water flooding

The third-party environmental report indicates the site is not within a Flood Zone. Reference to the NRW 'Flood and Coastal Erosion Risk Maps' shows the site is not within an area at risk of flooding from rivers or the sea. However, it does indicate a low to medium risk of surface water and small watercourse flooding in some areas near existing site drains.

No further consideration of flood risk is undertaken in this report. Specialist flood risk advice should be sought with regard to drainage and flooding.

2.8 Mining and mineral extraction

2.8.1 Coal mining

Reference to the Coal Authority (CA) interactive map shows the site is within a Coal Mining Reporting Area and there are sections of the site which lie within a Development High Risk Area. Therefore, as there is potential for past mine workings being present in coal seams beneath the site a Consultants Coal Mining Report was obtained from the CA and is included in Appendix D. The key statements within the report are that:

- » There are at least three workable seams which outcrop onsite. These are Mountain (also known as the 'Darren Ddu' but from herein referred to as the 'Mountain'), Wenallt (also known as the 'Hughes' but from herein referred to as the 'Wenallt') and Glyngwilym. The report also states there are other(s) which are unnamed.
- » Significant past underground mining has occurred on site within the Wenallt seam with recorded workings between 53m and 81m bgl. The No.1 Rhondda is also present, however this at a significant depth (264m bgl) and is not of concern.
- » There is a probability of unrecorded shallow workings.
- » There are no spine roadways recorded at shallow depths.
- » There are seventeen recorded mine entries on or within close proximity of the site. Some of these have been backfilled or blocked off.
- » Eight abandoned mine plan catalogue numbers are available for beneath the site. Three mine abandonment plans are available for the seams within 100m of ground level have been reviewed.
- » There are two major faults trending northwest to southeast on site which cut through the outcropping seams. Two minor faults trending northeast to southwest are also present in the southeast of the site
- » There are no opencast mines or CA managed tips within 500m of the site. Whilst there mention of tips on site in historic maps, these are not managed by the CA.

BGS geological mapping shows three seams outcropping on site including the Mountain, Wenallt and the Glyngwilym. The mapping also indicates the presence of a possible 'rider' seam deriving from the Wenallt seam. The positions of the mapped coal seam outcrops indicate that they dip towards the south / southwest, likely between 0° and 8°. Consequently, it is feasible for all seams to be present beneath the site.

The Consultants Coal Mining Report indicates that there are seventeen recorded mine entries on or in close proximity to the site with only one of these being a shaft and the rest being adits. During the

site walkover an adit (280199-007) was encountered and the surrounding soils contained coal tip material. Hydrock drawing 16044-HYD-XX-XX-DR-GE-1004 shows the slope angles across the site and in the north-east there appears to be multiple tear-drop shaped features on the surface which could represent the locations of the mine adit recorded by CA. The location of the mine adits are generally positioned along the length of the Wenallt seam outcrop

Historical mapping also records the presence of the Cefn-mawr Colliery in the northwest of the site from sometime between 1919 to 1964. According to the Welsh Coal Mines online forum the Cefn-Mawr Colliery extensively worked the Wenallt seam.

It is likely that shallow coal seams would have been worked on site and within the vicinity due to the general absence of superficial deposits. However, historical maps indicate that sluice valves came from the area of mining on site which may signify the presence of large volumes of water which needed to be pumped from the workings. This could have caused issues for the potentially extensive shallow workings.

Finally, the Consultants Coal Mining Report indicates several levels of worked seams beneath and surrounding the site from 53m to 283m bgl. Three existing coal abandonment plans were obtained from the CA, all from the Wenallt seam, and georeferenced (Appendix A). All three plans show significant shallow workings across the site with the shallowest areas likely to be in the north at the outcrop.

The conclusion, therefore, is that shallow coal seams are highly likely to be present beneath the site, especially in the northern section of the site where the outcrops lie, and are expected to have been worked. Thus, the risk of subsidence from shallow mine workings is considered to be moderate to high.

2.9 Natural ground instability

Generally, given the absence of superficial deposits on site it is unlikely to be unstable. However, the site generally slopes steeply towards the north and during the site walkover it was noted that there was a thickness of weathered bedrock and superficial deposits on some of the slopes. Slopes, in places, appeared unstable as there was evidence of localised unravelling and distinct slip surfaces. Elsewhere, during the site walkover the ground conditions in the east and west of the site, in the areas of plantation forests, were extremely boggy and soft. In the far west this also coincides with the area of mapped superficial Peat.

The BGS Infiltration SuDS report indicates ground instability problems are probably present in the areas surrounding the outcropping coal seams. Moreover, it shows that slope instability problems are probably present or have occurred in the past in these areas while in the rest of they may be present or anticipated. BGS geological mapping (1:10,560 mapping) also shows some areas of mass movement to the northwest and east of the site. For the remaining areas of the site these are likely to be stable.

2.10 Waste management

There are no current or historical waste management sites recorded within 250m of the site.

2.11 Regulatory Information

Information in the GroundSure Report (Appendix D), relating to various regulatory controls has been reviewed, with a summary presented below in Table 2.7.

Table 2.7: Regulatory information within 500m of the site

Regulatory Data	Distance from Site	Details	Potential Risk	Comment
Discharge Consents	N/A	No entries on discharge consents were recorded within 500m of the site.	No	-
Local Authority Pollution Prevention and Controls	N/A	No entries on local authority pollution prevention and controls were recorded within 500m of the site.	No	-
Pollution Incidents	326m southeast	March 2003, pollutant not identified, Category 3 – minor incident.	No	Due to its distance from the site and the Category 3 classification of the incident.
Trade Directory Entries	On site	Inactive Mine (coal mining)	Yes	Due to it being present on site.
	On site	Inactive Workings (quarrying)	No	Due to the small volumes of potential contaminants.
Fuel Station Entries	N/A	No entries on fuel station entries were recorded within 500m of the site.	No	-
Control of major accident hazards sites (COMAH)	N/A	No entries on COMAH sites within 500m of the site.	No	-
Registered radioactive substances	N/A	No entries on registered radioactive substances were recorded within 500m of the site.	No	-
Notification of installations handling hazardous substances	N/A	No entries on notification of installations handling hazardous substances were recorded within 500m of the site.	No	-

2.12 Natural soil chemistry

Information contained within the environmental report (Appendix D) gives indicative (estimated) concentration values for the natural soils at the site for a selection of Contaminants of Potential Concern (CoPC). These have been reproduced in Table 2.8.

Table 2.8: Natural soil chemistry

Element	Arsenic	Cadmium	Chromium	Lead	Nickel
Concentration (mg/kg)	60 – 120	1.8	60 – 90	100 – 200	30 – 45

The data in Table 2.8 is considered within the geo-environmental assessment. It is noted that the arsenic is of particular relevance as it is elevated, and may require further assessment.

2.13 Radon

The guidance indicates that the site is partially within a Radon Affected Area. It should be noted the site area extends beyond circular boundary used within the BGS Radon report and as such the risks have been discussed below for these areas.

Areas underlain by Peat are located in areas where radon levels in 10-30% of homes are above the action level and full radon protection measures are required for new buildings at these locations in line with current guidance.

Meanwhile, the remainder of the site is in an area where radon levels in up to 1-3% of homes are above the action level, therefore no radon protection measures are required for new buildings in these areas in line with current guidance. Consideration should be given to on-site testing to determine actual radon levels.

2.14 Unexploded ordnance (UXO)

In general accordance with CIRIA Report C681 (Stone et al 2009) a non-specialist UXO screening exercise has been undertaken for the purposes of ground investigation and is presented in Table 2.9.

Table 2.9: Non-specialist UXO screening (for the purposes of ground investigation)

Data	Comment	Further Assessment Required
Site History	There is no indication of former military use from the desk study.	No
Post War Development	OS mapping indicates the site continued being used for coal mining before being used for forestry following the closure of the Cefn-mawr Colliery sometime between 1948 and 1965. Three buildings located 200m east of the site, once part of Troed-y-rhiw, are marked as ruins between 1948 and 1965 indicating possible bomb damage. The colliery was operational pre and post war, therefore it is unlikely that bombs would have remained undetected.	No
Geology Type	The ground conditions comprise a thin covering of unmapped superficial deposits (weathered bedrock), over	Yes for areas of peat only.

Data	Comment	Further Assessment Required
	Hughes and Brithdir Member sandstones. It is unlikely UXO would remain undetected. However, in the far west of the site is a zone of superficial Peat where it is likely that UXO would remain undetected.	
Surface Cover during WWII	The surface cover during WWII comprised open fields and forests. However, given the colliery was operationally during WWII it is considered unlikely that any UXO would remain undetected.	No.
Indicator of Aerial Delivered UXO	Screening against the site-specific bomb risk map Appendix D indicates the site to be in an area where the bomb risk is low.	No

The non-specialist UXO screening exercise has indicated that whilst there is the potential for UXO to remain undetected due to the presence of Peat in the west of the site, no further assessment is required with regard to UXO in relation to ground investigation as the site is situated in an area of low bomb risk and it is considered very unlikely that any potential bombs dropped on the site would land in the small area of peat or the heterogenous spread of thicker superficial weathered bedrock. Moreover, the Cefn-mawr Colliery was present in the northwest of the site during WWII and it is unlikely that any UXO would remain undetected. Nevertheless, further assessment may be considered prudent for construction activities.

3. Initial conceptual site model

3.1 Introduction

The initial CSM incorporates evidence from the site walkover, the Desk Study and previous investigations carried out at the site. The formulation of an initial CSM is a key component of the LCRM methodology, and incorporates: a Ground Model of the site physical conditions; and an exposure model of the possible contaminant linkages. It forms the basis for Generic Quantitative Risk Assessment (GQRA) in accordance with current guidelines.

3.2 Ground model

The preliminary Ground Model presented in Section 2 provides an understanding of the ground conditions and is the basis for preparing the preliminary geotechnical hazard assessment (Section 3.3) and the preliminary geo-environmental exposure model (Section 3.4).

3.3 Geotechnical hazard identification

3.3.1 Context

The preliminary geotechnical hazard identification has been undertaken in accordance with the general requirements of ICE/DETR Document 'Managing Geotechnical Risk' and the HE documents HD 41/15 and CD 622.

The following section sets out the identified geotechnical hazards and the development elements potentially affected (see Table E.1 in Appendix E for further information).

3.3.2 *Plausible geotechnical hazards*

Plausible geotechnical hazards identified at the site are:

- » Uncontrolled Made Ground (variable strength and compressibility).
- » Soft / loose compressible ground (low strength and high settlement potential).
- » Variable lateral and vertical changes in ground conditions.
- » Attack of buried concrete by aggressive ground conditions.
- » Obstructions.
- » Existing below ground structures to remain (onsite tunnels).
- » Shallow groundwater.
- » Changing groundwater conditions.
- » Loose Made Ground, leading to difficulty with excavation and collapse of side walls.
- » Slope stability issues – general slopes.
- » Mining.
- » Relict slip surfaces.

3.3.3 *Potential development elements affected*

Development elements potentially affected by geotechnical hazards are:

- » Buildings – foundations.
- » Buildings – floor Slabs
- » Roads and pavements.
- » Services.
- » General slopes.

- » Retaining walls.
- » Gardens.
- » Construction staff, vehicles and plant operators.
- » Concrete below ground.
- » Earthworks control, inability to place and compact fill.

Health and safety risks to site Contractors and maintenance workers have not been assessed during these works and will need to be considered separately during design.

The above plausible geotechnical hazards and development elements affected have been carried forward for investigation and assessment.

3.4 Geo-environmental exposure model

3.4.1 Context

The preliminary exposure model is used to identify geo-environmental hazards and to establish potential contaminant linkages, based on the source-pathway-receptor (SPR) approach.

A viable contaminant linkage requires all the components of an SPR to be present. If only one or two are present, there is no linkage and no further assessment is required.

3.4.2 Potential contaminants

For the purpose of this assessment the potential contaminants have been separated according to whether they are likely to have originated from an on-site or off-site source.

3.4.2.1 Potential on-site sources of contamination

- » Made Ground, associated with the Cefn-mawr Colliery activities, possibly including elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials, PAHs, petroleum hydrocarbons, lubricants and solvents (S01).
- » Made Ground at the entrances of coal mine adits and used for backfilling, potentially containing metals and metalloids, asbestos fibres, asbestos containing materials, PAHs and petroleum hydrocarbons (S02).
- » Burnt fly tipped waste near the former quarry in the centre of the site including paint cans, plastics and metals, possibly a source of metals, metalloids, PAHs and petroleum hydrocarbons (S03).
- » Ground gases (methane and carbon dioxide) from organic materials in Made Ground / Peat / worked coal seams (S04).
- » Farm building in the centre of the site which has an asbestos tile roof and contains an Above Ground Storage Tank, and the storage area in the southwest, possibly a source of petroleum hydrocarbons, PAHs, VOCs, asbestos fibres and Asbestos Containing Materials (S05).
- » Workshop near the house in the centre of the site, possibly a source of elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials, PAHs, petroleum hydrocarbons, lubricants and solvents (S06).
- » Naturally elevated concentrations of arsenic within the natural soils across the site (S07).
- » Radon (S08).

3.4.2.2 Potential off-site sources of contamination

No potential off-site sources of contamination have been identified.

3.4.3 Potential receptors

The following potential receptors in relation to the proposed land use have been identified.

- » People (neighbours, site end users) (R01).
- » Development end use (buildings and utilities) (R02).
- » Flora and fauna (R03).
- » Groundwater: Secondary A aquifer status of the Hughes and Brithdir Members (R04).
- » Surface water: on-site and off-site drainage ditch networks and River Neath 585m northwest (R05).

3.4.4 Potential pathways

The following potential pathways have been identified.

- » Ingestion, skin contact, inhalation of dust and outdoor air by people (P01).
- » Ground gas and VOC ingress via permeable soils and/or construction gaps (P02).
- » Root uptake by plants (P03).
- » Migration of contaminant via leachate migration through the unsaturated zone towards the Hughes and Brithdir Members bedrock (P04).
- » Migration of contaminant via leachate migration through the saturated zone towards the River Neath (P05).
- » Surface water via overland flow (P06).

Health and safety risks to site development contractors and maintenance workers have not been assessed as part of this study and will need to be considered separately.

The above sources, pathways and receptors have been considered as part of the Preliminary Risk Assessment in accordance with LCRM (2023), are considered to be plausible in the context of this site and have been carried forward for investigation and assessment. An assessment of the Source – Pathway – Receptor linkages is undertaken following the assessment (Section 3.4) and is presented in Appendix F (Table F.1).

A summary of the plausible linkages is presented on the Initial Conceptual Site Model provided in Appendix A. (Ref: 16044-HYD-XX-XX-DR-GE-1003).

3.4.5 Potential implications of climate change

Climate change has the potential to change the risk profile for conceptual site models and associated contaminant linkages. The impact of climate change on the CSM is site-specific, and a qualitative assessment of the potential impact of climate change on the CSM for this site is summarised below. The assessment has primarily utilised the guidance in Environment Agency (2010)³ and SoBRA (2022)⁴ which set out the UK context to climate change and land contamination. Both guidance documents advocate a “what if” scenario approach in the context of changes in ambient temperatures, an increase in the frequency of extreme rainfall/storm events and heatwaves/droughts, and long-term changes in groundwater and sea levels.

Those “what if” scenarios that are relevant to this CSM are:

³ Environment Agency, 2010. *Guiding Principles for Land Contamination. Part 2. FAQs, technical information, detailed advice and references, March 2010.*

⁴ SoBRA, 2022. *Guidance on Assessing Risk to Controlled Waters from UK Land Contamination Under Conditions of Future Climate Change, Society of Brownfield Risk Assessment, August 2022.*

- » Increased long-term rainfall leading to increased infiltration and seasonally higher groundwater and water levels in surface waters.
- » Increased frequency and/or magnitude of extreme rainfall events leading to short-term surface flooding, surface water run-off, groundwater flooding, and/or land-based erosion.
- » Increased frequency and/or magnitude of storm events leading to short-term drops in barometric pressure and/or high winds.
- » Occurrence of extreme cold and hot weather events leading to changes in ground conditions such as soil temperature, evapo(trans)piration, and soil moisture (for example freeze-thaw effects and desiccation), decreased infiltration and fall in groundwater and surface water levels.
- » Long-term decrease in rainfall leading to lower infiltration and fall in groundwater and surface water levels.

4. Desk study conclusions

4.1 Site zonation geotechnical assessment

The below sections contain a high-level geotechnical appraisal of the proposed development areas on site and should be read in conjunction with the Hydrock drawing 16044-HYD-XX-XX-DR-GE-1008 which highlights each area. The below assessment is based on Hydrock's geotechnical experience using information obtained during site walkovers and information obtained from third-parties which is referenced and discussed within Section 2 of this report.

4.1.1 Lower Meadows

- » BGS mapped area of Peat beneath the forest floor and joining the western boundary. Peat was found in the field to the west of the zone. Dependant on thickness, this poses significant settlement issues for any new development.
- » Ground conditions across the forest floor were extremely soft and waterlogged, likely due to surface water retention caused by the mapped peat.
- » Surface slope is shallow.
- » An electricity transmission line passes through the site.
- » Mine abandonment plans indicate that the Wenallt seam has been worked in the central-south part of the zone and a roadway passes in from the north, from the direction of the Cefn-mawr Colliery, and leaves towards the southeast.
- » Overall geotechnical risk rating - **High**

4.1.2 Upper Meadows

- » The terrain is generally flat, however it became increasingly steeper in the west of the zone in the area of the access track.
- » A high-pressure gas pipeline passes through the south of the zone.
- » Some sandstone boulders were present at the surface in the northwest of the zone which may signify shallow bedrock.
- » Mine abandonment plans indicate the Wenallt seam has partially been worked in the south of this area from workings extending from the Cefn Mawr Colliery. Some workings extend from the north of this zone, possibly from adits within the outcrop. Hence, subsidence from mine workings is possible.
- » Overall geotechnical risk rating – **Moderate**

4.1.3 Community Hub and The Ponds

- » Two ponds are present and appear to be part of the surface drainage network on site.
- » Terraced landscaping around the farm house with a minor rock exposure likely cut for track construction. Generally weathered bedrock, dipping 60 degrees north, appeared stable in present condition.
- » Steep slope with dense vegetation to the northwest of the zone. Appeared stable in present condition.
- » A bedrock exposure lies just beyond the zone in the west which is 5m to 15m high, thin to thickly bedded with frequent sub horizontal faults and joints. Generally observed to be stable however some sections appeared unstable with scree at the base.
- » An electricity transmission line passes through the zone trending northeast to southwest.
- » The mine abandonment plans indicate there are some limited mine workings in the west of the site and subsidence from mine workings is possible.

