

Cwm Rheidol Lead Mine, Ystumtuen - Adit 9 and Lagoon Works (Phase 1)

Archaeological Watching Brief



By

Richard Scott Jones (BA, MA, MCIfA)

April 2022

HRS Wales Report No: 242

ARCHAEOLOGICAL WATCHING BRIEF

Cwm Rheidol Lead Mine, Ystumtuen - Adit 9 and Lagoon Works (Phase 1)

By Richard Scott Jones (BA Hons, MA, MCIfA)

Prepared for:

Walters UK Ltd.

On behalf of: The Coal Authority

Date: April 2022

HRSW Report No: 242



Egwyl, Llwyn-y-groes, Tregaron, Ceredigion SY25 6QE Tel: 01570 493759 Fax: 08712 428171 E-mail: richard@hrswales.co.uk

Contents

i) List of Illustrations and Photo plates	
Non Technical Summary	Page i
1. Introduction	Page 02
2. Aims & Objectives	Page 15
3. Methodology	Page 15
4. Results of Watching Brief	Page 16
5. Conclusions & Recommendations	Page 18
6. Acknowledgements	Page 18
7. Bibliography	Page 19

Appendix I: Figures

Appendix II: Photo plates

Appendix III: Archive Cover Sheet

Copyright Notice:

Heritage Recording Services Wales retain copyright of this report under the Copyright, Designs and Patents Act, 1988, and have granted a licence to the Coal Authority, Natural Resources Wales and Walters UK Ltd. Ltd to use and reproduce the material contained within.

The Ordnance Survey have granted Heritage Recording Services Wales a Copyright Licence (*No. 100052823*) to reproduce map information; Copyright remains otherwise with the Ordnance Survey.

i) List of Illustrations

Figures

- Fig 01: Location map (OS 1:50,000 Landranger)
- Fig 02: Location map (OS 1:25,000 Explorer)
- Fig 03: OS Aerial Photo
- Fig 04: Adit No.9 and lagoon works.
- Fig 05: Proposed lagoon scouring works.
- Fig 06: Proposed Adit 9 Blow-out works.
- Fig 07: Proposed Adit 9 Blow-out Channel and pipelines.
- Fig 08: Proposed Adit 9 Blow-out drainage details.
- Fig 09: OS First Edition Map (1886).
- Fig 10: OS Second Edition Map (1906)
- Fig 11: OS 1953 Edition Map.
- Fig 12: Finds Illustrations 19th Century finds.

Photo Plates

- Plates 01 06: Adit No.9 works
- Plates 07 10: Adit No.9 works
- Plates 11 12: Area of existing lagoon before groundwork.
- Plates 13 16: Working shots in lagoon.
- Plates 17 22: Working shots in lagoon.
- Plates 23 24: Recovered finds.
- Plates 25 26: Recovered finds.
- Plates 27 28: Recovered finds.
- Plates 29 36: Recovered finds.

Non Technical Summary

The following report presents the results of an Archaeological Watching Brief during the Phase I mine Blowout prevention works undertaken by Walters UK Ltd. on behalf of Natural Resources Wales for the upgrading and extension to the existing lagoon and the relocating of the existing discharge point pipeline at Adit No.9 at the Cwm Rheidol Lead Mine, Ystumtuen, Ceredigion (centered on OS grid reference SN 7297 7821), for Blow-out Prevention Works.

The specific objective of this work were to uundertake a watching brief during all penetrative groundwork for the upgrading and extension to the existing lagoon and the relocating of the existing discharge point pipeline at Adit No.9

In summary, the archaeological watching brief during the Phase I mine Blow-out prevention works at the Cwm Rheidol Lead Mine, did not expose any significant historic mining features in either the area of the Adit No.9 portal or the proposed new lagoon area. However, a small number of finds were recovered from the groundwork, and of special significance were two 19th Century finds, including one cast iron mine wagon wheel and the remains of one historic timber complete with wrought iron brackets that may once have been incorporated into a former level adit somewhere on the site. The discovery of these significant finds clearly confirms that there are significant early mining remains buried within the mining spoil/scree at the site. As such it is recommended that any future proposed groundworks within and within the close vicinity of the Cwm Rheidol Metal Mine are supervised under archaeological watching brief conditions.

Crynodeb Annhechnegol

Mae'r adroddiad a ganlyn yn cyflwyno canlyniadau Briff Gwylio Archeolegol yn ystod gwaith atal Chwythu Allan Gwaith Glo Cam I a wnaed gan Walters UK Ltd. ar ran Cyfoeth Naturiol Cymru ar gyfer uwchraddio ac ymestyn y morlyn presennol ac adleoli'r pwynt gollwng presennol. piblinell yn Geuffordd Rhif 9 ym Mwynglawdd Plwm Cwm Rheidol, Ystumtuen, Ceredigion (yn ganolog ar gyfeirnod grid OS SN 7297 7821), ar gyfer Gwaith Atal Chwythu Allan.

Amcan penodol y gwaith hwn oedd cynnal brîff gwylio yn ystod yr holl waith tir treiddiol ar gyfer uwchraddio ac ymestyn y morlyn presennol ac ail-leoli'r bibell gollwng bresennol yn Nhyffordd Rhif 9.

I grynhoi, ni ddatgelodd y briff gwylio archeolegol yn ystod gwaith atal Chwythu Allan Mwynglawdd Cam I Mwynglawdd Plwm Cwm Rheidol unrhyw nodweddion mwyngloddio hanesyddol arwyddocaol yn ardal porth mynedfa Rhif 9 nac yn ardal y morlyn newydd arfaethedig. Fodd bynnag, daethpwyd o hyd i nifer fach o ddarganfyddiadau o'r gwaith tir, ac o arwyddocâd arbennig oedd dau ddarganfyddiad o'r 19eg Ganrif, gan gynnwys un olwyn wagen mwynglawdd haearn bwrw ac olion un pren hanesyddol ynghyd â bracedi haearn gyr a allai fod wedi'u hymgorffori ar un adeg mewn un o'r rhain. cyn geuffordd lefel rhywle ar y safle. Mae darganfod y darganfyddiadau arwyddocaol hyn yn cadarnhau'n glir fod olion mwyngloddio cynnar sylweddol wedi eu claddu o fewn y rwbel mwyngloddio/sgrin ar y safle. Fel y cyfryw, argymhellir bod unrhyw waith tir arfaethedig yn y dyfodol o fewn ac o fewn cyffiniau Mwynglawdd Metel Cwm Rheidol yn cael eu goruchwylio dan amodau byr gwylio archaeolegol.

1 Introduction

- 1.1 The following report presents the results of an Archaeological Watching Brief during the Phase I mine Blow-out prevention works undertaken by Walters UK Ltd. on behalf of Natural Resources Wales for the upgrading and extension to the existing lagoon and the relocating of the existing discharge point pipeline at Adit No.9 at the Cwm Rheidol Lead Mine, Ystumtuen, Ceredigion (centered on OS grid reference SN 7297 7821), for Blow-out Prevention Works.
- 1.2 The specific objectives of this work were to:
 - Undertake a watching brief during all penetrative groundwork for the upgrading and extension to the existing lagoon and the relocating of the existing discharge point pipeline at Adit No.9
- 1.3 The Technical Appendices for this report contains the following information:
 Appendix I: Figures;
 Appendix II: Photographs
 Appendix III: Archive Cover Sheet

Site Location & Description (see Figures 1 - 4)

- 1.4 The Cwm Rheidol mining complex is 15km east of Aberystwyth, Ceredigion, and includes the mines of Ystumtuen, Penrhiw, Bwlchgwyn and Llwynteifi. The earliest definitive reference to mining in the area dates from 1698 at Ystumtuen, and over the following centuries the mines were developed and worked intermittently under numerous owners and various combinations. By the late 19th century these four mines were all connected underground, enabling the extensive workings to drain to the River Rheidol via adits No. 6 and No. 9, which emerge on the steep valley slopes at Cwm Rheidol. Here, a mill processed the ore to remove the waste rock before it was carried on an aerial ropeway to the Vale of Rheidol Railway on the opposite side of the valley, and then on to Aberystwyth.
- 1.5 Today the underground workings continue to drain from adits No.6 and No.9, both of which are highly acidic and contain significantly elevated concentrations of metals including zinc, lead and cadmium. These discharges are subsequently contributing to the River Rheidol failing European Water Framework Directive (WFD) standards for zinc and cadmium for 18km downstream of the mine to its tidal limit. The Rheidol catchment is impacted by many other abandoned metal mines and also fails WFD standards for zinc and cadmium upstream of Cwm Rheidol. The results of ecological impact assessments to date have been equivocal with fish population studies showing surprising tolerance of salmon to zinc concentrations in the Rheidol, which average more than ten times WFD standards in places.
- 1.6 The Cwm Rheidol Metal Mine is located within the Registered Historic Landscape (RHL) of Uplands Ceredigion and lies directly within the Historic Character Area (HCA) of the Rheidol Valley (HCA 131) but is linked by sub surface mining to the Rheidol Valley Woodland (HCA 55) and Ystumtuen (HCA 59). There are no designated scheduled or listed sites within the red line study area.

