

Archaeological Trial Trench at Ty'n y Clwt on Penrhyn Slate Quarry Railroad, Bethesda



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Project No. G2656

Report No. 1687

Event PRN 46538

Prepared for: Cadw

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Cover photograph: The trench

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CRYNODEB

Cynhaliodd Ymddiriedolaeth Archeolegol Gwynedd, gyda chymorth grant gan Cadw, gyda myfyrwyr o Brifysgol Dechnolegol Michigan, gloddiaid arbrofol ar safle cwt weindio ar ffordd haearn Chwarel y Penrhyn yn Nhy'n y Clwt, Bethesda (SH 61348 66717). Digwyddodd y gwaith dan Ganiatâd Heneb Gofrestredig ar 16 a 17 Awst 2022. Ni ddaethpwyd o hyd i unrhyw weddillion o'r cwt weindio ond darganfuwyd olion ffordd haearn 1801 a rheilffordd y 1870au.

SUMMARY

Gwynedd Archaeological Trust, grant aided by Cadw, with students from Michigan Technological University, carried out a trial excavation to investigate the site of a winding house on the Penrhyn Quarry railroad at Ty'n y Clwt, Bethesda (SH 61348 66717). The work took place under Scheduled Monument Consent on 16th and 17th August 2022. No remains of the winding house were located but traces of both the 1801 railroad and the 1870s railway were found.

1. INTRODUCTION

Gwynedd Archaeological Trust, in tandem with graduate students from Michigan Technological University, carried out a trial excavation at the Penrhyn Quarry railroad site at Ty'n y Clwt near Bethesda and part of the Slate Landscape of Northwest Wales World Heritage Site (Figure 1). Graduate students and faculty of Michigan Technological University in the Social Sciences department had travelled abroad to research and observe the various approaches to Heritage Management at the newly-inscribed *Slate Landscape of Northwest Wales* World Heritage Site. This group consisted of geographers, archaeologists, heritage interpreters, and environmental sociologists whose focus of study revolved around industrial landscapes, processes, and communities. Two of the archaeologists, Brooke Batterson and Timothy Maze, along with heritage manager Sean Gohman, were granted the opportunity to collaborate with the Gwynedd Archaeological Trust to engage first-hand with the archaeology of the site at Ty'n y Clwt. This opportunity not only allowed for engagement with the material culture, but also to participate in an element of heritage management at a World Heritage Site.

The location investigated (at SH 61348 66717) is part of a scheduled monument (Cn417: Penrhyn Quarry Railway), and Scheduled Monument Consent was obtained for the work. The site is on private land owned by Colin Keyse of Ty'n y Clwt Farm. Mr Keyse is interested in and knowledgeable about the industrial

archaeology on his land and not only gave permission for the work but gave physical and material assistance, as well as advice and his knowledge of the industrial remains.

The purpose of this excavation was to locate one of three inclined plane winding houses on the course of the Penrhyn quarry railroad and to identify surviving remains of the later Penrhyn Quarry Railway (PRN 21,185). Under supervision of the Gwynedd Archaeological Trust (GAT), the two archaeology graduate students and one alumnus from Michigan Technological University under-took the excavation, recording and contributed to this report. The excavation took place over the course of one day (16th August 2022), with additional recording being completed on the second day.

2. ARCHAEOLOGICAL AND HISTORICAL BACKGROUND

2.1. Context

The Ty'n y Clwt (Cilgeraint) inclined plane winding house (PRN 65,537) formed part of the Penrhyn quarry railroad of 1801 which connected nearby slate workings with a harbour at Port Penrhyn. It is believed to have housed winding and braking equipment to operate a counter-balanced inclined plane immediately to its north (PRN 65,536). It is one of three such features on this system which was identified in a survey of historic transport routes associated with the slate industry of Northwest Wales (Barker and Gwyn 2017). Its exact location, precise form and character are unknown, but its approximate location can be deduced from map evidence (Figure 2). It was demolished above ground level when the adjacent successor locomotive-worked railway was built in the 1870s.

The Penrhyn railroad's three inclined planes are particularly significant because they show the influence of canal technology on the building of this early iron railroad, by alternating level or near-level sections with inclined planes, in the manner of canal locks, at a time when reliance on horse-power to move wagons otherwise precluded any severe gradients.

The Ty'n y Clwt (Cilgeraint) inclined plane winding house is a Scheduled Monument (Cn415). It was necessary to carry out this work at this location as opposed to a non-scheduled site because only the Ty'n y Clwt winding house can potentially provide evidence of machinery bases and of historic modes of operation; the listed Marchogion winding house survives as a standing building but has been converted into a dwelling, and insufficient remains are evident at the site of the Dinas inclined plane winding house.

