Hafod-Morfa Copperworks

Archaeological Field Evaluation

Prepared
for

City and County of Swansea

By

- BLACK MOUNTAINS ARCHAEOLOGY -
- ARCHAEOLEG MYNYDD DU -

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Ym mis Chwefror 2018, cynhaliodd Black Mountains Archaeology Ltd / Archeoleg Mynydd Du Cyf werthusiad archeolegol ar ran Dinas a Sir Abertawe cyn cynigion i drosi safle hen Waith Copr Hafod-Morfa i gyrchfan treftadaeth, arloesi ac addysg o'r radd flaenaf. Cynhaliwyd y gwerthusiad ar wahân i brosiect archeoleg gymunedol a oedd hefyd yn cael ei reoli gan Archeoleg Mynydd Du Cyf ar gyfer Dinas a Sir Abertawe ar yr un safle. Roedd y rhaglen gymunedol yn cynnwys ystod eang o weithgareddau fel sgyrsiau, gweithdai a sesiynau ymarferol gan gynnwys gwersi ar sut i recordio adeiladau sy'n bodoli.

Cloddiwyd deuddeg ffos gwerthuso 20 metr o hyd yn strategol ar draws safle'r hen waith copr, mewn tair ardal ddiffiniedig, er mwyn sicrhau'r ddealltwriaeth fwyaf cynhwysfawr o botensial archeolegol y safle. Datgelodd canlyniadau'r gwerthusiad haen ddwfn o wastraff a malurion yn gorwedd dros weddillion archeolegol helaeth yr hen waith copr. Roedd yr olion hyn yn cynnwys: lloriau a waliau amrywiol adeiladau, cylfatiau, canolfannau ffwrnais ailgyfeiriol, canolfannau peiriannau a gwahanol haenau sylfaen. Roedd y malurion a'r gwastraff sylfaenol yn ganlyniad cynhyrchu copr a dymchwel y gwaith copr.

Cynhaliwyd y gwerthusiad maes i safonau proffesiynol Safon a Chanllawiau ar gyfer Gwerthusiad Maes Archeolegol *gan y* Sefydliad Siartredig Archeolegydd*, cyhoeddwyd 2014, diwygiwyd 2020.*

In February 2018, Black Mountains Archaeology Ltd undertook an archaeological evaluation on behalf of the City and County of Swansea in advance of proposals to convert the site of the former Hafod-Morfa Copperworks into a world class heritage, innovation and education destination. The evaluation was undertaken separately to a community archaeology project also being managed by Black Mountains Archaeology Ltd/Archeoleg Mynydd Du Cyf for the City and County of Swansea at the same site. The community programme comprised a wide range of activities such as talks, workshops and practical sessions including lessons on how to record extant buildings.

Twelve 20-metre-long evaluation trenches were strategically excavated across the site of the former copperworks, in three defined areas, in order to achieve the most comprehensive understanding of the archaeological potential of the site. The results of the evaluation revealed a deep layer of waste and debris overlying extensive archaeological remains of the former copperworks. These remains included: the floors and walls of various buildings, culverts, reverberatory furnace bases, machine bases and various foundation layers. The overlying debris and waste were the result of copper production and the demolition of the copperworks.

The field evaluation was undertaken to the professional standards of the Chartered Institute for Archaeologists' Standard and Guidance for an Archaeological Field Evaluation*, published 2014, revised 2020.*

Acknowledgements and Copyright

The project was managed by Richard Lewis BA MCIfA. The fieldwork was undertaken by Richard Lewis, Dr Graham Eyre-Morgan PhD and Ross Cook BA PGCert. The report was prepared by Dr Graham Eyre-Morgan and Dr Rhys Morgan PhD. The Welsh translation and

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	Name	**Date**
Report prepared by	Dr Rhys Morgan	15/04/21
Quality assurance by	Libby Langlands	14/06/21
Signed off by	Richard Lewis	15/06/21

1 Introduction

1.1 Project Background and Proposals

1.1.1 Black Mountains Archaeology Ltd/Archeoleg Mynydd Du Cyf were commissioned by the City and County of Swansea to undertake an archaeological field evaluation at the site of the former Hafod-Morfa Copperworks, Swansea. The evaluation formed part of a wider regeneration project that aims to turn the renowned copperworks site into a world class heritage, innovation and education destination.

1.1.2 Following the City and County of Swansea's recommendation for an archaeological field evaluation, a specification was drawn up by Black Mountains Archaeology Ltd and approved by the Glamorgan-Gwent Archaeological Trust (GGAT), who act as the archaeological advisors to the City and County of Swansea. The evaluation was carried out to assess, date and record the quality and condition of any archaeological remains at the site. A total of 480m^2 of land was evaluated in three discrete areas identified as A, B and C (Figure 1) within the boundary of the proposed development. The evaluation comprised a total of 12 approximately 20m x 1.8m trenches within three targeted areas. These trenches and areas are as follows:

- Trenches 1–3 (Area B): targeted over the canal dock and west end of the powerhouse/boilers of the Morfa Copperworks;
- Trenches 4–6 (Area A): targeted over the Long House furnaces (and calcining furnaces);
- Trenches 7–9 (Area A): targeted over the ore yards and later buildings housing Bessemer converters;
- Trenches 10–12 (Area C): targeted to the south of the rolling mills and gasworks.

1.1.3 The archaeological field evaluation was undertaken to the professional standards of the Chartered Institute for Archaeologists' *Standard and Guidance for an Archaeological Field Evaluation*, published 2014, revised 2020.

1.2 Objectives

1.2.1 The definition of an archaeological Field Evaluation, as set out by the *Chartered Institute for Archaeologists* (ClfA), is a programme of non-intrusive and/or intrusive fieldwork which determines the presence or absence of archaeological features, structures, deposits, artefacts or ecofacts within a specified area or site on land, inter-tidal zone or underwater. If such archaeological remains are present, the field evaluation defines their character, extent, quality and preservation, and enables an assessment of their significance in a local, regional, national or international context as appropriate.

1.2.2 The purpose of a field evaluation is to gain information about the archaeological resource within a given area or site (including its presence or absence, character, extent, date, integrity, state of preservation and quality), in order to make an assessment of its merit in the appropriate context, leading to one or more of the following:

- The formulation of a strategy to ensure the recording, preservation or management of the resource;

- The formulation of a strategy to mitigate a threat to the archaeological resource;
- The formulation of a proposal for further archaeological investigation within a programme of research.

1.2.3 (Chartered Institute for Archaeologists' Standard and Guidance for an Archaeological Field Evaluation, published 2014, revised 2020)

1.3 Legislative Framework

1.3.1 Planning legislation is set out in the *Town and Country Planning Act 1990*. *Planning Policy Wales (PPW 11th Edition)* sets out the land use planning policies of the Welsh Government. Chapter 6 sets out the Welsh Government's policy towards the historic environment. It states "*The planning system must take into account the Welsh Government's objectives to protect, conserve, promote and enhance the historic environment as a resource for the general well-being of present and future generations. The historic environment is a finite, non-renewable and shared resource and a vital and integral part of the historical and cultural identity of Wales. It contributes to economic vitality and culture, civic pride, local distinctiveness and the quality of Welsh life. The historic environment can only be maintained as a resource for future generations if the individual historic assets are protected and conserved. Cadw's published Conservation Principles highlights the need to base decisions on an understanding of the impact a proposal may have on the significance of an historic asset.*" (PPW 2021, 126).

1.3.2 Underpinning PPW is a series of legislative powers and TANs. The *Planning (Wales) Act 2015* sets out a series of legislative changes to deliver reform of the planning system in Wales, to ensure that it is fair, resilient and enables development. The 2015 Act also introduces a mandatory requirement to undertake pre-application consultation for certain types of development. The *Town and Country Planning (Development Management Procedure) (Wales) (Amendment) Order 2016* defines in *Schedule 4(l)* the parameters and definitions for the requirement of pre-application consultation by Welsh Ministers, particularly in response to the effect of statutory designated monuments, buildings, and parks and gardens.

1.3.3 Advice on archaeology and buildings in the planning process was contained in Welsh Office Circular 60/96 Planning and the Historic Environment: Archaeology and Welsh Office Circular 1/98 Planning and the Historic Environment, which updated Welsh Office Circular 61/96 Planning and the Historic Environment: Historic Buildings and Conservation Areas following the Shimizu (U.K.) Ltd. v. Westminster City Council Judgement (February 1997). Detailed advice on Environmental Impact Assessment is contained within Welsh Office Circular 11/99 Environmental Impact Assessment. Following adoption of the TAN 24 Historic Environment on 31st May 2017, Welsh Office Circulars 60/96 Planning and the Historic Environment: Archaeology; 61/96 Planning and the Historic Environment: Historic Buildings and Conservation Areas; and 1/98 Planning and the Historic Environment have been cancelled.

1.3.4 Any works affecting an ancient monument and its setting are protected through implementation of the *Ancient Monument and Archaeological Areas Act 1979*. In Wales the 1979 Act has been strengthened by *The Historic Environment (Wales) Act 2016.* The 2016 Act makes important improvements for the protection and

management of the Welsh historic environment. It also stands at the centre of an integrated package of secondary legislation (Annexes 1-6), new and updated planning policy and advice, and best-practice guidance on a wide range of topics (*TAN 24 Historic Environment*).

1.3.5 Taken together, these will support and promote the careful management of change in the historic environment in accordance with current conservation philosophy and practice.

1.3.6 The *Ancient Monument and Archaeological Areas Act 1979* and *The Historic Environment (Wales) Act 2016* sets out a presumption in favour of preservation *in-situ* concerning sites and monuments of national importance (scheduled/listed), and there exists in the current *Planning Policy Wales (Chapter 6)* a presumption in favour of preservation *in-situ* of all types of heritage assets.

1.4 Location, Topography and Geology

1.4.1 The proposed development is centred on NGR SS 266250 195020, located within the primarily residential area of Landore (Glandŵr), Swansea, approximately 4km north of the city centre and approximately 0.5m south of the Swansea Liberty Stadium. The River Tawe flanks the southern extremity of the proposed development, and the former Swansea Canal (GGAT Monument 01046.0w) to the north of the area is now the A4067 Beaufort Road/Fford Cwm Tawe.

1.4.2 The proposed development site comprises three discrete areas (Figure 1) defined as Areas A, B and C.

1.4.3 Area A is a fairly level irregular/sub-rectangular shaped parcel of land, some 5.612ha in area, on a terrace on the upper south-facing slope above the River Tawe. It became evident that this area, currently used as an overflow carpark for the Liberty Stadium, comprised a substantial build-up of industrial waste material from the production of the copper foundry and the removal of the works itself.

1.4.4 Area B is an irregular shaped parcel of land heavily overgrown with self-setting trees and scrub located to the northwest of (and overlooking) Area A, on the west side of the link road between Morfa Road and roundabout that fronts the Landore Park and Ride. The area is bounded to the west by a Grade II listed boundary wall (LB 16881) with a filled-in section of the Swansea Canal (GGAT Monument 01046.0w) and Morfa Road beyond. To the north the site is bounded by derelict Grade II listed laboratory buildings (LB 11690).

1.4.5 Area C is a triangular patch of land to the south of Area A, accessed by the footpath that runs along the western bank of the River Tawe. The area comprises a mixture of self-setting trees, scrub and an open, level area made up of industrial waste and demolition material. The area is bounded by fencing that surrounds the Musgrave Engine House and Chimney (LB 11697), Vivian Engine House (LB 11696) to its north, Grade II listed boundary walling to the west (GGAT Monument 01046.0w) and the footpath running along the west side of the River Tawe on its eastern edge.

1.4.6 Swansea is situated on Carboniferous coal measures and the extraction of coal from this area has greatly influenced the history and development of the region. The soils

over the study area are largely un-surveyed but are likely to include alluvium associated with the River Tawe and substantial peat deposits (SSEW 1983).

1.4.7 The superficial geology within the development area is confined to clays, silts, sands and gravels, deposited approximately 2 million years ago during the Quaternary period. The underlying bedrock comprises the South Wales Upper Coal Measures formation, which is made up of mudstone, siltstone, sandstone, coal, ironstone and ferricrete, deposited 306–308 million years ago during the Westphalian D and Bolsovian (Westphalian C) ages, both of which form part of the Quaternary period (BGS 2021).

1.5 History and Archaeology

1.5.1 History of the Hafod-Morfa Copperworks

1.5.2 Swansea was one of the hubs of the industrial revolution in Wales and contained a series of works and mines built alongside the River Tawe from 1720 onwards. From the start, the new works concentrated on the smelting of copper, although other industries also evolved as a direct result. These other industries included the fire clay industry, which manufactured fire brick and refractory linings; the alum and salt industry; the pottery industry, which produced mainly earthenware and, for a short while, fine porcelain; as well as other metal industries such as those related to the production of iron, tin plate and zinc. All these industries were reliant on coal which was initially transported by wagon before the construction of the Swansea Canal in 1794–96, which later became a vital conduit in supplying coal and other raw materials to these industries.