- » Overall geotechnical risk rating – **Moderate**

4.1.4 *The Quarry*

- » Disused quarry present in the east of the zone with 10m to 15m high vertical walls of competent thickly bedded sandstone bedrock with frequent vertical and subvertical joint sets. No clear signs of instability, however there could be the possibility for wedge failure to occur due to the orientation of joint sets.
- » Large piles of sandstone blocks at the base of the disused quarry.
- » Generally flat in the centre of the zone along the path with vertical walls to the south. Land to the north of the zone and in the west begins to slope towards the north up to 55 degrees and covered in loose sandstone blocks.
- » Cuttings for the path in the west are 2m to 3m tall in superficial weathered bedrock material, roughly 50 degrees and densely vegetated. Appeared generally stable in present condition.
- » The mine abandonment plans indicate some workings in the east of the site. One roadway appears to come from the outcropping seam in the north of the site and is recorded as starting on site, possibly indicating the presence of a mine adit. Moreover, due to quarrying activities, the ground level in this area has been reduced and this will decrease the distance to any potential shallow mine workings.
- » Overall geotechnical risk rating – **High**

4.1.5 *The Lower Woods*

- » Surface is hummocky and the slope angle is generally around 20 to 30 degrees which decreases towards the north.
- » Ground conditions were boggy in places with standing water and streams frequently encountered.
- » The eastern portion of the zone was densely vegetated with trees while the west was more open.
- » The mine abandonment plans for the Wenallt seam do not indicate the presence of any mine workings beneath this zone.
- » Overall geotechnical risk rating – **Moderate**

4.1.6 *The Upper Woods*

- » The northern section of the zone was the site of the Cefn-mawr Colliery and a large tip. During the walkover the tip could be seen (covered with dense vegetation), however no evidence of adits were found.
- » Outcrop of sandstone in the far northeast of the zone. It was heavily jointed with possible folding and conjugate joints which were generally vertical. Large amounts of scree were seen at the base of the outcrop. In its present condition the feature appeared to be unstable.
- » The terrain slopes steeply from the south of the site beginning at 40 degrees towards the north and gradually flattens at the northern edge. The ground was generally hummocky.
- » The mine abandonment plans for the Wenallt seam indicate the Cefn-mawr Colliery substantially worked this seam. As the colliery is present within this zone, it is likely that shallow workings will be present.
- » Overall geotechnical risk rating – **High**

4.2 Geotechnical conclusions

The following plausible geotechnical risks are identified as:

- » Uncontrolled Made Ground (variable strength and compressibility) – Made Ground is expected in areas of historical coal mining and quarrying activities, land surrounding the farm house, and land around the farm building and material storage area.
- » Soft / loose compressible ground (low strength and high settlement potential) – Risk of shear failure and excessive foundation settlement.
- » Variable lateral and vertical changes in ground conditions – Made Ground, Peat and superficial weathered bedrock likely to be heterogeneously spread across the site.
- » Attack of buried concrete by aggressive ground conditions – The development site may contain sulphate bearing soils.
- » Obstructions – Possible objects may remain in the Made Ground following historical developments.
- » Existing below ground structures to remain (tunnels) – A historical tunnel was noted in the northwest of the site and tunnels are expected to protrude into the site from adit locations.
- » Shallow groundwater – A spring was noted in the northwest of the site and groundwater is expected to be close to the surface, especially in the north.
- » Changing groundwater conditions – Heterogeneous spread of faults and fractures alongside side worked coal seams are likely to induce a variable groundwater level.
- » Loose Made Ground, leading to difficulty with excavation and collapse of side walls – Possibility for Made Ground to be loose and large objects to be present.
- » Slope stability issues – general slopes – Slope toes in the northeast of the site showed signs of failure.
- » Mining – The site is underlain by several coal seams which have been worked. A colliery and several adits were historically present on site.
- » Relict slip surfaces – Potential for relict slip surfaces to be present within the steep areas of the site within the weathered superficial bedrock material.

4.3 Geo-environmental conclusions

Based on historical and current land uses:

- » It is considered that it is likely that the site would be classified as Contaminated Land under Part 2A of the EPA 1990.
- » The overall risk from land contamination at the site is considered to be moderate for the current development, as it is almost entirely open land with large areas of potentially contaminated Made Ground and because of the risk of significant rainwater infiltration leading to leaching. Moreover, there are several sources of ground gases across the entire site.
- » The overall risk for a redeveloped site is assessed to be moderate, but this would need to be confirmed by appropriate intrusive investigation, testing and assessment of the results of the investigation.

The possible pollutant linkages (for risk levels of moderate or greater) on an unremediated redeveloped site, as determined by the desk study and walk-over, are summarised in Table 4.1:

Table 4.1: Possible Pollutant Linkages (for Risk Levels of Moderate or Greater)

Source(s)	◀ potential Impact on ▶	Receptor(s)
Made Ground, associated with the Cefn-mawr Colliery activities, possibly including elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials, PAHs, petroleum hydrocarbons, lubricants and solvents (S01).		People Groundwater Surface waters Development end use
Made Ground at the entrances of coal mine adits and used for backfilling, potentially containing metals and metalloids, asbestos fibres, asbestos containing materials, PAHs and petroleum hydrocarbons (S02).		
Burnt fly tipped waste near the former quarry in the centre of the site including paint cans, plastics and metals, possibly a source of metals, metalloids, PAHs and petroleum hydrocarbons (S03).		
Farm building in the centre of the site which has an asbestos tile roof and contains an Above Ground Storage Tank, and the storage area in the southwest, possibly a source of petroleum hydrocarbons, PAHs, VOCs, asbestos fibres and Asbestos Containing Materials (S05).		
Garage / workshop near the house in the centre of the site, possibly a source of elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials, PAHs, petroleum hydrocarbons, lubricants and solvents (S06).		
Ground gases (methane and carbon dioxide) from organic materials in Made Ground / Peat / superficial weathered bedrock and worked coal seams (S04).		People Development end use
Radon (S08).		

5. Uncertainties and limitations

5.1 Site-specific comments

It is unknown whether there are any contaminative materials stored within the closed buildings on site as we could not see inside of these. Unfortunately, no-one was on site to ask at the time.

Not all recorded coal mining adits were located during the site walkovers due to extensive vegetation. There might also be unrecorded mine adits on site.

5.2 General comments

Hydrock Consultants Limited (Hydrock) has prepared this report in accordance with the instructions of Trivselhus UK (the Client), by e-mail dated October 2023 under the terms of appointment for Hydrock, for the sole and specific use of the Client and parties commissioned by them to undertake work where reliance is placed on this report. Any third parties who use the information contained herein do so at their own risk. Hydrock shall not be responsible for any use of the report or its contents for any purpose other than that for which it was prepared or for use of the report by any parties not defined in Hydrock's appointment.

This report details the findings of work carried out in November 2023. The report has been prepared by Hydrock on the basis of available information obtained during the study period. Although every reasonable effort has been made to gather all relevant information, not all potential environmental constraints or liabilities associated with the site may have been revealed.

Unless otherwise stated, the recommendations in this report assume that ground levels will remain as existing. If there is to be any re-profiling (e.g., to create development platforms or for flood alleviation) then the recommendations may not apply.

Information provided by third parties has been used in good faith and is taken at face value; however, Hydrock cannot guarantee its accuracy or completeness.

Where the existing report(s) prepared by others have been provided by the Client, it is assumed that these have been either commissioned by the Client, or can be assigned to the Client, and can be relied upon by Hydrock. Should this not be the case Hydrock should be informed immediately as additional work may be required. Hydrock is not responsible for any factual errors or omissions in the supplied data, or for the opinions and recommendations of others. It is possible that the conditions described may have since changed through natural processes or later activities.

The work has been carried out in general accordance with recognised best practice. Unless otherwise stated, no assessment has been made for the presence of radioactive substances or unexploded ordnance. Where the phrase 'suitable for use' is used in this report, it is in keeping with the terminology used in planning control and does not imply any specific warranty or guarantee offered by Hydrock.

Whilst the preliminary risk assessment process has identified potential risks to construction workers, consideration of occupational health and safety issues is beyond the scope of this report.

The non-specialist UXO screening has been undertaken for the purposes of ground investigation only (i.e., low risk activity in accordance with CIRIA Report C681). Further assessment should be undertaken with regards to other higher risk activities e.g., construction.

Please note that notwithstanding any site observations concerning the presence or otherwise of archaeological sites, asbestos-containing materials or invasive weeds, this report does not constitute a formal survey of these potential constraints and specialist advice should be sought.

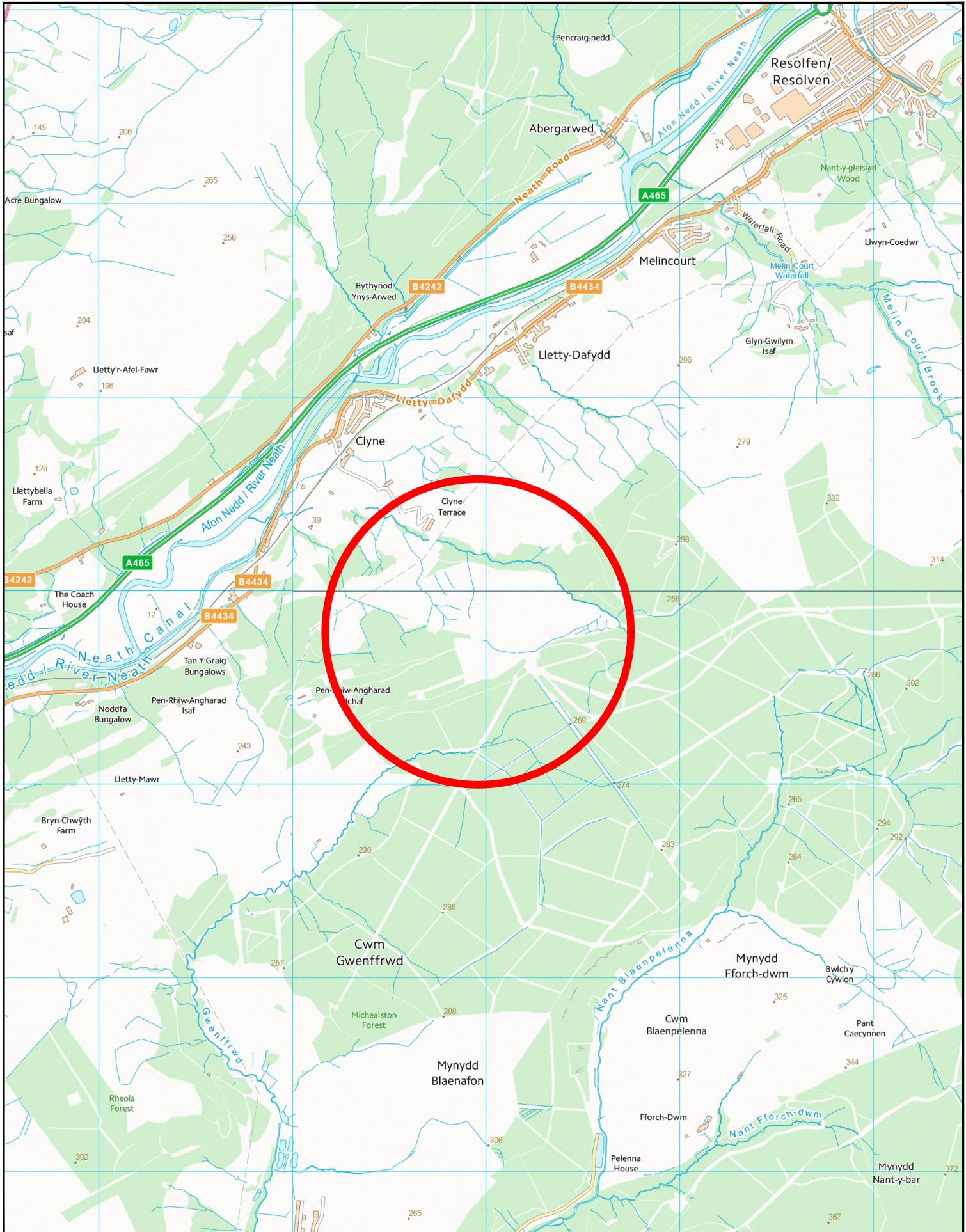
Any site boundary line depicted on plans does not imply legal ownership of land.

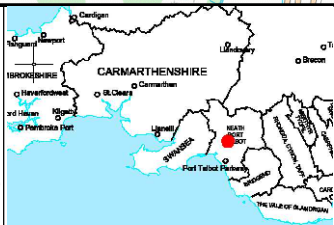
6. Recommendations for further work

The following further works will be required:

- » Intrusive investigation to confirm the presence, depth and composition of Made Ground across the site at development locations;
- » Intrusive investigation to determine depth and distribution of mine workings beneath the site at development locations;
- » Foundation assessment at proposed development locations;
- » Slope stability assessment at proposed development locations;
- » Vegetation clearance and additional site walkovers to determine distribution of mine adits on site.
- » Assess trench stability, over break potential and 'diggability';
- » Determine CBRs to assist with road pavement design;
- » Obtain information on soil sulphate conditions in terms of Aggressive Chemical Environment for Concrete Class (ACEC);
- » Determine depth to groundwater below the site;
- » Soil sampling for chemical and geotechnical laboratory testing;
- » Undertake ground gas monitoring and assessment; and
- » Complete a demolition / refurbishment asbestos survey of the existing buildings on site.

Appendix A Drawings



 Site Ref: SS72		 3rd Floor Wharton Place 13 Wharton Street Cardiff CF10 1GS t: +44(0) 2920 023 665 e: cardiff@hydrock.com		TITLE SITE LOCATION PLAN	
		CLIENT TRIVSELHUS UK		HYDROCK PROJECT NO. C-16044	
PROJECT PARC PELENNIA HOLIDAY RESORT		PURPOSE OF ISSUE SUITABLE FOR INFORMATION		STATUS S2	
DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER) 16044-HYD-XX-XX-DR-GE-1000		REVISION		REVISION	
P01		REV.		P01	
FIRST ISSUE		REVISION NOTES/COMMENTS		APPROVED BY DATE	
DK		23/11/23 MH		24/11/23 AE	
DRAWN BY		DATE		CHECKED BY	
DATE		DATE		DATE	





Site Walkover Boundary

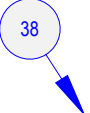


Photo location and number

NOTES

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.

2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.

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CLIENT

TRIVSELHUS

PROJECT

PARC PELENNIA HOLIDAY RESORT

TITLE

SITE WALKOVER PLAN

HYDROCK PROJECT NO.
C-16044

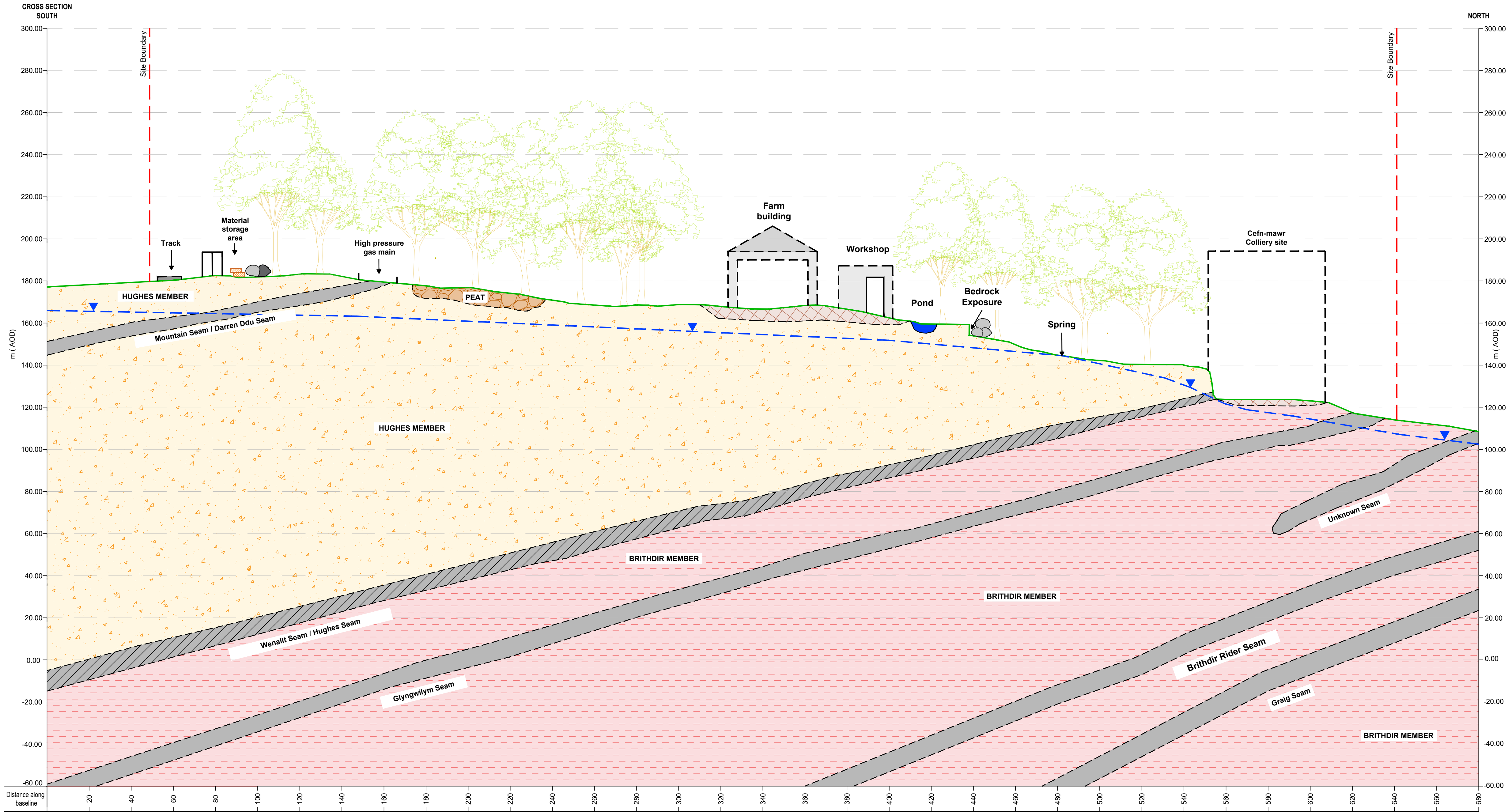
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PURPOSE OF ISSUE
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STATUS
S2

DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)
16044-HYD-XX-XX-DR-GE-1001

REVISION
P01



- KEY
- Existing ground profile
 - Conjectural geological boundary
 - Conjectural groundwater level
 - Made Ground
 - Peat
 - Hughes Member
 - Brithdir Member
 - Coal seam
 - Known worked coal seam

NOTES

1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.

2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.

P01	FIRST ISSUE					
	EP	22/11/23	DK	22/11/23	MH	22/11/23
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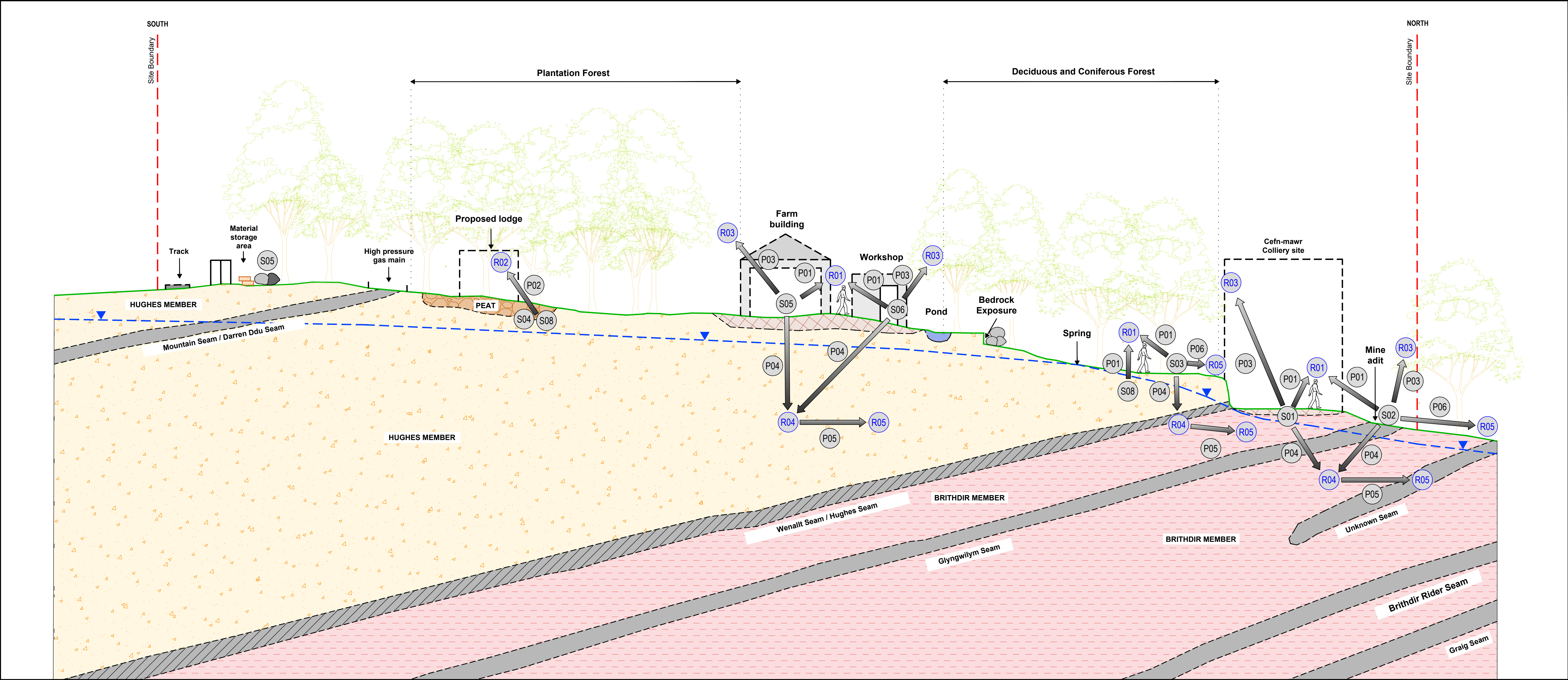
PROJECT

PARC PELENNIA HOLIDAY RESORT

TITLE

GEOLOGICAL CROSS SECTION

HYDROCK PROJECT NO. C-16044-C		SCALE @ A1 1:1100	
PURPOSE OF ISSUE SUITABLE FOR INFORMATION			STATUS S2
DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER) 16044-HYD-XX-XX-DR-GE-1002			REVISION P01



Potential on-site sources of contamination

- S01. Made Ground, associated with the Cefn-mawr Colliery activities, possibly including elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials, PAHs, petroleum hydrocarbons, lubricants and solvents.
- S02. Made Ground at the entrances of coal mine adits and used for backfilling, potentially containing metals and metalloids, asbestos fibres, asbestos containing materials, PAHs and petroleum hydrocarbons.
- S03. Burnt fly tipped waste near the former quarry in the centre of the site including paint cans, plastics and metals, possibly a source of metals, metalloids, PAHs and petroleum hydrocarbons.
- S04. Ground gases (methane and carbon dioxide) from organic materials in Made Ground / Peat / superficial weathered bedrock and worked coal seams.
- S05. Farm building in the centre of the site which has an asbestos tile roof and contains an Above Ground Storage Tank, and the storage area in the southwest, possibly a source of petroleum hydrocarbons, PAHs, VOCs, asbestos fibres and Asbestos Containing Materials.
- S06. Workshop near the house in the centre of the site, possibly a source of elevated concentrations of metals, metalloids, asbestos fibres, Asbestos Containing Materials, PAHs, petroleum hydrocarbons, lubricants and solvents.
- S07. Naturally elevated concentrations of arsenic within the natural soils across the site.
- S08. Radon.