2.2. Research objectives

The trial excavation seeks to establish the survival or otherwise of walls or foundations of this structure in order to inform future archaeological survey into a crucial early period of the development of the iron railway.

The World Heritage Site should be a focus for international interest and research. By working with students from the Michigan Technological University progress is being made to fulfil the objective of creating links with researchers across the world.

The site has been assessed by Louise Barker (RCAHMW) and Dr David Gwyn as part of a survey of historic transport routes associated with the slate industry of Northwest Wale (Barker and Gwyn 2017). The heritage

of the immediate area has also been considered in Govannon Report GC452, *Ty'n y Clwt Eco Retreat Setting and Heritage Impact Assessment* in August 2022.

2.3. Significance

The study area forms part of the scheduled relict routes of the Penrhyn quarry railroad (CN415; NPRN: 546002; PRN: 59451) and of the immediately adjacent Penrhyn Quarry Railway (CN417; NPRN: 546003; PRN: 21185).

Statement of significance: Penrhyn Quarry Railroad

The Penrhyn Quarry Railroad is significant as the longest overland iron railroad in the world when built, an early example of the use of a railway system within a quarrying industry, for the influence of canal engineering in its construction, by using inclined planes in a similar way to flights of locks, as the means by which Penrhyn slate was exported from 1801 to the 1870s, and as the design ancestor of the 0.6 metre gauge railway world-wide.

The Penrhyn quarry railroad was an 0.6 metre (2') gauge iron railroad built for horse and inclined plane operation, which adapted existing south Walian edge-rail practice. It ran from the Penrhyn slate quarry to the Felin Fawr slab mill complex and thence to Port Penrhyn. At the time of its completion in 1801, it was the longest iron edge railway in the world, and one of the earliest applications of a railway system to the quarrying industry. The railroad's engineer was Thomas Dadford, whose background in canal construction may be evident in the design of the inclines, of which there were three, at Ty'n y Clwt (Cilgeraint), at Dinas and the Marchogion incline, as well as a fourth in Llandygai village connecting the main alignment to the Penlan flint mill. The gauge and the general engineering of this system established much of what was to become standard practice in the slate industry and as such is the ultimate progenitor of the Ffestiniog system and its descendants. It was replaced by the Penrhyn Quarry Railway in the 1870s, and the track removed. Its course also includes some well-preserved sections of formation, a viaduct over the Cegin river and several bridges. Adjacent to the area of excavation, it is evident as a near-level alignment to the south and as a heavily disturbed inclined plane section to the north.

Statement of significance: Penrhyn Quarry Railway

The Penrhyn Quarry Railway is significant as the means by which Penrhyn quarry slate was exported from the 1870s to 1962. It shows how the evolving technology of the Ffestiniog Railway was applied to a mineral-carrying industrial system, and contrasts with its predecessor system, the Penrhyn quarry railroad in its use of steep gradients and locomotives.

The Penrhyn Quarry Railway was an 0.6 metre (2') gauge locomotive-operated railway built in stages to replace the Penrhyn quarry railroad. Though the route does not involve any major civil engineering features, it is steeply graded. It was designed by Charles Easton Spooner, engineer of the Ffestiniog Railway. It operated until 1962, and the track was removed three years later. It ran from the Felin Fawr slab mill complex to Port Penrhyn. Adjacent to the area of excavation to the area currently under assessment, it is evident as a near-level alignment to the north and south.

2.4. Documentary sources

The cast-iron railroad of 1801 was an innovative system which attracted considerable international attention. However, the only source which describes the operation of the inclines is a manuscript by the scientist Michael Faraday believed to be preserved in the Institution of Electrical Engineers, and which was

published in book form in 1972. This describes a visit in 1819. He states that the inclined plane he saw was “I should think fully 300 ft” in length, which agrees more readily with the length of the Ty’n y Clwt incline (97 m/318 feet), rather than the Dinas (275m/902 ft) and the Marchogion (224m/735 ft). He states “the cylinder was under cover and had a little house at the side. Its tackle was neater and the friction apparatus to retard the velocity of too rapid a descent was of a superior kind (*to an inclined plane he had seen at Dowlais ironworks*). The man was very quick in his motions. He let 3 wagons down at once and for each full one raised an empty one with sometimes a workman or two” (Tomos 1972, 92).

Dr Heinrich Spiker, librarian to the King of Prussia, refers to the inclined planes in his account of his travels to the United Kingdom in 1816. His account suggests that he called on Benjamin Wyatt who gave him a verbal description which he did not altogether understand (and Spiker also came away with the impression that Wyatt owned the quarries).