1.5.3 Both the Hafod and Morfa works were established on greenfield, if not virgin sites, shown as being empty on a 1777 map of the local area *(Plan of River Swansey in* Glamorganshire, by B Jones) but owned by the Duke of Beaufort, from whom the Hafod and Morfa sites were initially leased. A long field boundary, shown on an 1847 Tithe Map (*Map of the Parish of St John juxta Swansea, Glamorganshire*), persisted as the boundary wall between the two sites until the 1980s (Ludlow 2002, 14). The Hafod Copperworks were established in 1808–09 by the Cornish entrepreneur John Vivian (1750–1826) with his sons John Henry Vivian (1785–1855) and Richard Hussey Vivian (1775–1842). Later in 1835, a Cornish firm, Williams, Foster & Co., opened the Morfa Copperworks on adjacent land. The Vivians, in conjunction with other Cornish industrialists such as Michael Williams and Pascoe Grenfell, took over the majority of Swansea's smelting industry throughout the first decade of the 19th century (Hughes 2000, 35).

1.5.4 John Vivian was involved in business at an early age. He was a wine and lime merchant in partnership with William McCarmick in Truro until 1777 before beginning his involvement in the metal industry. His initial role in the copper trade was in Cornwall where he worked as an agent for the copper magnate Thomas Williams and the Staffordshire Cheadle Brass and Wire Company, purchasing copper ore from the mines in the county on their behalf and arranging for its shipment to their smelting works in South Wales.

1.5.5 Sometime close to 1800, John Vivian, who was now representing the associated miners of Cornwall, visited Swansea to investigate the conditions of copper-smelting

as a profitable occupation. In 1800 he became a partner in the Cheadle Brass and Wire Company, whose copper smelting works were at Penclawdd, to the west of Swansea. This marked the beginning of the Vivians' involvement in copper smelting in Wales. In 1808 he resigned from the Cheadle Brass and Wire Company to start his own company in partnership with his sons at Hafod. The Hafod site chosen by Vivian lay between the Swansea Canal to the west and the River Tawe to the southeast, allowing for efficient water transport of raw materials to the site, both by canal barge from the upper Swansea Valley and by ship from elsewhere in Britain. In addition, by 1810 a dedicated canal basin had been constructed at the northern end of the works, to offload coal from the barges into the works. The venture undertaken by Vivian and his sons was soon established as a major manufacturer of copper in Britain. The Hafod Copperworks was initially a rolling plant for making bars and plates from copper ingots brought from the nearby Rose Works, but smelting is believed to have started at the same time. Within ten years Vivian and Sons was the second largest producer of copper in Britain, accounting for about 17% of national output and by the mid-19th century was the largest copperworks in the world.

1.5.6 The Hafod site continually modernised, changed and expanded, with a rolling mill being added to the smelters sometime in 1819 for making bars and plates from copper ingots. Facilities were constantly improved over the course of the century, to enable the works to increase output and adopt improved technology. The prime obstacle became the lack of available land on which to maintain this expansion program, with the site becoming progressively cramped. Increased production led to an increased amount of waste that needed to be disposed of. Eventually, in 1865, with the construction of a new tramroad, the company was able to transport waste slag over the canal to the west, therefore releasing more areas for site development. The pressure created by the amount of waste slag was also partly eased by casting this waste material into usable blocks for building with. The company ceased smelting, and therefore the creation of slag waste, on site in 1904 (Wiggins 2004, 5).

1.5.7 By the mid-19th century, the neighbouring Morfa Copperworks was now well established and being run by Williams, Foster & Co. who started the company in 1828, running it until 1880. The Morfa Copperworks were built next door to the Hafod works with only a high stone wall between the two to divide them. Legend has it that workers at Morfa were instructed not to talk to the Hafod workers for fear of giving away trade secrets. Work at Morfa began in 1828 with the construction of a rolling mill to process the ingots produced by the Rose Copperworks in Plasmarl, before its copper smelting facilities were added in 1834–5. The Morfa Copperworks became the largest non-ferrous metal smelter in the world by the mid-19th century, employing over 1,000 people and supplying the Royal Mint with its copper. By 1861, Michael Williams had grown from a leading partner in Williams, Foster and Co to having almost complete control of the business until his death in 1880. At this time, it was also said that Williams was the richest man in Cornwall. The Hafod and Morfa works amalgamated in 1924 and were subsequently operated by Yorkshire Imperial Metals. These new works, the Hafod-Morfa Copperworks, closed in 1980, when it was the last operating copperworks in Swansea.

1.5.8 Both the Hafod and Morfa works were situated in the Lower Swansea Valley along with more than 11 other copperworks, which gave rise to the name Copperopolis. This

area, by the mid–late 19th, century accounted for 90% of the world's copper production (Hughes 2000). Swansea was key to the global copper industry and, by 1823, 10,000 of Swansea's 15,000 residents were supported by the copper industry within the 124 copperworks or related industries. The rise in this vast industry was made possible by a plentiful supply of coal in the Swansea Valley, brought down to the copperworks via the late 18th century canals. In addition, both the port at Swansea and the River Tawe, being navigable inland along its deepest three tidal miles, could carry sailing-ships up to the 13 main smelting works built alongside the river. It was these excellent and easily accessible facilities for shipping which allowed the import of copper ore from Cornwall, North Wales, South America and Australia, along with the easy export of finished metal.

1.5.9 **Archaeology within the local and surrounding area**

1.5.10 At least 15 or more significant structures, in varying degrees of condition, survive across the Hafod-Morfa Copperworks site. These include the former Morfa Rolling Mill (LB 16878), now used as a museum stores; the Laboratory Building (LB 11690); and the former Morfa Powerhouse and later Yorkshire Imperial Metals Canteen (LB 11691). The Hafod Limekiln (LB 11694), Copper Slag Abutment, Pier and Canal Boundary Walls (LB 11692 and 11693), the Vivian Engine House (LB 11695), the Chimney west of the Vivian Engine House (LB 11696) and the Boundary Wall for the Hafod Copperworks canal docks (LB 16881) are also situated within the immediate vicinity, as well as the *in-situ* Musgrave Engine and Rolls (SAMGm483) in the Musgrave Engine House and Chimney (LB 11697).

1.5.11 The White Rock Copperworks (SAMGm481) was established in 1736 and was one of the most important copper smelting works in the Lower Swansea Valley. White Rock was the third oldest of the Swansea copperworks, established by a partnership from Bristol at a time when copper smelting was switching from blast furnace to reverberatory furnace technology. The works closed in 1924 and the site was almost completely cleared in the 1960s by the army. Industrial remains include the revetment wall of the 1736 'Great Workhouse', kilns, furnaces, flues and a 17th century river dock flanked on the north by a series of later stone-built quays, with decks made of cast blocks of copper slag. In 1870–71, lead and silver smelting were introduced, and this resulted in the building of a brick condensing flue at the side of Kilvey Hill and an inclined railway to remove spoil. Part of the latter was supported by a stone arch that also housed two flues and a chimney, which still survives today (Hughes and Reynolds 1988; Hughes 2000).

1.5.12 The earliest transport route in the area was Chauncey Townsend's wooden horse-drawn wagonway, built in 1756 in order to connect the collieries of Llansamlet and Birchgrove with his copperworks at Middle and Upper Bank, as well as his dock at the White Rock Copperworks. Townsend brought the Newcastle-based railway engineer George Kirkhouse to Swansea, and over 27 years they built in excess of 13 miles of wooden tracked railways across land he leased in the Llansamlet and Gwernllwynchwyth coalfields (Hughes 2000, 82–96).

1.5.13 In 1783, the Smith's Canal was built by John Smith to transport coal from his collieries at Llansamlet. This privately owned canal largely replaced Townsend's earlier wooden surface wagonway. The canal stretched for 2.1km, from Llansamlet to the coal staithes

(SAMGm482) on the River Tawe at Foxhole and remained in use until 1852. The canal passed underground through the White Rock Copperworks in a cut-and-cover tunnel, together with underground wharves behind the Great Workhouse, where coal was offloaded directly into the furnaces (Hughes and Reynolds 1988; Hughes 2000, 96–102).

1.5.14 Several tramroads were constructed between 1816–19 to connect the collieries of John Scott, a London solicitor, in Llansamlet to the docks at the White Rock Copperworks and the Foxhole coal staithes. Scott's Tramroad (NPRN 403886) was built to carry coal from Scott's Pit (SAMGm336) to the docks and followed the course of Smith's Canal on its eastern side down to the Foxhole coal staithes. A George Stephenson locomotive may have worked the line for a short period. In 1828, the colliery and tramroad were sold to Charles Henry Smith of Gwernllwynchwyth, who also used a locomotive on the line in 1833 (Hughes and Reynolds 1988).

1.5.15 In 1845 the Swansea Vale Railway SVR (NPRN 418157) acquired the tramroad with a view to modernising and connecting it to the Swansea Docks with the proposed Midland Railway. By 1860, a passenger service between St Thomas's station in Swansea and Pontardawe had been established and the line was extended to Brynamman in the northern coalfield in 1864. The Midland Railway began by leasing the SVR in 1874, before purchasing it two years later. Passenger traffic ceased in 1950 and the line closed in stages between 1964 and 1983 (Barrie 1994, 205–9; Hughes and Reynolds 1988).

1.5.16 **Previous archaeological investigations**

1.5.17 2002 – a desk-based assessment was produced by GGAT for the Landore Park and Ride scheme. The assessment identified 21 extant buildings and the location of 14 demolished buildings associated with Hafod-Morfa Copperworks site.

1.5.18 2002 – a site appraisal was produced by Dyfed Archaeological Trust in order to establish management plans for the identifiable heritage assets at the Hafod-Morfa Copperworks site.

1.5.19 2004 – an archaeological watching brief was undertaken by GGAT during the excavation of ground contamination test pits. A total of 18 test pits were excavated across the site of the copperworks. Some of the test pits confirmed a depth for natural on this site, whilst other test pits revealed solid structures.

1.5.20 2004 – a building survey was undertaken by GGAT on a section of the Swansea Canal wall that was to be demolished to make way for a bus lane.

1.5.21 2008 – a desk-based assessment was undertaken by Cambria Archaeology on the area of the Hafod-Morfa Copperworks. This assessed the current condition of all buildings and features on the site and revised the individual building management plan.

1.5.22 2008 – an environmental impact assessment was undertaken by Cambria Archaeology for the Morfa Distributor Road which was intended to follow the line of the southern section of the Swansea Canal as it passes through the Hafod Copperworks.

1.5.23 2013 – GGAT were commissioned by Swansea University to undertake a community archaeological excavation of the Hafod Copperworks. Three trenches were excavated: Trenches 1 and 2 were both abandoned as a result of contamination and Trench 3 was

excavated to examine the approach to the works via the canal bridge to the main entrance.

2 Methodology

2.1.1 The archaeological field evaluation consisted of the excavation of 12 trenches, totalling 480m^2, in accordance with the specification provided by Black Mountains Archaeology Ltd and agreed trench location plan (Figure 1). The trenches were positioned to provide full coverage over the site, focusing on the canal dock and the western end of the Chili House furnaces, the Long House furnaces (and calcining furnaces), the ore yards and later buildings housing Bessemer Converters, and the area to the south of the rolling mills and gasworks (Figure 1).

2.1.2 The plant employed was a JCB 13-ton excavator with a 1.8m wide grading bucket. The trenches were laid out using a Geomax Zenith 35 Pro GNSS/Glonass (GPS) receiver and data logger. The survey was conducted to Ordnance Survey National Grid and Datum with a 20mm tolerance.

2.1.3 Where possible, trench sections were cleaned by hand and sections or sample sections were recorded in detail by written context, drawing and photography. The depth of trench and contamination often precluded cleaning the trench sections. The archaeological recording techniques conformed to the best industry standard; all deposits were recorded using a single continuous context numbering system pro forma. All contexts were recorded with the trench number prefix (e.g. context 03 in Trench 1 = 103) and are summarised in Appendix III. All trenches and sample sections were photographed in digital using a Fujifilm FinePix S4800 super wide (30x) 24-720mm and Nikon D90 camera, both at 16mp.

2.1.4 In all trenches, archaeological deposits and natural horizons that were encountered were recorded. Where no archaeological horizons were encountered during the machine excavation of the trenches, excavations were taken down to the natural. Each section of the trench was inspected, and sample sections were hand-cleaned and recorded where possible. The trench was then measured and backfilled. All trenches were monitored by the LPA between the 5th and the 16th February 2018, before being backfilled with the excavated material.

2.1.5 Due to the excessive contamination across the site, no finds or samples were recovered.

2.1.6 With the permission of the landowner, the site archive will be deposited with Swansea Museum and Art Gallery for permanent curation. An accession number will be generated upon submission. A digital copy of the report and archive summary will be supplied to the regional HER, the LPA and the Royal Commission on the Ancient and Historical Monuments of Wales.

2.1.7 The field evaluation was carried out to the standards of the Chartered Institute for Archaeologists' *Standard and Guidance for Archaeological Field* Evaluations**,** published 2014, revised 2020.