Potential off-site sources of contamination

No potential off-site sources of contamination have been identified.

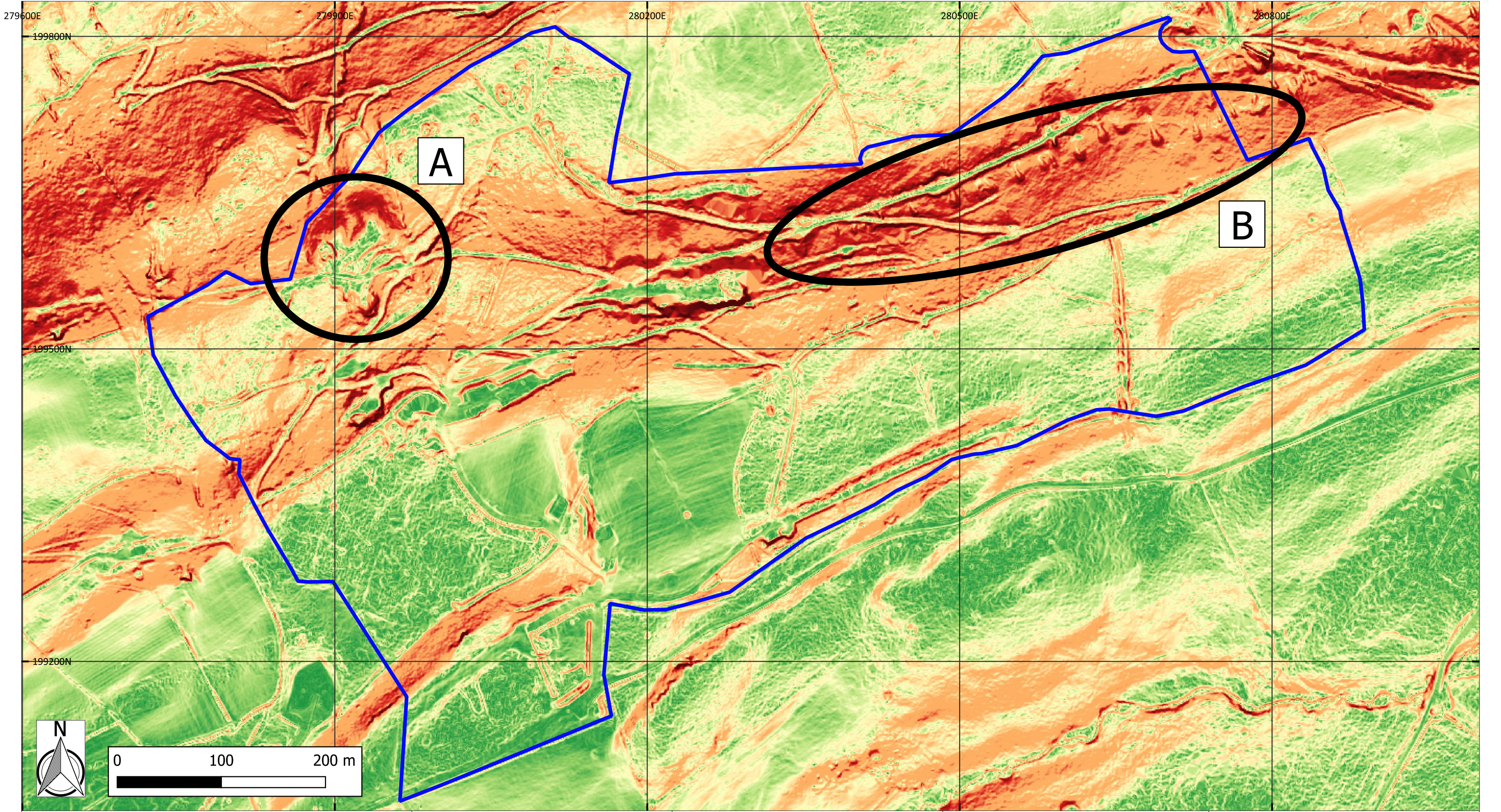
Potential receptors

- The following potential receptors in relation to the proposed land use have been identified.
- R01. People (neighbours, site end users).
- R02. Development end use (buildings and utilities).
- R03. Flora and fauna.
- R04. Groundwater: Secondary A aquifer status of the Hughes and Brithdir Members.
- R05. Surface water: on-site and off-site drainage ditch networks and River Neath 585m northwest.

Potential pathways

- The following potential pathways have been identified.
- P01. Ingestion, skin contact, inhalation of dust and outdoor air by people.
- P02. Ground gas and VOC ingress via permeable soils and/or construction gaps.
- P03. Root uptake by plants.
- P04. Migration of contaminant via leachate migration through the unsaturated zone towards the Hughes and Brithdir Members bedrock.
- P05. Migration of contaminant via leachate migration through the saturated zone towards the River Neath.
- P06. Surface water via overland flow.

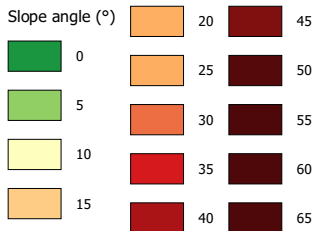
KEY Existing ground profile Conjectural geological boundary Conjectural groundwater level Made Ground Peat Hughes Member Brithdir Member Coal seam Known worked coal seam	NOTES 1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing. 2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.					Hydrock 3rd Floor Wharton Place 13 Wharton Street Cardiff CF10 1GS t: +44(0) 2920 023 665 e: cardiff@hydrock.com CLIENT TRIVSELHUS UK PROJECT PARC PELENNA HOLIDAY RESORT	TITLE INICAL CONCEPTUAL SITE MODEL
P01 FIRST ISSUE EP 22/11/23 DR 22/11/23 MH 22/11/23 REV. REVISION NOTES/COMMENTS DRAWN BY DATE CHECKED BY DATE APPROVED BY DATE					HYDROCK PROJECT NO. C-16044-C SCALE @ A1 NTS	PURPOSE OF ISSUE SUITABLE FOR INFORMATION DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER) 16044-HYD-XX-XX-DR-GE-1003	STATUS S2 REVISION P01



KEY PLAN



Site Boundary



A

Cefn-mawr Colliery site

B

Area of visible mine adits

NOTES

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TITLE

SLOPE ANGLE MAP

HYDROCK PROJECT
NO. 16044

SCALE @ A3
1:3,500

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PURPOSE OF ISSUE
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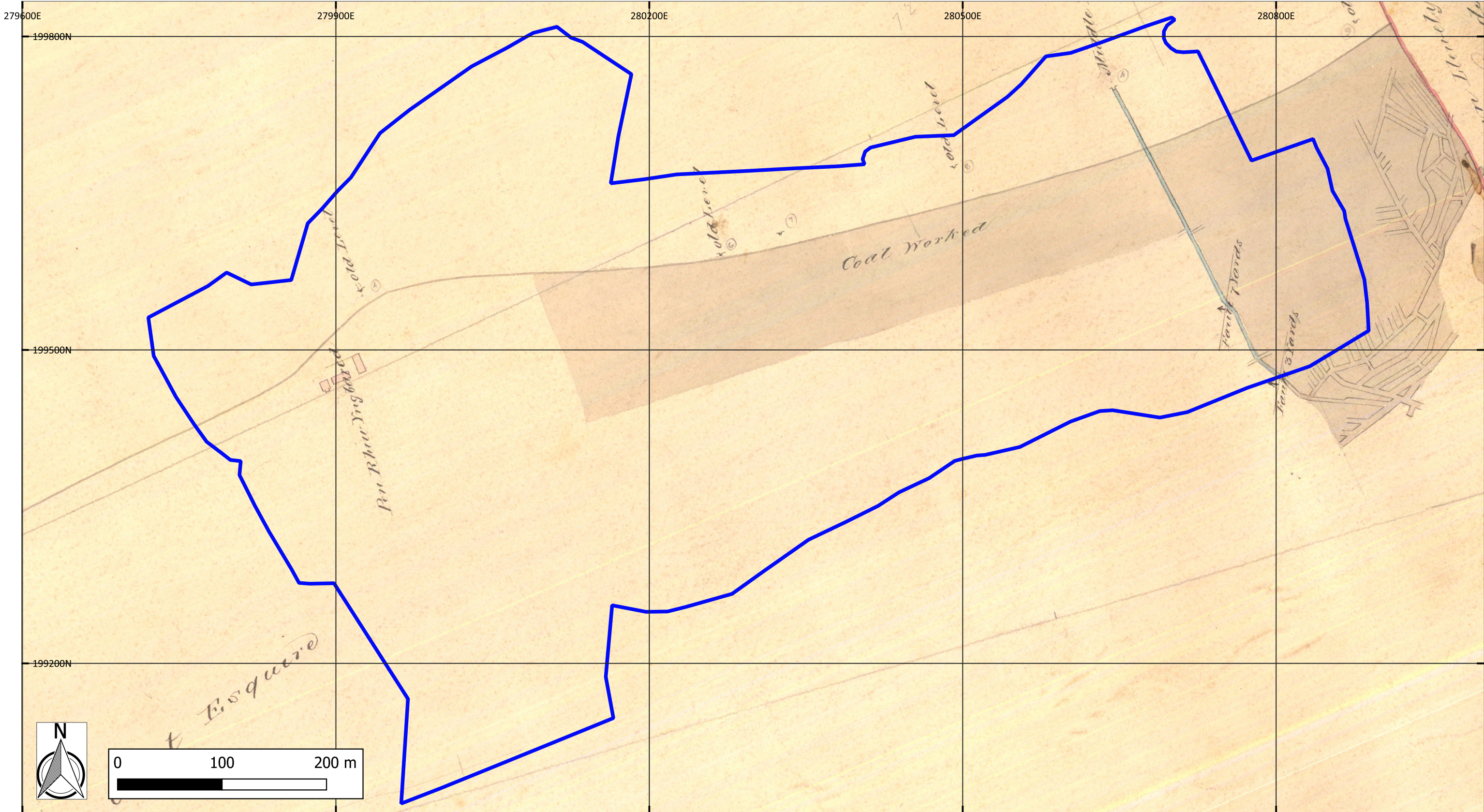
PROJECT
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DRAWING NO.
16044-HYD-XX-XX-DR-GE-1004

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KEY PLAN

 Site Boundary

NOTES

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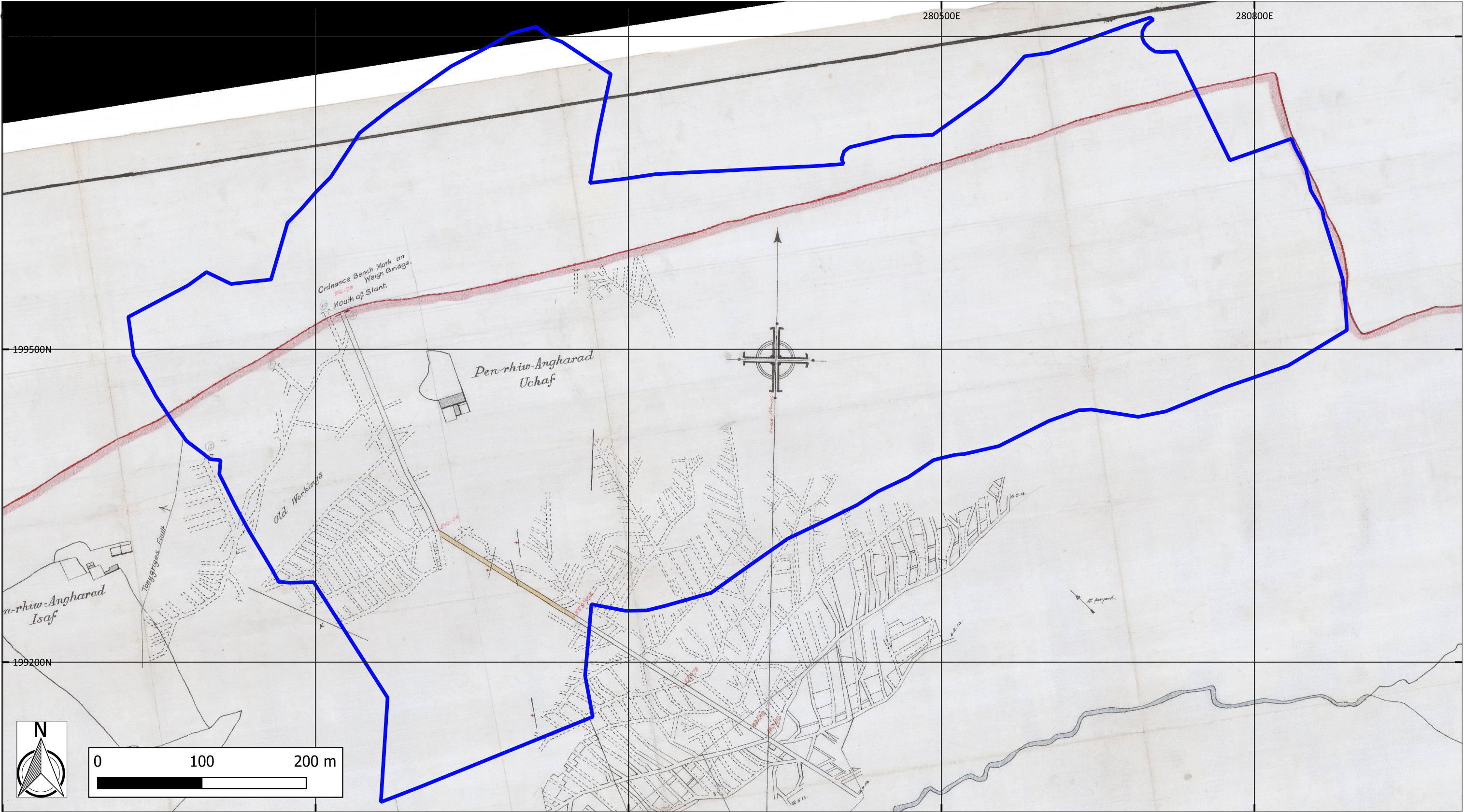
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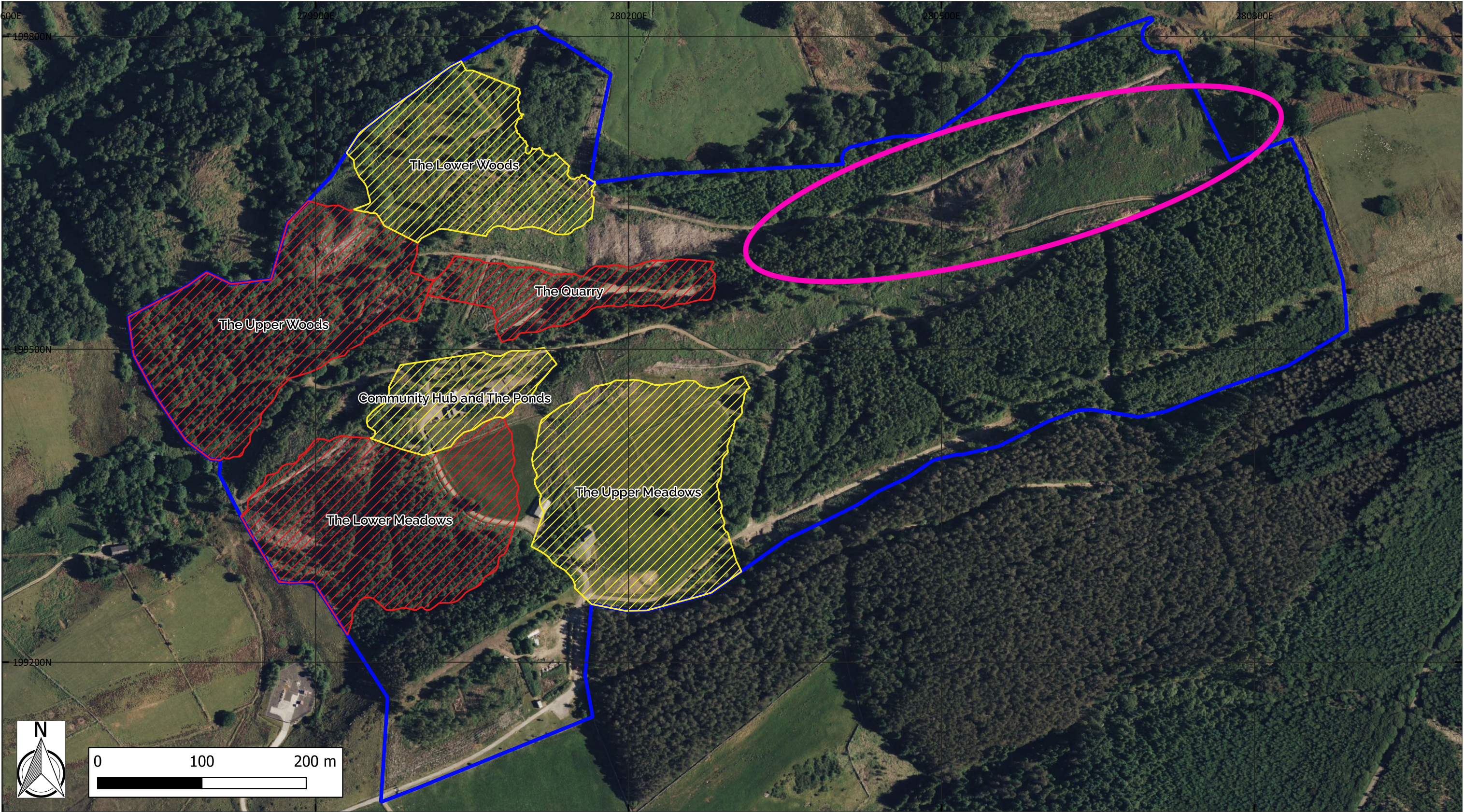
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PURPOSE OF ISSUE SUITABLE FOR INFORMATION	STATUS S2
DRAWING NO. 16044-HYD-XX-XX-DR-GE-1006	REVISIC P01



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PROJECT PARC PELENNIA HOLIDAY RESORT		DRAWING NO. 16044-HYD-XX-XX-DR-GE-1007		REVISIC P01															



KEY PLAN

-  Site Boundary
- Geotechnical Risk Rating**
 -  High
 -  Moderate
 -  Low
-  Area of visible mine adits

NOTES

- Contains OS data © Crown copyright and database right (2022)
- Magenta oval covering the area of mine adits associated with the Wenallt seam. During the walkover, areas of slope instability were identified in this area. The risk associated with this have not been assessed as the proposed development is not to planned entent into here.