Die Herauffchaffung des in den Bergwerken gebrochenen Schiefers , bis zu einer Unhöhe, von wo aus er mit Pferden zu dem Menai hinunter besördert wird , geschieht vermittelst der eigenen Last der Wagen, welche zu 20 oder 30 an einander befestigt, auf Eisenbahnen eine schiefe Ebene heraus und hinablaufen. Es sind zu dem Ende Häuser erbaut, in denen sich die Walzen besinden, um welche die Ketten sich auf - und abwinden , woran die Wagen besestigt sind. Die Arbeiter sagten uns, uns, das nicht weniger als 300 Wagen dieser Art im Gange waren, was uns auch seinesweges unglaublich schien , da wir bei dem Weiterfahren noch mehrere Häuser der Art am Wege stehend fanden ...

The slate quarried in the workings is brought up to a high point, from where it is transported down to the Menai by horses, by means of the loaded weight of the wagons, of which 20 or 30 are coupled together, on railroad tracks out and up an inclined plane. Houses are built at the end, in which are the rollers, around which the chains are wound up and down, to which the wagons are fastened. The workmen told us that no less than 300 wagons of this type were in use, which seemed incredible to us, since when we drove on we found several more houses of the type on the way (Spiker 1820, 48-49).

Von Oeyenhausen and Von Dechen make only the most cursory reference to the inclined planes but give no details (56 in English version).

3. METHODOLOGY

Scheduled Monument Consent was obtained for a small trial excavation potentially to investigate the remains of a 19th century winding house associated with the Penrhyn Quarry railroad. The trial excavation was located at SH 61348 66717 (Figure 1 and 3) and was completed on August 16th 2022, with further documentation and subsequent backfilling taking place on August 17th 2022. The investigation was completed by staff and students of Michigan Technological University (MTU) and Gwynedd Archaeological Trust (GAT), with assistance and advice from Colin Keyes and David Gwyn.

The trench was laid in the area where the winding house was estimated to be. The trench was measured 2 metres by 4 metres, located between both the original horse drawn railroad and the later steam railway (Plates 1, 2 and 3, Figure 3).

The excavation, which was done completely by hand, removed leaf-litter and other over-burden to expose archaeologically significant deposits or features. The exposed layers were then recorded with no further excavation. Once the archaeological deposits were fully exposed, they were recorded in regard to their spatial context.

Recording was completed by a hand-drawn plan of the trench at a scale of 1:20 (Figure 4) and the western section of the trench was drawn at a scale of 1:10 (Figure 5). Photographs were taken, and written records made on GAT proforma context sheets. The photographic images were taken using a digital SLR camera set to maximum resolution in RAW format. The site is under dense tree cover, so it was not possible to use a survey quality GPS to locate the trial trench or drawings. The trench was therefore located by measuring from hard map detail. Levels were taken in relation to a TBM. The height of the TBM was measured by GPS but the results were not accurate. The height of 6 readings were averaged to give a notional TBM height of 158.70m OD. Level heights on the figures have been calculated from this, but it is a notional height rather than an accurate one; however, the levels are all internally consistent.

Once recording was complete the trench was covered by geotextile and backfilled with the material dug out of it. Thanks to Colin Keyes for the geotextile and for assistance with backfilling (Plate 4).

4. RESULTS

This trial excavation was excavated only a few centimetres, going down to 5 different depositional layers. Additional layers were visible from this excavation, but not tested. See Figures 4 and 5.

The topsoil, or deposit 01, that covered the area of the site was composed of a dark grey, gritty loam that was inundated with roots and measured about 0.12m thick. Throughout the topsoil was dense leaf mould mixed with slate fragments and clinker. Underlying the south-eastern end of the trench was deposit 02, which was made up of dark grey gritty silt mixed with numerous small slate fragments and appeared to be the upper layer of an intentional dump of slate pieces. This was a thin deposit at only 0.05m, and was restricted to the south-western end of the trench.

Deposit 03 was restricted to the south-western end of the trench and consisted of a dark grey-brown gritty silt and roughly half of the deposit was made up of slate fragments, most of which were up to 0.25m long, with one large slab measuring approximately 1.25m long and lay along the edge of the deposit (Plates 5 and 6). In general, the slate pieces were laid flat but with a random distribution, indicating that they were dumped without intention. Inside this layer an unidentified iron object was found, but it was kept in place and not inspected. Although no section was dug through layer 03 the different levels visible suggested that this deposit was up to 0.25m thick. Just to the north-east of deposit 03 is deposit 04, which was a friable and compact yellowish-brown silty sand. This soil continued underneath deposit 03 and contained occasional stones (Plate 7). The yellowish-brown silty sand that made up this layer suggests that this deposit is made up of redeposited subsoil.