Background Information

- 1.7 In 2007 National Resources Wales (NRW) diverted a stream to prevent it flowing into a shaft, reducing the volume of contaminated discharge. This was followed in 2008 by the draining down of adit No. 9 to reduce the risk of a catastrophic mine-water blow-out, which has occurred periodically in the past. In 2009 NRW captured the discharges from both adits in pipes, preventing them from eroding the spoil tips and mobilising more metals. The pipes transfer the discharges to a pilot-scale Vertical Flow Pond (VFP) passive treatment system.
- 1.8 NRW commissioned the HERO Group at Newcastle University to carry out laboratory trials to assess the suitability of various substrates for the pilot VFP. These included ochre pellets (from coal minewater treatment residues) and paper waste, but the best results were obtained using mixtures of farm manure, woodchip and digested sewage sludge with crushed whelk shells or limestone. This combination successfully promoted microbial reduction of sulphate and precipitated metals as sulphides, but required "feeding" with methanol to sustain performance in the longer term. A similar mixture, with cockle shells, is being used in the pilot VFP treatment system, which has been in operation since September 2010. Removal rates of up to 99% have been achieved for zinc, lead and cadmium, although there is significant fluctuation in zinc removal, which averages ~60%.
- 1.9 NRW have periodically removed the build-up of ochre from the surface of the treatment media to maintain flow through the system. It may therefore be preferential to pre-treat the adit discharges to remove iron before they enter a full-scale VFP. NRW have calculated the size of a full-scale VFP required to treat the two discharges, and in 2014 commissioned CH2M Hill Ltd to assess the availability of land to construct such a treatment system as well as a pre-VFP ochre treatment pond. NRW are continuing to monitor the site to better understand the long-term performance and maintenance requirements of the VFP, and to reduce the risk of any future mine water blow-out.

Benefits of Remediation Works

- 1.10 Approximately 8 tonnes of harmful metals would be prevented from entering the River Rheidol each year.
 - The River Rheidol will be more likely to achieve Good Ecological Status, although there are other mining pressures on the catchment that will need to be addressed.
 - Reduced metal load to the Cardigan Bay Special Area of Conservation.
 - The stream diversion has reduced surface water ingress to the mines, reducing the volume of contaminated discharge.
 - The pipeline has reduced erosion and the mobilisation of metals from the spoil tips.
 - The pilot VFP will further our understanding of passive treatment for heavy metals removal.
- 1.11 In order to design a suitable treatment system NRW are seeking a methodology to compile a longer term metal mines remediation programme across Wales as a whole. The programme will identify potential annual progression of sites towards remediation over the next fifteen years, incorporating

checks at critical decision points to ensure only sites which are technically feasible and pass cost benefit assessments progress.

- 1.12 As a result of this remediation programme, a feasibility study of the Cwm Rheidol Metal Mine was undertaken in early 2019 and the Cultural Heritage and Archaeology of the mine played an important role in the decision and design making processes for the proposed blow-out prevention works.
- 1.13 As a result of this remediation programme, a feasibility study of the Cwm Rheidol Metal Mine was undertaken in early 2019 and the Cultural Heritage and Archaeology of the mine has played an important role in the decision and design making processes for the proposed blow-out prevention works.
- 1.14 In September 2019 Phase 1 investigative ground investigation works in the form of a series of trial pits (7) were undertaken at the site to further inform the design making process. These pits included two (2) trial pits on the existing scree slope around Adit 9, two (2) trial pits on the access track and three (3) trial pits within the 'lagoon' area. This groundwork was supervised archaeologically and the resulting report (HRSW Rpt 210) concluded that the groundwork managed to establish the character of the below ground surface in the targeted areas. Of the seven (7) trial pits excavated only one of the trenches exposed a significant find, Trial Pit No.7 (adjacent to Adit 9 entrance) where a length of un-mounted tram rail became exposed, protruding in the south facing section of the trench. The tram rail was left in situ as it appeared to be fairly long and would have damaged the section of the trench. However, its presence clearly demonstrates that there are significant mine working remains in the form of finds still present within the spoil and scree surrounding Adit No.9, finds which will need to be given careful consideration in any future ground works in this area.
- 1.15 In the area of the lagoon, the 2019 trial pits reached a maximum depth of only 2 meters. Deposits encountered in these trenches was predominantly a loose sedimentary deposit made up of consecutive layers of sand, silt and grit, suggestive of years of water and mine-water run-off from the spoil heaps to the north.
- 1.16 Following the 2019 geo-technical pits a series of five (5) dynamic bore-hole tests around the entrance to Adit 9 and the Lagoon area were undertaken. The tests extended to 10m below surface or to refusal, which averaged around 6 meters below the surface. Testing was undertaken at 1m intervals. These dynamic tests were not being supervised under archaeological watching brief conditions.
- 1.17 In late July 2020, further Phase 3 investigative works were undertaken in the area of the lagoon and the proposed lay-down area. This groundwork was supervised archaeologically (HRSW Rpt 220). Of the eight (8) trial pits none of the trenches exposed any finds or features. The only interesting feature from all of the eight trenches, was the fact that four of the trenches in the area of the proposed lagoon area had excavated through former mining spoil and scree, with the remaining trench alongside the track in this area exposing what appeared to be natural soil and mudstone, which

suggests that the access track marks the limit of the Cwm Rheidol Mine spoil/scree in this area. This is confirmed by the fact that none of the trenches in the area of the proposed compound area had any evidence of any mining scree / spoil within its stratigraphy.

1.18 Although no significant finds were exposed from this round of ground investigations, the results from the Phase I ground investigation works in the area of Adit 9 have clearly shown that there are significant mine remains buried within the mining spoil/scree. As such it was recommended that any proposed ground-works within and within the close vicinity of the Cwm Rheidol Metal Mine is supervised under archaeological watching brief conditions.

Development Proposals

1.19 The proposed new Blow-out Prevention Works (Phase 1) at the Cwm Rheidol Lead Mine are composed of initial preliminary works and three main Blow-out Prevention Works.

Preliminary Set-up Works

- 1.20 Preliminary set-up works will consist of the setting up of:
 - *i*) Setting up of a contractors welfare area immediately south of the mine area on the south side of the public road;
 - *ii)* Creation of a proposed lay-down area immediately west of the mine alongside the main access track west of the site. Presently it is proposed that any equipment and materials will be surface stored and any preparatory works for the creation of the lay-down area will consist at the most, a turf strip.
 - *iii)* Removal of existing twin-walled blow-out pipes to be removed and retained. The greater part of the existing pipeline is surface mounted. Removal of exposed pipeline will involve the removal of galvanized securing pins. Areas of buried pipeline will need to be removed by machine and any areas that need excavation will need to be backfilled and made good in accordance with the earthworks specification.
 - *iv*) Protection with barrier tape or other suitable protection fencing of a number of trees in the area of the proposed works and access track.
 - *v)* Protection with suitable protection fencing (e.g *heras* fencing) around historic and archaeological features, such as surface exposed historic mining timbers in and around the proposed ground-works area in order to avoid accidental damage by machinery or other.
 - *vi)* Route of existing Public Right of Way (PRoW) to be diverted during proposed works with appropriate signage.