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GEOTECHNICAL ZONATION PLAN

HYDROCK PROJECT
NO. 16044

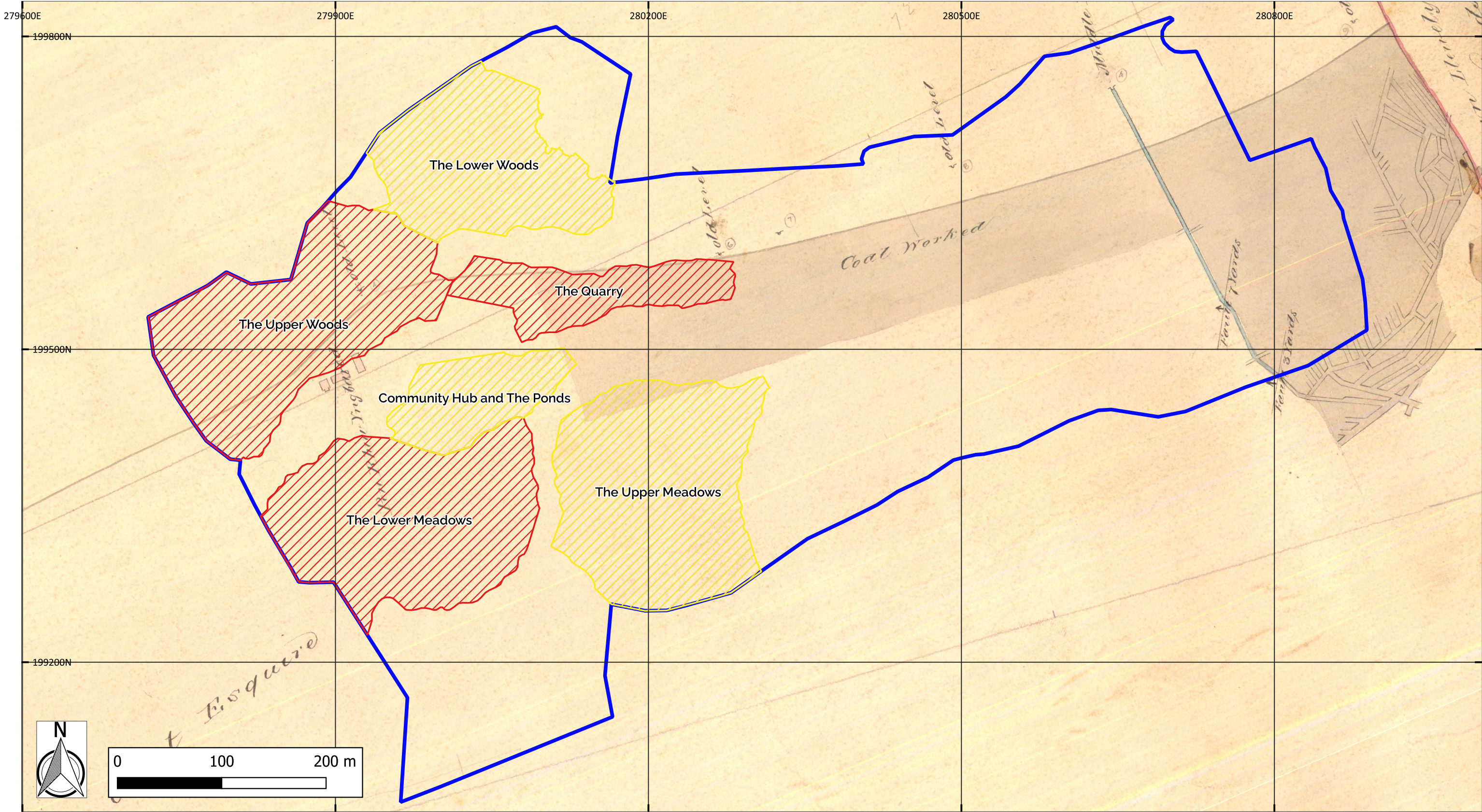
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DRAWING NO.
16044-HYD-XX-XX-DR-GE-1008

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P01



KEY PLAN

- Site Boundary
- Geotechnical Risk Rating
- High
 - Moderate
 - Low

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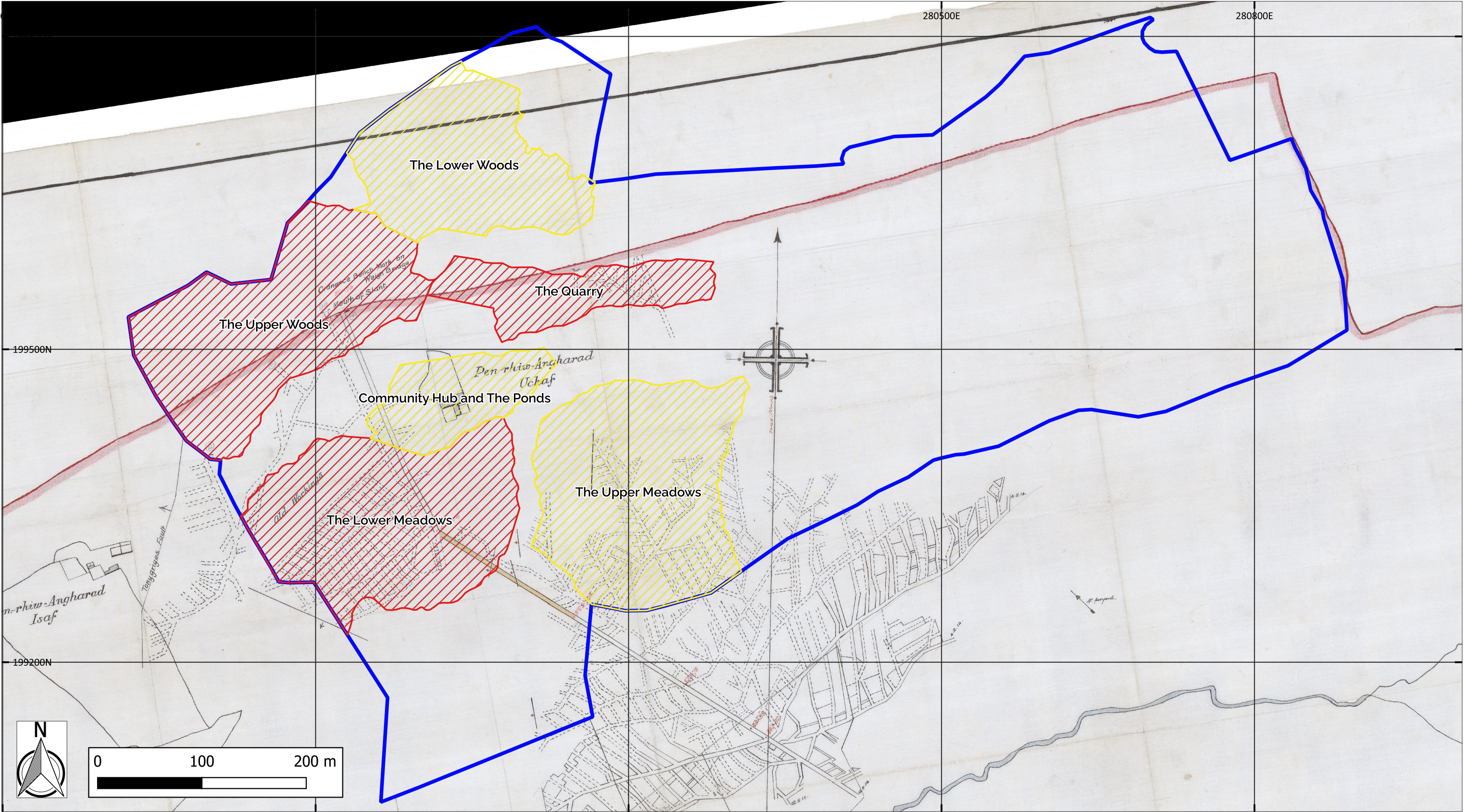
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TITLE MINE ABANDONMENT PLAN - R10966 WITH ZONATION OVERLAY		
HYDROCK PROJECT NO. 16044		SCALE @ A3 1:3,500
PURPOSE OF ISSUE SUITABLE FOR INFORMATION		STATUS S2
DRAWING NO. 16044-HYD-XX-XX-DR-GE-1010		REVISI P01



KEY PLAN

- Site Boundary
- Geotechnical Risk Rating
- High
 - Moderate
 - Low

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TITLE
MINE ABANDONMENT PLAN - 6446
WITH ZONATION OVERLAY

HYDROCK PROJECT
NO. 16044

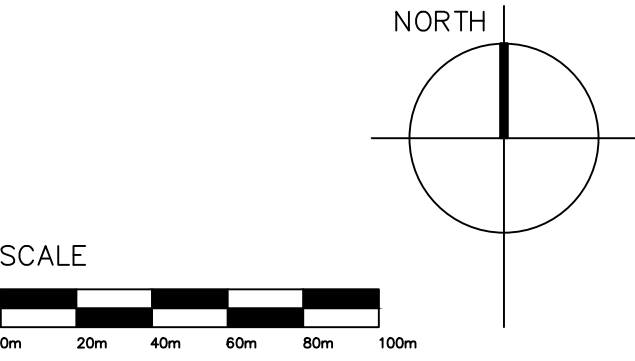
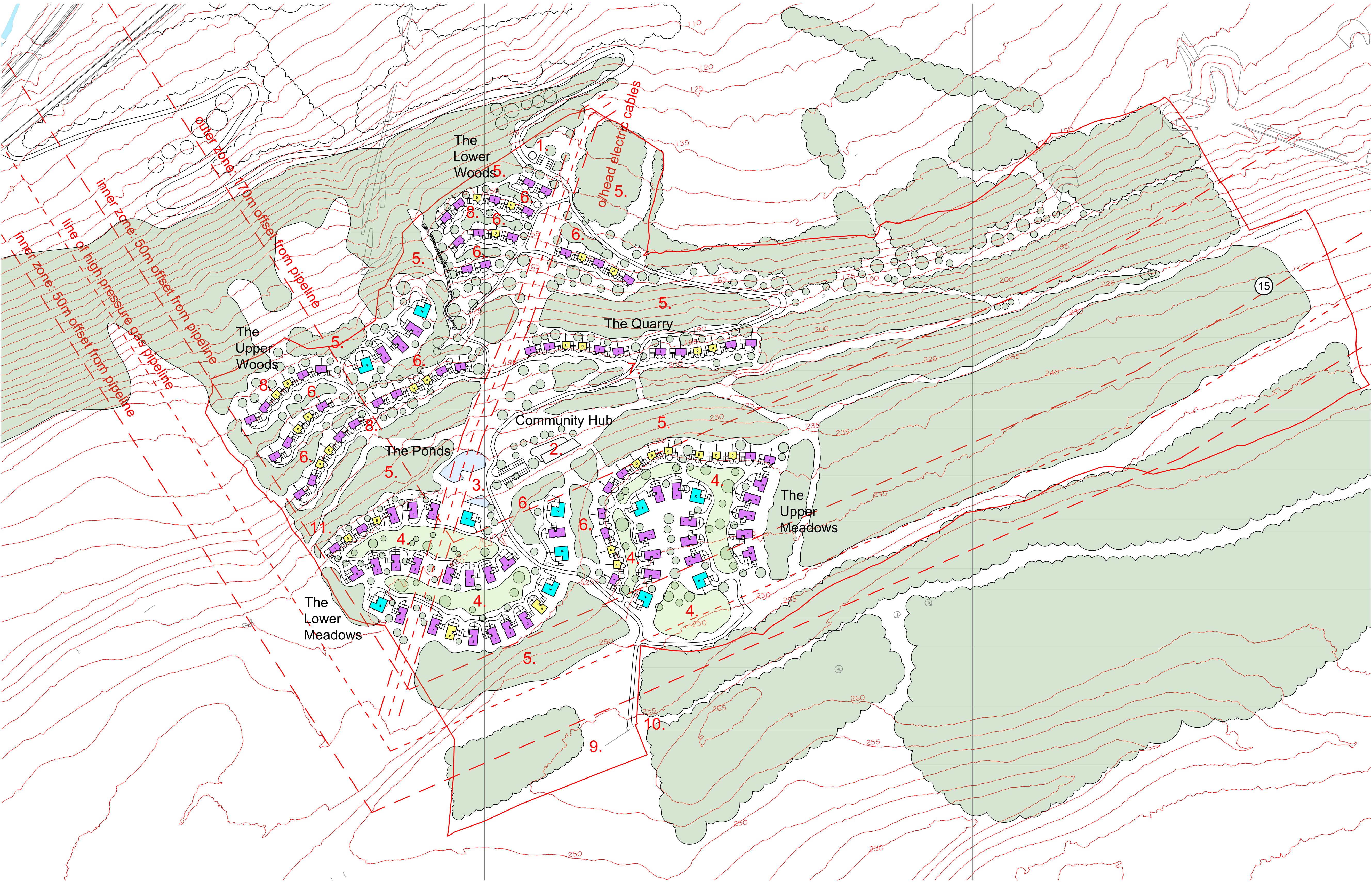
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Lodges

- Type D: 2 bed split level
- Type F: 2 bed single storey
- Type G: 3 bed single storey
- Type I: 3 bed split level
- Type J: 3 bed single storey
- Type K: 4 bed single storey

Accommodation Schedule

lodge type	bedrooms	area (m2)	area (sqft)	number	%
type D	2	92.9	1000	27	23%
type F	2	106.9	1150	4	3%
type G	3	111.5	1200	4	3%
type J	3	125.5	1350	28	23%
type I	3	125.5	1350	46	38%
type K	4	148.7	1600	11	9%
total				120	100%

Legend

- 1. the welcome centre
- 2. the community hub - single storey structure built into hillside with green roof over. Pool, gym, sports, bike hire, shop, management offices
- 3. the ponds - picnic spots and wild swimming
- 4. the meadows - single storey lodges on plateaus and gentle slopes, arranged around wild meadows
- 5. existing tree belts retained and enhanced
- 6. new tree belts to break up views from afar
- 7. the quarry - split level lodges on steep slopes with valley views
- 8. Terraced woodlands - split level lodges on steep slopes with woodland belts between clusters to break up views from afar. Lodges and access tracks follow existing contours to minimise engineering works and loss of existing trees and habitats.
- 9. no development near Scheduled Ancient Monument
- 10. link to National Cycle Route 47
- 11. existing PRoW retained within development

ross peedle architecture

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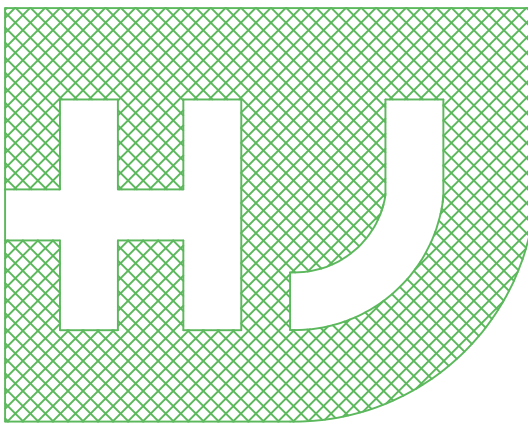
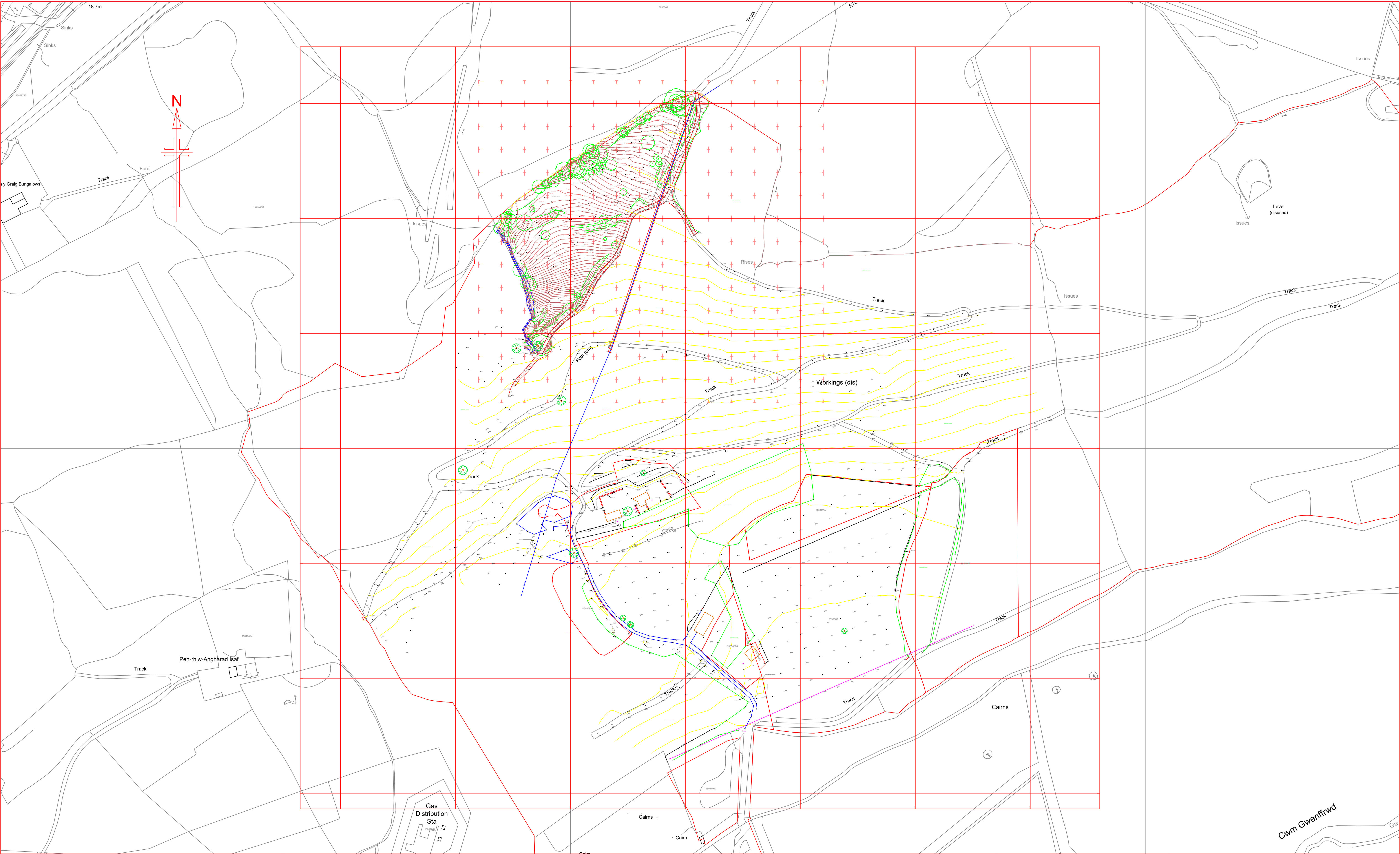
project: Parc Pelenna

drawing: concept masterplan

number: 2304/ SK001

revision: -

scale: 1:2000 @ A1



Hywel John Surveys Ltd
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Abbreviations

BD: Bollard	RW: Retaining Wall	RS: Road Sign
ER: Earth Rod	PR: Post & Rail	IR: Iron Railings
DP: Drain Pipe	BT: British Telecom	WL: Wall
TR: Traffic Lights	PW: Post & Wire	EL: Eaves Level
FH: Fire Hydrant	IC: Inspection Cover	RL: Ridge Level
GY: Road Gulley	ST: Stop Tap	TH: Threshold
MH: Manhole	GV: Gas Valve	FL: Floor Level
LP: Lamp Post	WM: Water Meter	PB: Post Box
BH: Borehole	CB: Crash Barrier	BN: Bin

Topographical Survey
Levels related to OS using GPS equipment

Issue Remarks

Date

Project

Parc Pelenna
Neath

Client

Trivselhus

Drawn:

HJ

Date:

22/10/23

Scale:

A1 1 : 1500

Drawing Number:

4223

Appendix B Field reconnaissance photographs

Desk Study Photograph 1	
Date: 14/11/23	
Direction Photograph Taken: Southeast.	
Description: Exposure of superficial weathered bedrock ~60-degree slope. Likely cut during track construction.	

Desk Study Photograph 2	
Date: 14/11/23	
Direction Photograph Taken: West.	
Description: Terraced lawn in the centre of the site, north of the farm house.	