Due to time constraints during this excavation, the exact relationship between the deposits was not tested but some of the context was visible. Layer 04 sat upon a layer of slate fragments, which was layer 05. Layer 05 was composed of roughly 80% smaller to medium slate pieces in a matrix of dark grey-brown sandy silt (Plate 8). These slate pieces were up to 0.3m long and laid horizontally. This layer projects 0.4m from underneath layer 04. Layer 05 appeared to overlap a low bank of friable and gritty clay sand, which made up layer 06. This layer was exceedingly compact and formed a band that was about 0.6m wide. On its north-west side, layer 06 had been partially eroded, leaving a slight bank (Plate 9). This bank had thin traces of the layer continuing to the north-western baulk but was worn through in patches, being visible in the layer above. Two parallel patches of very compact material with clinker and small stones overlaid the eroded portion of layer 06, making up layer 07. This layer consisted of a dark grey gritty silt. On the north-eastern patch of this layer, a single slate slab measuring 0.33m long rested on the surface. Between the patches of layer 07 were slightly hollowed areas where layer 06 had worn through and exposed a layer of small slate pieces, layer 08, and appeared to extend under this end of the trench.

5. INTERPRETATION

The excavation presented details of this area of the rail route that were previously unknown, providing an opportunity to investigate the inclined plane technology used to overcome differences in height between the quarry and the port. Though shallow, there were various features throughout the unit that demonstrated different functions of the landscape.

From their initial appearance, layers 05 and 04 form a low platform, probably the track bed for the horse drawn railroad. Further investigation of this feature was not possible due to being covered by a large mass of slate, which made up layer 03. This slate deposit is part of a low bank running along much of the area and lies parallel to the route of the steam railway, which is demonstrated in layers 07 and 08. Initially, it was assumed from the surface evidence that the railway had cut through existing deposits to create this slightly raised bank, but this was refuted by the evidence uncovered by the excavation. It is much more likely that the bank was created by moving slate waste away from the route of the railway during its construction and placing it parallel to the track. To the north of the trench is a revetment wall that was built to protect the railway from any slumping debris coming down from the parallel quarry waste heap. When considering the wall's orientation with that of the slate dump, it becomes more likely that the slate is related to the construction of the steam railway, and that the remains of the railroad itself lie underneath the slate heap.

Layer 07 marks the route of the steam railway. The compact deposits that make up this layer would have been laid around rail ties that would have rested in the hollowed ground between. In the base of the hollows is what appears to be a slate waste track bed, which is layer 08. The rail ties and the track itself have clearly been removed and are only evident from their impressions on the soil. Deposit 06 shows the formation of a low bank of hard standing next to the railway, but it is possible that this is a previously existing deposit due to its extension under layer 05. There is a section of layer 06 that extends up and over layer 08, and could be due to layer 06's erosion after layer 08 was laid down.

The relationships between these separate layers require further investigation to understand the sequence of deposition, but it appears that remains relating to both the horse-drawn railroad and the steam railway are present. No evidence of the winding house was found.

6. FURTHER WORK

The present trench was intended as a trial trench to establish the depth and survival of deposits in this area. No more than the topsoil (01) was removed and relationships between the layers revealed were not investigated in detail. It would be advantageous to reopen this trench, remove layer 03, investigate relationships between the layers and establish the full depth of deposits. This may reveal evidence for the horse railroad and would clarify the sequence of deposition and construction. A larger trench might locate the remains of the winding house.

7. ACKNOWLEDGEMENTS AND COPYRIGHT

The project has been grant aided by Cadw as part of the G2656 Slate Landscapes of Northwest Wales Project. The excavation was carried out by Brooke Batterson, Timothy Maze and Sean Gohman, under supervision of Jane Kenney. Timothy Maze wrote much of the text of the report, with David Gwyn contributing the historical background. Illustrations by Jane Kenney. Many thanks to David Gwyn for coordinating the work and the Scheduled Monument Consent application and for liaison with Colin Keyse and with the Michigan Technological University. The work would not have been possible without the permission and considerable help of landowner Colin Keyse, we are grateful for his involvement in this project.