3 Results

3.1.1 The archaeological field evaluation consisted of the excavation of 12 trenches, totalling 480m^2 in accordance with the specification provided by Black Mountains Archaeology Ltd and agreed trench location plan (Figure 1). The trenches were excavated in three defined areas as set out below:

- Trenches 1–3 (Area B)
- Trenches 4–9 (Area A)
- Trenches 10–12 (Area C)

3.1.2 The results of each evaluation trench are detailed below. Contextual information can be found in Appendix III.

3.2 Area B

3.2.1 **Trench 1 (Figures 1 and 2, Plates 1–5)**

3.2.2 Trench 1 was excavated at the most northerly extremity of Area B, which was targeted over the canal dock and the west end of the powerhouse/boilers of the Morfa Copperworks. This trench measured approximately 20m long x 2m wide with a depth of 2m in an area considered safe to work. The level at the top of Trench 1 was 15.36mOD, while the level at its base was 13.36mOD. The width of the trench was extended to allow scrutiny of the archaeological remains. In order to excavate this trench a substantial amount of self-setting trees and scrub was first removed. The mechanical excavator encountered near surface level remains beneath a shallow 0.1m organic topsoil layer (100). This directly overlaid an approximately 0.1m deep concrete floor/machine base [101] and floor composed of 6-inch red, ceramic quarry tiles [102] (Plate 2) set on a concrete mortar layer (103), which butted up to a slightly raised concrete layer [101] and a plinth made from a single line of tiles [104]. These features were set on a 0.05m deep concrete/mortar mixture shown in Plates 1 and 3**.** Such findings suggest that these features were part of a single large structure.

3.2.3 The full extent of tiled floor [102] was not established but it certainly extended beyond the area of evaluation (Plate 2). Underlying these tiles, as well as mortar base [104] and concrete surface [101], was a 0.25m deep concrete slab [105].

3.2.4 Underlying the concrete slab was a wall made from concrete blocks [106] (Plate 3**)**. The visible extent of this wall was approximately 0.5m deep x 2.5m long although neither its full width nor depth could be defined. The wall appeared to be running down beyond a rubble and concrete mix – possible fill (107) – which appeared to be filling a cavity between concrete wall [106] and brick wall [108], fronting the inner, south-facing side of this structure. The brick wall was approximately 3.5m wide with 13 courses of brick being observed above the rubble fill, whose depth was undetermined. This brick wall [108] butted up to concrete walls [109] and [110], which possibly formed three sides of a chamber or cellar. Wall [109] appeared to be built from concrete blocks similar to walls [106] and [110]. Due to the inaccessibility of the site and the inability to remove any further rubble, it was not possible to ascertain the exact depth of the south side of this particular feature nor the full dimensions of wall [109]. Overlying wall [109] was approximately 0.5m of concrete, brick and mortar

rubble (116). Feature [115] was found atop this rubble: it appeared to have a concrete base [113], concrete side walls [111], [112] and a concrete rear wall [114] (Plate 4), but its purpose was uncertain. Directly opposite this was wall [110], which was approximately 1m long with badly damaged upper courses. As a result, its depth was not ascertained. Wall [110] ended at the intersection of an angled concrete slab [117] that in turn overlay a concrete platform/step [118], which had a brick course overlying its upper surface. In considering that this area was the location of the former boiler house, it is possible that this feature was once a coal chute (Plate 5).

3.2.5 **Trench 2 (Figures 1 and 2, Plates 6–7)**

3.2.6 Trench 2 was excavated in the centre of Area B and was 19m long x 2m wide with a depth varying between 1–1.5m. The level at the top of Trench 2 was 13.91mOD, while the level at its base was 12.41mOD. The trench was excavated from N–S with the first archaeological feature – the remains of a 0.2m thick concrete slab or floor [207] – being revealed at 2.8m in from the trench's southern edge. The concrete slab (Plate 6) was discovered directly below layer (201), which comprised a 0.1m thick, very dark grey mixture of organic substance, coal dust and industrial waste (201), which itself overlaid a natural reddish brown clay layer (202). The concrete slab was observed to be 2m wide within the west-facing section of the trench and 2.85m within the east-facing section. It appeared to have been purposefully made in this shape, rather than being fractured.

3.2.7 The remains of a wall or foundation [205] that measured approximately 0.5m wide at its top x 0.45m deep and constructed with three courses of stone was revealed 1.1m further north of concrete slab [207]. This feature was only observed in the west-facing section of the trench, set within cut [206]**,** and underlay ground surface (201). This layer ran into a cavity between cut [206] and the north-facing side of the wall, which appeared to have been dressed (Plate 7). To the immediate north of this feature was a layer of demolition rubble (203) that appeared to merge into (201) and the clay natural (202).

3.2.8 No further features were observed in this trench. However, a vast amount of building debris and industrial waste (204) was apparent, varying from 0.5–1.5m in depth, located across the entirety of the trench and sandwiched between layers (201) and (202).

3.2.9 **Trench 3 (Figures 1 and 2, Plates 8–10)**

3.2.10 Trench 3 was NE/SW aligned and was excavated close to the access point of Area B and, as with Trench 1, contained an exceptional amount of archaeological remains. The trench measured 20m long x 2m wide x 1.2m deep. The level at the top of Trench 3 was 14.05mOD, while the level at its base was 12. 85mOD. Initially, the trench cut through a 0.05m thick concrete/slag surface layer (301), which overlaid a very mixed demolition layer (302) varying between 0.05–0.4m in depth. Revealed below this demolition layer were several features, starting from the western edge of the trench. A row of seven coping stones [303] were discovered overlying a wall 4–5 courses deep, constructed from fire bricks, which had side walls two courses wide and the same in depth. The base/floor of this feature was constructed from brick sets. The eastern end of this feature was determined by a layer of compressed slag coping [306] overlying a double course of brick walling. Beneath this was a dark grey gritty slag compound

(305) that sat between a feature composed of flooring and the double brick course. This feature [304] has been described as a possible stoke hole (Plate 8).

3.2.11 Directly beyond feature [304], heading towards the east side of the trench, was a row of fire bricks [307] running at an angle across the trench parallel to a 1.1m wide double-skinned brick-built culvert [309]. These features were separated by a deposit of hard, compressed mortar and crushed brick (308). Walling [307] and the crushed brick deposit (308) terminated at a wall [310], which ran below and parallel to the trench section. Running along the opposite side of the culvert (east side), a substantial brick-built supporting wall [311] was discovered. In addition to these features, a double row of bricks [312] was discovered running across the trench to the point where the culvert ran into the trench's west-facing section (Plate 9).

3.3 Area A

3.3.1 **Trench 4 (Figures 1 and 3, Plate 11)**

3.3.2 Trench 4, aligned N/S in the northwest of Area A, was 19m long x 2m wide x 2.8m deep to the first archaeological layer. The level at the top of the trench was 10mOD, while the level at its base was 7.2mOD. This trench revealed a 0.4m thick surface layer of tarmac shavings (401) overlying approximately 2m of unstable demolition rubble (402). Underlying rubble (402) were brick floor surfaces [405] and [403]. These were separated by a brick wall [404]. Set within the northern end of floor [403] was a metal pipe [407], situated within cut [406], which was filled with stone chippings (409). Within 1m to the north of the pipe, floor [403] terminated at a depth of rubble (408), that was established at over 4m. The trench was too deep and unsafe to undertake any close excavation or recording.

3.3.3 **Trench 5 (Figures 1 and 3, Plates 12–13)**

3.3.4 Trench 5 was aligned SW/NE and was located towards the centre of Area A. The trench was 20m long x 2m wide x 2m deep to the first archaeological layer (Plates 12 and 13). The level at the top of the trench was 9.54mOD, while the level at its base was 7.54mOD. Trench 5 revealed a 0.4m surface layer of tarmac shavings (501) overlying 1.6m of demolition rubble (502) before reaching brick floor surface [503], which further overlaid brick floor surface [504] and surface [505]. In addition to the floor surfaces, two curving walls constructed from a double course of bricks, numbered [506] and [507], were revealed. These walls appeared to curve around a pit [512] – undefined in depth and diameter – that in turn appeared to be filled with demolition rubble (511) to a depth in excess of 4m. Other features included a cast iron pipe [509] that appeared to feed through wall [506] and a large stone slab [510] of unknown use but possibly *in-situ*. The gap between the two walls was filled with rubble deposit (508) and its depth was undefined. The trench was too deep and unsafe to undertake any close excavation or recording.

3.3.5 **Trench 6 (Figures 1 and 4, Plate 14)**

3.3.6 Trench 6 was located towards the centre of Area A, was aligned N/S and was 19m long x 2.5m wide with a maximum depth of 2m. The level at the top of the trench was 7.95mOD, while the level at its base was 5.95mOD. The upper level of the trench comprised a 0.7–0.9m deep layer of compressed tarmac shavings (601) that formed the car park surface, overlying a layer of yellowy brown clay with an abundant amount

of demolition debris (602). This deposit was situated directly above a concrete floor [603] (Plate 14) that was revealed approximately 2m in from the southern end of the trench. The floor was 6.5–6.7m long an. Another possible floor (604), heavily fragmented, was revealed at a depth of 2m. Natural was not revealed.

3.3.7 **Trench 7 (Figures 1 and 4, Plate 15)**

3.3.8 Trench 7 was aligned NW/SE and was located towards the southeast corner of Area A. In total, the trench measured 20m long x 2.5m wide x 2m deep, with a 3.7–4m deep sondage also being excavated within its confines for the purposes of testing the natural subsoil. The level at the top of the trench was 8.34mOD, while the level at its base was 6.34mOD. The whole trench comprised made-up ground with visible tip lines throughout. The upper level (701) comprised compressed tarmac shavings approximately 0.4m deep that formed the car park surface. Underlying (701) was a pale brown clayey loam (702) with a vast amount of demolition debris within. This overlaid a very dark grey clay-ash mix (703) which, as with (702), contained a substantial amount of demolition debris (Plate 15). Underlying (703) was the natural deposit (704), which comprised pale-brownish clay with a large amount of river cobbles throughout. No archaeology was revealed within the trench.

3.3.9 **Trench 8 (Figures 1 and 4, Plates 16–18)**

3.3.10 Trench 8 was aligned NW/SE and was situated towards the south of Area A. In total, the trench measured 22m x 2m x a depth of 1.2–1.4m. The level at the top of the trench was 8.22mOD, while the level at its base was 6.82mOD. The uppermost deposit within the trench comprised a 0.2m thick hardcore surface (801) that overlaid a 0.2–1.2m thick rubble demolition layer (802). This demolition layer sat directly over concrete floor layers [803] and [810], located at either end of the trench.

3.3.11 At the northern end of the trench, a brick structure [805] (Plate 16) was revealed. It was substantially built with a central rectangular open area (possibly a flue) and a wall that stepped out on its northern side. It is probable that a similar stepped wall originally stood on the southern side as well but was lost during demolition. The surviving base of this wall was three courses wide. The west wall to this structure was also three brick courses wide and butted up to a concrete structure [804]. Within the central area of this trench an area of brick flooring was discovered [806] (Plate 17) as well as an associated demolition deposit (807), along with the remains of a brick wall [808].

3.3.12 Also revealed within this trench was a large metal plate [812] that appeared to be *in-situ* with a brick floor [813] (Plate 18) running up to it and possibly beneath it. Finally, a small patch of re-deposited natural was also observed on the southern edge of plate [812]. A substantial amount of asbestos-rich rubble (809) was also observed and marked throughout the trench.

3.3.13 **Trench 9 (Figures 1 and 4, Plates 19-22)**

3.3.14 Trench 9 was aligned N/S, was located towards the southwest corner of Area A and measured 12m long x 2m wide x 1.2m deep. However, the northern side of the trench was backfilled, and the trench was shortened immediately due to the excessive amount of ground contamination. The level at the top of the trench was 6.59mOD, while the level at its base was 5.39mOD. The trench comprised a 0.4–0.5m deep

surface layer of tarmac shavings (901) overlying a 0.3–0.5m deep mixed layer of demolition debris and industrial waste (902). Within layer (902) the brick constructed elements of a possible reverberatory furnace [903] were observed (Plate 19). The remains of this feature were five courses high but also severely damaged (Plate 20). Directly underlying layer (902) were the brick bases [904] for the reverberatory furnaces (Plates 21 and 22).

3.4 Area C

3.4.1 **Trench 10 (Figures 1 and 5, Plates 23–24)**

3.4.2 Trench 10 was aligned NE/SW, was located in the northwest of Area C and measured 20m long x 2m wide x a maximum depth of 0.4–0.5m (Plate 24). The level at the top of the trench was 7.19mOD, while the level at its base was 6.69mOD. The trench revealed a compressed surface of stone chippings and tarmac shavings (1001), 0.1m deep, overlying a 0.3–0.4m deep mixed layer of brick demolition material (1003). Running through this demolition material was a concrete pipe [1002] that ran at an angle across the southwest of the trench. Also throughout the trench were several remnants of concrete floor material [1005, 1006 and 1013]. Within the central area of the trench an inspection chamber [1008] (Plate 23) was discovered. The inspection chamber was constructed with an exterior of red bricks [1009] and an interior lining of white bricks [1010, 1011 and 1012].

3.4.3 **Trench 11 (Figures 1 and 5, Plate 25)**

3.4.4 Trench 11 was aligned E/W and was situated towards the centre of Area C. The level at the top of the trench was 7.2mOD, while the level at its base was 6.4mOD. The trench was 20m long x 2m wide x 0.4m deep but was 0.8m deep at its eastern end where a drain [1111] was revealed within a stone-filled pipe trench (1103). Below the upper tarmac (1101) and underlying demolition material (1102) several remnants of concrete floor were revealed [1104, 1105 and 1106] with cable ducting [1107] being observed within [1106]. In the central area of the trench, set at either end of a 1.6m long concrete base [1109], were two cut-off RSJ struts [1108]. It is possible that the feature to which these RSJs belonged was a machine housing. Underlying concrete base [1109] was a natural deposit of river silt with an abundance of river cobbles throughout (1110) (Plate 25).