Desk Study Photograph 3	
Date: 14/11/23	
Direction Photograph Taken: West.	
Description: One of the two ponds west of the farm house.	

Desk Study Photograph 4	
Date: 14/11/23	
Direction Photograph Taken: Northeast.	
Description: Looking northeast across the site, north of the farm house.	

Desk Study Photograph 5	
Date: 14/11/23	
Direction Photograph Taken: Southeast.	
Description: Track cutting exposing superficial weathered bedrock. 2m to 3m high and appeared unstable.	

Desk Study Photograph 6	
Date: 14/11/23	
Direction Photograph Taken: West.	
Description: Flat track area west of the disused quarry.	

Desk Study Photograph 7	
Date: 14/11/23	
Direction Photograph Taken: East.	
Description: Pile of sandstone blocks at the base of the disused quarry.	

Desk Study Photograph 8	
Date: 14/11/23	
Direction Photograph Taken: Southeast.	
Description: walls of the disused quarry. 10m to 15m high, competent, thickly bedded sandstone. Vertical to sub-vertical wide joints.	

Desk Study Photograph 9	
Date: 14/11/23	
Direction Photograph Taken: South.	
Description: wall of the disused quarry.	

Desk Study Photograph 10	
Date: 14/11/23	
Direction Photograph Taken: South.	
Description: pile of waste including burned paint cans, metals and plastics.	

Desk Study Photograph 11	
Date: 14/11/23	
Direction Photograph Taken: Northwest.	
Description: Steep slope covered in tree stumps and conifer saplings. Slope was 45 to 70 degrees and steepens to the east.	

Desk Study Photograph 12	
Date: 14/11/23	
Direction Photograph Taken: Northwest.	
Description: Looking northwest down one of the tracks on site in the north.	

Desk Study Photograph 13	
Date: 14/11/23	
Direction Photograph Taken: Southwest.	
Description: weathered superficial bedrock material, likely exposed by cutting for track construction.	

Desk Study Photograph 14	
Date: 14/11/23	
Direction Photograph Taken: Southeast.	
Description: Waterlogged ground in the north of the site.	

Desk Study Photograph 15	
Date: 14/11/23	
Direction Photograph Taken: West.	
Description: Looking across the northern area of the site.	

Desk Study Photograph 16	
Date: 14/11/23	
Direction Photograph Taken: East.	
Description: bedrock exposure of vertically jointed with possible folding/faulting sandstone. Some conjugate jointing. Appeared unstable.	

Desk Study Photograph 17	
Date: 14/11/23	
Direction Photograph Taken: South.	
Description: Steep curved slope in the north of the site in the area of the former Cefn-mawr Colliery. Roughly 15m to 20m high and densely vegetated.	

Desk Study Photograph 18	
Date: 14/11/23	
Direction Photograph Taken: Northeast.	
Description: Plateau in the northwest of the site.	

Desk Study Photograph 19	
Date: 14/11/23	
Direction Photograph Taken: North.	
Description: Steep slope in the northwest roughly 20 to 40 degrees and densely vegetated.	

Desk Study Photograph 20	
Date: 14/11/23	
Direction Photograph Taken: Northwest.	
Description: Mature vegetation in the northwest of the site.	

Desk Study Photograph 21	
Date: 14/11/23	
Direction Photograph Taken: Northeast.	
Description: Hummocky land in the west of the site along a track.	

Desk Study Photograph 22	
Date: 14/11/23	
Direction Photograph Taken: North.	
Description: Pile of excavated material which appeared natural.	

Desk Study Photograph 23	
Date: 14/11/23	
Direction Photograph Taken: South.	
Description: Dark runoff indicating possible presence of Peat.	

Desk Study Photograph 24	
Date: 14/11/23	
Direction Photograph Taken: West.	
Description: Excavated material possibly consisting of Peat.	

Desk Study Photograph 25	
Date: 14/11/23	
Direction Photograph Taken: Southwest.	
Description: Plateau in the central area of the site which appeared to be cut and fill.	

Desk Study Photograph 26	
Date: 14/11/23	
Direction Photograph Taken: East.	
Description: Bedrock exposure, thin to thickly bedded, frequently faulted and jointed with some folding. 5m to 15m high. Appeared mostly stable.	

Desk Study Photograph 27	
Date: 14/11/23	
Direction Photograph Taken: North.	
Description: Bedrock exposure showing some instability, however this appeared to be human caused.	

Desk Study Photograph 28	
Date: 14/11/23	
Direction Photograph Taken: Southeast.	
Description: Materials and waste stored on the cut and fill plateau in the central area of the site.	

Desk Study Photograph 29	
Date: 14/11/23	
Direction Photograph Taken: Southeast.	
Description: Garage / workshop adjacent to the farm house.	

Desk Study Photograph 30	
Date: 14/11/23	
Direction Photograph Taken: Southeast.	
Description: Side of the garage / workshop showing an outlet leading from the structure.	

Desk Study Photograph 31	
Date: 14/11/23	
Direction Photograph Taken: West.	
Description: Localised shallow circular failure in the slope.	

Desk Study Photograph 32	
Date: 14/11/23	
Direction Photograph Taken: East.	
Description: Superficial weathered bedrock exposure. 15 to 20 degree slope, roughly 2m high.	

Desk Study Photograph 33	
Date: 14/11/23	
Direction Photograph Taken: East.	
Description: Managed lawn area in the south-central area of the site showing a generally smooth and flat topography.	

Desk Study Photograph 34	
Date: 14/11/23	
Direction Photograph Taken: West.	
Description: Superficial weathered bedrock exposure roughly 3m high with standing water at the base. Appeared fairly stable.	

Desk Study Photograph 35	
Date: 14/11/23	
Direction Photograph Taken: Northeast.	
Description: Track in the south of the site showing the high-pressure gas main trending east to west.	

Desk Study Photograph 36	
Date: 14/11/23	
Direction Photograph Taken: South.	
Description: Above Ground Storage Tank with a fuelling hose attached in the farm building in the central area of the site. Appeared in good condition with no signs of leaks.	

Desk Study Photograph 37	
Date: 14/11/23	
Direction Photograph Taken: Northeast.	
Description: Equipment and vehicle storage in the farm building in the central area of the site.	

Desk Study Photograph 38	
Date: 14/11/23	
Direction Photograph Taken: Southeast.	
Description: Farm building in the south-central area in the site showing the asbestos tiled roof.	

Desk Study Photograph 39	
Date: 14/11/23	
Direction Photograph Taken: Southwest.	
Description: Looking across the managed lawn in the south-central area of the site.	

Desk Study Photograph 40	
Date: 14/11/23	
Direction Photograph Taken: Northwest.	
Description: Metal storage containers in the storage area in the southwest of the site.	

Desk Study Photograph 41	
Date: 14/11/23	
Direction Photograph Taken: Southeast.	
Description: Plastic pipe and pallet storage in the southwest storage area. Note the earth bund in the background which is roughly 2m high.	

Desk Study Photograph 42	
Date: 14/11/23	
Direction Photograph Taken: Northeast.	
Description: Sparsely vegetated path of the high-pressure gas main.	

Desk Study Photograph 43	
Date: 14/11/23	
Direction Photograph Taken: Southeast.	
Description: Looking across the southwest of the site showing a wooden storage shed.	

Desk Study Photograph 44	
Date: 14/11/23	
Direction Photograph Taken: Northwest.	
Description: Looking over to the gas distribution station 50m west of the site.	

Desk Study Photograph 45	
Date: 14/11/23	
Direction Photograph Taken: Southwest.	
Description: Excavator and equipment at the entrance to the forest in the west of the site.	

Desk Study Photograph 46	
Date: 14/11/23	
Direction Photograph Taken: Southwest.	
Description: Concrete cylinder in the forest in the west. Possibly a well.	

Desk Study Photograph 47	
Date: 14/11/23	
Direction Photograph Taken: West.	
Description: Exposure of peat in the land west of the site.	

Desk Study Photograph 48	
Date: 15/11/23	
Direction Photograph Taken: Northeast.	
Description: Looking northeast across the pathway of the high- pressure gas main.	

Desk Study Photograph 49	
Date: 15/11/23	
Direction Photograph Taken: West.	
Description: Hummocky ground at the northern base of the forest in the east. Boggy conditions encountered frequently.	

Desk Study Photograph 50	
Date: 15/11/23	
Direction Photograph Taken: Southwest.	
Description: Wooden planked bridge crossing over the high-pressure gas main.	

Desk Study Photograph 51	
Date: 15/11/23	
Direction Photograph Taken: West.	
Description: Steep slope in the east of the site. 45 to 55 degrees, stable at the crest and becoming unstable at the toe. Covered in tree trunks and dense vegetation.	

Desk Study Photograph 52	
Date: 15/11/23	
Direction Photograph Taken: East.	
Description: Looking east across the lands at the eastern boundary. Note the ancient woodland in the left side of the photograph.	

Desk Study Photograph 53	
Date: 15/11/23	
Direction Photograph Taken: East.	
Description: Superficial weathered bedrock exposure, ~1.5m high and appearing stable.	

Desk Study Photograph 54	
Date: 15/11/23	
Direction Photograph Taken: South.	
Description: Close- up of the exposed superficial weathered bedrock.	

Desk Study Photograph 55	
Date: 15/11/23	
Direction Photograph Taken: South.	
Description: Possible washout features on one the slopes in the east of the site.	

Desk Study Photograph 56	
Date: 15/11/23	
Direction Photograph Taken: Southeast.	
Description: Sandstone bedrock exposure. Thickly bedded with horizontal and vertical fractures and joints. Appeared unstable in places. Scree at the base.	

Desk Study Photograph 57	
Date: 15/11/23	
Direction Photograph Taken: South.	
Description: Culvert coming down the slope in the north of the site.	

Desk Study Photograph 58	
Date: 15/11/23	
Direction Photograph Taken: South.	
Description: Superficial weathered bedrock exposure, possibly a failure plane. 3m to 4m high. Note the band of coal.	

Desk Study Photograph 59	
Date: 15/11/23	
Direction Photograph Taken: South.	
Description: Failure in the superficial weathered bedrock at the base of the slope.	

Desk Study Photograph 60	
Date: 15/11/23	
Direction Photograph Taken: South.	
Description: Coal tip material at the base of the slope in the north of the site.	

Desk Study Photograph 61	
Date: 15/11/23	
Direction Photograph Taken: South.	
Description: Bricked up mine adit at the base of the slope in the north of the site.	

Desk Study Photograph 62	
Date: 15/11/23	
Direction Photograph Taken: South.	
Description: Photograph showing the inside of the mine adit.	

Appendix C Historical ordnance survey maps

Site Details:

280265.4930125342,199499.25
649367977

Client Ref: PO30015
Report Ref: GS-8J8-V4I-DZF-J90
Grid Ref: 280304, 199443

Map Name: County Series

Map date: 1877

Scale: 1:10,560

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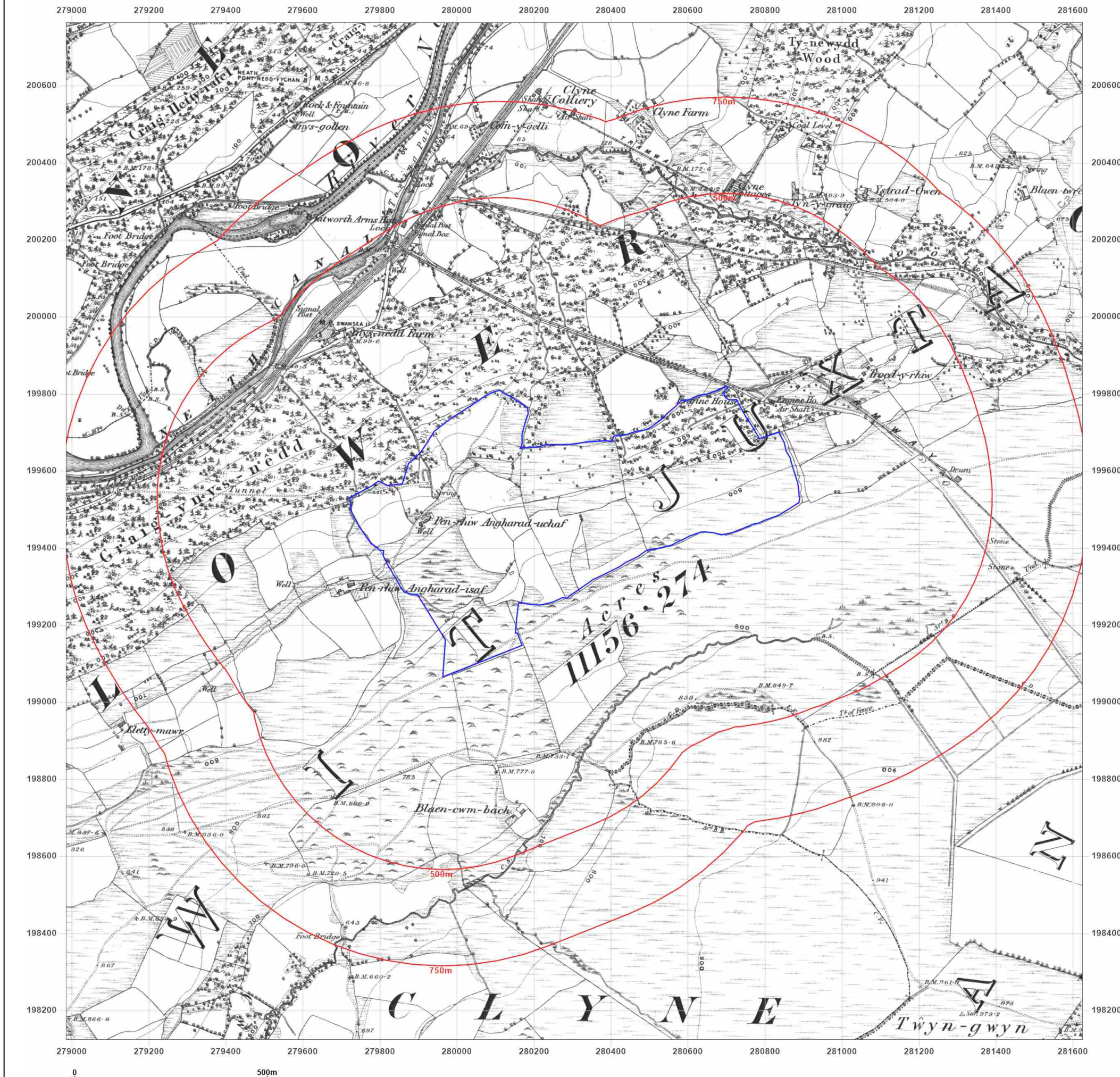


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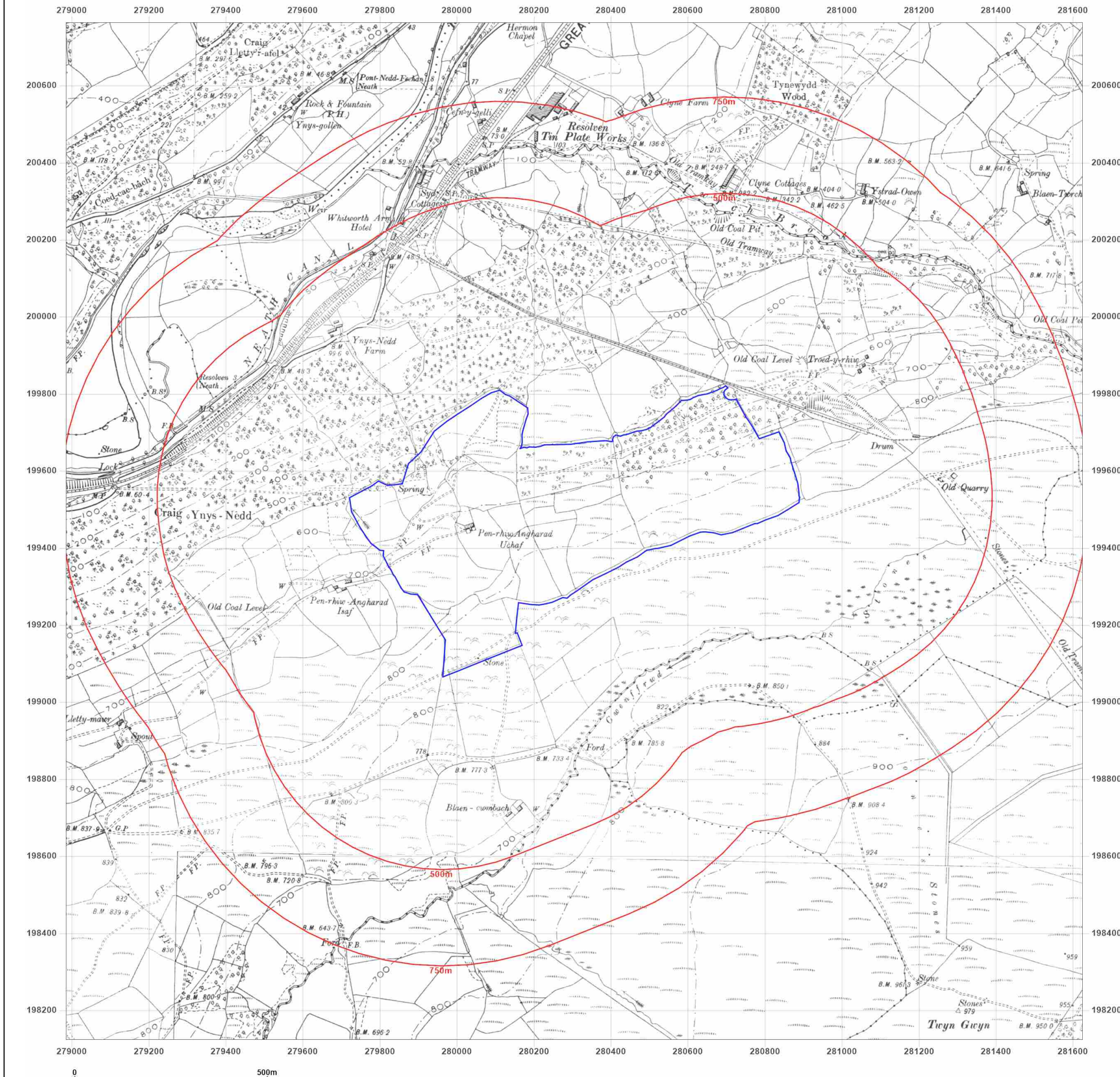