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9. FIGURES AND PLATES

Figures

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Figure 2. Plan of alternative routes for the Penrhyn Quarry railway by CE Spooner (1875), showing the position of the winding house (Bangor University Archives and Special Collections: Penrhyn Castle Further Additional 1873)

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Figure 4. Plan of the trench

Figure 5. Section of north-west facing side of the trench with matrix showing relationship of layers

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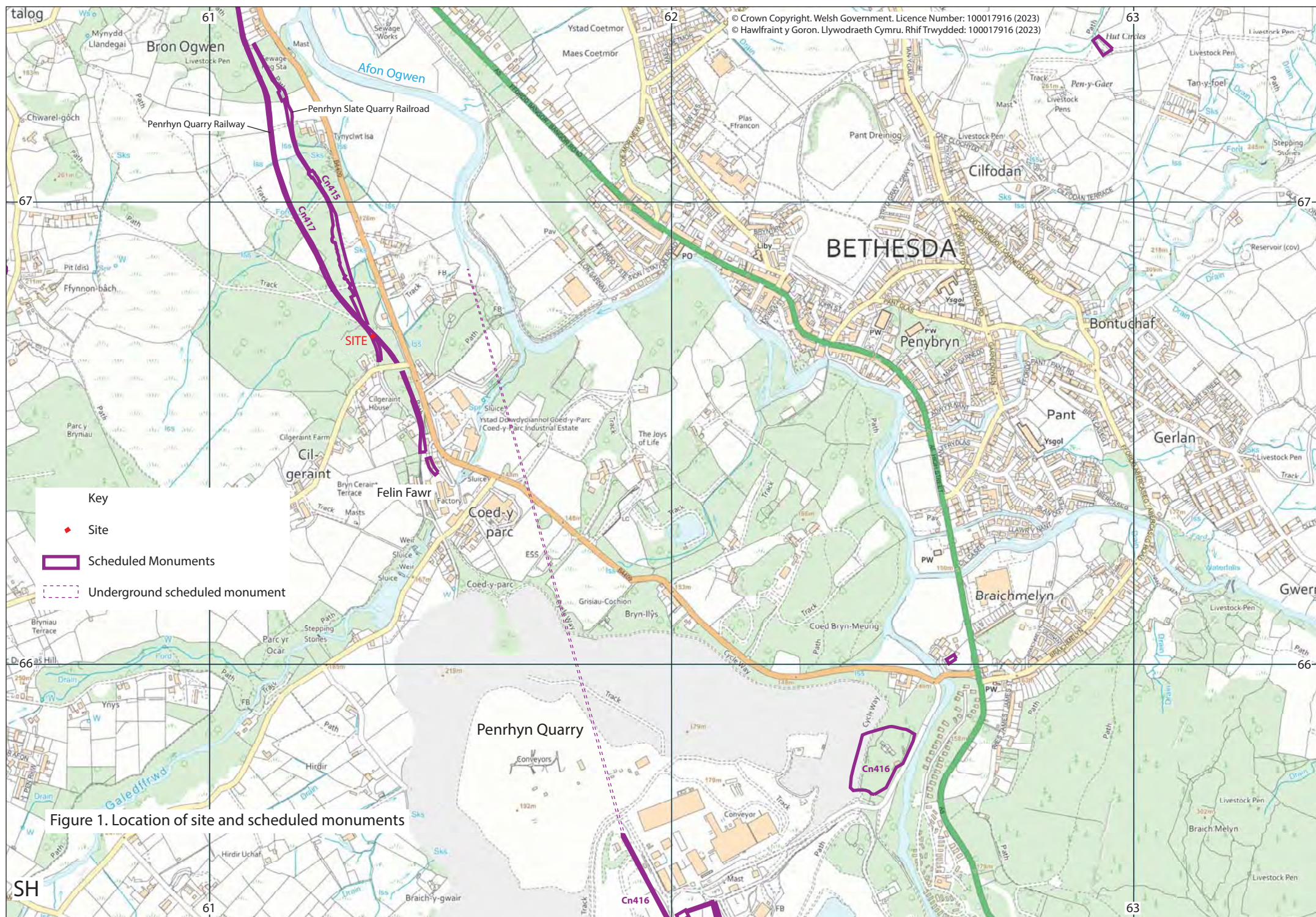
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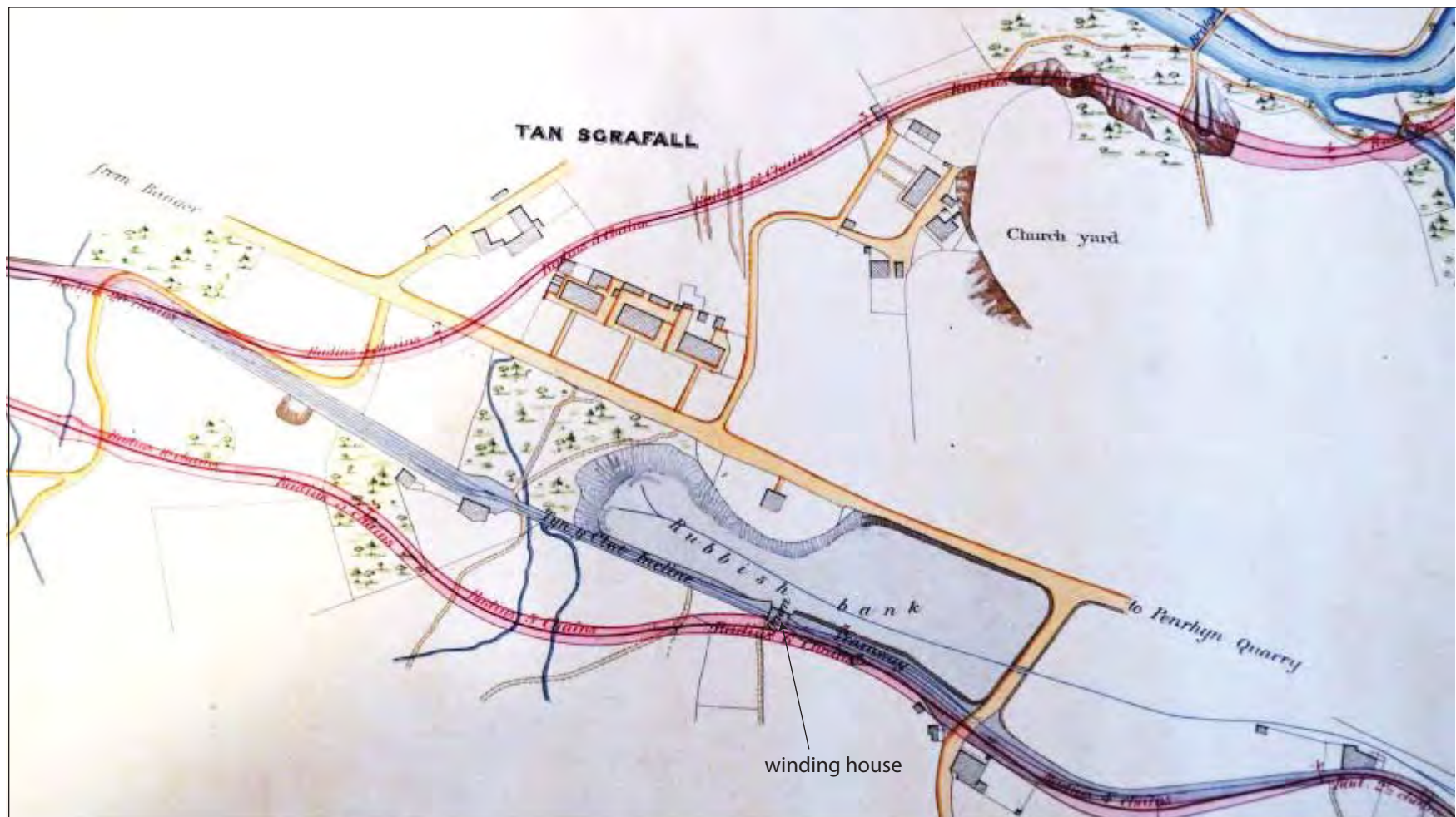
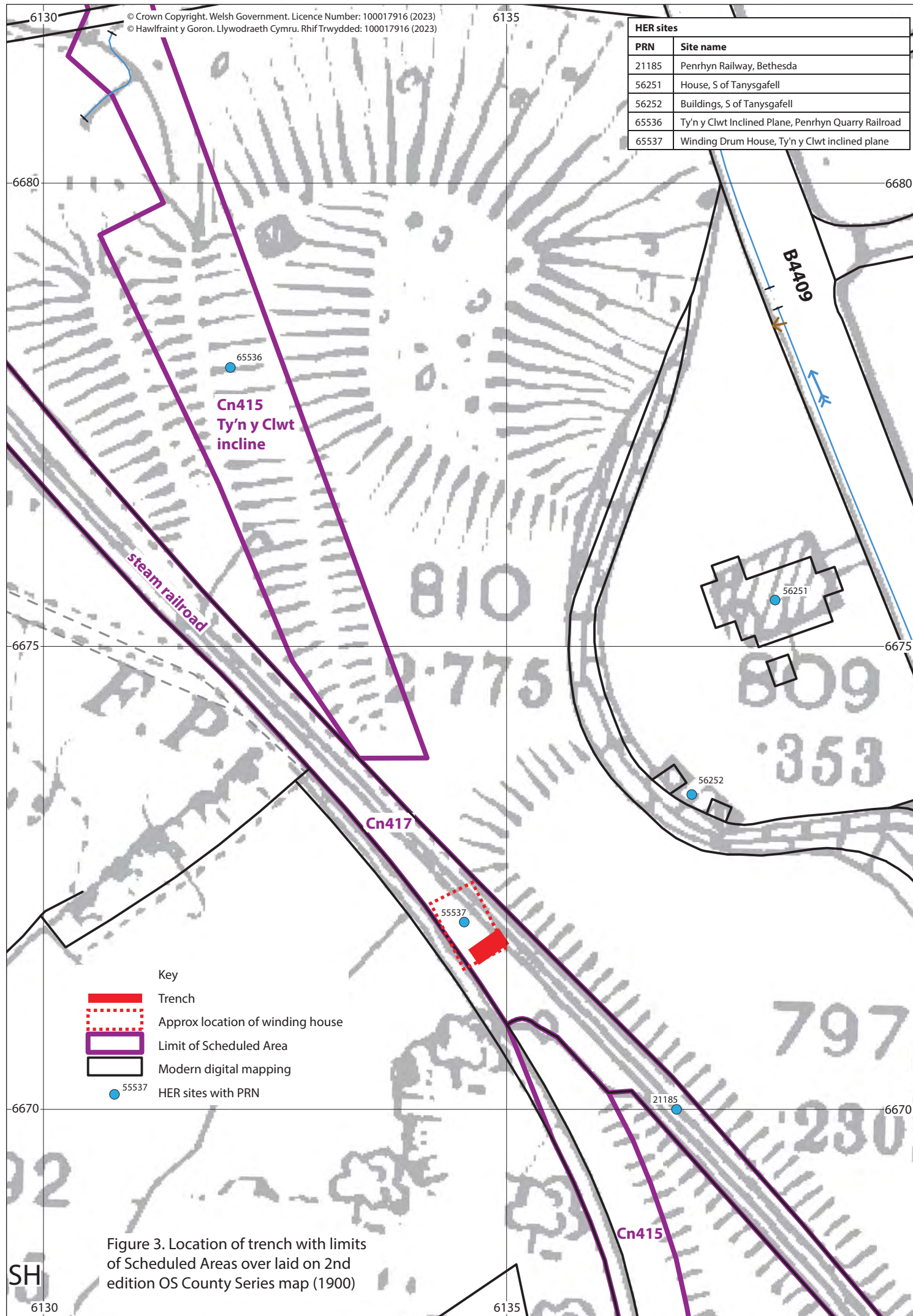