Blow-out Prevention Works

1.21 The proposed Blow-out Prevention Works will be focused on three main areas and will consist of the following proposed works:

i) Lagoon, Lagoon Spillway and Scour Protection – The existing lagoon surface area covers approximately 1,019 sq meters. The proposed lagoon extension to the existing lagoon will be positioned immediately west, covering an extended surface area of a further 2,272 sq meters, giving a total proposed lagoon surface area of approximately 3,291 sq meters. The entire base level of the new lagoon will cover approximately 811 sq meters. The proposed total capacity of the blow-out lagoon will be approximately 2,112 sq meters.

Regarding the existing lagoon, it has been proposed to retain its existing shape and batter and only the base level will be altered at a height of 75.6m AOD. The top embankment or *berm* surrounding the lagoon will be at 78m AOD.

Where the blow-out channel enters the lagoon a spillway will be constructed consisting of rock-roll mattresses laid over separating geo-textile and impermeable membrane. The pre-filled rock mattresses (2m x 1m x 0.25m) will offer scour protection to the lagoon and will follow the line of the slope and the base of the lagoon in the central area.

- *ii)* Adit 9 Portal Blow-out Protection Once the existing Adit 9 pipeline has been removed from the adit portal, a bund will be formed on either side of the portal from site won material and laid in 200mm compacted layers. The crest of the bund 1m wide and level to be 110.00mAOD. Once the bund has been formed, its internal sides will be lined with a concrete canvas which will be lapped under the Gabion mattress that lines the spillway and blow-out channel base. The newly formed bund and spillway will be enclosed with a realigned timber post and mesh fence that will help secure the adit portal.
- *Mine-water Transfer pipeline* Initially the existing Adit 6 pipeline will be diverted just above Adit 9 and reconnected to the new transfer pipeline. A manhole and a flow control chamber will be positioned just southwest of Adit 9. From here the pipeline will follow the route of an existing gulley/spillway positioned southwest of Adit 9, which will eventually run down-slope toward the proposed extension lagoon. The proposed transfer pipeline will be constructed from two 150mm HDPE twin-wall with ring seal joints at 6m spacing. The pipes will be bedded using site won material and will follow the topographical low point of the existing gulley. Across the channel/gulley invert will be placed rock-roll mattress for erosion/scour protection and laid down the full length of the blow-out channel. A series of vented break pressure chambers will be positioned in 10m steps along the pipeline. Where the pipes cross under the access track a class Z pipe bed will be used.

At the point where the blow-out channel meets the proposed lagoon extension, the surface mounted mine-water transfer pipeline will turn southwest and run parallel with the existing access track. This length of pipeline will have 225mm vertical rodding eyes provided which

will allow inspection and maintenance of the pipeline. From here the transfer pipeline will then be connected to the existing pipe manifold at the end of the access track alongside the public road.

Historical & Archaeological Background (see Figures 5 - 7)

- 1.22 What follows is a summary history of the Ystumtuen Mines taken from David Bick's work in 1975, Simon Hughes work undertaken in 1993 and Ioan Lord's recent 2018 work, with further references made to William Waller's and Lewis Morris's survey in the 18th Century. This section is also a transcript from an earlier feasibility study undertaken on the Cwm Rheidol Lead Mine by this author in early 2019.
- 1.23 The Ystumtuen Mine, also known as the Cwm Rheidol Led Mine was one of the largest mines in the Valley. It contained high amounts of Pyrite and Marcasite. It was also a high producer of Zinc. Over the years the mining of this has resulted in the exposed pyrite and marcasite lodes to react with oxygen and water and has decayed into sulphuric acid laden with polluting metals including zinc, cadmium and aluminium. Intermixed with this cocktail is dissolved ferrous iron which has oxygenated to form yellow ochre (LORD 2018).
- 1.24 The history of the Cwm Rheidol Lead & Zinc Mine (NPRN: 33828 / PRN: 5472) is a fairly complicated one, intimately and physically connected to all of the other mines in the landscape surrounding Ystumtuen, both below ground and on the surface. The history is also sometimes confounding given that it is strewn with continually changing owners, shareholders and investors with financial concerns, as well as the perplexity over frequently changing mine names and titles.
- 1.25 The earliest definitive references to mining in the Ystumtuen area are found in the Nanteos Estate documents, where a lease was granted to Sir Humphrey Mackworth and William Waller in 1698. In the same year Waller describes the Lead Mines of *Yftimtean*, where he had superintended the driving of a fifty yard cross cut into the Sun Vein (South Lode). From the intersection with the lode he had driven 33 yards along the lode and was working a rich bunch at 50 yards below the surface.
- 1.26 However, by 1704 Mackworth's enterprises failed and on the 22nd of February the mine was re-let by Powell of Nanteos to *The Company of Mine Adventurers*.
- 1.27 In 1709 the *Company of Mine Adventurers* fell into disrepute on account of fraudulent accounting, Waller was dismissed from his post and Mackworth kept a low profile within the Company from then on.
- 1.28 The Mines Adventurer's lease expired in 1727 and their agent is recorded as having destroyed the pumps, infilling open workings and removing cranches. At about this time some attention was given to following the lodes to the east and a minor discovery of ore was made at the neighbouring property of Pen y Berth or Berth Ddu, later to become the Penrhiw Mine, but still within the confines of the Nanteos Estate. However, in their search for ore, they explored beyond the Crown Boundary and discovered a productive vein at Bwlch Gwyn about the year 1735.

- 1.29 By 1742, some 500 tons of ore had been raised from the new mine with the royalties being paid to Thomas Powell and no authority to work the mine having been granted by the Crown. The whim shaft was ultimately sunk to about 75 metres / 246 feet to connect with the Ystumtuen No. 3 or 46 fathom level.
- 1.30 By 1754 the Ystumtuen Mine was abandoned and then leased to one Chauncey Townsend. In 1770 James Townsend, Chauncey's son, appointed Thomas Bonsall as his manager. Bonsall took over control of many of the sites circa 1780 and ran them in a rather ruthless and uncaring manner. His mismanagement was usually in the form of bad working practices. Few records have survived regarding the history and development of the Ystumtuen, Penrhiw and Bwlchgwyn Mines during the latter half of the eighteenth century.
- 1.31 By 1810 the Bwlchgwyn ownership problems appear to have been resolved with the Crown having granted the mine to the Powells of Nanteos.
- 1.32 A valuable insight into the mines of the area is provided by Walter Davies in 1815 who simply describes 'Ystum Tien' as an old mine, granted by the Crown to the Nant Eos family.
- 1.33 In 1822 the Alderson Brothers & James Raw moved from Swaledale to Cardiganshire to establish a mining business; commencing with the Cwmystwyth Mine, and then joined in 1824 by the Ystumtuen Mine. Initially, this exercise was most productive and justified the building of a lead smelter at Devil's Bridge in 1827 but, lead prices then declined rapidly which resulted in their insolvency in 1834.
- 1.34 In order to overcome the water problem at Ystumtuen Mine, the Aldersons & Raw partnership commenced driving a deep adit cross cut from the Rheidol Valley which, after 432 metres, was to intersect the lode at about 140 metres below the outcrop. This task appears to have taken about 3.5 years to complete and is believed to have been started in 1824 (LORD 2018).
- 1.35 This adit is known by a multitude of names :- Aldersons Level, the 78 Fathom Level, the Deep Adit, *Level Fawr* and most recently as the *Cwmrheidol No. 6 Adit* (PRN: 96416).
- 1.36 Other developments which took place during this period, to permit natural drainage, were that two winzes were put down 13 fathoms / 23.7 metres from the shallow level at the bottom of the Whimsey Shaft to a new drift called Raw's Level later to be called the 40 fathom or the No. 3 level. About 8 fathoms / 14.6 metres below this Owen's or Reese's level, later called No. 4 or the 48 fathom level, was driven as a drift to both the east and west with a 17 fathom shaft dropping into the No. 6 or Alderson's Level. This was later known as the No. 1 Rise.
- 1.37 In 1834, when the Aldersons were declared bankrupt, Lewis Pugh of Aberystwyth purchased the remaining 10 years of the lease on the Nanteos Mines, which included Ystumtuen and Bwlchgwyn.
- 1.38 Under Pugh's tenure, the worst accident recorded in the area occurred in the March of 1839 when four men were drowned. According to the Mining Journal of the 20th April, they were drowned by

holing into an old flooded shaft in the Ystumtuen Mine, but a local clergyman records that the cause was due to a scaffold breaking beneath four men and precipitating them into a sump.