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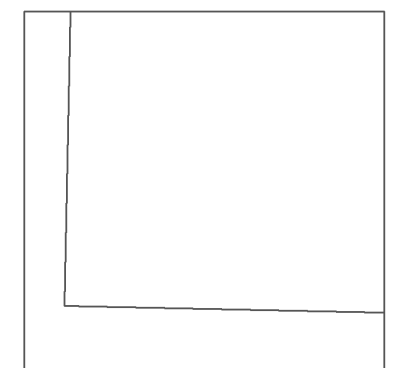
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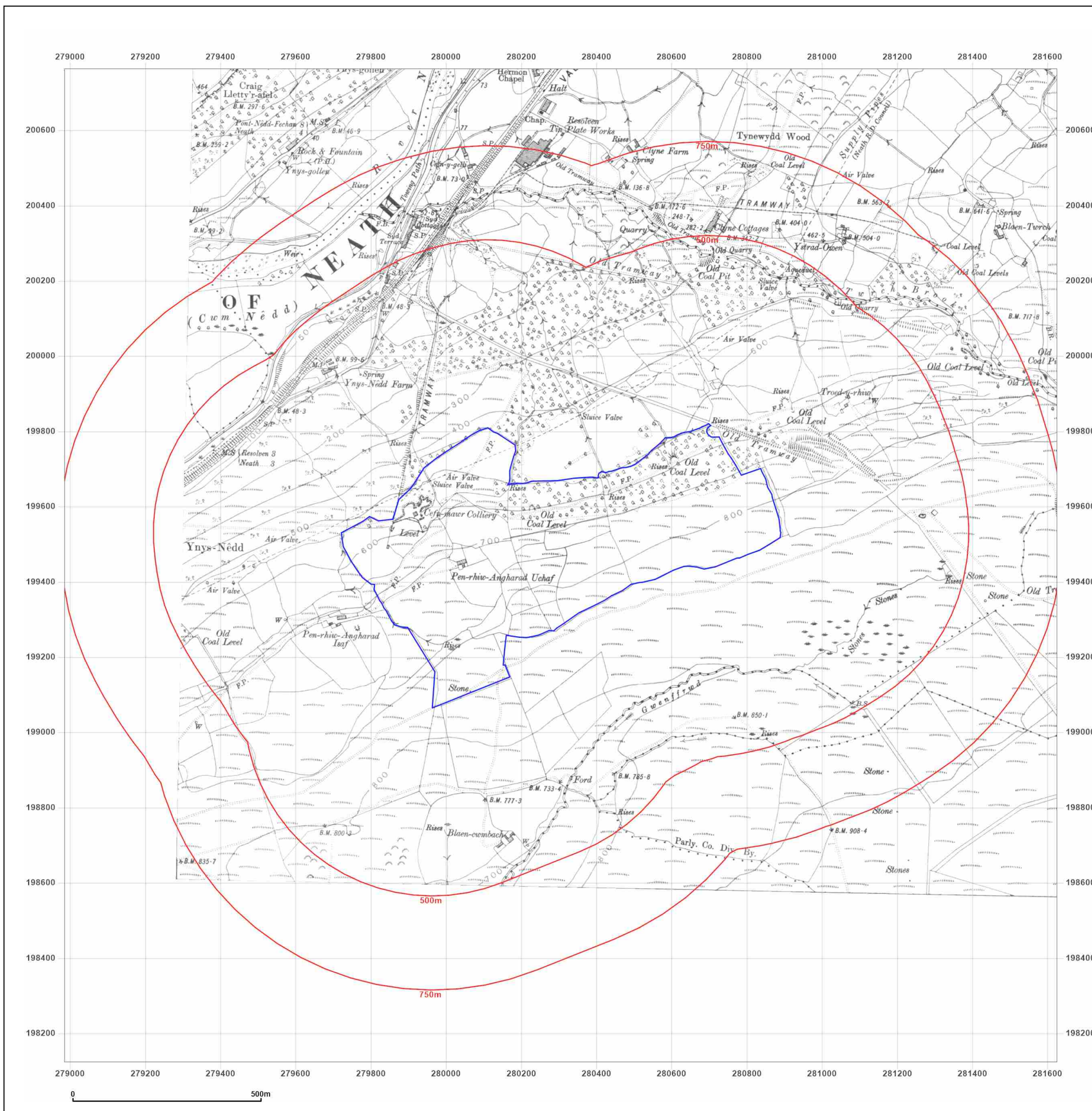


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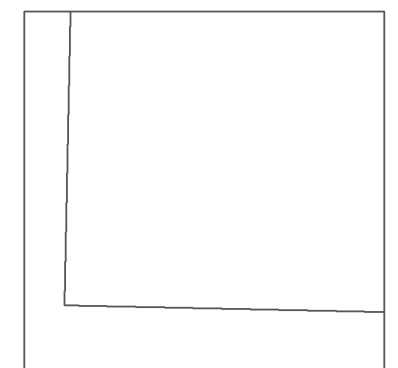
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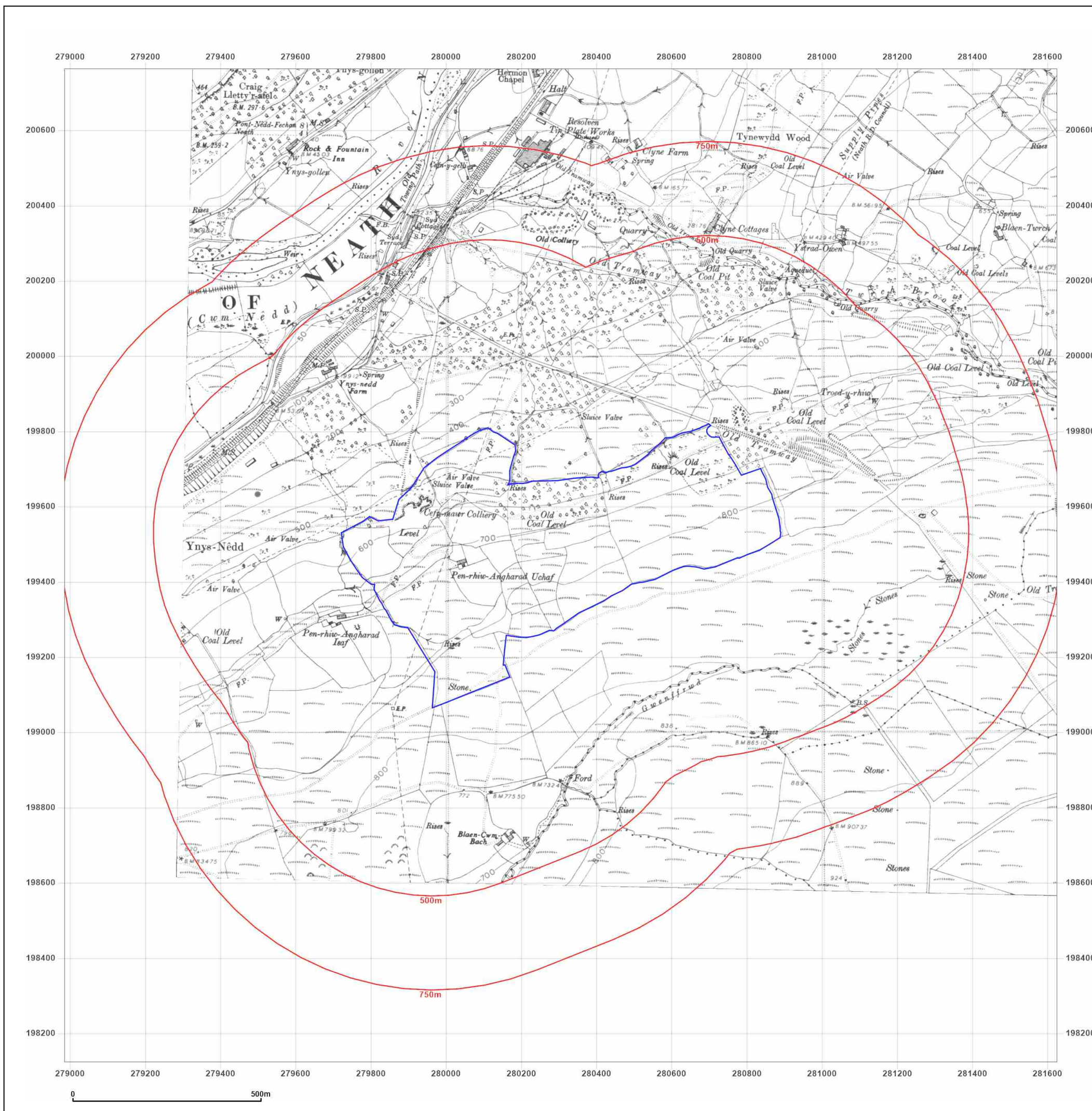


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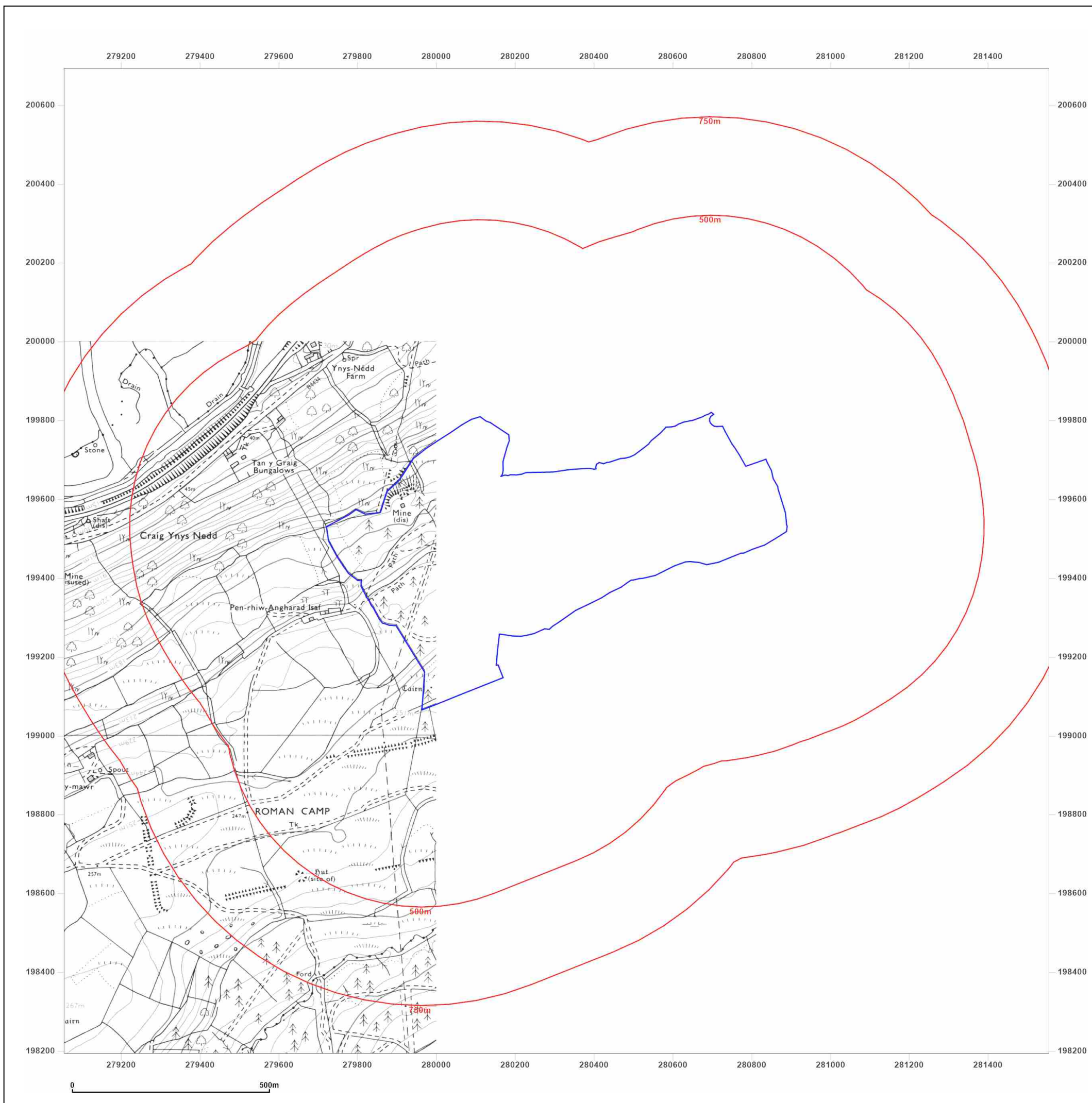


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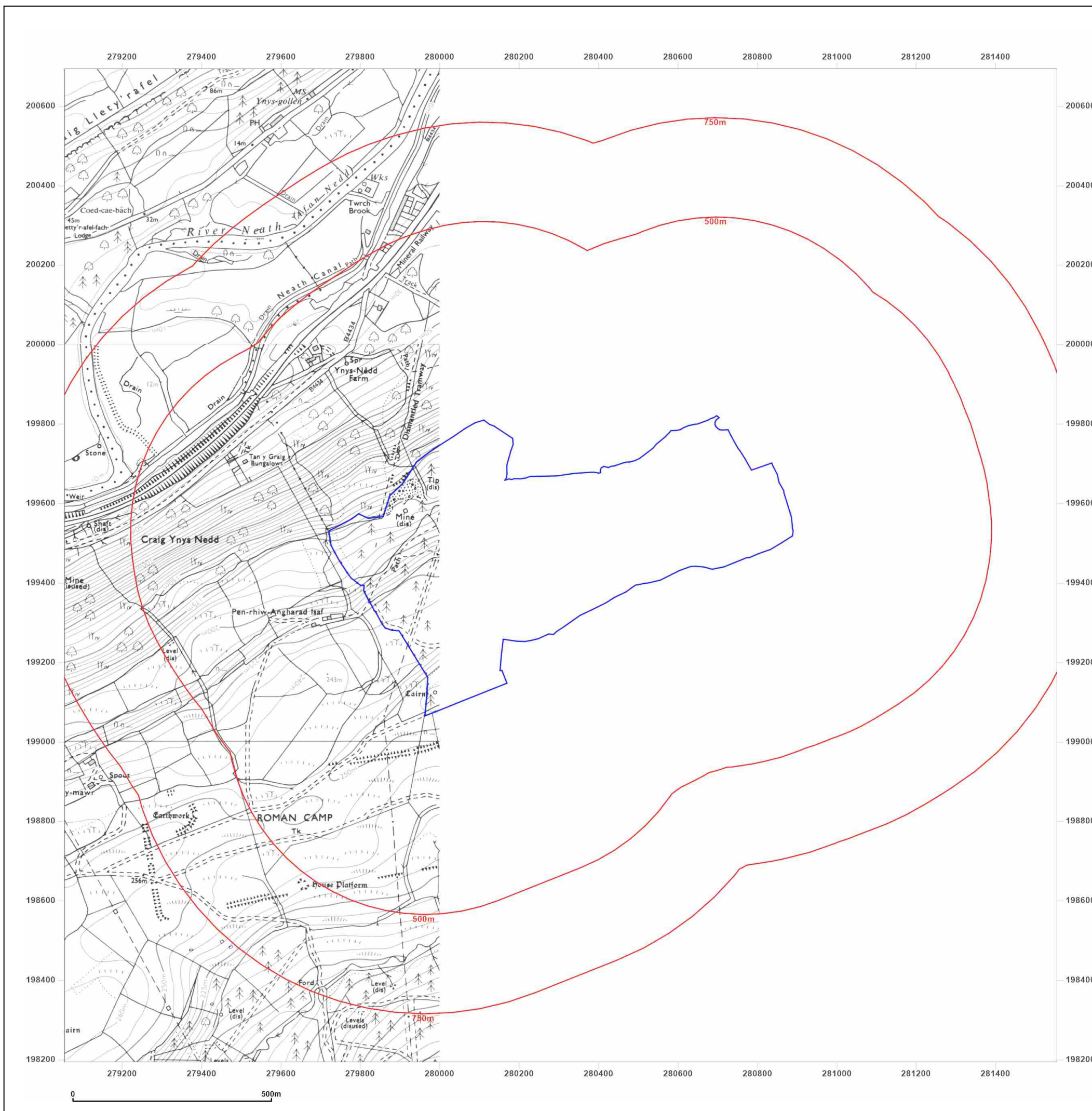


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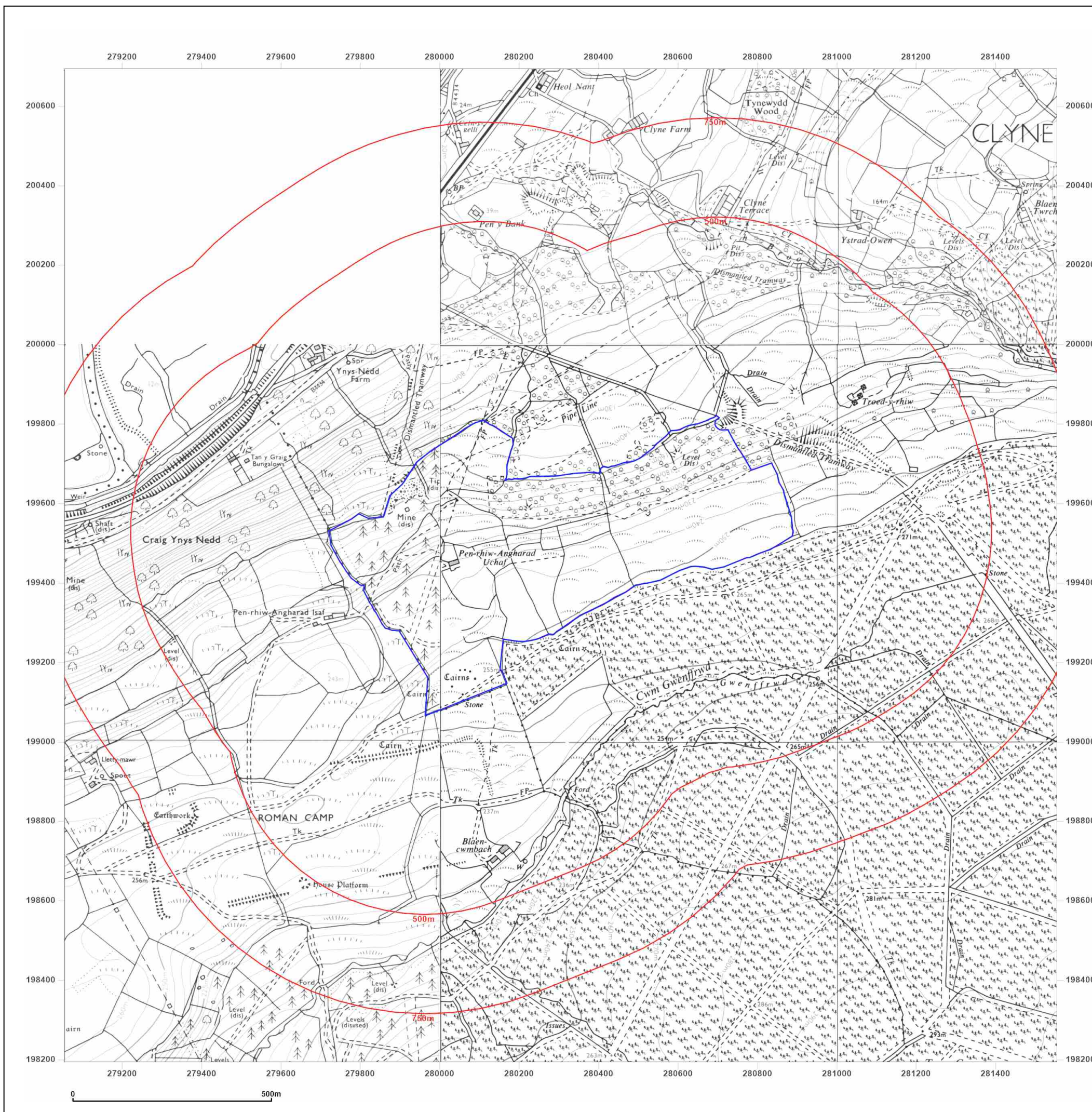


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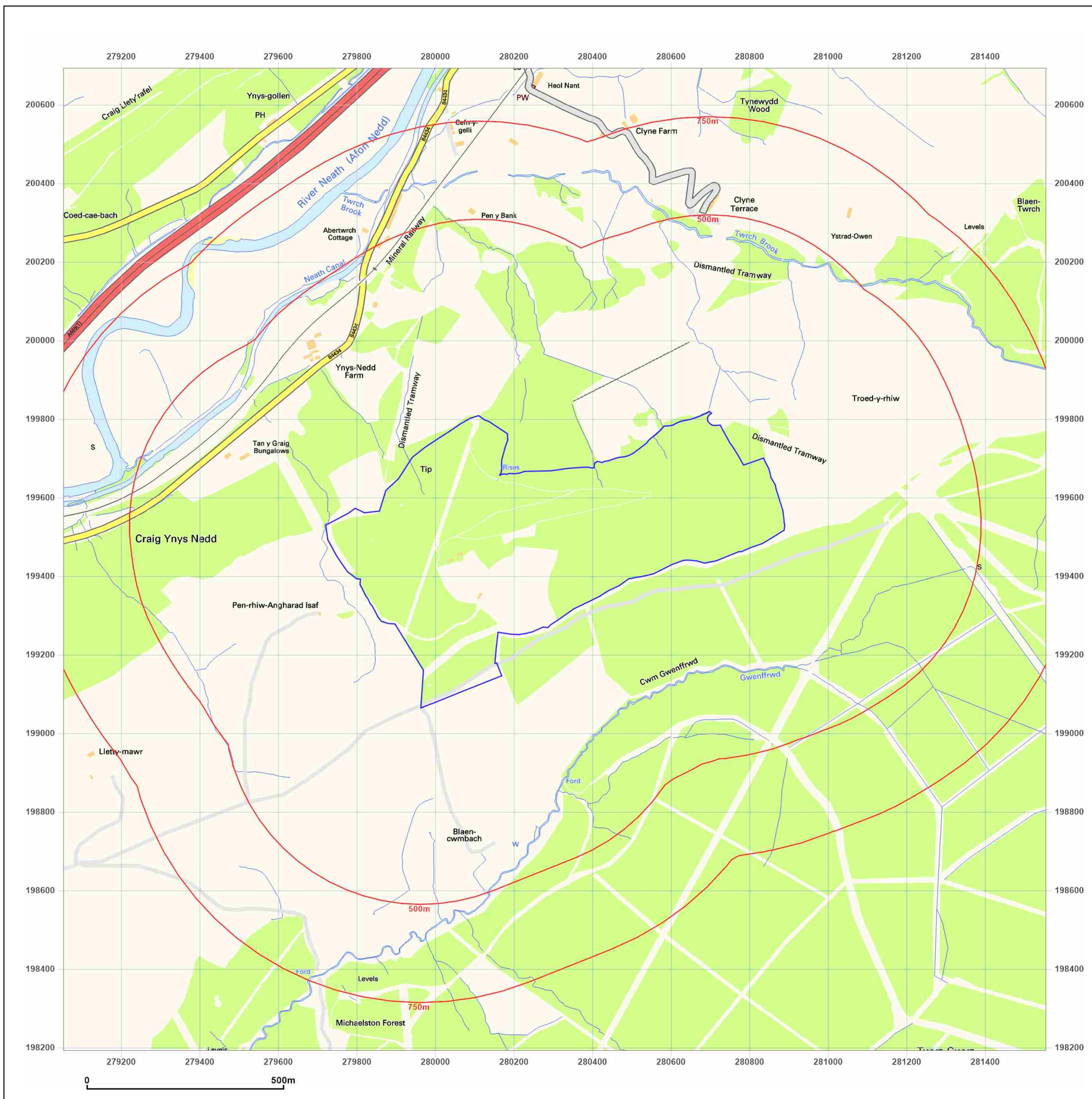