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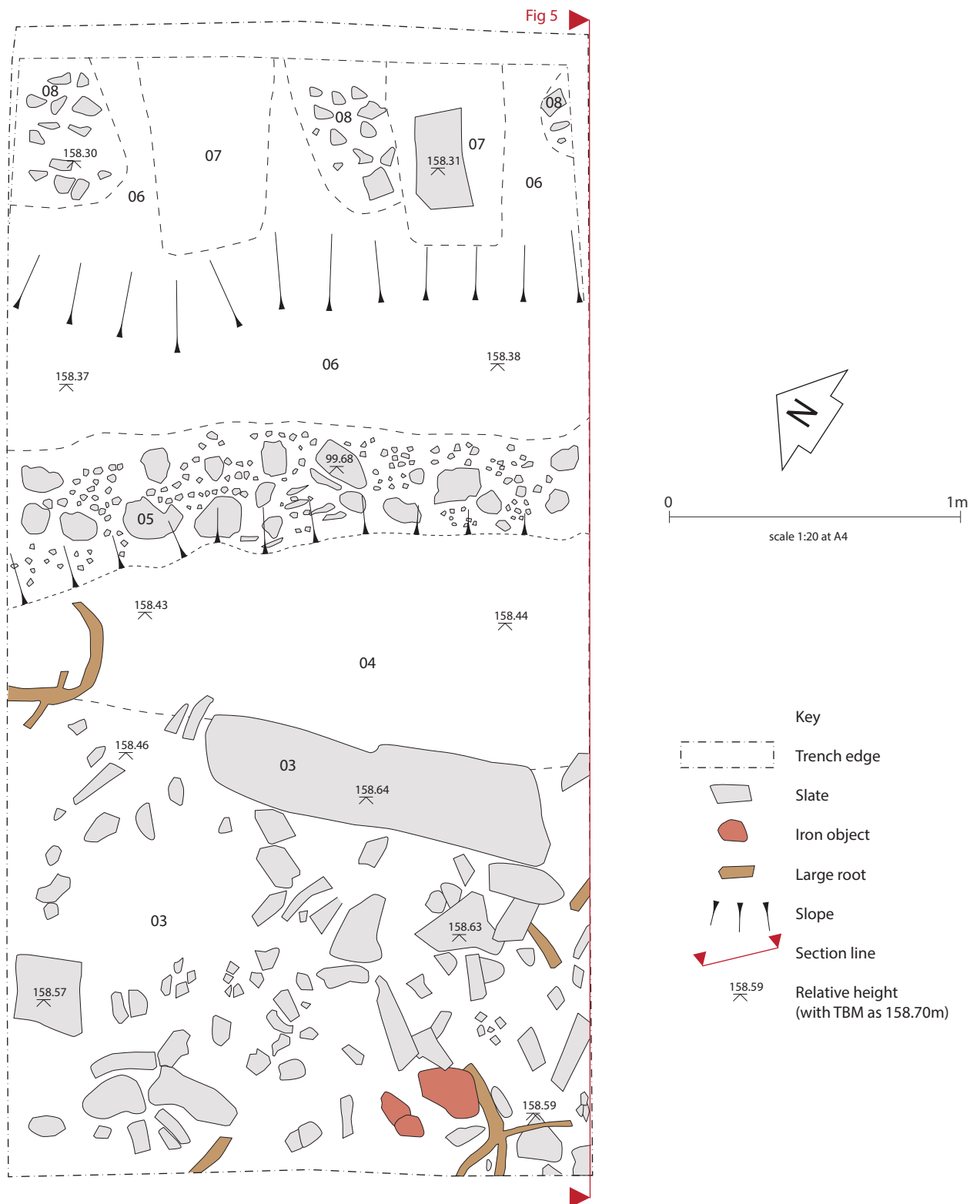