3.4.5 **Trench 12 (Figures 1 and 5, Plates 26–27)**

3.4.6 Trench 12 was situated on the southern edge of Area C and was aligned N/S. In total, the trench measured 20m long x 2m wide x a maximum of 2.5m deep. The level at the top of the trench was 7mOD, while the level at its base was 4.5mOD. The uppermost deposit within the trench was a brown sandy topsoil (1201) that contained an abundance of concrete and slag fragments. Underlying (1201) was a 0.5m deep layer of gritty black slag and industrial waste (1202). Lying beneath (1202) was a 0.25m deep hard and compacted grey ash layer (1203), which infilled cut [1206], along with a red gritty slag deposit (1204). Deposit (1204) sealed a 1.3m deep deposit of red gritty sand and slag that overlaid a natural river silt layer (1205), which included an abundance of small pebbles (Plate 26). The main archaeological elements within this trench occurred within 5m of its southern edge, with a layer of bricks and mortar (1207)

butting up to brick structure [1208] (plate 27), a possible brick furnace base [1209] and an associated deposit of greyish brown soot (1210).

4 Discussion and Conclusion

4.1.1 A total of 12 evaluation trenches, each measuring approximately 20m long x 2m wide, were strategically excavated across the site of the former Hafod-Morfa Copperworks. These trenches were situated in in three defined areas, in order to achieve the most comprehensive understanding of the archaeological potential of the site. These areas were termed Areas A, B and C. Trenches 1–3 (Area B) were targeted over the canal dock and west end of the powerhouse/boilers of the Morfa Copperworks; Trenches 4–6 (Area A) were targeted over the Long House furnaces (and calcining furnaces); Trenches 7–9 (Area A) were targeted over the ore yards and later buildings housing Bessemer Converters; Trenches 10–12 (Area C) were targeted to the south of the rolling mills and gasworks.

4.1.2 With the exception of Trench 7 in Area A, a substantial amount of archaeological remains was discovered in all trenches excavated during the archaeological field evaluation. In Areas B and C, remains were encountered directly beneath the topsoil, whereas in Area A, more recently modified into an overspill carpark for the Liberty Stadium, remains were encountered beneath a deep deposit of demolition debris that varied across the site. Area A proved difficult to evaluate in certain areas due to the depth of this unstable demolition debris and industrial waste, much of which was contaminated with asbestos, arsenic and other pollutants used in the manufacture of copper and other metals. The results of the evaluation revealed a deep layer of waste and debris overlying extensive archaeological remains of the former copperworks. The archaeological remains included: floors and walls of various buildings, culverts, reverberatory furnace bases, machine bases and various foundation layers. Due to the contaminated nature of the waste no samples or artefacts were recovered.

4.1.3 Overall, it is difficult to relate the archaeological evidence precisely to the structures or machinery being used at the copperworks or to the complex metallurgical processes that were implemented within. However, by tying the trench location plans in with historic maps and plans of the Hafod-Morfa Copperworks, it is possible to obtain some clues as to what the archaeological remains recorded during the field evaluation related to. The evaluation conducted below will briefly relate the archaeological remains uncovered within the trenches to the available cartographic evidence, as well as other historical sources.

4.1.4 **Trenches 1–3**

4.1.5 According to the 1951 plan of the Morfa works produced by ICI Metals Ltd (Figure 10), Trench 1 was excavated over the north-eastern end of Boiler Room C. In considering this, it seems likely that tiled floor [102] was the original floor of this boiler room. This same plan shows a 12” pipe running E/W beyond the southern edge of the boiler rooms, in an area within which Trench 2 was excavated. Concrete slab [207] was situated directly in line with this pipe, which may suggest that its placement within this area was connected to the pipe’s installation. However, as no traces of this pipe were discovered within Trench 2, this suggestion must remain tentative. Moreover, according to Hughes’ (2000) speculative plan of the Morfa works during the 19th

century (Figure 6), Trench 2 appears to have been located over an area previously occupied by one of the work's canal docks, constructed in 1810. It is therefore possible that masonry wall [207] relates to this canal dock, although again this remains tentative. The 1951 plan (Figure 10) also shows that Trench 3 was excavated directly over the centre of the Casemaker's Shop. The 1939 plan of the works (Figure 8) also indicates that the wall of this workshop may also have been located within Trench 3, possibly represented by wall [311]. Relating stoke hole [304] and culvert [309] to the available mapping and evidence remains difficult.

4.1.6 **Trenches 4 and 5**

4.1.7 According the 1951 plan of the works (Figure 10), Trench 4 is situated directly over the location of a petrol store, which wall [404] possibly relates to. Hughes' (2000) plan (Figure 6) also shows that Trench 4 was situated partially over the Chili House furnaces and it is therefore possible that floor surfaces [403] and [405] are related to this particular furnace house. If this is the case, then floors [403] and [405] are potentially of high significance, as they may relate to some of the earliest smelting activity being conducted within the Hafod works. This same plan also suggests that the area within which Trench 5 was excavated encompassed three of the furnaces situated within a furnace hall adjacent to the Long House furnace bank. This is again potentially significant, as when the forms of curving walls [506] and [507] are considered it may be suggested that they originally formed parts of flues. These possible flues may themselves have formed part of the furnaces indicated on Hughes' (2000) plan.

4.1.8 **Trenches 6–9**

4.1.9 The 1951 plan (Figure 10) indicates that Trench 6 transecting the westernmost wall of Warehouse no. 75. On the 1939 plan (Figure 8), this same building is shown as being used for shearing and pickling. It seems likely that concrete floor surfaces [603] and [604] formed part of this warehouse. The lack of archaeological remains within Trench 7 appears entirely consistent with its location to the exterior of the copperworks' main buildings. However, the 1951 plan (Figure 10) shows a tramroad running directly beneath the northern corner of Trench 7. The fact that this tramroad was not detected during the field evaluation serves as an indication that it was demolished prior to excavation. On Hughes' (2000) plan (Figure 6), Trench 7 is also shown as being situated directly within an ore yard located on the southern side of the calcining furnace bank of the Long House. No traces of this yard were detected within Trench 7. According to the 1939 plan (Figure 8), Trench 8 is shown as being situated above the Cutting House which, by the time of the 1951 plan (Figure 10), had become Warehouse 72D. In 1939, electric cables are also shown running through here, the remains of which were not encountered during the excavation of Trench 8. However, it is possible that brick structure [805] formed part of the northwest wall of the cutting house/warehouse. On Hughes' (2000) plan (Figure 6), the position of Trench 8 lies directly over an enclosed area that is shown as housing a Bessemer Converter. As structure [805] incorporated within it a flue, it is possible that it was either associated with the Bessemer Converter or at least the refining processes connected to the Bessemer Converter. The available plans reveal that the area within which Trench 9 was excavated was stratigraphically complex. Hughes' (2000) plan (Figure 6) indicates that Trench 9 was positioned directly over a small collection of four furnaces. The plan also shows that these furnaces belonged to a large building, whose name is not indicated,

inside which nine other furnaces are located, all situated along the northeast wall. The 1939 plan (Figure 8) indicates that a Furnace House/Pickling House was situated directly in line with Trench 9. The position of these furnaces seems to suggest that they were associated with the No 2 Rolling Mill nearby. It is possible that the reverberatory furnace bases, as represented by contexts [903] and [904], relate to this particular phase. By the time of the 1951 plan (Figure 10), the buildings within this area were dedicated to the processing of lead, and it is indicated that Trench 9 was situated above a lead rolling mill and a factory in which lead pipes were being manufactured. It is difficult to tie in any of the archaeological remains uncovered within Trench 9 with this later phase.

4.1.10 **Trenches 10–12**

4.1.11 On the 1951 plan (Figure 10), Trench 10 is indicated as being positioned directly over the Plate Mill. Moreover, according to the 1939 plan (Figure 8), Trench 10 transected the northwest wall of the No 1 Rolling Mill shed, while on the 1945 plan (Figure 9) the north-eastern edge of the trench is shown as overlying a structure labelled 'Pool', whose precise purpose remains unknown, but was possibly used for quenching. Water is also an important agent in the process of granulation, where melted metal (in this case copper) would be transferred directly from the furnace into a pool of water. In considering the pool's close proximity to a pair of furnaces, it may be also be suggested that this pool formed part of such an operation. It is possible that concrete floor [1013] formed the base of this this pool. However, considering their positions it seems more likely that concrete floors [1005] and [1006], situated towards the centre of the trench, were associated with the No 1 Rolling Mill shed. On Hughes' (2000) plan (Figure 6), the centre of Trench 10 is indicated as transecting the eastern wall of the Hammer House, although the archaeological evidence within the trench failed to marry up with this plan. The Hammer House is also shown as occupying this area on the 1926 (Figure 7). According to the 1939 plan (Figure 8), Trench 11 was situated directly within the confines of the No 1 Rolling Mill shed. More specifically, it was located towards the building's southern end. RSJ supports [1108] match well with the shed's known construction, which is visible on historic photographs of this area of the copperworks. Much like Trench 10, Trench 11 is also shown as transecting the Hammer House on Hughes' (2000) plan (Figure 6) and the 1926 plan (Figure 7). Finally, with regards to Trench 12, no mapping evidence is currently available that corroborates its position in relation to the copperwork's structures.

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6 Appendices

6.1 Appendix I: Figures

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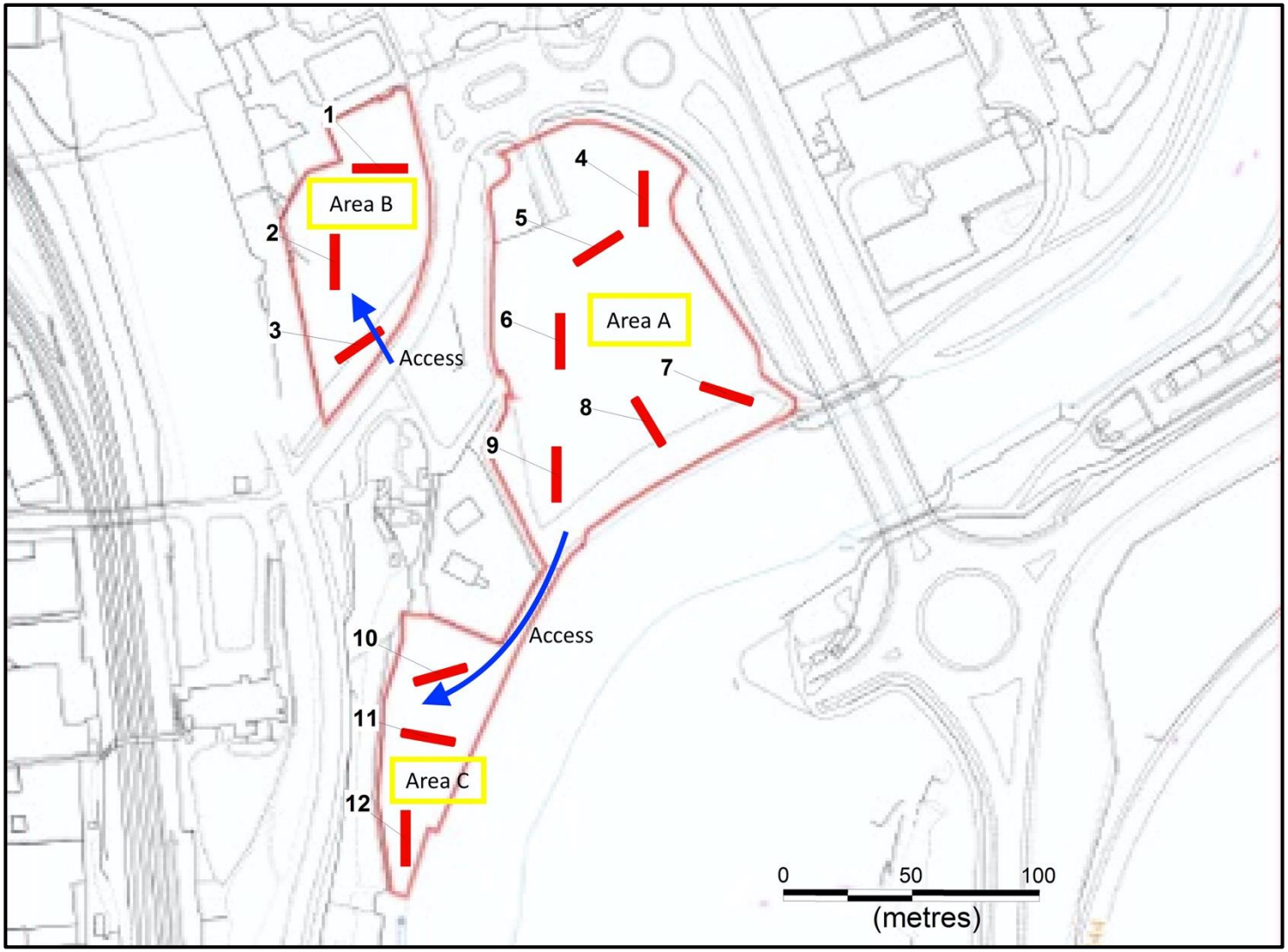