- 1.39 Lewis Pugh's tenure ended in 1844 and the Nanteos Estate then granted the mines to the highly reputable firm of John Taylor & Son. The Ystumtuen, Penrhiw and Bwlchgwyn Mines were owned by the Nanteos Estate, and the three appear to have been let together for the previous century. However; in the mid 19th century, Penrhiw passed out of the Nanteos Estate and into the hand of the Williams family of Llanfrothen.
- 1.40 The documentation of these mines is greatly improved after 1845 when Sir Robert Hunt started compiling the Mineral Statistics as part of the function of the Geological Survey. These show the output of individual ores, the ownership and management of the mines on an annual basis and assist greatly with subsequent chronicling. It is recorded that in 1845 the Penrhiw & Ystumtuen Mine were being worked jointly as the Nanteos Mine under the auspices of John Taylor and that Penrhiw produced 46 tons of rather inferior grade lead ore by the efforts of 36 persons.
- 1.41 Between 1850 and 1854, very little appears to have changed at these mines. Nanteos remained fairly buoyant and eventually merged with Penrhiw in 1855 and some minor interest was being shown in the Tynyfron Mine but this did not result in any development.
- 1.42 The merging of Nanteos with Penrhiw appears to have been precipitated by the possibility of being able to drain Bwlchgwyn through the 46 fathom level of the Penrhiw Mine. Alderson's Adit or the No. 6 Level was then driven east towards the Penrhiw 46 fathom level; the levels holed through in the April of 1856 but the Penrhiw 46 lay about 5.4 metres / 18 feet above the No. 6 which was smoothed out by building a long ramp between the levels rather than tipping the ore into a chute and thus creating unnecessary double handling.
- 1.43 In 1859 the amalgamated mines of Ystumtuen, Penrhiw and Bwlchgwyn were let to J.H. Murchison & Co. who ran them as 'The Nanteos Mines'.
- 1.44 In 1869 Murchison produced a revised report on mining as an investment within which are his version of the operations which he had formerly managed. The mines were now known as The Nanteos Consols Mine and were under the management of Thomas Phips Thomas a rather unsavoury colleague of Murchison who was also involved in some rather shady dealings with the Francis Brothers of Goginan and J. J. Attwood, a solicitor cum financier who had moved to Aberystwyth......Under Murchison, the Bwlchgwyn Mine seems to have fallen into a state of dilapidation as the Nanteos Estate were very concerned about the condition of the buildings shortly after Attwood had taken the lease. Attwood also made a proposal to the Estate that they let him convert the Bwlchgwyn Offices into a mine agent's house which does rather reflect how little was being done at Bwlchgwyn Mine.
- 1.45 Below ground, in 1861 a 24 foot diameter waterwheel and wheelpit was installed underground at Level Fawr at the 10 Fathom Level to pump and draw water. This wheel was assembled entirely

underground in candle light. Unfortunately it was only in operation for just over 1 year after the level was declared worthless. The 10 Fathom Level and wheelpit was accessed in 2017 by the Welsh Mines Preservation Trust. A reconstruction drawing of the waterwheel is given by Ioan Lord in his recently published work. On the surface, the railroad through the No. 6 adit terminated at the head of a double acting incline which lead to the dressing floors (PRN: 96420). The mill was (PRN: 96419) driven by a 30 foot waterwheel of 3 foot breast to which was attached a set of 30 inch rolls to reduce the ore to a sufficient size for the jigging machines and buddles.

- 1.46 The neighbouring Tynfron Mine had still not been amalgamated with the Ystumtuen / Cwmrheidol Mine and was being developed under the management of Robert Northey, of Bwlch Consols Mine, at this time.
- 1.47 In the early 1870s, lead had risen to the same high value as it commanded in the 1850's, but by 1880 had slumped to its 1830 price and this decline continued until about 1895. It was not until the stimulus and subsidies of the First World War that the value of lead rose to 1850 and 1870 levels. To promote the Cardiganshire lead mines, Captain Absalom Francis published his '*History of the Cardiganshire Mines*', in 1874, which contains further accounts of these mines.
- 1.48 In the 1870s, the Aberystwyth and Ystumtuen Mines were again let to new companies in 1875 and Bwlchgwyn in 1878. The Ystumtuen Lead & Sulphur Mining Co. only survived for part of 1875 and '76 and the mine was taken up by the Ystumtuen Lead Mining Co. Ltd. later that year. They relinquished their lease in 1881. George Green, a local foundry owner took up the lease in 1882 but relinquished it the following year. Ystumtuen then lay idle in 1884 and '85 and was amalgamated with Penrhiw in 1886, Tynyfron was then included within this Sett in 1890. The Bwlchgwyn Mining Co. was re-formed in the June of 1890 by Captains Nicholas Bray and James Phillips of Goginan, formerly the lessees of Tynyfron. This venture was even shorter lived than their previous attempt and was suspended in the following year.
- 1.49 The 1890s was a decade of miserable prices for base metals and only the Penrhiw Mine, amalgamated with Ystumtuen & Tynfron managed to avoid liquidation by suspending the work, they were forced to lay off their miners in 1894 and the dressers in 1895.
- 1.50 The Penrhiw, Ystumtuen & Tynyfron Mining Co. relinquished their rights in 1899 and in 1900 the Tynfron and Ystumtuen Mines were taken up by the Belgian owned Rheidol Mining Co. Ltd., both mines were managed by F. De Bal.
- 1.51 Initially, both mines appear to have been undergoing maintenance, development and refitting as there is no record of production on either site. It would appear that this company almost completely rebuilt the dressing mill and finished off the driving of the No. 9 Adit. Beneath the old Ystumtuen Mine, by way of the Cwmrheidol adits, they employed 12 miners to put the mine in order and at Tynyfron 8 miners were employed; Whilst on the surface at Cwmrheidol, a further 12 men appear to have been engaged to put the plant in order.

- 1.52 By 1901 the number of employees had increased to 36 underground and 40 on the surface at Cwmrheidol with no one at Tynyfron. A bulk sample from Ystumtuen Mine was milled and yielded 10 tons of 70 % Lead Ore and 68 tons of 36.7 % Zinc Ore. F De Bal and Henry Nottingham managed the mines, with the old mine surveyor, Henry Francis being retained.
- 1.53 De Bal departed from Tynfron and Ystumtuen in 1902 leaving the management to Henry Nottingham. Neither site produced any ore despite there being 39 men employed below ground and another 18 on the surface. In 1901 Francis re-surveyed Ystumtuen and Tynyfron as a single site, but there are manuscript additions on his original map which suggest that it was the working plan for the developments which took place after this date. These additions include the No. 9 Adit (PRN: 96424) and the tramway (PRN: 96425) to Tynyfron and it must be concluded that the large labour force which was taken on was for the purpose of these developments. Other additions included a Crushing House (PRN: 96427) and a further dressing floor to the south (PRN: 96432). The new dressing floor included a stationary and a revolving picking table, a stone breaker, a chat mill, 10 Trommels, 7 five compartment Jiggers, 8 four compartment Jiggers, 2 Wilfey Vanning Tables, 1 Jones Sliming Table a3 Round Buddles (LORD 2018). The Dressing Mill complex was constructed of timber frame clad in corrugated iron set on stone and concrete foundations. The mill was built on the hillside in the form of six terraces. It was lit by electricity powered by hydro from a turbine house built on the riverbank to the south in 1901. Water was brought to the turbine via a large leat some 10 foot deep and wide in places, much of it adapted from an earlier leat that served the Caecynon Mine. This leat ran parallel with the river before crossing it using a spanning aqueduct mounted on masonry and concrete pillars, now absent but recorded photographically by the RCAHMW in the 1980s. From here the leat then left the ground and the water was taken along a 200 foot long wooden flume (see Figures 32 -34).
- 1.54 In 1903 the company produced zinc blende valued at £6,020. Peak production for the Rheidol Mining
 Co. was reached in 1905 when 46 tons of lead and 1537 tons of zinc ores were produced and sold for £10,609, this gave employment to 70 miners and 36 surface workers.
- 1.55 In addition to this, Pyrite was also being sold, but the annual production is not given, however, the quantity appears to have been about 1/3rd of the blende tonnage. viz: about 400 tons in 1904 and 500 tons in 1905. The output of the Cwmrheidol Mine then started to decline after 1905 and apparently work at Tynyfron Mine was suspended from 1903 until 1912.
- 1.56 The Great War created problems for the Rheidol Mining Co., and coupled with the response of the British Government in shrouding domestic mineral production in a cloak of secrecy has resulted in very little information being available on these mines during this period.
- 1.57 There was no activity at Cwmrheidol in 1915 whilst Penrhiw is recorded as having sold 76 tons lead concentrate and 33 tons of zinc blende from the efforts of 12 men underground and 7 on the surface. Penrhiw was in production in 1916 and can only have sold a few tons of ore and it would seem that Cwmrheidol Mine was still suspended on operating only on a care and maintenance basis.