Figure 4. Plan of the trench

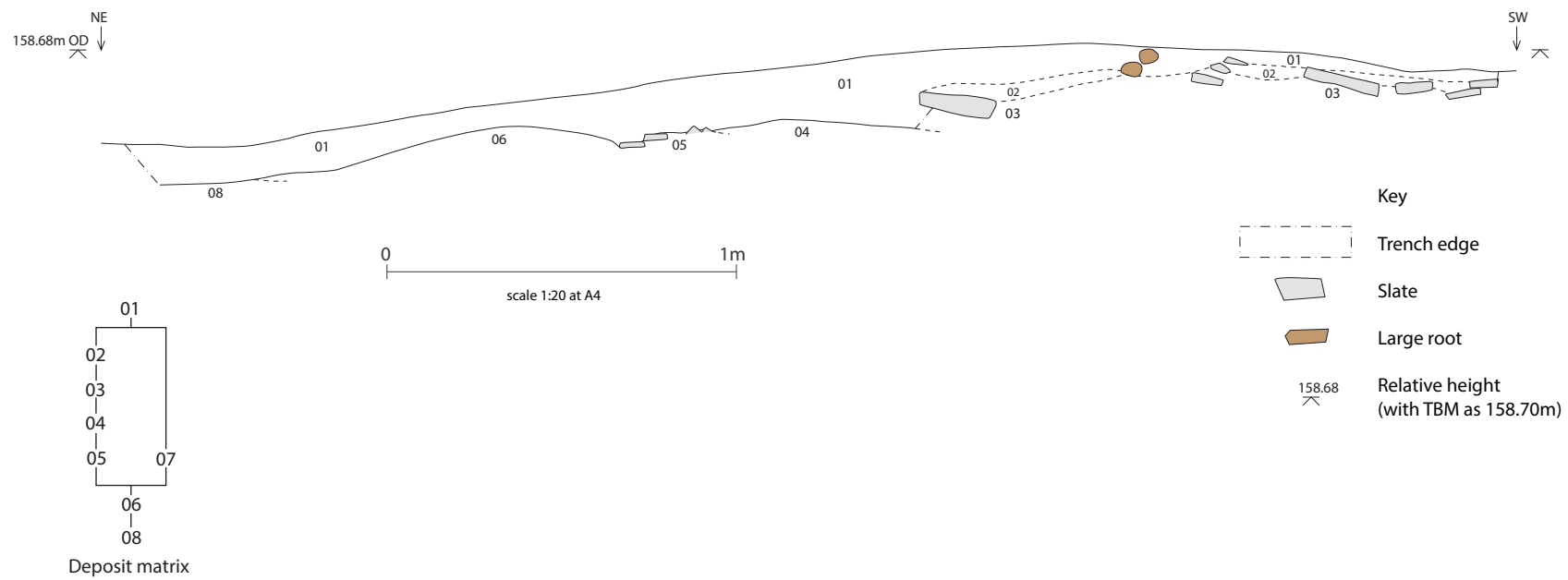


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