Figure 1. Plan showing location of Areas A–C and Trenches 1–12

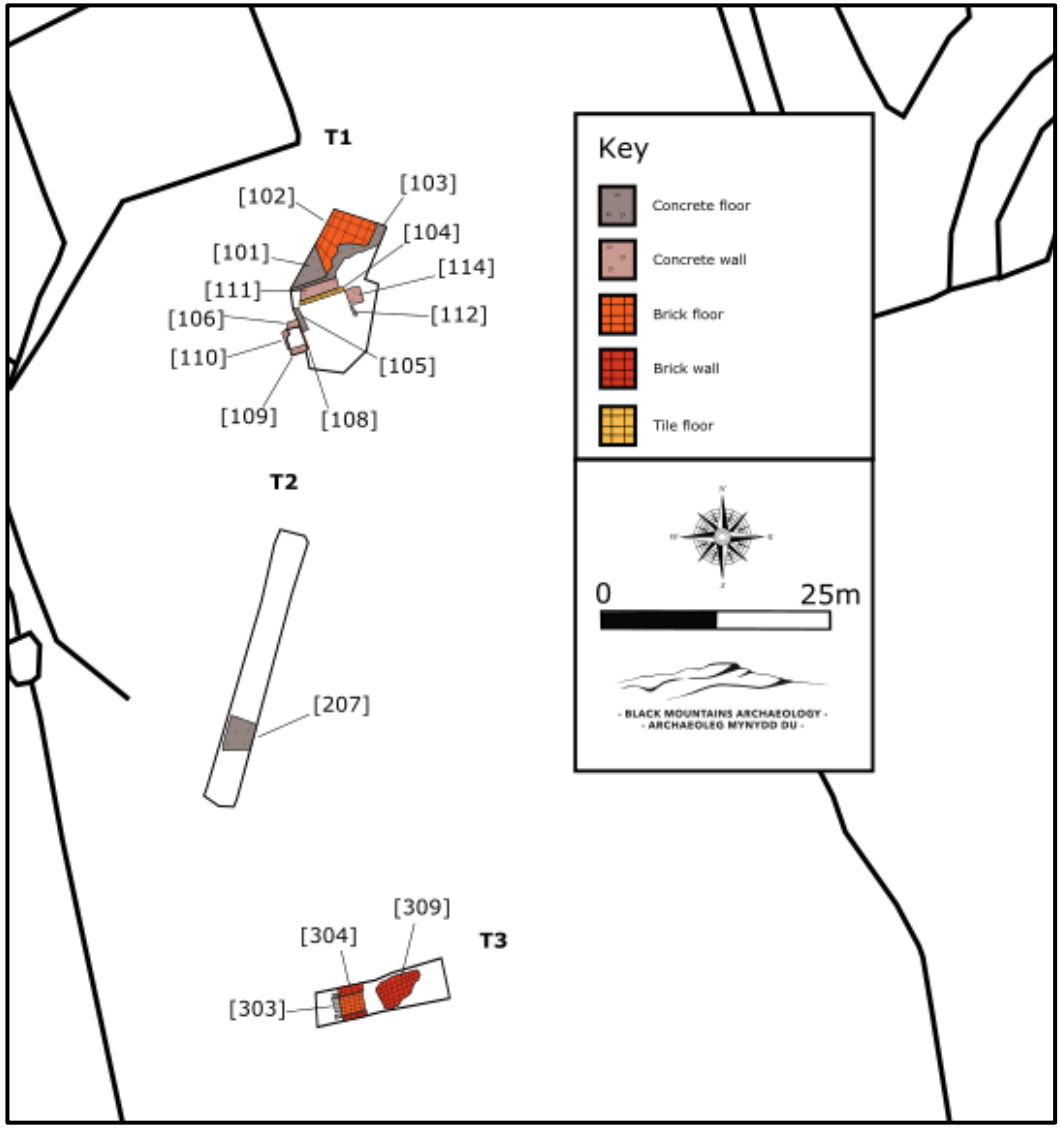

Figure 2. Plan of Trenches 1–3 in Area B

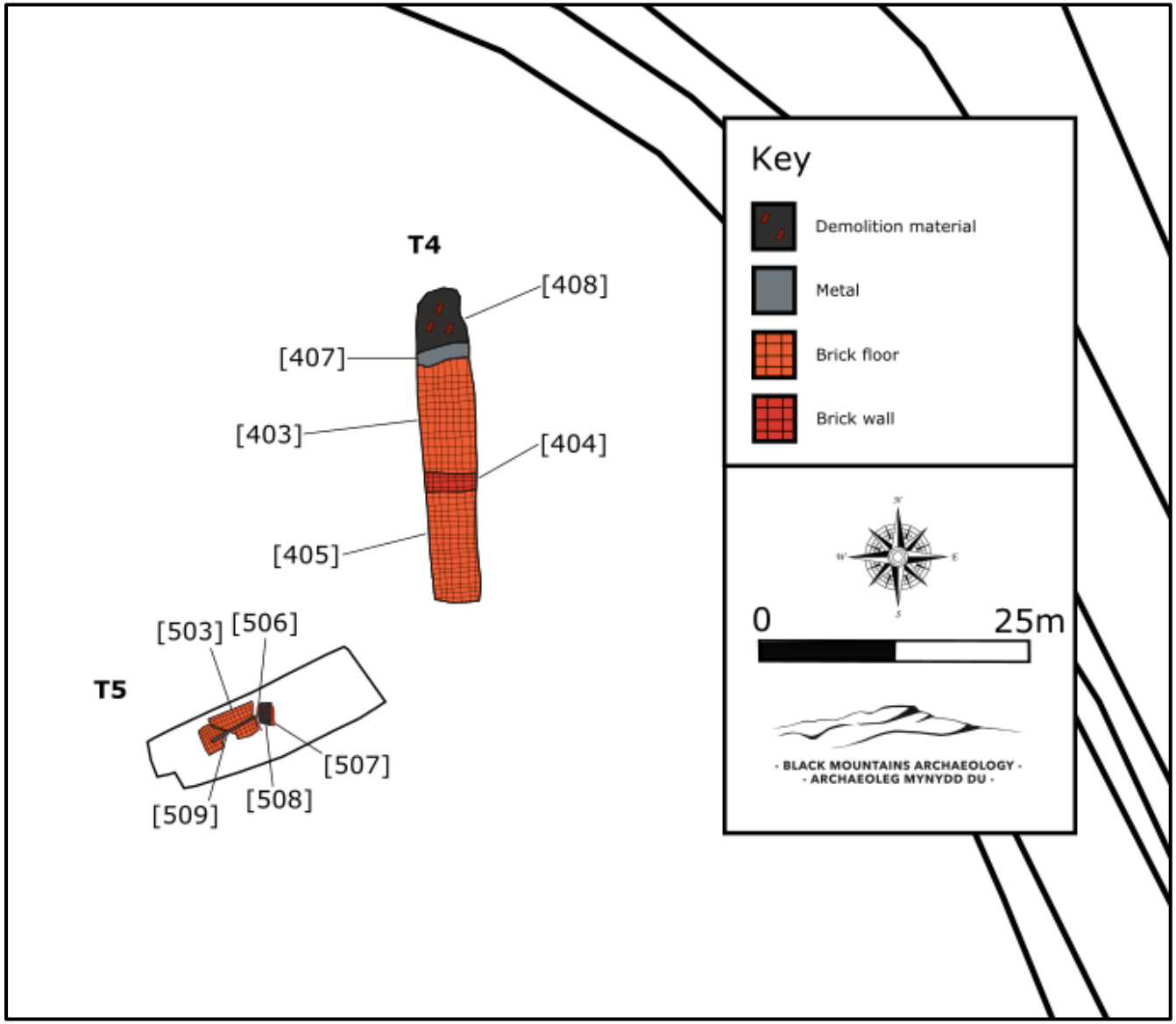

Figure 3. Plan of Trenches 4 and 5 in Area A

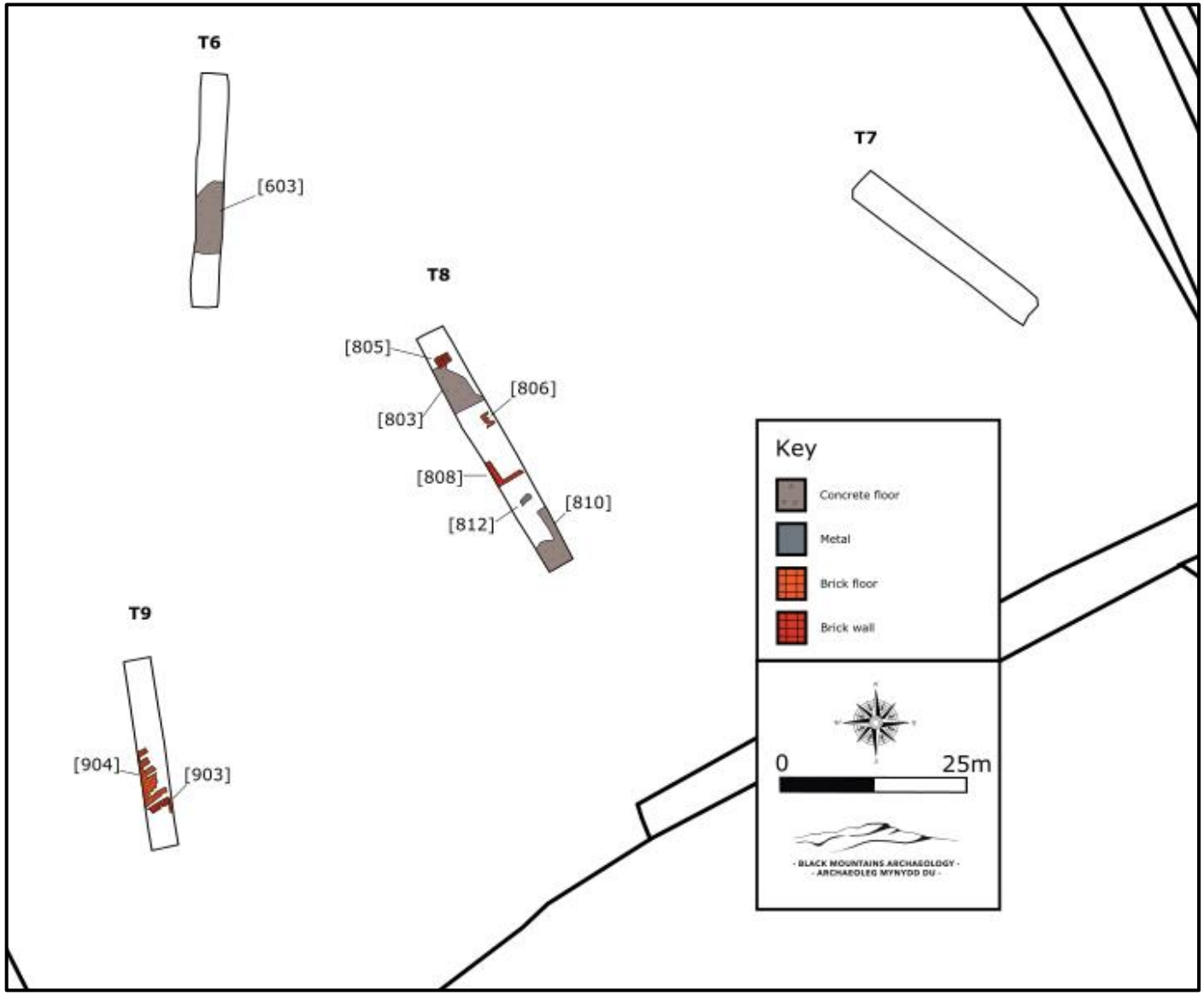

Figure 4. Plan of Trenches 6–9 in Area A

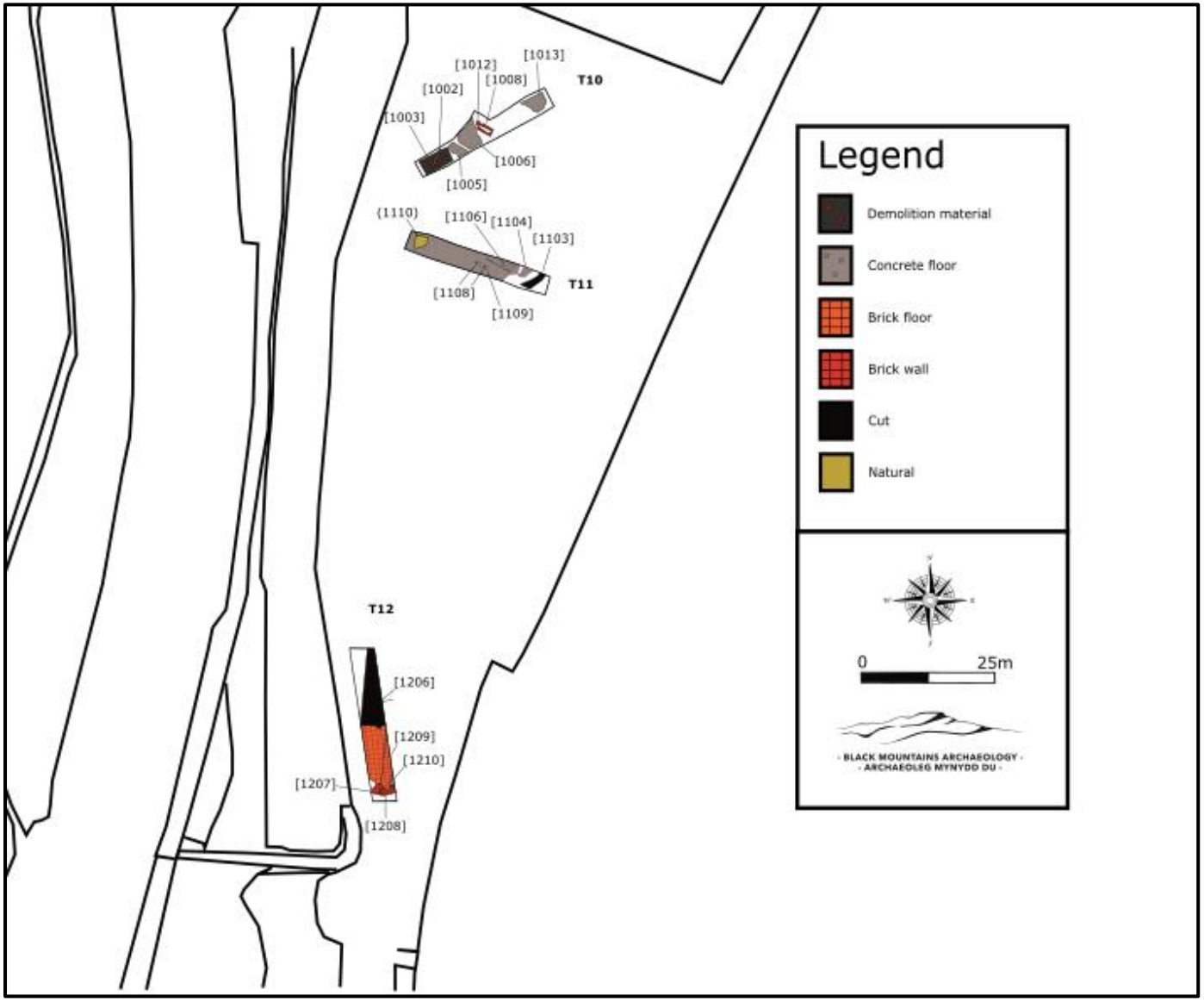

Figure 5. Plan of Trenches 10–12 in Area C

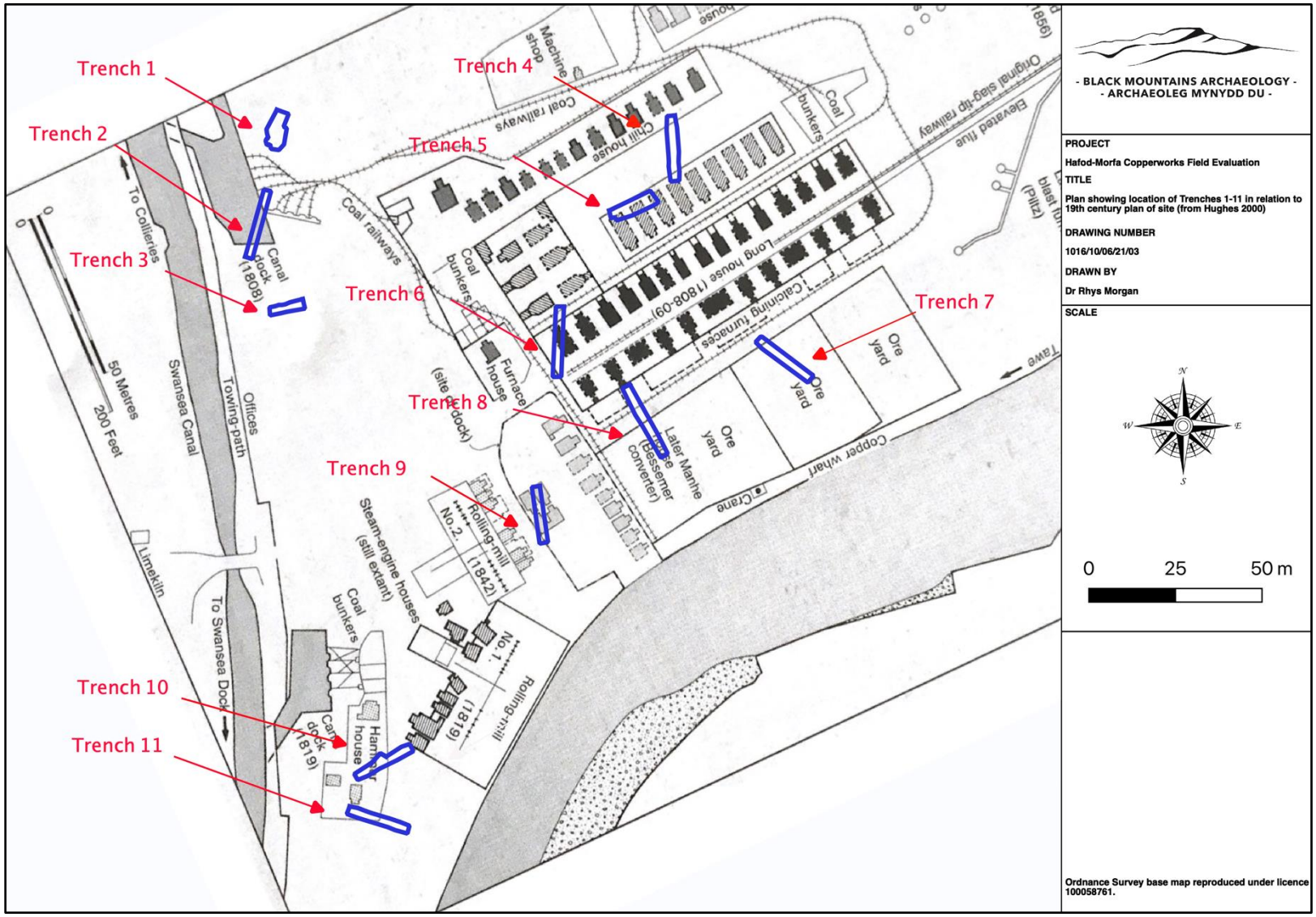