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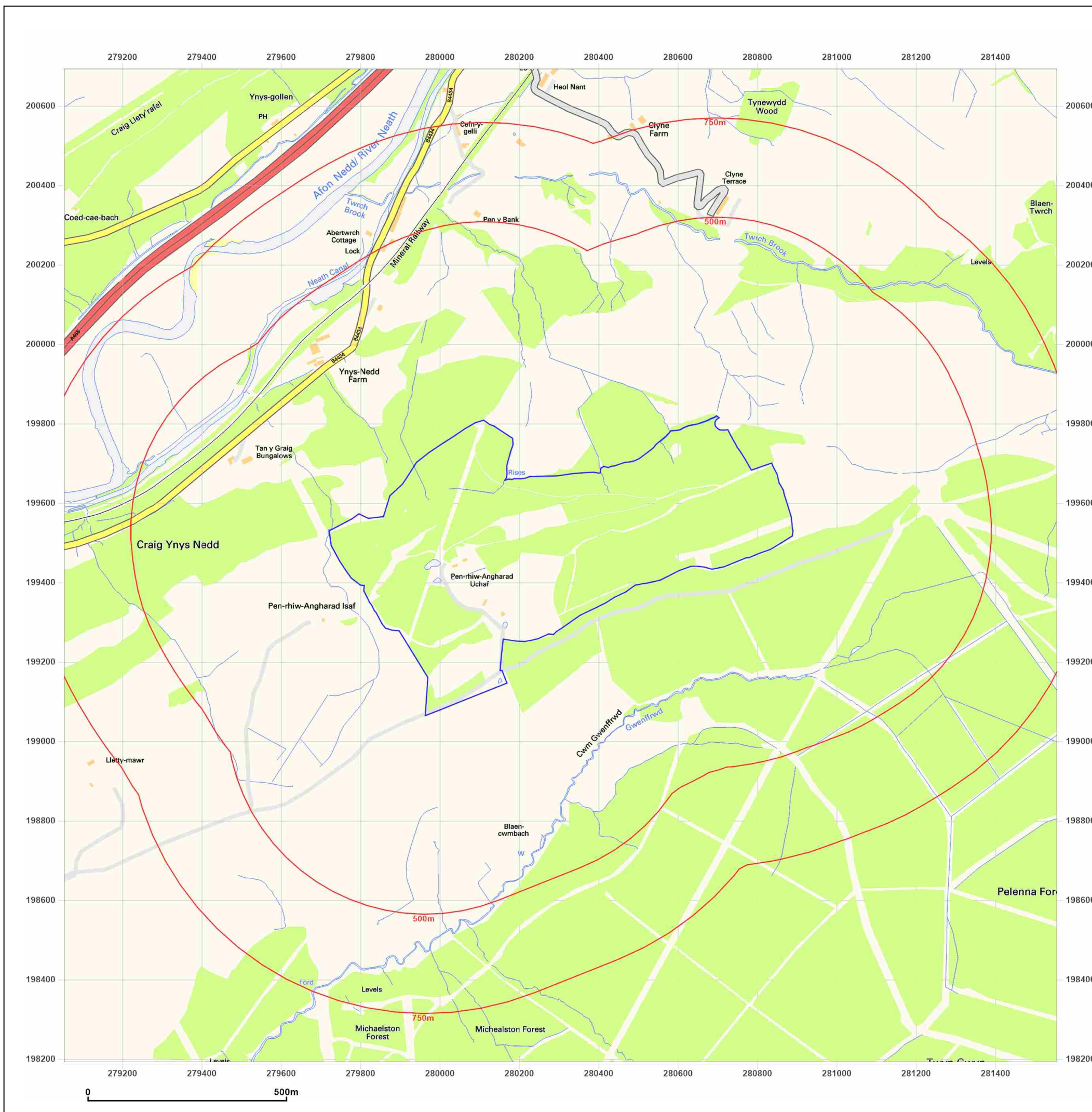


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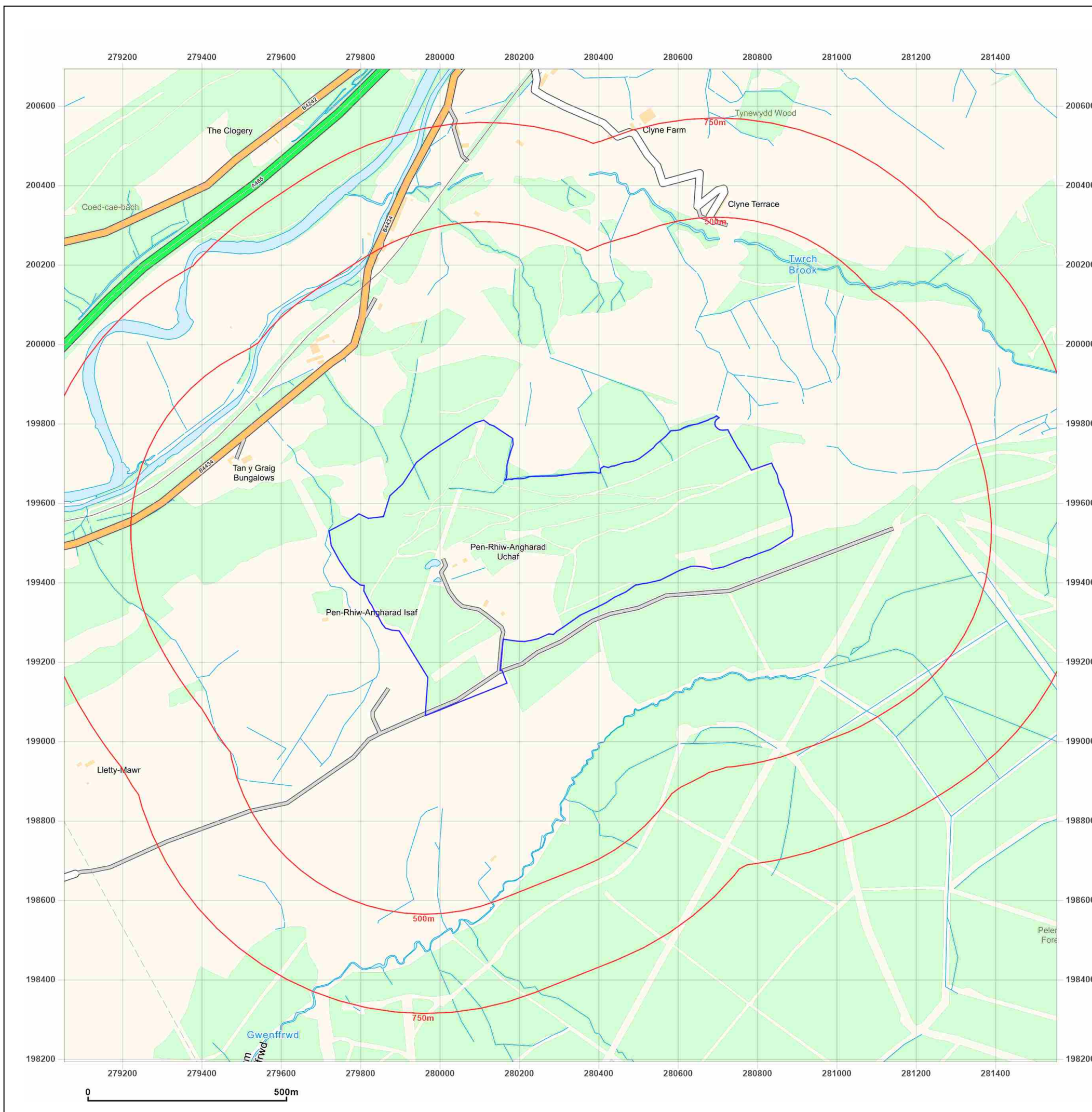


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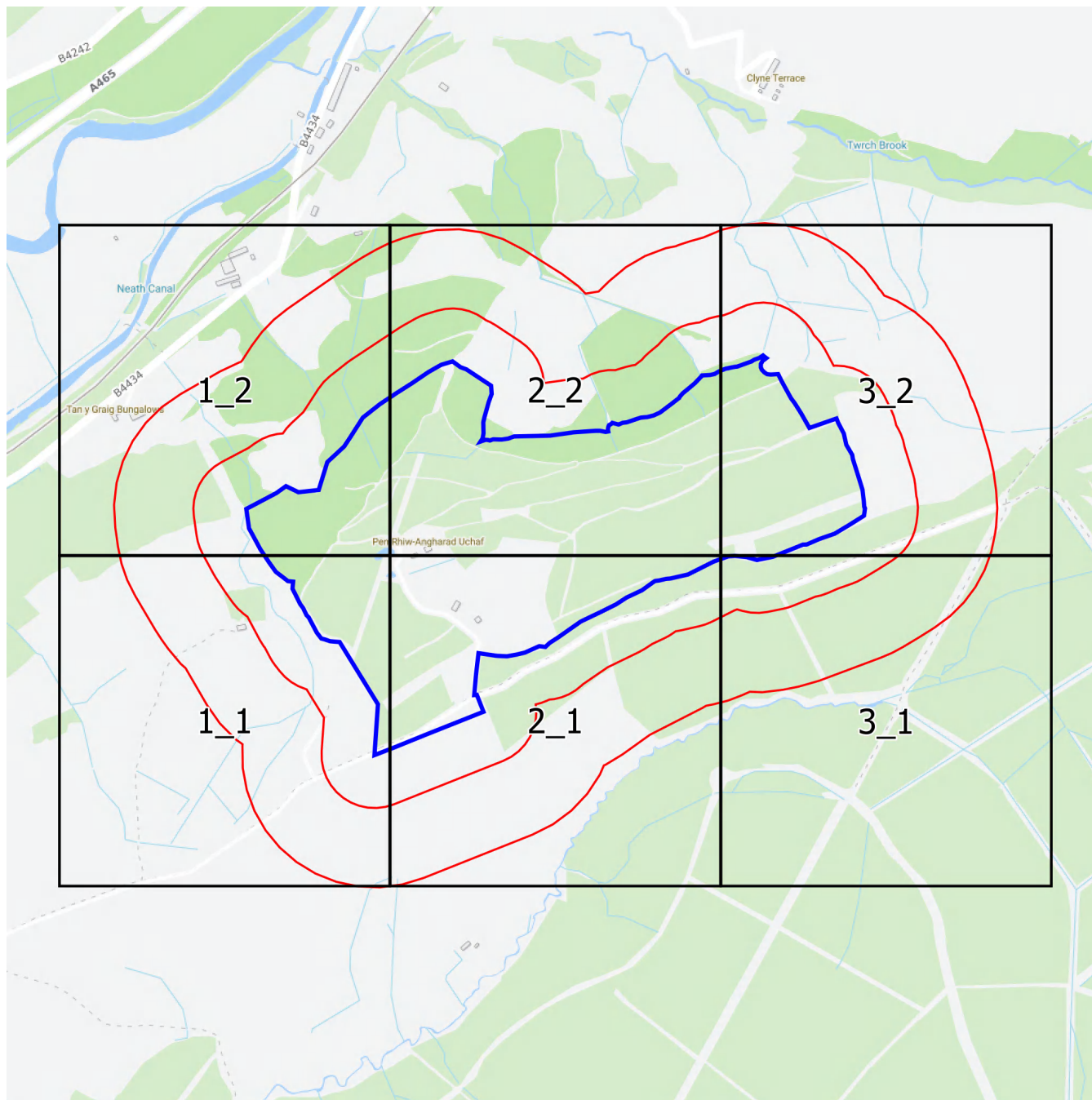
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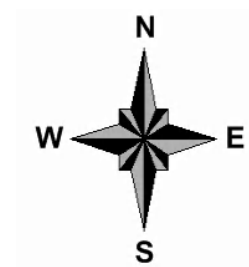






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Map date: 1877

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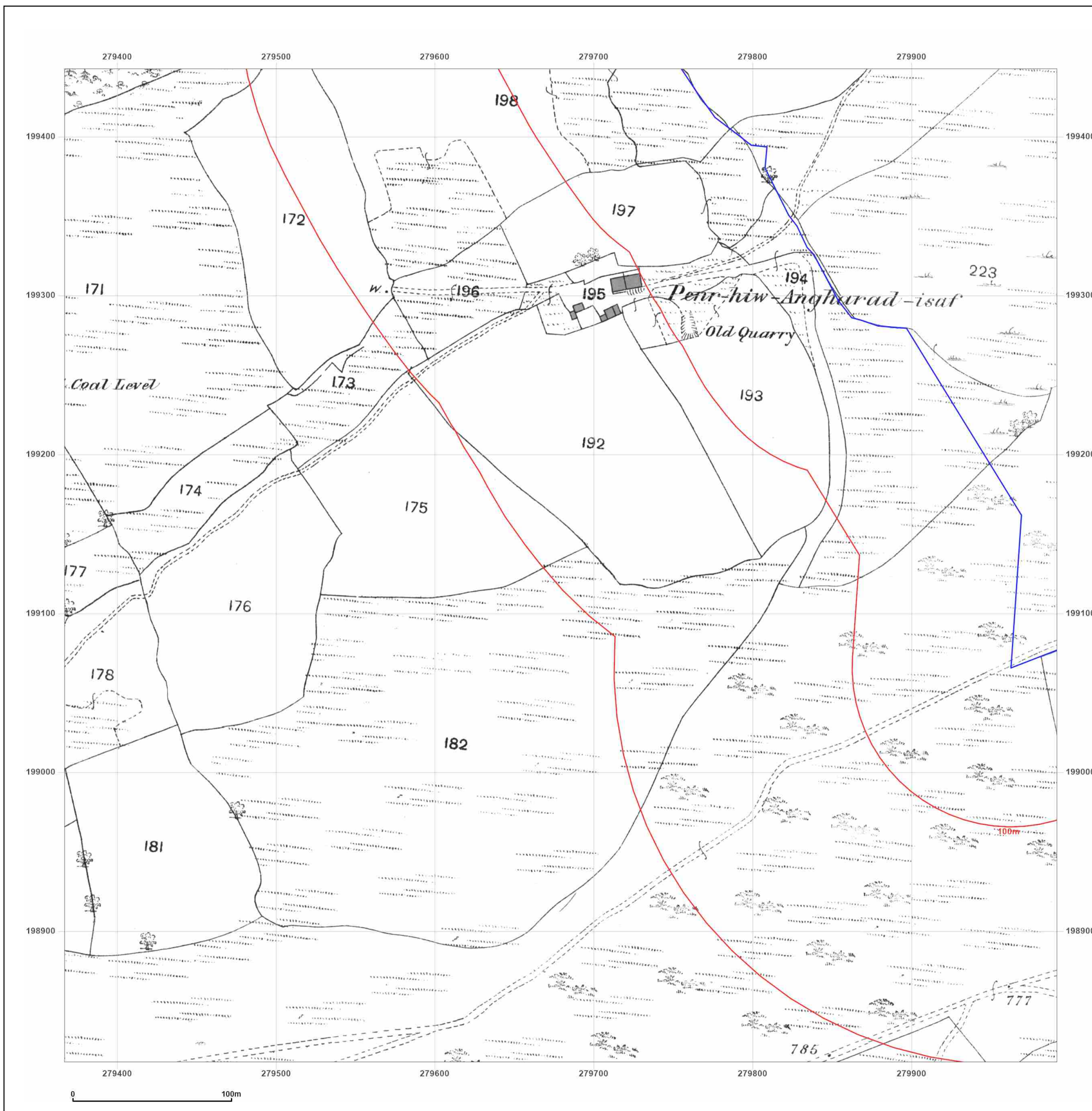


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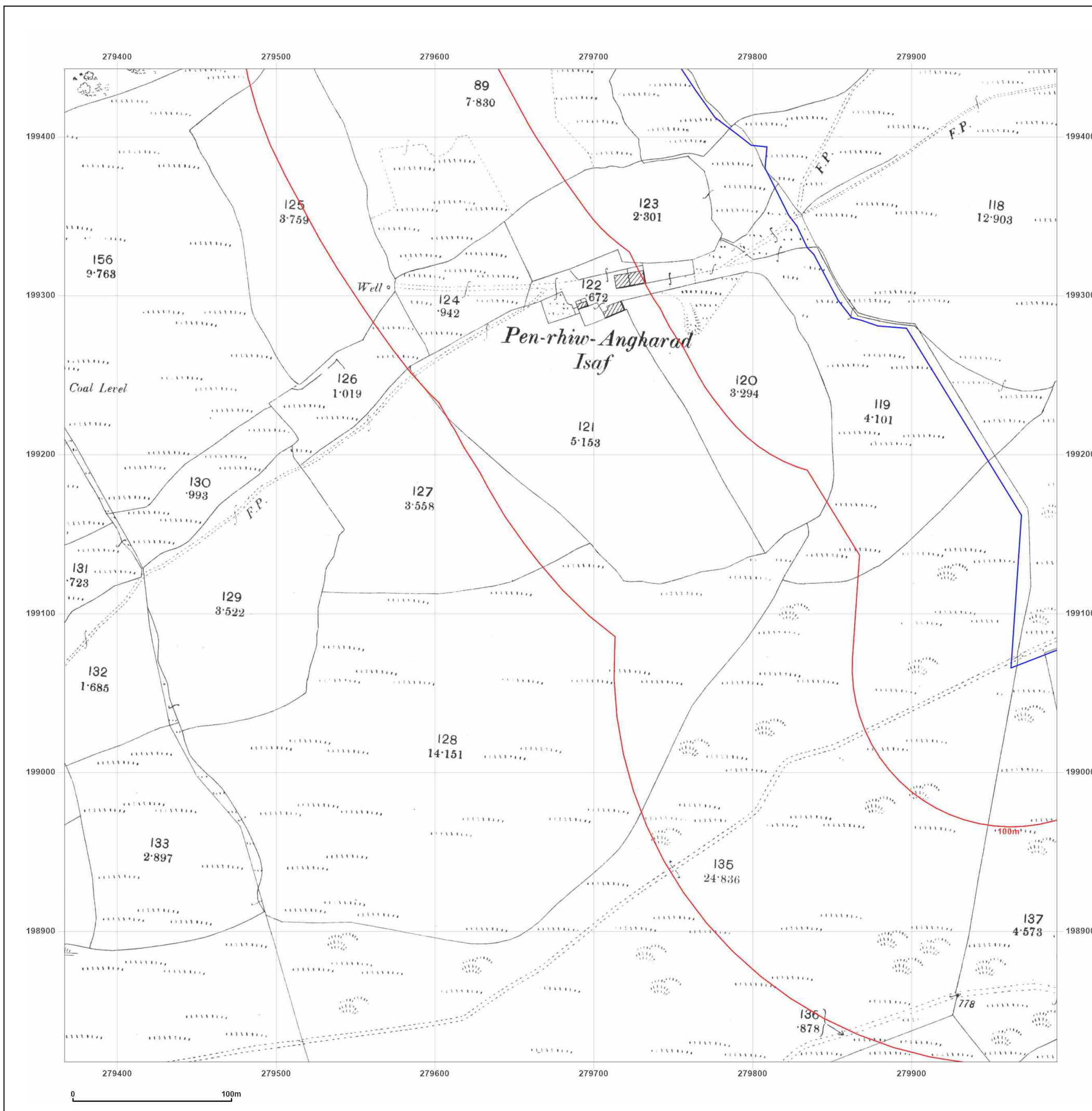