- 1.58 A valuable insight into the state of affairs at Cwmrheidol is provided by Astley, a government geologist, who visited the site on the 30th of August 1917 and noted that the mine had been closed since 1914.
- 1.59 The same year the mine was purchased by Anderson & Anderson of London, a company who may have been involved with improvements in the dressing of poor ores. They employed 26 below ground and 12 on the surface in 1920, this was reduced to 1 below and 12 above in 1921, and when they sold the site in 1922, 2 men were employed below ground with another 6 on the surface. There are no records of production available during these years but it cannot have been a significant amount and it is unlikely that any development work took place. Conveyances also show the involvement of one Alfred James Hodgkinson Carrington on the 27th of September 1918, but he appears to have taken a passive role until the mid 1920's.
- 1.60 In 1923 the Saron Anthracite Collieries Ltd. of London took over the Rheidol Mine from Anderson & Anderson and employed 2 miners with 2 surface workers. This was reduced to a single miner and two surface workers in the following year and in 1925 and '26 only David Mason of Ystumtuen was employed as the caretaker.
- 1.61 Saron then appear to have relinquished the mine, but there is evidence to suggest that they let it to A.J.H. Carrington, a Consulting Mining & Civil Engineer of Lancaster Gate, London. Carrington appears to have been assembling a portfolio of mines in the Rheidol Valley since the end of the Great War with the intent of working them collectively.
- 1.62 In the September of 1926, Carrington supplied details of the Rheidol and other mines to John Agnew of Consolidated Goldfields, one of the most eminent engineers in the world at that time, with the running of a joint venture project in mind. However, the financial climate was wrong and insufficient details could be given regarding the tonnages and grades of the reserves remaining in the mine.
- 1.63 In May 1938 The Saron Anthracite Collieries Limited sold the mine to Maurice Moulton Dandrick of Austin Friars House in the City of London, but with Carrington and the Andersons to have Rights of Way over it.
- 1.64 Dandrick was a European refugee who had fled to London in the mid 1930's. His background was never fully revealed, he always tried to give an air of affluence and superiority but his character and behaviour was deemed to be devious and filled with half-truths.
- 1.65 Dandrick it seems saw the mine as a good business opportunity, especially with the increasing hostilities in Europe, and very soon after the declaration of war in 1939, he was trying to persuade The Ministry of Supply to give him money to assist the war effort. Had he not been in financial difficulty at the time, and asked for a realistic sum he may have received a better response.
- 1.66 Several government geologists visited the Rheidol Mine in 1940 and failed to substantiate the picture which Dandrick had set. The mine was only partly accessible and had not been worked or maintained for years and yet it was stated that he had spent tens of thousands of pounds on care

and maintenance. The geologists were only able to view the lode in one place and the results of their sampling was rather disappointing. The pyrite, which was much needed to ensure the domestic supply of sulphur, was contaminated with zinc and silica and was only of "acceptable" quality. Dandrick tried to re- write the geologists reports on the mine to promote it and again saw nothing wrong with this. The Cwmrheidol plant was said to be used as a central ore dressing facility for his other mines; Professor David Williams of the Royal School of Mines was told by Dandrick that they had produced 500 tons of lead concentrate from a new mine near Tre'r Ddol but Williams was familiar with the site and considered that it had probably only produced about 25 tons of crude ore containing maybe 5 or 10 tons of concentrate (HUGHES 1993).

- 1.67 In April 1951, Dandrick pressed the Board of Trade to help develop the mine but they turned him down. At about this time, the portal of No. 9 collapsed.
- 1.68 Throughout the later 1950's Dandrick seems to have been content with the revenue which ochre sales were bringing in from the mine. By this date the mill had been emptied and three undercover settling tanks had been constructed to collect ochre from the No. 6 Adit. These settling tanks are still present on the site.
- 1.69 In the early 1960s Dandrick was running three companies on the strength of the Cwmrheidol Mine. By mid 1960 Dandrick had sold part of the mine as a joint venture to a contractor, wherein an agreed amount of work would be done on the mine. The contractors moved onto the site to commence deep core drilling at the portal of the No. 6 Adit. When this was completed, the contractors moved to the portal of the No. 9 Adit and commenced clearing a drilling platform. Up to this point, Dandrick was resident at Cwm Rheidol but then moved to London and never returned to the area.
- 1.70 Originally, this drill platform was only supposed to be about 4 metres square but the manager decided that it would be more convenient if it was 7 metres square and then thought that 10 metres square would be better. The portal of No. 9 Adit had collapsed in the 1950's and it was not appreciated that a considerable head of water had accumulated behind the fall.
- 1.71 During the final stages of excavation, the digger driver noticed that ochreous water was being emitted from fresh tension gashes and went to report the matter to the mine manager, Mr Grant. However, very soon a large volume of highly acidic ochreous water blew out the remains of the plug and caused considerable pollution to the River Rheidol. Due to a number of other factors, Grant was replaced with Mr Matt Blick as mine manager.
- 1.72 Blick then repaired the open portal of No. 9 adit, cleared the ochre, re-laid the old rails, installed an air main and compressor, and finally cut a chamber for a drill rig at 358 metres / 1175 feet in. Six or eight men were employed on these works. With the drill rig now located about 40 metres south of the South Lode in the No. 9 Adit the length of the hole which was necessary was reduced to 99 metres / 325 feet. Three holes were drilled from this chamber before the mine was once again abandoned in the autumn of 1970.

1.73 Since then, the mine has stood idle, Continental Mining became involved with Andex Mines of Vancouver and the operation was taken over by Shannon Mining & Manufacturing circa 1973. Shannon was eventually wound up when it transpired that it was part of a scandalous international fraud. Maurice Dandrick died in about 1975 and his solicitor, Derek Sparrow, continued to administer the Mineral Holdings Corporation until it was wound up in the late 1990s (HUGHES 1993).

1.74 Archaeological & Research Work

- 1.75 Although the significant historic descriptions and plans by both William Waller and Lewis Morris have offered invaluable information about the Ystumtuen Mines of the 17th and 18th centuries, it wasn't until the beginning of Industrial Archaeology that interest in lead mining in Wales began to emerge as a serious archaeological concern. One of the pioneers of this interest in lead mines of mid-Wales was of course the late David Bick who wrote a series of informed books in the mid 1970s, a series that are now seen as essential to any library on the history of lead mining. David Bick also wrote books on William Waller and Lewis Morris and as such helped spur interest in the history and archaeology of lead mines in Wales. David Bick was also the founder of the Welsh Mines Society in 1979, from which was born the Welsh Mines Preservation Trust in 1991, who have worked closely with Cadw and the Royal Commission (RCAHMW) over the years to help preserve and record these forever decaying mines.
- 1.76 In 1993 Robert Protheroe-Jones of the National Museum of Wales undertook a survey of the Cwm Rheidol Lead Mine as part of the Ceredigion Metal Mines Survey. This survey as well as recording the condition and character of the lead mines, also raised some important issues regarding the condition and preservation of the mines across Ceredigion as whole. In 2002 Paul Sambrook of the Dyfed Archaeological Trust (DAT) undertook the Cambria Archaeology Metal Mines Project, which intended to address scheduling issues raised by the Protheroe-Jones rapid survey. Regarding the Cwm Rheidol Lead Mine, the 2002 DAT report describes the mine as being "amongst the best preserved of the mine sites in the district in terms of surface remains. The Crusher House and ore preparation area are well preserved and the bulk of the mine area relatively undisturbed, despite the loss of elements of the standing structures recorded here during the 1970s and 1980s, such as timbers and tin sheet roofing and walling.... The mine remains an impressive landscape feature, particularly due to the reddish hue of some spoil tips derived from the processing of ochre mined at the nearby Tynyfron site.....It is recommended that the mine be considered for scheduling on the basis of the range and condition of the structures and mining features that survive, as well as their high landscape value" (SAMBROOK 2002, p9). Still, neither the mine, nor any of its standing structures, has been given scheduled status. However, although the mine is not a designated site, it is considered to be of schedulable quality and given that the mine lies within a significant Historic Character Area within a registered historic landscape then it is considered to be a high value site, where preservation of standing surface remains are an important consideration.
- 1.77 More recently, loan Lord published his book '*Rich Mountains of Lead: The metal mining industry of Cwm Rheidol and Ystumtuen*', in which the history of the mines in the Cwm Rheidol are fully

described and illustrated with old photographs and plans of the mines and their levels. As well as having recorded much of the underground of the mines in the valley Lord has also made invaluable surface plans.