Figure 6. Position of Trenches 1–11 in relation to a speculative plan of the Morfa Copperworks as it would have appeared in the 19th century (from Hughes 2000) (Reproduced with kind permission of RCAHMW)

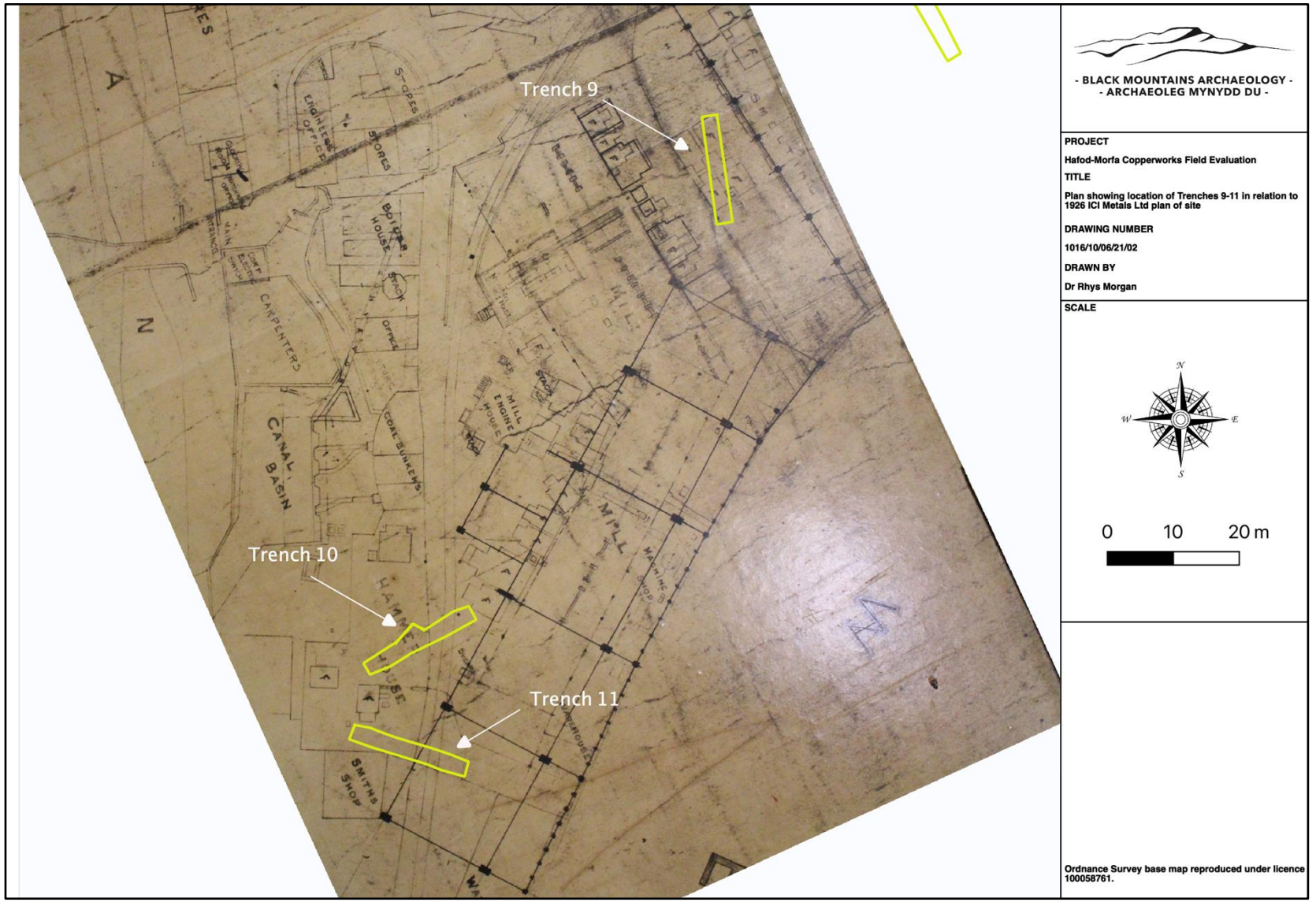

Figure 7. Position of Trenches 9–11 in relation to a c 1926 plan of the Hafod-Morfa Copperworks by ICI Metals Ltd, © City and County of Swansea

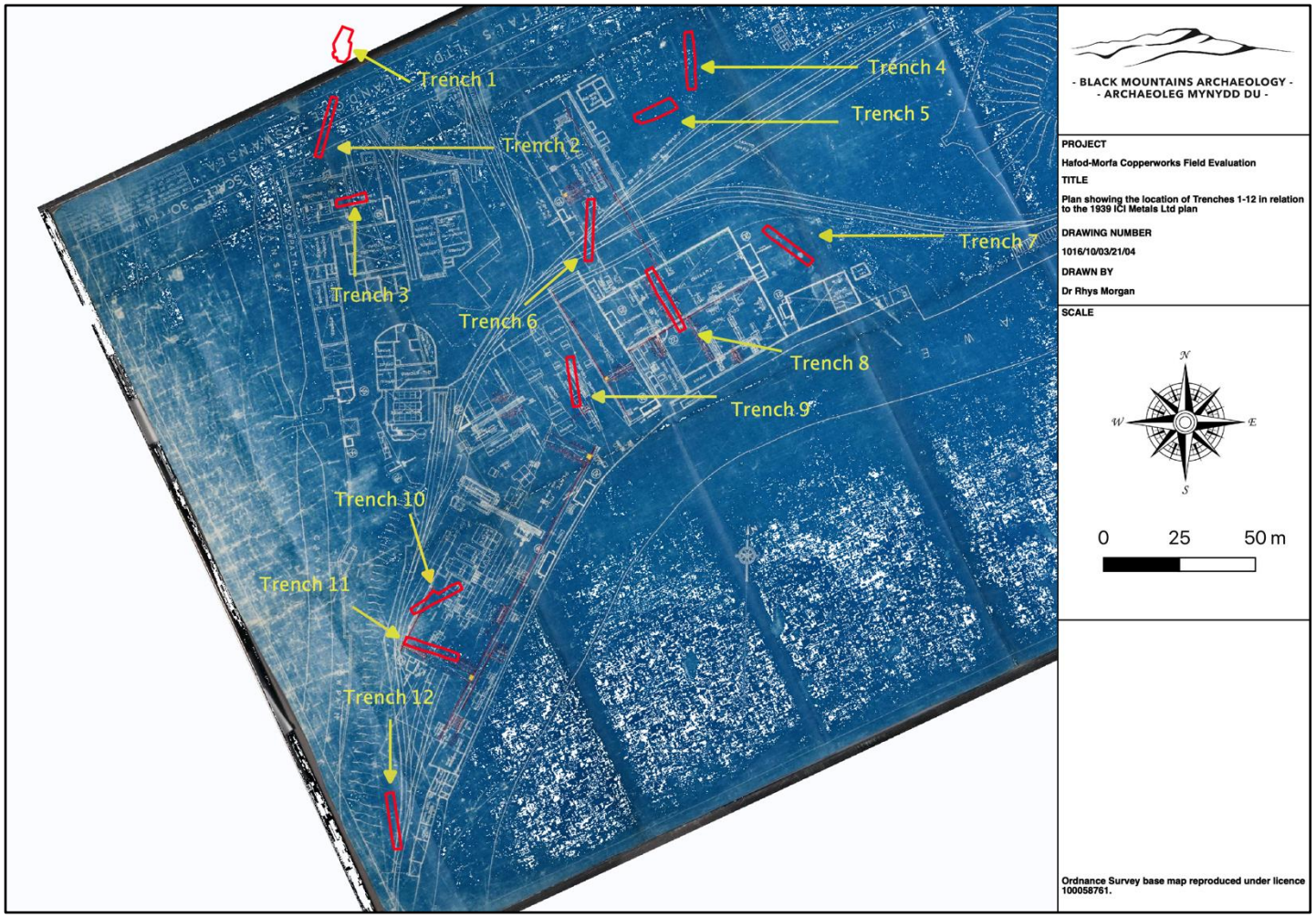

Figure 8, Position of Trench 1–12 in relation to a 1939 plan of the Hafod-Morfa Copperworks by ICI Metals Ltd, © National Museum Wales