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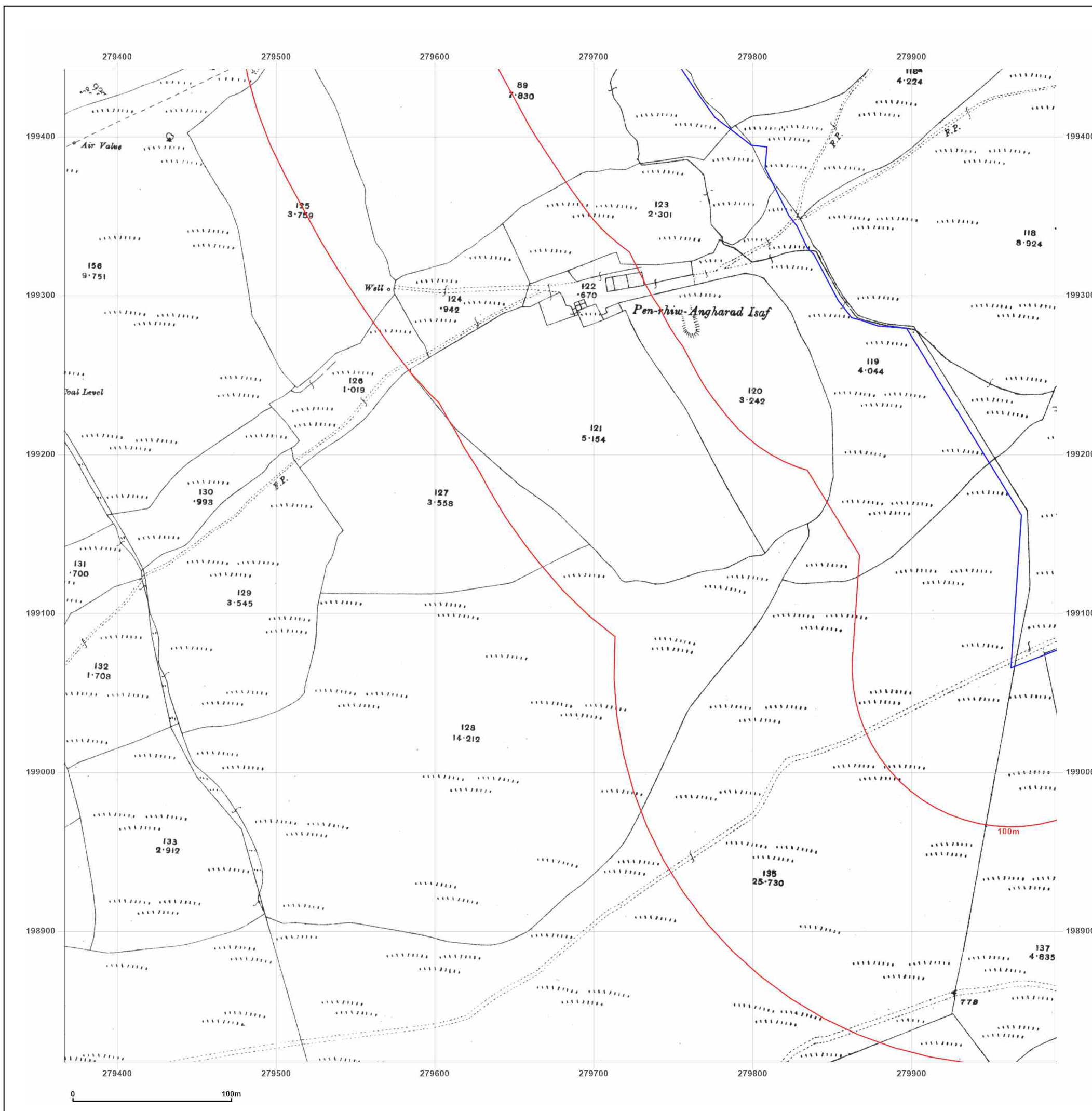


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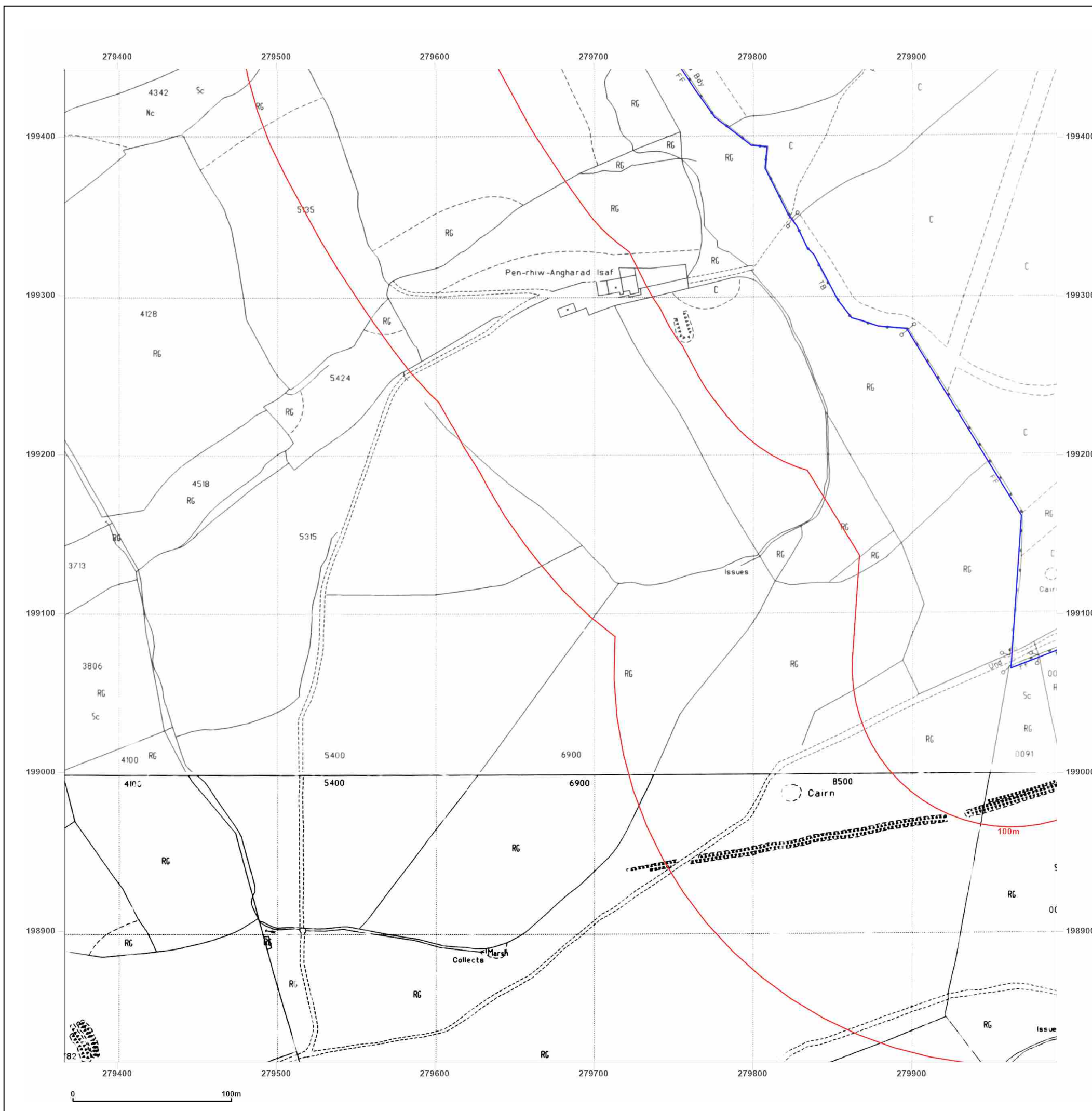


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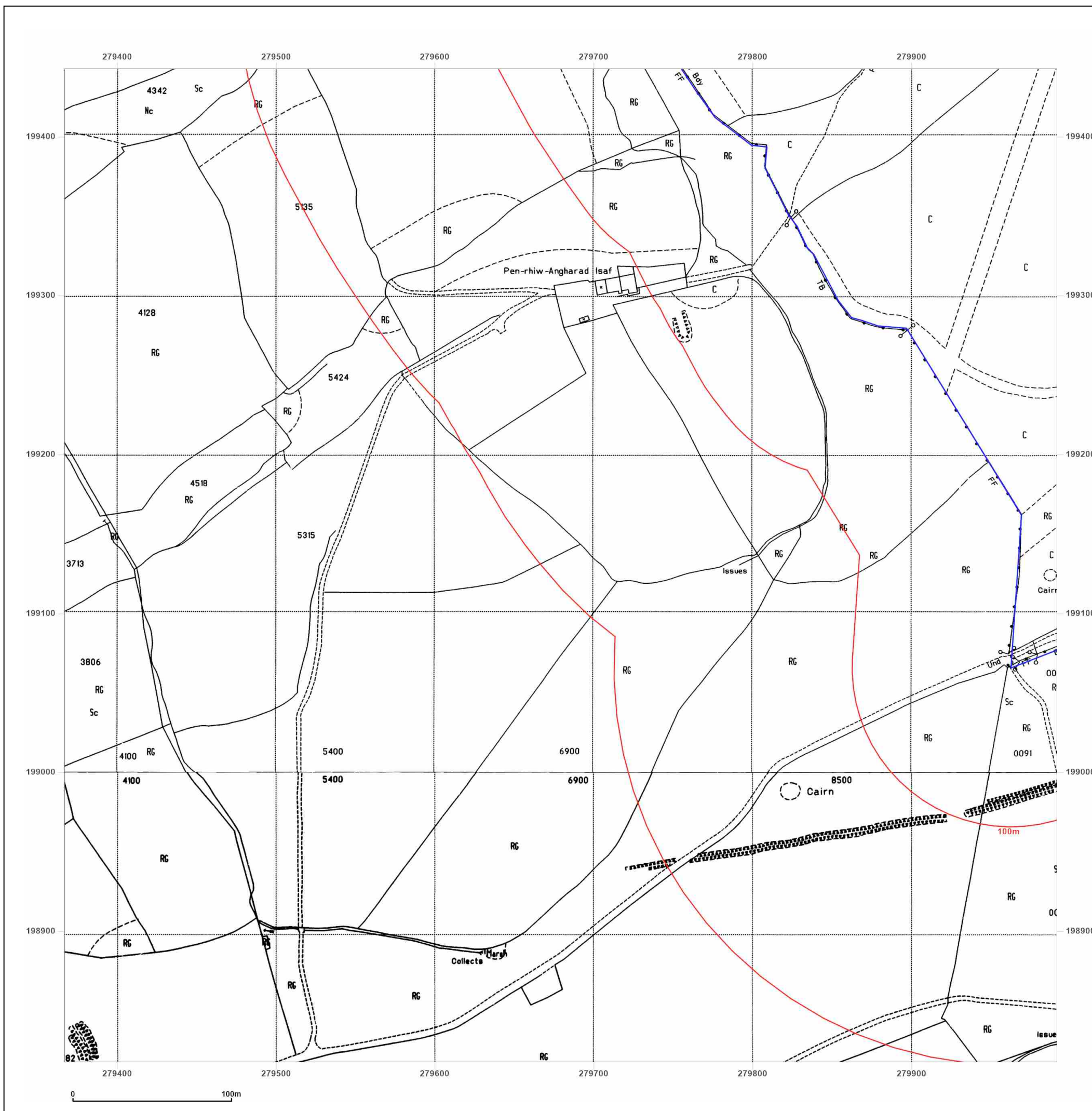


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280265.4930125342,199499.25
649367977

Client Ref: PO30015
Report Ref: GS-8J8-V4I-DZF-J9O_LS_1_2
Grid Ref: 279679, 199755

Map Name: County Series

Map date: 1877

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1877
Revised 1877
Edition N/A
Copyright N/A
Levelled N/A

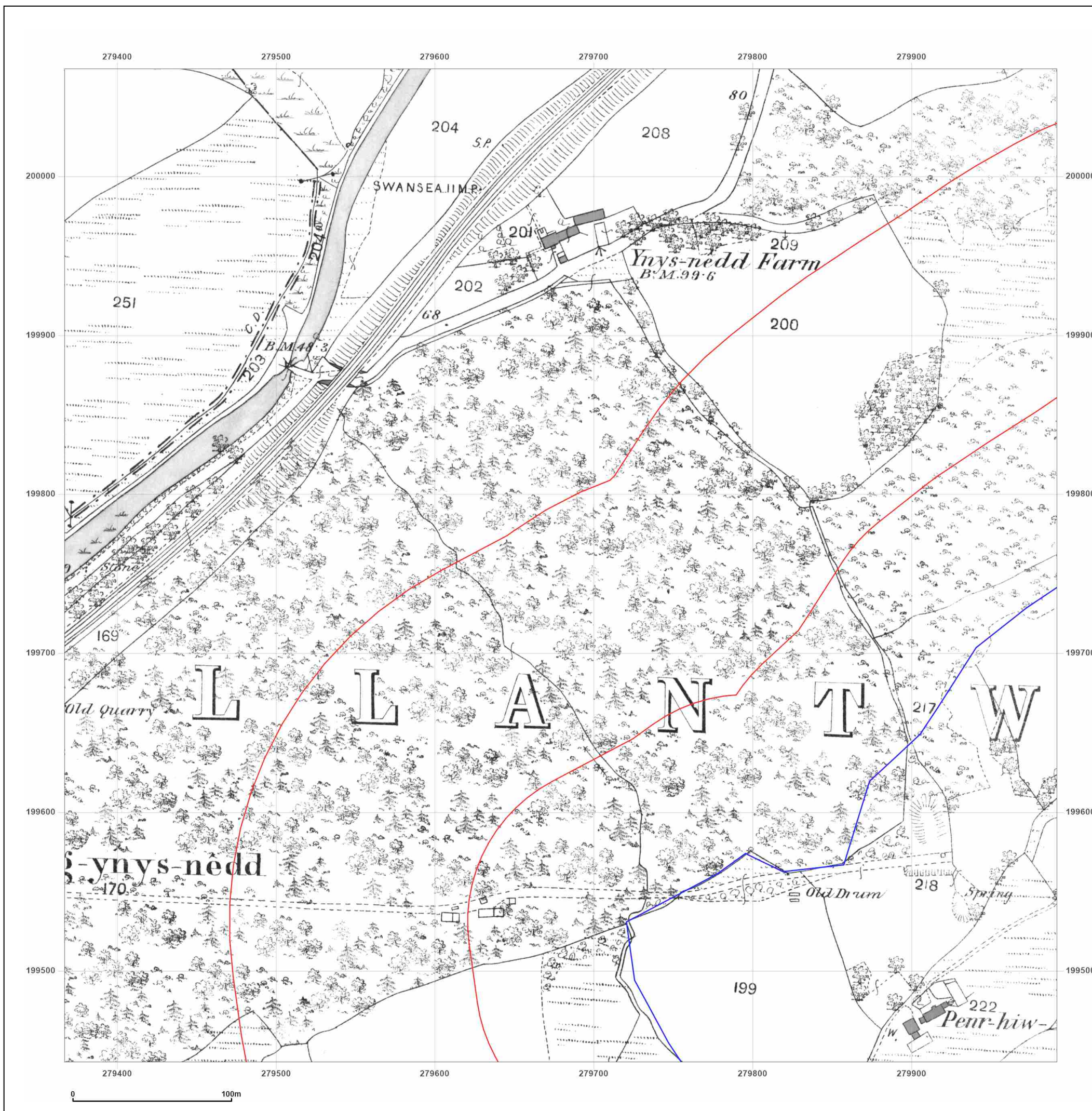


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Client Ref: PO30015
Report Ref: GS-8J8-V4I-DZF-J9O_LS_1_2
Grid Ref: 279679, 199755

Map Name: County Series

Map date: 1899

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1899
Revised 1899
Edition N/A
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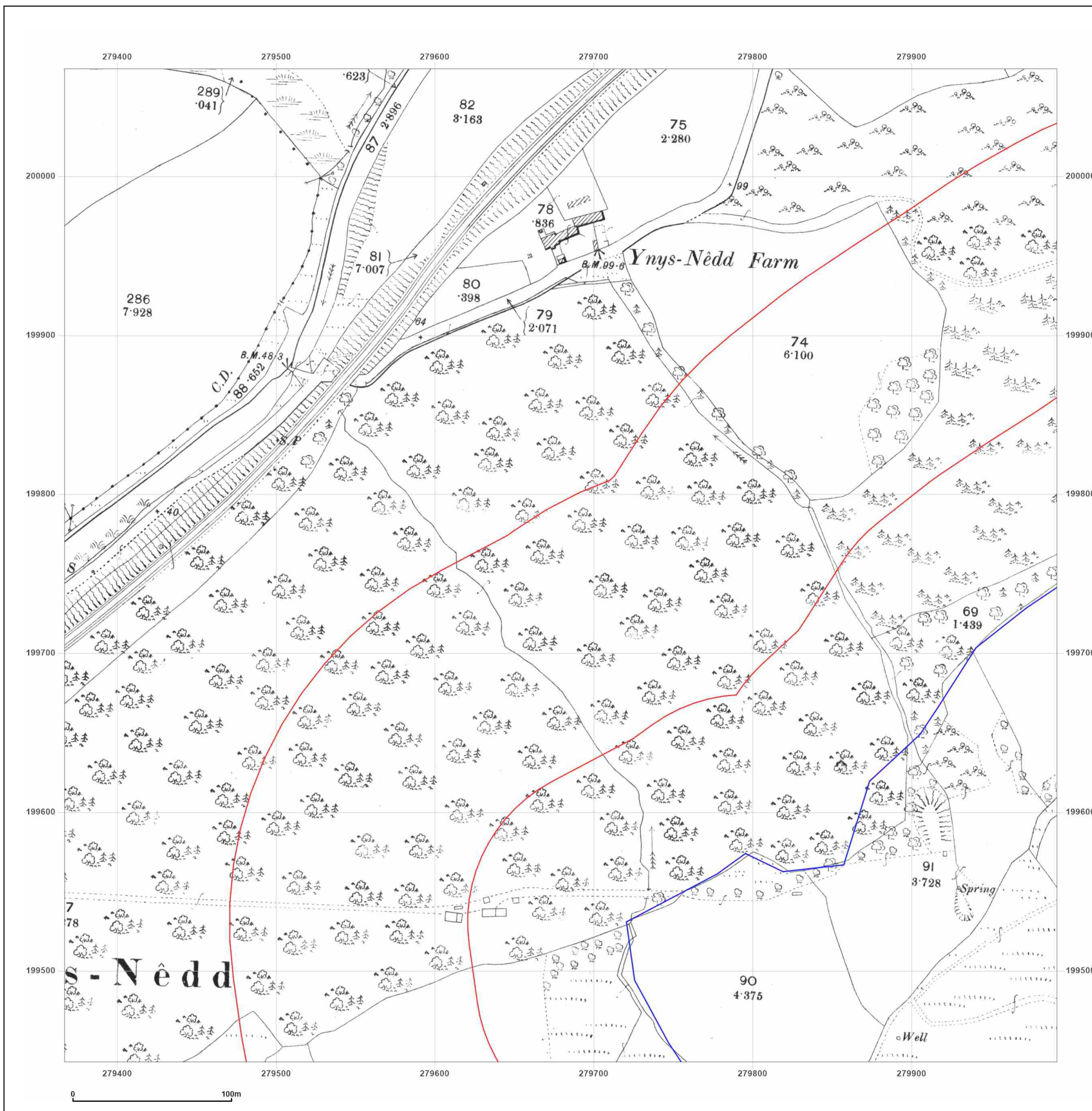


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Site Details:

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Client Ref: PO30015
Report Ref: GS-8J8-V4I-DZF-J9O_LS_1_2
Grid Ref: 279679, 199755

Map Name: County Series

Map date: 1919

Scale: 1:2,500

Printed at: 1:2,500



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