1.78 In Feb/March 2019 HRS Wales undertook the heritage and archaeological element of a comprehensive feasibility study for the Coal Authority on behalf of Natural Resources Wales as part of proposed remediation works associated with the existing metal pollution in the Rheidol River.

Geology

1.79 The geology of the area falls within the Undifferentiated Llandovery Rocks consisting of Mudstone, Siltstone and Sandstone.A fault at rockhead also runs from Cwm Rheidol and Ystumtuen and continues northeast.

2 Aims & Objectives

- 2.1 The aims of the watching brief, as defined by the ClfA (2014) were to:
 - Allow a rapid investigation and recording of any archaeological features that are uncovered during the proposed groundwork.
 - Provide the opportunity, if needed, for the watching archaeologist to signal to all interested parties, before the destruction of the material in question, that an archaeological find has been made for which the resources allocated to the watching brief are not sufficient to support the treatment to a satisfactory or proper standard.

3 Methodology

Watching Brief

- 3.1 The archaeological watching brief was undertaken intermittently by HRS Wales staff using current best practice from 8th December 2021 March 2022.
- 3.2 All work was carried out by a suitably qualified archaeologist with relevant level membership of the Chartered Institute for Archaeologists (CI*f*A) and followed the CI*f*A Standard and Guidance for an archaeological watching brief (CI*f*A 2014).
- 3.3 All proposed groundwork was undertaken under close and constant archaeological supervision. All groundwork by the contractor was undertaken using a mechanical digger using both a toothed and untoothed grading bucket.
- 3.4 All archaeological deposits or features when encountered were investigated and recorded. All finds recovered during the watching brief were to be bagged and a grid coordinate was taken using a handheld GPS device in order to locate the find-spot with the OS national grid.
- 3.5 Any recording required was to be carried out using HRS Wales recording systems (pro-forma context

sheets etc), using a continuous number sequence for all contexts.

- 3.6 Where considered necessary plans and sections were drawn to a scale of 1:50, 1:20 and 1:10 as required and related to Ordnance Survey datum and published boundaries where appropriate.
- 3.7 All features identified were tied in to both the OS National Grid and all local site and ground plans.
- 3.8 Photographs were appropriated in digital format, using an 18 mega-pixel DSLR camera in RAW format, to be exported later to TIFF format.

4 Results of Watching Brief (see Figures 4 – 12)

- 4.1 The archaeological watching brief was undertaken intermittently by HRS Wales staff using current best practice from 8th December 2021 March 2022.
- 4.2 4.2 The archaeological watching brief was focused on two areas of proposed development works, the groundwork around the portal of Adit No.9 and, groundworks in the existing lagoon and the proposed extension to the lagoon. With regards the proposed new blow-out channel for the twin walled transfer pipes, this was an already existing natural channel positioned to the west and just below Adit No.9. Groundwork along the route of this channel was limited to clearance of surface stone and vegetation only so as to allow accessibility for the new transfer pipes. All number enclosed in () refer to contexts encountered.

4.3 Adit 9 Portal Blow-out Works

- 4.4 Groundwork around the portal to Adit No.9 involved the creation of a bund of material around the portal by excavating the ground material in front of the portal and, once completed, the excavation of a slot to insert a new manhole and the creation of a new concrete slipway. Once completed the new twin walled pipes were then laid into an existing channel to the southwest.
- 4.5 Excavation of the ground directly in front of the adit portal for the creation of a bund around the portal, revealed, as had already been confirmed from the earlier ground investigations, that the material was entirely mining spoil, consisting of yellow ochre coloured mine waste. Initial removal of this waste material down to the required depth revealed the existing twin walled transfer pipe from Adit No.6. This was left in situ. The only find recovered from this groundwork was the remains of a 1970s corrugated tin sheet and a timber fence post that had former helped retain the bank on the west side of the portal. This is evident from an existing 1970s photo of the portal that clearly shows a series of vertically laid corrugated tin sheets in this position. Excavation for the approximately 2 meter wide slot for the new man-hole revealed that the ground at an approximately 2 meter depth below the bund was still mine waste material. No further finds, features or deposits were discovered during this groundwork other than the corrugated tin sheet and fence post.

4.6 Blow-out Lagoon Works

- 4.7 The proposed new blow-out works for the new lagoon involved the upgrading of the existing lagoon (SN 7291 7816) by excavating deeper and the resulting material used to increase the height of the existing bund to the south, and the creation of an extension to the existing lagoon to the west-north-west by using further excavated material from the existing lagoon to raise the ground level to the same height as the base of the upgraded existing lagoon. The design of the new lagoon also considered the retention of a vertical historic timber on the edge of the lagoon (SN 7289 7815) that may once have been used as fencing or else was associated with the former zip wire that took processed material up to the Rheidol railway. In order to retain and preserve this historic timber the edge of the lagoon was dog-legged and protective fencing erected around it.
- 4.8 Preliminary cartographic analysis had confirmed that in the area of the new lagoon extension to the west. Close to the existing lagoon, the OS first edition map of 1886 shows that there had once been a mining level in this area (SN 72887 78174). Although no surface remains exist today there was a chance that buried remains exist pertaining to this feature. Also, the later OS Second edition map of 1906 appears to show a mine building (PRN 96440) on the edge of the proposed lagoon extension at SN 7286 7816), nut in the area of the proposed new bund at the southern end. The possible buried remains of both of these sites were considered throughout the archaeological watching brief.
- 4.9 The excavation of the existing lagoon to the required depth cut through a succession of early mining spoil, consisting of mining spoil/scree, made up of mudstone with orange iron staining (100), with occasional pockets of loose orange/yellow sandy soil (101), an orange grit (102) and a grey sand (103), all deposits found scattered throughout the base of the existing lagoon, suggestive of sequential dumping of mine waste/spoil.
- 4.10 Throughout the groundwork for the new lagoon, no features or structures became exposed. However, there were a number of finds recovered (see Figure 12 and Photos 29 - 36). These included a 1970s can of Diamond White cider, several fragments of timber, a fragment of one hand made red brick, an iron clasp or hitch, a handle/lever for a mining wagon or tipping device, one very corroded 19th Century cast iron mine wagon wheel and a long length of 19th Century oak timber (approximately 1.6m in length) complete with tenon joints and a pair of corroded wrought iron brackets at each end, suggestive of the remains former mine adit support timbers. All of these finds were recovered within a 4 meter radius of grid reference SN 7289 7817. Given that the 19th Century finds were recovered from this area suggests that they may very well be associated with the former mining level in this location as shown on the OS first edition of 1886. If not, then they merely are representative of the continued moving and successive tipping of mine waste/spoil over a period of 140 years or so. All of the finds were recorded and were left stored on site next to the vertical historic timber that resides alongside the lagoon at the southern end of the site. Other than these finds, no other finds, features or significant deposits were encountered during the watching brief in the area of the lagoon. Given that the ground west of the existing lagoon needed to be raised rather than

lowered, no penetrative groundwork was required to the west and such no archaeological remains or deposits were encountered here.

4.11 Adit 6 & 9 Mine water Transfer Pipes

4.12 Groundwork along the route of the Adit 6 and 9 mine water transfer pipes channel was limited to clearance of surface stone and vegetation only so as to allow accessibility for the new transfer pipes, as such no archaeological remains or deposits were encountered.