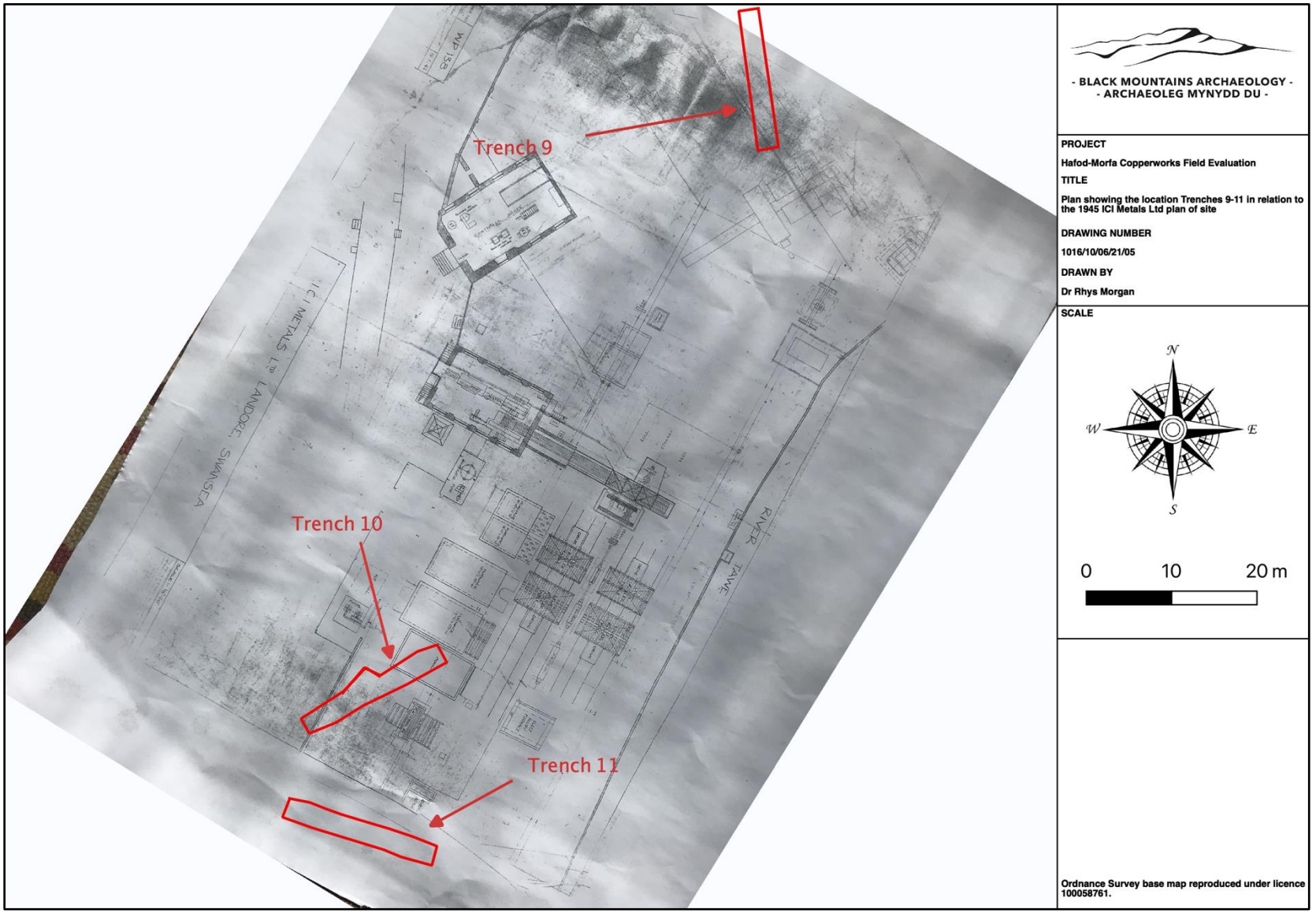

Figure 9. Position of Trench 9–11 in relation to a 1945 plan of the Hafod-Morfa Copperworks by ICI Metals Ltd, © City and County of Swansea

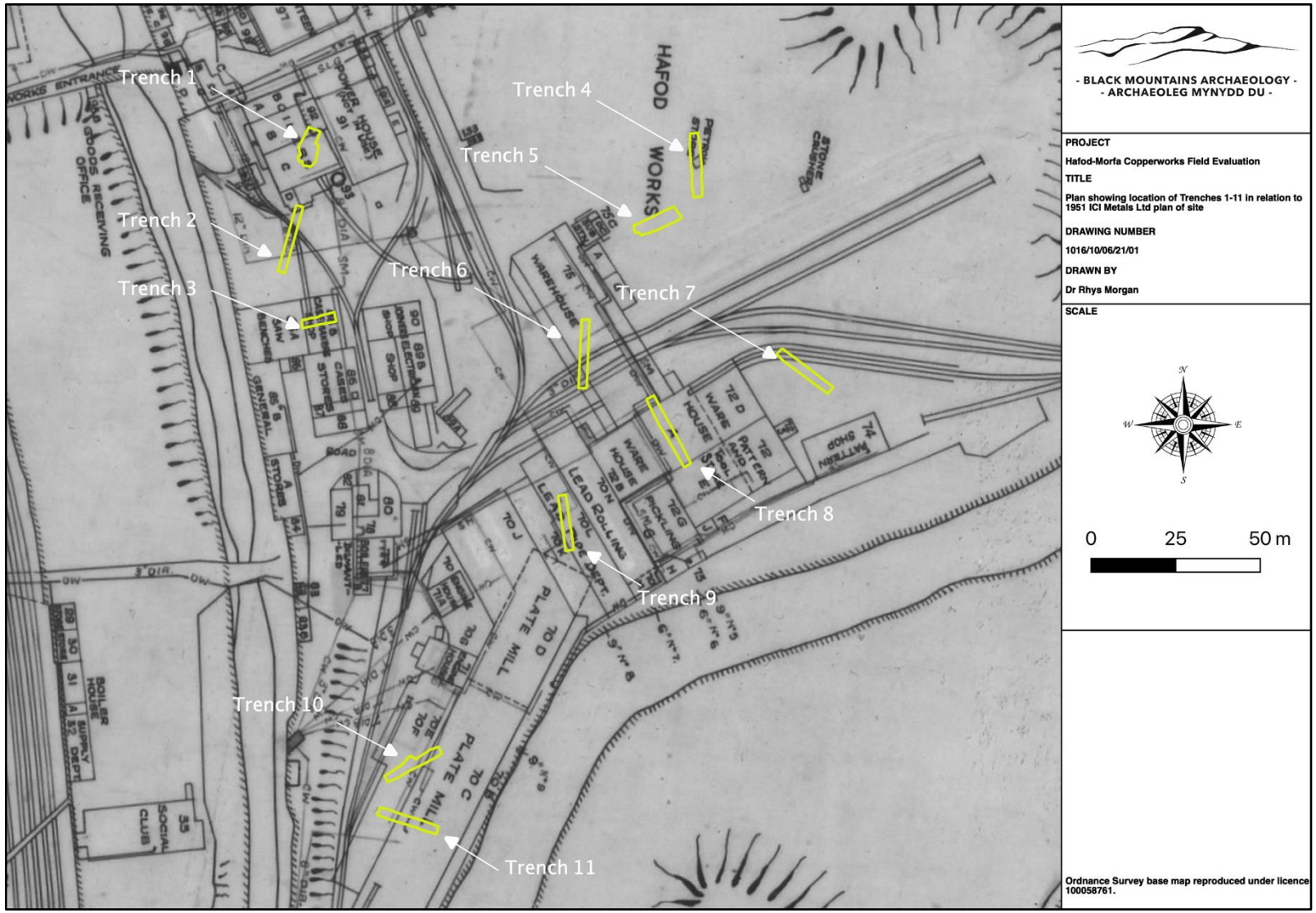

Figure 10. Position of Trench 1–11 in relation to a 1951 plan of the Hafod-Morfa Copperworks by ICI Metals Ltd (from photograph of original plan kindly provided by Swansea Museum Collections Centre)

6.2 Appendix II: Plates

Plate 1. Concrete [101], tiled floor [102] and concrete plinth [104] in Trench 1 (view west)

Plate 2. Tiled Floor [102] in Trench 1 (view northeast)

Plate 3. Floors [101] and [102], plinth [104] and walls [108] and [110] in Trench 1 (view north)

Plate 4. Wall [109] and concrete structure [115] in Trench 1 (view northwest)

Plate 5. Concrete slab [117], platform [118] and wall [110], forming possible coal chute in Trench 1 (view west)

Plate 6. Concrete floor [207] in Trench 2 (view northeast)

Plate 7. Wall [205] in Trench 2 (view east)

Plate 8. Possible stoke hole [304] in Trench 3 (view east)

Plate 9. Culvert [309], walls [307], [310], [311] and [312] and compacted deposit (308) in Trench 3 (view east)

Plate 10. View of interior of culvert [309] in Trench 3

Plate 11. General view of Trench 4 showing floors [405] and [403] (view north)

Plate 12. Floors [503], [504], [505], [506] and [507] in Trench 5 (view northwest)

Plate 13. Walls [506] and [507] with deep rubble deposits (508) and (511) in Trench 5 (view northwest)

Plate 14. General view of Trench 6 showing surface [603] (view north)

Plate 15. Demolition deposit (802) in southwest-facing section of Trench 7

Plate 16. Brick structure [805] in Trench 8 (view northwest)

Plate 17. Brick walling [806] in Trench 8 (view northeast)

Plate 18. Concrete surface [810], metal plate [812] and brick flooring [813] in Trench 9 (view northwest)

Plate 19. Remains of reverberatory furnace [902] and [903] in Trench 9 (view west)

Plate 20. Remains of reverberatory furnace [903] in east-facing section Trench 9

Plate 21. Base of reverberatory furnace [904] in Trench 9 (view west)

Plate 22. Base of reverberatory furnace [904] in Trench 9 (view west)

Plate 23. Inspection chamber [1008] in Trench 10 (view east)

Plate 24. General view of Trench 10 (view west)

Plate 25. General view of Trench 11 (view west)

Plate 26. Cut [1206] and fill (1204) in Trench 12 (view north)

Plate 27. Southern end of Trench 12 showing layer (1207) and brick structure [1208] (view north)

6.3 Appendix III: Context Inventory

Trench 1

Trench 1 measured approximately 20m long x 2m wide with a depth exceeding 2m in an area considered safe to work, with the width of the trench also extended to allow scrutiny of archaeological remains. The level at the top of Trench 1 was 15.36mOD, while the level at its base was 13.36mOD.

Context	Type	Depth	Description	Period
100	Deposit	0–0.1m	Organic topsoil.	Modern
101	Structure	1m	Concrete floor, possible machine base. Abutted by (103).	Modern/post-medieval
102	Structure		Floor composed of 6-inch ceramic, red quarry tiles. Possibly overlying [105].	Modern/post-medieval
103	Deposit		Deposit of concrete abutting [101]. Possibly overlying [105].	Modern/post-medieval
104	Structure		Small concrete plinth formed of a single line of red quarry tiles.	Modern/post-medieval
105	Structure		Concrete slab, possibly overlying [102] and (103). Overlies [106].	Modern/post-medieval
106	Structure		Wall composed of concrete blocks. Underlies [105]. Abutted by (108).	Modern/post-medieval

107	Deposit		Brick and stone rubble with fragments of concrete. Abuts [106] and [108].	Modern/post-medieval
108	Structure		Brick wall. With [109] and [110], possibly formed a cell-like structure. Abutted by (107). Abuts [109] and [110].	Modern/post-medieval
109			Wall composed of concrete blocks. With [108] and [110], possibly formed a cell-like structure. Underlies (116). Abutted by [108].	Modern/post-medieval
110	Structure		Wall composed of concrete blocks. With [108] and [109], possibly formed a cell-like structure. Abutted by [108].	Modern/post-medieval
111	Structure		Concrete side wall of [115].	Modern/post-medieval
112	Structure		Concrete side wall of [115].	Modern/post-medieval
113	Structure		Concrete base of [115].	Modern/post-medieval
114	Structure		Concrete rear wall of [115].	Modern/post-medieval
115	Structure		Structural feature of unknown purpose.	Modern/post-medieval

			Formed of walls [111], [112] and [114] and concrete base [113]	
116	Deposit		Concrete, brick and mortar rubble overlying [109].	Modern/post-medieval
117	Structure		Concrete slab overlying [118].	Modern/post-medieval
118	Structure		Possible coal chute. Concrete block platform/step with remains of a brick course overlying its upper surface. Underlies [117].	Modern/post-medieval

Trench 2

Trench 2 was excavated in the central area of area B and was 19m long x 2m wide with a depth varying between 1–1.5m. The trench was excavated from N–S with the first archaeological remains being revealed at 2.8m in from the trench's S edge. The level at the top of Trench 2 was 13.91mOD, while the level at its base was 12.41mOD.