5. Conclusion & Recommendations

5.1 The archaeological watching brief during the Phase I mine Blow-out prevention works at the Cwm Rheidol Lead Mine, did not expose any significant historic mining features in either the area of the Adit No.9 portal or the proposed new lagoon area. However, a small number of finds were recovered from the groundwork, and of special significance were two 19th Century finds, including one cast iron mine wagon wheel and the remains of one historic timber complete with wrought iron brackets that may once have been incorporated into a former level adit somewhere on the site. The discovery of these significant finds clearly confirms that there are significant early mining remains buried within the mining spoil/scree at the site. As such it is recommended that any future proposed groundworks within and within the close vicinity of the Cwm Rheidol Metal Mine are supervised under archaeological watching brief conditions.

6 Acknowledgements

Thanks to; Walters UK Ltd. for all their patience and understanding during the groundwork.

7 Bibliography

- Bick, D. 1975. Old Metal Mines of Mid-Wales: Part 2 The Rheidol to Goginan.
- Bick, D. 2004. Waller's Description of the Mines in Cardiganshire.
- Bick, D; Davies, PW, 1994. Lewis Morris and the Cardiganshire Mines. National Library Wales.
- Burt,R: Waite,P: Burnley,R. 1986. Mines of Cardiganshire.
- Cadw; CCW, WAG, 2007. Guide to Good Practice on Using the Register of Landscapes of Historic Interest In Wales in the Planning and Development Process (Revised 2nd Edition, including revisions to the Assessment Process (ASIDOHL2).

Clouston, B & partners. 1988. Cambrian Mountains Metal Mines Project.

- Environment Agency. 2006. Cwm Rheidol Metal Mine Remediation: Pilot Treatment System and Diversion Works.
- Environment Agency. 2012. Cwm Rheidol lead and zinc mine.
- Foster-Smith, J R , 1979. Mines of Cardiganshire.
- Francis, A, 1874. History of the Cardiganshire Mines.
- Hughes, S, 1976. Cardiganshire: It's Mines and Miners.
- Hughes, S, 1993. A Brief History of the Ystumtuen Mines
- Jones, O, T.1922. Lead & Zinc: N.Cardiganshire & W.Montgomeryshire,
- Jones, R, S. 2019. Cwm Rheidol Lead Mine: Feasibility Study (HRSW Rpt 206).
- Lewis, F R, 1938. Archaeologia Cambrensis..
- Lewis, S, 1833. Topographical Dictionary of Wales.
- Lewis, W J, 1951. Ceredigion.
- Lewis, W J, 1967. Lead Mining in Wales.
- Liscombe & Co. 1870. Mines of Cardiganshire, Montgomeryshire and Shropshire.
- Lord, I, 2018. Rich Mountains of Lead.
- Natural Resources Wales, 2013. Metal Mines Strategy for Wales Newsletter Summer 2013
- Palmer, M: Neaverson, P. 1989. Nineteenth Century Tin and Lead Dressing.
- Sambrook, P, 2002. Metal Mines Project 2002: Interim Report (DAT).
- Sambrook, RP & Hall, JJ, 2003. Blaenrheidol Community Audit.
- Spargo, T, 1870. Mines of Wales.
- Welsh Office, 1988. Survey of Contaminated Land in Wales.

Other References

British Geological Survey 1979, Ten Mile Map 3rd edition (solid) 1:625000)

Soils of England and Wales 1983. Sheet 2: Wales, 1:25000

Cartographic Sources

- •
- Ordnance Survey 1st Edition map of 1886 (1:10560); Ordnance Survey 2nd Edition map of 1906 (1:10560); Ordnance 1953 (1:10560) ٠
- •

APPENDIX I: Figures







 Project Title:
 Cwm Rheidol Lead & Zinc Mine, Ystumtuen.
 Figure 3.

 Date:
 Approx. Scale (@ A4):
 OS Aerial photo (2014) within Cwm Rheidol Lead Mine showing Adits 6 and 9 and area of proposed extended lagoon and outflow pipeline.

 Drawn by:
 Drawing No.





These maps are translated by the Oderers Soury maps and the Basersand of Debrase Soury an Intel of the anaroted of the Maps Tablacian (de Cons Cabyer) (the Mark Soury and Landon (Debry)(f) and the Maps Tablacian (de Spindlard), The Can Alling: Can Charles (1997)(1) (501)	BLOW OUT CHANNEL LINED WITH RICKROLL MATTRESS (OR EQUIVALENT) INCREMENTATION RESS.	NOTES 1 discrete formation and the second s
PROPOSED MINEWATER TRADEGE PROVINE OF WARTER TRADEGE PROVINE OF TWAN WALL POR DETAILS OF LADOON SETTING OUT TREOBMATION REFER TO DRAWING EVANUE CEID2-38	PROCK MATTRESEES BY LADOOM AND ON BREENANCE WITH THE BASTALED ON TOP OF BREENANCE WITH THE MASTALED ON TOP OF BREENANCE WITH THE BASTALED ON TOP OF BREENANCE WITH THE BASTALED ON BALL BE BASCARD TO BE REAVED EXCLUSION BHALL BE BASCARD TO BE REAVED EXCLUSION BHALL BE BASCARD TO BE REAVED EXCLUSION THE ACCORDANCE WITH THE BASTALED ON ACCORDANCE WITH THE BASTALED ON ACCORDANCE WITH THE BASTALED ON ACCORDANCE WITH THE BASTALED ON ACCORDANCE WITH THE BASTALED ON THE BECTON TO BE REAVED EXCLUSION OF REFER DRAVINGS 35-38 THE BECTON TO BE REAVED EXCLUSION OF THE EXEMPTION OF	ESY TO DRAVENS STATUS ED DRAVENS STATUS ED DRAVENS STATUS
BPILLIVA AND SCOUR PROTECTION (1:200)	PIECTION TO BE FILL OF THE ADDRESS O	EXEMPTION CONTINUES (SALE OF DESIGN EXEMPTION CONTINUES (SALE OF EXEMPTION CONTINUES (SALE OF EXEMPTION CONTINUES (SALE OF EXEMPTION CONTENT OF INCOMPTON CONTENT OF INCOMPTON CONTENT OF EXEMPTION CONTENT EXEMPTION CONTENT EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION EXEMPTION
	SCOUR PROTECTION MEASURES SPOLUMAY DIAMONES OF EQUIVALENT) PRE-FILED ROCK MATTRESSED OF EQUIVALENT) ACROSS CHANNEL WYETT	17 31827 VPESRC MD CHARGE (2016, 897980) V1 60 17 51827 SCHTERER VPESRC MD CHARGE (2016, 897980) VPE 17 51829 SCHTERER VPESRC MD CHARGE (2016, 897980) VPE 17 51829 SCHTERER VPESRC MD CHARGE (2016, 997980) VPE VPESRC MD CHARGE (2016, 997980) 17 51829 SCHTERER (2016) VPESRC MD CHARGE (2016, 997980) VPESRC MD CHARGE (2016, 997980) VPESRC MD CHARGE (2016, 997880) 18 VPESRC MD CHARGE (2016, 997880) 19 SCHTERER (2016, 997880) VPESRC MD CHARGE (2016, 997880) VPESRC MD CHARGE (2016, 997880) VPESRC MD CHARGE (2016, 997880) 19 SCHTERER (2016, 997880) VPESRC MD CHARGE (2016, 997880) VPESRC MD CHARGE (2016, 997880) 19 SCHTERER (2016, 997880) VPESRC MD CHARGE (2016, 997880) VPESRC MD CHARGE (2016, 997880) 19 SCHTERER (2016, 997880) VPESRC MD CHARGE (2016, 997880) VPESRC MD CHARGE (2016, 997880) 19 SCHTERER (2016, 997880) VPESRC MD CHARGE (2016, 997880) V
OALVANEED STEEL 'I PHY' SHALL BE PROVEED IN ACCORDANCE WITH SPECIFICATION FOGHAGPICTI AND IMMUGACTURERS GUIDAICE.	PRECE, HRIDEL HRIDE, HRIDE PRECE, HRIDEL HRIDEL PRECE, HRIDEL PRECE, HRIDEL HRIDEL PRECE, HRIDEL HRIDEL PRECE, H	Engineering 200 Lichfield Lane Mansfield Nottinghamshire NOT84 4RG Tel. 01623 637000
SECTION E-E': LAGOON SECTION AT SPILLWAY / SCOUR PROTECTION	(1:75) SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION THE FOLLOWING NOTES HIGH IGHT SIGNIFICANT RESIDUAL HAZARDS IDENTIFIED BY THE DESIGNER. TYPICAL HAZARDS THAT SHOULD BE IDENTIFIED BY A COMPETENT CONTRACTOR ARE NOT INCLUDED. THE CONTRACTOR SHALL CARRY OUT THE WORKS USING AN APPROVED SAFE SYSTEM OF WORK. FURTHER INFORMATION ON HAZARDS CAN BE FOUND IN THE DESIGN RISK ASSESSMENT.	CWM RHEIDOL (BOP) PHASE 1: LAGOON WORKS
	HR002 BURIED AND OWERHEAD SERVICES - RISK OF SERVICE STRIKE DURING CONSTRUCTION / DEMOLITION WORKS HR003 INTERFACE BETWEEN PLANT AND PUBLIC / PEDESTRIANS - RISK OF COLLISION BETWEEN VEHICLES AND PEDESTRIANS.	LAGOON SCOUR PROTECTION
	HR064 WORKING IN / ADJACENT TO WATERCOURSES - RISK OF ILLNESS (E.G. LEPTOSPIROSIS) HR005 CONTAMINATED GROUND HR006 CONSTRUCTION OF ADT INNEWATER TRANSFER PIPES - CONFINED SPACE HAZARD WHEN WORKING WITHIN TRENCH HR006 CONSTRUCTION OF EROPORT POTON HEATER TRANSFER PIPES - CONFINED SPACE HAZARD WHEN	Imm AS EHO(IN Imm 8. WLDING Iss A1 Womend P. TEISPY Damey WAx TENDER Image: Market and M
8 Copyright The Coart Autors for	GABION STONE IN RENO MATTRESSES	EV00440-CE022-34
Cwm Rheidol Lead Mine, Ystumtuen, Ystuntuen.	Figure 5.	No.
20222 Approx. Scale (@ A4): Drawing No.	Proposed Lagoon scour protection works.	1.