Context	Type	Depth	Description	Period
201	Deposit	0.1m	Very dark grey mixture of organic substance, coal dust and industrial waste. Overlies (202), (204) and [207].	Modern
202	Deposit		Reddish brown clay. Underlies (201) and (204).	Natural
203	Deposit		Demolition rubble. Appears	Modern/post-medieval

			to merge into (201) and (202).	
204	Deposit		Building debris and industrial waste covering whole of trench. Underlies (201). Overlies (202).	Modern/post-medieval
205	Structure		Stone wall or foundation. 3 courses of stone visible. Set within cut [206].	Modern/post-medieval
206	Cut		Cut for wall/foundation [205]. Cuts (202).	Modern/post-medieval
207	Structure		Concrete slab/floor. Underlies (201).	Modern/post-medieval

Trench 3

Trench 3 was excavated close to the access point of Area B and, as with Trench 1, had an exceptional amount of archaeological remains. It was aligned NE/SW. Th trench measured 20m long x 2m wide x 1.2m deep. The level at the top of Trench 3 was 14.05mOD, while the level at its base was 12. 85mOD.

Context	Type	Depth	Description	Period
301	Deposit	0–0.05m	Thick concrete/slag surface layer. Overlies (302).	Modern/post-medieval
302	Deposit	0.05–0.4m	Mixed demolition deposit. Underlies (301).	Modern/post-medieval
303	Structure		Wall composed of 4–5 courses of fire bricks, with side walls two courses	

			wide and the same in depth. Topped with row of 7 coping stones.	
304	Structure		Possible stoke hole.	Modern/post-medieval
305	Deposit		Dark grey gritty slag. Underlies [306].	Modern/post-medieval
306	Structure		Compressed slag coping stones overlying a double course of brick walling.	Modern/post-medieval
307	Structure		Wall composed of fire bricks. Overlies (308). Abuts [310].	Modern/post-medieval
308	Deposit		Deposit of hard compressed mortar and crushed brick. Underlies [307]. Overlies [309]. Abuts [310].	Modern/post-medieval
309	Structure		Double-skinned brick-built culvert. Wall [311] runs alongside it. Likely associated with walling [312]. Underlies (308).	Modern/post-medieval
310	Structure		Brick walling. Abutted by [307] and (308).	Modern/post-medieval
311	Structure		Substantial brick-built supporting wall.	Modern/post-medieval

			Runs alongside culvert [309].	
312	Structure		Double row of bricks. Likely associated with culvert [309].	Modern/post-medieval

Trench 4

Trench 4, aligned N/S, was situated in the NW area of Area A. It was 19m long x 2m wide 2.8m deep to the first archaeological layer. The trench was too deep and unsafe to undertake any close examination or recording. The level at the top of the trench was 10mOD, while the level at its base was 7.2mOD.

Context	Type	Depth	Description	Period
401	Deposit	0–0.4m	Tarmac shavings. Overlies (402).	Modern
402	Deposit	0.4–0.6m	Unstable demolition rubble. Underlies (401). Overlies [403], [404] and [405].	Modern/post-medieval
403	Structure		Brick floor surface. Underlies (402). Cut by [406].	Modern/post-medieval
404	Structure		Brick wall. Underlies (402).	Modern/post-medieval
405	Structure		Brick floor surface. Underlies (402).	Modern/post-medieval
406	Cut		Cut from metal pipe [407]. Cuts [403]. Contains (409).	Modern/post-medieval
407	Object		Metal pipe within cut [406]. Surrounded by (409).	Modern/post-medieval

408	Deposit	4m+	Large deposit of rubble on N end of trench.	Modern/post-medieval
409	Deposit		Stone chipping within cut [406]. Surround pipe [407].	Modern/post-medieval

Trench 5

Trench 5 was aligned SW/NE and was located in the N/central area of Area A. The trench was 20m long x 2m wide x 2m deep to the first archaeological layer. The level at the top of the trench was 9.54mOD, while the level at its base was 7.54mOD.

Context	Type	Depth	Description	Period
501	Deposit	0–0.4m	Tarmac shavings. Overlies (502).	Modern
502	Deposit	0.4–1.6m	Demolition rubble. Underlies (501). Overlies [503], [506] and [507].	Modern/post-medieval
503	Structure		Brick floor surface. Underlies (502). Overlies [504].	Modern/post-medieval
504	Structure		Brick floor surface. Underlies [503].	Modern/post-medieval
505	Structure		Floor surface. Underlies [503].	Modern/post-medieval
506	Structure		Curving brick wall. Underlies (502). Abutted by (508). Contains pipe [509].	Modern/post-medieval
507	Structure		Curving brick wall. Underlies (502). Abutted by (508).	Modern/post-medieval

508	Deposit		Demolition rubble. Abuts [506] and [507].	Modern/post-medieval
509	Object		Cast iron pipe feeding through wall [506].	Modern/post-medieval
510	Structure		Large stone slab of unknown purpose.	Modern/post-medieval
511	Deposit	4m+	Demolition rubble. Fills pits [512].	Modern/post-medieval
512	Cut		Cut of pit. Situated in between walls [506] and [507]. Filled with (511).	Modern/post-medieval

Trench 6

Trench 6 was located towards the centre of Area A, was aligned N/S and was 19m long x 2.5m wide with a maximum depth of 2m. The level at the top of the trench was 7.95mOD, while the level at its base was 5.95mOD.

Context	Type	Depth	Description	Period
601	Deposit	0–0.7m	Tarmac shavings. Overlies (602).	Modern
602	Deposit	0.3m+	Yellowy brown clay with an abundant amount of demolition debris. Underlies (601).	Modern/post-medieval
603	Structure		Concrete floor towards S end of trench. Underlies (602). Truncated by [604].	Modern/post-medieval

604	Structure	2m	Possible fragmented floor. Truncates [603].	Modern/post-medieval

Trench 7

Trench 7 was aligned NW/SE in the SE corner of Area A and measured 20m long x 2.5m wide x 2m deep, with a 3.7–4m deep sondage to the natural subsoil. The level at the top of the trench was 8.34mOD, while the level at its base was 6.34mOD.

Context	Type	Depth	Description	Period
701	Deposit	0–0.4m	Tarmac shavings. Overlies (702).	Modern
702	Deposit	0.4–0.5m	Pale brown clayey loam (702) with a vast amount of demolition debris. Underlies (701). Overlies (703).	Modern
703	Deposit		Dark grey clay-ash mix with large amounts of rubble throughout. Underlies (702). Overlies (704).	Modern
704	Deposit		Pale-brownish clay with a large amount of river cobbles. Underlies (703).	Natural

Trench 8

Trench 8 was aligned N/S in the central area to the S of the site and measured 22m x 2m x a depth of 1.2–1.4m. The level at the top of the trench was 8.22mOD, while the level at its base was 6.82mOD.

Context	Type	Depth	Description	Period
801	Deposit	0–0.2m	Compressed hardcore	Modern

			surface. Overlies (802).	
802	Deposit	1.2m+	Demolition rubble. Underlies (801). Overlies [803].	Modern/post-medieval
803	Structure		Concrete floor. Underlies (802).	Modern/post-medieval
804	Structure		Concrete structure of unknown purpose. Abutted by [805].	Modern/post-medieval
805	Structure		Brick structure. Substantially built with a central rectangular open area (possibly a flue) and a wall that steps out on its N side. Abuts [804].	Modern/post-medieval
806	Structure		Brick floor.	Modern/post-medieval
807	Structure		Demolition rubble with frequent asbestos inclusions.	Modern/post-medieval
808	Structure		Small stretch of brick wall.	Modern/post-medieval
809	Deposit		Rubble with frequent asbestos inclusions.	Modern/post-medieval
810	Structure		Concrete floor.	Modern/post-medieval
811	Deposit		Re-deposited natural	Modern/post-medieval

812	Structure		Metal plate, apparently *in situ*. Possibly overlying [813].	Modern/post-medieval
813	Structure		Brick floor. Possibly underlying [812].	Modern/post-medieval

Trench 9

Trench 9 was aligned N/S, was located in the SW corner of Area A and measured 12m long x 2m wide x 1.2m deep. The level at the top of the trench was 6.59mOD, while the level at its base was 5.39mOD.

Context	Type	Depth	Description	Period
901	Deposit	0–0.5m	Tarmac shavings.	Modern
902	Deposit	0.3–0.5m	Demolition debris and industrial waste. Underlies (901).	Modern/post-medieval
903	Structure		Brick elements of a possibly reverberatory furnace. Observed within deposit (902).	Modern/post-medieval
904	Structure		Base of reverberatory furnace comprising a brick floor.	Modern/post-medieval

Trench 10

Trench 10 was aligned NE/SW in the NW of Area C and measured 20m long x 2m wide x a maximum of 0.4–0.5m deep. The level at the top of the trench was 7.19mOD, while the level at its base was 6.69mOD.

Context	Type	Depth	Description	Period
1001	Deposit	0–0.1m	Stone chippings and tarmac	Modern

			shavings. Overlies (1003).	
1002	Object		Concrete pipe. Contained by [1004].	Modern/post-medieval
1003	Deposit	0.3–0.4m	Mixed demolition deposit, mostly comprising brick rubble. Underlies (1001).	Modern/post-medieval
1004	Cut		Service trench for concrete pipe [1002].	Modern/post-medieval
1005	Structure		Remnants of concrete floor.	Modern/post-medieval
1006	Structure		Remnants of concrete floor.	Modern/post-medieval
1008	Structure		Brick filled inspection chamber.	Modern/post-medieval
1009	Structure		Red brick exterior to [1008].	Modern/post-medieval
1010	Structure		Remnants of interior white brick lining within [1008].	Modern/post-medieval
1011	Structure		Remnants of interior white brick lining within [1008].	Modern/post-medieval
1012	Structure		Remnants of interior white brick lining within [1008].	Modern/post-medieval
1013	Structure		Remnants of concrete floor.	Modern/post-medieval

Trench 11

Trench 11 was aligned E/W just N of the centre of Area C. The trench was 20m long x 2m wide x 0.4m deep but was 0.8m deep at the E end. The level at the top of the trench was 7.2mOD, while the level at its base was 6.4mOD.

Context	Type	Depth	Description	Period
1101	Deposit	0–0.1m	Stone chippings and tarmac shavings. Overlies (1102).	Modern
1102	Deposit	0.3–0.4m	Mixed demolition material. Underlies (1101).	Modern/post-medieval
1103	Cut		Pipe trench. Contains [1111].	Modern/post-medieval
1104	Structure		Remnants of concrete floor.	Modern/post-medieval
1105	Structure		Remnants of concrete floor.	Modern/post-medieval
1106	Structure		Remnants of concrete floor. Appears to contain or is at least overlain by [1107].	Modern/post-medieval
1107	Object		Cable ducting observed within [1106].	Modern
1108	Object		2 RSJ struts. Abuts [1109].	Modern/post-medieval
1109	Structure		Concrete floor. Abutted by [1108]. Overlies (1110).	Modern/post-medieval
1110	Deposit		River silt with an abundance of river cobbles. Underlies [1109].	Natural

1111	Structure		Drain within [1103].	Modern/post-medieval

Trench 12

Trench 12 was situated on the S edge of Area C and was aligned N/S. The trench was 20m long x 2m wide x a maximum of 2.5m deep. The level at the top of the trench was 7mOD, while the level at its base was 4.5mOD.

Context	Type	Depth	Description	Period
1201	Deposit	0–0.25m	Dark brown sandy silty topsoil. Contains an abundance of concrete fragments, grit, red sand and slag. Overlies (1202).	Modern
1202	Deposit	0.25–0.75m	Gritty black slag and industrial waste. Underlies (1201). Overlies (1203).	Modern/post-medieval
1203	Deposit		Compacted grey ash and slag. Underlies (1202). Contained by [1206].	Modern/post-medieval
1204	Deposit		Red gritty slag deposit. Underlies (1202).	Modern/post-medieval
1205	Deposit		River silt with an abundance of river cobbles.	Natural
1206	Cut		Cut containing deposit (1203). Unknown purpose and extent.	Modern/post-medieval

1207	Structure		Layer of bricks and mortar. Abuts [1208].	Modern/post-medieval
1208	Structure		Brick structure. Abutted by [1207].	Modern/post-medieval
1209	Structure		Possible furnace base. Underlies and surrounded by (1210).	Modern/post-medieval
1210	Structure		Greyish brown soot, overlying and surrounding [1209].	Modern/post-medieval

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