Proposed Adit 9 Blow-out Channel and pipelines

Approx. Scale (@ A4):

Drawing No.

Date:

Drawn by:

April 20222

APPENDIX II: Photo plates

Plate 01. Adit No.9 prior to groundwork.

Plate 02. Adit No.9 prior to groundwork.

Plate 03. Adit No.9 prior to groundwork.

Plate 04. Working shot for drain alongside Adit No.9

Plate 05. Working shot for drain alongside Adit No.9

Plate 06. Working shot for drain alongside Adit No.9

Plate 07. Adit No.9 following clearance groundwork for pipeline.

Plate 08. Adit No.9 following clearance groundwork for pipeline.

Plate 09. Adit No.9 during groundwork for manhole.

Plate 10. Adit No.9 - Working shot Adit No.9 during groundwork for manhole.

Plate 11. Area of existing lagoon prior to groundwork for upgraded lagoon. Looking eastward.

11 - 12

Plate 12. Area of existing lagoon prior to groundwork for upgraded lagoon. Looking westwards

 Project Title:
 Cwm Rheidol Lead Mine, Ystumtuen
 Photo Plate No's.

 Date Taken:
 24th January 2022
 Approx. Scale (@ A4):

 Appropriated by:
 RSJ
 Drawing No.

Plate 13. Working shot during groundwork for the proposed lagoon upgrade and extension. Looking westward.

Plate 14. Working shot during groundwork for the proposed lagoon upgrade and extension. Looking southwest and westward.

Plate 15. Working shot during groundwork for the proposed lagoon upgrade and extension. Looking south to southwest.

Plate 16. Working shot during groundwork for the proposed lagoon upgrade and extension. Looking westward.

Project Title: Cwm Rheidol Lead I	Mine, Ystumtuen	Photo Plate No's.	Sell.
Date Taken: 28th Jan - 2nd Feb 2022	Approx. Scale (@ A4):	13 - 16	HRS
Appropriated by: RSJ	Drawing No.		223

Plate 17. Working shot during groundwork for the proposed lagoon upgrade and extension. Looking westward.

Plate 18. Working shot during groundwork for the proposed lagoon upgrade and extension. Looking westward.

Plate 19. Working shot during groundwork for the proposed lagoon upgrade and extension. Looking westward.

Plate 20. Working shot during groundwork for the proposed lagoon upgrade and extension. Looking westward.

Plate 21. Working shot during groundwork for the proposed lagoon upgrade and extension. Looking eastward.

Plate 22. Working shot during groundwork for the proposed lagoon upgrade and extension. Looking south.

Project Title: Cwm Rheidol Lead Mine, Ystumtuen		Photo Plate No's.
Date Taken: 2nd Feb - 17th Feb 2022	Approx. Scale (@ A4):	17 - 22
Appropriated by: RSJ	Drawing No.	

Plate 23. Remains of heavily corroded 19th Century cast iron wagon wheel recovered from spoil tip.

Plate 24. Remains of heavily corroded 19th Century cast iron wagon wheel recovered from spoil tip.

Project Title: Cwm Rheidol Lead Mine, Ystumtuen		Photo Plate No's.	St 1
Date Taken: 28th January 2022	Approx. Scale (@ A4):	23 - 24	HRS
Appropriated by: RSJ	Drawing No.		223

Plate 25. Remains of 19th Century oak timber with corrroded wrought iron brackets recovered from spoil tip alongside existing lagoon.

Plate 26. Remains of 19th Century oak timber with corrroded wrought iron brackets recovered from spoil tip alongside existing lagoon.

Project Title: Cwm Rheidol Lead I	Vine, Ystumtuen	Photo Plate No's.	
Date Taken: 28th January 2022	Approx. Scale (@ A4):	25 - 26	HRS
Appropriated by: RSJ	Drawing No.		222

Plate 27. Remains of 19th Century oak timber with corrroded wrought iron brackets recovered from spoil tip alongside existing lagoon.

Plate 28. Remains of 19th Century oak timber with corrroded wrought iron brackets recovered from spoil tip alongside existing lagoon.

Project Title: Cwm Rheidol Lead I	Vine, Ystumtuen	Photo Plate No's.	
Date Taken: 28th January 2022	Approx. Scale (@ A4):	27 - 28	HRS
Appropriated by: RSJ	Drawing No.		223

Plate 29. Red brick recovered from mine spoil.

Plate 31. Remains of 1970s can of Diamond White cidar recovered from mine spoil.

Plate 33. Remains of wrought iron staple recovered from mine spoil.

Plate 35. Remains of iron bracket fasten recovered from mine spoil.

Plate 30. Remains of timber plank recovered from mine spoil.

Plate 34. Remains of sheet of corrugated tin sheet recovered from mine spoil.

Plate 36. Remains of iron lever recovered from mine spoil.

29 - 36

APPENDIX III: Archive Cover Sheet

ARCHIVE COVER SHEET

Cwm Rheidol Lead & Zinc Mine, Ystumtuen, Ceredigion

ARCHIVE DESTINATION - RCAHMW

Site Name:	Cwm Rheidol Led & Zinc Mine, Ystumtuen, Ceredigion
Site Code:	CRLM/2021/WB
PRN:	5472
NPRN:	33828
SAM No.	
Other Ref No.	HRSW Rpt No. 242
NGR:	SN 7297 7821
Site Type:	Lead & Zinc Mine.
Project Type:	Archaeological Watching Brief
Project Manager:	Richard Scott Jones
Project Date(s):	December 2021 - March 2022
Categories Present:	None
Location of Original Archive:	HRSW
Location of Duplicate Archive:	RCAHMW
Number of Find Boxes:	N/A
Location of Finds:	N/A
Museum Ref:	N/A
Copyright:	HRS Wales
Restrictions to Access:	None

Egwyl, Llwyn-y-groes, Tregaron, Ceredigion SY25 6QE Tel: 01570 493759 Fax: 08712 428171 E-mail: richard@hrswales.co.uk